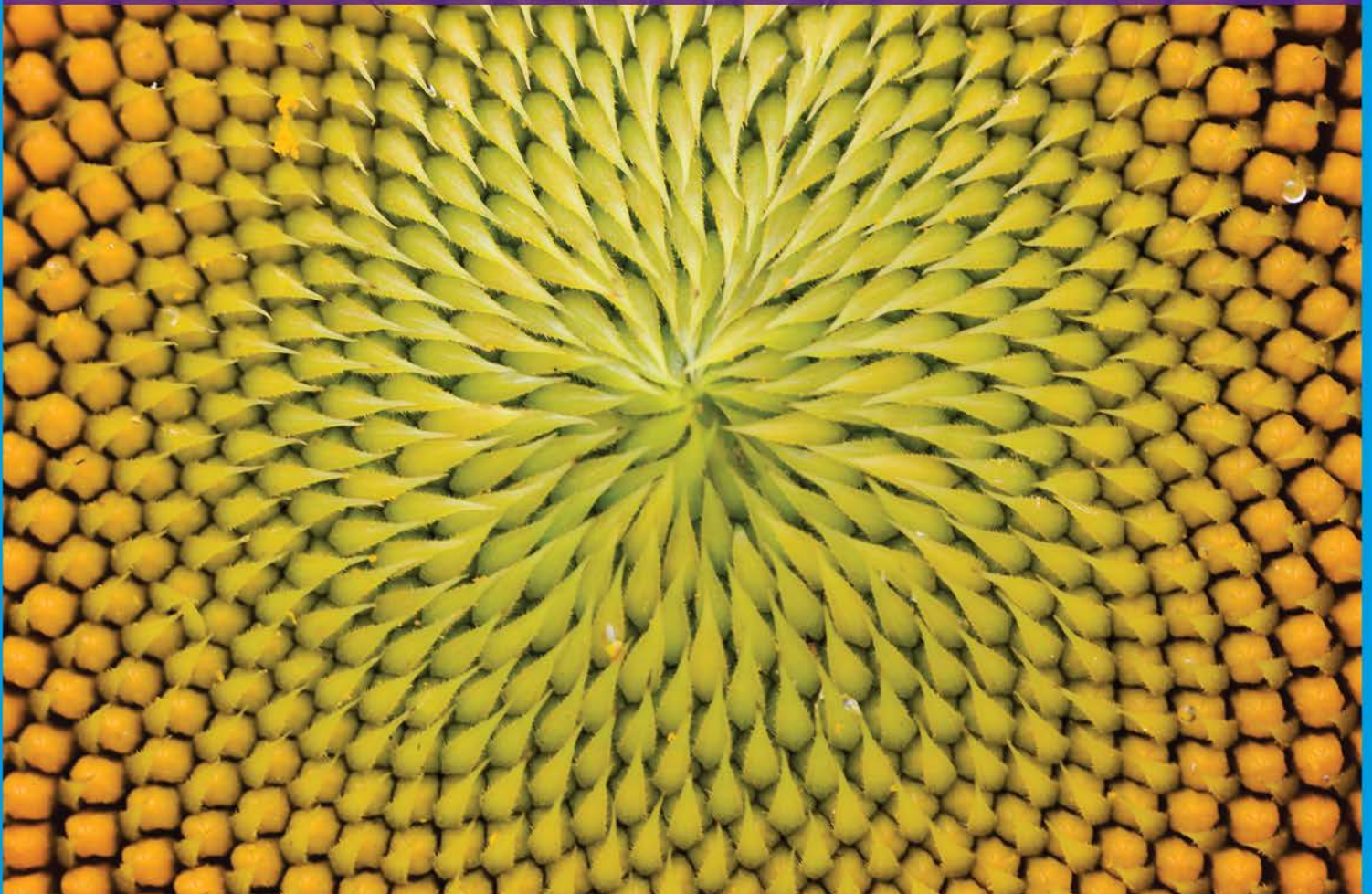


NEW PERSPECTIVES

CAREY

HTML 5 and CSS

Comprehensive

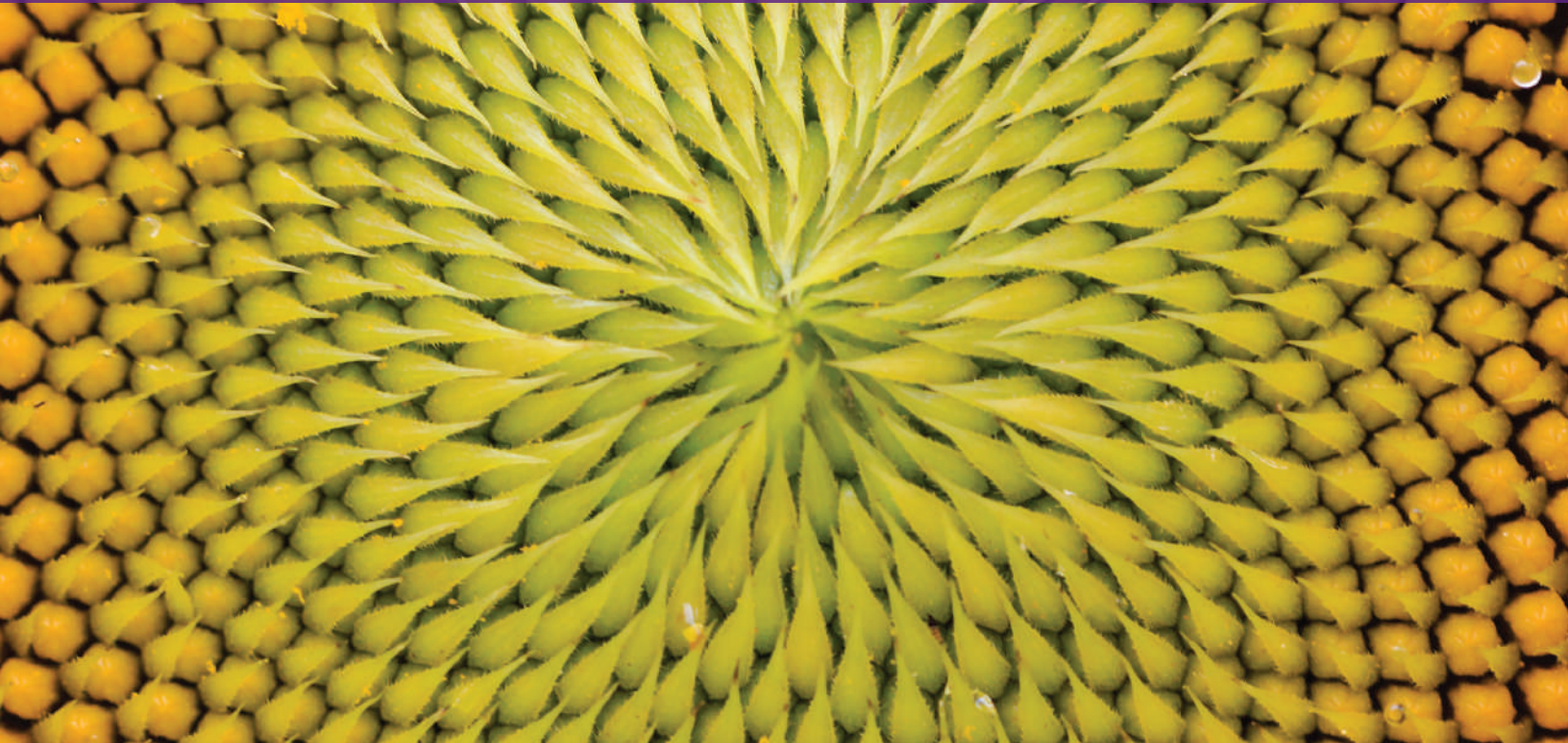


NEW PERSPECTIVES

PATRICK CAREY

HTML 5 and CSS

Comprehensive



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Preface

The New Perspectives Series' critical-thinking, problem-solving approach is the ideal way to prepare students to transcend point-and-click skills and take advantage of all that HTML 5 and CSS has to offer.

In developing the New Perspectives Series, our goal was to create books that give students the software concepts and practical skills they need to succeed beyond the classroom. We've updated our proven case-based pedagogy with more practical content to make learning skills more meaningful to students. With the New Perspectives Series, students understand *why* they are learning *what* they are learning, and are fully prepared to apply their skills to real-life situations.

"I love this text because it provides detailed instructions and real-world application examples. It is ideal for classroom and online instruction. At the end of the term my students comment on how much they've learned and put to use outside the classroom."

—Customer at
St. Johns River
Community College

About This Book

This book provides thorough coverage of HTML 5 and CSS, and includes the following:

- Up-to-date coverage of using HTML 5 to create structured websites
- Instruction on the most current CSS styles to create visually-interesting pages and captivating graphical designs
- Working with browser developer tools to aid in the creation and maintenance of fully-functioning websites

New for this edition!

- Coverage of CSS grid styles for creating grid-based layouts.
- Exploration of new CSS styles for filters and transformations.
- New hands-on demo pages to interactively explore HTML and CSS concepts.
- New coding challenges for each tutorial to focus on specific tasks and concepts.
- New debugging challenges for each tutorial to explore how to fix malfunctioning websites.

System Requirements

This book assumes that students have an Internet connection, a text editor, and a current browser that supports HTML 5 and CSS. The following is a list of the most recent versions of the major browsers at the time this text was published: Internet Explorer 11, Microsoft Edge 44, Firefox 66, Safari 12.1, Opera 60, and Google Chrome 75. More recent versions may have come out since the publication of this book. Students should go to the web browser home page to download the most current version. All browsers interpret HTML 5 and CSS code in slightly different ways. It is highly recommended that students have several different browsers installed on their systems for comparison and, if possible, access to a mobile browser or a mobile emulator. Students might also want to run older versions of these browsers to highlight compatibility issues. The screenshots in this book were produced using Google Chrome 75 running on Windows 10 (64-bit), unless otherwise noted. If students are using different devices, browsers, or operating systems, their screens might vary from those shown in the book; this should not present any problems in completing the tutorials.

“New Perspectives texts provide up-to-date, real-world application of content, making book selection easy. The step-by-step, hands-on approach teaches students concepts they can apply immediately.”

—Customer at
Southeastern Technical
College

VISUAL OVERVIEW

PROSKILLS

KEY STEP

INSIGHT

TIP

TRY IT

REVIEW

CODE

DEBUG

APPLY

CHALLENGE

CREATE

REFERENCE

GLOSSARY/INDEX

The New Perspectives Approach

Context

Each tutorial begins with a problem presented in a “real-world” case that is meaningful to students. The case sets the scene to help students understand what they will do in the tutorial.

Hands-on Approach

Each tutorial is divided into manageable sessions that combine reading and hands-on, step-by-step work. Colorful screenshots help guide students through the steps. **Trouble?** tips, which anticipate common mistakes or problems, help students stay on track and continue with the tutorial.

Visual Overviews

Each session begins with a Visual Overview, a two-page spread that includes colorful, enlarged figures with numerous callouts and key term definitions, giving students a comprehensive preview of the topics covered in the session, as well as a handy study guide.

ProSkills Boxes

ProSkills boxes provide guidance for applying concepts to real-world, professional situations, involving one or more of the following soft skills: decision making, problem solving, teamwork, verbal communication, and written communication.

Key Steps

Important steps are highlighted in yellow with attached margin notes to help students pay close attention to completing the steps correctly and avoid time-consuming rework.

InSight Boxes

InSight boxes offer expert advice and best practices to help students achieve a deeper understanding of the concepts behind the software features and skills.

Margin Tips

Margin Tips provide helpful hints and shortcuts for more efficient use of the software. The Tips appear in the margin at key points throughout each tutorial, giving students extra information when and where they need it.

Try It tips point to demo pages provided with the data folder for interactive exploration of key concepts.

Assessment

Retention is a key component to learning. At the end of each session, a series of Quick Check multiple choice questions helps students test their understanding of the material before moving on. New with this edition are Coding Challenges and debugging exercises that focus on a few key challenges. Engaging end-of-tutorial Review Assignments and Case Problems have always been a hallmark feature of the New Perspectives Series. Colorful bars and brief descriptions accompany the exercises, making it easy to understand both the goal and level of challenge a particular assignment holds.

Reference

Within each tutorial, Reference boxes appear before a set of steps to provide a succinct summary or preview of how to perform a task. In addition, each book includes a combination Glossary/Index to promote easy reference of material.

INTRODUCTORY

COMPREHENSIVE

Our Complete System of Instruction

Coverage To Meet Your Needs

Whether you're looking for just a small amount of coverage or enough to fill a semester-long class, we can provide you with a textbook that meets your needs.

- Introductory books contain an average of 5 to 8 tutorials and include essential skills on the books concepts.
- Comprehensive books, which cover additional concepts and skills in depth, are great for a full-semester class, and contain 9 to 12+ tutorials.

So, if you are looking for just the essential skills or more complete in-depth coverage of a topic, we have an offering available to meet your needs. Go to our web site or contact your Cengage sales representative to find out what else we offer.

MindTap

MindTap is a personalized learning experience with relevant assignments that guide students to analyze, apply, and improve thinking, allowing you to measure skills and outcomes with ease.

For instructors: personalized teaching becomes yours with a Learning Path that is built with key student objectives. Control what students see and when they see it. Use as-is, or match to your syllabus exactly: hide, rearrange, add, or create your own content.

For students: a unique Learning Path of relevant readings, multimedia, and activities that guide you through basic knowledge and comprehension to analysis and application.

Better outcomes: empower instructors and motivate students with analytics and reports that provide a snapshot of class progress, time in course, engagement, and completion rates.

The MindTap for HTML 5 and CSS includes coding labs, study tools, and interactive quizzing, all integrated into an eReader that includes the full content of the printed text.

Instructor Resources

We offer more than just a book. We have all the tools you need to enhance your lectures, check students' work, and generate exams in a new, easier-to-use and completely revised package. This book's Instructor's Manual, Cognero testbank, PowerPoint presentations, data files, solution files, figure files, and a sample syllabus are all available at sso.cengage.com.

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Kate Mason, Learning Designer; Tom Benedetto, Product Assistant; Erin Griffin, Art Director; Fola Orekoya, Manufacturing Planner; Lumina Datamatics Ltd., Compositor, as well as John Freitas and Danielle Shaw, Technical Editors.

This book is dedicated to my wife Joan who is my inspiration and role model for her good humor, dedication, and tireless support.

– **Patrick Carey**

BRIEF CONTENTS

HTML

Level I Tutorials

Tutorial 1 Getting Started with HTML 5	HTML 1
<i>Creating a Website for a Food Vendor</i>	
Tutorial 2 Getting Started with CSS	HTML 85
<i>Designing a Website for a Fitness Club</i>	

Level II Tutorials

Tutorial 3 Designing a Page Layout	HTML 175
<i>Creating a Website for a Chocolatier</i>	
Tutorial 4 Graphic Design with CSS	HTML 273
<i>Creating a Graphic Design for a Genealogy Website</i>	
Tutorial 5 Designing for the Mobile Web	HTML 361
<i>Creating a Mobile Website for a Daycare Center</i>	

Level III Tutorials

Tutorial 6 Working with Tables and Columns	HTML 451
<i>Creating a Program Schedule for a Radio Station</i>	
Tutorial 7 Designing a Web Form	HTML 517
<i>Creating a Survey Form</i>	
Tutorial 8 Enhancing a Website with Multimedia	HTML 601
<i>Working with Sound, Video, and Animation</i>	
Tutorial 9 Getting Started with JavaScript	HTML 681
<i>Creating a Countdown Clock</i>	
Tutorial 10 Exploring Arrays, Loops, and Conditional Statements . . .	HTML 751
<i>Creating a Monthly Calendar</i>	
Appendix A Color Names with Color Values, and HTML Character Entities	HTML A1
Appendix B HTML Elements and Attributes	HTML B1
Appendix C Cascading Styles and Selectors	HTML C1
Appendix D Making the Web More Accessible	HTML D1
Appendix E Designing for the Web	HTML E1
Appendix F Page Validation with XHTML	HTML F1

Glossary

REF 1

Index

REF 11

TABLE OF CONTENTS

Preface	iii
---------------	-----

HTML LEVEL I TUTORIALS

Tutorial 1 Getting Started with HTML 5

<i>Creating a Website for a Food Vendor</i>	HTML 1
---	--------

SESSION 1.1.....HTML 2

Exploring the World Wide Web.....	HTML 4
-----------------------------------	--------

Networks	HTML 4
----------------	--------

Locating Information on a Network	HTML 4
---	--------

Web Pages and Web Servers	HTML 4
---------------------------------	--------

Introducing HTML	HTML 5
------------------------	--------

The History of HTML.....	HTML 5
--------------------------	--------

Tools for Working with HTML.....	HTML 6
----------------------------------	--------

Content Management Systems and Frameworks.....	HTML 7
---	--------

Testing your Code.....	HTML 7
------------------------	--------

Exploring an HTML Document	HTML 8
----------------------------------	--------

The Document Type Declaration.....	HTML 8
------------------------------------	--------

Introducing Element Tags.....	HTML 9
-------------------------------	--------

The Element Hierarchy.....	HTML 10
----------------------------	---------

Introducing Element Attributes.....	HTML 11
-------------------------------------	---------

Handling White Space	HTML 12
----------------------------	---------

Viewing an HTML File in a Browser.....	HTML 12
--	---------

Creating an HTML File.....	HTML 13
----------------------------	---------

Creating the Document Head.....	HTML 15
---------------------------------	---------

Setting the Page Title	HTML 16
------------------------------	---------

Adding Metadata to the Document.....	HTML 16
--------------------------------------	---------

Adding Comments to Your Document.....	HTML 18
---------------------------------------	---------

Session 1.1 Quick Check	HTML 21
-------------------------------	---------

SESSION 1.2

HTML 22

Writing the Page Body	HTML 24
-----------------------------	---------

Using Sectioning Elements.....	HTML 24
--------------------------------	---------

Comparing Sections in HTML 4 and HTML 5 ...	HTML 26
---	---------

Using Grouping Elements	HTML 26
-------------------------------	---------

Using Text-Level Elements.....	HTML 29
--------------------------------	---------

Linking an HTML Document to a Style Sheet	HTML 32
---	---------

Working with Character Sets and Special Characters	HTML 33
---	---------

Character Encoding	HTML 33
--------------------------	---------

Character Entity References.....	HTML 34
----------------------------------	---------

Working with Inline Images.....	HTML 36
---------------------------------	---------

Line Breaks and Other Empty Elements	HTML 38
--	---------

Working with Block Quotes and Other Elements ...	HTML 39
--	---------

Session 1.2 Quick Check	HTML 45
-------------------------------	---------

SESSION 1.3

HTML 46

Working with Lists	HTML 48
--------------------------	---------

Ordered Lists	HTML 48
---------------------	---------

Unordered Lists	HTML 49
-----------------------	---------

Description Lists.....	HTML 51
------------------------	---------

Navigation Lists	HTML 55
------------------------	---------

Working with Hypertext Links.....	HTML 57
-----------------------------------	---------

Turning an Inline Image into a Link	HTML 59
---	---------

Specifying the Folder Path	HTML 60
----------------------------------	---------

Absolute Paths.....	HTML 61
---------------------	---------

Relative Paths	HTML 61
----------------------	---------

Setting the Base Path	HTML 62
-----------------------------	---------

Linking to a Location within a Document.....	HTML 63
--	---------

Marking Locations with the id Attribute	HTML 63
Linking to an id	HTML 63
Anchors and the name Attribute	HTML 63
Linking to the Internet and Other Resources	HTML 64
Linking to a Web Resource	HTML 64
Linking to an Email Address	HTML 65
Linking to a Phone Number	HTML 67
Working with Hypertext Attributes	HTML 68
Validating Your Website	HTML 69
Session 1.3 Quick Check	HTML 71
Review Assignments	HTML 76
Case Problems	HTML 79
Tutorial 2 Getting Started with CSS	
<i>Designing a Website for a Fitness Club</i>	HTML 85
SESSION 2.1	HTML 86
Introducing CSS	HTML 88
Types of Style Sheets	HTML 88
Viewing a Page Using Different Style Sheets . . .	HTML 89
Exploring Style Rules	HTML 92
Browser Extensions	HTML 92
Embedded Style Sheets	HTML 93
Inline Styles	HTML 93
Style Specificity and Precedence	HTML 94
Style Inheritance	HTML 94
Browser Developer Tools	HTML 95
Creating a Style Sheet	HTML 96
Writing Style Comments	HTML 96
Defining the Character Encoding	HTML 97
Importing Style Sheets	HTML 98
Working with Color in CSS	HTML 98
Color Names	HTML 98

RGB Color Values	HTML 99
HSL Color Values	HTML 101
Defining Semi-Opaque Colors	HTML 102
Setting Text and Background Colors	HTML 102
Employing Progressive Enhancement	HTML 106
Session 2.1 Quick Check	HTML 107
SESSION 2.2	HTML 108
Exploring Selector Patterns	HTML 110
Contextual Selectors	HTML 110
Attribute Selectors	HTML 113
Working with Fonts	HTML 117
Choosing a Font	HTML 117
Exploring Web Fonts	HTML 119
The @font-face Rule	HTML 120
Setting the Font Size	HTML 123
Absolute Units	HTML 123
Relative Units	HTML 123
Scaling Fonts with ems and rems	HTML 124
Using Viewport Units	HTML 125
Sizing Keywords	HTML 125
Controlling Spacing and Indentation	HTML 127
Working with Font Styles	HTML 129
Aligning Text Horizontally and Vertically	HTML 130
Combining All Text Formatting in a Single Style	HTML 131
Session 2.2 Quick Check	HTML 133
SESSION 2.3	HTML 136
Formatting Lists	HTML 138
Choosing a List Style Type	HTML 138
Creating an Outline Style	HTML 138

Using Images for List Markers	HTML 141
Setting the List Marker Position.	HTML 142
Working with Margins and Padding.	HTML 143
Setting the Padding Space	HTML 144
Setting the Margin and the Border Spaces . . .	HTML 146
Using Pseudo-Classes and Pseudo-Elements	HTML 149
Pseudo-Classes	HTML 149
Pseudo-classes for Hypertext	HTML 152
Pseudo-Elements	HTML 154
Generating Content with CSS	HTML 155
Displaying Attribute Values.	HTML 156
Inserting Quotation Marks.	HTML 157
Validating Your Style Sheet.	HTML 158
Session 2.3 Quick Check	HTML 160
Review Assignments	HTML 166
Case Problems	HTML 169

HTML LEVEL II TUTORIALS

Tutorial 3 Designing a Page Layout

Creating a Website for a Chocolatier HTML 175

SESSION 3.1 HTML 176

Introducing the display Style	HTML 178
Creating a Reset Style Sheet.	HTML 178
Exploring Page Layout Designs.	HTML 182
Fixed, Fluid, and Elastic Layouts	HTML 182
Working with Width and Height.	HTML 184
Setting Maximum and Minimum Dimensions. . .	HTML 184
Centering a Block Element.	HTML 187
Vertical Centering	HTML 188
Floating Page Content.	HTML 189
Clearing a Float	HTML 193
Refining a Floated Layout	HTML 197

Working with Container Collapse	HTML 201
Session 3.1 Quick Check	HTML 204

SESSION 3.2. HTML 206

Introducing Grid Layouts.	HTML 208
Overview of Grid-Based Layouts.	HTML 208
Fixed and Fluid Grids	HTML 209
CSS Frameworks	HTML 210
Introducing CSS Grids.	HTML 210
Creating a CSS Grid	HTML 213
Working with Grid Rows and Columns	HTML 215
Track Sizes with Fractional Units	HTML 217
Repeating Columns and Rows	HTML 218
Applying a Grid Layout.	HTML 219
Outlining a Grid.	HTML 221
Placing Items within a Grid	HTML 223
Placing Items by Row and Column	HTML 224
Using the span Keyword	HTML 226
Placing Grid Items by Area.	HTML 228
Defining the Grid Gap	HTML 232
Managing Space within a Grid.	HTML 234
Alignment for a Single Grid Cell	HTML 235
Aligning the Grid	HTML 235
Session 3.2 Quick Check	HTML 237

SESSION 3.3 HTML 238

Positioning Objects	HTML 240
The CSS Positioning Styles.	HTML 240
Relative Positioning	HTML 240
Absolute Positioning.	HTML 241
Fixed and Inherited Positioning	HTML 244
Using the Positioning Styles	HTML 244

Handling Overflow	HTML 254
Clipping an Element	HTML 257
Stacking Elements	HTML 258
Session 3.3 Quick Check	HTML 260
Review Assignments	HTML 267
Case Problems	HTML 269

Tutorial 4 Graphic Design with CSS

<i>Creating a Graphic Design for a Genealogy Website</i>	HTML 273
--	-----------------

SESSION 4.1HTML 274

Creating Figure Boxes	HTML 276
Exploring Background Styles	HTML 280
Tiling a Background Image	HTML 281
Attaching the Background Image	HTML 283
Setting the Background Image Position	HTML 283
Defining the Extent of the Background	HTML 284
Sizing and Clipping an Image	HTML 285
The background Property	HTML 286
Adding Multiple Backgrounds	HTML 288
Working with Borders	HTML 290
Setting Border Width and Color	HTML 290
Setting the Border Design	HTML 291
Creating Rounded Corners	HTML 293
Applying a Border Image	HTML 297
Session 4.1 Quick Check	HTML 301

SESSION 4.2HTML 302

Creating Drop Shadows	HTML 304
Creating a Text Shadow	HTML 304
Creating a Box Shadow	HTML 306
Applying a Color Gradient	HTML 312
Creating a Linear Gradient	HTML 312

Gradients and Color Stops	HTML 315
Creating a Radial Gradient	HTML 316
Repeating a Gradient	HTML 320
Creating Semi-Transparent Objects	HTML 322
Session 4.2 Quick Check	HTML 324

SESSION 4.3HTML 326

Transforming Page Objects	HTML 328
Transformations in Three Dimensions	HTML 332
Understanding Perspective	HTML 333
Exploring CSS Filters	HTML 337
Working with Image Maps	HTML 341
Defining a Client-Side Image Map	HTML 341
Applying an Image Map	HTML 345
Session 4.3 Quick Check	HTML 347
Review Assignments	HTML 354
Case Problems	HTML 357

Tutorial 5 Designing for the Mobile Web

<i>Creating a Mobile Website for a Daycare Center</i>	HTML 361
---	-----------------

SESSION 5.1HTML 362

Introducing Responsive Design	HTML 364
Introducing Media Queries	HTML 365
The @media Rule	HTML 366
Media Queries and Device Features	HTML 367
Applying Media Queries to a Style Sheet	HTML 369
Exploring Viewports and Device Width	HTML 372
Creating a Mobile Design	HTML 375
Creating a Pulldown Menu with CSS	HTML 376
Testing Your Mobile Website	HTML 379
Creating a Tablet Design	HTML 383
Creating a Desktop Design	HTML 387
Session 5.1 Quick Check	HTML 391

SESSION 5.2	HTML 392
Introducing Flexible Boxes	HTML 394
Defining a Flexible Box	HTML 394
Cross-Browser Flexboxes	HTML 395
Setting the Flexbox Flow	HTML 395
Working with Flex Items	HTML 397
Setting the Flex Basis	HTML 397
Defining the Flex Growth	HTML 398
Defining the Shrink Rate	HTML 399
The flex Property	HTML 401
Applying a Flexbox Layout	HTML 402
Reordering Page Content with Flexboxes	HTML 407
Exploring Flexbox Layouts	HTML 409
Aligning Items along the Main Axis	HTML 409
Aligning Flex Lines	HTML 410
Aligning Items along the Cross Axis	HTML 410
Creating a Navicon Menu	HTML 412
Session 5.2 Quick Check	HTML 417
 SESSION 5.3	 HTML 418
Designing for Printed Media	HTML 420
Previewing the Print Version	HTML 420
Applying a Media Query for Printed Output. . .	HTML 421
Working with the @page Rule	HTML 422
Setting the Page Size	HTML 423
Using the Page Pseudo-Classes	HTML 423
Page Names and the Page Property	HTML 423
Formatting Hypertext Links for Printing.	HTML 428
Working with Page Breaks	HTML 431
Preventing Page Breaks	HTML 432
Working with Widows and Orphans	HTML 434

Session 5.3 Quick Check	HTML 437
Review Assignments	HTML 443
Case Problems	HTML 446

HTML LEVEL III TUTORIALS

Tutorial 6 Working with Tables and Columns

<i>Creating a Program Schedule for a Radio Station. .</i>	HTML 451
---	----------

SESSION 6.1

Introducing Web Tables	HTML 454
Marking Tables and Table Rows	HTML 454
Marking Table Headings and Table Data.	HTML 456
Adding Table Borders with CSS	HTML 459
Spanning Rows and Columns	HTML 464
Creating a Table Caption	HTML 471
Session 6.1 Quick Check	HTML 475

SESSION 6.2

Creating Row Groups	HTML 478
Creating Column Groups	HTML 482
Exploring CSS Styles and Web Tables	HTML 485
Working with Width and Height	HTML 486
Applying Table Styles to Other Page Elements	HTML 490
Tables and Responsive Design	HTML 492
Designing a Column Layout	HTML 496
Setting the Number of Columns	HTML 496
Defining Columns Widths and Gaps	HTML 498
Managing Column Breaks	HTML 501
Spanning Cell Columns	HTML 503
Session 6.2 Quick Check	HTML 505
Review Assignments	HTML 510
Case Problems	HTML 512

Tutorial 7 Designing a Web Form*Creating a Survey Form* HTML 517**SESSION 7.1** HTML 518

Introducing Web Forms HTML 520

Parts of a Web Form HTML 520

Forms and Server-Based Programs HTML 521

Starting a Web Form HTML 522

Interacting with the Web Server HTML 523

Creating a Field Set HTML 525

Marking a Field Set HTML 525

Adding a Field Set Legend HTML 526

Creating Input Boxes HTML 528

Input Types HTML 528

Input Types and Virtual Keyboards HTML 531

Adding Field Labels HTML 532

Designing a Form Layout HTML 534

Defining Default Values and Placeholders HTML 539

Session 7.1 Quick Check HTML 543

SESSION 7.2 HTML 544

Entering Date and Time Values HTML 546

Creating a Selection List HTML 547

Working with select Attributes HTML 549

Grouping Selection Options HTML 551

Creating Option Buttons HTML 553

Creating Check Boxes HTML 556

Creating a Text Area Box HTML 558

Session 7.2 Quick Check HTML 561

SESSION 7.3 HTML 562

Entering Numeric Data HTML 564

Creating a Spinner Control HTML 564

Creating a Range Slider HTML 566

Suggesting Options with Data Lists HTML 569

Working with Form Buttons HTML 572

Creating a Command Button HTML 572

Creating Submit and Reset Buttons HTML 572

Designing a Custom Button HTML 575

Validating a Web Form HTML 575

Identifying Required Values HTML 575

Validating Based on Data Type HTML 577

Testing for a Valid Pattern HTML 578

Defining the Length of the Field Value HTML 580

Applying Inline Validation HTML 581

Using the focus Pseudo-Class HTML 581

Pseudo-Classes for Valid and Invalid Data HTML 583

Session 7.3 Quick Check HTML 586

Review Assignments HTML 592

Case Problems HTML 595

Tutorial 8 Enhancing a Website with Multimedia*Working with Sound, Video, and Animation* . . . HTML 601**SESSION 8.1** HTML 602

Introducing Multimedia on the Web HTML 604

Understanding Codecs and Containers HTML 604

Understanding Plug-Ins HTML 605

Working with the audio Element HTML 607

Browsers and Audio Formats HTML 607

Applying Styles to the Media Player HTML 610

Providing a Fallback to an Audio Clip HTML 613

Exploring Embedded Objects HTML 615

Plug-In Attributes HTML 615

Plug-Ins as Fallback Options HTML 616

Session 8.1 Quick Check HTML 616

SESSION 8.2 HTML 618

Exploring Digital Video HTML 620

Video Formats and Codecs HTML 620

Using the HTML 5 video Element HTML 621

Adding a Text Track to Video HTML 624

Making Tracks with WebVTT HTML 625

Placing the Cue Text HTML 628

Applying Styles to Track Cues HTML 630

Using Third-Party Video Players HTML 634

Exploring the Flash Player HTML 635

Embedding Videos from YouTube HTML 636

HTML 5 Video Players HTML 637

Session 8.2 Quick Check HTML 639

SESSION 8.3 HTML 640

Creating Transitions with CSS HTML 642

Introducing Transitions HTML 642

Setting the Transition Timing HTML 644

Delaying a Transition HTML 647

Creating a Hover Transition HTML 647

Animating Objects with CSS HTML 652

The @keyframes Rule HTML 652

Applying an Animation HTML 655

Controlling an Animation HTML 658

Session 8.3 Quick Check HTML 666

Review Assignments HTML 673

Case Problems HTML 676

Tutorial 9 Getting Started with JavaScript*Creating a Countdown Clock* HTML 681**SESSION 9.1 HTML 682**

Introducing JavaScript HTML 684

Server-Side and Client-Side Programming HTML 684

The Development of JavaScript HTML 685

Working with the script Element HTML 686

Loading the script Element HTML 686

Inserting the script Element HTML 687

Creating a JavaScript Program HTML 689

Adding Comments to your JavaScript Code HTML 689

Writing a JavaScript Command HTML 690

Understanding JavaScript Syntax HTML 691

Debugging Your Code HTML 692

Opening a Debugger HTML 692

Inserting a Breakpoint HTML 694

Applying Strict Usage of JavaScript HTML 695

Session 9.1 Quick Check HTML 697

SESSION 9.2 HTML 698

Introducing Objects HTML 700

Object References HTML 701

Referencing Object Collections HTML 701

Referencing an Object by ID and Name HTML 703

Changing Properties and Applying Methods HTML 704

Object Properties HTML 704

Applying a Method HTML 704

Writing HTML Code HTML 705

Working with Variables HTML 709

Declaring a Variable HTML 709

Variables and Data Types HTML 710

Using a Variable HTML 711

Working with Date Objects HTML 711

Creating a Date Object HTML 712

Applying Date Methods HTML 713

Setting Date and Time Values HTML 716

Session 9.2 Quick Check HTML 717

SESSION 9.3 HTML 718

Working with Operators and Operands HTML 720

Using Assignment Operators HTML 720

Calculating the Days Left in the Year HTML 721

Working with the Math Object HTML 723

Using Math Methods HTML 723

Using Math Constants HTML 728

Working with JavaScript Functions HTML 730

Calling a Function HTML 732

Creating a Function to Return a Value HTML 733

Running Timed Commands HTML 734

Working with Time-Delayed Commands HTML 734

Running Commands at Specified Intervals HTML 734

Controlling How JavaScript Works with
Numeric Values HTML 736

Handling Illegal Operations HTML 736

Defining a Number Format HTML 737

Converting Between Numbers and Text HTML 737

Session 9.3 Quick Check HTML 739

Review Assignments HTML 744

Case Problems HTML 746

**Tutorial 10 Exploring Arrays, Loops, and Conditional
Statements***Creating a Monthly Calendar HTML 751***SESSION 10.1 HTML 752**

Introducing the Monthly Calendar HTML 754

Reviewing the Calendar Structure HTML 755

Adding the calendar() Function HTML 756

Introducing Arrays HTML 757

Creating and Populating an Array HTML 758

Working with Array Length HTML 761

Reversing an Array HTML 763

Sorting an Array HTML 764

Extracting and Inserting Array Items HTML 765

Using Arrays as Data Stacks HTML 766

Session 10.1 Quick Check HTML 769

SESSION 10.2 HTML 770

Working with Program Loops HTML 772

Exploring the for Loop HTML 772

Exploring the while Loop HTML 774

Exploring the do/while Loop HTML 775

Comparison and Logical Operators HTML 776

Program Loops and Arrays HTML 777

Array Methods to Loop Through Arrays HTML 780

Running a Function for Each Array Item HTML 781

Mapping an Array HTML 781

Filtering an Array HTML 782

Session 10.2 Quick Check HTML 785

SESSION 10.3 HTML 786

Introducing Conditional Statements HTML 788

Exploring the if Statement HTML 789

Nesting if Statements HTML 791

Exploring the if else Statement HTML 793

Using Multiple else if Statements HTML 794

Completing the Calendar App HTML 796

Setting the First Day of the Month HTML 797

Placing the First Day of the Month HTML 798

Writing the Calendar Days HTML 799

Highlighting the Current Date HTML 801

Displaying Daily Events HTML 803

Managing Program Loops and Conditional Statements	HTML 806
Exploring the break Command	HTML 806
Exploring the continue Command	HTML 806
Exploring Statement Labels	HTML 807
Session 10.3 Quick Check	HTML 809
Review Assignments	HTML 815
Case Problems	HTML 817

**Appendix A Color Names with Color Values,
and HTML Character EntitiesHTML A1**

Appendix B HTML Elements and Attributes ...HTML B1

Appendix C Cascading Styles and Selectors ..HTML C1

Appendix D Making the Web

More AccessibleHTML D1

Appendix E Designing for the Web.....HTML E1

Appendix F Page Validation with XHTMLHTML F1

GLOSSARYREF 1

INDEXREF 11

OBJECTIVES

Session 1.1

- Explore the history of the web
- Create the structure of an HTML document
- Insert HTML elements and attributes
- Insert metadata into a document
- Define a page title

Session 1.2

- Mark page structures with sectioning elements
- Organize page content with grouping elements
- Mark content with text-level elements
- Insert inline images
- Insert symbols based on character codes

Session 1.3

- Mark content using lists
- Create a navigation list
- Link to files within a website with hypertext links
- Link to email addresses and telephone numbers

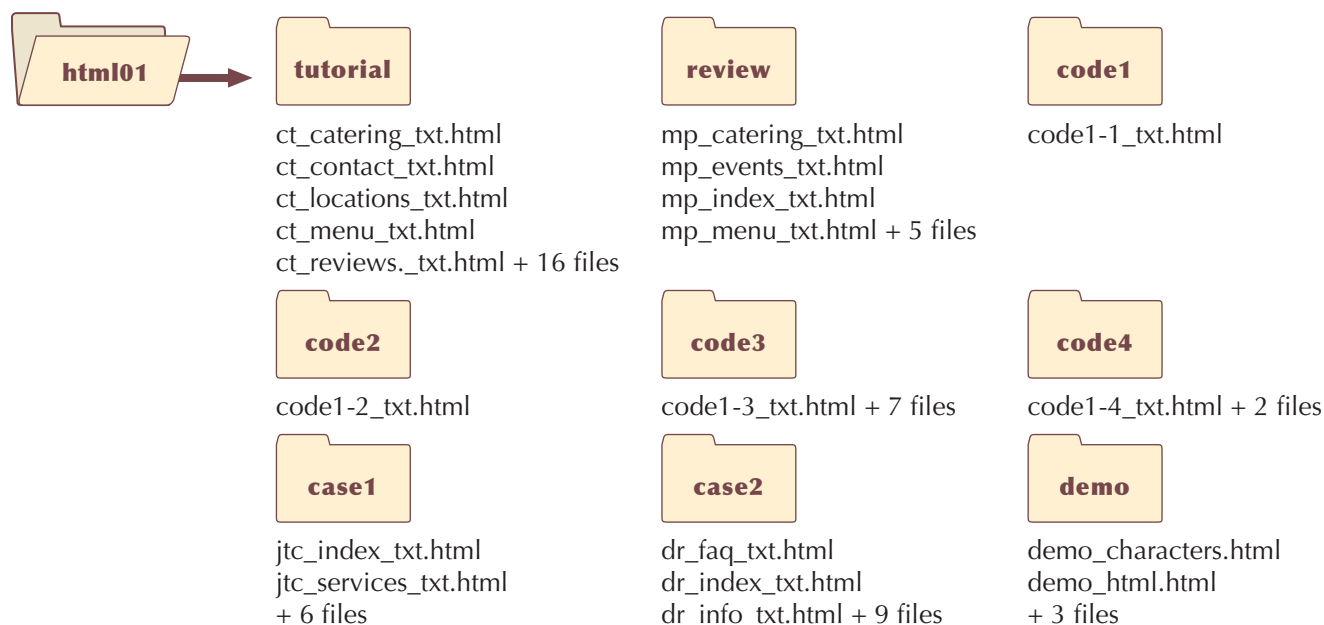
Getting Started with HTML 5

Creating a Website for a Food Vendor

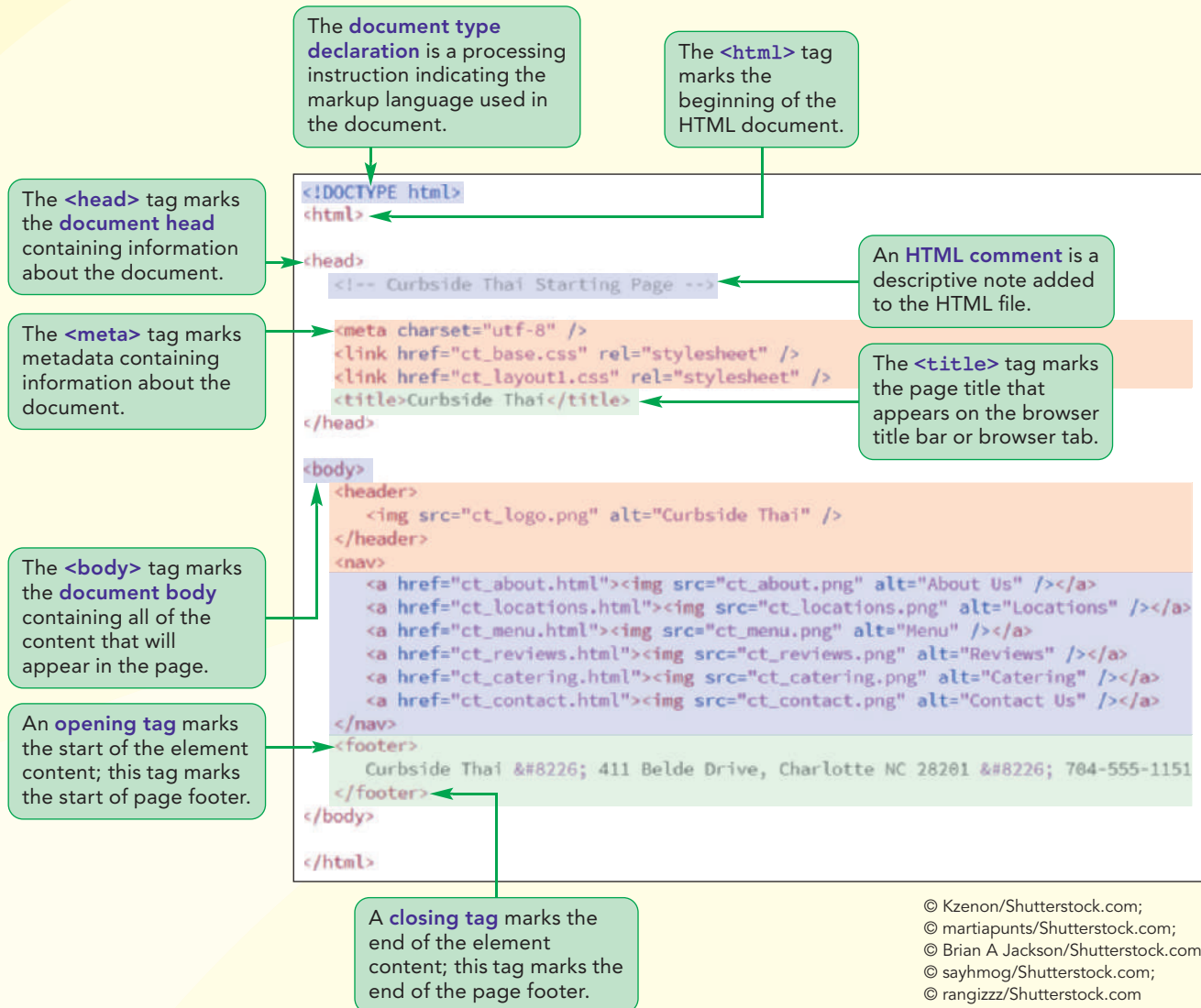
Case | *Curbside Thai*

Sajja Adulet is the owner and master chef of Curbside Thai, a restaurant owner and now food truck vendor in Charlotte, North Carolina that specializes in Thai dishes. Sajja has hired you to develop the company's website. The website will display information about Curbside Thai, including the truck's daily locations, menu, catering opportunities, and contact information. Sajja wants the pages to convey the message that customers will get the same great food and service whether they order in the restaurant or from the food truck. Some of the materials for these pages have already been completed by a former employee and Sajja needs you to finish the job by converting that work into a collection of web page documents. To complete this task, you'll learn how to write and edit HTML 5 code and how to get your HTML files ready for display on the World Wide Web.

STARTING DATA FILES



Session 1.1 Visual Overview:



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The Structure of an HTML Document

Document as it appears in the browser.



The exact layout of the document elements is determined by a style sheet and not by the document markup.

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Exploring the World Wide Web

It is no exaggeration to say that the World Wide Web has had as profound an effect on human communication as the printing press. One key difference is that operation of the printing press was limited to a few select tradesmen but on the web everyone can be a publisher of a website. Before creating your first website, you'll examine a short history of the web because that history impacts the way you write code for your web pages. You'll start by exploring the basic terminology of computer networks.

Networks

A **network** is a structure in which information and services are shared among devices known as **nodes** or **hosts**. A host can be any device that is capable of sending or receiving data electronically. The most common hosts that you will work with are desktop computers, laptops, tablets, mobile phones, and printers.

A host that provides information or a service to other devices on the network is called a **server**. For example, a print server provides printing services; a file server provides storage space for saving and retrieving files. The device receiving these services is called a **client**. A common network design is the **client-server network**, in which the clients access information provided by one or more servers.

Networks are classified based on the range of devices they cover. A network confined to a small geographic area, such as within a building or department, is referred to as a **local area network** or **LAN**. A network that covers a wider area, such as several buildings or cities, is called a **wide area network** or **WAN**. Wide area networks typically consist of two or more interconnected local area networks. The largest WAN in existence is the **Internet**, which incorporates an almost uncountable number of networks and hosts involving computers, mobile devices (such as phones, tablets, and so forth), MP3 players, and gaming systems.

Locating Information on a Network

The biggest obstacle to effectively using the Internet is the network's sheer scope and size. Most of the early Internet tools required users to master a bewildering array of terms, acronyms, and commands. Because network users had to be well versed in computers and network technology, Internet use was largely limited to programmers and computer specialists working for universities, large businesses, and the government.

The solution to this problem was developed in 1989 by Timothy Berners-Lee and other researchers at the CERN nuclear research facility near Geneva, Switzerland. They needed an information system that would make it easy for their researchers to locate and share data on the CERN network, and so developed a system of hypertext documents. **Hypertext** is a method of organization in which data sources are interconnected through a series of links or **hyperlinks** activated to jump from one data source to another. Hypertext is ideally suited for the Internet because end users don't need to know where a service is located—they only need to know how to activate the link. The effectiveness of this technique quickly spread beyond Geneva and was adopted across the Internet. The totality of these interconnected hypertext documents became known as the **World Wide Web**. The fact that the Internet and the World Wide Web are synonymous in many users' minds is a testament to the success of the hypertext approach.

Web Pages and Web Servers

Documents on the web are stored on **web servers** in the form of **web pages** and accessed through a software program called a **web browser**. The browser retrieves the

document from the web server and renders it in a form readable on a client device. However, because there is a wide selection of client devices ranging from desktop computers to mobile phones to screen readers that relay data aurally, each web page must be written in code that is compatible with every device. How does the same document work with so many different devices? To understand, you need to look at how web pages are created.

Introducing HTML

A web page is a simple text file written in **HTML (Hypertext Markup Language)**. You've already read about hypertext, but what is a markup language? A **markup language** is a language that describes the content and structure of a document by "marking up" or tagging, different document elements. For example, this tutorial contains several document elements such as the tutorial title, main headings, subheadings, paragraphs, figures, figure captions, and so forth. Using a markup language, each of these elements could be tagged as a distinct item within the "tutorial document." Thus, a Hypertext Markup Language is a language that supports tagging distinct document elements and connecting documents through hypertext links.

The History of HTML

In the early years, no single organization defined the rules or **syntax** of HTML. Browser developers were free to define and modify the language in different ways that, of course, led to problems as different browsers supported different "flavors" of HTML and a web page that was written based on one browser's standard might appear totally different when rendered by another browser. Ultimately, a group of web designers and programmers called the **World Wide Web Consortium**, or the **W3C**, settled on a set of standards or specifications for all browser manufacturers to follow. The W3C has no enforcement power, but, because using a uniform language is in everyone's best interest, the W3C's recommendations are usually followed, though not always immediately. Each new version of HTML goes through years of discussion and testing before it is formally adopted as the accepted standard. For more information on the W3C and its services, see its website at www.w3.org.

By 1999, HTML had progressed to the fourth version of the language, **HTML 4.01**, which provided support for multimedia, online commerce, and interactive scripts running within the web page. However, there were still many incompatibilities in how HTML was implemented across different browsers and how HTML code was written by web developers. The W3C sought to take control of what had been a haphazard process and enforce a stricter set of standards in a different version of the language called **XHTML (Extensible Hypertext Markup Language)**. By 2002, the W3C had released the specifications for XHTML 1.1. But XHTML 1.1 was intended to be only a minor upgrade on the way to XHTML 2.0, which would correct many of the deficiencies found in HTML 4.01 and become the future language of the web. One problem was that XHTML 2.0 would not be backward compatible with HTML and, as a result, older websites could not be easily brought into the new standard.

Web designers rebelled at this development and, in response, the **Web Hypertext Application Technology Working Group (WHATWG)** was formed in 2004 with the mission to develop a rival version to XHTML 2.0, called **HTML 5**. Unlike XHTML 2.0, HTML 5 would be compatible with earlier versions of HTML and would not apply the same strict standards that XHTML demanded. For several years, it was unclear which specification would win out; but by 2006, work on XHTML 2.0 had completely stalled and the W3C issued a new charter for WHATWG to develop HTML 5 as the de facto standard for the next generation of HTML. You can learn more about WHATWG and its current projects at www.whatwg.org. The current version of HTML is HTML 5.2, which achieved Recommendation status in 2017.

TIP

You can find out which browsers support the features of HTML 5 by going to the website caniuse.com.

As HTML has evolved, features and code found in earlier versions of the language are often **deprecated**, or phased out, and while deprecated features might not be part of HTML 5, that doesn't mean that you won't encounter them in your work—indeed, if you are maintaining older websites, you will often need to interpret code from earlier versions of HTML. Moreover, there are still many older browsers and devices in active use that do not support HTML 5. Thus, a major challenge for website designers is writing code that takes advantage of HTML 5 but is still accessible to older technology.

Figure 1–1 summarizes some of the different versions of HTML that have been implemented over the years. You can read detailed specifications for these versions at the W3C website.

Figure 1–1**HTML version history**

Version	Date	Description
HTML 1.0	1989	The first public version of HTML
HTML 2.0	1995	HTML version that added interactive elements including web forms
HTML 3.2	1997	HTML version that provided additional support for web tables and expanded the options for interactive form elements and a scripting language
HTML 4.01	1999	HTML version that added support for style sheets to give web designers greater control over page layout and appearance, and provided support for multimedia elements such as audio and video
XHTML 1.0	2001	A reformulation of HTML 4.01 using the XML markup language in order to provide enforceable standards for HTML content and to allow HTML to interact with other XML languages
XHTML 2.0	discontinued in 2009	The follow-up version to XHTML 1.1 designed to fix some of the problems inherent in HTML 4.01 syntax
HTML 5.0	2012	HTML version providing support for mobile design, semantic page elements, column layout, form validation, offline storage, and enhanced multimedia
HTML 5.2	2017	The current version of HTML 5

This book focuses on HTML 5, but you will also review some of the specifications for HTML 4.01 and XHTML 1.1. Deprecated features from older versions of HTML will be noted as such in the text.

Tools for Working with HTML

Because HTML documents are simple text files, the first tool you will need is a text editor. You can use a basic text editor such as Windows Notepad or TextEdit for the Macintosh, but it is highly recommended that you use one of the many inexpensive editors that provide built-in support for HTML. These editors include syntax checking to weed out errors and automatic insertion of HTML code. Some of the more popular HTML editors are Notepad++ (notepad-plus-plus.org), Eclipse (www.eclipse.org), and CoffeeCup (www.coffeecup.com).

These enhanced editors are a good way to start learning HTML and they will be all you need for most basic projects, but professional web developers working on large websites will quickly gravitate toward using a web **IDE (Integrated Development Environment)**, which is a software package providing comprehensive coverage of all

phases of the development process from writing HTML code to creating scripts for programs running on web servers. Some of the popular IDEs for web development include Adobe Dreamweaver (www.adobe.com), Aptana Studio (www.aptana.com), NetBeans IDE (netbeans.org), and Komodo IDE (komodoide.com). Web IDEs can be very expensive, but most software companies will provide a free evaluation period for you to test their product to see if it meets your needs.

Content Management Systems and Frameworks

You can also invest in a **web content management system (wcms)** which provides authoring tools for website content and administration. Management systems provide prepackaged templates so that users can get websites up and running with only a minimal knowledge of HTML. Popular content management systems include WordPress (www.wordpress.org), Joomla (www.joomla.org), and Drupal (www.drupal.org). Content management systems are not without drawbacks. A wcms can be expensive to maintain and put extra load on server resources. In addition, the templates and authoring tools can be difficult to modify if they don't exactly meet your needs.

A website usually involves the integration of many technologies and languages beyond HTML, including databases for storing and retrieving data and programs running on the web server for managing electronic commerce and communication. Managing all those technologies is the job of a **web framework** that provides the foundation of the design and deployment of web applications. Popular frameworks include Ruby on Rails (rubyonrails.org), ASP.NET (www.asp.net), AngularJS (angularjs.org), and Django (www.djangoproject.com).

Choosing among all these tools might seem intimidating to you. The bottom line is that no matter what tools you use, the final code for the website is written in HTML. So, even if that code is generated by a framework or content management system, you still need to understand HTML to effectively manage your website. In this book, we'll try to keep things as simple as possible: just you, a text editor, and a web browser creating a foundation for future study.

Testing your Code

TIP

You can analyze each browser for its compatibility with HTML 5 at the website www.html5test.com.

Once you've written your code, you can test whether your HTML code employs proper syntax and structure by validating it at the W3C validation website (validator.w3.org). **Validators**, like the one available through the W3C website, are programs that test code to ensure that it contains no syntax errors. The W3C validator will highlight all of the syntax errors in your document with suggestions about how to fix those errors.

Finally, you'll need to test it to ensure that your content is rendered correctly. You should test your code under a variety of screen resolutions, on several different browsers and, if possible, on different versions of the same browser because users are not always quick to upgrade their browsers. What may look good on a widescreen monitor might look horrible on a mobile phone. At a minimum you should test your website using the following popular browsers: Google Chrome, Internet Explorer, Apple Safari, Mozilla Firefox, and Opera.

It is not always possible to load multiple versions of the same browser on one computer, so, in order to test a website against multiple browser versions, professional designers will upload their code to online testing services that report on the website's compatibility across a wide range of browsers, screen resolutions, and devices, including both desktop and mobile devices. Among the popular testing services are BrowserStack (www.browserstack.com), CrossBrowserTesting (www.crossbrowsertesting.com), and Browsera (www.browsera.com). Most of these sites charge a monthly connection fee with a limited number of testing minutes, so you should not upload your code until you are past the initial stages of development.

Exploring an HTML Document

Now that you have reviewed the history of the web and some of the challenges in developing your own website, you will look at the code of an actual HTML file. To get you started, Sajja Adulet has provided you with the `ct_start.html` file containing the code for the initial page users see when they access the Curbside Thai website. Open Sajja's file now.

TIP

All HTML files have the file extension `.html` or `.htm`.

To open the `ct_start.html` file:

1. Use the editor of your choice to open the `ct_start.html` file from the `html01` tutorial folder.

Figure 1–2 shows the complete contents of the file as viewed in the Notepad++ editor.

Figure 1–2

Elements and attributes from an HTML document

```
<!DOCTYPE html>
<html>
<head>
  <title>Curbside Thai</title>
  <meta charset="utf-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1" />
  <link href="ct_base.css" rel="stylesheet" />
  <link href="ct_layout1.css" rel="stylesheet" />
</head>
<body>
  <header>
    
  </header>
  <nav>
    <a href="ct_about.html"></a>
    <a href="ct_locations.html"></a>
    <a href="ct_menu.html"></a>
    <a href="ct_reviews.html"></a>
    <a href="ct_catering.html"></a>
    <a href="ct_contact.html"></a>
  </nav>
  <footer>
    Curbside Thai &#8226; 411 Belde Drive, Charlotte NC 28201 &#8226; 704-555-1151
  </footer>
</body>
</html>
```

Trouble? Depending on your editor and its configuration, the text style applied to your code might not match that shown in Figure 1–2. This is not a problem. Because HTML documents are simple text files, any text styles are a feature of the editor and have no impact on how the document is rendered by the browser.

2. Scroll through the document to become familiar with its content but do not make any changes to the text.

The Document Type Declaration

The first line in an HTML file is the document type declaration or doctype, which is a processing instruction indicating the markup language used in the document. The browser uses the document type declaration to know which standard to use for displaying the content. For HTML 5, the doctype is entered as

```
<!DOCTYPE html>
```

You might also see the doctype entered in lowercase letters as

```
<!doctype html>
```

Both are accepted by all browsers. Older versions of HTML had more complicated doctypes. For example, the doctype for HTML 4.01 is the rather foreboding

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN"
"http://www.w3.org/TR/html4/strict.dtd">
```

You might even come across older HTML files that do not have a doctype. Because early versions of HTML did not require a doctype, many browsers interpret the absence of the doctype as a signal that the page should be rendered in **quirks mode**, based on styles and practices from the 1990s and early 2000s. When the doctype is present, browsers will render the page in **standards mode**, employing the most current specifications of HTML. The difference between quirks mode and standards mode can mean the difference between a nicely laid-out page and a confusing mess, so always put your HTML 5 file in standards mode by including the doctype.

Introducing Element Tags

The fundamental building block in every HTML document is the **element tag**, which marks an element in the document. A **starting tag** indicates the beginning of that element, while an **ending tag** indicates the ending. The general syntax of a two-sided element tag is

```
<element>content</element>
```

where *element* is the name of the element, *content* is the element's content, *<element>* is the starting tag, and *</element>* is the ending tag. The following code marks a paragraph element enclosed within the *<p>* and *</p>* tags:

```
<p>Welcome to Curbside Thai.</p>
```

The *<p></p>* tags indicate the presence of a paragraph and the text *Welcome to Curbside Thai.* comprises the paragraph text.

Not every element tag encloses document content. **Empty elements** are elements that are either nontextual (such as images) or contain directives to the browser about how the page should be treated. An empty element is entered using one of the following forms of the **one-sided element tag**:

```
<element />
```

or

```
<element>
```

The following *br* element indicates the presence of a line break in the text, and thus does not contain any content:

```
<br />
```

Note that, while this code could also be entered as *
*, the ending slash */>* form is required in XHTML documents as well as other markup languages. While HTML 5 allows for either form, it's a good idea to get accustomed to using the ending slash */>* form if you intend to work with other markup languages. We'll follow the */>* convention in the code in this book.

Elements can contain other elements, which are called **nested elements**. In the following code, the *em* element (used to mark emphasized text) is nested within the paragraph element by placing the ** tag completely within the *<p>* tag.

Proper syntax:

```
<p>Welcome to <em>Curbside Thai</em>.</p>
```

When nesting one element inside of another, the entire code of the inner element must be contained within the outer element, including opening and closing tags. Thus, it would not be correct to place the closing tag for the `em` element outside of the `p` element as in the following code:

Improper syntax:

```
<p>Welcome to <em>Curbside Thai</p>.</em>
```

Now that you've examined the basics of tags, you'll examine at how they're organized within an HTML file.

The Element Hierarchy

The entire structure of an HTML document can be thought of as a set of nested elements in a hierarchical tree. At the top of the tree is the `html` element marking the entire document. Within the `html` element is the `head` element enclosing information about the document itself and the `body` element enclosing the content of the web page. Thus, the general structure of an HTML file, like the one shown in Figure 1–2, is

```
<!DOCTYPE html>
<html>
  <head>
    head content
  </head>

  <body>
    body content
  </body>
</html>
```

where *head content* and *body content* are nested elements placed within the document head and body. Note that the `body` element is always placed after the `head` element.

REFERENCE

Creating the Basic Structure of an HTML File

- To create the basic structure of an HTML file, enter the tags

```
<!DOCTYPE html>
<html>
  <head>
    head content
  </head>

  <body>
    body content
  </body>
</html>
```

where *head*, *content*, and *body content* contain nested elements that mark the content of the head and body sections.

TIP

Attributes can be listed in any order but they must come after the element name and be separated from each other by a blank space; each attribute value must be enclosed within single or double quotation marks.

Introducing Element Attributes

Elements often contain one or more **element attributes** providing additional information about the purpose of the element or how the element should be handled by the browser. The general syntax of an element attribute within a two-sided tag is

```
<element attr1="value1" attr2="value2" ...>
    content
</element>
```

Or, for a one-sided tag

```
<element attr1="value1" attr2="value2" ... />
```

where *attr1*, *attr2*, and so forth are attributes associated with *element* and *value1*, *value2*, and so forth are the corresponding attribute values. For example, the following code adds the `id` attribute with the value "intro" to the `<p>` tag in order to identify the paragraph as an introductory paragraph.

```
<p id="intro">Welcome to Curbside Thai.</p>
```

Each element has its own set of attributes but, in addition to these element-specific attributes, there is a core set of attributes that can be applied to almost every HTML element. Figure 1–3 lists some of the most commonly used core attributes; others are listed in Appendix B.

Figure 1–3

Commonly used core HTML attributes

Attribute	Description
<code>class="text"</code>	Defines the general classification of the element
<code>dir="ltr rtl auto"</code>	Defines the text direction of the element content as left-to-right, right-to-left, or determined by the browser
<code>hidden</code>	Indicates that the element should be hidden or is no longer relevant
<code>id="text"</code>	Provides a unique identifier for the element
<code>lang="text"</code>	Specifies the language of the element content
<code>style="definition"</code>	Defines the style or appearance of the element content
<code>tabindex="integer"</code>	Specifies the tab order of the element (when the tab button is used to navigate the page)
<code>title="text"</code>	Assigns a title to the element content

For attributes that do not require a value, HTML supports **attribute minimization** by removing the attribute value completely. For example, the `hidden` attribute used in the following code does not require a value; its mere presence indicates that the marked paragraph should be hidden in the rendered page.

```
<p hidden>Placeholder Text</p>
```

Attribute minimization is another example of how HTML 5 differs from other markup languages such as XHTML in which minimization is not allowed and all attributes must have attribute values.

Adding an Attribute to an Element

- To add an attribute to an element, enter

```
<element attr1="value1" attr2="value2" ...>
    content
</element>
```

where *attr1*, *attr2*, and so forth are HTML attributes associated with *element* and *value1*, *value2*, and so forth are the corresponding attribute values.

Handling White Space

An HTML file is composed only of text characters and white-space characters. A **white-space character** is any empty or blank character such as a space, tab, or line break.

The browser reading the HTML code ignores the presence of white-space characters between element tags and makes no distinction between spaces, tabs, or line breaks. Thus, a browser will treat the following two pieces of code the same:

```
<p>Welcome to <em>Curbside Thai</em>.</p>
```

and

```
<p>
    Welcome to <em>Curbside Thai</em>.
</p>
```

The browser also collapses consecutive occurrences of white-space characters into a single occurrence, so that the text of the paragraph in the following code is still treated as “Welcome to Curbside Thai”, ignoring the extra white spaces between “Curbside” and “Thai”.

```
<p>
    Welcome to <em>Curbside      Thai</em>.
</p>
```

The bottom line is that it doesn’t matter how you lay out your HTML code because the browser is only interested in the text content and not how that text is entered. This means you can make your file easier to read by indenting lines and by adding extra white-space characters to separate one code block from another. However, this also means that any formatting you do for the page text to make the code more readable, such as tabs or extra white spaces, is *not* transferred to the web page.

Viewing an HTML File in a Browser

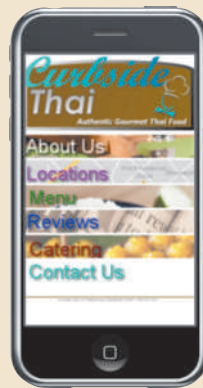
The structure of the HTML file shown in Figure 1–2 should now be a little clearer, even if you don’t yet know how to interpret the meaning and purpose of each of element and attribute. To see what this page looks like, open it within a web browser.

To open the `ct_start.html` file in a web browser:

1. Open your web browser. You do not need to be connected to the Internet to view local files stored on your computer.
2. After your browser loads its home page, open the `ct_start.html` file from the `html01 ► tutorial` folder. Figure 1–4 shows the page as it appears on a mobile phone and on a tablet device. The two devices have different screen widths, which affects how the page is rendered.

Figure 1–4

The Curbside Thai starting page as rendered by a mobile and tablet device



mobile device



tablet device

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 © Brian A. Jackson/Shutterstock.com; © sayhmog/Shutterstock.com;
 © rangizz/Shutterstock.com; BenBois/opencolipart;
 Jmlevick/opencolipart

Trouble? If you're not sure how to open a local file with your browser, check for an Open or Open File command under the browser's File menu. You can also open a file by double-clicking the file name from within Windows Explorer or Apple Finder.

3. Reduce the width of your browser window and note that when the width falls below a certain value (in this case 480 pixels), the layout automatically changes to a stacked row of images (as shown in the mobile device image in Figure 1–4) that are better suited to the narrower layout.
4. Increase the width of the browser window and confirm that the layout changes to a 2×3 grid of images (as shown in the tablet device image in Figure 1–4), which is a design more appropriate for the wider window.

Figure 1–4 illustrates an important principle: *HTML does not describe the document's appearance, it only describes the document's content and structure.* The same HTML document can be rendered differently on different devices or screen sizes. The actual appearance of the document is determined by style sheets—a topic you'll explore later in this tutorial.

Creating an HTML File

Now that you've studied the structure of an HTML file, you'll start creating your own documents for the Curbside Thai website. Sajja wants you to create a web page containing information about the restaurant. Start by inserting the doctype and the markup tags for the `html`, `head`, and `body` elements. You will also specify English (`en`) as the language of the web page by adding the `lang` attribute to the `<html>` tag.

TIP

HTML filenames should be entered in lowercase letters and have no blank spaces.

To begin writing the HTML file:

1. Using the editor of your choice, create a new blank HTML file in the html01 ► tutorial folder, saving the file as **ct_about.html**.
2. Enter the following code into the file:

```
<!DOCTYPE html>
<html lang="en">

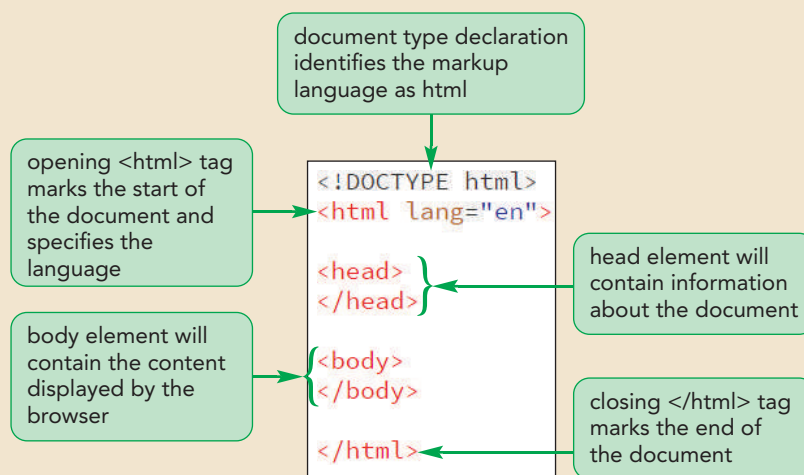
<head>
</head>

<body>
</body>

</html>
```

Figure 1–5 shows the initial elements in the document.

Figure 1–5 Initial structure of the ct_about.html file



3. Save your changes to the file.

Next, you'll add elements to the document head.



PROSKILLS

Written Communication: Writing Effective HTML Code

Part of writing good HTML code is being aware of the requirements of various browsers and devices, as well as understanding the different versions of the language. Here are a few guidelines for writing good HTML code:

- Become well versed in the history of HTML and the various versions of HTML and XHTML. Unlike other languages, HTML's history does impact how you write your code.
- Know your market. Do you have to support older browsers, or have your clients standardized on one particular browser or browser version? Will your web pages be viewed on a single device such as a computer, or do you have to support a variety of devices?
- Test your code on several different browsers and browser versions. Don't assume that if your page works in one browser, it will work in other browsers or even in earlier versions of the same browser. Also check on the speed of the connection. A large file that performs well with a high-speed connection might be unusable with a slower connection.
- Read the documentation on the different versions of HTML and XHTML at the W3C website and keep up to date with the latest developments in the language.

To effectively communicate with customers and users, you need to make sure your website content is always readable. Writing good HTML code is a great place to start.

Creating the Document Head

The document head contains **metadata**, which is content that describes the document or provides information about how the document should be processed by the browser. Figure 1–6 describes the different metadata elements found in the document head.

Figure 1–6 HTML metadata elements

Element	Description
head	Contains a collection of metadata elements that describe the document or provide instructions to the browser
base	Specifies the document's location for use with resolving relative hypertext links
link	Specifies an external resource that the document is connected to
meta	Provides a generic list of metadata values such as search keywords, viewport properties, and the file's character encoding
script	Provides programming code for programs to be run within the document
style	Defines the display styles used to render the document content
title	Stores the document's title or name, usually displayed in the browser title bar or on a browser tab

The first metadata you'll add to the About Curbside Thai web page is the `title` element.

Setting the Page Title

The `title` element is part of the document head because it's not displayed within the web page, but rather in the browser title bar or browser tab. Page titles are defined using the following `title` element

```
<title>document title</title>
```

where *document title* is the text of the title. Add a page title to the Curbside Thai page now.

REFERENCE

Adding a Document Title

- To define the document title, enter the following tag into the document head:

```
<title>document title</title>
```

where *document title* is the text that will appear on the browser title bar or a browser tab.

TIP

Document titles should be no more than 64 characters in length to ensure that the text fits on the browser title bar or a browser tab.

To insert the document title:

1. Directly after the opening `<head>` tag, insert the following `title` element, indented to make the code easier to read.

```
<title>About Curbside Thai</title>
```

Figure 1–7 highlights the code for the page title.

Figure 1–7

Entering the document title

title text that appears in the browser title bar or on a browser tab

```
<!DOCTYPE html>
<html lang="en">
<head>
  <title>About Curbside Thai</title>
</head>

<body>
</body>

</html>
```

2. Save your changes to the file.

Adding Metadata to the Document

Another metadata is the `meta` element, which is used for general lists of metadata values. The `meta` element structure is

```
<meta attributes />
```

where *attributes* define the type of metadata that is to be added to a document. Figure 1–8 lists the attributes of the `meta` element.

Figure 1–8 Attributes of the meta element

Attribute	Description
<code>charset="encoding"</code>	Specifies the character encoding used in the HTML document
<code>content="text"</code>	Provides the value associated with the <code>http-equiv</code> or <code>name</code> attributes
<code>http-equiv="content-type default-style refresh"</code>	Provides an HTTP header for the document's content, default style, or refresh interval (in seconds)
<code>name="text"</code>	Sets the name associated with the metadata

For example, you can use the following `meta` element to provide a collection of keywords for the Curbside Thai website that would aid web search engines, such as Google or Bing search tools, to locate the page for potential customers:

```
<meta name="keywords" content="Thai, restaurant, Charlotte, food" />
```

The `name` attribute defines the type of metadata and the `content` attribute provides the data values. HTML does not specify a set of values for the `name` attribute, but commonly used names include `keywords`, `description`, `author`, and `viewport`.

TIP

The title element and the charset meta element are both required in a valid HTML 5 document.

Another use of the `meta` element is to define the character encoding used in the HTML file. **Character encoding** is the process by which the computer converts text into a sequence of bytes when it stores the text and then converts those bytes back into characters when the text is read. The most common character encoding is **UTF-8**, which supports almost all of the characters you will need. To indicate that the document is written using UTF-8, add the following `meta` element to the document head:

```
<meta charset="utf-8" />
```

The `charset` attribute was introduced in HTML 5 and replaces the following more complicated expression used in earlier versions of HTML:

```
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
```

REFERENCE**Adding Metadata to the Document**

- To define the character encoding used in the document, enter

```
<meta charset="encoding" />
```

 where *encoding* is the character encoding used in the document.
- To define search keywords associated with the document, enter

```
<meta name="keywords" content="terms" />
```

 where *terms* is a comma-separated list of keyword terms.

Add `meta` elements to the document head now, providing the character set and a list of keywords describing the page.

TIP

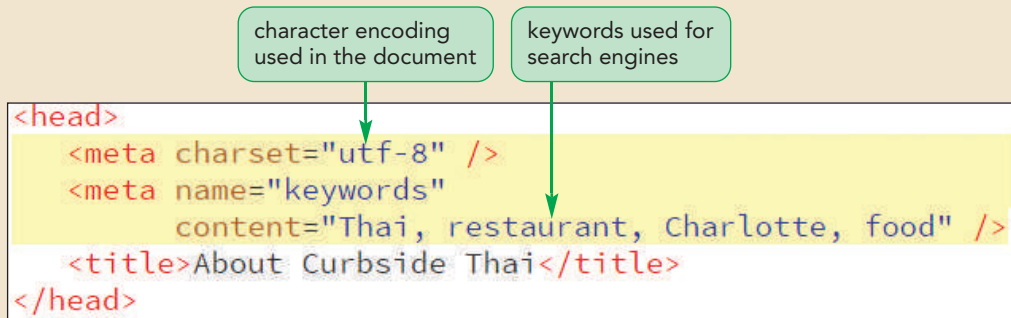
The `<meta>` tag that defines the character encoding should always be the first meta element in the document head.

To insert metadata:

1. Directly after the opening `<head>` tag, insert the following meta elements, indented to make the code easier to read:

```
<meta charset="utf-8" />
<meta name="keywords"
      content="Thai, restaurant, Charlotte, food" />
```

Figure 1–9 highlights the newly added meta elements used in the document head.

Figure 1–9**Adding metadata to a document**

2. Save your changes to the file.
3. Open the **ct_about.html** file in your browser. Confirm that the browser tab or browser title bar contains the text "About Curbside Thai". There should be no text displayed in the browser window because you have not added any content to the page body yet.

Before continuing with your edits to the `ct_about.html` file, you should document your work. You can do this with HTML comments.

Adding Comments to Your Document

An HTML comment is descriptive text that is added to the HTML file but that does not appear in the page. Comments can include the name of the document's author, the date the document was created, and the purpose for which the document was created. Comments are added with the following markup:

```
<!-- comment -->
```

where *comment* is the text of the comment or note. For example, the following code inserts a comment describing the Curbside Thai page:

```
<!-- General Information about Curbside Thai -->
```

TIP

Always include comments when working with a team so that you can document the development process for other team members.

A comment can be spread across several lines as long as the comment begins with `<!--` and ends with `-->`. Because comments are ignored by the browser, they can be added anywhere within a document, though it's good practice to always include a comment in the document head in order to describe the document content that follows.

Adding a Comment to an HTML Document

- To insert a comment anywhere within your HTML document, enter

```
<!-- comment -->
```

where *comment* is the text of the HTML comment.

Add comments to the `ct_about.html` file indicating the document's author, date of creation, and purpose.

HTML comments must be closed with the `-->` characters.

To add a comment to the document:

1. Return to the `ct_about.html` file in your HTML editor.
2. Directly after the opening `<head>` tag, insert the following comment text, indented to make the code easier to read:

```
<!--
New Perspectives on HTML 5 and CSS, 8th Edition
Tutorial 1
Tutorial Case
General Information about Curbside Thai
Author: your name
Date: the date

Filename: ct_about.html
-->
```

where **your name** is your name and **the date** is the current date. Figure 1–10 highlights the newly added comment in the file.

Figure 1–10 Adding a comment to the document

Comment added to the document

```
<head>
<!--
  New Perspectives on HTML5 and CSS3, 8th Edition
  Tutorial 1
  Tutorial Case
  General Information about Curbside Thai
  Author:  Sajja Adulet
  Date:    3/1/2021
  Filename: ct_about.html
-->
  <meta charset="utf-8" />
  <meta name="keywords"
        content="Thai, restaurant, Charlotte, food" />
  <title>About Curbside Thai</title>
</head>
```

3. Save your changes to the file.

Conditional Comments and Internet Explorer

Another type of comment you will encounter in many HTML files is a **conditional comment**, which encloses content that should only be run by particular versions of the Internet Explorer browser. The general form of the conditional comment is

```
<!-- [if operator IE version]>
    content
<![endif]-->
```

where *operator* is a logical operator (such as less than or greater than), *version* is the version number of an Internet Explorer browser, and *content* is the HTML code that will be run only if the conditional expression is true. The following code uses the lt (less than) logical operator to warn users that they need to upgrade their browser if they are running Internet Explorer prior to version 8.

```
<!-- [if lt IE 8]>
    <p>Upgrade your browser to view this page.</p>
<![endif]-->
```

Other logical operators include lte (less than or equal to), gt (greater than), gte (greater than or equal to), and ! (not). For example, the following code uses the logical operator ! to display the paragraph text only when the browser is *not* Internet Explorer:

```
<!-- [if !IE]>
    <p>You are not running Internet Explorer.</p>
<![endif]-->
```

Note that if you omit the version number, the conditional comment is applied to all Internet Explorer versions.

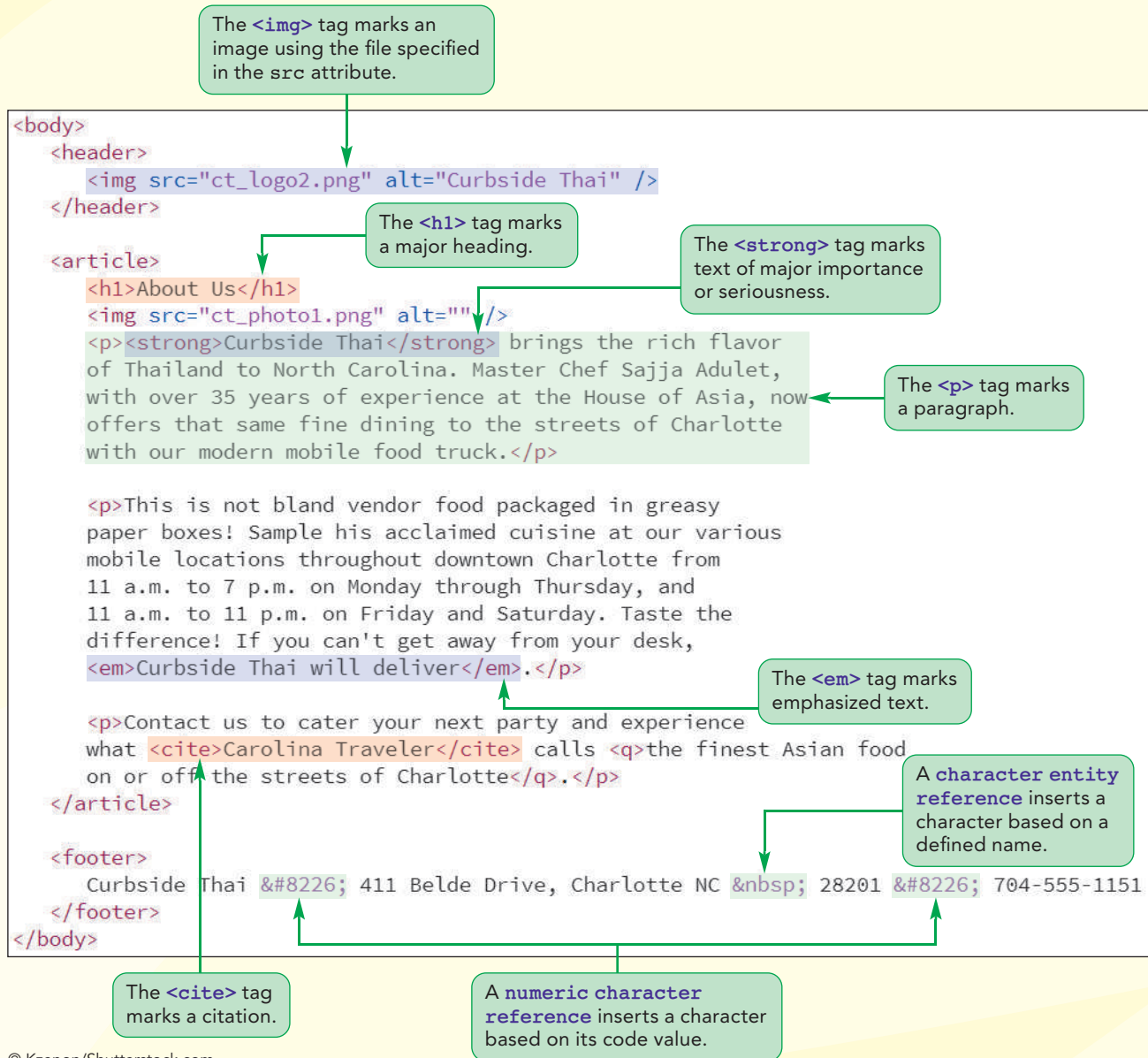
The need for conditional comments arose because Internet Explorer significantly differed from other browsers in how it implemented HTML and there was a need to separate the code meant for the IE browser from code meant for other browsers. This is not as much of a problem with Microsoft ending development of Internet Explorer in favor of the Edge browser, but you may still encounter legacy websites that use conditional comments in their code.

In the next session, you'll continue your work on the ct_about.html file by adding content to the page body.

Session 1.1 Quick Check

1. What is a markup language?
 - a. A language used for e-commerce websites
 - b. A language describing the content and structure of a document by tagging document elements
 - c. A language introduced by Microsoft for use in web browsers
 - d. A language that defines the appearance of web pages for computers and cell phones
2. WordPress is a:
 - a. web browser
 - b. text editor
 - c. web content management system
 - d. web framework
3. What does W3C stand for?
 - a. World Wide Web Computing
 - b. World Wide Web Corporation
 - c. World Wide Web Creators
 - d. World Wide Web Consortium
4. Which of the following is the proper form of an HTML 5 doctype?
 - a. `<doctype html>`
 - b. `<DOCTYPE html>`
 - c. `<doctype>html</doctype>`
 - d. `<!DOCTYPE html>`
5. Which of the following defines the page title for an HTML document?
 - a. `<title>My Web Page</title>`
 - b. `<pageTitle>My Web Page</title>`
 - c. `<head id="title">My Web Page</title>`
 - d. `<titleStart>My Web Page</titleEnd>`
6. Which of the following is *not* proper HTML syntax?
 - a. `<p>Welcome to my web page</p>`
 - b. `<p>Welcome to my web page</p>`
 - c. `<p>
Welcome to my
web page
</p>`
 - d. `<p>Welcome to my
web page
</p>`
7. Which of the following defines “restaurant” as a search keyword for a web page?
 - a. `<keyword>restaurant</keyword>`
 - b. `<meta>restaurant</meta>`
 - c. `<meta name="keywords" content="restaurant" />`
 - d. `<meta keyword="restaurant" type="search" />`
8. Which of the following uses the proper syntax for creating an HTML comment?
 - a. `<! Home page for my personal website>`
 - b. `<comment>Home page for my personal website</comment>`
 - c. `// Home page for my personal website`
 - d. `<!-- Home page for my personal website -->`
9. True or false: HTML describes how content should be rendered by the browser.

Session 1.2 Visual Overview:



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HTML Page Elements

The opening paragraph of the article is marked with the <p> tag.

Images are added to the web page.

The main heading of the article is marked with the <h1> tag.

The restaurant name is marked with the tag to indicate its importance.

About Us

Curbside Thai brings the rich flavor of Thailand to North Carolina. Owner and chef Sajja Adulet, with over 35 years of experience as the award-winning master chef at the House of Asia, now offers that same fine dining to the streets of Charlotte through our modern mobile food truck.

This is not bland vendor food packaged in greasy paper boxes! Sample our acclaimed cuisine at our various mobile locations throughout downtown Charlotte from 11 a.m. to 7 p.m. (M-R) and 11 a.m. to 11 p.m. on Friday and Saturday. Taste the difference! If you can't get away from your desk, *Curbside Thai will deliver.*

Contact us to cater your next party and experience what *Carolina Traveler* calls "the finest Asian food on or off the streets of Charlotte."


Curbside Thai • 411 Belde Drive, Charlotte NC 28201 • 704-555-1151

Nonbreaking space is inserted with the character entity reference.

A citation to a magazine is marked with the <cite> tag.

An example of emphasized text is marked with the tag.

Bullet characters are inserted with the • numeric character reference.



Writing the Page Body

Now that you have created the document head of the About Curbside Thai web page, you'll begin writing the document body, starting with general markup tags identifying the major sections of the page body, and working inward to more specific content within those sections.

Using Sectioning Elements

The first task in designing the page body is identifying the page's major topics. A page typically has a header, one or more articles that are the chief focus of the page, and a footer that provides contact information for the author or company. HTML marks these major topical areas using the **sectioning elements** described in Figure 1–11.

Figure 1–11 HTML sectioning elements

Element	Description
address	Marks contact information for an individual or group
article	Marks a self-contained composition in the document such as a newspaper story
aside	Marks content that is related to a main article
body	Contains the entire content of the document
footer	Contains closing content that concludes an article or section
h1, h2, h3, h4, h5, h6	Marks major to minor headings with h1 representing the heading with the highest rank, h2 representing next highest-ranked heading, and so forth
header	Contains opening content that introduces an article or section
nav	Marks a list of hypertext or navigation links
section	Marks content that shares a common theme or purpose on the page

For example, a news blog page might contain several major topics. To identify these areas, the HTML code for the blog might include the following elements marking off the page's header, navigation list, article, aside, and footer.

```
<body>
  <header>
  </header>
  <nav>
  </nav>
  <article>
  </article>
  <aside>
  </aside>
  <footer>
  </footer>
</body>
```

TIP

Sectioning elements can be nested within each other; an article might contain its own header, footer, and collection of navigation links.

These sectioning elements are also referred to as **semantic elements** because the tag name describes the purpose of the element and the type of content it contains. Even without knowing much about HTML, the page structure defined in the above code is easily understood from the tag names.

REFERENCE

Defining Page Sections

- To mark the page header, use the `header` element.
- To mark self-contained content, use the `article` element.
- To mark a navigation list of hypertext links, use the `nav` element.
- To mark a sidebar, use the `aside` element.
- To mark the page footer, use the `footer` element.
- To group general content, use the `section` element.

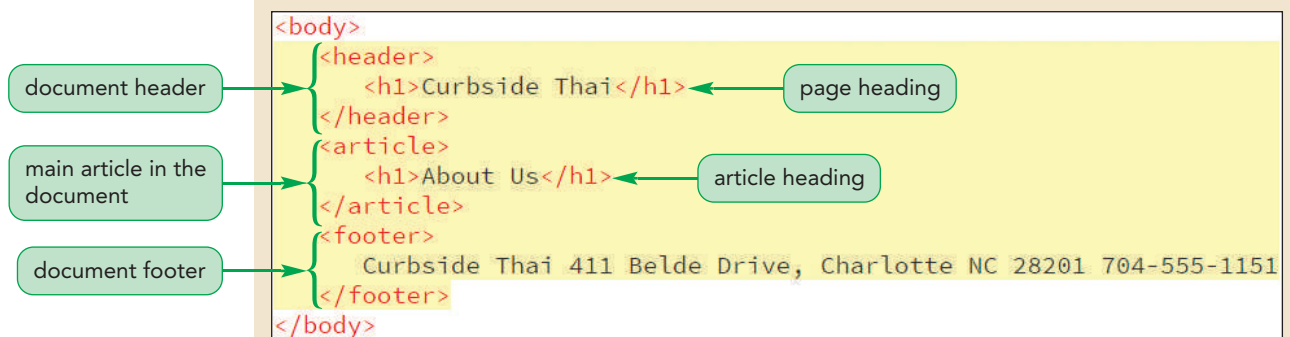
The About Curbside Thai page will have a simple structure containing a header, a single article, and a footer. Within the header, there will be an `h1` element providing a main topic heading (not to be confused with the document title, which is displayed on the browser title bar or a browser tab). Add this structure to the document body.

To define the sections in the page body:

1. If you took a break after the previous session, return to the `ct_about.html` file in your HTML editor.
2. Directly after the opening `<body>` tag, insert the following HTML code, indented to make the code easier to read:

```
<header>
  <h1>Curbside Thai</h1>
</header>
<article>
  <h1>About Us</h1>
</article>
<footer>
  Curbside Thai 411 Belde Drive, Charlotte NC 28201 704-555-1151
</footer>
```

Figure 1–12 highlights the sectioning elements used in the page body.

Figure 1–12**Adding sectioning elements to the page body**

3. Save your changes to the file.

Comparing Sections in HTML 4 and HTML 5

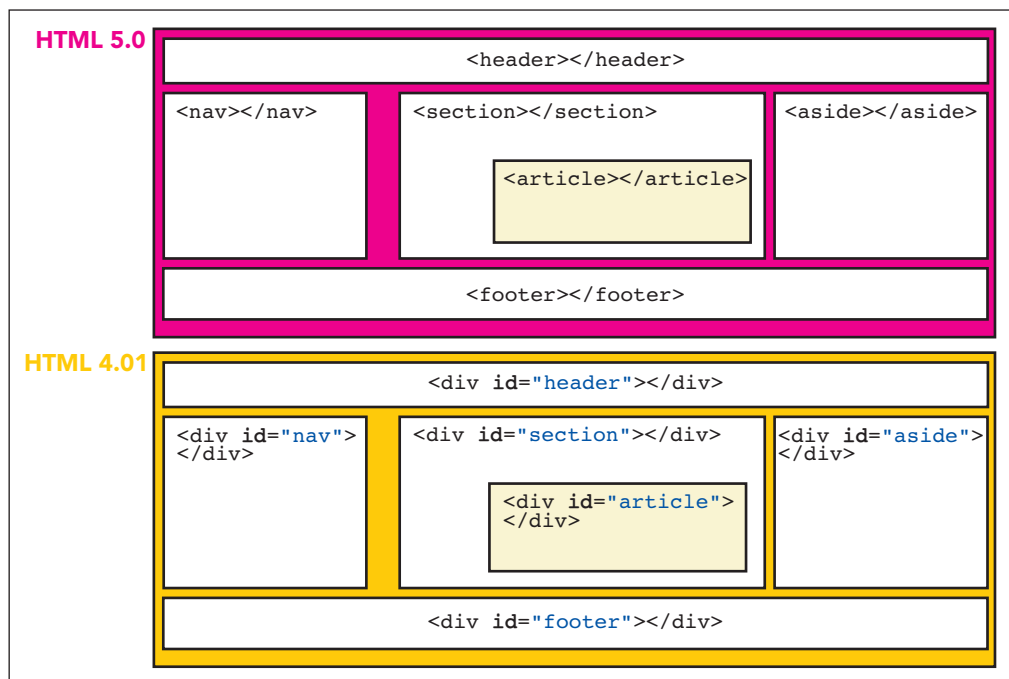
Many of the sectioning elements described in Figure 1–11 were introduced in HTML 5. Prior to HTML 5, sections were defined as divisions created using the following `div` element:

```
<div id="id">
  content
</div>
```

where *id* uniquely identifies the division. Figure 1–13 shows how the same page layout marked up using sectioning elements in HTML 5 would have been defined in HTML 4.01 using `div` elements.

Figure 1–13

Sections in HTML 5.0 vs. divisions in HTML 4.01



One problem with `div` elements is that there are no rules for `ids`. One web designer might identify the page heading with the `id` *header*, while another designer might use *heading* or *top*. The lack of consistency makes it harder for search engines to identify the page's main topics. The advantage of the HTML 5 sectioning elements is that their tag name indicates their purpose in the document, leading to greater uniformity in how pages are designed and interpreted. However, you might still encounter use of the `div` element in older websites and within the code generated by web frameworks.

Using Grouping Elements

Within sectioning elements are **grouping elements**. Each grouping element organizes similar content into a distinct group, much like a paragraph groups sentences that share a common theme. Figure 1–14 describes the HTML grouping elements.

Figure 1–14 HTML grouping elements

Element	Description
<code>blockquote</code>	Contains content that is quoted from another source, often with a citation and often indented on the page
<code>div</code>	Contains a generic grouping of elements within the document
<code>dl</code>	Marks a description list containing one or more <code>dt</code> elements with each followed by one or more <code>dd</code> elements
<code>dt</code>	Contains a single term from a description list
<code>dd</code>	Contains the description or definition associated with a term from a description list
<code>figure</code>	Contains an illustration, photo, diagram, or similar object that is cross-referenced elsewhere in the document
<code>figcaption</code>	Contains the caption associated with a figure
<code>hr</code>	Marks a thematic break such as a scene change or a transition to a new topic (often displayed as a horizontal rule)
<code>main</code>	Marks the main content of the document or application; only one <code>main</code> element should be used in the document
<code>ol</code>	Contains an ordered list of items
<code>ul</code>	Contains an unordered list of items
<code>li</code>	Contains a single item from an ordered or unordered list
<code>p</code>	Contains the text of a paragraph
<code>pre</code>	Contains a block of preformatted text in which line breaks and extra spaces in the code are retained (often displayed in a monospace font)

The following code shows three paragraphs nested within a page article with each paragraph representing a group of similar content:

```
<article>
  <p>Content of 1st paragraph.</p>
  <p>Content of 2nd paragraph.</p>
  <p>Content of 3rd paragraph.</p>
</article>
```

The default style for browsers is to start sectioning or grouping elements on a new line, separating them from any content that appears before it. Thus, each of these paragraphs will appear in the web page on a new line as will the article itself. Note that the exact appearance of the paragraphs and the space between them depends on the styles applied by the browser to those elements. You'll learn more about styles later in this tutorial.

REFERENCE

Defining Page Groups

- To mark a paragraph, use the `p` element.
- To mark an extended quote, use the `blockquote` element.
- To mark the main content of a page or section, use the `main` element.
- To mark a figure box, use the `figure` element.
- To mark a generic division of page content, use the `div` element.

Sajja has written an article describing Curbside Thai. Enter the text of the article into the `article` element in the About Curbside Thai web page and use `p` elements to mark the paragraphs in the article.

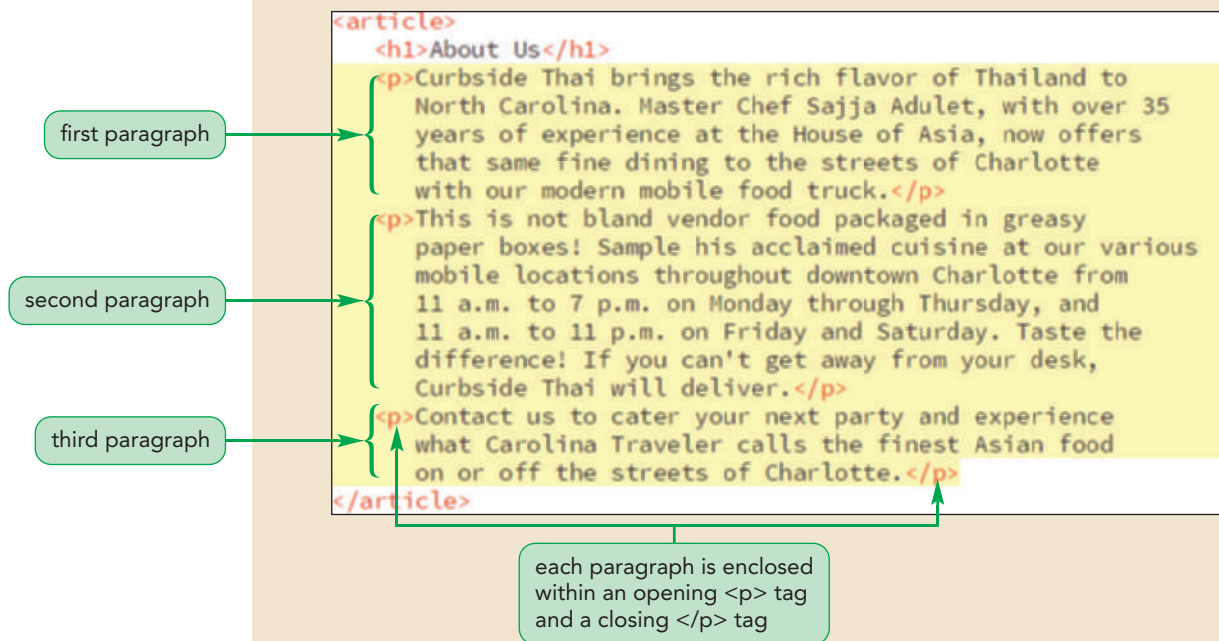
To group the page text into paragraphs:

1. Use a text editor to open the `ct_pages.txt` file from the `html01` ► tutorial folder.
2. Select and copy the three paragraphs of text directly after the About Us title.
3. Close the file, but do not save any changes you may have inadvertently made to the document.
4. Return to the `ct_about.html` file in your HTML editor.
5. Directly after the `<h1>About Us</h1>` line within the page article, insert a new blank line and paste the text you copied.
6. Enclose each of the three paragraphs of pasted content between an opening `<p>` tag and a closing `</p>` tag. Indent the code within the `article` element to make the code easier to read.

Figure 1–15 highlights the newly added code for the three paragraphs of article text.

Figure 1–15

Grouping article content by paragraphs



7. Save your changes to the file.

Using Text-Level Elements

Within each grouping element are **text-level elements**, which mark phrases or characters within a paragraph. Unlike sectioning or grouping elements that mark a self-contained block of content, text-level elements appear in line with the surrounding content and are known as **inline elements**. For example, the *italicized* or **boldface** text in this paragraph is considered inline content because it appears alongside the surrounding text. Figure 1–16 describes some of the many text-level elements in HTML.

Figure 1–16

HTML text-level elements

Element	Description
a	Marks content that acts as a hypertext link
abbr	Marks an abbreviation or acronym
b	Indicates a span of text to which attention should be drawn (text usually appears in bold)
br	Represents a line break within the grouping element
cite	Marks a citation to a title or author of a creative work (text usually appears in italics)
code	Marks content that represents computer code (text usually appears in a monospace font)
data	Associates a data value with the marked text with the value attribute providing the value
dfn	Marks a defined term for which a definition is given elsewhere in the document
em	Indicates content that is emphasized or stressed (text usually appears in italics)
i	Indicates a span of text that expresses an alternate voice or mood (text usually appears in italics)
kbd	Marks text that represents user input, typically from a computer keyboard or a voice command
mark	Marks content that is highlighted for reference purposes
q	Marks content that is quoted from another source
s	Marks content that is no longer accurate or relevant (text is usually struck through)
samp	Marks text that represents the sample output from a computer program or application
small	Marks side comments (text usually in small print)
span	Contains a generic run of text within the document
strong	Indicates content of strong importance or seriousness (text usually appears in bold)
sub	Marks text that should be treated as a text subscript
sup	Marks text that should be treated as a text superscript
time	Marks a time value or text string
u	Indicates text that appears stylistically different from normal text (text usually appears underlined)
var	Marks text that is treated as a variable in a mathematical expression or computer program
wbr	Represents where a line break should occur, if needed, for a long text string

The following HTML code demonstrates how to employ text-level elements to mark select phrases or characters within a paragraph.

```
<p>
  Contact us to cater your next party and experience what
  <cite>Carolina Traveler</cite> calls <q>the finest
  Asian food on or off the streets of Charlotte.</q>
</p>
```

Two text-level elements are used in this paragraph: the `cite` element marks the citation to the *Carolina Traveler* magazine and the `q` element marks the direct quote from the magazine's review of Curbside Thai. Both the citation and the quoted material will appear alongside other text within the paragraph.

REFERENCE

Defining Text-Level Content

- To mark emphasized text, use the `em` element.
- To mark text of great importance, use the `strong` element.
- To mark a citation, use the `cite` element.
- To mark a selection of quoted material, use the `q` element.
- To mark a subscript, use the `sub` element; to mark a superscript, use the `sup` element.
- To mark a generic selection of text-level content, use the `span` element.

Use text-level elements in the About Curbside Thai web page to mark examples of emphasized text, strongly important text, citations, and quoted material.

To apply text-level elements to a page:

1. Go to the first paragraph within the page article and enclose the opening words *Curbside Thai* within a set of opening and closing `` tags. Use `` tags when you want to strongly reinforce the importance of the text, such as the restaurant name, for the reader.
2. In the second paragraph, enclose the phrase, *Curbside Thai will deliver* within a set of opening and closing `` tags to emphasize this text.
3. Go the third paragraph and mark *Carolina Traveler* using the `cite` element and then mark the extended quote, *the finest Asian food on or off the streets of Charlotte*, using the `q` element.

Figure 1–17 highlights the application of the four text-level elements to the paragraph text.

Figure 1–17

Marking text-level content

strong and important text marked with the `` tag

emphasized text marked with the `` tag

citation marked with the `<cite>` tag

quoted material marked with the `<q>` tag

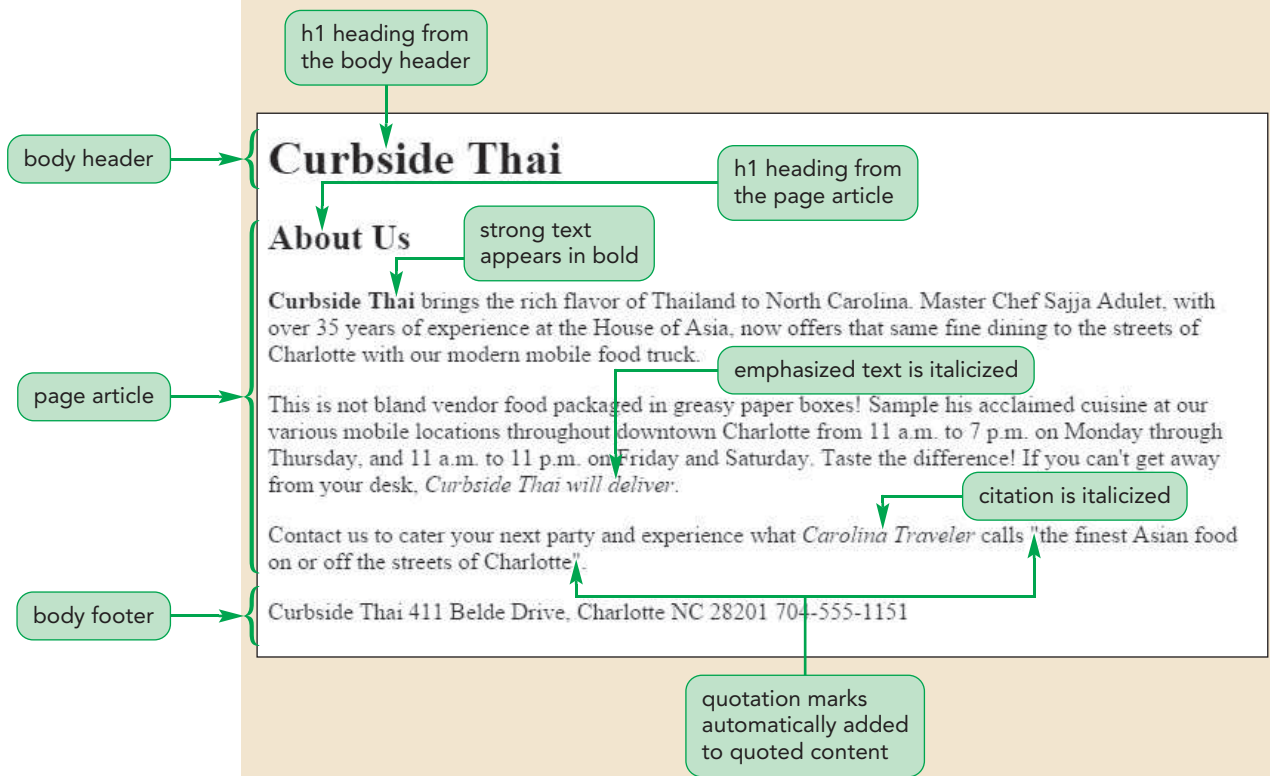
```
<article>
  <h1>About Us</h1>
  <p><strong>Curbside Thai</strong> brings the rich flavor of Thailand to
    North Carolina. Master Chef Sajja Adulet, with over 35
    years of experience at the House of Asia, now offers
    that same fine dining to the streets of Charlotte
    with our modern mobile food truck.</p>
  <p>This is not bland vendor food packaged in greasy
    paper boxes! Sample his acclaimed cuisine at our various
    mobile locations throughout downtown Charlotte from
    11 a.m. to 7 p.m. on Monday through Thursday, and
    11 a.m. to 11 p.m. on Friday and Saturday. Taste the
    difference! If you can't get away from your desk,
    <em>Curbside Thai will deliver</em>.</p>
  <p>Contact us to cater your next party and experience
    what <cite>Carolina Traveler</cite> calls <q>the finest Asian food
    on or off the streets of Charlotte</q>.</p>
</article>
```

- 4. Save your changes to the file.
- 5. Open the **ct_about.html** file in your browser to view how your browser renders the page content.

Figure 1–18 shows the current appearance of the page.

Figure 1–18

The About Curbside Thai page as rendered by the browser



Trouble? Depending on your browser, device, and screen settings, you might see some minor differences in the appearance of the About Curbside Thai web page from that shown in Figure 1–18.

In rendering the page, the browser made the following stylistic choices for the different page elements:

TRY IT

You can explore the impact of different HTML tags using the `demo_html.html` file in the `html01 ▶ demo` folder.

- The h1 heading from the body header is assigned the largest font and is displayed in bold to emphasize its importance. The h1 heading from the page article is given a slightly smaller font but is still displayed in bold.
- Strong text is displayed in bold while emphasized text is displayed in italics.
- Citations are displayed in italic while quoted material is automatically surrounded by quotation marks.

It needs to be emphasized again that all of these stylistic choices are not determined by the markup tags; they are default styles used by the browser. Different browsers and different devices might render these page elements differently. To exert more control over your page's appearance, you can apply a style sheet to the document.

Linking an HTML Document to a Style Sheet

A **style sheet** is a set of rules specifying how page elements are displayed. Style sheets are written in the **Cascading Style Sheets (CSS)** language. Like HTML, the CSS language was developed and enhanced as the web grew and changed and, like HTML, CSS specifications are managed by the W3C. To replace the browser's internal style sheet with one of your own, you can link your HTML file to a style sheet file using the following `link` element:

```
<link href="file" rel="stylesheet" />
```

where *file* is a text file containing the CSS style sheet. Because the `link` element can also be used to link to data other than style sheets, the `rel` attribute is required to tell the browser that it is linking to style sheet data. Older websites might include `type="text/css"` as part of the `link href` element.

REFERENCE

Linking an HTML Document to an External Style Sheet

- To link an HTML document to an external style sheet file, add the following element to the document head:

```
<link href="file" rel="stylesheet" />
```

where *file* is a text file containing the CSS style rules.

TIP

Because the `link` element is metadata, it's always added to the document head.

Sajja has supplied you with two CSS files that he wants applied to his website. The `ct_base.css` file contains styles specifying the appearance of text-level elements. The `ct_layout2.css` file contains styles that govern the arrangement of sectioning and grouping elements on the page. Link the `ct_about.html` file to both of these style sheets now.

To link an HTML document to a style sheet:

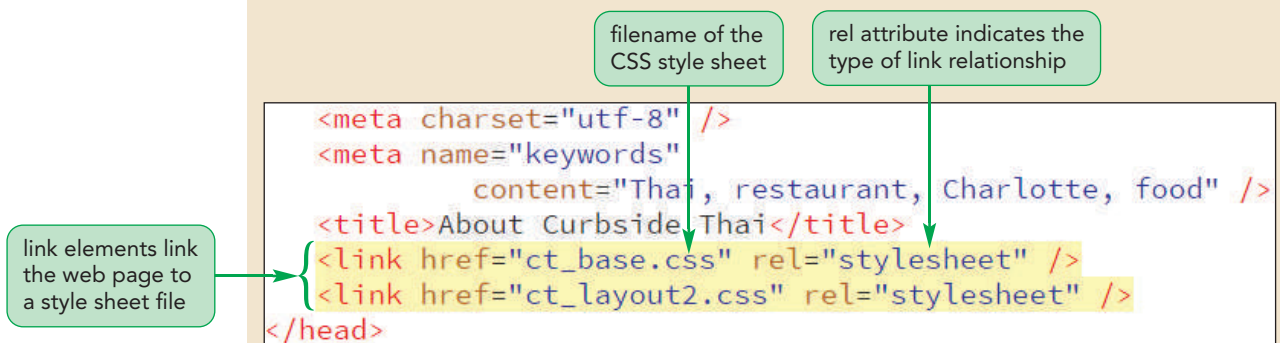
1. Return to the `ct_about.html` file in your HTML editor.
2. Directly before the closing `</head>` tag, insert the following `link` elements:

```
<link href="ct_base.css" rel="stylesheet" />
<link href="ct_layout2.css" rel="stylesheet" />
```

Figure 1–19 highlights the two style sheet links added to the document.

Figure 1–19

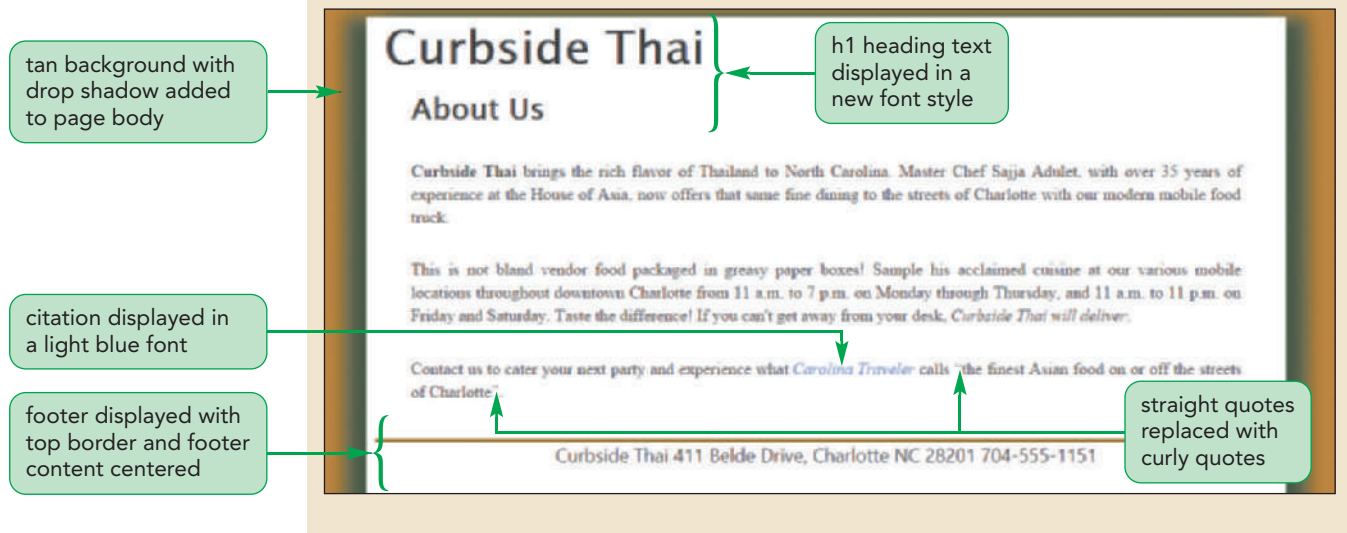
Linking to style sheets



3. Save your changes to the file and then reload the ct_about.html file in your browser. Figure 1–20 shows the new appearance of the page using the style sheets provided by Sajja.

Figure 1–20

The About Curbside Thai page rendered under a new style sheet



Applying these style sheets displays the page body on a tan background with a drop shadow, the font used in the two h1 headings has changed, a top border has been added to the footer to set it off from the preceding content, and the citation to the *Carolina Traveler* magazine is displayed in a light blue font. The effect makes the page content easier to read and more pleasing to the eye.

Sajja is concerned that the contact information in the page footer is difficult to read. He wants you to add bullet characters (•) separating the name of the restaurant, the street address, and the restaurant phone number. However, this character is not represented by any keys on your keyboard. How then, do you insert this symbol into the web page?

Working with Character Sets and Special Characters

Every character that your browser is capable of rendering belongs to a collection of characters and symbols called a **character set**. The character set used for the English alphabet is the **American Standard Code for Information Interchange** more simply known as **ASCII**. A more extended character set, called **Latin-1** or the **ISO 8859-1** character set, supports 255 characters and can be used by most languages that employ the Latin alphabet, including English, French, Spanish, and Italian. **Unicode**, the most extended character set, supports up to 65,536 symbols and can be used with any of the world's languages.

Character Encoding

TRY IT

You can explore different character encoding values using the demo_characters.html file in the html01 ► demo folder.

Each character from a character set is associated with an encoding value that can then be stored and read by a computer program. For example, the copyright symbol © from the Unicode character set is encoded with the number 169. If you know the encoding value, you can insert the corresponding character directly into your web page using the following character encoding reference:

```
&#code;
```

where *code* is the encoding reference number. Thus, to display the © symbol in your web page, you would enter

```
&#169;
```

into your HTML file.

Character Entity References

Another way to insert a special symbol is to insert a character entity reference, which is a short memorable name used in place of the encoding reference number. Character entity references are inserted as

```
&char;
```

where *char* is the character's entity reference. The character entity reference for the copyright symbol is *copy*, so to display the © symbol in your web page, you could insert the following expression into your HTML code:

```
&copy;
```

In the last session, you learned that HTML will collapse consecutive occurrences of white space into a single white-space character. You can force HTML to display extra white space by using the following character entity reference

```
&nbsp;
```

where *nbsp* stands for *nonbreaking space*. When you want to display extra white space, you need to insert the nonbreaking space character reference in the HTML code for each space you want to display.

REFERENCE

Inserting Symbols from a Character Set

- To insert a symbol based on the character encoding reference number, enter

```
&#code;
```

where *code* is the character encoding reference number.

- To insert a symbol based on a character entity reference, enter

```
&char;
```

where *char* is the name assigned to the character.

- To insert a white-space character, use

```
&nbsp;
```

For the footer in the About Curbside Thai page, use the bullet symbol (•), which has the encoding value 8226, to separate the restaurant name, address, and phone number. Use the ` ` character reference to insert an extra blank space prior to the postal code in the restaurant address.

To insert a character encoding reference number and an entity reference:

Character encoding reference numbers must always begin with `&#` and end with a semicolon, otherwise the code won't be recognized as a code number.

1. Return to the `ct_about.html` file in your HTML editor.
2. Go to the `footer` element and insert the character encoding number `•` directly after the word *Thai* and after the postal code `28201`. Insert the character reference ` ` directly before the postal code.

Figure 1–21 highlights the character codes and references added to the footer.

Figure 1–21

Inserting special characters

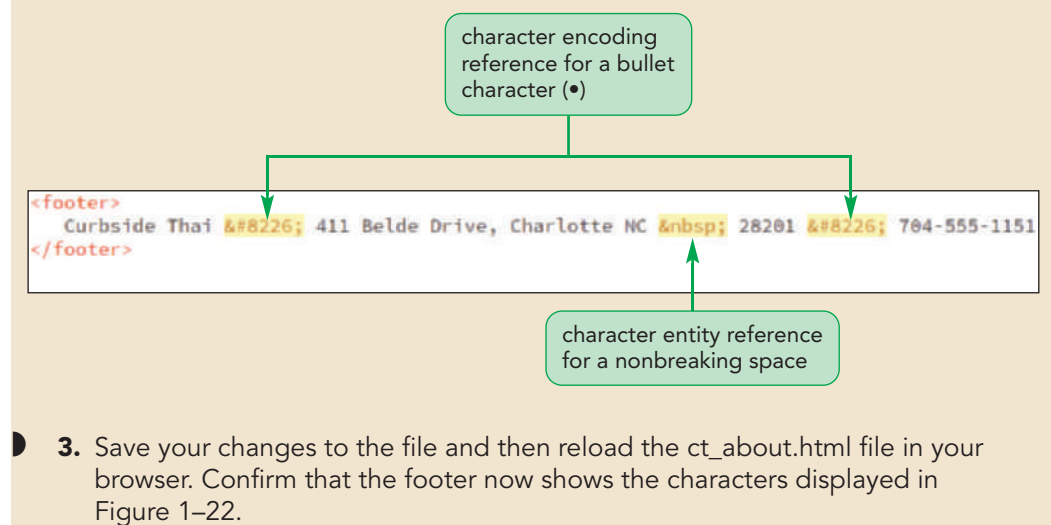
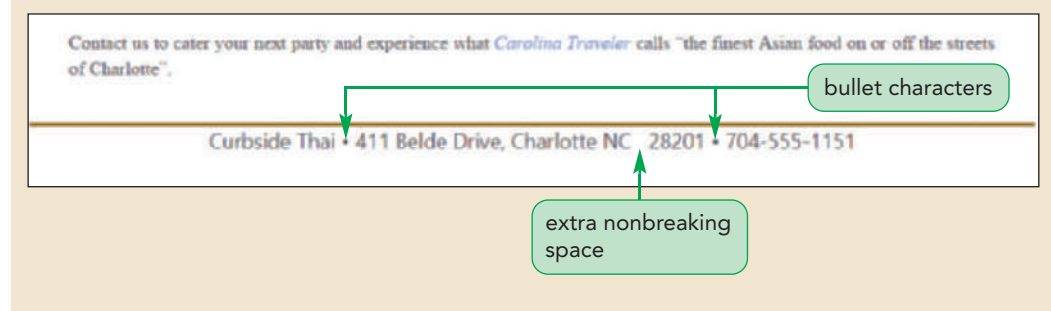


Figure 1–22

Revised page footer



INSIGHT

Presentational Attributes

Early versions of HTML supported **presentational elements** and **presentational attributes** describing how each element should be rendered by the browser. For example, to align text on a page, HTML included the following `align` attribute

```
<element align="alignment">content</element>
```

where *alignment* is either `left`, `right`, `center`, or `justify`. Thus, to center an `h1` heading on a page, apply the following code:

```
<h1 align="center">Curbside Thai</h1>
```

Almost all presentational elements and attributes are now deprecated in favor of style sheets, but you may still see them in the code from older websites. Using a deprecated attribute like `align` would probably not cause your web page to fail, however, it's still best practice to adhere to a standard in which HTML is used only to describe the content and structure of the document and style sheets are used to format its appearance.

So far your work on the Curbside Thai page has been limited to textual content. Next, you'll explore how to add graphical content to your web page.

Working with Inline Images

Most web pages include **embedded content**, which is content imported from another resource, often nontextual, such as graphic images, audio soundtracks, video clips, or interactive games. To support this type of content, HTML provides the **embedded elements** listed in Figure 1–23.

Figure 1–23

HTML embedded elements

Element	Description
<code>audio</code>	Represents a sound clip or audio stream
<code>canvas</code>	Contains programming scripts used to construct bitmap images and graphics
<code>embed</code>	Contains general embedded content including application or interactive content
<code>iframe</code>	Contains the contents of an external web page or Internet resource
<code>img</code>	Contains a graphic image retrieved from an image file
<code>object</code>	Contains general embedded content including application or interactive content
<code>video</code>	Represents a video clip or video stream with captions

TIP

Always include the `alt` attribute; it is required in XHTML code and is highly recommended as a way of accommodating users running nonvisual web browsers.

These elements are also known as **interactive elements** because they allow for interaction between the user and the embedded object. For example, embedded audio or video content usually contains player buttons to control the playback.

Images are inserted into a web page using the following `img` element

```

```

where *file* is the name of the image file. If the browser cannot display images, the text in the `alt` attribute is used in place of the image. As with other one-sided tags, the `img` element can be entered without the closing slash as

```

```

Images marked with the `` tag are also known as **inline images** because they are placed, like text-level elements, in line with surrounding content.

By default, the image size matches the size of the image in the file but you can specify a different size by adding the following `width` and `height` attributes to the `img` element

```
width="value" height="value"
```

where the `width` and `height` values are expressed in pixels. If you specify only the `width`, browsers automatically set the `height` to maintain the proportions of the image; similarly, if you define the `height`, browsers automatically set the `width` to maintain the image proportions. Image sizes can also be set within the document's style sheet.

REFERENCE

Embedding an Inline Image

- To embed an inline image into the document, use

```

```

where *file* is the name of the graphic image file, and *text* is text displayed by browsers in place of the graphic image.

Sajja has provided you with two images. The image from the `ct_logo2.png` file displays the restaurant logo, while the `ct_photo1.png` image provides an image of customers being served by an employee at his brick-and-mortar restaurant. Sajja included this image to emphasize that the food from his food truck is the same quality and great taste as the food at his award winning restaurant. Add both of these images to the `ct_about.html` file.

TIP

Include the `alt` attribute as a blank text string if the image file does not convey any text message to the user.

To insert inline images into a document:

1. Return to the `ct_about.html` file in your HTML editor.
2. Go to the header element and replace the `h1` element with the tag

```

```
3. Go to the article element and, directly after the `h1` element, insert the tag

```

```

Figure 1–24 highlights the newly added `img` elements in the document.

Figure 1–24

Inserting inline images

image added to the About Us article

```
<header>
  
</header>
<article>
  <h1>About Us</h1>
  
  <p><strong>Curbside Thai</strong> brings the rich flavor of Thailand to
  North Carolina. Master Chef Sajja Adulet, with over 35
  years of experience at the House of Asia, now offers
  that same fine dining to the streets of Charlotte
  with our modern mobile food truck.</p>
```

h1 heading replaced with an inline image

4. Save your changes to the file and then reload the `ct_about.html` file in your browser. Figure 1–25 displays the newly added graphic images in the web page.

Figure 1–25

Images on the About Curbside Thai page



Note that the photo of the Curbside Thai customers is floated alongside the right margin of the article, with the surrounding paragraphs flowing around the image. This is the result of code in the style sheets. You'll learn about styles used to float images in Tutorial 3.

Line Breaks and Other Empty Elements

The `img` element is inserted using the empty element tag because it does not enclose any text content, but instead links to an external image file. Another important empty element is the following `br` element, which creates a line break

```
<br />
```

Line breaks are placed within grouping elements, such as paragraphs or headings, to force page content to start on a new line within the group. While useful for controlling the flow of text within a group, the `br` element should not be used as a formatting tool. For example, it would not make semantic sense to insert two or more `br` elements in a row if the only reason to do so is to increase the spacing between lines of text. Instead, all such formatting choices belong in a style sheet.

If the text of a line cannot fit within the width of the viewing window, the browser will wrap the text automatically at the point the browser identifies as the most appropriate. To recommend a different line break point, use the `wbr` (word break) element to indicate where a line break should occur if needed. For example, the following HTML code uses the `wbr` element to break a long web address between ".com/" and "general", but this break happens only if the address will not fit on one line.

```
www.curbsidethai.com/<wbr />general/docs/ct_about.html
```

Finally, another oft-used empty element is the following `hr` or horizontal rule element, which denotes a major topic change within a section

```
<hr />
```

Originally, the `hr` element was used to insert horizontal lines into the page and, although that task is better left to style sheets, you will still see the `hr` element used in that capacity in older web pages.

INSIGHT

Supporting HTML 5 with Legacy Browsers

HTML 5 introduced several new semantic elements including the `header`, `footer`, `article`, and `nav` elements. Some browsers, such as Internet Explorer Version 8, could not cope with new elements without an external program known as a **script** running in the browser.

One script that provides support for HTML 5 is **Modernizr** (<http://modernizr.com>); another is **HTML 5 Shiv** (<https://github.com/aFarkas/html5shiv>). Many HTML editors, such as Dreamweaver, supply their own script files to cope with legacy browsers. Note that even with these scripts, the rendering of your page under old browsers might not match current browsers.

Working with Block Quotes and Other Elements

Now that you've written the code for the `ct_about.html` file, you'll work on other pages in the Curbside Thai website. The `ct_reviews.html` file provides excerpts of reviews from food critics and magazines. Because these excerpts contain extended quotes, you'll place each review in the following `blockquote` element

```
<blockquote>
  content
</blockquote>
```

where *content* is the text of the quote. By default, most browsers render block quotes by indenting the quoted material to separate it from the website author's words, however, you can substitute your own style with a custom style sheet.

Sajja has created much of the code required for the reviews page. The code is contained in the two style sheets that are already linked to the reviews page. Complete the page by adding the excerpts of the reviews marked as block quotes.

To create the reviews page:

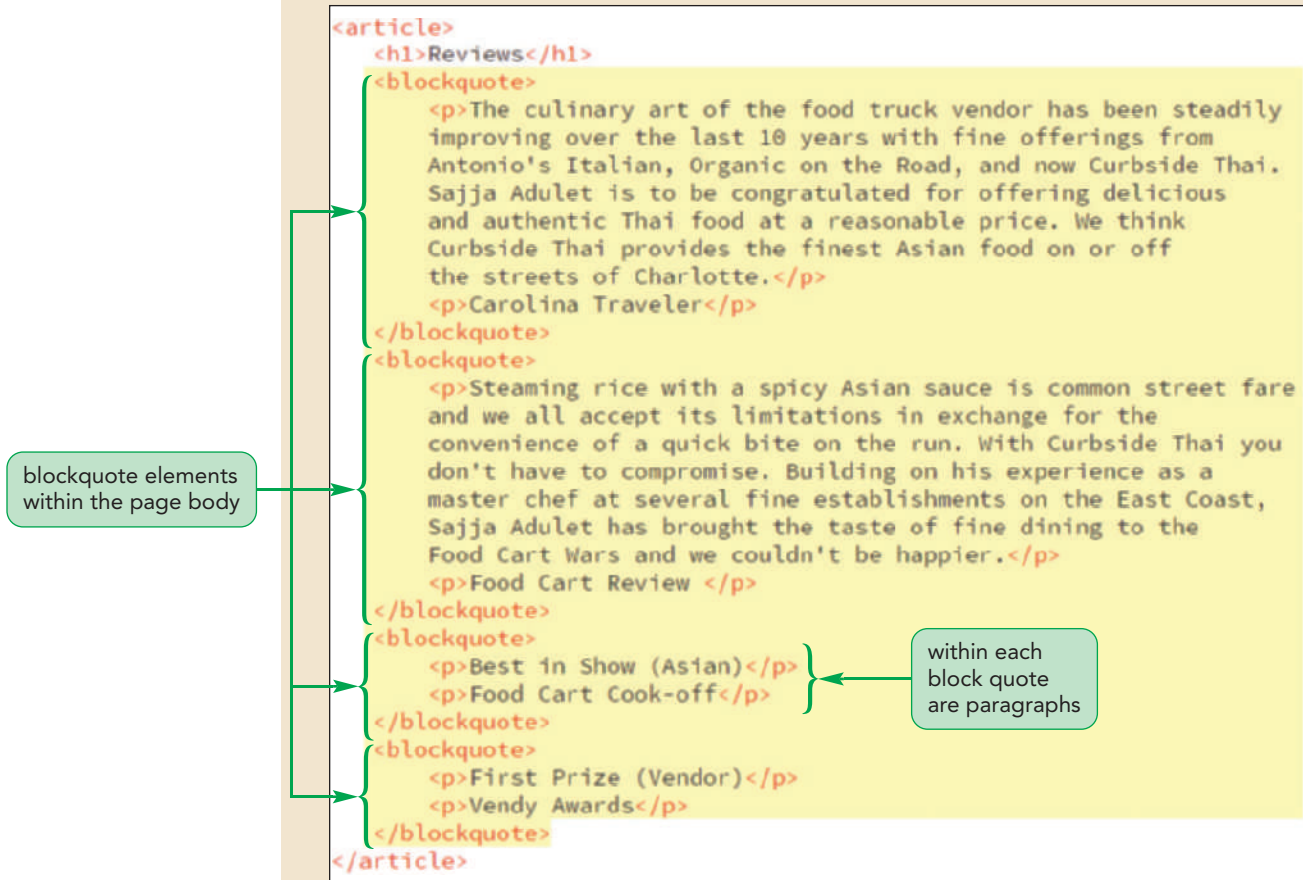
1. Open the **ct_reviews_txt.html** file from the `html01 ► tutorial` folder in your HTML editor. Enter **your name** and **the date** in the comment section and save the file as **ct_reviews.html**.
2. Go to the **ct_pages.txt** file in your text editor.
3. Locate the section containing the restaurant reviews and copy the text of the two reviews and two awards.
4. Return to the **ct_reviews.html** file in your HTML editor and paste the text of the four reviews directly after the `<h1>Reviews</h1>` line.

5. Enclose each review within a set of `<blockquote>` tags. Enclose each paragraph within each review with a set of `<p>` tags. Align and indent your code to make it easier to read.

Figure 1–26 highlights the newly added code in the document.

Figure 1–26

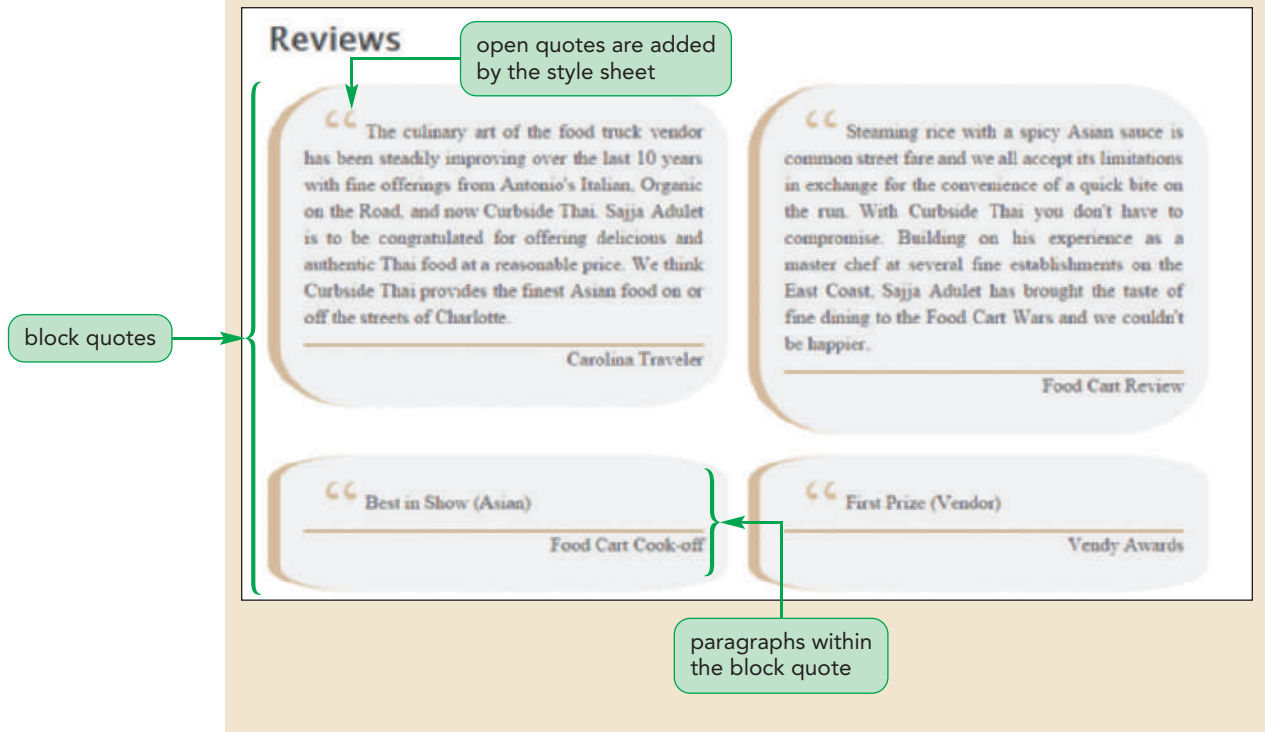
Marking extended text as block quotes



6. Save your changes to the file and then open the **ct_reviews.html** file in your browser. Figure 1–27 shows the appearance of the restaurant review quotes using Sajja's style sheet.

Figure 1–27

Block quotes of restaurant reviews



Because of the styles in Sajja’s style sheets, each `blockquote` element appears within its own formatted box with an opening quote character added to reinforce the fact that this is quoted material.

The next page you’ll create contains information about catering from Curbside Thai. The structure of this page is identical to the structure of the About Curbside Thai page. Sajja has linked the catering page to two style sheets containing the style rules that dictate how the page will look when the page is rendered in a browser.

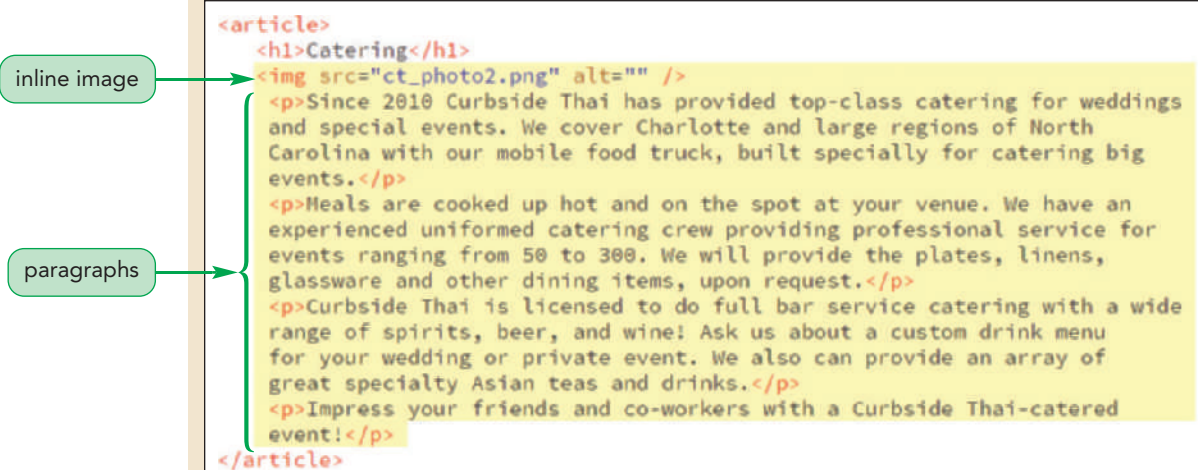
To create the Catering page:

1. Open the **ct_catering_txt.html** file from the html01 ► tutorial folder in your HTML editor. Enter **your name** and **the date** in the comment section and save the file as **ct_catering.html**.
2. Return to the **ct_pages.txt** file in your text editor.
3. Locate the section containing information about Curbside Thai’s catering service and copy the four paragraphs of information.
4. Return to the **ct_catering.html** file in your HTML editor and paste the copied text directly after the `<h1>Catering</h1>` line.
5. Mark each paragraph in the article using the `p` element. Align and indent your code to make it easier to read.
6. Directly after the `<h1>Catering</h1>` tag, insert an inline image using **ct_photo2.png** as the source and an empty text string for the `alt` attribute.

Figure 1–28 highlights the newly added paragraphs in the document.

Figure 1–28

Entering the markup for the Catering page



7. Save your changes to the file and then open the **ct_catering.html** file in your browser. Figure 1–29 shows the appearance of the page.

Figure 1–29

Content of the Catering page



The final page you'll create in this session will contain contact information for Curbside Thai. Mark the content within the main page article.

To create the Contact Us page:

1. Open the **ct_contact_txt.html** file from the html01 ► tutorial folder in your HTML editor. Enter **your name** and **the date** in the comment section and save the file as **ct_contact.html**. Note that this page is linked to two style sheets that Sajja created.
2. Go to the **ct_pages.txt** file in your text editor.
3. Copy the Contact Us section in the text file (excluding the title).

4. Return to the **ct_contact.html** file in your HTML editor and paste the copied text directly after the `<h1>Contact Us</h1>` tag.
5. Enclose the introductory paragraph within a set of opening and closing `<p>` tags to mark it as a paragraph.
6. Enclose the three lines containing the street address within a set of opening and closing `<address>` tags to mark that content as an address. Insert the `
` tag at the end of the first two lines to create a line break between the name of the restaurant and the street address.
7. Mark each of the last two lines as paragraphs using the `p` element.

Figure 1–30 highlights the marked up code for Curbside Thai's contact information.

Figure 1–30

Entering the markup for the Contact Us page

address element
to mark up a
mailing address

```
<article>
  <h1>Contact Us</h1>
  <p>Contact Curbside Thai for your next event or just to find
    out when our mobile truck will next be in your area. Employment
    opportunities available now!</p>

  <address>
    Curbside Thai<br />
    411 Belde Drive<br />
    Charlotte NC 28201
  </address>

  <p>Call: (704) 555-1151</p>
  <p>Email: curbside.thai@example.com </p>
</article>
```

line breaks to start the
next part of the address
on a new line

8. Save your changes to the file and then open the **ct_contact.html** file in your browser as shown in Figure 1–31.

Figure 1–31

Content of the Contact Us page

street address

Contact Us

Contact Curbside Thai for your next event or just to find out when our mobile truck will next be in your area. Employment opportunities available now!

Curbside Thai
411 Belde Drive
Charlotte NC 28201

Call: (704) 555-1151

Email: curbside.thai@example.com

The Contact Us page only provides the text of the contact information but that text is static. In the next session, you'll learn how to make this content interactive by turning the contact information into hypertext.

**PROSKILLS**

Problem Solving: Making your Page Accessible with ARIA

The web is for everyone and that presents a special challenge when writing code for the visually impaired who will be accessing your website with a screen reader. One standard to assist screen readers is **Accessible Rich Internet Applications (ARIA)**, which supplements HTML elements with additional attributes that provide clues as to the element's purpose as well as provide information on the current status of every page element.

One of the cornerstones of ARIA is the role attribute, which specifies the purpose of a given element. For example, the following `role` attribute indicates that the `header` element contains a banner, such as a logo that introduces the web page

```
<header role="banner">
  content
</header>
```

ARIA supports a list of approved role names including the following:

- | | |
|----------------|--|
| • alert | Content with important and usually time-sensitive information |
| • application | A web application, as opposed to a web document |
| • definition | A definition term or concept |
| • dialog | An application window that will require user input |
| • log | A region of data that is constantly modified and updated |
| • progress bar | Content that displays the progress status for ongoing tasks |
| • search | Content that provides search capability to the user |
| • separator | A divider that separates one region of content from another |
| • timer | A region that contains a numerical counter reporting on elapsed time |

You can view the complete list of role attribute values and how to apply them at www.w3.org/WAI/PF/aria/roles.

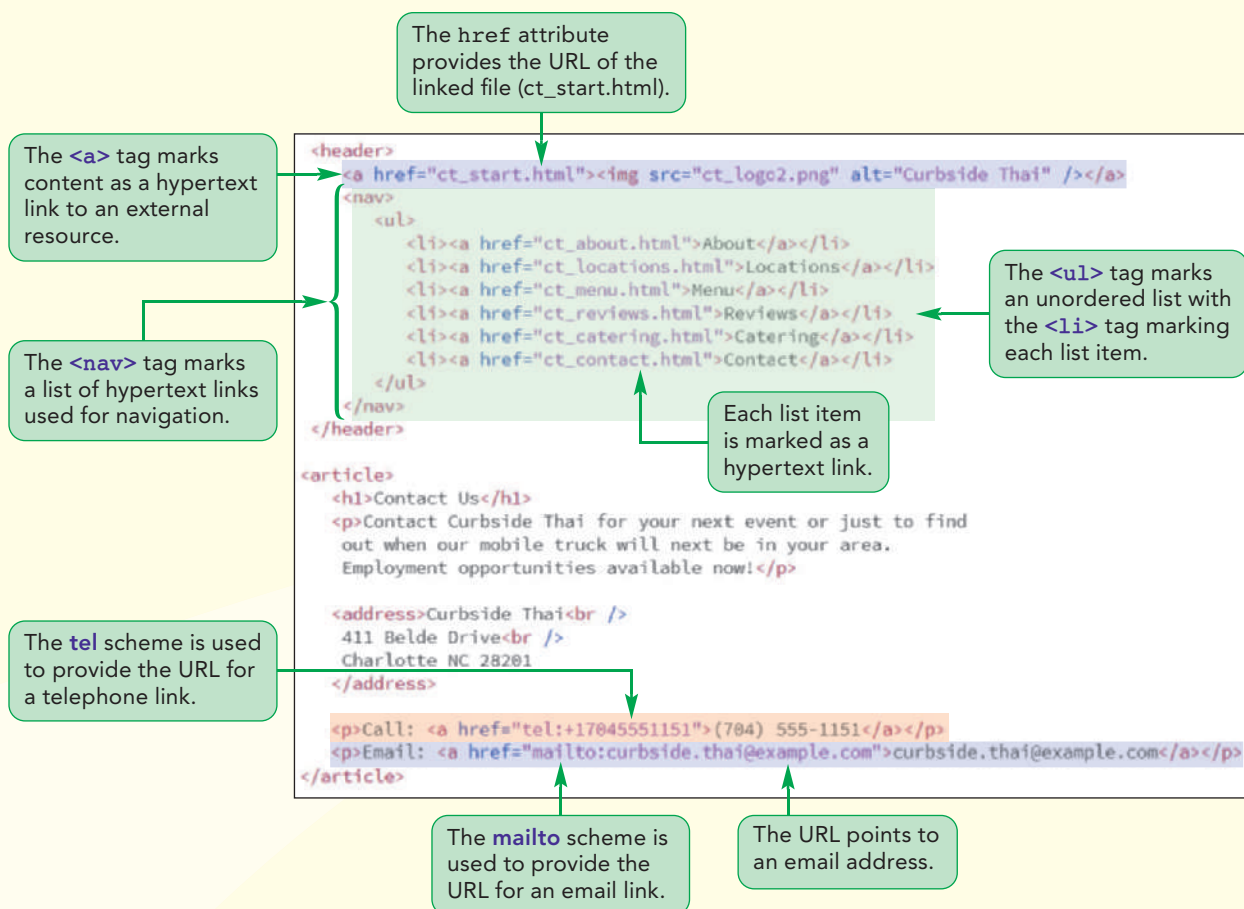
ARIA is a useful tool for enhancing the accessibility of your web page and making the rich resource that is the World Wide Web open to all. A side benefit is that accessibility and usability go hand-in-hand. A website that is highly accessible is also highly usable and that is of value to all users.

In the next session, you'll continue to work on the Curbside Thai website by adding pages describing the restaurant menu and listing the time and locations where the mobile food truck is parked.

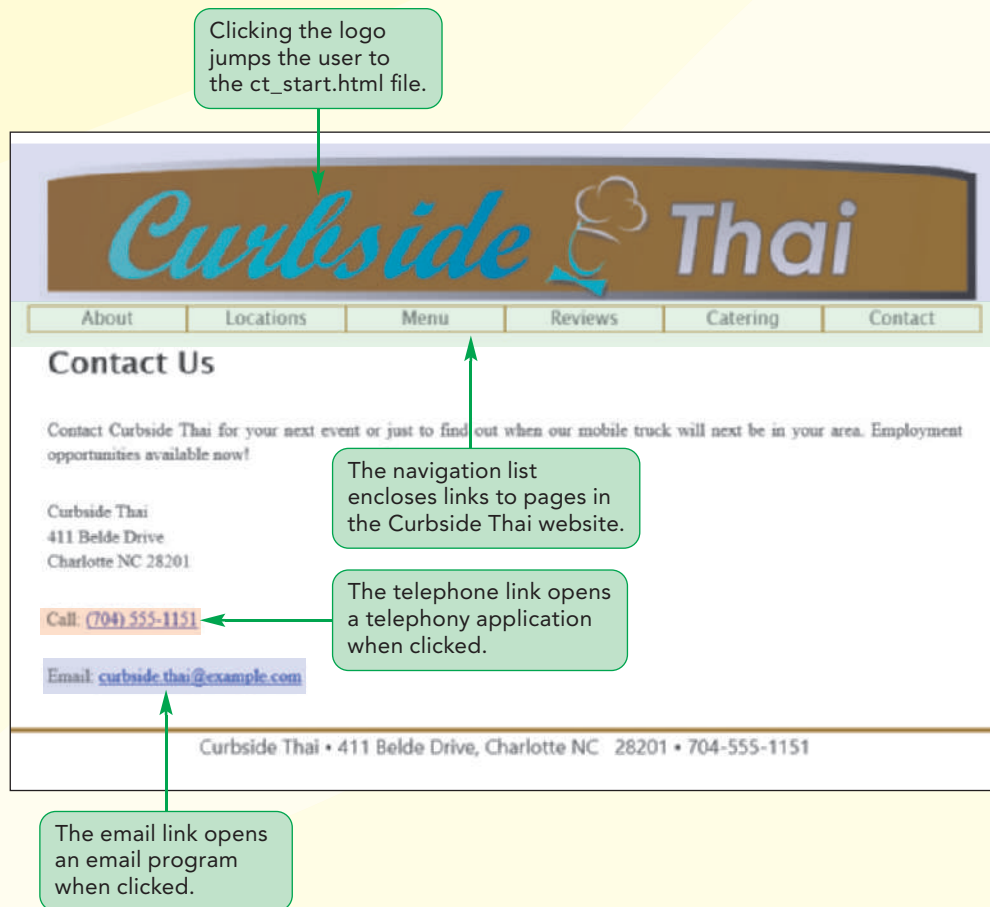
Session 1.2 Quick Check

1. Which of the following marks a heading with the second level of importance?
 - a. `<h level="2">Gourmet Thai Cooking</h>`
 - b. `<hLevel2>Gourmet Thai Cooking</hLevel2>`
 - c. `<heading2>Gourmet Thai Cooking</heading2>`
 - d. `<h2>Gourmet Thai Cooking</h2>`
2. Prior to HTML 5, sections were identified with:
 - a. the `section` element and the `name` attribute
 - b. the `div` element and the `id` attribute
 - c. the `article` element and the `section` attribute
 - d. the `aside` element and the `id` attribute
3. To mark content that is related to the main article, use
 - a. the `sidebar` element
 - b. the `extraContent` element
 - c. the `aside` element
 - d. the `section` element
4. Which of the following marks the content as emphasized text?
 - a. `<i>Daily Special</i>`
 - b. `Daily Special`
 - c. `Daily Special`
 - d. `Daily Special`
5. Which of the following should be used to mark the text string "H₂SO₄"?
 - a. `H<lower>2</lower>SO<lower>4</lower>`
 - b. `H²SO⁴`
 - c. `H<code>2</code>SO<code>4</code>`
 - d. `H₂SO₄`
6. Which of the following links the HTML file to the CSS style sheet file, `mystyles.css`?
 - a. `<stylesheet rel=link">mystyles.css</mystyles>`
 - b. `<stylesheet src="mystyles.css" />`
 - c. `<link rel="stylesheet">mystyles.css</link>`
 - d. `<link href="mystyles.css" rel="stylesheet" />`
7. Which of the following tags might be used to indicate a change of topic within a section?
 - a. `<hr />`
 - b. `
`
 - c. `<aside />`
 - d. ``
8. Which character reference is used to insert a nonbreaking space within a text string?
 - a. `&space;`
 - b. ` `
 - c. `&ws;`
 - d. `©`
9. Which of the following tags inserts an inline image with the alternative text "Art World"?
 - a. `<image src="awlogo.png" alt="Art World" />`
 - b. `Art World`
 - c. `<figure src="awlogo.png" alt="Art World" />`
 - d. ``

Session 1.3 Visual Overview:



Lists and Hypertext Links



Working with Lists

In the last session, you added order and structure to your web page with some of HTML's sectioning and grouping elements. Another type of grouping element is a list. HTML supports three types of lists: ordered lists, unordered lists, and description lists.

Ordered Lists

Ordered lists are used for items that follow some defined sequential order, such as items arranged alphabetically or numerically. An ordered list is marked using the `ol` (ordered list) element with each list item marked using the `li` element. The general structure is

```
<ol>
  <li>item1</li>
  <li>item2</li>
  ...
</ol>
```

where *item1*, *item2*, and so forth are the items in the list. For example, the following ordered list ranks the top-three most populated states:

```
<ol>
  <li>California</li>
  <li>Texas</li>
  <li>New York</li>
</ol>
```

By default, browsers display list items alongside a numeric marker. In the case of ordered lists, this is a numeric value starting with the number 1 and ascending in value. For example, the ordered list of states would be rendered in most browsers as

1. California
2. Texas
3. New York

Note that because both the `ol` and `li` elements are considered grouping elements, each list item will appear, by default, on a new line in the document.

To display different numbering, use the `start` and `reversed` attributes of the `ol` element. The `start` attribute provides the numeric value for the first item in the list, while the `reversed` attribute specifies that the list numbers should be displayed in descending order. Thus, the following HTML code that lists the most populated states

```
<ol reversed start="50">
  <li>California</li>
  <li>Texas</li>
  <li>New York</li>
</ol>
```

would be rendered as a list in descending order starting from 50

50. California
49. Texas
48. New York

You can explicitly define the item value by adding the `value` attribute to each list item. The list shown previously could also have been generated with the following code:

```
<ol>
  <li value="50">California</li>
  <li value="49">Texas</li>
  <li value="48">New York</li>
</ol>
```

You can use style sheets to display lists using alphabetical markers (A, B, C, ...) or Roman Numerals (I, II, III, ...) in place of numeric values. You'll explore this technique in Tutorial 2.

Unordered Lists

Unordered lists are lists in which the items have no sequential order. The structure for an unordered list is similar to that used with ordered lists except that the list items are grouped within the following `ul` (unordered list) element:

```
<ul>
  <li>item1</li>
  <li>item2</li>
  ...
</ul>
```

For example, the following HTML code creates an ordered list of all of the states along the Pacific coast:

```
<ul>
  <li>California</li>
  <li>Oregon</li>
  <li>Washington</li>
</ul>
```

By default, browsers display items from an unordered list alongside a marker such as a bullet point. Thus, an unordered list of Pacific coast states might be rendered as

- California
- Oregon
- Washington

Once again, the exact appearance of an unordered list will depend on the style sheet that is applied to the element.

Creating a Nested List

Because the `li` element is itself a grouping element, it can be used to create a series of **nested lists**. The general structure for a nested collection of unordered list is

```
<ul>
  <li>Item 1</li>
  <li>Item 2
    <ul>
      <li>Sub Item 1</li>
      <li>Sub Item 2</li>
    </ul>
  </li>
</ul>
```

where *Sub Item 1*, *Sub Item 2*, and so forth are items contained within the *Item 2* list. For example, an unordered list of states and cities within those states could be marked up as

```
<ul>
  <li>California</li>
  <li>Oregon
    <ul>
      <li>Portland</li>
      <li>Salem</li>
    </ul>
  </li>
  <li>Washington</li>
</ul>
```

Most browsers will differentiate the various levels by increasing the indentation and using a different list symbol at each level of nested lists, for example, rendering the HTML code above as

- California
- Oregon
 - Portland
 - Salem
- Washington

The markers used at each level and the amount of indentation applied to each nested list is determined by style sheets, either those built into the browser or those supplied by the page designer. You'll explore this technique in Tutorial 2.

Description Lists

A third type of list is the **description list** containing a list of terms and matching descriptions. The description list is grouped by the `dl` (description list) element, the terms are marked with the `dt` (description term) element, and the description(s) associated with each term is marked by the `dd` element. The general structure is

```
<dl>
  <dt>term1</dt>
  <dd>description1</dd>
  <dt>term2</dt>
  <dd>description2a</dd>
  <dd>description2b</dd>
  ...
</dl>
```

where *term1*, *term2*, and so forth are the terms in the list, and *description1*, *description2a*, *description2b*, and so forth are the descriptions associated with the terms. Note that descriptions must always directly follow the term they describe and that more than one description may be provided with each term.

By default, most browsers indent the descriptions associated with each term. Markers are rarely displayed alongside either the description term or the description.

Sajja wants to use a description list in a page that displays some of the menu items sold by Curbside Thai. He's already started work on the HTML code but needs you to complete it by adding the markup for the description list.

To complete the menu page:

1. Open the **ct_menu_txt.html** file from the html01 ► tutorial folder in your HTML editor. Enter **your name** and **the date** in the comment section and save the file as **ct_menu.html**.
2. Open the **ct_pages.txt** file in your text editor if it is not already open and copy the five menu items listed in the Mobile Menu section.
3. Return to the **ct_menu.html** file in your HTML editor and paste the copied text directly after the `<h1>Mobile Menu</h1>` tag.
4. Enclose the entire menu within an opening and closing `<dl>` tag.
5. Mark the name of each menu item using the `dt` element. Mark the corresponding description using the `dd` element. Indent your code to make it easier to read and interpret.

Figure 1–32 shows the completed code for the description list of the mobile menu.

Figure 1–32

Marking the restaurant menu as a description list

the name of each menu item is marked as a description term; information about the item is marked as a description

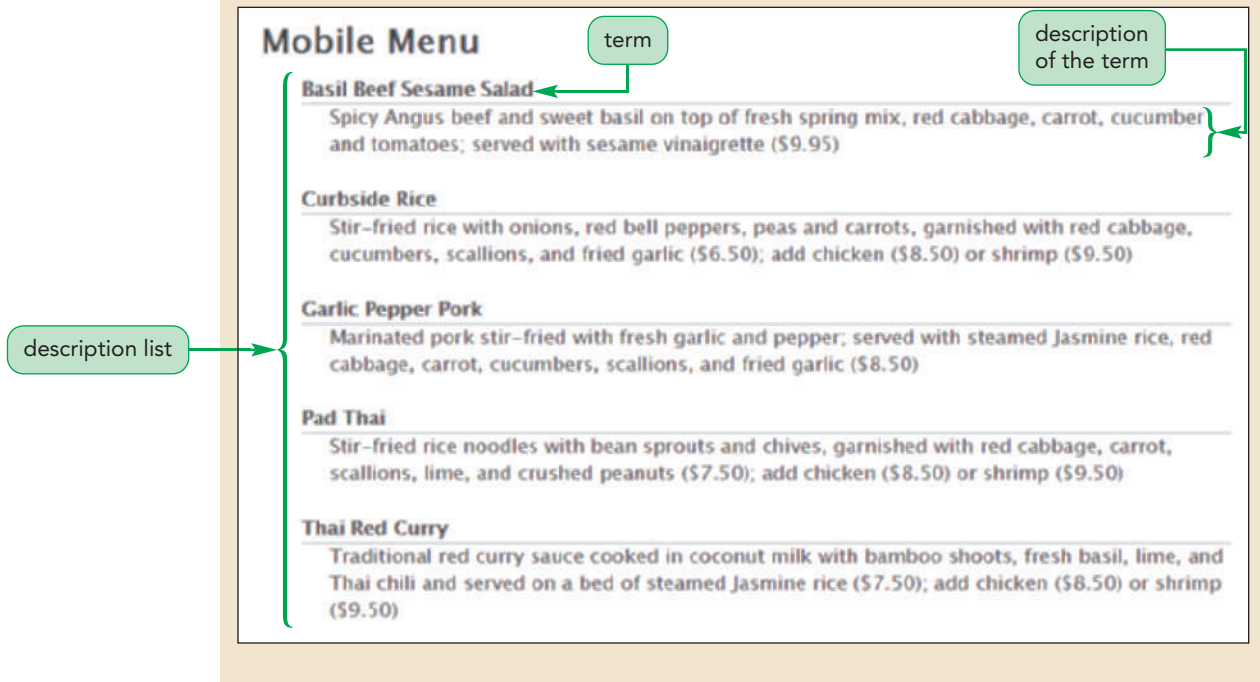
description list

```
<article>
  <h1>Mobile Menu</h1>
  <dl>
    <dt>Basil Beef Sesame Salad</dt>
    <dd>Spicy Angus beef and sweet basil on top of fresh spring mix,
      red cabbage, carrot, cucumber and tomatoes; served with
      sesame vinaigrette ($9.95)</dd>
    <dt>Curbside Rice</dt>
    <dd>Stir-fried rice with onions, red bell peppers, peas and
      carrots, garnished with red cabbage, cucumbers, scallions,
      and fried garlic ($6.50); add chicken ($8.50)
      or shrimp ($9.50)</dd>
    <dt>Garlic Pepper Pork</dt>
    <dd>Marinated pork stir-fried with fresh garlic and pepper;
      served with steamed Jasmine rice, red cabbage, carrot,
      cucumbers, scallions, and fried garlic ($8.50)</dd>
    <dt>Pad Thai</dt>
    <dd>Stir-fried rice noodles with bean sprouts and chives,
      garnished with red cabbage, carrot,
      scallions, lime, and crushed peanuts ($7.50);
      add chicken ($8.50) or shrimp ($9.50)</dd>
    <dt>Thai Red Curry</dt>
    <dd>Traditional red curry sauce cooked in coconut milk with
      bamboo shoots, fresh basil, lime, and Thai chili and
      served on a bed of steamed Jasmine rice ($7.50); add
      chicken ($8.50) or shrimp ($9.50)</dd>
  </dl>
</article>
```

6. Save your changes to the file and then open the **ct_menu.html** file in your browser. Figure 1–33 shows the completed menu for Curbside Thai.

Figure 1–33

Curbside Thai menu as a description list



Note that the style sheet that Sajja uses for his website inserts a dividing line between each term and description in the list. This is *not* the default browser style for description lists.

Description lists can be used with any general list that pairs one list of items with another list providing additional information. For example, Sajja has a page that lists the times and locations at which the Curbside Thai truck will make an appearance. Complete this page by enclosing the content within a description list, marking the times as the list “terms” and the locations as the list “descriptions”.

To create a page of times and locations:

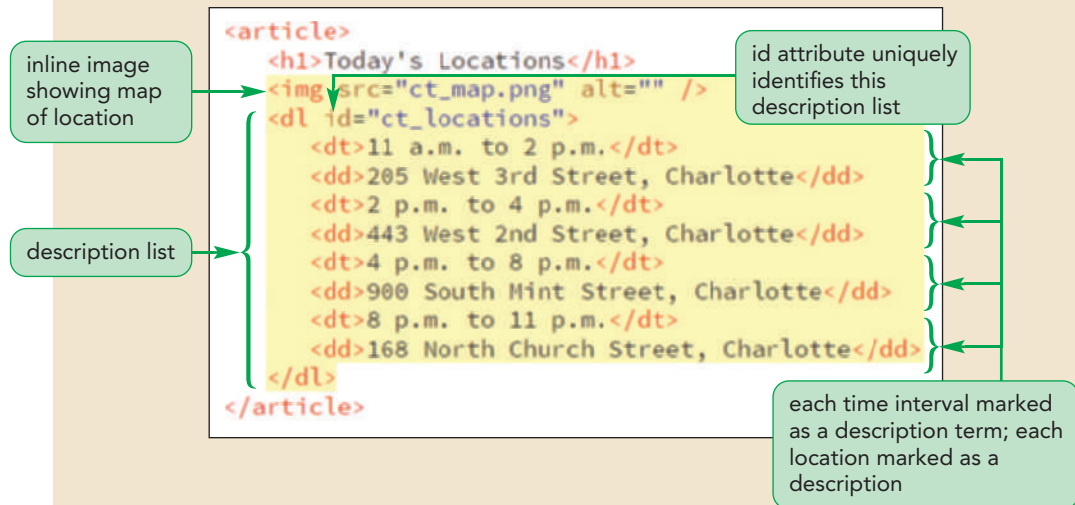
1. Open the **ct_locations_txt.html** file from the html01 ► tutorial folder in your HTML editor. Enter **your name** and **the date** in the comment section and save the file as **ct_locations.html**.
2. Return to **the ct_pages.txt** file in your text editor and copy the four locations from the Today's Locations section.
3. Return to the **ct_locations.html** file in your HTML editor and paste the copied text directly after the `<h1>Today's Locations</h1>` tag.
4. Mark the entire list of times and locations using the `d1` element. Mark each time using the `dt` element and each location using the `dd` element. Indent your code to make it easier to read and interpret.
5. In order to distinguish this description list from other description lists in the website, add the attribute `id="ct_locations"` to the opening `<d1>` tag.
6. Sajja has a map that he wants displayed alongside the list of times and locations. Directly after the `h1` element within the `article` element, insert the following inline image:

```

```

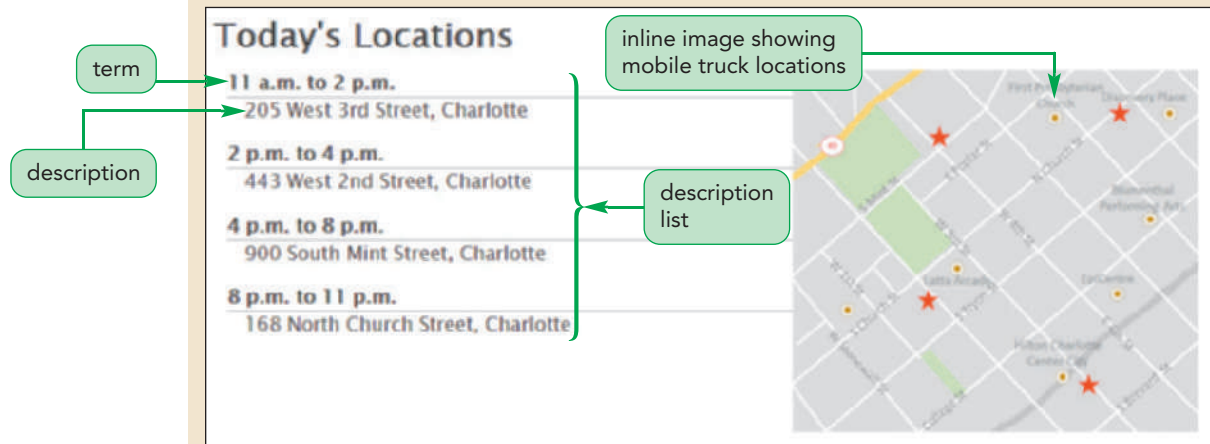
Figure 1–34 highlights the newly added code for the Today's Locations page.

Figure 1–34 Creating a description list



7. Save your changes to the file and then open the **ct_locations.html** file in your browser. Figure 1–35 shows the appearance of the page. Remember, the placement of items on the screen is a result of the style sheets.

Figure 1–35 Locations of the Curbside Thai food truck



From this page, Curbside Thai customers can quickly find the mobile truck. A page like this will have to be updated, probably daily, as the truck moves around. This is often better accomplished using database programs on the web server that will generate code for both the HTML and the inline image file.

INSIGHT

Marking Dates and Times

The adage that nothing ever quite disappears on the Internet also means that the web is populated with old articles, documents, and news stories that are no longer relevant or perhaps, even accurate. Any content you publish to the web should be time-stamped to document its history. One way of marking a date-time value is with the following `time` element

```
<time datetime="value">content</time>
```

where *value* is the date and time associated with the enclosed content. Dates should be entered in the *yyyy-mm-dd* format, where *yyyy* is the four-digit year value, *mm* is the two-digit month value, and *dd* is the two-digit day value. Times should be entered in the *hh:mm* format for the two-digit hour and minute values entered in 24-hour time. To combine both dates and times, enter the date and time values separated by a space or the letter T as in the following code:

```
<footer>Last updated at:
  <time datetime="2021-03-01T14:52">March 1 2021 at 2:52
  p.m.</time>
</footer>
```

For international applications, you can base your time values on the common standard of Greenwich Mean Time. For example, the following code includes the information that the time is based on the Eastern time zone, which is 5 hours behind Greenwich Mean Time:

```
<p>Webinar starts at:
  <time datetime="2021-03-10T20:30-05:00">3:30 p.m.
  (EST)</time>
</p>
```

While the value of the `datetime` attribute is not visible to users, it is readable by machines such as search engines, which can include the date and time in reporting search results. You can read more about the `time` element on the W3C website, including information on marking a time duration between two events.

You've now created six web pages for the Curbside Thai website. Next, you'll link these pages together so that users can easily navigate between the pages in the website. You'll start by creating a navigation list.

Navigation Lists

A **navigation list** is an unordered list of hypertext links placed within the `nav` element. The general structure is

```
<nav>
  <ul>
    <li>link1</li>
    <li>link2</li>
  ...
  </ul>
</nav>
```

where *link1*, *link2*, and so forth are hypertext links. While hypertext links can be placed anywhere within the page, having a central list of links makes the website easier to work with and navigate.

Add this structure to the About Curbside Thai web page, creating entries for each of the six web pages you created in this tutorial.

To create a navigation list:

1. Open the **ct_about.html** file in your HTML editor if it is not already open.
2. Go to the body header and, directly below the inline image for the Curbside Thai logo, insert the following navigation list:

```
<nav>
  <ul>
    <li>About</li>
    <li>Locations</li>
    <li>Menu</li>
    <li>Reviews</li>
    <li>Catering</li>
    <li>Contact</li>
  </ul>
</nav>
```

Figure 1–36 highlights the structure of the navigation list.

Figure 1–36

Creating a navigation list

navigation list section
created with the nav
element

```
<body>
  <header>
    
    <nav>
      <ul>
        <li>About</li>
        <li>Locations</li>
        <li>Menu</li>
        <li>Reviews</li>
        <li>Catering</li>
        <li>Contact</li>
      </ul>
    </nav>
  </header>
```

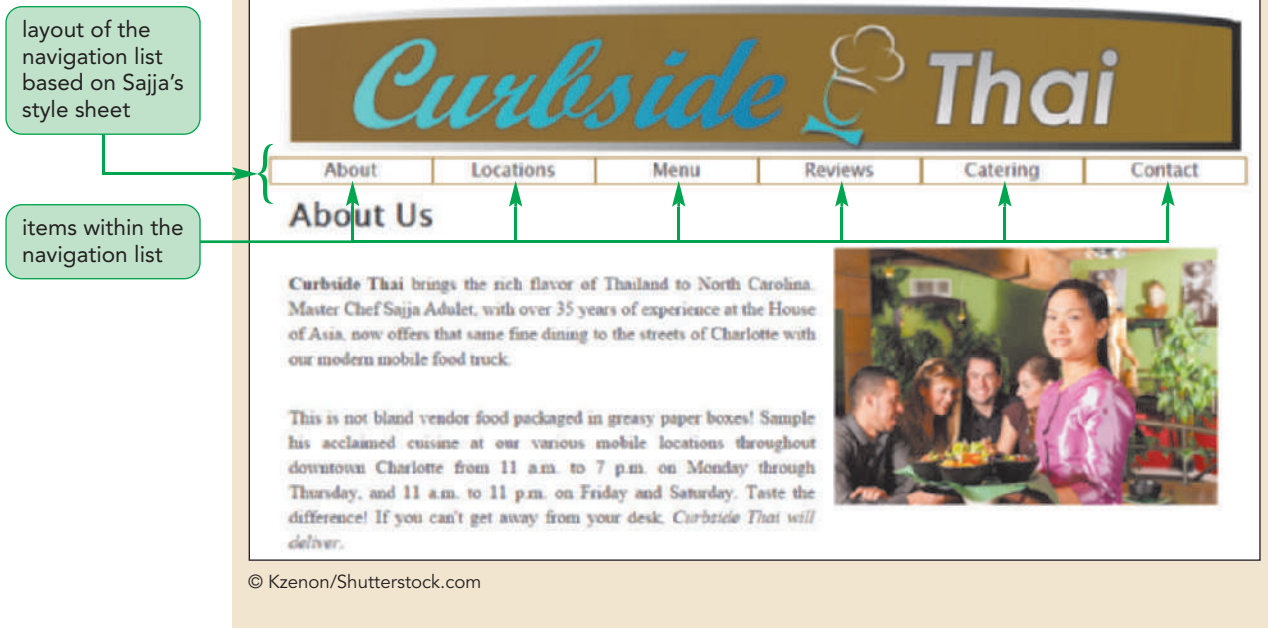
unordered list
within the nav
section

3. Save your changes to the file and then reopen the **ct_about.html** file in your browser.

Figure 1–37 shows appearance of the navigation list.

Figure 1–37

Navigation list for the Curbside Thai website



Note that the appearance of the navigation list in the `ct_about.html` file is based on styles in Sajja's style sheets. Navigation lists can be displayed in a wide variety of ways depending on the styles being employed and the same navigation list might be laid out horizontally for desktop devices and vertically for mobile devices. You'll learn more about how to format navigation lists in Tutorial 5.

Now that you've created the structure of the navigation list, mark the list items as hypertext links.

Working with Hypertext Links

Hypertext is created by enclosing content within a set of opening and closing `<a>` tags in the following structure

TIP

Keep your filenames short and descriptive so that users are less apt to make a typing error when accessing your website.

```
<a href="url">content</a>
```

where `url` is the **Uniform Resource Locator (URL)**, which is a standard address format used to link to a variety of resources including documents, email addresses, telephone numbers, and text messaging services, and `content` is the document content marked as a link. When linking to another HTML file in the same folder, the URL is simply the name of the file. For example, a hypertext link to the `ct_menu.html` file would be marked as

```
<a href="ct_menu.html">Menu</a>
```

When the user clicks or touches the word *Menu*, the browser will load the `ct_menu.html` file in the browser. Note that filenames are case sensitive on some web servers so that those servers differentiate between files named `ct_menu.html` and `CT_Menu.html`. The standard for all web filenames is to always use lowercase letters and to avoid using special characters and blank spaces.

The default browser style is to underline hypertext links and to display those links in a different text color if the user has previously visited the page. However, page designers can substitute different hypertext link styles from their own style sheets. We'll explore this technique in Tutorial 2.

Marking a Hypertext Link

- To mark content as a hypertext link, use

```
<a href="url">content</a>
```

where *url* is the address of the linked document, and *content* is the document content that is being marked as a link.

Mark the six entries in the navigation list, pointing each entry to the corresponding Curbside Thai page.

To create hypertext links:

1. Return to the **ct_about.html** file in your HTML editor.
2. Mark the first entry as a hypertext link pointing to **ct_about.html** file by changing the list item to

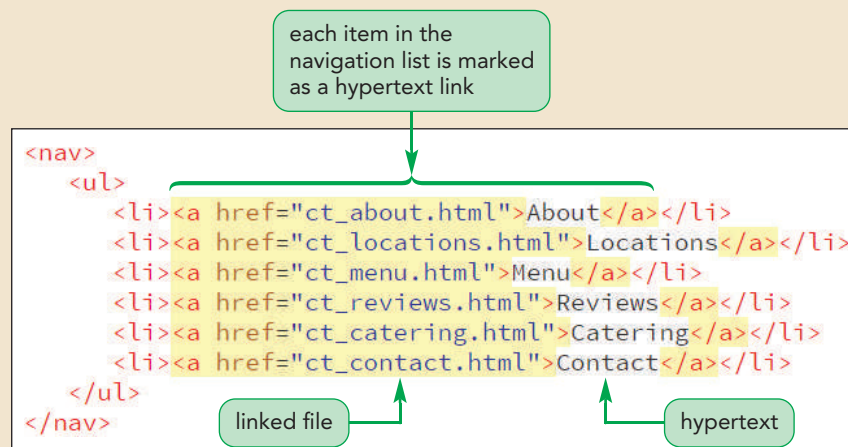
```
<a href="ct_about.html">About</a>
```
3. Change the code of the second list item to

```
<a href="ct_locations.html">Locations</a>
```
4. Continuing in the same fashion, change the Menu entry to a link pointing to the **ct_menu.html** file, the Reviews entry to a link pointing to the **ct_reviews.html** file, the Catering entry to a link pointing to the **ct_catering.html** file, and the Contact entry to a link pointing to the **ct_contact.html** file.

Figure 1–38 highlights the newly added code that changes all of the items in the navigation list to hypertext links.

Figure 1–38

Marking hypertext links



5. Save your changes to the file and then reopen the **ct_about.html** file in your browser.
6. Click each of the six navigation list entries and verify that the browser loads the corresponding web page. Use the Back button on your browser to return to the About Curbside Thai page after you view each document.

Trouble? If the links do not work, be sure your code matches Figure 1–38. For example, check the spelling of each filename in the href attribute of each `<a>` tag to ensure it matches the filename of the corresponding Curbside Thai web page and check to be sure you have all needed opening and closing tags.

You may have noticed that when your mouse pointer moved over a hypertext link in the navigation list, the appearance of the link changed to white text on a black background. This is an example of a **rollover effect**, which is used to provide visual clues that the text is hypertext rather than normal text. You'll learn how to create rollover effects in Tutorial 2.

Turning an Inline Image into a Link

Inline images can also be turned into links by enclosing the image within opening and closing `<a>` tags. Turn the Curbside Thai logo into a hyperlink that points to the Startup page you opened in the first session.

To mark an image as a hypertext link:

1. Return to the **ct_about.html** file in your HTML editor.
2. Mark the image in the body header as a hyperlink by changing the HTML code for the inline image to

```
<a href="ct_start.html"></a>
```

Figure 1–39 highlights the code to change the logo image to a hypertext link.

Figure 1–39

Marking an inline image as a hypertext link

reference to the
hypertext link

```
<body>
<header>
  <a href="ct_start.html"></a>
<nav>
  <ul>
```

3. Save your changes to the file and then reopen the **ct_about.html** file in your browser.
4. Click the Curbside Thai logo and verify that the browser opens the Curbside Thai Startup page. Click the Back button to return to the About Curbside Thai page.

Sajja wants to be able to jump to any document in the Curbside Thai website from any page. He asks you to copy the hypertext links, including the image hyperlink, you just created in the **ct_about.html** file to the other documents in the website.

TIP

You can give your websites a uniform design by including the same navigation list on each page so that users can easily move from one page to the next.

To copy and paste the hypertext links:

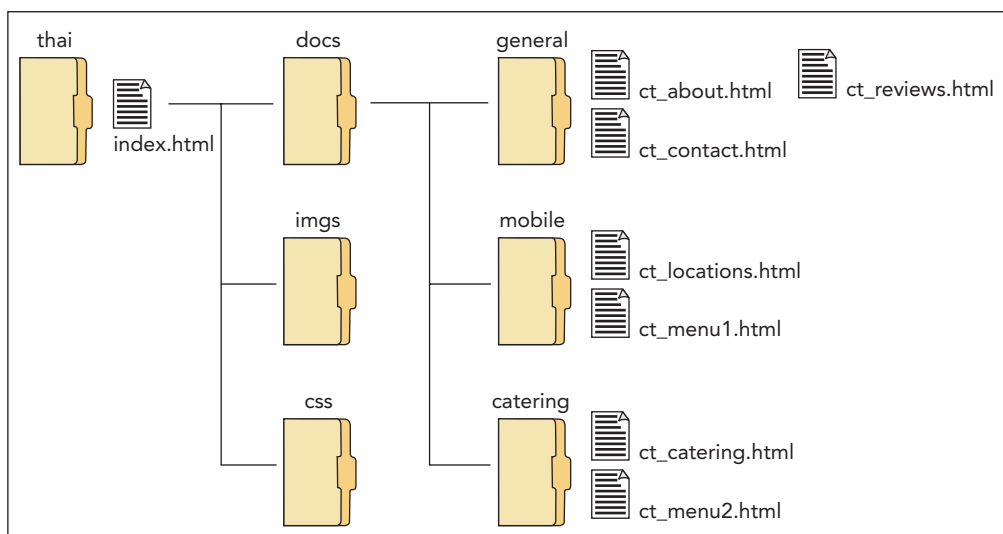
1. Return to the **ct_about.html** file in your HTML editor.
2. Copy the entire content of the page header from the opening `<header>` tag through to the closing `</header>` tag, including the revised code for the company logo and navigation list.
3. Go to the **ct_locations.html** file in your HTML editor. Paste the copied HTML code, replacing the previous page header in this document. Save your changes to the file.
4. Repeat the previous step for the **ct_menu.html**, **ct_reviews.html**, **ct_catering.html**, and **ct_contact.html** files, replacing the body header in each of those documents with the revised header from **ct_about.html**. Save your changes to each file.
5. Reopen the **ct_locations.html** file in your browser and verify that you can jump from one page to another by clicking items in the navigation list at the top of each page. Also verify that you can jump to the Startup page at any time by clicking the Curbside Thai logo.

Specifying the Folder Path

In the links you created, the browser assumed that the linked files were in the same folder as the current page. However, large websites containing hundreds of documents often place documents in separate folders to make them easier to manage.

Figure 1–40 shows a preview of how Sajja might organize his files as the Curbside Thai website increases in size and complexity. In this structure, all folders start from a **root folder** named *thai* that contains the site's home page, which Sajja has stored in the `index.html` file. Sajja has moved all of his images and CSS style sheet files into their own folders. He has divided the rest of the web pages among three subfolders: the general folder for pages containing general information about the restaurant, the mobile folder for pages with content specifically about the mobile food service, and the catering folder for pages describing Curbside Thai's catering opportunities.

Figure 1–40 A sample folder structure



To create links between files in separate folders, you must provide a path to the linked file. HTML supports two kinds of paths: absolute and relative.

Absolute Paths

An **absolute path** is a path that starts from the root folder and processes down the entire folder structure described with the expression

```
/folder1/folder2/folder3/file
```

where *folder1* is the root folder, followed by the subfolders *folder2*, *folder3*, and so forth, down to the linked file. Based on the structure shown previously in Figure 1–40, an absolute path pointing to the `ct_catering.html` file would be

```
/thai/docs/catering/ct_catering.html
```

If files are located on different drives as well as in different folders, you must include the drive letter in the path with the expression

```
/drive|/folder1/folder2/folder3/file
```

where *drive* is the letter assigned to the drive. Note that the drive letter must be followed by the `|` character. Thus, if the `ct_catering.html` file were located on drive E, the absolute path that includes the drive would have the expression

```
/E|/thai/docs/catering/ct_catering.html
```

Note that you don't have to include a drive letter if the linked document is located on the same drive as the current file.

Relative Paths

When many folders and subfolders are involved, absolute path expression can quickly become long and cumbersome to work with. For this reason, most web designers prefer **relative paths** in which the path is expressed relative to the location of the current document. If the current document and linked file are in the same folder, there is no path and you need only include the filename. If the linked file is in a subfolder of the current document, the path includes all of the subfolder names starting from the location of the current page using the expression

```
folder1/folder2/folder3/file
```

where *folder1*, *folder2*, *folder3*, and so forth are subfolders of the current document. The relative path to the `ct_about.html` file starting from the `index.html` file is

```
docs/general/ct_about.html
```

Note that relative paths are often expressed in terms of familial relationships such as parent, child, descendant, sibling, and so forth in order to indicate the hierarchical nature of the folder structure. Relative paths can also go up the hierarchy to parent folders by including the symbol (`..`), which means “go up one level.” Thus, to go from `ct_about.html` in the `general` folder up two levels to the `index.html` file, enter the expression

```
../../index.html
```

TIP

You can reference the current folder using a single period (`.`) character.

Finally, to go sideways in the folder structure by going to a file in a different folder but on the same level, you go up to the parent folder and then back down to a different child folder. To go from the `ct_about.html` file in the `general` folder to the `ct_locations.html` file in the `mobile` folder, use the relative path expression

```
../mobile/ct_locations.html
```

In this expression, the link goes up to the parent folder `docs` through the use of the `..` reference and then back down through the `mobile` folder to `ct_locations.html`.

You should almost always use relative paths in your links. If you have to move your files to a different computer or server, you can move the entire folder structure without having to edit the relative paths you've created. If you use absolute paths, you will have to revise each link to reflect the new location of the folder tree on the new device.

Setting the Base Path

A browser resolves relative paths based on the location of the current document. You define a different starting point for relative paths by adding the following `base` element to the document head

```
<base href="url" />
```

where `url` is the location that you want the browser to use when resolving relative paths in the current document. The `base` element is useful when a single document from the website is moved to a new folder. Rather than rewriting all of the relative paths to reflect the document's new location, the `base` element can point to the document's old location allowing relative paths to work as before.



PROSKILLS

Decision Making: Managing Your Website

Websites can quickly grow to dozens or hundreds of pages. As the size of a site increases, it becomes more difficult to get a clear picture of the site's structure and content. Imagine deleting or moving a file in a website that contains dozens of folders and hundreds of files. Could you easily project the effect of this change? Would all of your hypertext links still work after you moved or deleted the file?

To effectively manage a website, you should implement clear decision-making skills by following a few important rules. The first is to be consistent in how you structure the site. If you decide to collect all image files in one folder, you should continue that practice as you add more pages and images. Websites are more likely to break down if files and folders are scattered throughout the server without a consistent rule or pattern. Decide on a structure early and stick with it.

A second rule is to decide on and then create a folder structure that matches the structure of the website itself. If the pages can be easily categorized into different groups, those groupings should also be reflected in the groupings of the subfolders. The names you assign to your files and folders should also reflect their uses on the website. This makes it easier for you to predict how modifying a file or folder might impact other pages on the website.

Finally, you should document your work by adding comments to each new web page. Comments are useful not only for colleagues who may be working on the site but also for the author who must revisit those files months or even years after creating them. The comments should include

- The page's filename and location
- The page's author and the date the page was initially created
- A list of any supporting files used in the document, such as image and audio files
- A list of the files that link to the page and their locations
- A list of the files that the page links to and their locations

By following these rules, you can reduce a lot of the headaches associated with maintaining a large and complex website.

Linking to a Location within a Document

TIP

In general, a web page should not span more than one or two screen heights. Studies show that users often skip long pages where the content runs off the screen.

Hypertext can point to locations within a document. For example, you could link a specific definition within a long glossary page to save users the trouble of scrolling through the document. Websites containing the text of novels or plays can contain links to key passages or phrases within those works. When a link is established to a location within a document, the browser will jump to that location automatically scrolling the page to the linked location.

Marking Locations with the `id` Attribute

In order to enable users to jump to a specific location within a document, identify that location by adding the following `id` attribute to an element tag at that location

```
id="text"
```

where `text` is the name assigned to the ID. Imagine that Sajja writes a long page describing the full menu offered by Curbside Thai. He could mark the location in the page where the lunch menu is displayed by adding the following `id` attribute to the `h2` heading that marks the start of the Lunch Menu section.

```
<h2 id="lunch">Lunch Menu</h2>
```

TIP

IDs are case-sensitive: an ID of "top" is different from an ID of "TOP".

Note that IDs must be unique. If you assign the same ID to more than one element, the browser will jump to the first occurrence of that ID value.

Linking to an `id`

Once you've marked the location with an ID, you link to that element using the following hypertext link:

```
<a href="file#id">content</a>
```

where `file` points to the location and filename of the linked document and `id` is associated with the element within that document. The following hypertext link points to the element with the ID "lunch" within the `ct_fullmenus.html` file.

```
<a href="ct_fullmenus.html#lunch">View our Lunch Menu</a>
```

To link to a location within the current page, include only the ID value along with the `#` symbol. Thus, the following hypertext link points to the lunch ID within the current web page:

```
<a href="#lunch">View our Lunch Menu</a>
```

In both cases, clicking or tapping the link will cause the browser to automatically scroll to the location within the page.

Anchors and the `name` Attribute

Early web pages did not support the use of the `id` attribute as a way of marking locations within a document. Instead, they used the `<a>` tag as an anchor to mark that page location (hence the "a" in `<a>` tag). The general form of the anchor was

```
<a name="anchor">content</a>
```

where `anchor` is the name given to the anchored text. Inserting content within the `<a>` tag was optional because the primary purpose of the tag was to mark a document location, not to mark up content. The following code would establish an anchor at the start of the lunch section in the Curbside Thai full menu:

```
<h2><a name="lunch"></a>Lunch Menu</h2>
```

Once an anchor had been set, you link to the anchor using the same syntax you would use with the `id` attribute. The use of anchors is a deprecated feature of HTML and is not supported in strict applications of XHTML, but you will still see anchors used in older websites.

Linking to a Location within a Document

- To mark a location, add a unique ID to an element at that document location using the following `id` attribute

```
id="text"
```

where *text* is the value of the ID.

- To link to that location from a different document, use the hypertext reference

```
<a href="file#text">content</a>
```

where *file* is the name and path location (if necessary) of the external file and *text* is the value of the ID.

- To link to that location from within the same document, use the hypertext reference

```
<a href="#text">content</a>
```

Linking to the Internet and Other Resources

The type of resource that a hypertext link points to is indicated by the link's URL. All URLs share the general structure

```
scheme:location
```

where *scheme* indicates the resource type and *location* provides the resource location. The name of the scheme is taken from the network protocol used to access the resource where a **protocol** is a set of rules defining how information is passed between two devices. Pages on the web use the **Hypertext Transfer Protocol (HTTP)** protocol and therefore the URL for many web pages start with the `http` scheme. Other schemes that can be included within a URL are described in Figure 1–41.

Figure 1–41

Commonly used URL schemes

Scheme	Description
fax	A fax phone number
file	A document stored locally on a user's computer
ftp	A document stored on an FTP server
geo	A geophysical coordinate
http	A resource on the World Wide Web
https	A resource on the World Wide Web accessed over a secure encrypted connection
mailto	An email address
tel	A telephone number
sms	A mobile text message sent via the Short Message Service

Linking to a Web Resource

If you have ever accessed the web, you should be very familiar with website URLs, which have the general structure

```
http://server/path/filename#id
```

or for secure connections

```
https://server/path/filename#id
```

where *server* is the name of the web server hosting the resource, *path* is the path to the file on that server, *filename* is the name of the file, and if necessary, *id* is the name of an id or anchor within the file. For example, the following URL uses the HTTP protocol to access the web server at *www.curbsidethai.com*, linking to the document location named *lunch* within the *ct_menus.html* file in the */thai/docs* folder:

```
http://www.curbsidethai.com/thai/docs/ct_menus.html#lunch
```

URLs are often entered in a more abbreviated form, *http://www.curbsidethai.com* for example, with no path or filename. Those URLs point to the default home page located in the top folder in the server's folder tree. Many servers use *index.html* as the filename for the default home page, so the URL *http://www.curbsidethai.com* would be equivalent to *http://www.curbsidethai.com/index.html*.

INSIGHT

Understanding Domain Names

The server name portion of a URL is also called the **domain name**. By studying a domain name, you learn about the server hosting the website. Each domain name contains a hierarchy of names separated by periods (.), with the top level appearing at the far right end. The top level, called an **extension**, indicates the general audience supported by the web server. For example, *.edu* is the extension reserved for educational institutions, *.gov* is used for agencies of the United States government, and *.com* is used for commercial sites or general-use sites.

The next lower level appearing to the immediate left of the extension displays the name of the individual or organization hosting the site. The domain name *curbsidethai.com* indicates a commercial or general-use site owned by Curbside Thai. To avoid duplicating domain names, the top two levels of the domain must be registered with the **Internet Assigned Numbers Authority (IANA)** before they can be used. You can usually register your domain name through your web hosting company. Note: You must pay an annual fee to keep a domain name.

The lowest levels of the domain, which appear farthest to the left in the domain name, are assigned by the individual or company hosting the site. Large websites involving hundreds of pages typically divide their domain names into several levels. For example, a large company like Microsoft might have one domain name for file downloads—*downloads.microsoft.com*—and another domain name for customer service—*service.microsoft.com*. Finally, the first part of the domain name displays the name of the hard drive or resource storing the website files. Many companies have standardized on *www* as the initial part of their domain names.

Linking to an Email Address

Many websites use email to allow users to communicate with a site's owner, sales representative, or technical support staff. You can turn an email address into a hypertext link using the URL:

```
mailto:address
```

where *address* is the email address. Activating the link opens the user's email program with the email address automatically inserted into the To field of a new outgoing message. To create a hypertext link to the email address *s.adulet@example.com*, you could use the following URL:

```
mailto:s.adulet@example.com
```

TIP

To link to more than one email address, add the addresses to the mailto link in a comma-separated list.

The mailto protocol also allows you to insert additional fields into the email message using the URL:

```
mailto:address?field1=value1&field2=value2&...
```

where *field1*, *field2*, and so forth are different email fields and *value1*, *value2*, and so forth are the field values. Fields include subject for the subject line of the email message and body for the message body. To create a link to an email message with the following content

```
TO: s.adulet@example.com
SUBJECT: Test
BODY: Test Message
```

you would use the URL

```
mailto:s.adulet@example.com?subject=Test&body=Test%20Message
```

Notice that the body text uses %20 character code to represent a blank space since URLs cannot contain blank spaces.

On the Contact Us page, Sajja has inserted the Curbside Thai's email address. Convert this email address into a hypertext link.

To link to an email address:

1. Go to the **ct_contact.html** file in your HTML editor.
2. Change the Curbside Thai email address into the following mailto hypertext link:

```
<a href="mailto:curbside.thai@example.com">
  curbside.thai@example.com
</a>
```

Note that this is a fictional email address. If you want to test this link, change the URL to a link pointing to your own email address. Figure 1–42 highlights the hypertext code to the linked email address.

A mailto hypertext link to an external resource must include the mailto scheme name in order to be recognized by the browser.

Figure 1–42

Linking to an email address

mailto scheme indicates that this is an email link

email address

email address marked as a hyperlink

```
<p>Call: (704) 555-1151</p>
<p>Email: <a href="mailto:curbside.thai@example.com">curbside.thai@example.com</a></p>
</article>
```

3. Save your changes to the file and then reopen the ct_contact.html file in your browser.
4. Click the email address link and verify that your device opens your email program with the Curbside Thai address already entered. Close the email program without sending a message.

Trouble? Depending on your device, you may have to set up your email program to accept hypertext links.

INSIGHT

Email Links and Spam

Use caution when adding email links to your website. While it may make it more convenient for users to contact you, it also might make you more vulnerable to spam. **Spam** is unsolicited email sent to large numbers of people, promoting products, services, and in some cases inappropriate websites. Spammers create their email lists by scanning discussion groups, stealing Internet mailing lists, and using programs called **email harvesters** to scan HTML code for the email addresses contained in mailto URLs. Many developers have removed email links from their websites in order to foil these harvesters, replacing the links with web forms that submit email requests to a secure server.

Fighting spammers is an ongoing battle, and they have proved very resourceful in overcoming some of the defenses people have created. As you develop your website, you should carefully consider how to handle email addresses and review the most current methods for safeguarding that information.

Linking to a Phone Number

With the increased use of mobile phones to access the web, many developers now include links to phone numbers for their company's customer service or help line. Activating the link brings up the user's phone app with the number already entered, making it easier and more convenient to call the business or organization. The URL for a phone link is

`tel:phone`

where *phone* are the digits of the linked number. For example, the following code creates a telephone link to the Curbside Thai number:

```
Call: <a href="tel:+17045551151">(704) 555-1151</a>
```

TIP

Skype on the desktop uses `callto:` in place of the `tel:` scheme for telephone links. There are program scripts available on the web that you can use in order to work with both protocols.

Because websites are international, any telephone link should include the international dialing prefix (+1 for the United States) and the area code. Spaces or dashes between digits are optional with the exception of the + symbol before the international calling code. However, you can insert pauses in the phone number (used when accessing an extension) by inserting the `p` symbol, as in the following telephone link:

```
<a href="tel:+17045551151p22">Call: 555-1151 ext. 22</a>
```

Sajja asks you to change the telephone number from the Contact Us page into a telephone link.

To link to a phone number:

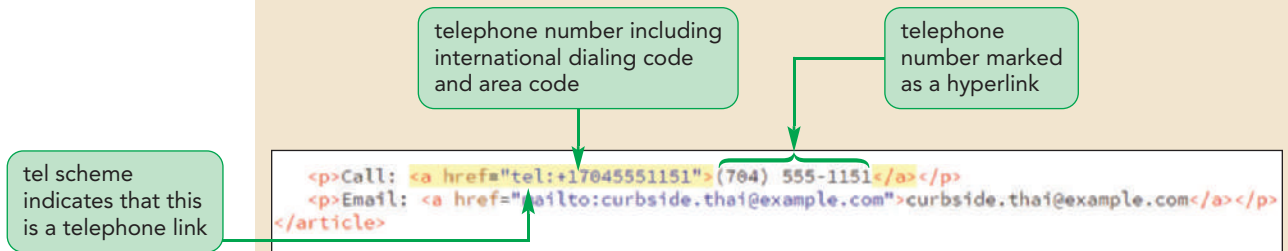
1. Return to the **ct_contact.html** file in your HTML editor.
2. Change the Curbside Thai phone number into the following hypertext link:

```
<a href="tel:+17045551151">
  (704) 555-1151
</a>
```

Once again this number is fictional; you can change the URL to a link pointing to your own phone number if you want to test the link on a mobile device. Figure 1–43 highlights the hypertext code of the telephone link.

Figure 1–43

Marking a telephone link



3. Save your changes to the file.

HTML supports links to other types of telephony devices. You can create a link to a fax machine using the `fax:` scheme and a link to your text messaging app by using the `sms:` scheme.

Working with Hypertext Attributes

HTML provides several attributes to the `a` element that control the behavior and appearance of hypertext links. Figure 1–44 describes these attributes.

Figure 1–44

Attributes of the `a` element

Attribute	Description
<code>href="url"</code>	Provides the <i>url</i> of the hypertext link
<code>target=(_blank _parent _self _top)</code>	Specifies where to open the linked document
<code>download="filename"</code>	Indicates that the link should be downloaded as a file, where <i>filename</i> is the name given to the downloaded file
<code>rel="type"</code>	Provides the relationship between the linked document and the current page
<code>hreflang="lang"</code>	Indicates the language of the linked document
<code>type="mime-type"</code>	Indicates the media type of the linked document

Using the `target` attribute, you can control how a page is opened. By default the target of a link replaces the contents of the current page in the browser window. In some websites, you will want to open a link in a new browser window or tab so that you can keep the current page and the linked page in view. To force a document to appear in a new window or tab, add the following `target` attribute to the `<a>` tag:

```
<a href="url" target="window">content</a>
```

where *window* is a name assigned to the browser window or browser tab in which the linked page will appear. You can choose any name you wish for the browser window or you can use one of the following target names:

- `_self` opens the page in the current window or tab (the default)
- `_blank` opens the page in a new unnamed window or tab, depending on how the browser is configured
- `_parent` opens the page in the parent of the current frame (for framed websites)
- `_top` opens the page in the top frame (for framed websites)

You should use the `target` attribute sparingly in your website. Creating secondary windows can clutter up a user's desktop. Also, because the page is placed in a new window, users cannot use the Back button to return to the previous page in that window; they must click the browser's program button or the tab for the original website. This confuses some users and annoys others. Many designers now advocate not using the `target` attribute at all, but instead provide the user with the choice of opening a link in a new tab or window.

**PROSKILLS**

Written Communication: Creating Effective Hypertext Links

To make it easier for users to navigate your website, the text of your hypertext links should tell readers exactly what type of document the link points to. For example, the link text

Click [here](#) for more information.

doesn't tell the user what type of document will appear when [here](#) is clicked. In place of phrases like "click here", you should use descriptive link text such as

For more information, view our list of [frequently asked questions](#).

If the link points to a non-HTML file, such as a PDF document, include that information in the link text. If the linked document is extremely large and will take a while to download to the user's computer, include that information in your link text so that users can decide whether or not to initiate the transfer. For example, the following link text informs users of both the type of document and its size so users have this information before they initiate the link:

Download our [complete manual \(PDF 2 MB\)](#).

Finally, when designing the style of your website, make your links easy to recognize. Users should never be confused about a link. Also, if you apply a color to your text, do not choose colors that make your hyperlinks harder to pick out against the web page background.

Validating Your Website

After finishing the code for your website, you can validate that code to ensure that there are no syntax errors. While browsers are very forgiving of syntax errors and will often render the page correctly, you should still perform a validation test for those browsers that might not be so accommodating.

Many HTML editors and web content management systems have built-in validators. If you don't have direct access to an HTML validator you can upload your code to the validator at the W3C website. To see how a validator can catch HTML syntax errors, you will introduce errors to the `ct_about.html` file and then test that file in the W3C validator.

To introduce errors to the `ct_about.html` file:

- 1. Return to the `ct_about.html` file in your editor.
- 2. Scroll down and delete the line `<h1>About Us</h1>`.
- 3. Go to the `` tag for the `ct_photo1.png` inline image and delete the `alt` attribute, `alt=""`, changing the tag to simply ``.
- 4. Save your changes to the file.

Using the validator at the W3C website or one built into your editor, validate the `ct_about.html` file to see the impact of these changes.

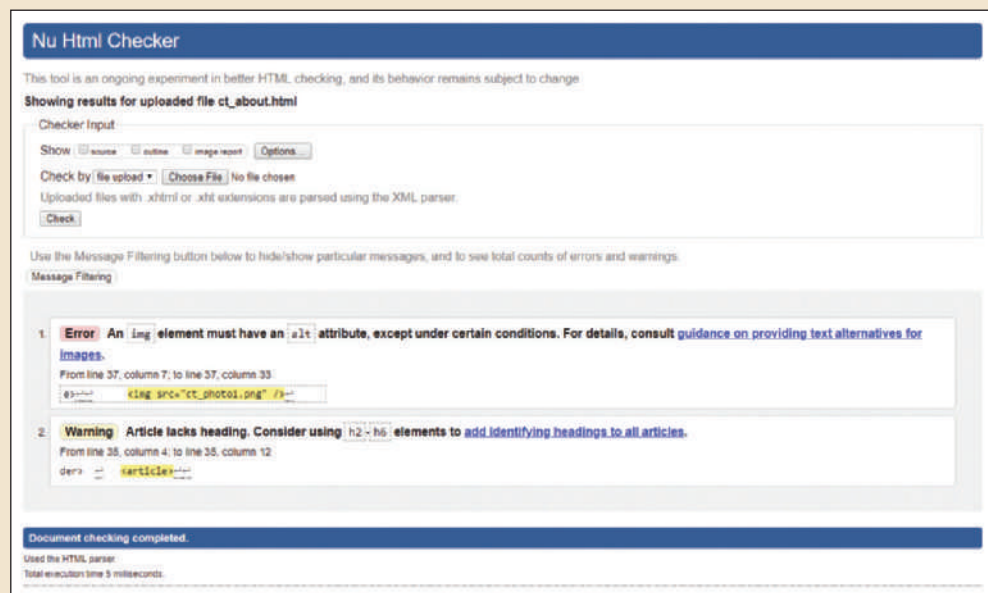
To validate the code in the `ct_about.html` file:

1. Open your browser to W3C validator at <https://validator.w3.org/>.
Trouble? If you are using an HTML editor with a built-in validator, talk to your instructor about accessing that editor's validation command.
2. Click the **Validate by File Upload** tab within the web page.
3. Click the **Choose File** or **Browse** button in the web form and locate the `ct_about.html` file from the `html01 ► tutorial` folder.
4. Click the **Check** button to validate the file.

The validator reports 1 error and provides 1 warning. See Figure 1–45.

Figure 1–45

Validation report



Because every `img` element must have an `alt` attribute (to make the page accessible to *all users*), the validator reports an error that the inline image for the `ct_photo.png` image is missing alternate text. The validator also issues a warning that the page article is lacking a heading. While this is not a syntax error (hence the validator only issued a warning) it is strongly recommended that all articles have at least one heading.

To fix the errors in the `ct_about.html` file:

1. Return to the `ct_about.html` file in your editor.
2. Re-insert the heading `<h1>About Us</h1>` directly below the opening `<article>` tag.
3. Add the attribute `alt=""` to the `img` element for the `ct_photo1.png` inline image.
4. Save your changes to the file.
5. Return in your browser to the W3C validator at <https://validator.w3.org/> or run the validator within your HTML editor.
6. Retest the `ct_about.html` file, verifying that no errors or warnings are reported.

You've completed your work on the Curbside Thai website. Sajja will study your work and get back to you with future projects for his restaurant. For now, you can close any open files or applications.

REVIEW

Session 1.3 Quick Check

- Which of the follow tags is *not* used to mark a list?
 - ` ...`
 - ` ... `
 - `<dl> ... </dl>`
 - ` ... `
- To have an ordered list count down from 100, which attributes should you use?
 - `down start="100"`
 - `reversed start="100"`
 - `decrease start="100"`
 - `reversed from="100"`
- Lists of hypertext links should be enclosed within what tags?
 - `<a> ...`
 - `<dl> ... </dl>`
 - `<links> ... </link>`
 - `<nav> ... </nav>`
- To link text to the website *https://www.mobilepanini.com*, use the tag:
 - ` ... `
 - `<link a=" https://www.mobilepanini.com"> ... </link>`
 - ` ... `
 - ` ... `
- Using Figure 1–40, the relative path going from the *ct_about.html* file to the *ct_catering.html* file is:
 - `../catering/ct_catering.html`
 - `ct_catering.html`
 - `/catering/ct_catering.html`
 - `./catering/ct_catering.html`
- What tag can be used to define the starting point for relative paths?
 - `<start />`
 - `<base />`
 - `<a> ... `
 - `<link />`
- What tag should you use to mark the h1 heading with the location *topHeading*?
 - `<h1 id="TopHeading">Mobile Panini</h1>`
 - `<h1 id="topHeading">Mobile Panini</h1>`
 - `<h1>Mobile Panini</h1>`
 - All of the above
- To link to the email address *sajja@example.com*, use the URL:
 - `mail:sajja@example.com`
 - `sms:sajja@example.com`
 - `fax:sajja@example.com`
 - `mailto:sajja@example.com`
- To link to the phone number 970-555-0002, use the URL:
 - `tel:9705550002`
 - `phone:9705550002`
 - `call:9705550002`
 - `dial:9705550002`

Coding Challenge 1

Data Files needed for this Coding Challenge: **code1-1_txt.html**

Use HTML to create a navigation list of 10 government websites as shown in Figure 1–46. Each item in the list should act as a hypertext link to the government side.

Figure 1–46 Coding Challenge 1-1 example page

Government Sites on the Web

- [USA Government](https://www.usa.gov)
- [Library of Congress](https://www.loc.gov)
- [U.S. Congress](https://www.congress.gov)
- [Federal Depository Library System](https://www.fdlp.gov)
- [Ben's Guide to US Government for Kids](https://bensguide.gpo.gov)
- [Health Finder](https://www.healthfinder.gov)
- [National Center for Health Statistics](https://www.cdc.gov/nchs)
- [The Whitehouse](https://www.whitehouse.gov)
- [U.S. Census Bureau](https://www.census.gov)
- [CIA World Factbook](https://www.cia.gov/library/publications/the-world-factbook/)

The following are the URLs associated with each website:

- USA government (<https://www.usa.gov>)
- Library of Congress (<https://www.loc.gov>)
- U.S. Congress (<https://www.congress.gov>)
- Federal Depository Library System (<https://www.fdlp.gov>)
- Ben's Guide to US Government for Kids (<https://bensguide.gpo.gov>)
- Health Finder (<https://www.healthfinder.gov>)
- National Center for Health Statistics (<https://www.cdc.gov/nchs>)
- The Whitehouse (<https://www.whitehouse.gov>)
- U.S. Census Bureau (<https://www.census.gov>)
- CIA World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/>)

Do the following:

1. Open the **code1-1_txt.html** file from the tutorial1 ► code1 folder. Enter **your name** and **the date** in the head section of the document and save the file as **code1-1.html** to the same location.
2. Within the body section of the file, enter the text **Government Sites on the Web**. Mark that text as an h1 heading.
3. Place the list of government websites within an unordered list nested within a navigation list. Mark each government website as a separate list item.
4. Mark the text of each government site as a hypertext link using the <a> tag. Set the href attribute to the URLs specified above.
5. Save your changes to the file.
6. Test the page in your browser, verifying that each item in the list is linked to the appropriate government website.
7. Submit the completed file to your instructor.

Coding Challenge 2

Data Files needed for this Coding Challenge: `code1-2_txt.html`

Mark up a web page containing the poem *Revelation* by Robert Frost shown in Figure 1–47.

Figure 1–47

Coding Challenge 1-2 example page

Revelation

by Robert Frost

We make ourselves a place apart
Behind light words that tease and flout,
But oh, the agitated heart
Till someone find us really out.

'Tis pity if the case require
(Or so we say) that in the end
We speak the literal to inspire
The understanding of a friend.

But so with all, from babes that play
At hide-and-seek to God afar,
So all who hide too well away
Must speak and tell us there they are.

From *A Boy's Will*, published by A Henry Holt and Company © 1913 (in the public domain)

Do the following:

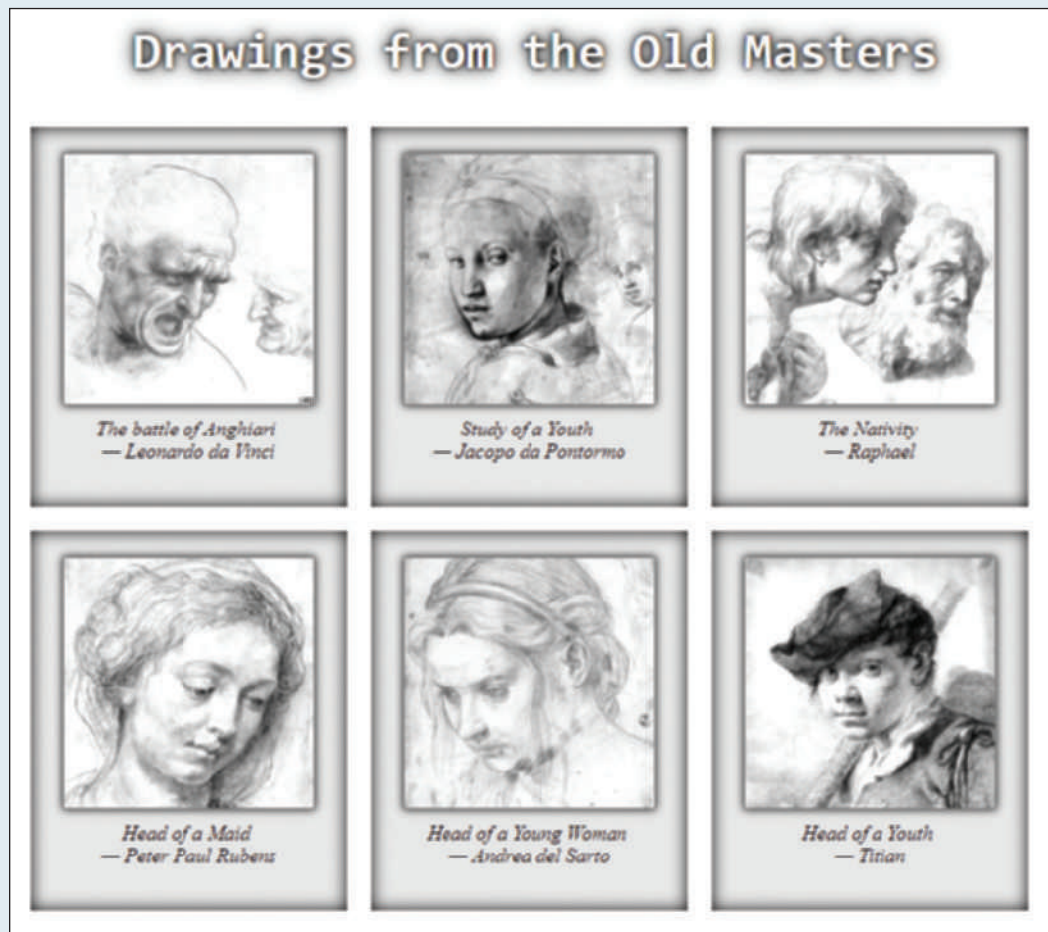
1. Open the `code1-2_txt.html` file from the tutorial1 ► code2 folder. Enter **your name** and **the date** in the head section of the document and save the file as `code1-2.html` to the same location.
2. Mark the text *Revelation* as an h1 heading and the text *by Robert Frost* as an h2 heading.
3. Mark each stanza of the poem as a paragraph.
4. Within each of the three stanzas, end each line with a line break using the `
` tag.
5. For alternating lines within the three stanzas, insert three ` ` character entities to indent the text of those lines three spaces.
6. Replace the line of dashes after the poem with the `<hr />` tag to indicate a horizontal rule.
7. Enclose the reference to the poem's origin within a `<footer>` tag.
8. Mark the text *A Boy's Will* using the `<cite>` tag.
9. Replace the word *copyright* with the character reference `©`
10. Save your changes to the file.
11. View the page in your browser to verify that the poem's structure resembles that shown in Figure 1–47.
12. Submit the completed file to your instructor.

Coding Challenge 3

Data Files needed for this Coding Challenge: `code1-3_txt.html`, `code1-3_styles.css`, `drawing01.png` – `drawing06.png`

Display a gallery of six drawings by Renaissance masters using HTML and a CSS style sheet. The page containing the drawings is shown in Figure 1–48.

Figure 1–48 Coding Challenge 1-3 example page



Do the following:

1. Open the `code1-3_txt.html` file from the tutorial1 ► code3 folder. Enter **your name** and **the date** in the head section of the document and save the file as `code1-3.html` to the same location.
2. Add an attribute to the opening `<html>` tag to set the language of the page to “en” (for English).
3. Within the head section of the document do the following:
 - a. Set the character encoding of the file to **utf-8**.
 - b. Set the page title to **Coding Challenge 1-3**.
 - c. Link the file to designs stored in the `code1-3_styles.css` style sheet file.
4. Within the page body, insert an h1 heading containing the text **Drawings from the Old Masters**.
5. After the h1 heading, insert six section elements using the `<section>` tag.

6. Within each of the six sections, insert an inline image using the `` tag, displaying the image files `drawing01.png` through `drawing06.png`. For the six inline images, specify the following alternate text: **Leonardo da Vinci, Jacopo da Pontormo, Raphael, Peter Paul Rubens, Andrea del Sarto, and Titian.**
7. After each of the six inline images within the section elements, add a footer element using the `<footer>` tag. Within the six footers, add the following text captions: **The Battle of Anghiari --- Leonardo da Vinci, Study of a Youth -- Jacopo da Pontormo, The Nativity -- Raphael, Head of a Maid -- Peter Paul Rubens, Head of a Young Woman -- Andrea del Sarto, and Head of a Youth -- Titian.**
8. For the figure captions in the previous step, replace the six “---” character strings with a line break tag (`
`) followed by the `—` character reference.
9. Save your changes to the file.
10. View the page in your browser to verify that the drawing gallery resembles Figure 1–48.
11. Submit the completed file to your instructor.

DEBUG

Coding Challenge 4

Data Files needed for this Coding Challenge: `code1-4_txt.html`, `code1-4_styles.css`, `code1-4_image.png`

You have been given a file containing several coding errors that need to be fixed for the page to pass validation. Locate and fix the errors in the web page. A preview of the fixed page is shown in Figure 1–49.

Figure 1–49

Coding Challenge 1-4 example page


The Teton Crest Trail

The Teton Crest Trail is an awe-inspiring 40-mile hike along the Grand Teton range in western Wyoming. The trail extends from Phillips Pass on the border of the Bridger Teton National Forest and proceeds north to String Lake in Grand Teton National Park.

You can access the Teton Crest Trail from the Granite Canyon Trail or from the aerial tramway in Jackson Hole, which provides a gradual ascent to the Teton range. There are several access trails adjacent from national forest lands of varying degrees of difficulty.

Along the trail, enjoy an exciting traverse of the Death Canyon Shelf with a difficult climb over Mount Meek Pass, Hurrican Pass, and the Paintbrush Divide. This is a challenging 3- to 4-day trip, so you must pack sufficient supplies and a water purifier. The Teton Crest Trail goes through grizzly bear country, so bear spray is a must.

- **Distance** 40 miles
- **Elevation Gain** 10,779 feet
- **Permit Required** Yes
- **Difficulty Rating** 4 (strenuous)



© Courtesy Patrick Carey

Do the following:

1. Open the **code1-4_txt.html** file from the tutorial1 ► code3 folder. Enter **your name** and **the date** in the document and save the file as **code1-4.html** to the same location.
2. Test the page in the validator at the W3C website (validator.w3.org) or with another validator of your choice. Make a note of the errors reported as a guide to debugging the page. Not every error will be initially reported. There are 10 syntax errors in the HTML file.
3. Fix all 10 errors you discover and then resubmit the saved document to validation until it passes with no warnings or errors.
4. View the page in your browser to verify that the page resembles Figure 1–49.
5. Submit the completed file to your instructor.

Review Assignments

Data Files needed for the Review Assignments: mp_index_txt.html, mp_menu_txt.html, mp_events_txt.html, mp_catering_txt.html, 2 CSS files, 2 PNG files, 1 TXT file

Curbside Thai has partnered with another food truck vendor Mobile Panini. Sajja asks you to create a website for the company similar to what you did for his restaurant. The site will have a home page, an online menu, a description of catering opportunities, and a calendar of upcoming events that Mobile Panini will host. A preview of the home page is shown in Figure 1–50.

Figure 1–50

Mobile Panini home page



© Glenn Price/Shutterstock.com

The page text has already been written for you and style sheets and graphic files have been created. Your job will be to complete this project by writing the HTML markup.

Complete the following:

1. Use your HTML editor to open the **mp_index_txt.html**, **mp_menu.txt.html**, **mp_events_txt.html**, and **mp_catering_txt.html** files from the html01 ► review folder. Enter *your name* and *the date* in the comment section of each file, and save them as **mp_index.html**, **mp_menu.html**, **mp_events.html**, and **mp_catering.html** respectively.
2. Go to the **mp_index.html** file in your HTML editor. Within the document head, do the following:
 - a. Use the `meta` element to set the character encoding of the file to **utf-8**.
 - b. Add the following search keywords to the document: **Italian**, **Mobile**, **food**, and **Charlotte**.
 - c. Set the title of the document to **Mobile Panini**.
 - d. Link the document to the `mp_base.css` and `mp_layout.css` style sheet files.
3. Go to the document body and insert a `header` element containing the following:
 - a. An inline image from the `mp_logo.png` file with the alternate text **Mobile Panini**. Mark the image as a hypertext link pointing to the `mp_index.html` file.
 - b. A navigation list containing an unordered list with the following list items: **Home**, **Menu**, **Events**, and **Catering**. Link the items to the `mp_index.html`, `mp_menu.html`, `mp_events.html`, and `mp_catering.html` files respectively.
4. Below the `header` element insert an `article` element. Below the `article` element, insert a `footer` element containing the following text:
Mobile Panini ☎ 31 West Avenue, Charlotte NC 28204 ☎ 704-555-2188
 where ☎ is inserted using the **9832** character code and an extra space is added between NC and **28204** using the `nbsp` character name.
5. Go to the **mp_pages.txt** file in your text editor. This file contains the text content of the four pages in the Mobile Panini website. Copy the text of the Welcome section, which will be used in the home page of the website. Return to **mp_index.html** in your HTML editor and paste the copied text into the `article` element.
6. Within the `article` element, do the following:
 - a. Mark the Welcome line as an `h1` heading.
 - b. Below the `h1` element, insert an inline image containing the `mp_photo1.png` file with an empty text string for the alternate text.
 - c. Mark the next five paragraphs as paragraphs using the `p` element. Within the first paragraph, mark the text *Mobile Panini* as strong text. Within the third paragraph mark the text *Curbside Thai* as emphasized text.
 - d. The fourth paragraph contains Mobile Panini's phone number. Mark the phone number as a telephone link and be sure to include the international code in the URL. Note that this number is fictional, so, if you have access to a mobile browser and want to test the link, you might want to replace this number with your phone number.
 - e. The fifth paragraph contains Mobile Panini's email address. Mark the email address as a hypertext link. Once again, note that this email address is fictional, so, if you want to test this link, you will need to replace the Mobile Panini email address with your email address.
7. Save your changes to the file and then open the **mp_index.html** file in your browser. Verify that the layout and appearance of the page resemble that shown in Figure 1–45. If possible, test the telephone links and email links to verify that they open the correct application.
8. Go to the **mp_index.html** file in your HTML editor, and copy the `header` and `footer` elements. Then go to the **mp_menu.html** file in your HTML editor and paste the `header` and `footer` elements into the `body` element so that this page has the same logo and navigation list and footer used in the home page. Insert an `article` element between the `header` and `footer`.
9. Return to the **mp_pages.txt** file in your text editor and copy the contents of the Mobile Panini menu. Then, go to the **mp_menu.html** file in your HTML editor and paste the copied text into the `article` element.

10. Within the `article` element of the `mp_menu.htm` file, do the following:
 - a. Mark the text title *Our Menu* as an `h1` heading.
 - b. Enclose the menu items in a description list with the name of each menu item marked with the `dt` element and each menu description marked with the `dd` element.
11. Save your changes to `mp_menu.html` file. Open the page in your browser and verify that each menu item name appears in a bold font and is separated from the indented item description by a horizontal line.
12. Go to the **`mp_index.html`** file in your HTML editor and copy the `header` and `footer` elements. Then, go to the **`mp_events.html`** file in your HTML editor and paste the `header` and `footer` elements into the `body` element. Insert an `article` element between the header and footer.
13. Return to the **`mp_pages.txt`** file in your text editor and copy the list of upcoming events at the bottom of the file. Then, go to the **`mp_events.html`** file in your HTML editor and paste the copied text into the `article` element.
14. Within the `article` element, do the following:
 - a. Mark the text *Where Are We This Week?* as an `h1` heading.
 - b. Enclose each day's worth of events within a separate `div` (or `division`) element.
 - c. Within each of the seven day divisions, enclose the day and date as an `h1` heading. Enclose the location within a paragraph element. Insert a line break element, `
`, directly before the time of the event so that each time interval is displayed on a new line within the paragraph.
15. Save your changes to `mp_events.html` file. Open the page in your browser and verify that each calendar event appears in its own box with the day and date rendered as a heading.
16. Go to the **`mp_index.html`** file in your HTML editor and copy the `header` and `footer` elements. Then, go to the **`mp_catering.html`** file in your HTML editor and paste the `header` and `footer` elements into the `body` element. Insert an `article` element between the header and footer and then insert an `aside` element within the article.
17. Directly after the opening `<article>` tag, insert an `h1` element containing the text **Catering**.
18. Return to the **`mp_pages.txt`** file in your text editor and copy the text about the mobile kitchen, including the heading. Then, go to the **`mp_catering.html`** file in your HTML editor and paste the copied text into the `aside` element.
19. Within the `article` element, do the following:
 - a. Mark the text *About the Mobile Kitchen* as an `h1` heading.
 - b. Mark the next two paragraphs as paragraphs.
20. Return to the **`mp_pages.txt`** file in your text editor and copy the text describing Mobile Panini's catering opportunities; do not copy the Catering head. Then, go to the **`mp_catering.html`** file in your HTML editor and paste the copied text directly after the `aside` element.
21. Make the following edits to the pasted text:
 - a. Mark the first two paragraphs as paragraphs.
 - b. Enclose the list of the six catering possibilities within an unordered list with each item marked as a list item.
 - c. Mark the concluding paragraph as a paragraph.
22. Save your changes to `mp_catering.html` file. Open the page in your browser and verify that the information about the mobile kitchen appears as a sidebar on the right edge of the article.
23. Return to the **`mp_index.html`** file in your browser and verify that you can jump from one page to another by clicking the entries in the navigation list at the top of each page.

Case Problem 1

Data Files needed for this Case Problem: `jtc_index_txt.html`, `jtc_services_txt.html`, 2 CSS files, 3 PNG files, 1 TXT file

Jedds Tree Care Carol Jedds is the owner and operator of Jedds Tree Care and tree removal and landscaping company in Lansing, Michigan. She has asked for your help in developing her company's website. She has already written some of the text for a few sample pages and wants you to write the HTML code. Figure 1–51 shows a preview of the company's home page that you'll create.

Figure 1–51 Jedds Tree Care home page



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The style sheets and graphic files have already been created for you. Your job is to write the HTML markup.

Complete the following:

1. Using your editor, open the `jtc_index_txt.html` and `jtc_services_txt.html` files from the `html01 ► case1` folder. Enter **your name** and **the date** in the comment section of each file, and save them as `jtc_index.html` and `jtc_services.html` respectively.
2. Go to the `jtc_index.html` file in your HTML editor. Within the document head, do the following:
 - a. Use the `meta` element to set the character encoding of the file to **utf-8**.
 - b. Set the document title to **Jedds Tree Care**.
 - c. Link the document to the `jtc_base.css` and `jtc_layout.css` style sheet files.
3. Within the document body, insert a `header` element, an `aside` element, and an `article` element.

4. Within the `header` element, insert a navigation list with links to `jtc_index.html` and `jtc_services.html` file. The text of the links should be **home** and **services** respectively.
5. Go to the `jtc_pages.txt` file in your text editor. The first section in the file contains comments made by Jedds Tree Care customers. Copy the text of the three reviews including the reviewer names. Then, go to the `jtc_index.html` file in your HTML editor and paste the copied text within the `aside` element.
6. Within the `aside` element, add the following content and markup:
 - a. Directly after the opening `<aside>` tag, insert an inline image for the `jtc_comments.png` file. Specify **Comments** as the alternate text.
 - b. Enclose each of the three reviewer comments within a `blockquote` element, including both the text of the quote and the name of the review.
 - c. Within each of the three `blockquote` elements,
 - i. mark the review as a paragraph.
 - ii. mark the line containing the reviewer name as a `cite` element.
 - iii. replace the “---” text with the em dash character (—) using the character reference `—`.
7. Go to the `article` element and insert a `header` element containing the inline image file `jtc_photo1.png` with the alternate text *Jedds Tree Care*.
8. Return to the `jtc_pages.txt` file in your text editor and copy the second section of text containing the description of the company and its contact information. Then, go to the `jtc_index.html` file in your HTML editor and paste the copied text in the `article` element, directly below the article header.
9. Mark up the content of the page article as follows:
 - a. Mark the first two paragraphs using the `<p>` tag.
 - b. Enclose the five lines of the contact information within an `address` element. Insert a line break element at the end of the first four lines so that each part of the address appears on a new line in the rendered page.
 - c. Mark the text *Jedds Tree Care* in the first line of the address as a `strong` element.
 - d. Mark the email address as a hypertext link. Make the telephone number a telephone link, including the international access code.
10. Save your changes to the `jtc_index.html` file. Open the page in your browser and verify that the layout and contents of the page resemble that shown in Figure 1–51. Note that under the smaller screen widths associated with mobile devices, the text of the reviewer comments is not displayed.
11. Go to the `jtc_services.html` file in your HTML editor. Insert the same metadata in the document head to match what you did for the `jtc_index.html` file *except* name the page title **Jedds Tree Care Services**.
12. Go to the `jtc_index.html` file in your HTML editor and copy the body header. Then, go to the `jtc_services.html` file and paste the copied header into the document body so that both files share a common header design.
13. Return to the `jtc_pages.txt` file in your text editor and copy the content of the third section, which contains information on the services offered by Jedds Tree Care. Be sure to copy the heading as well. Then, go to the `jtc_services.html` file in your HTML editor and paste the copied text directly after the header.
14. Mark the content describing Jedds Tree Care services as follows:
 - a. Mark the heading *Jedds Tree Care Services* as an `h1` heading.
 - b. Directly after the `h1` element, insert an inline image file for the `jtc_photo2.png` with the alternate text set to an empty text string (“”).
 - c. Mark each of the headings associated with individual services as `h2` headings.
 - d. Mark each service description as a paragraph.

15. Directly after the text of the last service, insert a `footer` element containing the following text:
Jedds Tree Care ♦ 201 Edward Ave. ♦ Lansing, MI 48930
where the ♦ symbol is inserted using the character reference `♦`.
16. Save your changes to the file and open the `jtc_services.html` file in your browser. Verify that the page title is displayed as a major heading and the name of each service is displayed as a second level heading.

CHALLENGE

Case Problem 2

Data Files needed for this Case Problem: `dr_index_txt.html`, `dr_info_txt.htm`, `dr_faq_txt.html`, 4 CSS files, 2 PNG files, 3 TXT files

Diane's Run *Diane's Run* is a charity run to raise money for breast cancer awareness and research funding. Peter Wheaton is the charity run's organizer and he has asked you to help modify the run's website. He has revised text that he wants added to the current site. A preview of the page you'll create is shown in Figure 1–52.

Figure 1–52

Diane's Run home page

[FAQ](#)
[Race Info](#)
[Home](#)

What Your Support Does

Every 10 minutes a woman is diagnosed with breast cancer. Her first reaction is fear and confusion. Support is just a phone call or mouse click away. Our free services offer a friendly ear and expert guidance to anyone dealing with this life-threatening illness.

By running or walking with us, you can ensure that we are there when people need us. Here is how your contribution can help:

- **\$15** pays for a headscarf set, boosting the confidence of women who have lost their hair from breast cancer treatment.
- **\$50** trains a member of our support network for a year to help improve the care of women with breast cancer.
- **\$125** covers the cost of counseling sessions to help women cope with the distress of their cancer treatment.
- **\$250** funds a hospital information station for a year so that people affected by breast cancer have easy access to the latest resources and help.



Diane's Run - September 12, 2021

Join over 2000 athletes in Cheyenne, Wyoming, for **Diane's Run** to raise money for breast cancer awareness and research. The 5K and 10K races are challenging, yet achievable. You can aim for a personal best while taking part to raise money for this important charity. If you can't run, consider walking. Join young and old in the fight by participating in the 1-Mile Walk for Hope.

How to Join

You can guarantee a spot by filling out the entry form and mailing it to dianesrun@example.com. The \$35 entry fee is tax deductible and goes directly to important research and women in need. We keep our overhead very low so every dollar counts. More than 75% of the net proceeds fund screening and treatment programs in your communities. We welcome out-of-town visitors. We will help you find [accommodations](#) during your visit.

History

Since its inception in 2014, Diane's Run has grown from a purely local event involving 100 runners to a signature Wyoming event with more than 2000 participants annually. The event is enormously effective in spreading the message that breast cancer need not be fatal if caught early enough with mammography and regular breast self-exams. As well as a top-flight athletic event, Diane's Run is an emotionally moving event attracting many first timers and recreational runners. This event provides all of us with the opportunity to spread a hopeful message about breast cancer to our families and our communities.

Remembering Diane

Diane's Run is named in remembrance of Diane Wheaton, mother of two and wife of Peter, who passed away in May, 2013. Diane was an outspoken advocate of physical fitness and healthy living. She was an inspiration to all who knew her and continues to be an inspiration to the thousands of runners who have participated in this event.

We hope you can join us this year and become part of the Diane's Run family.



Diane's Run ♦ 45 Mountain Drive ♦ Cheyenne, WY 82001


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Peter has supplied you with the text content, the graphic images, and style sheets you need for the project. Your job will be to write HTML code for three pages: the site's home page, a page containing race information, and finally a page containing a list of frequently asked questions (FAQ).

Complete the following:

1. Using your editor, open the **dr_index_txt.html**, **dr_info_txt.html**, and **dr_faq_txt.html** files from the **html01 ► case2** folder. Enter *your name* and *the date* in the comment section of each file, and save them as **dr_index.html**, **dr_info.html**, and **dr_faq.html** respectively.
2. Go to the **dr_index.html** file in your HTML editor. Within the document head, add the following metadata:
 - a. Set the character encoding of the file to **utf-8**.
 - b. Insert the search keywords: **breast cancer**, **run**, **race**, and **charity**.
 - c. Set the title of the document to **Diane's Run**.
 - d. Link the document to the **dr_base.css** and **dr_layout.css** style sheet files.
3. Within the document body, insert a **header** element, two **section** elements, and a **footer** element.
4. In the **header** element, insert a navigation list containing an **unordered** list with the items: **Home**, **Race Info**, and **FAQ**. Link the items to the **dr_index.html**, **dr_info.html**, and **dr_faq.html** files respectively.
5. The file **dr_index.txt** contains the text to be inserted into the Diane's Run home page. Go to the **dr_index.txt** file in your text editor and copy the text from the first section of the file. Then, go to the **dr_index.html** file in your HTML editor and paste it into the first **section** element.
6. Add the following markup to the content of the first **section** element:
 - a. Mark the line *What Your Support Does* as an **h1** heading.
 - b. Mark the next two paragraphs as paragraphs using the **p** element.
 - c. Mark the four ways a contribution can help as an **unordered** list. Mark the dollar amounts of each list item using the **strong** element.
7. Return to the **dr_index.txt** file in your text editor, copy the text from the second section, then close the **dr_index.txt** file. Go to the **dr_index.html** file in your HTML editor and paste the copied text within the second **section** element.
8. Within the second **section** element in the **dr_index.html** file, add the following:
 - a. Enclose the opening heading *Diane's Run - September 12, 2021* within a **header** element and marked as an **h1** heading. Directly above this heading, insert the inline image file **dr_photo1.png** with **Diane's Run** as the alternate text of the image.
 - b. Mark the first paragraph after the header as a paragraph. Mark the text *Diane's Run* in this opening paragraph using the **strong** element.
 - c. Mark the minor headings *How to Join*, *History*, and *Remembering Diane* as **h2** headings. Mark the other blocks of text as paragraphs.
9. Within the **footer** element, insert the following text:
Diane's Run ♥ 45 Mountain Drive ♥ Cheyenne, WY 82001
where the ♥ character is inserted using the character reference **♥**.
10. Save your changes to the file and then open **dr_index.html** in your browser. Verify that the content and the layout of the page resemble that shown in Figure 1–52.
11. Go to the **dr_info.html** file in your HTML editor. Within the document head, link the page to the **dr_base.css** and **dr_layout2.css** style sheets.
12. Go to the **dr_index.html** file in your HTML editor and copy the body header content. Then, go to the **dr_info.html** file in your HTML editor and paste the copied content into the document body. Repeat for the body footer so that the Racing Information page has the same navigation list and footer as the home page. Between the **header** and **footer** element, insert a **section** element.

-  **Explore** 13. Within the `section` element, insert a header element with the following content:
- Insert a paragraph with the text **Page last updated: Tuesday, August 31, 2021**. Mark the date using the `time` element with the `datetime` attribute equal to **2021-08-31**.
 - Add the text **Race Information** as an `h1` heading.
 - Insert the inline image file `dr_logo.png` with **Diane's Run** as the alternate text.
- Go to the **dr_info.txt** file in your text editor. This file contains the text describing the race. Copy the content describing the race from the file, then close the `dr_info.txt` file. Go to the `dr_info.html` file in your HTML editor and paste the copied text into the `section` element, directly after the section header.
 - Mark the content of the `section` element as follows:
 - Mark the opening block of text directly after the section header as a paragraph.
 - Mark the headings *Race Times*, *Goodies and Stuff*, and *Notes* as `h2` headings.
 - Below each of the `h2` elements, mark the list of items that follows as an unordered list.
 - Save your changes to the file and then load **dr_info.html** in your browser to verify that the layout and content are readable.
 - Go to the **dr_faq.html** file in your HTML editor. Within the document head, link the page to the `dr_base.css` and `dr_layout3.css` style sheets.
 - Go to the **dr_index.html** file in your HTML editor and copy the body header content. Then, go to the **dr_faq.html** file in your HTML editor and paste the copied content into the document body. Repeat with the body footer so that the FAQ page has the same navigation list and footer as was used in the home page. Between the `header` and `footer` element, insert a `section` element.
 - Within the `section` element, insert a header element with the `id` attribute **pagetop**. Within the header, insert the inline image file `dr_logo.png` with the alternate text **Diane's Run** followed by the `h1` element with the text **Frequently Asked Questions**.
 - Go to the **dr_faq.txt** file in your text editor. This file contains a list of frequently asked questions followed by the question answers. Copy the text and then close the `dr_faq.txt` file. Then, go to the **dr_faq.html** file in your HTML editor and paste the copied text into the `section` element, directly after the section header.
-  **Explore** 21. Next, you'll create a series of hypertext links between the list of questions and their answers within the same document. Make the following changes to the `section` element in the `dr_faq.html` file:
- Mark the 13 questions at the top of the section as an ordered list.
 - Notice that below the ordered list you just created, the questions are repeated and each question is followed by its answer. Mark the text of those questions as an `h2` heading and the answer as a paragraph. Add an `id` attribute to each of the 13 `h2` headings with the first heading given the `id` **faq1**, the second heading **faq2**, and so forth down to **faq13** for the last `h2` heading.
 - After the last answer, insert a paragraph with the text **Return to the Top** and mark the text as a hypertext link pointing to the `header` element with the `id` **pagetop**.
 - Return to the ordered list at the top of the section that you created in Step a. Change each item in the ordered list to a hypertext link pointing to the `h2` heading containing the question's answer that you created in Step b. For example, the first question *How do I sign up?* should be linked to the `h2` heading with the `faq1` `id`.
- Save your changes to the file and then open **dr_faq.html** in your browser. Verify that by clicking a question within the ordered list, the browser jumps to that question's answer. Further, verify that clicking the Return to the Top link at the bottom of the page causes the browser to return to the top of the page.

-  **Explore** 23. Return to the **dr_index.html** file in your HTML editor. Add the following two hypertext links to the *How to Join* paragraph in the second `section` element:
- Change the email address *dianesrun@example.com* to an email link with the subject heading Entry Form.
 - Change the word *accommodations* to a hypertext link pointing to the element with the id `faq13` in the `dr_faq.html` file.
24. Save your changes to the file and reload `dr_index.html` in your browser. Verify that clicking the email link brings up your email program with the email address and the subject heading already filled in.
25. Click the accommodations hypertext link and verify that the browser goes to the last answer on the FAQ page.
26. Verify that you can jump between all three pages by clicking the navigation links at the top of the page.

OBJECTIVES

Session 2.1

- Explore the history of CSS
- Study different types of style sheets
- Explore style precedence and inheritance
- Apply colors in CSS

Session 2.2

- Use contextual selectors
- Work with attribute selectors
- Apply text and font styles
- Use a web font

Session 2.3

- Define list styles
- Work with margins and padding space
- Use pseudo-classes and pseudo-elements
- Insert page content with CSS

Getting Started with CSS

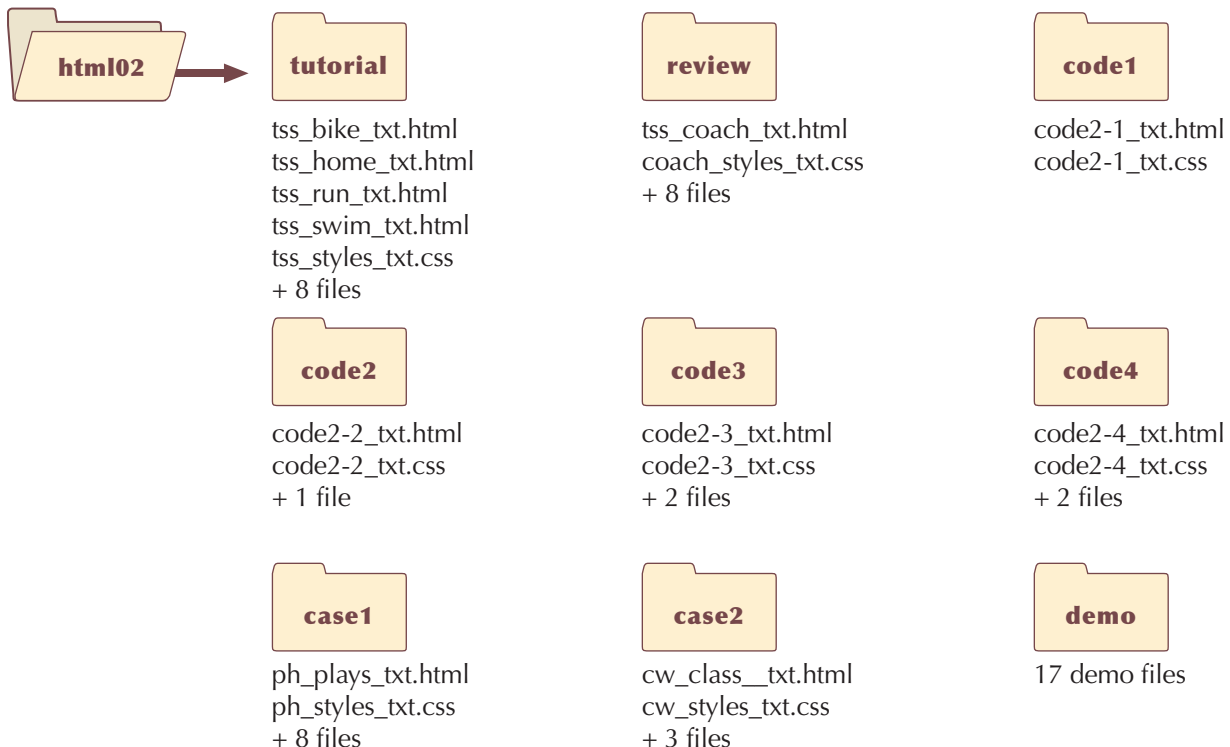
Designing a Website for a Fitness Club

Case | *Tri and Succeed Sports*

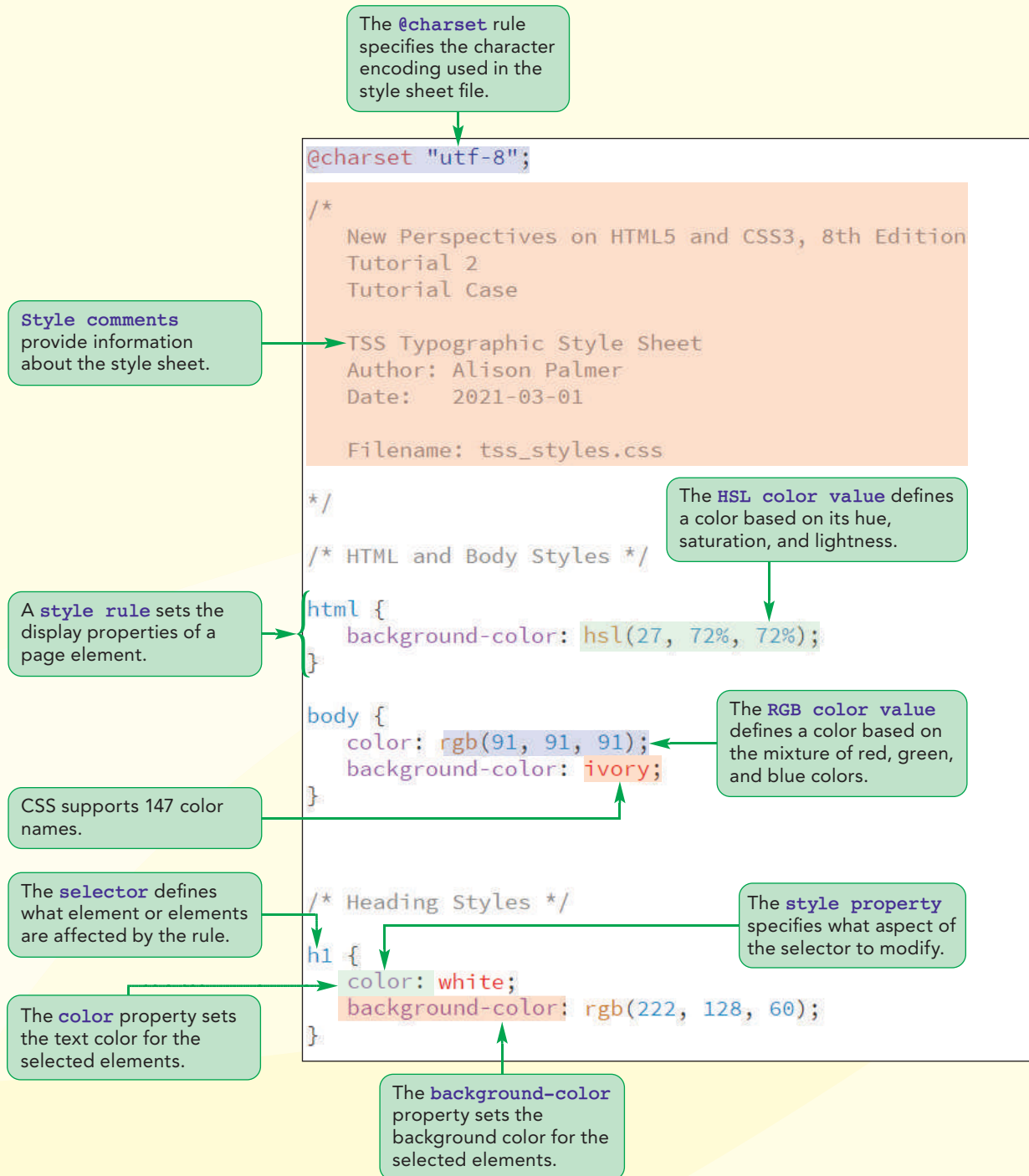
Alison Palmer runs Tri and Succeed Sports, an athletic club in Austin, Texas, that specializes in coaching men and women aspiring to compete in triathlons and other endurance sports. The center provides year-round instruction in running, swimming, cycling, and general fitness with one-on-one and group training classes. Alison has asked you to work on the company's new website.

Alison designed the original Tri and Succeed Sports website several years ago but she now feels that the site needs a makeover. She wants a new design that uses color and interesting typography to create visual interest and impact. She wants you to use CSS to help give the website a new look.

STARTING DATA FILES



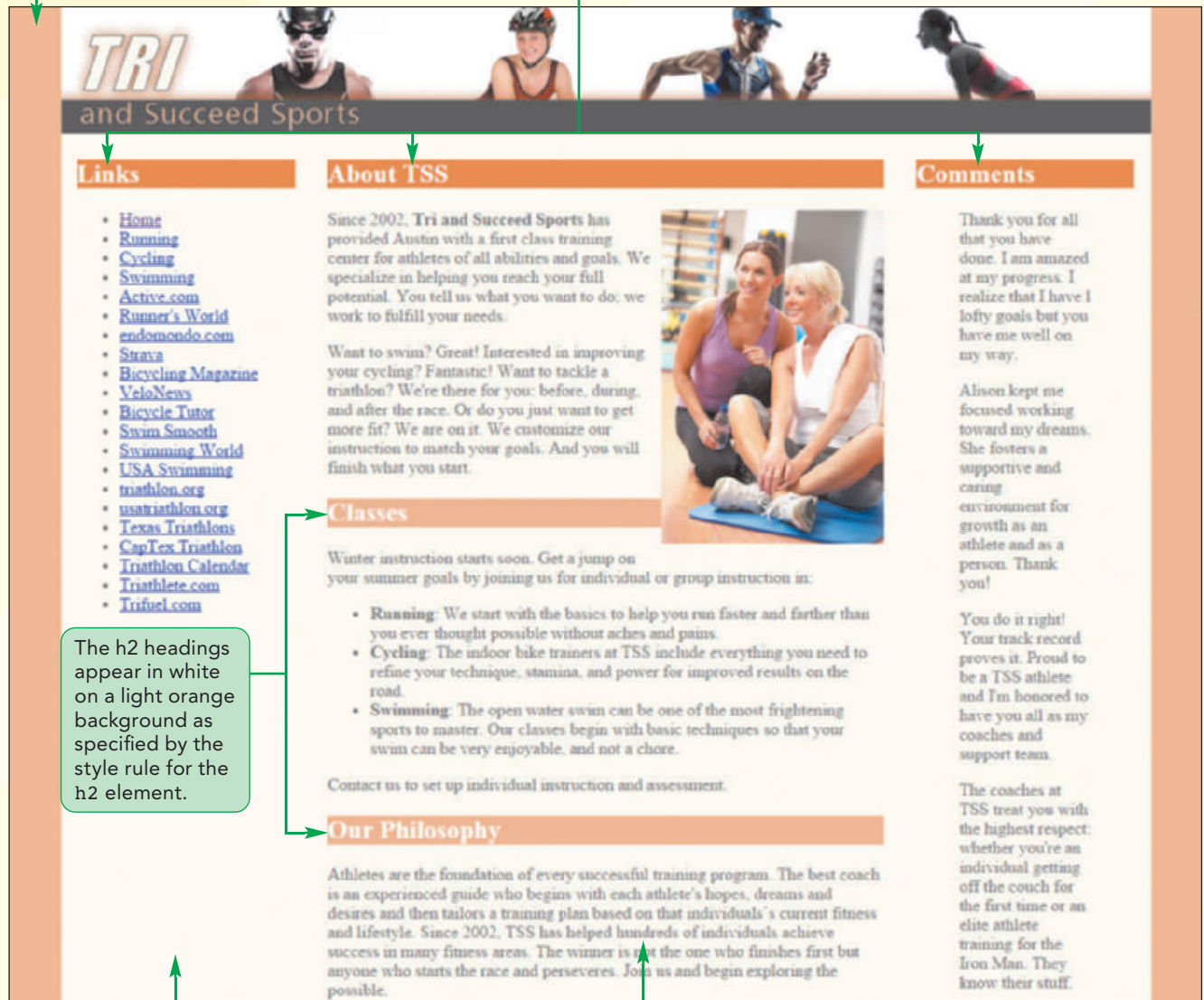
Session 2.1 Visual Overview:



CSS Styles and Colors

The browser window background color is set to the color value `hsl(27, 72%, 72%)` using style rule for the `html` element.

The `h1` headings appear in white on a dark orange background as specified by the style rule for the `h1` element.



The `h2` headings appear in white on a light orange background as specified by the style rule for the `h2` element.

Page body background color is set to ivory using the style rule for the `body` element.

Page text is set to the color value `rgb(91, 91, 91)`.

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Introducing CSS

An important principle discussed in the previous tutorial was that HTML only defines a document's content and structure, not how it should be displayed. The appearance of the page is determined by style sheets written in the Cascading Style Sheets (CSS) language. Starting with this tutorial, you'll learn how to write your own CSS style sheets.

TIP

You can research browser support for CSS at www.caniuse.com.

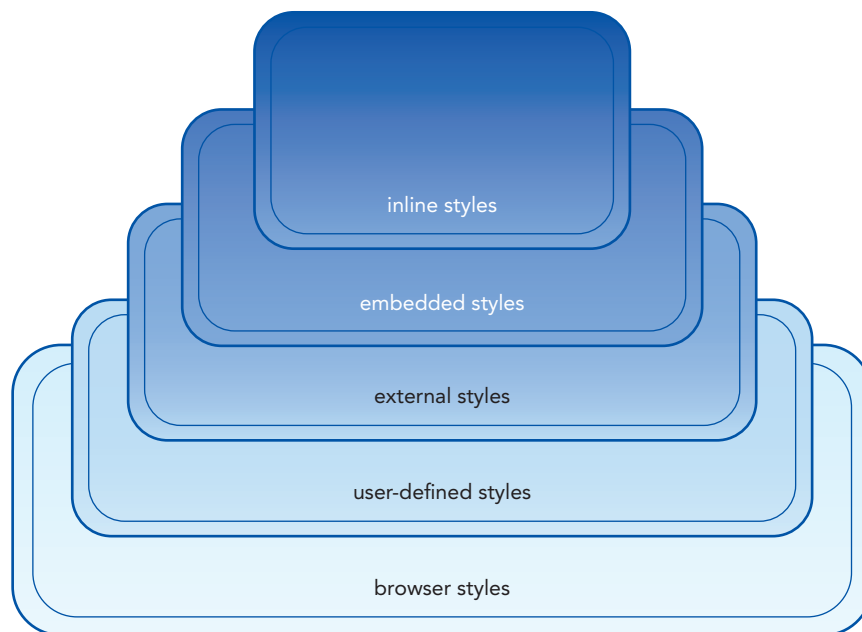
The CSS language is maintained by the same World Wide Web Consortium (W3C) that defines the standards for HTML. As with HTML, CSS has gone through several versions, the latest of which is CSS Version 3, more commonly known as **CSS**. CSS is not based on a single specification but rather is built upon several **modules**, where each module is focused on a separate design topic. At the time of this writing, there were over 50 CSS modules with each module enjoying different level of browser support. The W3C continues to expand the scope of the language, which means that many new design features are still at the stage where few, if any, browsers support them.

In this tutorial, you'll focus mostly on CSS features that have near-universal support among current browsers. However, you'll also examine workarounds to support older browsers and study ways to accommodate the difference between browsers in how they implement the CSS language.

Types of Style Sheets

A website's appearance is not the product of a single style sheet; rather, it is a combination of style sheets starting from the browser style sheet and then superseded by user-defined style sheets, external style sheets, embedded style sheets, and finally, inline styles (see Figure 2–1.) Let's examine each of these style sheets in more detail.

Figure 2–1 Hierarchy of style sheets



The first styles to be processed in rendering a website are the **browser styles** or **user agent styles**, built into the browser itself. In the absence of competing styles from other style sheets, browser styles are the ones applied to the web page.

The next styles to be processed are **user-defined styles**, created by the user within the browser. For example, a user with a visual impairment could make a website easier to read by altering the browser's default settings, displaying text in highly contrasting colors and a large font. Any user-defined style has precedence over a browser style.

User-defined styles can be superseded by **external styles**, which are styles created and placed within a CSS file and linked to the website. You used external style sheets in the last tutorial when you linked the Curbside Thai website to a collection of CSS files. As you saw in that tutorial, multiple documents can access the same style sheet, making it easier to apply a common design to an entire website.

Above external style sheets in the hierarchy are **embedded styles**, which are the styles placed within the HTML file itself. Embedded styles only apply to the HTML document in which they are created and are not accessible to other documents in the website.

Finally, at the highest order of precedence are **inline styles**, which are added as attributes of specific elements within the HTML file. The use of embedded styles and inline styles is not considered best practice because it violates one of the basic tenets of HTML: that HTML files should only describe the content and structure of the document and not the design itself.

Thus, the final appearance of the website is based on a combination of the styles from these different sources. Some of the styles might originate from the browser style sheet while others will be defined in an external style sheet or an embedded style sheet. Part of the challenge of CSS is determining how styles from these different style sheets interact to determine the page's final appearance.

Viewing a Page Using Different Style Sheets

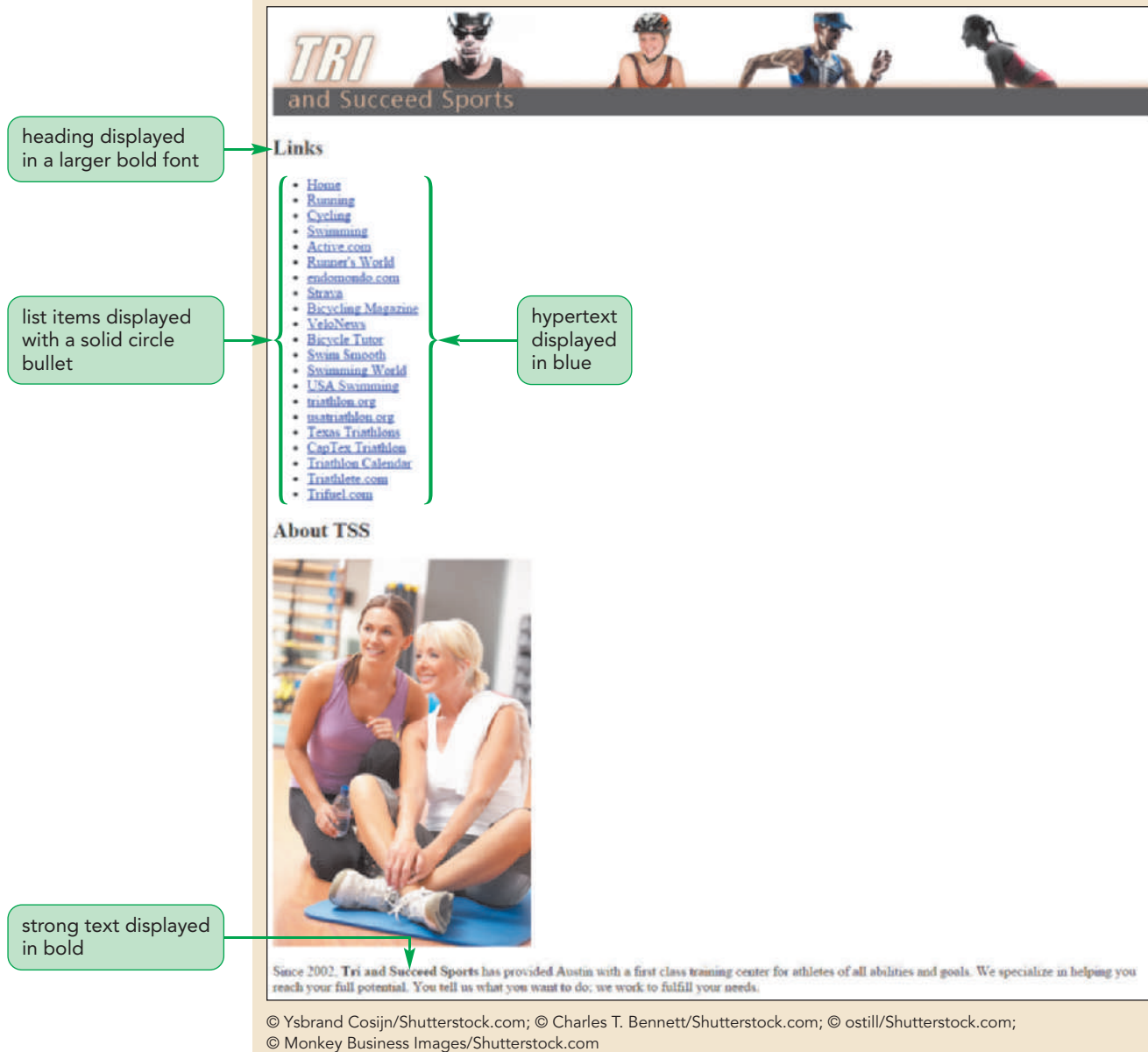
You'll start your work on the Tri and Succeed Sports website by viewing how the home page appears when it is rendered using only those styles in the browser style sheet.

To view the Tri and Succeed Sports home page:

1. Use your editor to open the **tss_home_txt.html** file from the html02 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save the document as **tss_home.html**.
2. Take some time to scroll through the document to become familiar with its content and structure.
3. Open the **tss_home.html** page in your browser. Part of the appearance of the page is shown in Figure 2–2.

Figure 2–2

The TSS home page rendered using only the browser style sheet



Trouble? Depending on your browser's style sheet, your page might not exactly resemble the one shown in Figure 2–2.

The browser style sheet applies a few specific styles to the page, including adding solid circles to the navigation list items, as well as displaying hypertext in blue, headings in a large bold font, and strong text in a bold font.

However, the layout of these elements makes the page difficult to read. Alison has an external style sheet containing styles that will present this page in a more pleasing three-column layout. Link this page now to her style sheet file and then reload the document in your browser to view the impact on the page's appearance.

To change the layout of the TSS home page:

1. Return to the **tss_home.html** file in your HTML editor and add the following link element to the head section directly after the **title** element:

```
<link href="tss_layout.css" rel="stylesheet" />
```

Figure 2–3 highlights the newly added code in the document.

Figure 2–3

Linking to the tss_layout.css file

rel attribute indicates that the file is a style sheet

```
<meta charset="utf-8" />
<meta name="keywords" content="triathlon, running, swimming, cycling" />
<title>Tri and Succeed Sports</title>
<link href="tss_layout.css" rel="stylesheet" />
</head>
```

filename of style sheet

2. Save your changes to the file and then reopen the **tss_home.html** file in your browser. Figure 2–4 shows the appearance of the page using the layout styles defined in the **tss_layout.css** file.

Figure 2–4

The TSS home page using the tss_layout.css style sheet



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The **tss_layout.css** file controls the placement of the page elements but not their appearance. The colors, fonts, and other design styles are still based on the browser style sheet.

Exploring Style Rules

If the element tag is the building block of the HTML file, then the **style rule**, which defines the styles applied to an element or group of elements, is the building block of the CSS style sheet. Style rules have the general form

```
selector {
    property1: value1;
    property2: value2;
    ...
}
```

where *selector* identifies an element or a group of elements within the document and the *property: value* pairs specify the style properties and their values applied to that element or elements. For example, the following style rule has a selector of `h1` to match all `h1` elements in the document and it has *property: value* pairs of `color: red` and `text-align: center` that tell the browser to display all `h1` headings in red and centered on the page:

```
h1 {
    color: red;
    text-align: center;
}
```

Selectors can also be entered as comma-separated lists as in the following style rule to display both `h1` and `h2` headings in red:

```
h1, h2 {
    color: red;
}
```

Like HTML, CSS ignores the use of white space, so you can also enter this style more compactly in a single line:

```
h1, h2 {color: red;}
```

Writing a style rule on a single line saves space, but entering each style property on a separate line often makes your code easier to read and edit. You will see both approaches used in the CSS files you encounter on the web.

Browser Extensions

In addition to the W3C-supported style properties, most browsers supply their own extended library of style properties, known as **browser extensions**. Many of the styles that become part of the W3C specifications start as browser extensions and for older browser versions, sometimes the only way to support a particular CSS feature is through a browser extension tailored to a particular browser.

Browser extensions are identified through the use of a **vendor prefix** indicating the browser vendor that created and supports the property. Figure 2–5 lists the browser extensions you'll encounter in your work on web design.

Figure 2–5

Vendor prefixes for browser extensions

Vendor Prefix	Rendering Engine	Browsers
-khtml-	KHTML	Konqueror
-moz-	Mozilla	Firefox, Camino
-ms-	Trident	Internet Explorer
-o-	Presto	Opera, Nintendo Wii browser
-webkit-	WebKit	Android browser, Chrome, Safari

For example, one of the more recent style features added to CSS is the layout style to display content in separate columns. The number of columns is indicated using the `column-count` property. To apply this style in a way that supports both older and current browsers, you would include the browser extensions first followed by the most current CSS specification:

```
article {
  -webkit-column-count: 3;
  -moz-column-count: 3;
  column-count: 3;
}
```

In general, browsers process style properties in the order they're listed, ignoring those properties they don't recognize or support, so you always want the most current specifications listed last.

Embedded Style Sheets

The style rule structure is also used in embedded style sheets and inline styles. Embedded styles are inserted directly into the HTML file by adding the following `style` element to the document head

```
<style>
  style rules
</style>
```

where *style rules* are the different rules you want to embed in the HTML page. For example, the following embedded style applies the same style rules described previously to make all h1 headings in the current document appear in red and centered:

```
<style>
  h1 {
    color: red;
    text-align: center;
  }
</style>
```

Remember that, when all else is equal, the style that is loaded last has precedence over styles defined earlier. In the following code, the browser will load the embedded style sheet last, giving it precedence over the style rules in the `tss_styles.css` file.

```
<link href="tss_styles.css" rel="stylesheet" />
<style>
  style rules
</style>
```

TIP

To avoid confusion, always place your embedded styles after any links to external style sheet files so that the embedded styles always have precedence.

If the order of the `link` and `style` elements is reversed, the styles from the `tss_styles.css` file are loaded last and given precedence.

Inline Styles

The very last styles to be interpreted by the browser are inline styles, which are styles applied directly to specific elements using the following `style` attribute

```
<element style="property1: value1;property2: value2; ...">
  content
</element>
```

where the *property: value* pairs define the styles, which are applied directly to that element. Thus, the following inline style sets the appearance of the h1 heading to red text centered on the page:

```
<h1 style="color: red; text-align: center;">
  Tri and Succeed Sports
</h1>
```

This style applies only to this particular h1 heading and not to any other h1 heading on the page or in the website. The advantage of inline styles is that it is clear exactly what page element is being formatted; however, inline styles are not recommended in most cases because they make it difficult to manage your website design. For example, if you used inline styles to format all of your headings, you would have to locate all of the h1 through h6 elements in all of the pages within the entire website and add *style* attributes to each tag. This would be no small task on a large website containing hundreds of headings spread out among dozens of pages. Likewise, it would be a nightmare if you had to modify the design of those headings at a later date. Thus, the recommended practice is to always use external style sheets that can be applied across the entire website.

Style Specificity and Precedence

With so many different style rules to be applied to the same document, there has to be an orderly method by which conflicts between those different rules are resolved. You've already learned that the style that is defined last has precedence, but that is not the whole story. Another important principle is that *the more specific style rule has precedence over the more general style rule*. Thus, a rule applied to a paragraph takes precedence over a rule applied to the entire page, and a rule applied to a section of text within that paragraph takes precedence over the rule for the paragraph. In the following style rules, the color of the text in all paragraphs is set to red, taking precedence over the color black applied to the rest of the text in the page:

```
p {color: red;}
body {color: black;}
```

Note that specificity is only an issue when two or more styles conflict, as in the example above. When the style rules involve different properties (such as color and size), there is no conflict and both rules are applied. If two rules have equal specificity and thus equal importance, then the one that is defined last has precedence.

Style Inheritance

TIP

Not all properties are inherited; for example, a style property that defines text color has no meaning for an inline image.

An additional factor in how style rules are interpreted is that styles are passed from a parent element to its children in a process known as **style inheritance**. Thus, the following style rule sets the color of article text to blue and that rule is passed to any paragraph, header, footer, or other element nested within an article element. In addition, the paragraph text within that article is centered:

```
article {color: blue;}
p {text-align: center;}
```

The final rendering of any page element is the result of styles drawn from rules across multiple style sheets and from properties passed down from one element to another within the hierarchy of page elements. These style sheets and style rules form the "cascade" of styles in Cascading Style Sheets.

Browser Developer Tools

TIP

In most browsers, you can quickly access information about a specific page element by right-clicking the element in the browser window and choosing Inspect Element from the pop-up menu.

If the idea of multiple style sheets and multiple style rules is intimidating, there are tools available to help you manage your styles. Most browsers include developer tools allowing the designer to view HTML code, CSS styles, and other parts of the web page. These developer tools make it easier for the designer to locate the source of a style that has been applied to a specific page element.

Each browser's developer tools are different and are constantly being updated and improved with every new browser version. However, to give you the flavor of the tools you have at your disposal, you'll examine both the HTML code and the CSS style sheet under the developer tools built into your desktop browser. Note that the figures in the steps that follow use the desktop version of the Google Chrome browser.

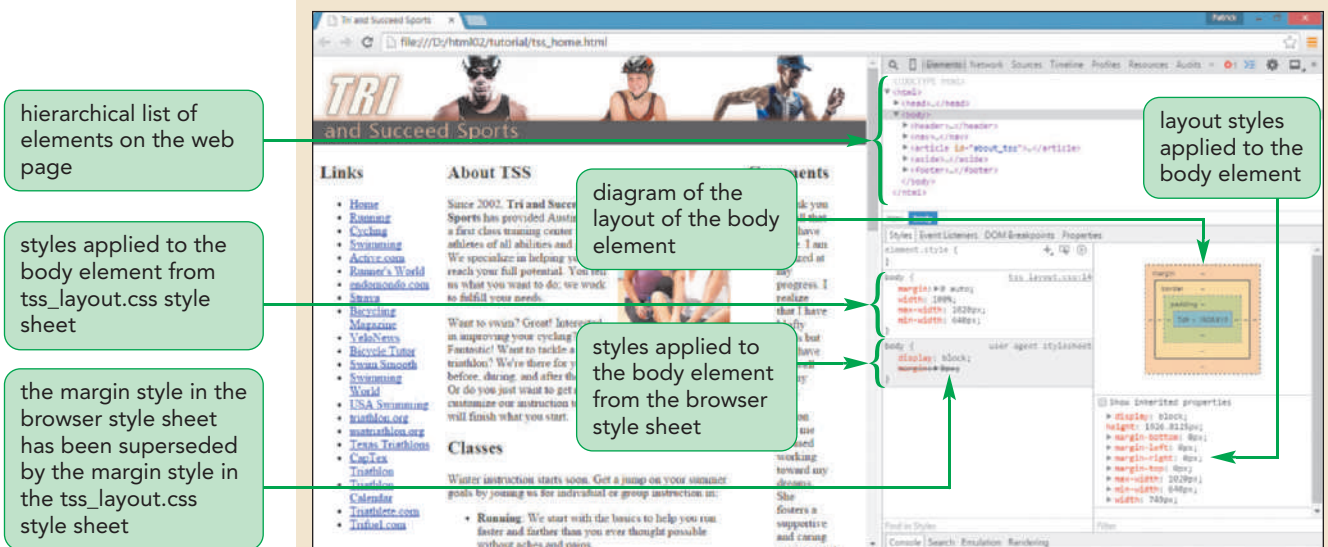
Accessing the browser developer tools:

1. Return to the **tss_home.html** file in your browser.
 2. Press **F12** to open the developer tools window.
- Trouble?** If pressing F12 doesn't open the developer tools, your browser might need a different keyboard combination. In Safari for the Macintosh, you can view the developer tools by pressing **ctrl+shift+I** or **command+option+I**.
3. From the hierarchical list of elements in the web page, click the **<body>** tag if it is not already selected.

Figure 2–6 shows the layout of panes using the developer tools under Google Chrome for the desktop.

Figure 2–6

Developer tools in Google Chrome



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As shown in Figure 2–6, the styles pane lists the styles that have been applied to the **body** element. Note that the **margin** property from the browser style sheet has been crossed out, indicating that this browser style has been superseded by a style defined in the external style sheet.

Trouble? Every browser has a different set of developer tools and configurations. Your tools might not resemble those shown in Figure 2–6.

- 4. Take some time to explore the content and styles used in the other page elements by selecting the elements tags from the hierarchical list of elements.
- 5. Press **F12** again to close the developer tools window.

Trouble? In Safari, you can close the developer tools by pressing ctrl+shift+I or by command+option+I.

In this and future tutorials, you may find that your browser's developer tools are a great aid to working through your website designs. Most developer tools allow the user to insert new style rules in order to view their immediate impact on the page's appearance; however, these modifications are only applied during the current session and are not saved. So, once you find a setting that you want to use, you must enter it in the appropriate style sheet for it to take effect permanently.

INSIGHT

Defining an *!important* Style

You can override the style cascade by marking a particular property with the following **!important** keyword:

```
property: value !important;
```

The following style rule sets the color of all h1 headings to orange; and because this property is marked as important, it takes precedence over any conflicting styles found in other style sheets.

```
h1 {color: orange !important;}
```

The **!important** keyword is most often used in user-defined style sheets in which the user needs to substitute his or her own styles in place of the designer's. For example, a visually impaired user might need to have text displayed in a large font with highly contrasting colors. In general, designers should not use the **!important** keyword because it interferes with the cascade order built into the CSS language.

Creating a Style Sheet

Now that you've reviewed some history and concepts behind style sheets, you'll start creating your own. You should usually begin your style sheets with comments that document the purpose of the style sheet and provide information about who created the document and when.

Writing Style Comments

Style sheet comments are entered as

```
/*
  comment
*/
```

where *comment* is the text of the comment. Because CSS ignores the presence of white space, you can insert your comments on a single line to save space as:

```
/* comment */
```

Create a style sheet file now, placing a comment with your name and the current date at the top of the file.

Writing a Style Comment:

1. Use your editor to open the **tss_styles.txt.css** file from the html02 ► tutorial folder.
2. Within the comment section at the top of the file, enter **your name** following the Author: comment and **the date** following the Date: comment.
3. Save the file as **tss_styles.css**.
4. Return to the **tss_home.html** file in your HTML editor and add the following `link` element directly before the closing `</head>` tag.

```
<link href="tss_styles.css" rel="stylesheet" />
```

5. Close the `tss_home.html` file, saving your changes.

Defining the Character Encoding

As with HTML files, it is a good idea in every CSS document to define the character encoding used in the file. In CSS, you accomplish this using the following `@charset` rule

```
@charset "encoding";
```

where *encoding* defines the character encoding used in the file. Add the `@charset` rule to the `tss_styles.css` style sheet file now, specifying that the UTF-8 character set is used in the CSS code.

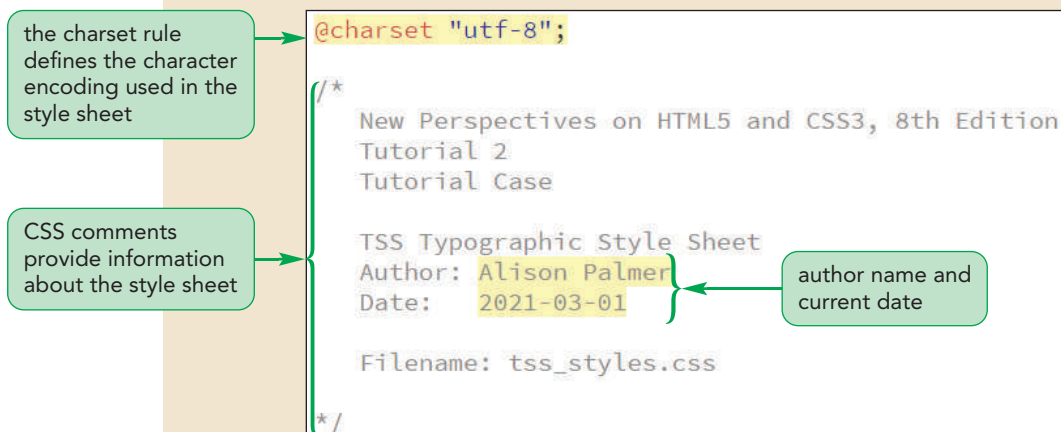
To indicate the character encoding:

1. Return to the **tss_styles.css** file in your editor.
2. Directly above the initial comment section, insert the line: `@charset "utf-8";`.

Figure 2–7 highlights the new code in the style sheet.

Figure 2–7

Adding the `@charset` rule and style comments



Note that only one `@charset` rule should appear in a style sheet and it should always precede any other characters, including comments.

3. Save your changes to the file.

Importing Style Sheets

TIP

The `@import` statement must always come before any other style rules in the style sheet.

The `@charset` rule is an example of a **CSS at-rule**, which is a rule used to send directives to the browser indicating how the contents of the CSS file should be interpreted and parsed. Another at-rule is the following `@import` used to import the contents of a style sheet file

```
@import url(url);
```

where `url` is the URL of an external style sheet file.

The `@import` is used to combine style rules from several style sheets into a single file. For example, an online store might have one style sheet named `basic.css` containing all of the basic styles used in every web page and another style sheet named `sales.css` containing styles used with merchandise-related pages. The following code imports styles from both files:

```
@import url(basic.css);  
@import url(sales.css);
```

Using multiple `@import` rules in a CSS file has the same impact as adding multiple `link` elements to the HTML file. One advantage of the `@import` rule is that it simplifies your HTML code by placing the decision about which style sheets to include and exclude in the CSS file rather than in the HTML file.

Working with Color in CSS

The first part of your style sheet for the Tri and Succeed Sports website will focus on color. If you've worked with graphics software, you've probably made your color selections using a graphical interface where you can see your color options. Specifying color with CSS is somewhat less intuitive because CSS is a text-based language and requires colors to be defined in textual terms. This is done through a color name or a color value.

Color Names

TIP

You can view the complete list of CSS color names by opening the `demo_color_names.html` file in the `html02 ► demo` folder.

You've already seen from previous code examples that you can set the color of page text using the `color` property along with a color name such as `red`, `blue`, or `black`. CSS supports 147 color names covering common names such as `red`, `green`, and `yellow` to more exotic colors such as `ivory`, `orange`, `crimson`, `khaki`, and `brown`.



PROSKILLS

Written Communication: Communicating in Color

Humans are born to respond to color. Studies have shown that infants as young as two months prefer bright colors with strong contrast to drab colors with little contrast, and market research for clothing often focuses on what colors are “in” and what colors are passé.

Your color choices can impact the way your website is received so you want to choose a color scheme that is tailored to the personality and interests of your target audience. Color can evoke an emotional response and is associated with particular feelings or concepts, such as

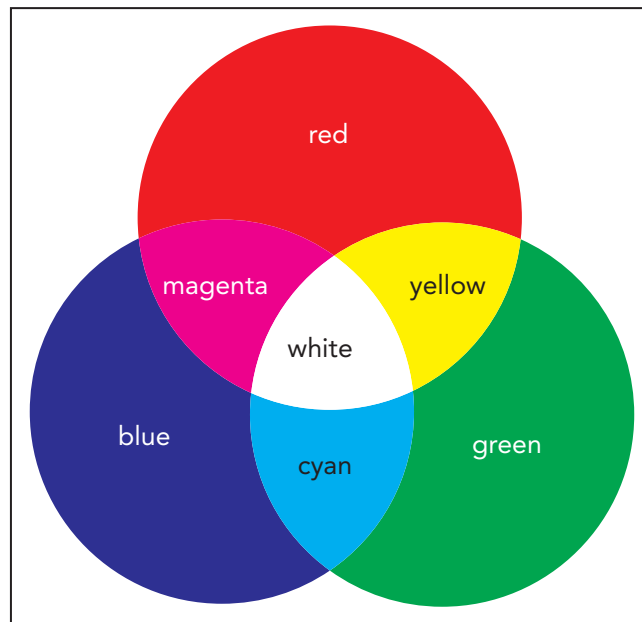
- *red*—assertive, powerful, sexy, dangerous
- *pink*—innocent, romantic, feminine
- *black*—strong, classic, stylish
- *gray*—business-like, detached
- *yellow*—warm, cheerful, optimistic
- *blue*—consoling, serene, quiet
- *orange*—friendly, vigorous, inviting
- *white*—clean, pure, straightforward, innocent

If your website will be used internationally, you need to be aware of how cultural differences can affect your audience’s response to color. For instance, white, which is associated with innocence in Western cultures, is the color of mourning in China; yellow, which is considered a bright, cheerful color in the West, represents spirituality in Buddhist countries.

RGB Color Values

Because a palette of 147 color names is extremely limited for graphic design and color names can be constricting (how do you name a color that is slightly redder than ivory with a tinge of blue?), CSS also supports **color values**, in which the color is given by an exact numeric representation. CSS supports two types of color values: RGB values and HSL values.

RGB color values are based on classical color theory in which all colors are determined by adding three primary colors—red, green, and blue—at different levels of intensity. For example, adding all three primary colors at maximum intensity produces the color white, while adding any two of the three primary colors at maximum intensity produces the trio of complementary colors—yellow, magenta, and cyan (see Figure 2–8).

Figure 2–8 Color addition in the RGB color model

Varying the intensity of the three primary colors extends the palette to other colors. Orange, for example, is created from a high intensity of red, a moderate intensity of green, and a total absence of blue. CSS represents these intensities mathematically as a set of numbers called an **RGB triplet**, which has the format

```
rgb(red, green, blue)
```

TRY IT

You can explore the RGB color values using the `demo_rgb.html` file in the `html02 ▶ demo` folder.

where *red*, *green*, and *blue* are the intensities of the red, green, and blue components of the color. Intensities range from 0 (absence of color) to 255 (maximum intensity); thus, the color white has the value `rgb(255, 255, 255)`, indicating that red, green, and blue are mixed equally at the highest intensity, and orange is represented by `rgb(255, 165, 0)`. RGB triplets can describe 256^3 (16.7 million) possible colors, which is a greater number of colors than the human eye can distinguish.

RGB values are sometimes expressed as hexadecimal numbers where a **hexadecimal number** is a number expressed in the base 16 numbering system rather than in the commonly used base 10 system. In base 10 counting, numeric values are expressed using combinations of 10 characters (0 through 9). Hexadecimal numbering includes these ten numeric characters and six extra characters: A (for 10), B (for 11), C (for 12), D (for 13), E (for 14), and F (for 15). For values above 15, you use a combination of those 16 characters. For example, the number 16 has a hexadecimal representation of 10, and a value of 255 has a hexadecimal representation of FF. The style value for color represented as a hexadecimal number has the form

```
#redgreenblue
```

where *red*, *green*, and *blue* are the hexadecimal values of the red, green, and blue components. Therefore, the color yellow could be represented either by the RGB triplet

```
rgb(255, 255, 0)
```

or more compactly as the hexadecimal

```
#FFFF00
```

Most HTML editors and graphic programs provide color picking tools that allow the user to choose a color and then copy and paste the RGB or hexadecimal color value. Hexadecimal color values have the advantage of creating smaller style sheets, which can be loaded faster—an important consideration for mobile devices. However, for others viewing and studying your style sheet code, they are more difficult to interpret than RGB values.

Finally you can enter each component value as a percentage, with 100% representing the highest intensity. In this form, you would specify the color orange with the following values

```
rgb(100%, 65%, 0%)
```

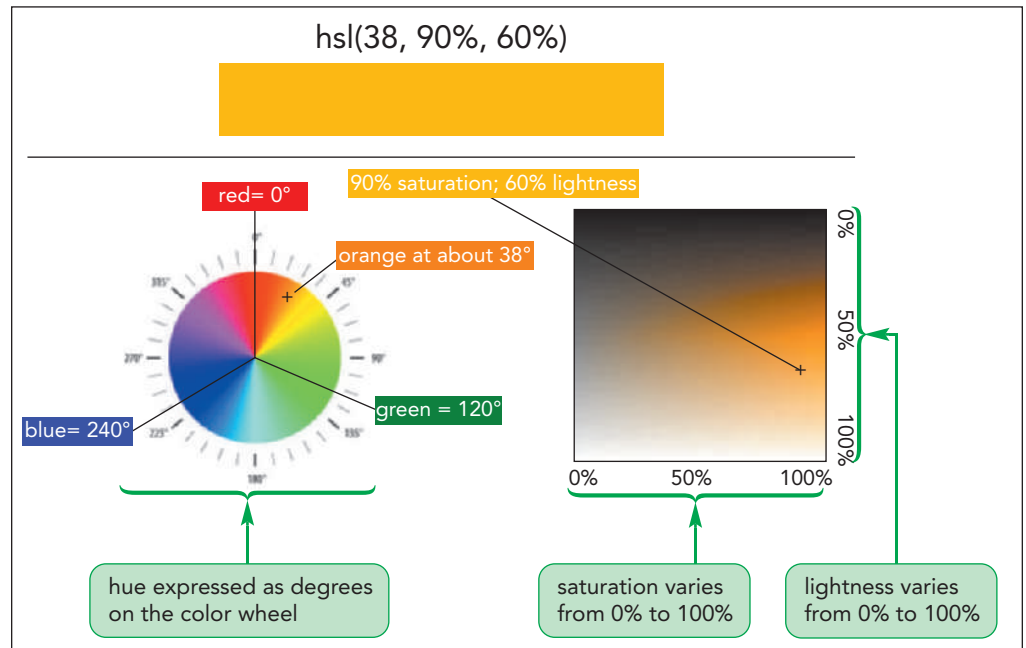
which is equivalent to the `rgb(255, 165, 0)` value described above.

HSL Color Values

HSL color values are based on a color model in which each color is determined by its hue, saturation, and lightness. **Hue** is the tint of the color and is usually represented by a direction on a color wheel. Hue values range from 0° up to 360°, where 0° matches the location of red on the color wheel, 120° matches green, and 240° matches blue. **Saturation** measures the intensity of the chosen color and ranges from 0% (no color) up to 100% (full color). Finally, **lightness** measures the brightness of the color and ranges from 0% (black) up to 100% (white). Figure 2–9 shows how setting the hue to 38°, the saturation to 90%, and the lightness to 60% results in a medium shade of orange.

Figure 2–9

Defining the color orange under the HSL color model



Color values using the HSL model are described in CSS using

```
hsl(hue, saturation, lightness)
```

TRY IT

You can explore the HSL color values using the `demo_hsl.html` file in the `html02 ▶ demo` folder.

where *hue* is the tint of the color in degrees, *saturation* is the intensity in percent, and *lightness* is the brightness in percent of the color. Thus, a medium orange color would be represented as

```
hsl(38, 90%, 60%)
```

Graphic designers consider HSL easier to use because it allows them to set the initial color based on hue and then fine-tune the saturation and lightness values. This is more difficult in the RGB model because you have to balance three completely different colors to achieve the right mix. For example, the RGB equivalent to the color orange in Figure 2–9 would be the color value `rgb(245, 177, 61)`; however, it's not immediately apparent why that mixture of red, green, and blue would result in that particular shade of orange.

Defining Semi-Opaque Colors

Colors can also be semi-opaque by setting the color's **opacity**, which defines how solid the color appears. The color's opacity can be specified using either of the following `rgba` and `hsla` properties

```
rgba(red, green, blue, opacity)
hsla(hue, saturation, lightness, opacity)
```

TRY IT

You can explore the RGBA and HSLA color values using the `demo_rgba.html` and `demo_hsla.html` files in the `html02 ▶ demo` folder.

where *opacity* is the opacity of the color ranging from 0 (completely transparent) up to 1.0 (completely opaque). For example, the following style property uses the HSL color model to define a medium orange color with an opacity of 0.7:

```
hsla(38, 90%, 60%, 0.7)
```

The final appearance of a semi-opaque color is influenced by the colors behind it on the page. Displayed against a white background, a medium orange color would appear in a lighter shade of orange because the orange will appear mixed with the background white.

On the other hand, the same orange color displayed on a black background would appear as a darker shade of orange. The advantage of using semi-transparent colors is that it makes it easier to create a color theme in which similarly tinted colors blend with other colors on the page.

Setting Text and Background Colors

Now that you've studied how CSS works with colors, you can start applying color to some of the elements displayed on the Tri and Succeed Sports website. CSS supports the following styles to define both the text and background color for each element on your page

```
color: color;
background-color: color;
```

where *color* is either a color value or a color name.

Alison wants to use an HSL color value (27, 72%, 72%) to set the background of the document to orange and she would like the text of the home page to appear in a medium gray color on an ivory background. The style rules to modify the appearance of these document elements are

```
html {
    background-color: hsl(27, 72%, 72%);
}
body {
    color: rgb(91, 91, 91);
    background-color: ivory;
}
```

The `html` selector in this code selects the entire HTML document so that any part of the browser window background that is not within the page body will be displayed using the HSL color (27, 72%, 72%).

Within the page body, Alison wants the `h1` and `h2` headings displayed in white text on dark and lighter orange colors using the RGB color values (222, 128, 60) and (235, 177, 131) respectively. The style rules are

```
h1 {
  color: white;
  background-color: rgb(222, 128, 60);
}
h2 {
  color: white;
  background-color: rgb(235, 177, 131);
}
```

REFERENCE

Setting Text and Background Color

- To set the text color of an element, use the following property
`color: color;`
- To set the background color of an element, use the following property
`background-color: color;`
where *color* is a color name or a color value.

Next, add style rules for text and background colors to the `tss_styles.css` file.

Saturation and lightness values in an hsl color value must be expressed as percentages.

To define background and text colors:

1. Add the following code within the HTML and Body Styles section:

```
html {
  background-color: hsl(27, 72%, 72%);
}

body {
  color: rgb(91, 91, 91);
  background-color: ivory;
}
```

TIP

Almost 8% of all men and 0.5% of all women have some sort of color blindness. Because redgreen color blindness is the most common type of color impairment, you should avoid using red text on a green background and vice versa.

2. Add the following style rules within the Heading Styles section:

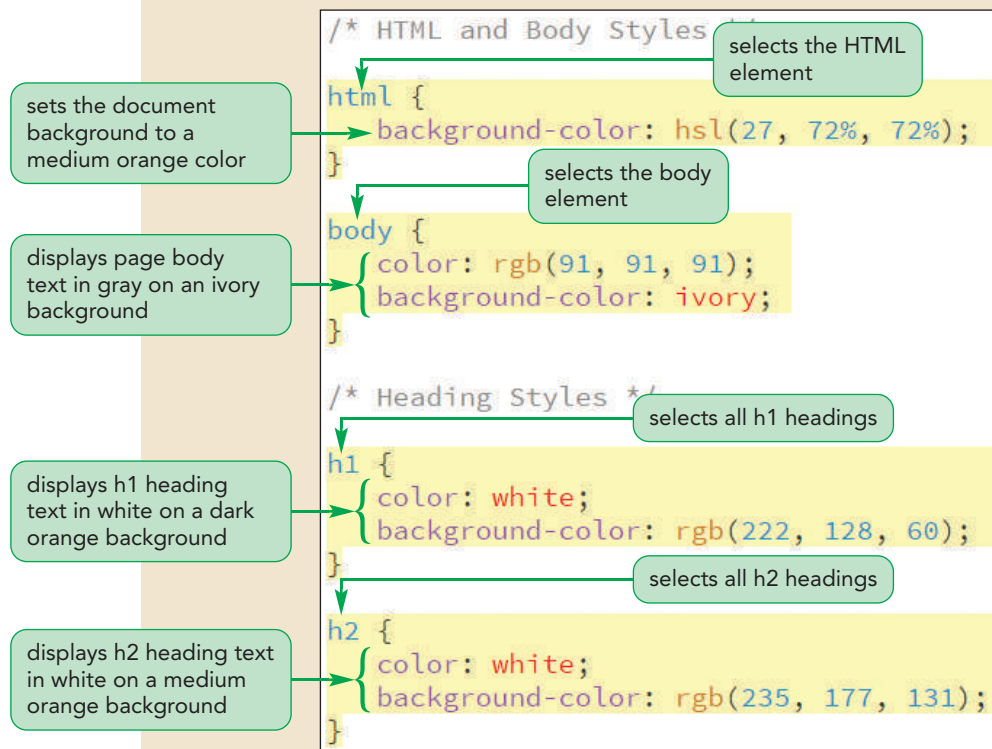
```
h1 {
    color: white;
    background-color: rgb(222, 128, 60);
}

h2 {
    color: white;
    background-color: rgb(235, 177, 131);
}
```

Figure 2–10 highlights the new style rules.

Figure 2–10

Adding text and background colors



3. Save your changes to the file and then reload the `tss_home.html` file in your browser. Figure 2–11 shows the appearance of the page under the new styles.

Figure 2–11

Text and background colors in the web page

white h1 heading
text on a dark orange
background

browser window
background is
medium orange

white h2 heading
text on a light
orange background



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page body style shows
gray text on an ivory
background

Trouble? The text of hypertext links in the left column is blue, using the default browser styles applied to hypertext links. You'll modify these colors later in the tutorial.


PROSKILLS

Problem Solving: Choosing a Color Scheme

One of the worst things you can do to your website is to associate interesting and useful content with jarring and disagreeable color. Many designers prefer the HSL color system because it makes it easier to select visually pleasing color schemes. The following are some basic color schemes you may want to apply to websites you design:

- *monochrome*—a single hue with varying values for saturation and lightness; this color scheme is easy to manage but is not as vibrant as other designs
- *complementary*—two hues separated by 180° on the color wheel; this color scheme is the most vibrant and offers the highest contrast and visual interest, but it can be misused and might distract users from the page content
- *triad*—three hues separated by 120° on the color wheel; this color scheme provides the same opportunity for pleasing color contrasts as a complementary design, but it might not be as visibly striking
- *tetrad*—four hues separated by 90° on the color wheel; perhaps the richest of all color schemes, it is also the hardest one in which to achieve color balance
- *analogic*—three hues close to one another on the color wheel in which one color is the dominant color and the other two are supporting colors used only for highlights and nuance; this scheme lacks color contrasts and is not as vibrant as other color schemes

TRY IT

You can explore color schemes with the `demo_anal.html`, `demo_comp.html`, `demo_mono.html`, `demo_split.html`, and `demo_triad.html` files in the `html02 ▶ demo` folder.

Once you have selected a color design and the main hues, you then vary those colors by altering the saturation and lightness. One of the great advantages of style sheets is that you can quickly modify your color design choices and view the impact of those changes on your page content.

Employing Progressive Enhancement

The HSL color you used for the `html` selector was introduced with CSS and thus it is not supported in very old browsers. If this is a concern, you can insert the older style properties first followed by the newer standards. For example, the following style rule sets the background color of the `html` element to a lighter orange using the RGB value first, and then the equivalent HSL value.

```
html {
    background-color: rgb(235, 177, 131);
    background-color: hsl(27, 72%, 72%);
}
```

Old browsers that don't recognize the HSL color value will ignore it and use the RGB value, while browsers that recognize both values will use the one that is defined last, which in this case is the HSL value. This is an example of a technique known as **progressive enhancement**, which places code conforming to older standards before newer properties, providing support for old browsers but still allowing newer standards and techniques to be used by the browsers that support them.

You show Alison the work you've done on colors. She's pleased with the ease of using CSS to modify the design and appearance of elements on the Tri and Succeed Sports website. In the next session, you'll continue to explore CSS styles, focusing on text styles.

Session 2.1 Quick Check

1. Which styles are applied directly to elements within an HTML file?
 - a. browser styles
 - b. inline styles
 - c. embedded styles
 - d. external styles
2. What keyword do you add to a style property to override style precedence and style inheritance?
 - a. cascade!
 - b. use!
 - c. important!
 - d. import!
3. CSS comments are entered as:
 - a. `/* comment */`
 - b. `! comment !`
 - c. `/* comment`
 - d. `<!-- comment --->`
4. Which of the following values is used to represent the color red?
 - a. `rgb(10, 0, 0)`
 - b. `rgb(1000, 0, 0)`
 - c. `rgb(255, 0, 0)`
 - d. `rgb(0, 255, 0)`
5. What is the hue associated with the color value `hsl(90, 100%, 50%)`?
 - a. 90
 - b. 100%
 - c. 50%
 - d. Cannot be determined by the color value
6. What is the vendor prefix associated with the Google Chrome browser?
 - a. -chrome-
 - b. -google-
 - c. -moz-
 - d. -webkit-
7. What is the HSL color value for red displayed with the highest saturation and lightness and with 50% transparency?
 - a. `hsl(0, 100%, 100%, 0.5)`
 - b. `hsl(255, 100%, 100%, 0.5)`
 - c. `hsla(0, 100%, 100%, 0.5)`
 - d. `hsla(0.5, 0, 100%, 100%)`
8. What is the style to display h1 headings in green text on a yellow background?
 - a. `h1 {color: green; background-color: yellow;}`
 - b. `h1 {color: green; bgcolor: yellow;}`
 - c. `h1 {text: green; background: yellow;}`
 - d. `h1 {textColor: green; backgroundColor: yellow;}`
9. Which of the following matches the color blue?
 - a. `rgb(0, 0, 255)`
 - b. `hsl(240, 100%, 50%)`
 - c. `rgba(0, 0, 255, 1)`
 - d. All of the above

Session 2.2 Visual Overview:

The `@font-face` rule imports a web font into the style sheet.

```
@font-face {
  font-family: Quicksand;
  src: url('Quicksand-Regular.woff') format('woff'),
       url('Quicksand-Regular.ttf') format('truetype');
}
```

The `font-family` property lists the possible fonts used for the element text.

```
body {
  color: rgb(91, 91, 91);
  background-color: ivory;
  font-family: Verdana, Geneva, sans-serif;
}
```

The `font-size` property sets the text size in absolute or relative units.

```
h1 {font-size: 2.2em;}
h2 {font-size: 1.5em;}
```

The `em` unit is a relative unit of length that expresses a size relative to the font size of the containing element.

The `letter-spacing` property sets the **kerning** or space between letters.

```
h1, h2 {
  font-family: Quicksand, Verdana, Geneva, sans-serif;
  letter-spacing: 0.1em;
}
```

The `aside blockquote` selector selects blockquote elements that are descendants of the `aside` element.

```
aside blockquote {
  color: rgb(232, 165, 116);
}
```

The `line-height` property sets the height of the lines of text in the element.

```
nav > ul {
  line-height: 2em;
}
```

The `nav > ul` selector selects `ul` elements that are direct children of the `nav` element.

The `text-align` property sets the horizontal alignment of the text.

```
body > footer address {
  background-color: rgb(222,128,60);
  color: rgba(255, 255, 255, 0.7);
  font: normal small-caps bold 0.9em/3em
        Quicksand, Verdana, Geneva, sans-serif;
  text-align: center;
}
```

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CSS Typography

The h1 heading is displayed in the Quicksand font with a font size of 2.2em and letter spacing of 0.1em.

The mockup shows a website layout with the following sections and annotations:

- Links:** A vertical list of links on the left side, including Home, Running, Cycling, Swimming, Active.com, Runner's World, endomondo.com, Strava, Bicycling Magazine, VeloNews, Bicycle Tutor, Swim Smooth, Swimming World, USA Swimming, triathlon.org, usatriathlon.org, Texas Triathlons, CapTex Triathlon, Triathlon Calendar, Triathlete.com, and Trifuel.com. An annotation points to this list: "Navigation list is double-spaced with a line height of 2em."
- About TSS:** A section with a title "About TSS" and a paragraph: "Since 2002, Tri and Succeed Sports has provided Austin with a first class training center for athletes of all abilities and goals. We specialize in helping you reach your full potential. You tell us what you want to do; we work to fulfill your needs." An annotation points to the body text: "Body text is displayed in a Verdana font." Below this is another paragraph: "Want to swim? Great! Interested in improving your cycling? Fantastic! Want to tackle a triathlon? We're there for you: before, during, and after the race. Or do you just want to get more fit? We are on it. We customize our instruction to match your goals. And you will finish what you start."
- Classes:** A section with a title "Classes" and a paragraph: "Winter instruction starts soon. Get a jump on your summer goals by joining us for individual or group instruction in:". Below this is a list of classes:
 - Running:** We start with the basics to help you run faster and farther than you ever thought possible without aches and pains.
 - Cycling:** The indoor bike trainers at TSS include everything you need to refine your technique, stamina, and power for improved results on the road.
 - Swimming:** The open water swim can be one of the most frightening sports to master. Our classes begin with basic techniques so that your swim can be very enjoyable, and not a chore.
- Our Philosophy:** A section with a title "Our Philosophy" and a paragraph: "Athletes are the foundation of every successful training program. The best coach is an experienced guide who begins with each athlete's hopes, dreams and desires and then tailors a training plan based on that individual's current fitness and lifestyle. Since 2002, TSS has helped hundreds of individuals achieve success in many fitness areas. The winner is not the one who finishes first but anyone who starts the race and perseveres. Join us and begin exploring the possible."
- Comments:** A section with a title "Comments" and several paragraphs of user comments, including: "Thank you for all that you have done. I am amazed at my progress. I realize that I have lofty goals but you have me well on my way.", "Alison kept me focused working toward my dreams. She fosters a supportive and caring environment for growth as an athlete and as a person. Thank you!", "You do it right! Your track record proves it. Proud to be a TSS athlete and I'm honored to have you all as my coaches and support team.", "The coaches at TSS treat you with the highest respect: whether you're an individual getting off the couch for the first time or an elite athlete training for the Iron Man. They know their stuff.", and "I just completed my first marathon, following your fitness schedule to the letter. Never once did I come close to bonking and two days later I felt ready for another race!"
- Page Footer:** A footer at the bottom with the text: "TRI AND SUCCEED SPORTS • 41 VENTURE DR. • AUSTIN, TX 78711 • 512.555.9917". An annotation points to this text: "Page footer is centered and displayed in small caps as specified by the body > footer address style rule."

The h2 headings are displayed in the Quicksand font with a font size of 1.5em and letter spacing of 0.1em.

Exploring Selector Patterns

The following style rule matches every `h1` element in the HTML document, regardless of its location within the page:

```
h1 {  
    color: red;  
}
```

Often, however, you will want your style rules to apply to elements only placed within specific locations, such as `h1` headings found within articles but not anywhere else. To direct a style rule to an element at a specific location use **selector patterns** to match only those page elements that match a specified pattern.

Contextual Selectors

The first selector pattern you'll examine is a **contextual selector**, which specifies the context under which a particular page element is used. Context is based on the hierarchical structure of the document, which involves the relationships between a **parent element** containing one or more **child elements** and within those child elements several levels of **descendant elements**. A contextual selector relating a parent element to its descendants has the following pattern

```
parent descendant { styles }
```

where *parent* is a parent element, *descendant* is a descendant of that parent, and *styles* are styles applied to the descendant element. For example, the following style rule sets the text color of `h1` headings to red but only when those headings are nested somewhere within the `header` element:

```
header h1 {  
    color: red;  
}
```

As shown in the following code, the descendant element does not have to be a direct child of the parent; in fact, it can appear several levels below the parent in the hierarchy. This means that the above style rule matches the `h1` element in the following HTML code:

```
<header>  
  <div>  
    <h1>Tri and Succeed Sports</h1>  
  </div>  
</header>
```

The `h1` element is a direct child of the `div` element; but, because it is still a descendant of the `header` element, the style rule still applies.

Contextual selectors follow the general rule discussed in the last session; that is, the more specific style is applied in preference to the more general rule. For instance, the following style rules would result in `h1` headings within the `section` element being displayed in red while all other `h1` headings would appear in blue:

```
section h1 {color: red;}  
h1          {color: blue;}
```

Figure 2–12 describes some of the other contextual selectors supported by CSS.

Figure 2–12 Contextual selectors

Selector	Description
<code>*</code>	Matches any element
<code>elem</code>	Matches the element <i>elem</i> located anywhere in the document
<code>elem1, elem2, ...</code>	Matches any of the elements <i>elem1</i> , <i>elem2</i> , etc.
<code>parent descendant</code>	Matches the <i>descendant</i> element that is nested within the <i>parent</i> element at some level
<code>parent > child</code>	Matches the <i>child</i> element that is a child of the <i>parent</i> element
<code>elem1 + elem2</code>	Matches <i>elem2</i> that is immediately preceded by the sibling element <i>elem1</i>
<code>elem1 ~ elem2</code>	Matches <i>elem2</i> that follows the sibling element <i>elem1</i>

To match any element, use the **wildcard selector** with the `*` character. For example, the following style rule matches every child of the `article` element, setting the text color to blue:

```
article > * {color: blue;}
```

Sibling selectors select elements based on the elements that are adjacent to them in the document hierarchy. The following style rule uses the `+` symbol to select the `h2` element, but only if it is immediately preceded by an `h1` element:

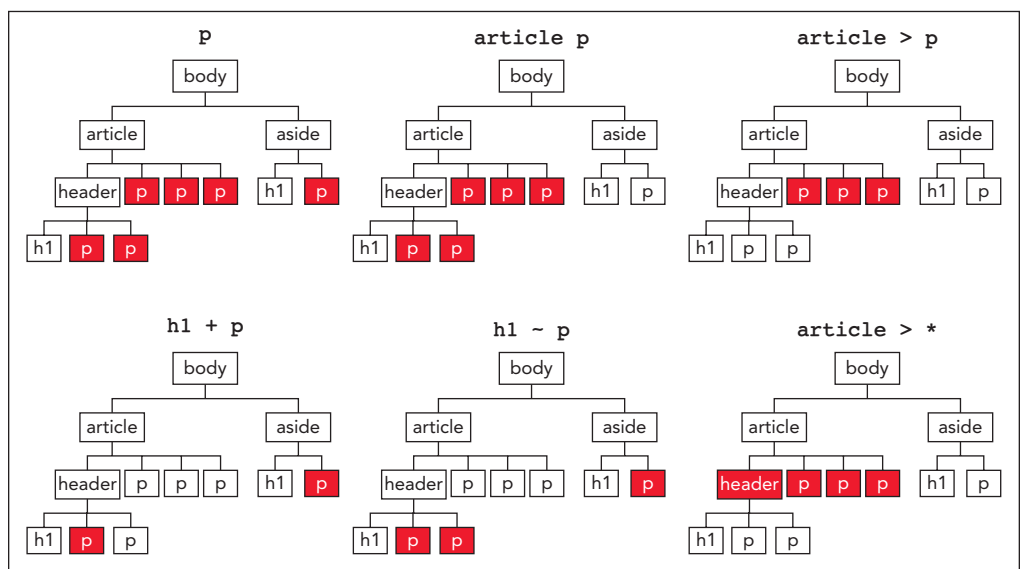
```
h1+h2 {color: blue;}
```

On the other hand, the following style rule uses the `~` symbol to select any `h2` element that is preceded (but, not necessarily immediately) by an `h1` element:

```
h1 ~ h2 {color: blue;}
```

Figure 2–13 provides additional examples of selectors and highlights in red those elements in the document that would be selected by the specified selector.

Figure 2–13 Contextual selector patterns



Remember that, because of style inheritance, any style applied to an element is passed down the document tree. Thus, a style applied to a header element is automatically passed down to elements contained within that header unless that style conflicts with a more specific style.

REFERENCE

Using Contextual Selectors

- To select all elements, use the `*` selector.
- To select a single element, use the `elem` selector, where `elem` is the name of the element.
- To select a descendant element, use the `parent descendant` selector where `parent` is a parent element and `descendant` is an element nested within the parent at some lower level.
- To select a child element, use the `parent > child` selector.
- To select a sibling element, `elem2`, that directly follows `elem1`, use the `elem1 + elem2` selector.
- To select a sibling element, `elem2`, that follows, but not necessarily directly `elem1`, use the `elem1 ~ elem2` selector.

Now, you'll create a style rule to change the text color of the customer testimonials on the Tri and Succeed Sports home page to a dark orange using the RGB color value `rgb(232, 165, 116)`. You'll use a contextual selector to apply the style rule only to block quotes that are descendants of the `aside` element.

To create style rule with a contextual selector:

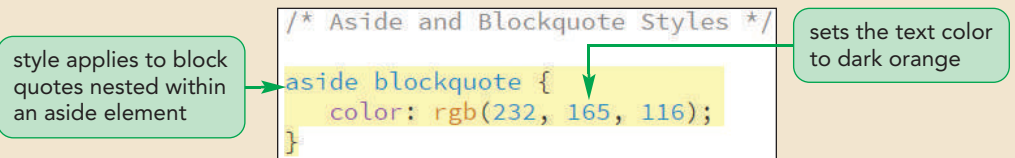
1. If you took a break after the previous session, make sure the `tss_styles.css` file is open in your editor.
2. Within the Aside and Blockquote Styles section, insert the following style rule:

```
aside blockquote {
    color: rgb(232, 165, 116);
}
```

Figure 2–14 highlights the new style rule for the `blockquote` element.

Figure 2–14

Setting the text color of block quotes



3. Save your changes to the file and then reload the `tss_home.html` file in your browser. Verify that the text of the customer quotes appears in orange.

Attribute Selectors

Contextual selectors can also be based on attributes and attribute values within elements. Two attributes, `id` and `class`, are often key in targeting styles to specific elements. Recall that the `id` attribute is used to identify specific elements within the document. To apply a style to an element based on its `id`, you use either the selector

```
#id
```

or the selector

```
elem#id
```

where `id` is the value of the `id` attribute and `elem` is the name of the element. Because `ids` are supposed to be unique, either form is acceptable but including the element name removes any confusion about the location of the selector. For example, the selector for the following `h1` heading from the HTML file

```
<h1 id="title">Tri and Succeed Sports</h1>
```

can be entered as either `#title` or `h1#title` in your CSS style sheet.

Because no two elements can share the same ID, HTML uses the `class` attribute to identify groups of elements that share a similar characteristic or property. The following `h1` element and paragraph element both belong to the `intro` class of elements:

```
<h1 class="intro">Tri and Succeed Sports</h1>
<p class="intro"> ... </p>
```

To select an element based on its `class` value, use the selector

```
elem.class
```

where `class` is the value of the `class` attribute. Thus the following style rule displays the text of `h1` headings from the `intro` class in blue:

```
h1.intro {color: blue;}
```

TIP

An element can belong to several classes by including the class names in a space-separated list in the `class` attribute.

To apply the same style rule to all elements of a particular class, omit the element name. The following style rule displays the text of all elements from the `intro` class in blue:

```
.intro {color: blue;}
```

While `id` and `class` are the most common attributes to use with selectors, any attribute or attribute value can be the basis for a selector. Figure 2–15 lists all of the CSS attribute selector patterns based on attributes and attribute values.

Figure 2–15 Attribute selectors

Selector	Selects	Example	Selects
<code>elem#id</code>	Element <i>elem</i> with the ID value <i>id</i>	<code>h1#intro</code>	The h1 heading with the id <i>intro</i>
<code>#id</code>	Any element with the ID value <i>id</i>	<code>#intro</code>	Any element with the id <i>intro</i>
<code>elem.class</code>	All <i>elem</i> elements with the class attribute value <i>class</i>	<code>p.main</code>	All paragraphs belonging to the <i>main</i> class
<code>.class</code>	All elements with the class value <i>class</i>	<code>.main</code>	All elements belonging to the <i>main</i> class
<code>elem[att]</code>	All <i>elem</i> elements containing the <i>att</i> attribute	<code>a[href]</code>	All hypertext elements containing the href attribute
<code>elem[att="text"]</code>	All <i>elem</i> elements whose <i>att</i> attribute equals <i>text</i>	<code>a[href="top.html"]</code>	All hypertext elements whose href attribute equals <i>top.html</i>
<code>elem[att~="text"]</code>	All <i>elem</i> elements whose <i>att</i> attribute contains the word <i>text</i>	<code>a[rel~="glossary"]</code>	All hypertext elements whose rel attribute contains the word <i>glossary</i>
<code>elem[att ="text"]</code>	All <i>elem</i> elements whose <i>att</i> attribute value is a hyphen-separated list of words beginning with <i>text</i>	<code>p[id ="first"]</code>	All paragraphs whose id attribute starts with the word <i>first</i> in a hyphen-separated list of words
<code>elem[att^="text"]</code>	All <i>elem</i> elements whose <i>att</i> attribute begins with <i>text</i>	<code>a[rel^="prev"]</code>	All hypertext elements whose rel attribute begins with <i>prev</i>
<code>elem[att\$="text"]</code>	All <i>elem</i> elements whose <i>att</i> attribute ends with <i>text</i>	<code>a[href\$="org"]</code>	All hypertext elements whose href attribute ends with <i>org</i>
<code>elem[att*="text"]</code>	All <i>elem</i> elements whose <i>att</i> attribute contains the value <i>text</i>	<code>a[href*="faq"]</code>	All hypertext elements whose href attribute contains the text string <i>faq</i>

REFERENCE

Using Attribute Selectors

- To select an element based on its ID, use the `elem#id` or `#id` selector, where *elem* is the name of the element and *id* is the value of the id attribute.
- To select an element based on its class value, use the `.class` or the `elem.class` selectors, where *class* is the value of the class attribute.
- To select an element that contains an *att* attribute, use `elem[att]`.
- To select an element based on whether its attribute value equals a specified value, *val*, use `elem[att="val"]`.

In the Tri and Succeed Sports home page, the main content is enclosed within an `article` element with the ID `about_tss`. Alison wants the h1 and h2 heading styles you entered in the last session to be applied only to h1 and h2 elements within articles that have this particular ID. Revise the style sheet now.

To apply an id selector:

1. Return to the **tss_styles.css** file in your editor.
2. Change the selectors for the h1 and h2 elements in the Heading Styles section to **article#about_tss h1** and **article#about_tss h2** respectively.

Figure 2–16 highlights the revised selectors in the style sheet.

Figure 2–16**Using an id selector**

selects h1 headings within an article element with the about_tss id

selects h2 headings within an article element with the about_tss id

```
/* Heading Styles */
article#about_tss h1 {
    color: white;
    background-color: rgb(222, 128, 60);
}
article#about_tss h2 {
    color: white;
    background-color: rgb(235, 177, 131);
}
```

3. Save your changes to the file and then reload the tss_home.html file in your browser. Verify that the design of the h1 and h2 headings is only applied to the headings in the about_tss article but not to the other headings on the page.

The `article` element will be used in other pages in the Tri and Succeed Sports website. Alison has provided you with three additional HTML files containing descriptions of the services her company offers for runners, cyclists, and swimmers. On those pages the `article` elements have the `class` attribute with the value *syllabus*. Create style rules for the h1 and h2 elements within the articles on those pages.

To apply a class selector:

1. Use your editor to open the **tss_run_txt.html**, **tss_bike_txt.html**, and **tss_swim_txt.html** files from the html02 ► tutorial folder. Enter **your name** and **the date** in the comment section of each file and save them as **tss_run.html**, **tss_bike.html**, and **tss_swim.html** respectively.
2. Within each of the three files insert the following `link` elements directly before the closing `</head>` tag to link these files to the tss_layout.css and tss_styles.css files, respectively:


```
<link href="tss_layout.css" rel="stylesheet" />
<link href="tss_styles.css" rel="stylesheet" />
```
3. Take some time to study the content and structure of the files. Note that the `article` element has the `class` attribute with the value *syllabus*. Save your changes to the files.
4. Return to the **tss_style.css** file in your editor.

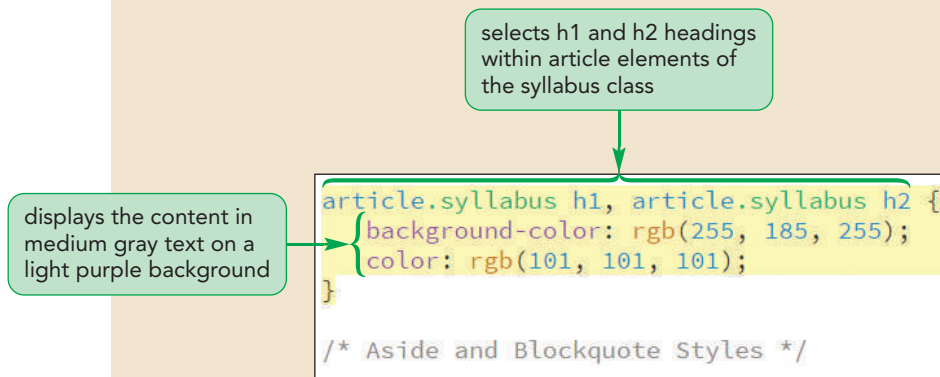
5. Within the Heading Styles section, add the following style rule to display the text of h1 and h2 headings in medium gray on a light purple background:

```
article.syllabus h1, article.syllabus h2 {
    background-color: rgb(255, 185, 255);
    color: rgb(101, 101, 101);
}
```

Figure 2–17 highlights the new style rule in the file.

Figure 2–17

Using a class selector



6. Save your changes to the style sheet and then open the **tss_run.html** file in your browser. Figure 2–18 shows the appearance of the h1 and h2 headings on this page.

Figure 2–18

Headings on the running class page



7. Use the navigation links on the page to view the content and design of the cycling and the swimming pages, and then confirm that the h1 and h2 headings on these pages have similar formats.

INSIGHT

Calculating Selector Specificity

The general rule in CSS is that the more specific selector takes precedence over the more general selector, but the application of this rule is not always clear. For example, which of the following selectors is the more specific?

```
header h1.top
```

vs.

```
#main h1
```

To answer that question, CSS assigns a numeric value to the specificity of the selector using the formula

```
(inline, ids, classes, elements)
```

where *inline* is 1 for an inline style and 0 otherwise, *ids* is 1 for every id in the selector, *classes* is 1 for every class or attribute in the selector, and *elements* is 1 for every element in the selector. For example, the selector `ul#links li.first` would have a value of (0, 1, 1, 2) because it references one id value (`#links`), 1 class value (`.first`) and two elements (`ul` and `li`). Specificity values are read from left to right with a larger number considered more specific than a smaller number.

To answer our earlier question: the selector `header h1.top` has a value of (0, 0, 1, 2) but `#main h1` has a value of (0, 1, 0, 1) and, thus, is considered more specific because 0101 is larger than 0012.

By the way, since every inline style has the value (1, 0, 0, 0), they will always be more specific than any style set in an embedded or external style sheet.

Working with Fonts

Typography is the art of designing the appearance of characters and letters on a page. So far, the only typographic style you've used is the `color` property to set the text color. For the rest of this session, you'll explore other properties in the CSS family of typographical styles, starting with choosing the text font.

Choosing a Font

Text characters are based on **fonts** that define the style and appearance of each character in the alphabet. The default font used by most browsers for displaying text is Times New Roman, but you can specify a different font for any page element using the following `font-family` property

```
font-family: fonts;
```

where *fonts* is a comma-separated list, also known as a **font stack**, of specific or generic font names. A **specific font** is a font that is identified by name, such as Times New Roman or Helvetica, and based on a font definition file that is stored on the user's computer or accessible on the web. A **generic font** describes the general appearance of the characters in the text but does not specify any particular font definition file. Instead, the font definition file is selected by the browser to match the general characteristics of the generic font. CSS supports the following generic font groups:

- **serif**—a typeface in which a small ornamentation appears at the tail end of each character
- **sans-serif**—a typeface without any serif ornamentation
- **monospace**—a typeface in which each character has the same width; often used to display programming code

- **cursive**—a typeface that mimics handwriting with highly stylized elements and flourishes; best used in small doses for decorative page elements
- **fantasy**—a highly ornamental typeface used for page decoration; should never be used as body text

Because you have no control over which font definition file the browser will choose for a generic font, the common practice is to list specific fonts first, in order of preference, ending the font stack with a generic font. If the browser cannot find any of the specific fonts listed, it uses a generic font of its own choosing. For example, the style

```
font-family: 'Arial Black', Gadget, sans-serif;
```

tells a browser to use the Arial Black font if available; if not, to look for the Gadget font; and if neither of those fonts are available, to use its own generic sans-serif font. Note that font names containing one or more blank spaces (such as Arial Black) must be enclosed within single or double quotes.

Because the available fonts vary by operating system and device, the challenge is to choose a font stack limited to **web safe fonts**, which are fonts that will be displayed in mostly the same way in all operating systems and on all devices. Figure 2–19 lists several commonly used web safe font stacks.

Figure 2–19

Web safe font stacks

Arial abcdefghijklmnopqrstuvwxyz/1234567890 font-family: Arial, Helvetica, sans-serif;	Lucida Console abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Lucida Console', Monaco, monospace;
Arial Black abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Arial Black', Gadget, sans-serif;	Lucida Sans Unicode abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Lucida Sans Unicode', 'Lucida Grande', sans-serif;
Century Gothic abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Century Gothic', sans-serif;	Palatino Linotype abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Palatino Linotype', 'Book Antiqua', Palatino, serif;
Comic Sans MS abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Comic Sans MS', cursive;	Tahoma abcdefghijklmnopqrstuvwxyz/1234567890 font-family: Tahoma, Geneva, sans-serif;
Courier New abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Courier New', Courier, monospace;	Times New Roman abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Times New Roman', Times, serif;
Georgia abcdefghijklmnopqrstuvwxyz/1234567890 font-family: Georgia, serif;	Trebuchet MS abcdefghijklmnopqrstuvwxyz/1234567890 font-family: 'Trebuchet MS', Helvetica, sans-serif;
Impact abcdefghijklmnopqrstuvwxyz/1234567890 font-family: Impact, Charcoal, sans-serif;	Verdana abcdefghijklmnopqrstuvwxyz/1234567890 font-family: Verdana, Geneva, sans-serif;

TIP

Including too many fonts can make your page difficult to read. Don't use more than two or three typefaces within a single page.

A general rule for printing is to use sans-serif fonts for headlines and serif fonts for body text. For computer monitors, which have lower resolutions than printed material, the general rule is to use sans-serif fonts for headlines and body text, leaving serif fonts for special effects and large text.

Currently, the body text for the Tri and Succeed Sports website is based on a serif font selected by the browser. You'll add the following font stack for sans-serif fonts, which will take precedence over the browser font style rule:

```
font-family: Verdana, Geneva, sans-serif;
```

As a result of this style rule, the browser will first try to load the Verdana font, followed by the Geneva font. If both of these fonts are unavailable, the browser will load a generic sans-serif font of its own choosing. Add this font family to the style rule for the page body.

To specify a font family for the page body:

1. Return to the **tss_styles.css** file in your editor.
2. Add the following style to the style rule for the body element:

```
font-family: Verdana, Geneva, sans-serif;
```

Figure 2–20 highlights the new style for the body element.

Font stacks should be listed in a comma-separated list with the most desired fonts listed first.

Figure 2–20 Specifying a font stack

browser attempts to use the Verdana font first, followed by Geneva, and finally any generic sans-serif font

```
body {
  color: rgb(91, 91, 91);
  background-color: ivory;
  font-family: Verdana, Geneva, sans-serif;
}
```

3. Save your changes to the file and then reload the **tss_home.html** file in your browser. Figure 2–21 shows the revised appearance of the body text using the sans-serif font.

Figure 2–21 Sans-serif font applied to the home page



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4. View the other three pages in the website to verify that the sans-serif font is also applied to the body text on those pages.

Exploring Web Fonts

Because web safe fonts limit your choices to a select number of fonts that have universal support, another approach is to supply a **web font** in which the definition font is supplied to the browser in an external file. Figure 2–22 describes the different web font file formats and their current levels of browser support. The format most universally accepted in almost all current browsers and on almost all devices is the Web Open Font Format (WOFF).

Figure 2–22

Web font formats

Format	Description	Browser
Embedded OpenType (EOT)	A compact form of OpenType fonts designed for use as embedded fonts in style sheets	Internet Explorer (IE)
TrueType (TTF)	Font standard used on the Mac OS and Microsoft Windows operating systems	IE, Firefox, Chrome, Safari, Opera
OpenType (OTF)	Font format built on the TrueType format developed by Microsoft	IE, Firefox, Chrome, Safari, Opera
Scalable Vector Graphics (SVG)	Font format based on an XML vocabulary designed to describe resizable graphics and vector images	Safari
Web Open Font Format (WOFF)	The W3C recommendation font format based on OpenType and TrueType with compression and additional metadata	IE, Firefox, Chrome, Safari, Opera

Web font files can be downloaded from several sites on the Internet. In many cases, you must pay for their use; in some cases, the fonts are free but are licensed only for non-commercial use. You should always check the EULA (End User License Agreement) before downloading and using a web font to make sure you are in compliance with the license. Finally, many web fonts are available through Web Font Service Bureaus that supply web fonts on their servers, which page designers can link to for a fee.

The great advantage of a web font is that it gives the author more control over the fonts used in the document; the disadvantage is that it becomes another file for the browser to download, adding to the time required to render the page. This can be a huge issue with mobile devices in which you want to limit the number and size of files downloaded by the browser.

The @font-face Rule

To access and load a web font, you add the following `@font-face` rule to the style sheet

```
@font-face {
    font-family: name;
    src: url('url1') format('text1'),
        url('url2') format('text2'),
    ...;
    descriptor1: value1;
    descriptor2: value2;
    ...
}
```

TIP

It is considered best practice to always include a format value to alert the browser about the font's format so that it doesn't download a font definition file it can't display.

where *name* is the name of the font, *url* is the location of the font definition file, *text* is an optional text description of the font format, and the *descriptor: value* pairs are optional style properties that describe when the font should be used. Note several font definition files can be placed in a comma-separated list, allowing the browser to pick the file format it supports. For example, the following `@font-face` rule defines a font named Gentium installed from either the Gentium.woff file or if that fails, the Gentium.ttf file:

```
@font-face {
    font-family: Gentium;
    src: url('Gentium.woff') format('woff'),
        url('Gentium.ttf') format('truetype');
}
```

If the style sheet includes instructions to display a web font in italics, boldface, or other variants, the browser will modify the font, which sometimes results in poorly rendered text. However if the manufacturer has supplied its own version of the font variant, you can direct the browser to use that font file. For example, the following `@font-face` rule directs the browser to use the `GentiumBold.woff` or `GentiumBold.ttf` file when it needs to display Gentium in bold.

```
@font-face {
  font-family: Gentium;
  src: url('GentiumBold.woff') format('woff'),
       url('GentiumBold.ttf') format('truetype');
  font-weight: bold;
}
```

Note that the web font is given the same font-family name `Gentium`, which is the font name you use in a font stack. The added `descriptor: value` pair and `font-weight: bold` declarations tell the browser that these font files should be used with boldface Gentium.

Once you've defined a web font using the `@font-face` rule, you can include it in a font stack. For example, the following style will attempt to load the Gentium font first, followed by Arial Black, Gadget, and then a sans-serif font of the browser's choosing:

```
font-family: Gentium, 'Arial Black', Gadget, sans-serif;
```

Alison decides that the rendering of the Verdana font in the `h1` and `h2` heading text is too thick and heavy. She has located a web font named Quicksand that she is free to use under the End User License Agreement and she thinks it would work better for the page headings. She asks you to add this font to the style sheet and apply it to all `h1` and `h2` elements.

TIP

The `@font-face` rule should be placed at the top of the style sheet after the `@charset` rule and before any styles that use the web font.

To install and use a web font:

1. Return to the `tss_styles.css` file in your editor.
2. Directly after the `@charset` rule at the top of the file, insert the following `@font-face` rule:

```
@font-face {
  font-family: Quicksand;
  src: url('Quicksand-Regular.woff') format('woff'),
       url('Quicksand-Regular.ttf') format('truetype');
}
```

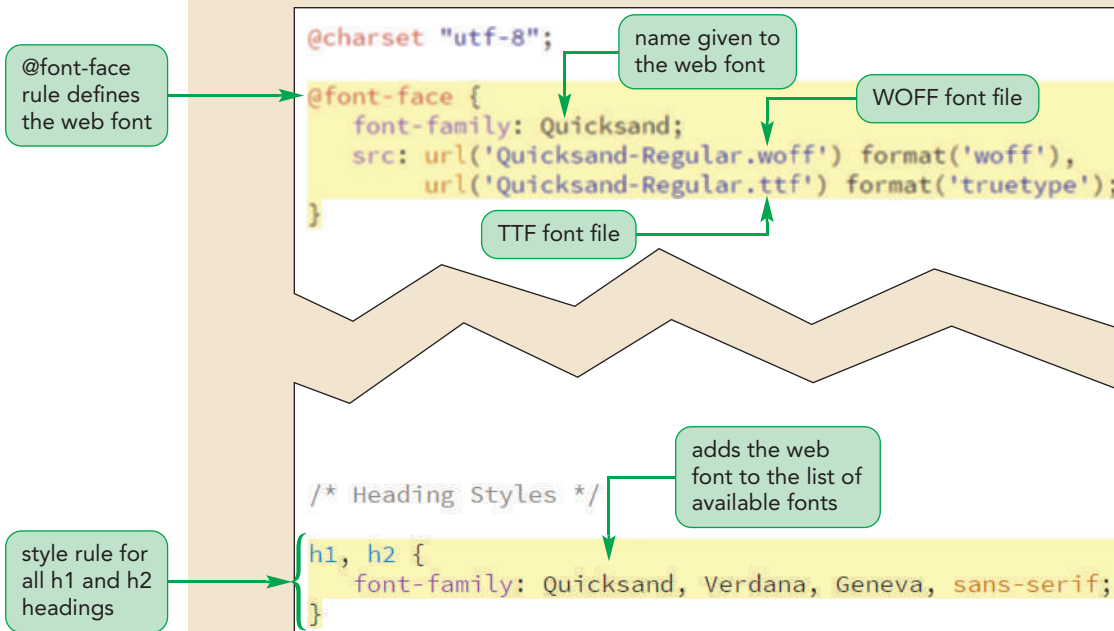
3. At the top of the Heading Styles section, insert the style rule:

```
h1, h2 {
  font-family: Quicksand, Verdana, Geneva, sans-serif;
}
```

Figure 2-23 highlights the code to create and use the Quicksand web font.

Figure 2–23

Accessing a web font



4. Save your changes to the file and reload the tss_home.html file in your browser. Figure 2–24 shows the revised appearance of the h1 and h2 headings using the Quicksand web font.

Figure 2–24

Quicksand font used for all h1 and h2 headings



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INSIGHT

Using Google Fonts

Google Fonts (google.com/fonts) hosts a library of free web fonts. After selecting a font from the Google Font catalog, you will receive the code for the `link` element to access the font files. For example, the following `link` element accesses a style sheet for a Google font named Monoton:

```
<link href="http://fonts.googleapis.com/css?family=Monoton"
      rel="stylesheet"/>
```

To use the Monoton font, include the following `font-family` property in the CSS style sheet:

```
font-family: Monoton, fantasy;
```

Google fonts, like all web fonts, need to be used in moderation because they can greatly increase the load times for your website. To help you know when you have exceeded a reasonable limit, the Google Fonts page shows a timer estimating the load times for all of the fonts you have selected. You can also limit the size of the font file by using the `&text` parameter to specify only those characters you want to download. For example, the following `link` element limits the Monoton font file to only the characters found in "TSS Sports":

```
<link href="http://fonts.googleapis.com/css?family=Monoton
&text=TSS%20Sports" rel="stylesheet" />
```

Note that blank spaces are indicated using the `%20` character. If you have a longer text string, you can shorten the value of the `href` attribute by removing duplicate characters, as the order of characters doesn't matter.

Setting the Font Size

Another important consideration in typography is the text size, which is defined using the following `font-size` property

```
font-size: size;
```

where *size* is a length in a CSS unit of measurement. Size values for any of these measurements can be whole numbers (0, 1, 2 ...) or decimals (0.5, 1.6, 3.9 ...). Lengths (and widths) in CSS are expressed in either absolute units or relative units.

Absolute Units

Absolute units are units that are fixed in size regardless of the output device and are usually used only with printed media. They are specified in one of five standard units of measurement: `mm` (millimeters), `cm` (centimeters), `in` (inches), `pt` (points), and `pc` (picas). For example, to set the font size of your page body text to a 12pt font, you would apply the following style rule:

```
body {font-size: 12pt;}
```

Note that you should not insert a space between the size value and the unit abbreviation.

Relative Units

Absolute units are of limited use because, in most cases, the page designer does not know the exact properties of the device rendering the page. In place of absolute units, designers use **relative units**, which are expressed relative to the size of other objects within the web page or relative to the display properties of the device itself.

The basic unit for most devices is the **pixel (px)**, which represents a single dot on the output device. A pixel is a relative unit because the actual pixel size depends on the resolution and density of the output device. A desktop monitor might have a pixel density of about 96ppi (pixels per inch), laptops are about 100 to 135ppi, while mobile phones have dense displays at 200 to 300ppi or more. Typically, most browsers will apply a base font size of 16px to body text with slightly larger font sizes applied to h1, h2, and h3 headings. You can override these default sizes with your own style sheet. The following style rules set the font size of the text on the page body to 10px and the font size of all h1 headings text to 14px:

```
body {font-size: 10px;}
h1 {font-size: 14px;}
```

TRY IT

You can explore typographic styles using the `demo_css.html` file in the `html02 ► demo` folder.

The exact appearance of the text depends greatly on the device's pixel density. While a 10px font might be fine on a desktop monitor, that same font size could be unreadable on a mobile device.

Scaling Fonts with ems and rems

Because the page designer doesn't know the exact properties of the user's device, the common practice is to make the text **scalable** with all font sizes expressed relative to a default font size. There are three relative measurements used to provide scalability: percentages, ems, and rems.

A percentage sets the font size as a percent of the font size used by the containing element. For example, the following style rule sets the font size of an h1 heading to 200% or twice the font size of the h1 heading's parent element:

```
h1 {font-size: 200%;}
```

The em unit acts the same way as a percentage, expressing the font size relative to the font size of the parent element. Thus, to set the font size of h1 headings to twice the font size used in their parent elements, you can also use the style rule:

```
h1 {font-size: 2em;}
```

The em unit is the preferred style unit for web page text because it makes it easy to develop pages in which different page elements have consistent relative font sizes under any device.

Context is very important with relative units. For example, if the h1 element is placed within a body element where the font size is 16px, the h1 heading will have a font size twice that size or 32px. On the other hand, an h1 heading nested within an article element where the font size is 9px will have a font size of 18px. In general, you can think of font sizes based on percentages and em units as relative to the size of immediately adjacent text.

The fact that relative units cascade through the style sheet can lead to confusing outcomes. For example, consider the following set of style rules for an h1 element nested within an article element in the page body:

```
body {font-size: 16px;}
body > article {font-size: 0.75em;}
body > article > h1 {font-size: 1em;}
```

Glancing at the style rules, you might conclude that the font size of the h1 element is larger than the font size used in the article element (since 1em > 0.75em). However, this is not the case: both font sizes are the same. Remember, em unit expresses the text size relative to font size used in the parent element and since the h1 heading is contained within the article element its font size of 1em indicates that it will have the same size used in the article element. In this case, the font size in the article element is 75% of 16px or 12 pixels as is the size of h1 headings in the article.

Because of this confusion, some designers advocate using the **rem** or **root em unit** in which all font sizes are always expressed relative to the font size used in the `html`

element. Using rems, the following style rule sets the font size of article text to 75% of 16 pixels or 12 pixels while the h1 heading size is set to 16 pixels, equal to the font size of the html element:

```
html {font-size: 16px;}
article {font-size: 0.75rem;}
article > h1 {font-size: 1rem;}
```

The rem unit has become increasingly popular with designers as browser support grows and its use might possibly replace the use of the em unit as the font size unit of choice in upcoming years.

Using Viewport Units

Another relative unit is the **viewport unit** in which lengths are expressed as a percentage of the width or height of the browser window. As the browser window is resized, the size of text based on a viewport unit changes to match. There are four viewport units: vw, vh, vmin, and vmax where

- 1vw = 1% of the browser window width
- 1vh = 1% of the browser window height
- 1vmin = 1vw or 1vh (whichever is smaller)
- 1vmax = 1vw or 1vh (whichever is larger)

For example, if the browser window is 1366 pixels wide, a length of 1vw would be equal to 13.66px. If the width of the window is reduced to 780 pixels, 1vw is automatically rescaled to 7.8 pixels. Auto-rescaling has the advantage that font sizes set with a viewport unit will be sized to match the browser window, maintaining a consistent page layout. The disadvantage is that page text can quickly become unreadable if the browser window becomes too small.

Sizing Keywords

Finally, you also can express font sizes using the following keywords: xx-small, x-small, small, medium, large, x-large, xx-large, larger, or smaller. The font size corresponding to each of these keywords is determined by the browser. Note that the larger and smaller keywords are relative sizes, making the font size of the element one size larger or smaller than the font size of the container element. For example, the following style rules set the sidebar to be displayed in a small font, while an h1 element nested within that aside element is displayed in a font one size larger (medium):

```
aside {font-size: small;}
aside > h1 {font-size: larger;}
```

Use em units now to set the font size for the h1 and h2 headings, as well as the text within the navigation list and the aside element.

To set font sizes of the page elements:

1. Return to the **tss_styles.css** file in your editor.
2. Add the following style rules directly below the Heading Styles comment to define the font sizes for h1 and h2 headings throughout the website:

```
h1 {
    font-size: 2.2em;
}

h2 {
    font-size: 1.5em;
}
```

3. Go to the Aside and Blockquote Styles section and insert the following style rule to set the default font size of text in the `aside` element to 0.8em:

```
aside {  
    font-size: 0.8em;  
}
```

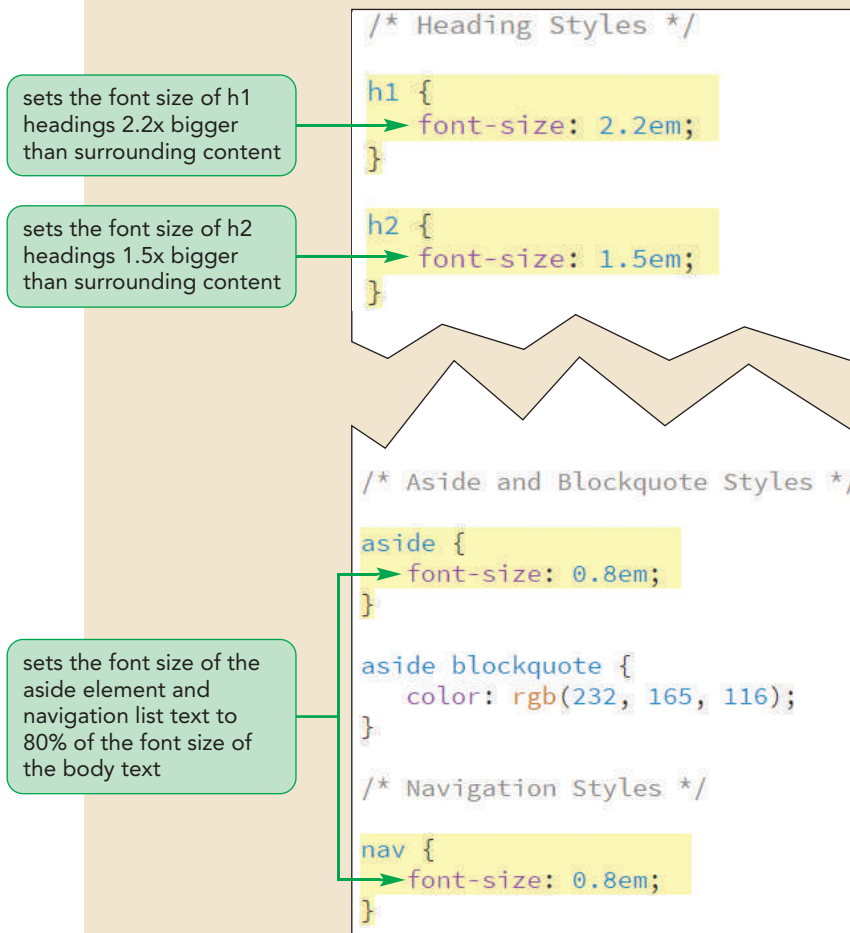
4. Go to the Navigation Styles section and insert the following style rule to set the default font size of text in the navigation list to 0.8em:

```
nav {  
    font-size: 0.8em;  
}
```

Figure 2–25 highlights the new font sizes for the website.

Figure 2–25

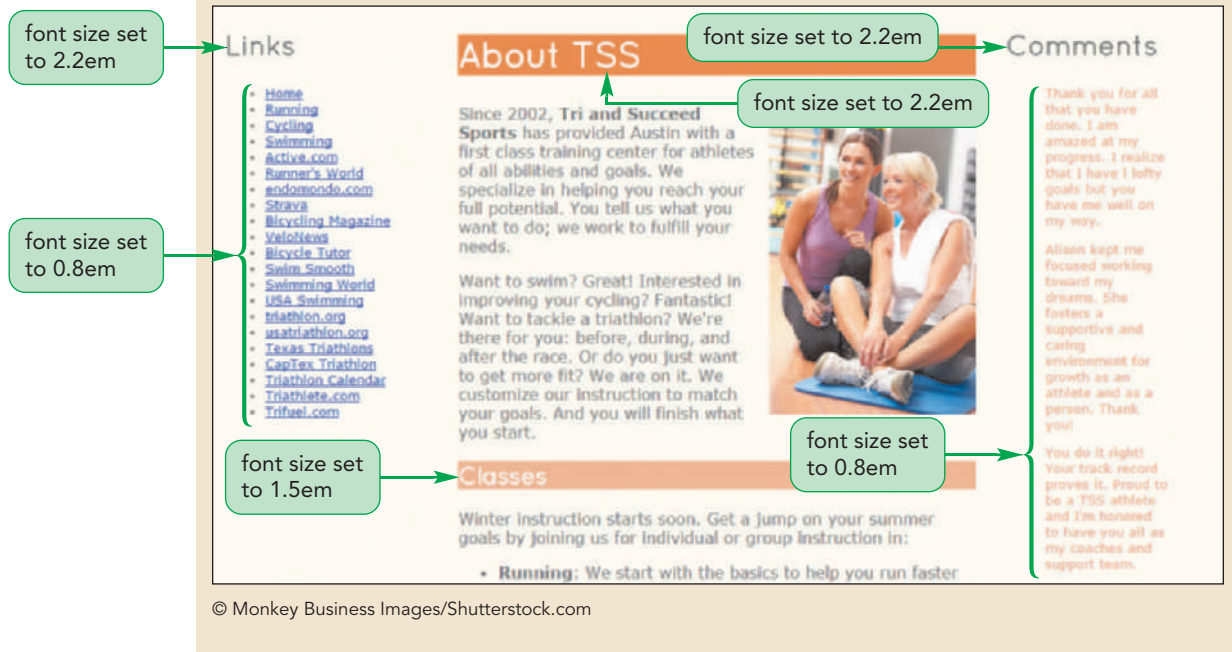
Setting font sizes for the website



5. Save your changes to the file and then reload the `tss_home.html` file in your browser. Figure 2–26 shows the revised font sizes of the headings, navigation list, and aside element.

Figure 2–26

Revised font sizes in the About TSS page



Note that the text of the h1 heading in the page article is larger than the text in the h1 headings from the navigation list and the aside element even though all headings have a font size of 2.2em. This is because you reduced the default font size of the text in the navigation list and aside elements by 80% and thus the h1 headings in those elements are also reduced by the same proportion.

Controlling Spacing and Indentation

CSS supports styles to control some basic typographic attributes, such as kerning, tracking, and leading. Kerning sets the space between characters, while **tracking** sets the space between words. The properties to control an element's kerning and tracking are

```
letter-spacing: value;
word-spacing: value;
```

where *value* is the size of space between individual letters or words. You specify these sizes with the same units that you use for font sizing. The default value for both kerning and tracking is 0 pixels. A positive value increases the letter and word spacing, while a negative value reduces the space between letters and words. If you choose to make your text scalable under a variety of devices and resolutions, you can express kerning and tracking values as percentages or em units.

Leading sets the space between lines of text and is defined with the following `line-height` property

```
line-height: size;
```

TIP

You can give multi-line titles more impact by tightening the space between the lines using a large font-size along with a small line-height.

where *size* is a value or a percentage of the font size of the text on the affected lines. If no unit is specified, the size value represents the ratio of the line height to the font size. The default value is 1.2 or 1.2em so that the line height is 20% larger than the font size. By contrast, the following style sets the line height to twice the font size, making the text appear double-spaced:

```
line-height: 2em;
```

An additional way to control text spacing is to set the indentation for the first line of a text block by using the following `text-indent` property

```
text-indent: size;
```

where *size* is expressed in absolute or relative units, or as a percentage of the width of the text block. For example, an indentation value of 5% indents the first line by 5% of the width of the block. The indentation value also can be negative, extending the first line to the left of the text block to create a **hanging indent**.

Alison suggests you increase the kerning used in the h1 and h2 headings to 0.1em so that the letters don't crowd each other on the page. She also asks that you increase the line height of the text of the navigation list to 2em so that the list of links on the home page is double-spaced.

To set font sizes of the page elements:

1. Return to the **tss_styles.css** file in your editor.
2. In the Heading Styles section, insert the following style as part of the style rule for the h1, h2 selector:

```
letter-spacing: 0.1em;
```

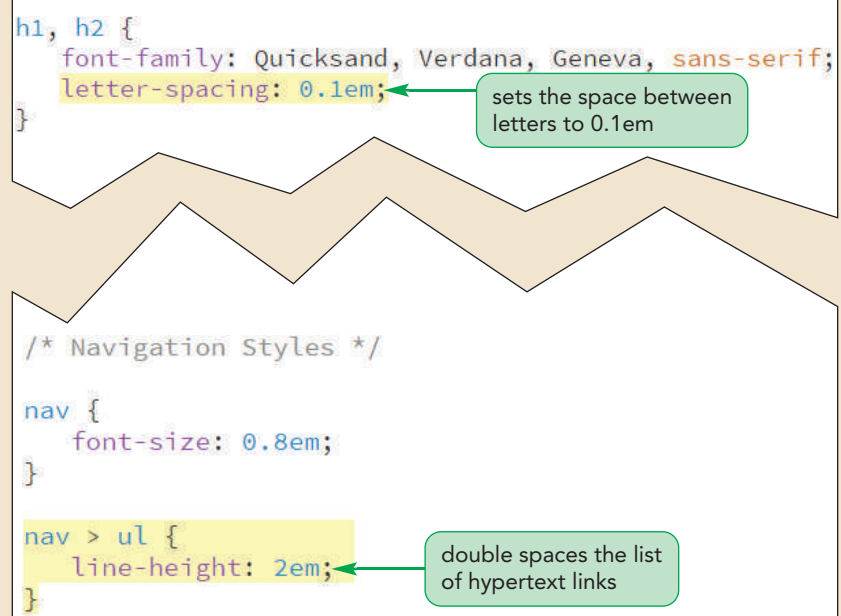
3. Scroll down to the Navigation Styles section near the bottom of the file and add the following style rule for the text of ul elements nested within the nav element:

```
nav > ul {  
    line-height: 2em;  
}
```

Figure 2–27 highlights the letter-spacing and line-height styles for the website.

Figure 2–27

Controlling letter spacing and line height



4. Save your changes to the file and then reload the `tss_home.html` file in your browser. Verify that the space between letters in the `h1` and `h2` headings has been increased and the list of links is now double-spaced.

By increasing the kerning in the headings, you've made the text appear less crowded, making it easier to read.

Working with Font Styles

The style sheet built into your browser applies specific styles to key page elements; for instance, address elements are often displayed in italic, headings are often displayed in boldface. You can specify a different font style using the following `font-style` property

```
font-style: type;
```

where *type* is *normal*, *italic*, or *oblique*. The italic and oblique styles are similar in appearance, but might differ subtly depending on the font in use.

To change the weight of the text, use the following `font-weight` property

```
font-weight: weight;
```

where *weight* is the level of bold formatting applied to the text. CSS uses the keyword `bold` for boldfaced text and `normal` for non-boldfaced text. You also can use the keywords `bolder` or `lighter` to express the weight of the text relative to its surrounding content. Finally for precise weights, CSS supports weight values ranging from 100 (extremely light) up to 900 (extremely heavy) in increments of 100. In practice, however, it's difficult to distinguish font weights at that level of precision.

You can apply decorative features to text through the following `text-decoration` property

```
text-decoration: type;
```

where *type* equals *none* (for no decoration), *underline*, *overline*, or *line-through*. The *text-decoration* property supports multiple types so that the following style places a line under and over the element text:

```
text-decoration: underline overline;
```

Note that the *text-decoration* style has no effect on non-textual elements, such as inline images.

To control the case of the text within an element, use the following *text-transform* property

```
text-transform: type;
```

where *type* is *capitalize*, *uppercase*, *lowercase*, or *none* (to make no changes to the text case). For example, to capitalize the first letter of each word in an element, apply the style:

```
text-transform: capitalize;
```

Finally, CSS supports variations of the text using the *font-variant* property

```
font-variant: type;
```

where *type* is *normal* (for no variation) or *small-caps* (small capital letters). Small caps are often used in legal documents, such as software agreements, in which the capital letters indicate the importance of a phrase or point, but the text is made small so as not to detract from other elements in the document.

Aligning Text Horizontally and Vertically

Text can be aligned horizontally or vertically within an element. To align the text horizontally, use the following *text-align* property

```
text-align: alignment;
```

where *alignment* is *left*, *right*, *center*, or *justify* (align the text with both the left and the right margins).

To vertically align the text within each line, use the *vertical-align* property

```
vertical-align: alignment;
```

where *alignment* is one of the keywords described in Figure 2–28.

Figure 2–28

Values of the vertical-align property

Value	Description
baseline	Aligns the baseline of the element with the baseline of the parent element
bottom	Aligns the bottom of the element with the bottom of the lowest element in the line
middle	Aligns the middle of the element with the middle of the surrounding content in the line
sub	Subscripts the element
super	Superscripts the element
text-bottom	Aligns the bottom of the element with the bottom of the text in the line
text-top	Aligns the top of the element with the top of the text in the line
top	Aligns the top of the element with the top of the tallest object in the line

TIP

The subscript and superscript styles lower or raise text vertically, but do not resize it. To create true subscripts and superscripts, you also must reduce the font size.

Instead of using keywords, you can specify a length or a percentage for an element to be vertically aligned relative to the surrounding content. A positive value moves the element up as in the following style that raises the element by half the line height of the surrounding content:

```
vertical-align: 50%;
```

A negative value drops the content. For example, the following style drops the element an entire line height below the baseline of the current line:

```
vertical-align: -100%;
```

Combining All Text Formatting in a Single Style

You can combine most of the text and font style properties into the following shorthand font property

```
font: style variant weight size/height family;
```

where *style* is the font's style, *variant* is the font variant, *weight* is the font weight, *size* is the font size, *height* is the height of each line, and *family* is the font stack. For example, the following style rule displays the element text in italic, bold, and small capital letters using Arial or another sans-serif font, with a font size of 1.5em and a line height of 2em:

```
font: italic small-caps bold 1.5em/2em Arial, sans-serif;
```

You do not have to include all of the values in the shorthand font property; the only required values are the *size* and *family* values. A browser assumes the default value for any omitted property; however, you must place any properties that you do include in the order indicated above.

At the bottom of each page in the Tri and Succeed Sports website, Alison has nested an address element within the body footer. The default browser style sheet displays address text in italics. Alison suggests that you display the text in a semi-transparent bold white font on a dark orange background and centered on the page. She also suggests that you use the small-cap font variant to add visual interest, and she wants you to increase the height of the address line to 3em. To make your CSS code more compact, you'll set all of the font values using the shorthand font property.

To apply the font property:

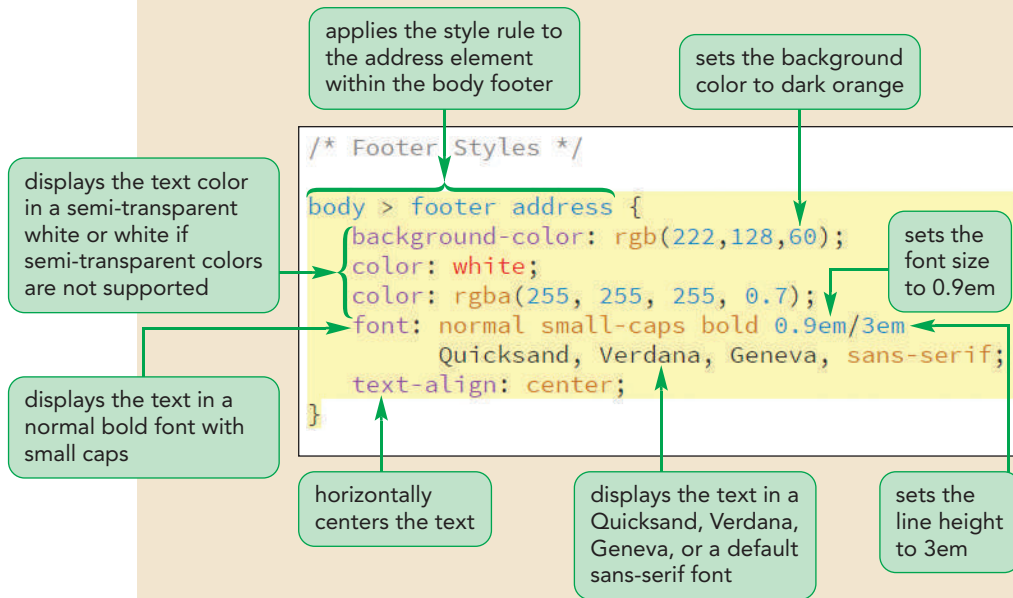
1. Return to the **tss_styles.css** file in your editor.
2. Go down to the Footer Styles section and add the following style rule:

```
body > footer address {
    background-color: rgb(222,128,60);
    color: white; color: rgba(255, 255, 255, 0.7);
    font: normal small-caps bold 0.9em/3em
        Quicksand, Verdana, Geneva, sans-serif;
    text-align: center;
}
```

Note that this style rule uses progressive enhancement by placing each color rule on its own line so that browsers that do not support semi-transparent colors will display the address text in white. Figure 2-29 highlights the style rule for the footer.

Figure 2–29

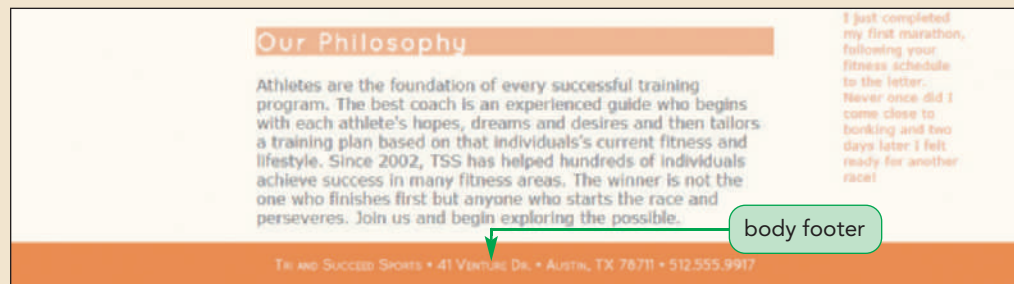
Style rule for the body footer



3. Save your changes to the file and then reload the `tss_home.html` file in your browser. Figure 2–30 shows the revised appearance of the body footer.

Figure 2–30

Formatted body footer





PROSKILLS

Decision Making: Selecting a Font

HTML and CSS provide several typographic options. Your main goal, however, is always to make your text easily readable. When designing your page, keep in mind the following principles:

- *Keep it plain*—Avoid large blocks of italicized text and boldfaced text. Those styles are designed for emphasis, not readability.
- *Sans-serif vs. serif*—Sans-serif fonts are more readable on a computer monitor and should be used for body text. Reserve the use of serif, cursive, and fantasy fonts for page headings and special decorative elements.
- *Relative vs. absolute*—Font sizes can be expressed in relative or absolute units. A relative unit like the *em* unit is more flexible and will be sized to match the screen resolution of the user's device, but you have more control over your page's appearance with an absolute unit. Generally, you want to use an absolute unit only when you know the configuration of the device the reader is using to view your page.
- *Size matters*—Almost all fonts are readable at a size of 14 pixels or greater; however, for smaller sizes, you should choose fonts that were designed for screen display, such as Verdana and Georgia. If you have to go really small (at a size of only a few pixels), you should either use a web font that is specially designed for that purpose or replace the text with an inline image.
- *Avoid long lines*—In general, try to keep the length of your lines to 60 characters or fewer. Anything longer is difficult to read.

When choosing any typeface and font style, the key is to test your selection on a variety of browsers, devices, screen resolutions, and densities. Don't assume that text that is readable and pleasing to the eye on your device screen will work as well on another device.

Alison likes the typographic changes you made to her website. In the next session, you'll explore how to design styles for hypertext links and lists, and you'll learn how to use CSS to add special visual effects to your web pages.

REVIEW

Session 2.2 Quick Check

1. Which of the following selectors is used to match only paragraphs that are children of the `aside` element?
 - a. `aside p`
 - b. `p`
 - c. `aside > p`
 - d. All of the above
2. Which of the following selectors matches an `h1` heading with the id "topHeading"?
 - a. `h1#topHeading`
 - b. `h1[id="topHeading"]`
 - c. `h1`
 - d. All of the above

3. For the following style rules, what is the font size of the h1 heading in pixels?
- ```
body {font-size: 16px;}
body > article {font-size: 0.75em;}
body > article > h1 {font-size: 1.5em;}
```
- 16px;
  - 12px;
  - 18px;
  - 18.25px;
4. Which of the following styles will set the font size to 2% of the viewport width?
- 2%vw;
  - 2vw;
  - 2vmin;
  - 2%view;
5. Provide a style rule to remove underlining from hypertext links marked with the <a> tag and nested within a navigation list.
- nav > a {text-decoration: none;}
  - nav > a {text-decoration: no-underline;}
  - nav a {text-decoration: none;}
  - nav a {text-decoration: underline="no";}
6. Provide an @font-face rule to create a web font named Cantarell based on the font file cantarell.woff and cantarell.ttf.
- ```
@font-face {
  font-family: Cantarell;
  src: url('Cantarell.woff') format('woff'),
  src: url('Cantarell.ttf') format('truetype');
}
```
 - font-family: Cantarell, cantarell.woff, cantarell.ttf.
 - ```
Cantarell {
 src: url('Cantarell.woff') format('woff'),
 src: url('Cantarell.ttf') format('truetype');
}
```
  - All of the above will work
7. Which of the following provides a style rule to display all blockquote elements belonging to the Reviews class in italic and indented 3em?
- ```
Reviews > blockquote {
  font-style: italic;
  indent: 3em;
}
```
 - ```
blockquote#Reviews {
 font-style: italic;
 indent: 3em;
}
```
  - ```
blockquote.Reviews {
  font-style: italic;
  text-indent: 3em;
}
```
 - ```
blockquote#Reviews {
 italic: true;
 indent: 3em;
}
```

8. Which of the following style rules will center the text of all h1 through h6 headings with the text displayed at normal weight?
- a. 

```
h1 - h6 {
 text-align: center;
 weight: normal;
}
```
  - b. 

```
h1, h2, h3, h4, h5, h6 {
 align: center;
 weight: normal;
}
```
  - c. 

```
h1, h2, h3, h4, h5, h6 {
 text-align: center;
 font-weight: normal;
}
```
  - d. 

```
h1 - h6 {
 text-align: center;
 font-weight: normal;
}
```
9. What style property sets the kerning of the text within an element?
- a. letter-spacing
  - b. word-spacing
  - c. kerning-size
  - d. kerning

# Session 2.3 Visual Overview:

The **list-style-type** property defines the appearance of the list marker.

The **margin-top** property sets the margin space above the element.

The **hover** pseudo-class selects links that are hovered over; the **active** pseudo-class selects actively clicked links.

The **first-of-type** pseudo-class selects the first element type of the parent element.

The **list-style-image** property is used to insert an image for the list marker.

The **quotes** property defines characters for quotation marks.

The **content** property is used to insert content into a page element.

The **visited** pseudo-class selects previously visited links; the **link** pseudo-class selects unvisited links.

```
nav > ul {
 list-style-type: none;
 padding-left: 5px;
}

nav > ul > li.newgroup {
 margin-top: 20px;
}

nav > ul > li > a:visited, nav > ul > li > a:link {
 color: rgb(151, 151, 151);
 text-decoration: none;
}

nav > ul > li > a:hover, nav > ul > li > a:active {
 color: rgb(255, 64, 255);
}

article#about_tss ul li:first-of-type {
 list-style-image: url(runicon.png);
}

article#about_tss ul li:nth-of-type(2) {
 list-style-image: url(bikeicon.png);
}

article#about_tss ul li:last-of-type {
 list-style-image: url(swimicon.png);
}

aside blockquote {
 quotes: "\201C" "\201D";
}

aside blockquote::before {
 content: open-quote;
}

aside blockquote::after {
 content: close-quote;
}
```

The **nth-of-type** pseudo-class selects the nth element type of the parent.

The **last-of-type** pseudo-class selects the last element type of the parent element.

The **before** and **after** pseudo-elements are used to select page space before and after a page element.

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© Courtesy Patrick Carey

# Pseudo Elements and Classes

Style of the link changes when the mouse pointer hovers over it.

Open quote character is inserted using the content property.

Close quote character is inserted using the content property.

## Links


- Home
- Running
- Cycling
- Swimming
- Active.com
- Runner's World
- endomondo.com
- Strava
- Bicycling Magazine
- VeloNews
- Bicycle Tutor
- Swim Smooth
- Swimming World
- USA Swimming
- triathlon.org
- usatriathlon.org
- Texas Triathlons
- CapTex Triathlon
- Triathlon Calendar
- Triathlete.com
- Trifuel.com

Top margins at each newgroup class are set to 20 pixels.

## About TSS

Since 2002, **Tri and Succeed Sports** has provided Austin with a first class training center for athletes of all abilities and goals. We specialize in helping you reach your full potential. You tell us what you want to do; we work to fulfill your needs.




Want to swim? Great! Interested in improving your cycling? Fantastic! Want to tackle a triathlon? We're there for you: before, during, and after the race. Or do you just want to get more fit? We are on it. We customize our instruction to match your goals. And you will finish what you start.



Monkey Business Images/Shutterstock.com

## Classes

Winter instruction starts soon. Get a jump on your summer goals by joining us for individual or group instruction in:

-  **Running:** We start with the basics to help you run faster and farther than you ever thought possible without aches and pains.
-  **Cycling:** The indoor bike trainers at TSS include everything you need to refine your technique, stamina, and power for improved results on the road.
-  **Swimming:** The open water swim can be one of the most frightening sports to master. Our classes begin with basic techniques so that your swim can be very enjoyable, and not a chore.

An image is used to mark each of the three list markers.

## Comments

"Thank you for all that you have done. I am amazed at my progress. I realize that I have lofty goals but you have me well on my way."

"Alison kept me focused working toward my dreams. She fosters a supportive and caring environment for growth as an athlete and as a person. Thank you!"

"You do it right! Your track record proves it. Proud to be a TSS athlete and I'm honored to have you all as my coaches and support team."

"The coaches at TSS treat you with the highest respect: whether you're an individual getting off the couch for the first time or an elite athlete training for the Iron Man. They know their stuff."

"I just completed my first marathon, following your fitness schedule to the letter. Never once did I come close to bonking and two days later I felt ready for another race!"

This is the first li element.

This is the last li element.

This is the second li element.

## Formatting Lists

In this session, you'll explore how to use CSS to create styles for different types of lists that you learned about in Tutorial 1. You'll start by examining how to create styles for the list marker.

### Choosing a List Style Type

The default browser style for unordered and ordered lists is to display each list item alongside a symbol known as a **list marker**. By default, unordered lists are displayed with a solid disc while ordered lists are displayed with numerals. To change the type of list marker or to prevent any display of a list marker, apply the following `list-style-type` property

```
list-style-type: type;
```

where `type` is one of the markers described in Figure 2–31.

**Figure 2–31** Values of the `list-style-type` property

| list-style-type      | Marker(s)           |
|----------------------|---------------------|
| disc                 | ●                   |
| circle               | ○                   |
| square               | ■                   |
| decimal              | 1, 2, 3, 4, ...     |
| decimal-leading-zero | 01, 02, 03, 04, ... |
| lower-roman          | i, ii, iii, iv, ... |
| upper-roman          | I, II, III, IV, ... |
| lower-alpha          | a, b, c, d, ...     |
| upper-alpha          | A, B, C, D, ...     |
| lower-greek          | α, β, γ, δ, ...     |
| upper-greek          | Α, Β, Γ, Δ, ...     |
| none                 | no marker displayed |

#### TIP

List style properties can be applied to individual list items using the `li` selector in the style rule.

For example, the following style rule marks each item from an ordered list with an uppercase Roman numeral:

```
ol {list-style-type: upper-roman;}
```

### Creating an Outline Style

Nested lists can be displayed in an outline style through the use of contextual selectors. For example, the following style rules create an outline style for a nested ordered list:

```
ol {list-style-type: upper-roman;}
ol ol {list-style-type: upper-alpha;}
ol ol ol {list-style-type: decimal;}
```

In this style, the `ol` selector selects the top level of the list, displaying the list items with a Roman numeral. The `ol ol` selector selects the second level, marking the items with capital letters. The third level indicated by the `ol ol ol` selector is marked with decimal values.

To see how these style rules are rendered on a page, you'll apply them to the three pages that Alison has set up describing the running, cycling, and swimming programs offered by Tri and Succeed sports. Each page contains a syllabus outlining the course of study for the next several weeks.

### To apply an outline style:

1. If you took a break after the previous session, make sure the **tss\_styles.css** file is open in your editor.
2. Scroll down to the List Styles section and insert the following style rules to format nested ordered lists within the syllabus article:

```
article.syllabus ol {
 list-style-type: upper-roman;
}

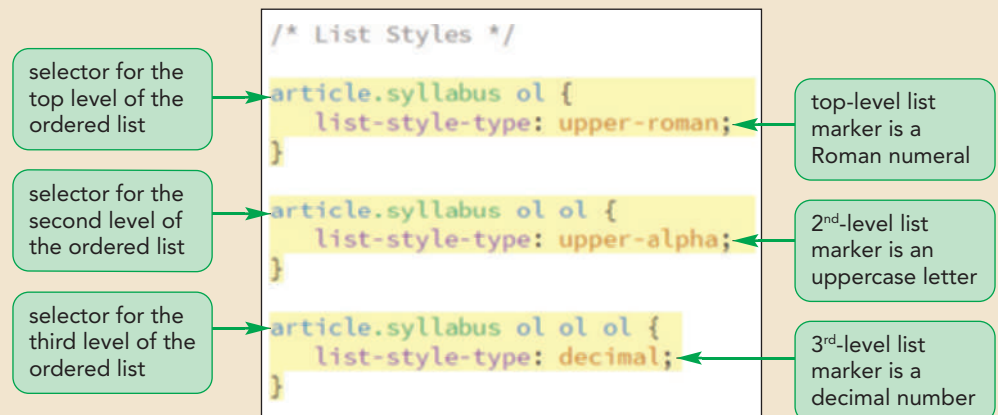
article.syllabus ol ol {
 list-style-type: upper-alpha;
}

article.syllabus ol ol ol {
 list-style-type: decimal;
}
```

Figure 2–32 highlights the style rule for the nested lists.

Figure 2–32

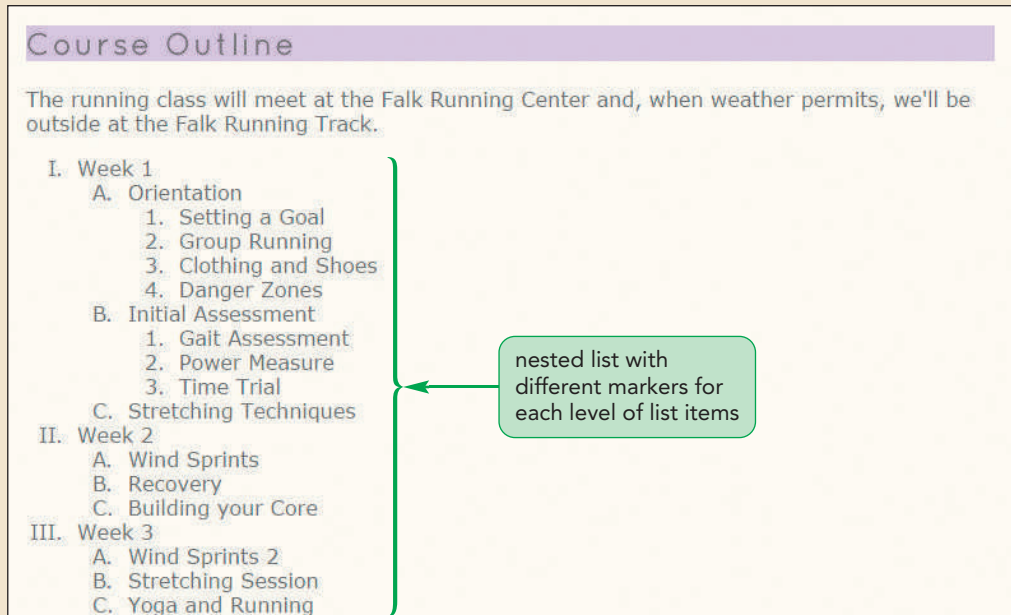
### Creating an outline style for a nested list



3. Save your changes to the file and then open the **tss\_run.html** file in your browser. As shown in Figure 2–33, the syllabus for the class should now be displayed in an outline style.

Figure 2–33

## Course outline



Alison points out that the hypertext links from the navigation list are displayed with a disc marker. She asks you to remove the markers from the navigation list by setting the `list-style-type` property to `none`.

## To remove the markers from navigation lists:

1. Return to the **tss\_styles.css** file in your editor.
2. Go to the Navigation Styles section and, within the style rule for the `nav > ul` selector, add the style `list-style-type: none;`

Figure 2–34 highlights the new style.

Figure 2–34

## Removing list markers from navigation lists

```
nav > ul {
 line-height: 2em;
 list-style-type: none;
}
```

displays no markers for unordered lists within the nav element

3. Save your changes to the file and then open the **tss\_home.html** file in your browser. Verify that there are no markers next to the navigation list items in the left column.
4. Go to the other three pages in the website and verify that navigation lists in these pages also do not have list markers.

### Designing a List

- To define the appearance of the list marker, use the property  
`list-style-type: type;`  
 where *type* is `disc`, `circle`, `square`, `decimal`, `decimal-leading-zero`, `lower-roman`, `upper-roman`, `lower-alpha`, `upper-alpha`, `lower-greek`, `upper-greek`, or `none`.
- To insert a graphic image as a list marker, use the property  
`list-style-image: url(url);`  
 where *url* is the URL of the graphic image file.
- To set the position of list markers, use the property  
`list-style-position: position;`  
 where *position* is `inside` or `outside`.
- To define all of the list style properties in a single style, use the property  
`list-style: type url(url) position;`

## Using Images for List Markers

You can supply your own graphic image for the list marker with the following `list-style-image` property

```
list-style-image: url(url);
```

where *url* is the URL of a graphic file containing the marker image. Marker images are only used with unordered lists in which the list marker is the same for every list item. For example, the following style rule displays items from unordered lists marked with the graphic image in the `redball.png` file:

```
ul {list-style-image: url(redball.png);}
```

Alison has an icon image in a file named `runicon.png` that she wants to use for the classes listed on the Tri and Succeed Sports home page in the About TSS article. Apply her image file to the list now.

### To use an image for a list marker:

1. Return to the **tss\_styles.css** file in your editor.
2. At the top of the List Styles section, insert the following style rule:

```
article#about_tss ul {
 list-style-image: url(runicon.png);
}
```

Figure 2–35 highlights the style rule to use the `runicon.png` file as the list marker image.

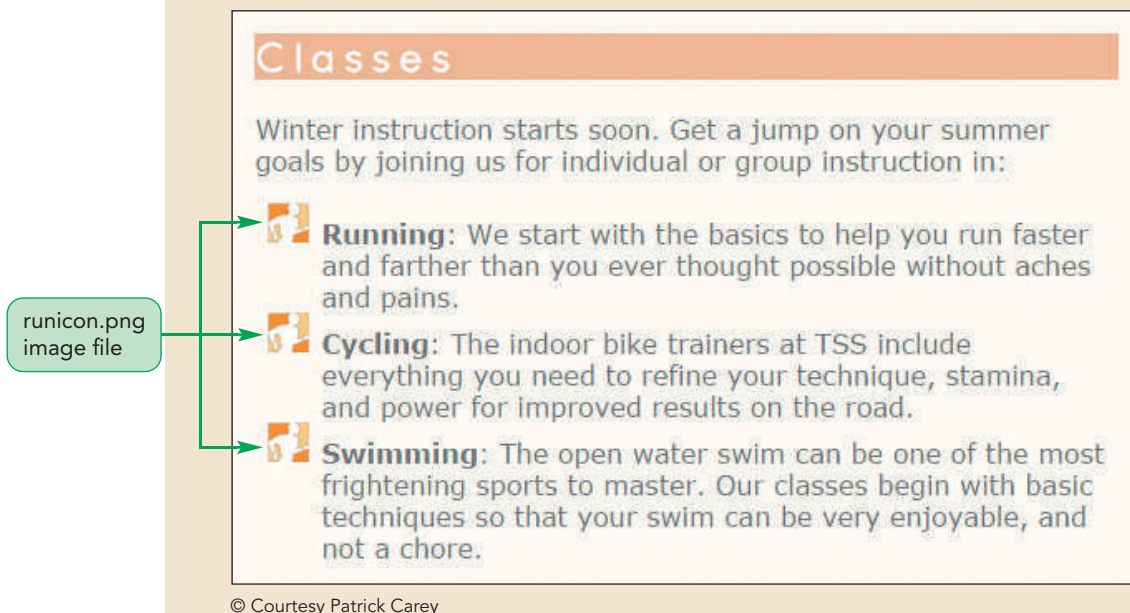
**Figure 2–35** Displaying an image in place of a list marker

style rule applied to the unordered list within the about\_tss article

```
/* List Styles */
article#about_tss ul {
 list-style-image: url(runicon.png);
}
```

displays the runicon.png file as the list marker

3. Save your changes to the file and then open the **tss\_home.html** file in your browser. As shown in Figure 2–36 the items in the unordered list now use the runicon.png image file as their list marker.

**Figure 2–36** Unordered list with the runicon.png image marker

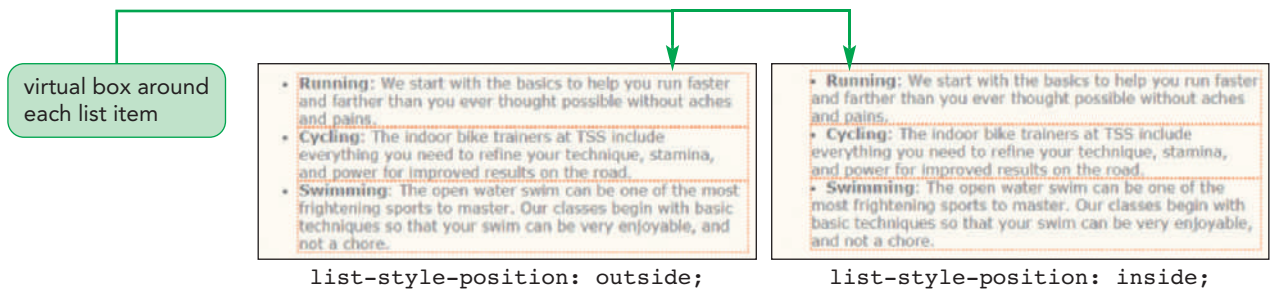
Notice that the list marker is aligned with the baseline of the first line in each list item. This is the default placement for list marker images.

## Setting the List Marker Position

CSS treats each list item as a block-level element, placed within a virtual box in which the list marker is placed outside of the list text. You can change this default behavior using the following `list-style-position` property

```
list-style-position: position;
```

where *position* is either `outside` (the default) or `inside`. Placing the marker inside the virtual box causes the list text to flow around the marker. Figure 2–37 shows how the `list-style-position` property affects the flow of the text around the bullet marker.

**Figure 2–37** Values of the list-style-position property

All three of the list styles just discussed can be combined within the following shorthand `list-style` property

```
list-style: type image position;
```

where *type* is the marker type, *image* is an image to be displayed in place of the marker, and *position* is the location of the marker. For example, the following style rule displays unordered lists using the marker found in the `bullet.png` image placed inside the containing block:

```
ul {list-style: circle url(bullet.png) inside;}
```

If a browser is unable to display the `bullet.png` image, it uses a default circle marker instead. You do not need to include all three style properties with the list style. Browsers will set any property you omit to the default value.

Allison notes that there is a lot of unused space to the left of the items in the navigation list now that the list markers have been removed. She wants you to move the navigation list into that empty space. To do this, you'll work with the CSS styles for margin and padding space.

## Working with Margins and Padding

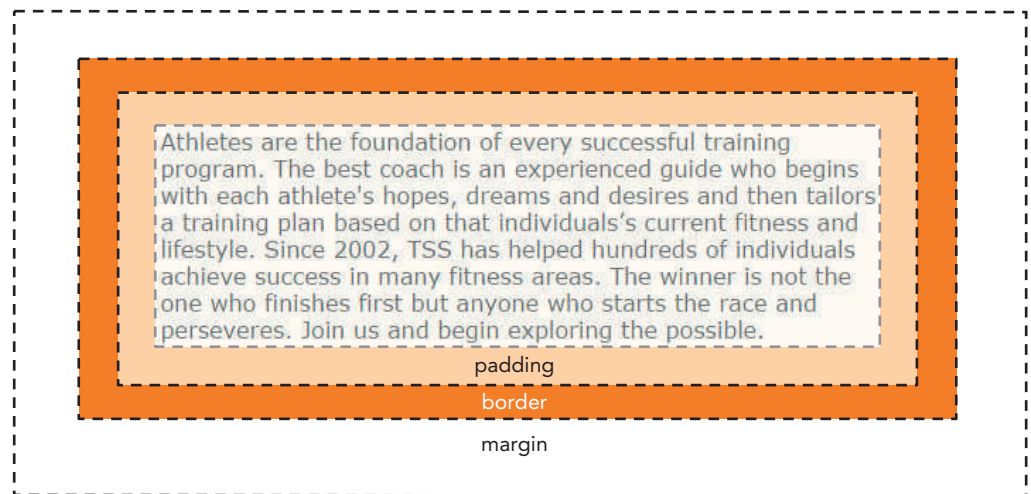
Block-level elements like paragraphs or headings or lists follow the structure of the **box model** in which the content is enclosed within the following series of nested boxes:

- the content of the element itself
- the **padding space**, which extends from the element's content to the element's border
- the **border** surrounding the padding space and marking the extent of the element
- the **margin space** comprised of the space between the element and the next page element

Figure 2–38 shows a diagram of the box model for a sample paragraph discussing athletes at Tri and Succeed Sports.

Figure 2–38

The CSS box model

**TIP**

Your browser's developer tools will display a schematic diagram of the box model for each element on your page so that you can determine the size of the padding, border, and margin spaces.

The browser's internal style sheet sets the size of the padding, border, and margin spaces but you can specify different sizes in your style sheet.

## Setting the Padding Space

To set the width of the padding space, use the following padding property

```
padding: size;
```

where *size* is expressed in one of the CSS units of length or the keyword `auto` to let the browser automatically choose the padding. For example, the following style rule sets the padding space around every paragraph to 20 pixels:

```
p {padding: 20px;}
```

The padding space can also be defined for each of the four sides of the virtual box by writing the padding property as follows

```
padding: top right bottom left;
```

where *top* is the size of the padding space along the top edge of the content, *right* is padding along the right edge, *bottom* is the size of the bottom padding, and *left* is the size of the padding along the left edge. Thus, the following style rule creates a padding space that is 10 pixels on top, 0 pixels to the right, 15 pixels on the bottom, and 5 pixels to the left:

```
p {padding: 10px 0px 15px 5px;}
```

To help remember this order, think of moving clockwise around the box, starting with the top edge. While you don't have to supply values for all of the edges, the values you supply are interpreted based on how many values you supply. So, if you specify a single value, it's applied to all four sides equally. Two values set the padding spaces for the top/bottom edges and the right/left edges. For example, the following style rule sets the top and bottom padding spaces at 10 pixels and the right and left padding spaces at 5 pixels:

```
p {padding: 10px 5px;}
```

With three values, the padding spaces are set for the top, right/left, and bottom edges. Thus, the following rule sets the size of the top padding space to 10 pixels, the left/right spaces to 5 pixels, and the bottom space to 0 pixels:

```
p {padding: 10px 5px 0px;}
```

To define the padding space for one edge but not for the others, apply the following style properties:

```
padding-top: size;
padding-right: size;
padding-bottom: size;
padding-left: size;
```

The following style rule sets the top padding of every paragraph to 10 pixels but it does not specify a padding size for any of the three remaining edges:

```
p {padding-top: 10px;}
```

With ordered and unordered lists, the default browser style sets the left padding space to 40 pixels in order to provide the extra space needed for the list markers. Removing the list markers doesn't remove this padding space. Allison suggests you recover this unused space by reducing the size of the left padding space in the navigation list to 5 pixels.

Include the unit in any style involving padding or margin spaces.

### To change the left padding used in the navigation list:

1. Return to the **tss\_styles.css** file in your editor.
2. Locate the **nav > ul** style rule in the Navigation Styles section and add the style **padding-left: 5px;**.

Figure 2–39 highlights the new style for all navigation lists.

Figure 2–39

### Setting the size of the left padding space

selects unordered lists within the nav element

```
nav > ul {
 line-height: 2em;
 list-style-type: none;
 padding-left: 5px;
}
```

sets the padding on the left edge to 5 pixels

3. Save your changes to the file and then reload the **tss\_home.html** file in your browser. Verify that the entries in the navigation list in the left column have been shifted to the left, which is the result of changing the left padding setting to 5 pixels.

Now that you've worked with the padding space, you'll examine how to work with margins.

## REFERENCE

### Setting Padding and Margin Space

- To set the padding space around all sides of the element, use  

```
padding: size;
```

 where *size* is the size of the padding using one of the CSS units of length.
- To set the margin space around all sides of the element, use  

```
margin: size;
```
- To set padding or margin on only one side (top, right, bottom, or left) include the name of the side in the property as  

```
padding-side: size;
```

```
margin-side: size;
```

 where *side* is top, right, bottom, or left.
- To set different padding or margins on each side of the element, enter the sides as  

```
padding: top right bottom left;
```

```
margin: top right bottom left;
```

 where *top*, *right*, *bottom*, and *left* are individual sizes for the associated side.

## Setting the Margin and the Border Spaces

Styles to set the margin space are similar to the padding styles. To set the size of the margin around your block elements, use either of the following properties:

```
margin: size;
```

or

```
margin: top right bottom left;
```

The margins of individual sides are set using the style properties

```
margin-top: size;
```

```
margin-right: size;
```

```
margin-bottom: size;
```

```
margin-left: size;
```

where once again *size* is expressed in one of the CSS units of length or using the keyword `auto` to have the browser automatically set the margin.

The size of the border space is set using the following `border-width` property

```
border-width: size;
```

or

```
border-width: top right bottom left;
```

or with the properties `border-top-width`, `border-right-width`, `border-bottom-width`, and `border-left-width` used to specify the size of individual borders. You'll explore borders in more detail in Tutorial 4.

The navigation list that Alison created for the home page groups the list into those links for pages within the Tri and Succeed Sports website and those links to external websites. The list item at the start of each group is marked with the `class` value *newgroup*. Alison suggests you increase the top margin above each group of links to 20 pixels in order to offset it from the preceding group. The groups will be easier to recognize after the top margin for each group has been increased.

### To increase the top margin:

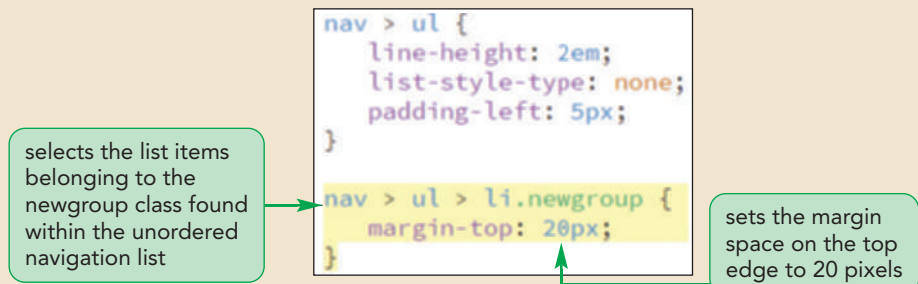
1. Return to the **tss\_styles.css** file in your editor.
2. Directly below the style rule for the `nav > ul` selector in the Navigation Styles section, add the following rule:

```
nav > ul > li.newgroup {
 margin-top: 20px;
}
```

Figure 2–40 highlights the style rule setting the top margin value.

Figure 2–40

### Setting the size of the top margin



3. Save your changes to the file and then reload the `tss_home.html` file in your browser. Verify that the entries in the navigation list are now split into three groups: the first group containing the links from the Tri and Succeed Sports website; the second group containing links to websites on running, cycling, and swimming; and the third group containing links to triathlon websites.

Alison has also noticed that the block quotes in the right column of the home page have unused space to the left, leaving less space for the customer quotes. The default browser style for the `blockquote` element offsets block quotes from the surrounding text by setting the left and right margins to 40 pixels. To adjust this spacing and to make the block quotes more readable, you'll reduce the left/right margins to 5 pixels. You'll also increase the top/bottom margins to 20 pixels to better separate one customer quote from another.

### To change the margin space around block quotes:

1. Return to the **tss\_styles.css** file in your editor.
2. Locate the style rule for the `aside blockquote` selector in the Aside and Blockquote Styles section and insert the **margin: 20px 5px;** style into the style rule for the `aside blockquote` selector.

Figure 2–41 displays the style to change the margin space around the `blockquote` element.

Figure 2–41

## Setting the margin size for block quotes

selects block quotes within the aside element

```
aside blockquote {
 color: rgb(232, 165, 116);
 margin: 20px 5px;
}
```

sets the size of the top and bottom margins to 20 pixels

sets the size of the left and right margins to 5 pixels

3. Save your changes to the file and then reload the tss\_home.html file in your browser. Figure 2–42 displays the revised appearance of the page with the new padding and margin sizes applied to the navigation list and the block quotes.

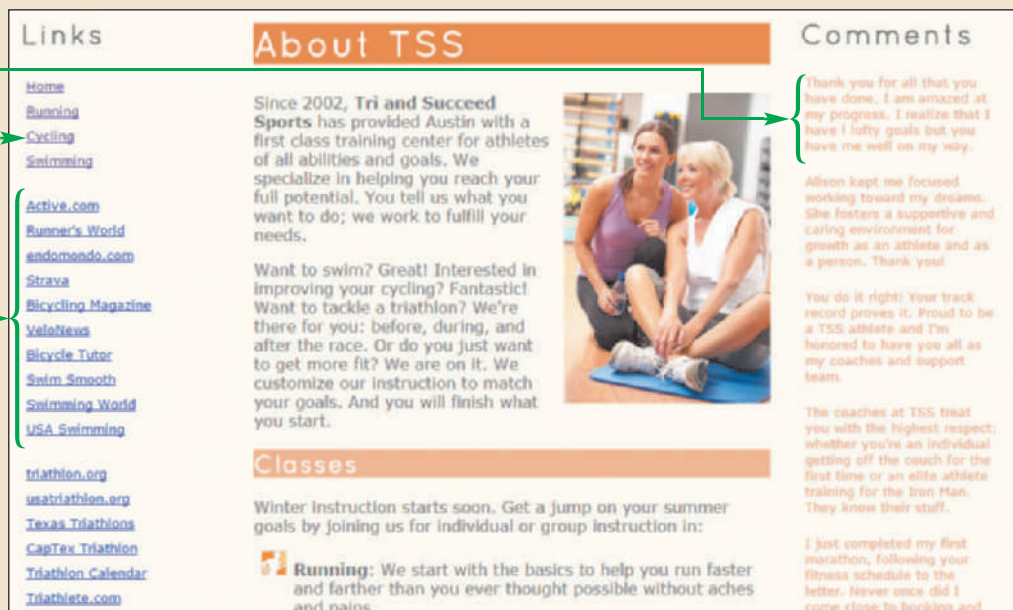
Figure 2–42

## Home page with new margins and padding

each block quote surrounded by a 20 pixel top/bottom margin and a 5 pixel left/right margin

left padding set to 5 pixels

each new group offset by a 20 pixel top margin



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Alison thinks the revised appearance of the navigation list and the customer quotes is a big improvement. However, she doesn't like the underlining in the navigation list. She would like the underlining to appear only when the user hovers the mouse pointer over the link. She would also like a different list marker to appear next to each list item in the classes section. You can make these changes using pseudo-classes and pseudo-elements.

## Using Pseudo-Classes and Pseudo-Elements

Not everything that appears in the rendered page is marked up in the HTML file. For example, a paragraph has a first letter or a first line but those are not marked as distinct elements. Similarly, an element can be classified based on a particular property without having a `class` attribute. The initial entry from an ordered list has the property of being the first item, but no `class` attribute in the HTML file identifies it as such. These elements and `class` attributes that exist only within the rendered page but not within the HTML document are known as pseudo-elements and pseudo-classes. Despite not being part of the HTML document, you can still write style rules for them.

### Pseudo-Classes

A **pseudo-class** is a classification of an element based on its current status, position, or use in the document. The style rule for a pseudo-class uses the selector

```
element:pseudo-class
```

where *element* is an element from the document and *pseudo-class* is the name of a CSS pseudo-class. Pseudo-classes are organized into structural and dynamic classes. A **structural pseudo-class** classifies an element based on its location within the structure of the HTML document. Figure 2–43 lists the structural pseudo-classes supported in CSS.

**Figure 2–43** Structural pseudo-classes

| Pseudo-Class                             | Matches                                                                              |
|------------------------------------------|--------------------------------------------------------------------------------------|
| <code>:root</code>                       | The top element in the document hierarchy (the <code>html</code> element)            |
| <code>:empty</code>                      | An element with no content                                                           |
| <code>:only-child</code>                 | An element with no siblings                                                          |
| <code>:first-child</code>                | The first child of the parent element                                                |
| <code>:last-child</code>                 | The last child of the parent element                                                 |
| <code>:first-of-type</code>              | The first descendant of the parent that matches the specified type                   |
| <code>:last-of-type</code>               | The last descendant of the parent that matches the specified type                    |
| <code>:nth-of-type(<i>n</i>)</code>      | The <i>n</i> <sup>th</sup> element of the parent of the specified type               |
| <code>:nth-last-of-type(<i>n</i>)</code> | The <i>n</i> <sup>th</sup> from the last element of the parent of the specified type |
| <code>:only-of-type</code>               | An element that has no siblings of the same type                                     |
| <code>:lang(<i>code</i>)</code>          | The element that has the specified language indicated by <i>code</i>                 |
| <code>:not(<i>selector</i>)</code>       | An element not matching the specified <i>selector</i>                                |

For example, the `first-of-type` pseudo-class identifies the first element of a particular type. The following selector uses this `first-of-type` pseudo-class to select the first list item found within an unordered list:

```
ul > li:first-of-type
```

This selector will not select any other list item and it will not select the first list item if it is not part of an unordered list.

Alison would like to modify the marker images used with the list of classes on the home page. Currently the `runicon.png` image file is used as the marker for all three list items. Instead, she would like to use the `runicon.png` image only for the first item, the `bikeicon.png` image as the marker for the second list item, and the `swimicon.png` as the third and last item's maker. You can use the `first-of-type`, `nth-of-type`, and `last-of-type` pseudo-classes to match the appropriate `png` file with each item.

### To apply pseudo-classes to an unordered list:

1. Return to the **tss\_styles.css** file in your editor.
2. Go to the List Styles section at the bottom of the style sheet, delete the `article#about_tss ul` style rule that sets the list style image marker and replace it with the following three style rules:

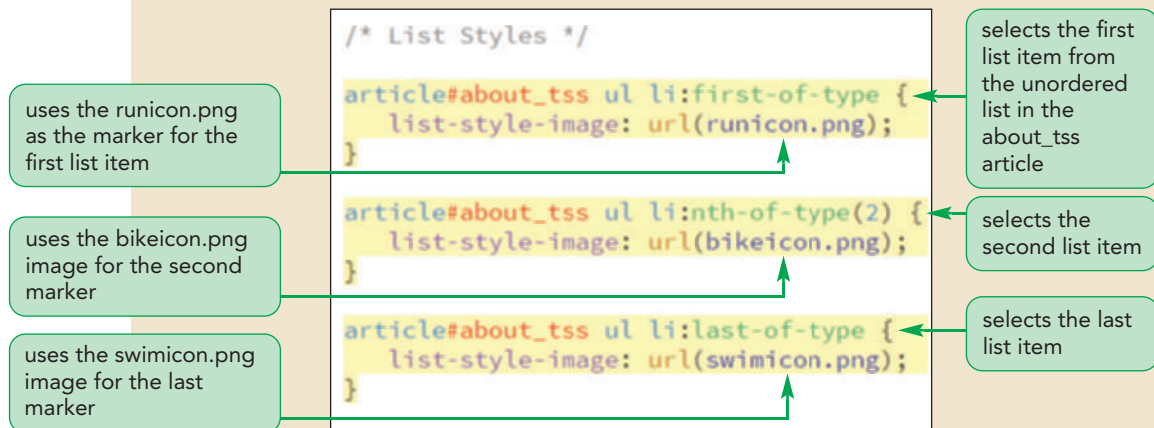
```
article#about_tss ul li:first-of-type {
 list-style-image: url(runicon.png);
}

article#about_tss ul li:nth-of-type(2) {
 list-style-image: url(bikeicon.png);
}

article#about_tss ul li:last-of-type {
 list-style-image: url(swimicon.png);
}
```

Figure 2–44 highlights the three selectors and their associated style rules using pseudo-classes with the unordered list items.

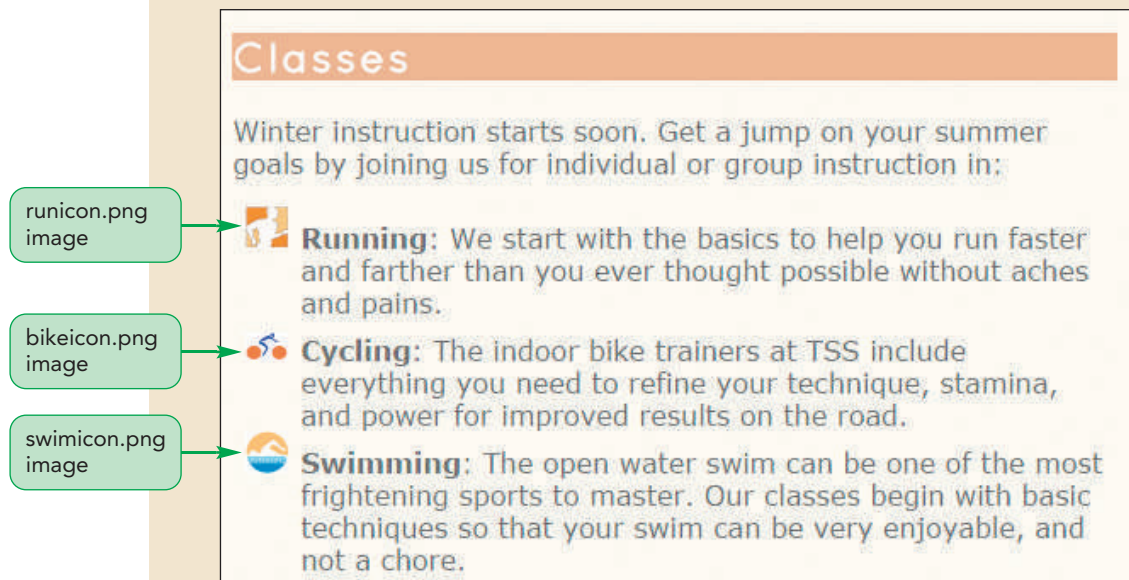
**Figure 2–44** Applying pseudo-classes to list items



3. Save your changes to the file and then reload the `tss_home.html` file in your browser. Figure 2–45 shows the new format of the unordered list with different image markers used with each of the list items.

Figure 2–45

List marker images for each item



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## INSIGHT

### Exploring the *nth-of-type* Pseudo-class

The *nth-of-type* pseudo-class is a powerful tool for formatting groups of elements in cyclical order. Cycles are created using the selector

```
nth-of-type (a+n)
```

where *a* is the length of the cycle, *b* is an offset from the start of the cycle, and *n* is a counter, which starts at 0 and increases by 1 through each iteration of the cycle. For example, the following style rules create a cycle of length 3 with the first list item displayed in red, the second displayed in blue, and the third displayed in green, after which the cycle repeats red-blue-green until the last item is reached:

```
li:nth-of-type (3n+1) {color: red;}
li:nth-of-type (3n+2) {color: blue;}
li:nth-of-type (3n+3) {color: green;}
```

When the cycle length is 1, the *nth-of-type* selector selects elements after the specified offset has passed. The following style rule sets the text color to blue for all list items starting from the 5<sup>th</sup> item

```
li:nth-of-type (n+5) {color: blue;}
```

CSS also supports the keywords *even* and *odd* so that two-length cycles can be more compactly entered as

```
li:nth-of-type (even) {color: red;}
li:nth-of-type (odd) {color: blue;}
```

with a red font applied to the even-numbered list items and a blue font applied to the odd-numbered items.

The same cyclical methods described above can be applied to the *nth-child* selector with the important difference that the *nth-child* selector selects any child element of the parent while the *nth-of-type* selector only selects elements of a specified type.

## Pseudo-classes for Hypertext

Another type of pseudo-class is a **dynamic pseudo-class** in which the class can change state based on the actions of the user. Dynamic pseudo-classes are used with hypertext links such as the `visited` class, which indicates whether the target of the link has already been visited by the user. Figure 2–46 describes the dynamic pseudo-classes.

**Figure 2–46****Dynamic pseudo-classes**

| Pseudo-Class          | Description                                                              |
|-----------------------|--------------------------------------------------------------------------|
| <code>:link</code>    | The link has not yet been visited by the user.                           |
| <code>:visited</code> | The link has been visited by the user.                                   |
| <code>:active</code>  | The element is in the process of being activated or clicked by the user. |
| <code>:hover</code>   | The mouse pointer is hovering over the element.                          |
| <code>:focus</code>   | The element is receiving the focus of the keyboard or mouse pointer.     |

For example, to display all previously visited links in a red font, you could apply the following style rule to the `a` element:

```
a:visited {color: red;}
```

To change the text color to blue when the mouse pointer is hovered over the link, apply the following rule:

```
a:hover {color: blue;}
```

### TIP

The `hover`, `active`, and `focus` pseudo-classes also can be applied to non-hypertext elements to create dynamic page elements that change their appearance in response to user actions.

In some cases, two or more pseudo-classes can apply to the same element. For example, a hypertext link can be both visited previously and hovered over. In such situations, the standard cascading rules apply with the pseudo-class listed last applied to the element. As a result, you should enter the hypertext pseudo-classes in the following order—`link`, `visited`, `hover`, and `active`. The `link` pseudo-class comes first because it represents a hypertext link that has not been visited yet. The `visited` pseudo-class comes next, for links that have been previously visited. The `hover` pseudo-class follows, for the situation in which a user has moved the mouse pointer over a hypertext link prior to clicking the link. The `active` pseudo-class is last, representing the exact instant in which a link is activated.

Users with disabilities might interact with hypertext links through their keyboard rather than through a mouse pointer. Most browsers allow users to press the Tab key to navigate through the list of hypertext links on the page and to activate those links by pressing the Enter key. A link reached through the keyboard has the focus of the page and most browsers will indicate this focus by displaying an outline around the linked text. You can substitute your own style by using the `focus` pseudo-class in the same way that you used the `hover` pseudo-class.

### Using Dynamic Pseudo-Class to Create Hypertext

- To create a rollover for a hypertext link, use the pseudo-classes

```
a:link
a:visited
a:hover
a:active
```

where the `link` pseudo-element matches unvisited link, `visited` matches previously visited links, `hover` matches links that have the mouse pointer hovering over them, and `active` matches links that are in the action of being clicked.

The default browser style is to underline all hypertext links; displaying the links in a blue font with previously visited links in purple. Alison wants the links in the navigation list to appear in a medium gray font with no distinction between unvisited and previously visited links. She does not want the hypertext underlined in the navigation list except when the link is hovered over or active. She also wants hovered or active links to appear in purple. Add these style rules to the style sheet now.

### To apply pseudo-classes to a hypertext links:

1. Return to the **tss\_styles.css** file in your editor.
2. Go to the Navigation Styles section and add the following style rules for hypertext links that have been visited or not visited.

```
nav > ul > li > a:link, nav > ul > li > a:visited {
 color: rgb(151, 151, 151);
 text-decoration: none;
}
```

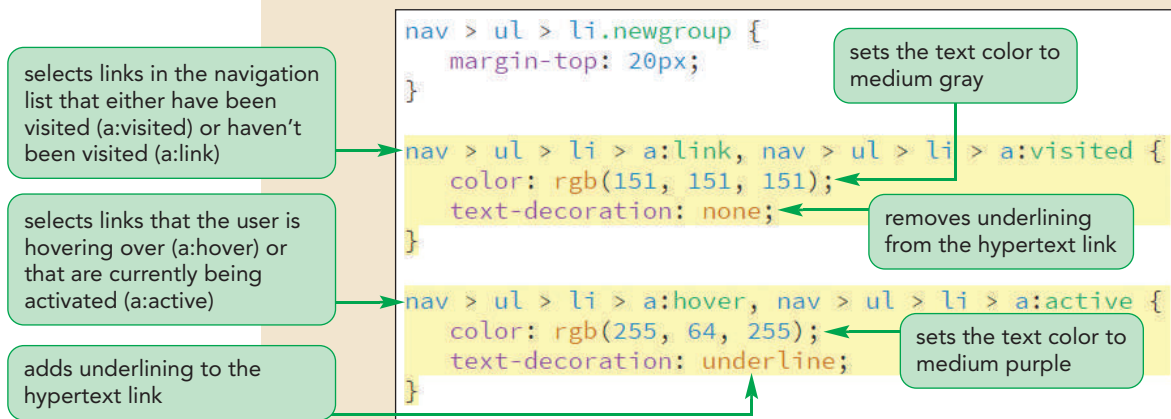
3. Add the following new style rules for links that are being hovered over or are active:

```
nav > ul > li > a:hover, nav > ul > li > a:active {
 color: rgb(255, 64, 255);
 text-decoration: underline;
}
```

Figure 2–47 highlights the style rules for hypertext links in the navigation list.

Figure 2–47

### Using pseudo-classes with hypertext links



4. Save your changes to the file and then reload the `tss_home.html` file in your browser and hover your mouse pointer over the links in the navigation list. Figure 2–48 shows the hover effect applied to the link to the TSS swimming class.

Figure 2–48

Style applied to a hovered link



## PROSKILLS

### Problem Solving: Hover with Touch Devices

The `hover` pseudo-class was written to apply only to user interfaces that support mice or similar pointing devices. Technically, there is no `hover` event with touch devices, such as mobile phones and tablets. However, most mobile devices will still respond to a `hover` style by briefly applying the style when the user initially touches a hypertext link.

Many mobile devices also apply a “double tap” response so that initially touching a page element invokes the `hover` style and then immediately tapping the page element a second time invokes the `click` event. This technique is most often used for web pages that use the `hover` event to reveal hidden menus and page objects.

With the increasing importance of touch devices, a good guiding principle is that you should avoid making support for the `hover` style necessary for the end-user. `Hover` effects should be limited to enhancing the user experience but they should not be a critical component of that experience.

## Pseudo-Elements

Another type of pseudo selector is a **pseudo-element**, which is an object that exists only in the rendered page. For example, a paragraph is an element that is marked in the HTML file, but the first line of that paragraph is not. Similarly, the first letter of that paragraph is also not a document element, but it certainly can be identified as an object in the web page. Pseudo-elements can be selected using the following CSS selector

```
element::pseudo-element
```

where *element* is an element from the HTML file and *pseudo-element* is the name of a CSS pseudo-element. Figure 2–49 describes the pseudo-elements supported in CSS.

Figure 2–49

Pseudo-elements

| Pseudo-Element              | Description                                  |
|-----------------------------|----------------------------------------------|
| <code>::first-letter</code> | The first letter of the element text         |
| <code>::first-line</code>   | The first line of the element text           |
| <code>::before</code>       | Content inserted directly before the element |
| <code>::after</code>        | Content inserted directly after the element  |

For example, the following style rule matches the first displayed line of every paragraph in the rendered web page and transforms the text of that line to uppercase letters:

```
p::first-line {text-transform: uppercase;}
```

The following style rule matches the first letter of every paragraph within a block quote and displays the character in a Times New Roman font that is 250% larger than the surrounding text:

```
blockquote p::first-letter {
 font-family: 'Times New Roman', Times, serif;
 font-size: 250%;
}
```

The double colon separator “:” was introduced in CSS to differentiate pseudo-elements from pseudo-classes. Older browsers use the single colon “:” for both pseudo-elements and pseudo-classes.

## Generating Content with CSS

Another type of pseudo-element is used to generate content for the web page. New content can be added either before or after an element using the following `before` and `after` pseudo-elements

```
element::before {content: text;}
element::after {content: text;}
```

where `text` is the content to be inserted into the rendered web page. The `content` property supports several types of text content as described in Figure 2–50.

**Figure 2–50** Values of the content property

| Value                        | Description                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------|
| <code>none</code>            | Sets the content to an empty text string                                                   |
| <code>counter</code>         | Displays a counter value                                                                   |
| <code>attr(attribute)</code> | Displays the value of the selector's <i>attribute</i>                                      |
| <code>text</code>            | Displays the specified <i>text</i>                                                         |
| <code>open-quote</code>      | Displays an opening quotation mark                                                         |
| <code>close-quote</code>     | Displays a closing quotation mark                                                          |
| <code>no-open-quote</code>   | Removes an opening quotation mark, if previously specified                                 |
| <code>no-close-quote</code>  | Removes a closing quotation mark, if previously specified                                  |
| <code>url(url)</code>        | Displays the content of the media (image, video, etc.) from the file located at <i>url</i> |

For example, the following style rules combine the `before` and `after` pseudo-elements with the `hover` pseudo-class to insert the “<” and “>” characters around every hypertext link in a navigation list:

### TIP

You cannot use CSS to insert HTML markup tags, character references, or entity references. Those can only be done within the HTML file.

```
nav a:hover::before {content: "<";}
nav a:hover::after {content: ">";}
```

Note that these style rules use both the `hover` pseudo-class and the `before/after` pseudo-elements so that the content is only inserted in response to the hover event.

If you want to insert a special symbol, you have to insert the code number for that symbol using text string “\code” where *code* is the code number. For example, if instead of single angled brackets as indicated above, you wanted to show double

angled brackets, « and », you would need to use the Unicode character code for these characters, 00ab and 00bb respectively. To insert these characters before and after a navigation list hypertext link, you would apply the following style rules:

```
nav a:hover::before {content: "\00ab";}
nav a:hover::after {content: "\00bb";}

```

In addition to adding content to an element as just discussed, you can also insert content that is a media file, such as an image or video clip, by using the following content property

```
content: url(url);

```

where *url* is the location of the media file. For example, the following style rule appends the image file uparrow.png to any hypertext link in the document when it is hovered over:

```
a:hover::after {content: url(uparrow.png);}

```

An image file or any content generated by the style sheet should not consist of material that is crucial to understanding your page. Instead, generated content should only consist of material that supplements the page for artistic or design-related reasons. If the generated content is crucial to understanding the page, it should be placed in the HTML file in the first place.

## Displaying Attribute Values

The content property can also be used to insert an attribute value into the rendered web page through the use of the following `attr()` function

```
content: attr(attribute);

```

where *attribute* is an attribute of the selected element. One application of the `attr()` function is to add the URL of any hypertext link to the link text. In the following code, the value of the `href` attribute is appended to every occurrence of text marked with the `a` element:

```
a::after {
 content: "(" attr(href))";
}

```

Notice that URL is enclosed within opening and closing parentheses. Thus, a hypertext link in an HTML document, such as

```
Triathlons

```

will be displayed in the rendered web page as:

Triathlons (<http://www.triathlon.org>)

This technique is particularly useful for printed output in which the author wants to have the URLs of all links displayed on the printed page for users to read and have as references.

### REFERENCE

#### Inserting Content using CSS

- To insert content directly before a page element, use the style rule

```
element::before {content: text;}

```

where *element* is the page element and *text* is the content to be inserted before the element.

- To insert content directly after a page element, use the style rule

```
element::after {content: text;}

```

## Inserting Quotation Marks

The `blockquote` and `q` elements are used for quoted material. The content of these elements is usually placed in quotation marks and, while you can insert these quotation marks within the HTML file, you can also insert decorative opening and closing quotation marks using the `content` property with the following values:

```
content: open-quote;
content: close-quote;
```

The actual characters used for the open and closing quotation marks are defined for the selector with the following `quotes` property

```
quotes: "open1" "close1" "open2" "close2" ...;
```

where *open1* is the character used for the opening quotation mark and *close1* is character used for the closing quotation mark. The text strings *open2*, *close2*, and so on are used for nested quotation marks. In the example that follows, character codes are used to define the curly quotes for opening and closing quotation marks

```
quotes: "\201C" "\201D" "\2018" "\2019";
```

### TIP

Quotation marks generated by CSS are often used with international pages in which different languages require different quotation mark symbols.

where the character code 201C returns the opening curly double quote “, the code 201D returns the closing curly double quote ”, the code 2018 returns the nested opening single quote ‘, and 2019 provides the closing single quote ’.

Alison suggests that you use decorative quotes for the customer comments on the Tri and Succeed Sports home page. You display curly quotes in a bold Times New Roman font with a font size of 1.6em (which is slightly bigger than the font size of the block quote text.)

### To insert quotes into block quotes:

1. Return to the `tss_styles.css` file in your editor.
2. Go to the **Aside and Blockquote Styles** section and, within the style rule for the `aside blockquote` selector, add the following `quotes` property to use curly quotes for the quotation marks:

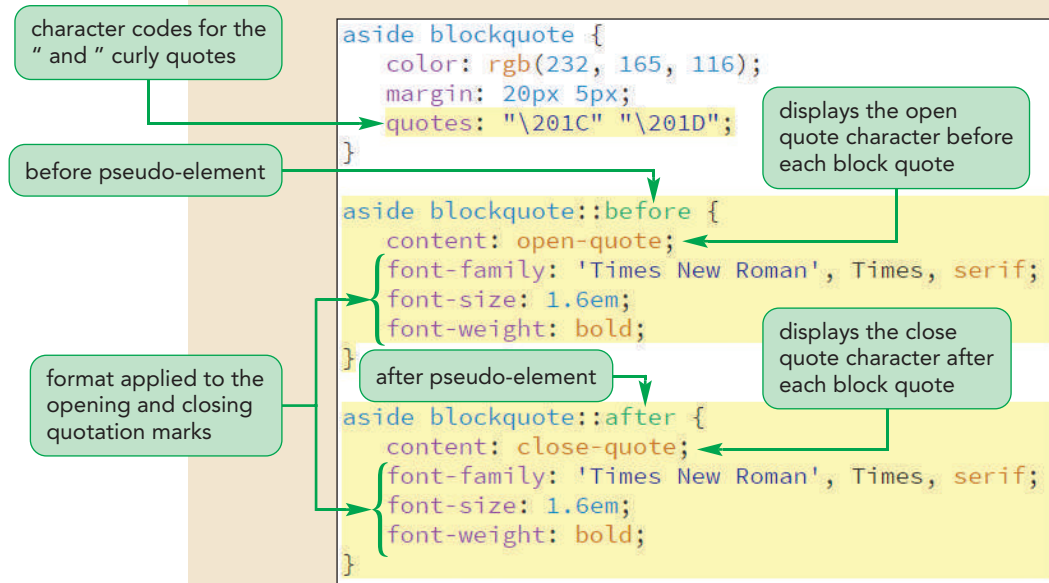
```
quotes: "\201C" "\201D";
```

3. Add the following style rules to insert quotation marks before and after each block quote in the `aside` element:

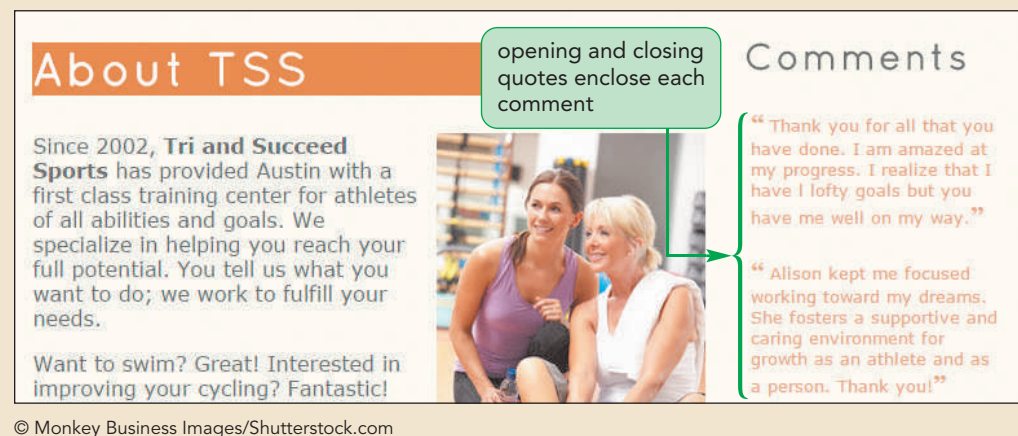
```
aside blockquote::before {
 content: open-quote;
 font-family: 'Times New Roman', Times, serif;
 font-size: 1.6em;
 font-weight: bold;
}
```

```
aside blockquote::after {
 content: close-quote;
 font-family: 'Times New Roman', Times, serif;
 font-size: 1.6em;
 font-weight: bold;
}
```

Figure 2–51 highlights the styles to add curly quotes before and after each block quote.

**Figure 2–51** Adding quotation marks to block quotes

4. Save your changes to the file and then reload the `tss_home.html` file in your browser. As shown in Figure 2–52, bold quotation marks have been added before and after each customer comment.

**Figure 2–52** Quotation marks added to reviewer comments

## Validating Your Style Sheet

As with your HTML code, you can submit your CSS style sheet for validation, either to a web content management system or to the validation site at the W3C. You decide to test your CSS code for possible errors by using a validator. First add a deliberate error to the code so you can see how the CSS validator works.

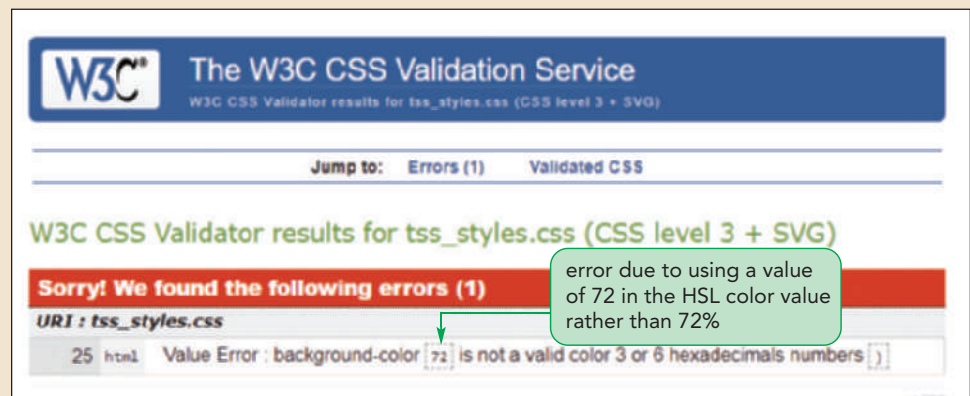
**To introduce an error to the `tss_styles.css` file:**

1. Scroll up and change the background color value for the `html` element from `hsl(27, 72%, 72%)` to **`hsl(27, 72, 72)`** (deleting the % symbols from the saturation and lightness values).
2. Save your changes to the file.

Using the validator at the W3C website or one built into your editor, validate the `tss_styles.css` file to see the impact of this change.

**To validate the code in the `tss_styles.css` file:**

1. Open your browser to the W3C validator at <https://jigsaw.w3.org/css-validator/>.
2. Click the **Validate by File Upload** or **By file upload** tab within the web page.
3. Click the **Choose File** or **Browse** button in the web form and locate the **`tss_styles.css`** file from the `html02 ► tutorial` folder. Select the file and click **Open** to load the file into the validator.
4. Click the **Check** button to validate the file. See Figure 2–53.

**Figure 2–53****CSS validation report**

Saturation and lightness in the HSL color value must be entered as percentages, such as 72%, rather than numbers, such as 72. The validator caught this mistake and reported it as an error. Note that unlike HTML errors, browsers are very unforgiving about CSS errors. If you make a mistake in your CSS files, the browser will ignore the style rule with the syntax error and resort to its own browser style sheet if necessary to render the page object.

**To fix the error in the `tss_styles.css` file:**

1. Return to the **`tss_styles.css`** file in your editor.
2. Change the background color value for the `html` element back to **`hsl(27, 72%, 72%)`**.
3. Save your changes to the file.
4. Return in your browser to the W3C validator at <https://jigsaw.w3.org/css-validator/> or run the validator with your HTML editor.
5. Retest the `tss_styles.css` file, verifying that no errors or warnings are reported.

## PROSKILLS

### Teamwork: Managing a Style Sheet

Your style sheets often will be as long and as complex as your website content. As the size of a style sheet increases, you might find yourself overwhelmed by multiple style rules and definitions. This can be an especially critical problem in a workplace where several people need to interpret and sometimes edit the same style sheet. Good management skills are as crucial to good design as a well-chosen color or typeface are. As you create your own style sheets, here are some techniques to help you manage your creations:

- Use style comments throughout, especially at the top of the file. Clearly describe the purpose of the style sheet, where it's used, who created it, and when it was created.
- Because color values are not always immediately obvious, include comments that describe your colors. For example, annotate a color value with a comment such as "body text is tan".
- Divide your style sheet into sections, with comments marking the section headings.
- Choose an organizing scheme and stick with it. You may want to organize style rules by the order in which they appear in your documents, or you may want to insert them alphabetically. Whichever you choose, be consistent and document the organizing scheme in your style comments.
- Keep your style sheets as small as possible, and break them into separate files if necessary. Use one style sheet for layout, another for text design, and perhaps another for color and graphics. Combine the style sheets using the `@import` rule, or combine them using the `link` element within each page. Also, consider creating one style sheet for basic pages on your website, and another for pages that deal with special content. For example, an online store could use one style sheet (or set of sheets) for product information and another for customer information.

By following some of these basic techniques, you'll find your style sheets easier to manage and develop, and it will be easier for your colleagues to collaborate with you to create an eye-catching website.

Alison is pleased with the work you've done on the typography and design of the Tri and Succeed Sports website. Alison will continue to develop the new version of the website and will get back to you with future changes and design ideas.

## REVIEW

### Session 2.3 Quick Check

1. Which style will display a list with lowercase letters as the list marker?
  - a. `list-style-type: lower-letter;`
  - b. `list-style-case: lower;`
  - c. `list-style: lower-case;`
  - d. `list-style-type: lower-alpha;`
2. Which style rule will display all unordered lists using the `star.png` image file placed inside the virtual box?
  - a. 

```
ul { list-style-image: star.png;
 list-position: inside;
}
```
  - b. 

```
ul { list-style-image: url(star.png);
 list-style-position: inside;
}
```

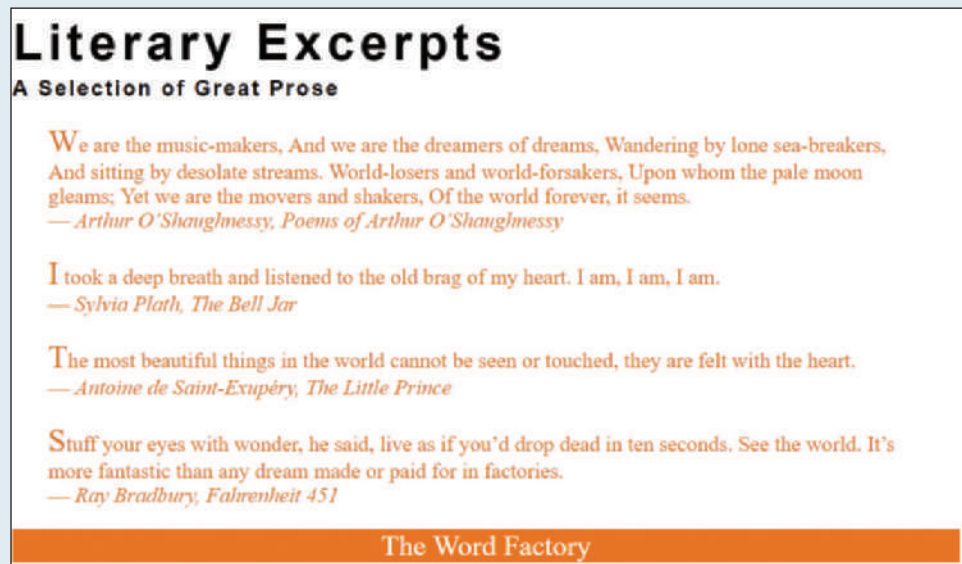
- c. `ul { list-image: url(star.png);  
list-position: inside;  
}`
  - d. `ul { list-style-listImage: star.png;  
inside: true;  
}`
3. Which style displays all previously visited hypertext links in gray?
    - a. `a:visited {  
color: gray;  
}`
    - b. `a:previousVisit {  
color: gray;  
}`
    - c. `a:link {  
color: gray;  
}`
    - d. `a#visited {  
color: gray;  
}`
  4. What is the size of the left padding space in the style property `padding-spacing: 10px 5px 8px; ?`
    - a. 10px
    - b. 5px
    - c. 8px
    - d. The size is not specified
  5. Which of the following styles sets the size of the left margin to 30 pixels?
    - a. `margin: 30px;`
    - b. `margin: 10px 30px;`
    - c. `margin: 10px 30px 5px;`
    - d. All of the above
  6. The first line of a paragraph is referenced using which selector?
    - a. `p#first-line;`
    - b. `p.first-line;`
    - c. `p > first-line;`
    - d. `p::first-line;`
  7. The space at the outer extent of an element is found within the element's
    - a. content
    - b. padding
    - c. border
    - d. margin
  8. Which style rule will insert the text string "\*\*\*\*" before every paragraph belonging to the Reviews class?
    - a. `p#Reviews {content: "****";}`
    - b. `p#Reviews {before: "****";}`
    - c. `p.Reviews.before {content: "****";}`
    - d. `p.Reviews::before {content: "****";}`
  9. Which style rule will underline the last item in an ordered list?
    - a. `ol li:last {text-decoration: underline;}`
    - b. `ol li:last-of-type {text-decoration: underline;}`
    - c. `ol li#last {text-decoration: underline;}`
    - d. `ol li.last-of-type {text-decoration: underline;}`

## Coding Challenge 1

Data Files needed for this Coding Challenge: `code2-1_txt.html`, `code2-1_txt.css`

Use CSS to format the appearance of a web page containing several literary quotes marked as blockquote elements. Figure 2–54 shows a preview of the formatted page.

Figure 2–54 Coding Challenge 2-1 example page



Do the following:

1. Open the `code2-1_txt.html` and `code2-1_txt.css` files from the `html02 ► /code1` folder. Enter your name and the date in each document and save the files as `code2-1.html` and `code2-1.css` respectively.
2. Go to the `code2-1.html` file in your editor. Within the head section insert a link element linking the page to the `code2-1.css` file. Review the contents of the file and then save your changes.
3. Go to the `code2-1.css` file in your editor.
4. Create a style rule for the `h1` element that sets the font-size property to **3.5em** and sets the line-height property to **0em**.
5. Create a style rule for `h1` and `h2` elements that applies the fonts **Helvetica, Arial, sans-serif** to the font-family property and sets the letter-spacing property to **0.1em**.
6. Create a style rule for the blockquote element that sets the color property to the value **hsl(30, 85%, 45%)** and sets the font-size property to **1.5em**.
7. Create a style for the first letter of the blockquote element that sets the font-size property to **1.5em**.
8. Create a style for the footer element that:
  - a) Centers the text by setting the text-align property to **center**,
  - b) Sets the font-size property to **2em**,
  - c) Sets the color property to **white**, and
  - d) Sets the background-color property to the color value **hsl(30, 85%, 45%)**.
9. Save your changes to the file.
10. Test the `code2-1.html` file in your browser, verifying that the page resembles that shown in Figure 2–54 (aside from the line length which depends on the width of your browser window.)
11. Submit the completed file to your instructor.

## Coding Challenge 2

Data Files needed for this Coding Challenge: `code2-2_txt.html`, `code2-2_txt.css`, `code2-2_layout.css`

Figure 2–55 shows part of a web page for a website on sports. Use CSS to complete the style rules for the document.

Figure 2–55 Coding Challenge 2-2 example page



Do the following:

1. Open the `code2-2_txt.html` and `code2-2_txt.css` files from the `html02 ► /code2` folder. Enter your name and the date in each document and save the files as `code2-2.html` and `code2-2.css` respectively.
2. Go to the `code2-2.html` file in your editor. Within the head section insert link elements linking the page to the `code2-2_layout.css` and `code2-2.css` files. Review the contents of the file and then save your changes.
3. Go to the `code2-2.css` file in your editor.
4. For h1 headings that are direct children of the header element create a style rule to:
  - a) Set the text-align property to **center**,
  - b) Set the font family to **Impact** or **sans-serif**, and
  - c) Set the font size to **3em**.
5. For h1 headings that are direct children of the nav element:
  - a) Set the font size to **1.2em**,
  - b) Set the font color to **white**,
  - c) Set the background color to **black**, and
  - d) Set the text-align property to **center**.
6. For h1 headings that are direct children of the article element, set the font size to **2em** and set the font family to **cursive**.
7. For ul elements nested within the nav element, set the list style type to **none** and set the line height to **2em**.
8. For all hypertext links in the document, set the font color to **ivory** and set the text decoration to **none**.
9. For all hyperlinks that are hovered over, set the text decoration to **underline**.

10. Save your changes to the style sheet file and then open **code2-2.html** in your browser, verifying that the appearance resembles that shown in Figure 2–55. Verify that when you hover your mouse pointer over the list of sports websites, the text of the link is underlined.
11. Submit the completed file to your instructor.

## CODE

### Coding Challenge 3

Data Files needed for this Coding Challenge: **code2-3\_txt.html**, **code2-3\_txt.css**, **code2-3\_layout.css**, **code2-3\_img.png**

An article describing the fresco *School of Athens* by the Renaissance painter Raphael is shown in Figure 2–56. Much of the HTML and CSS code has been created for you. Complete the web page design by adding the missing CSS styles.

Figure 2–56

Coding Challenge 2-3 example page


## The School of Athens

*By Raphael*

THE *SCHOOL OF ATHENS*, CONSIDERED BY MANY TO BE Raphael's masterwork, is a fresco representing the greatest minds of classical antiquity, gathered together to share their thoughts and beliefs. The fresco was painted between 1509 and 1511 as a part of a commission to decorate the rooms of the Stanze di Raffaello in the Apostolic Palace in the Vatican.

The two center figures, Aristotle and Plato, are key philosophers in the development of Western thought. Plato, with his belief in a higher reality, points skyward. Within his hands, Plato holds the *Timaeus* — one of Plato's famous dialogs on the nature of reality and time. In contrast, Aristotle points downward, indicating that he is grounded in a reality that can be experienced by sight and touch. In his hands, he holds his book *Ethics*, a tome that emphasizes the need for justice, friendship, and ethical government.

Other famous philosophers fill the pseudo-architecture. In many cases, when Raphael did not have classical images to draw upon, he used images of contemporary figures to stand in for their classical counterparts. Look for a portrait of Michelangelo on the left-forward steps, his thoughts concerned with sketching and art.



Source: Wikimedia Commons

Do the following:

1. Open the **code2-3\_txt.html** and **code2-3\_txt.css** files from the html02 ► /code3 folder. Enter your name and the date in each document and save the files as **code2-3.html** and **code2-3.css** respectively.
2. Go to the **code2-3.html** file in your editor. Within the head section insert link elements linking the page to the **code2-3\_layout.css** and **code2-3.css** files. Review the contents of the file and then save your changes.
3. Go to the **code2-3.css** file in your editor.
4. For the html element, set the left padding space to **30** pixels and set the background color to the value **hsla(40, 80%, 75%, 0.5)**.
5. Display all h1 and h2 headings in a **Helvetica, Arial, or sans-serif** font.
6. For all h1 headings:
  - a) Set the font size to **3em**,
  - b) Set the line height to **1em**, and
  - c) Set the bottom margin to **0**.

7. For all h2 headings:
  - a) Set the top margin to **0**,
  - b) Set the font style to **italic**, and
  - c) Set the font weight to **normal**.
8. For all inline images, set the top and right margins to **0**, the bottom margin to **10px**, and the left margin to **20px**.
9. For all paragraphs, set the font size to **1.4em** and set the text indent to **1em**.
10. For the first paragraph, using the first-of-type pseudo-class, set the text indent to **0**.
11. For the first line of the first paragraph, set the font variant to **small-caps**. (Hint: Use the p:first-of-type::first-line pseudo-class and pseudo-element as the selector.)
12. Save your changes to the file.
13. View the page in your browser to verify that page resembles Figure 2–56.
14. Submit the completed file to your instructor.

## DEBUG

## Coding Challenge 4

Data Files needed for this Coding Challenge: `code2-4_txt.html`, `code2-4_txt.css`, `code2-4_layout.css`, `code2-4_img.png`

You have been given a style sheet file containing several errors. Locate all of the errors and fix the file.

Figure 2–57

Coding Challenge 2-4 example page



Do the following:

1. Open the **code2-4\_txt.html** and **code2-4\_txt.css** files from the html02 ► /code4 folder. Enter your name and the date in each document and save the files as **code2-4.html** and **code2-4.css** respectively.
2. Go to the **code2-4.html** file in your editor. Within the head section insert link elements linking the page to the code2-4\_layout.css and code2-4.css files. Review the contents of the file and then save your changes.
3. View the **code2-4.html** file in your browser and compare it to Figure 2–57. Does it match the figure?
4. Test the **code2-4.css** file in the CSS validator at the W3C website or with another validator of your choice. Make a note of the errors reported as a guide to debugging the page. There are six syntax errors in the CSS file.
5. Fix all six errors you discover and then resubmit the saved stylesheet file to validation until it passes with no warnings or errors.
6. View the page in your browser to verify that your page resembles Figure 2–57.
7. Submit the completed file to your instructor.

## PRACTICE

### Review Assignments

**Data Files needed for the Review Assignments: coach\_styles\_txt.css, tss\_coach\_txt.html, 1 CSS file, 5 PNG files, 1 TTF file, 1 WOFF file**

Alison has created another page for the Tri and Succeed Sports website providing biographies of the coaches at the club. She has already written the page content, acquired image files, and created a style sheet for the page layout. She wants you to finish the design of the page by developing a style sheet for the page's color scheme and typography. A preview of the page you'll design is shown in Figure 2–58.

Figure 2–58 TSS coaches profile page



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Complete the following:

1. Use your HTML editor to open the **tss\_coach\_txt.html** and **coach\_styles\_txt.css** files from the **html02 ► review** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **tss\_coach.html** and **coach\_styles.css** respectively.
2. Go to the **tss\_coach.html** file in your editor and then within the document head, create links to the **coach\_layout.css** and **coach\_styles.css** style sheets.
3. Take some time to study the content and structure of the file and then close the document, saving your changes.

4. Go to the **coach\_styles.css** file in your editor. At the top of the file and before the comment section do the following:
  - a. Insert an `@charset` rule to set the character encoding for the file to `utf-8`.
  - b. Use the `@font-face` rule to define a web font named Nobile, which is based on the `nobile-webfont.woff` file and, if that format is not supported, on the `nobile-webfont.ttf` file.
5. Go to the Main Structural Styles section and do the following:
  - a. Change the background color of the browser window by creating a style rule for the `html` element that sets the background color to the value `hsl(27, 72%, 72%)`.
  - b. For the `body` element, create a style rule to set the text color to the value `rgb(91, 91, 91)`, the background color to ivory, and body text to the font stack: `Verdana, Geneva, sans-serif`.
6. Create a style rule for the `body > footer address` selector containing the following styles:
  - a. The background color set to the value `rgb(222, 128, 60)`
  - b. The font color to white and then to the semitransparent value `rgba(255, 255, 255, 0.6)`
  - c. The font style to normal displayed in bold small capital letters with a font size of `0.9em` and a line height of `3em` using the font stack `Nobile, Verdana, Geneva, sans-serif`
  - d. The text horizontally centered on the page
7. Go to the Heading Styles section and create a style rule for every `h1` heading that displays the text with a normal font weight from the font stack: `Nobile, Verdana, Geneva, sans-serif`. Set the letter spacing to `0.2em` and the margin to `0` pixels.
8. Alison wants you to format the main `h1` heading at the top of the page. Create a style rule for the `section#tss_coaches h1` selector that sets the font size to `2.5em` with a color value of `hsl(27, 82%, 85%)` and background color of `hsl(27, 6%, 21%)`. Set the left padding space to `10` pixels.
9. Alison also wants you to format the `h2` headings for each coach. Create a style rule for the `article.coach_bio h2` selector that sets the font size to `1.6em` with normal weight and the font color to `rgb(240, 125, 0)`.
10. Alison has inserted a comment from an athlete about the coaches. Format this comment by going to the Blockquote Styles section and creating a style rule for the `aside blockquote` selector to do the following:
  - a. Set the font size to `0.95em` using the font stack `'Comic Sans MS', cursive`.
  - b. Set the font color to `rgb(222, 128, 60)` and use a semi-transparent background color with the value `rgba(255, 255, 255, 0.75)`.
  - c. Set the padding space to `10` pixels.
  - d. Define opening and closing quotes for the element using the Unicode character `201C` and `201D` respectively.
11. Format the appearance of the opening quotes by creating a style rule for the `aside blockquote::before` selector to write a boldfaced open quote before the block quote with the font size set to `1.6em` from the font stack `'Times New Roman', Times, serif`.
12. Format the appearance of the closing quotes by creating a style rule for the `aside blockquote::after` selector to write a boldfaced open quote after the block quote with the font size once again set to `1.6em` from the font stack `'Times New Roman', Times, serif`.
13. Next, you'll format the appearance of the navigation list by going to the Navigation Styles section and creating a style rule for `body > nav` selector that sets the text of the navigation list in a `0.8em` font size with a line height of `2em`.
14. Create a style rule for the `nav > ul` selector that removes the list marker and sets the left padding to `5` pixels.
15. Alison wants to break up the long list of links in the navigation list. Create style rules for the `6th` and `16th` `li` elements within the `nav > ul` selector that sets the size of the top margin of those items to `20` pixels.
16. For every previously visited or unvisited hypertext link within the `nav > ul > li` selector, set the text to the RGB color value `rgb(151, 151, 151)` and remove the underlining from the text link.

17. For every hovered or active hypertext link within the `nav > ul > li` selector, set the text color to RGB value `rgb(222, 128, 60)` and underline the hypertext link.
18. Go to the Paragraph Styles section and insert a style rule that sets the top margin and bottom margin to 10 pixels, the right margin to 30 pixels, and the left margin to 0 pixels for every paragraph in the document.
19. Every coach has a list of accomplishments. Go to the List Styles section and insert a style rule for the `article.coach_bio > header > ul` selector that displays the `check.png` file as the list marker and sets the margin space to 0 pixels, except for the bottom margin, which should be set to 10 pixels.
20. Save your changes to the style sheet and then open the **tss\_coach.html** file in your browser. Verify that the color and typography match that shown in Figure 2–58. Verify that when you hover the mouse pointer over the links in the navigation list the text is displayed in an underlined orange font.

## APPLY

### Case Problem 1

**Data Files needed for this Case Problem:** `ph_plays_txt.html`, `ph_styles_txt.css`, 1 CSS file, 1 PNG file, 3 TTF files, 3 WOFF files

**Philip Henslowe Classic Theatre** Randall Chen is the media director for the *Philip Henslowe Classic Theatre*, a regional classical theatre in Coeur d'Alene, Idaho. You've been asked to work on the website design for the company. The first page you'll manage lists the plays for next summer's repertoire. A preview of the page is shown in Figure 2–59.

Figure 2–59 List of Plays at the Philip Henslowe Classic Theatre



© Christian Bertrand/Shutterstock.com

The content and layout of the page has already been created for you. Your job will be to create a style sheet for the typography of the page.

Do the following:

1. Using your editor, open the **ph\_plays\_txt.html** and **ph\_styles\_txt.css** files from the **html02 ▶ case1** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **ph\_plays.html** and **ph\_styles.css** respectively.
2. Go to the **ph\_plays.html** file in your HTML editor, and within the document head create links to the **ph\_layout.css** and **ph\_styles.css** style sheet files. Take some time to study the content and structure of the document and then close the file, saving your changes.

3. Go to the **ph\_styles.css** file in your editor, and at the top of the file before the comment section, define the character encoding used in the document as utf-8.
4. Randall has several web fonts that he wants used for the titles of the plays produced by the company. Add the following web fonts to the style sheet, using `@font-face` rules before the comment section:
  - a. The Champagne font using the `cac_champagne.woff` and `cac_champagne.ttf` files
  - b. The Grunge font using the `1942.woff` and `1942.ttf` files
  - c. The Dobkin font using the `DobkinPlain.woff` and `DobkinPlain.ttf` files
5. Go to the Structural Styles section, creating a style rule that sets the background color of the `html` element to the value `hsl(91, 8%, 56%)`.
6. Add a style rule for the `body` element to set the background color to the value `hsl(58, 31%, 84%)` and the font of the body text to the font stack: 'Palatino Linotype', 'Book Antiqua', Palatino, serif.
7. Create a style rule for the `header` element that sets the background color to black.
8. Create a style rule for every paragraph that sets the margin space to 0 pixels and the padding space to 5 pixels on top and 25 pixels on the right, bottom, and left.
9. For paragraphs that are direct children of the body element, create a style rule that sets the font size to 1.1em and horizontally centers the paragraph text.
10. Create a style rule for the address element that sets the font style to normal with a font size of 0.9em, horizontally centered on the page. Set the top and bottom padding to 10 pixels.
11. Next, you'll format the appearance of navigation lists on the page. Go to the Navigation Styles section and create a style rule for the `nav` selector that displays the hypertext links using the font stack 'Trebuchet MS', Helvetica, sans-serif, and sets the top and bottom padding to 10 pixels.
12. For every unvisited and previously visited hypertext link within a `nav` element, set the text color to white, remove underlining from the link text, and set the background color to the semi-transparent value `hsla(0, 0%, 42%, 0.4)`.
13. For every active or hovered link in a `nav` element, set the text color to the semi-transparent value `hsla(0, 0%, 100%, 0.7)` and set the background color to the semi-transparent value `hsl(0, 0%, 42%, 0.7)`.
14. Go to the Section Styles section of the style sheet. In this section, you'll define the appearance of the four playbills. You'll start with the `h1` headings from the sections. Create a style rule for the `section.playbill h1` selector that sets the font size to 3em and the font weight to normal. Set the margin space around the `h1` headings to 0 pixels. Set the padding space to 20 pixels on top, 0 pixels on the right, 10 pixels on the bottom, and 20 pixels on the left.
15. Each playbill section is identified by a different ID value ranging from `play1` to `play4`. Create style rules that set a different background color for each playbill using the following background colors:
  - ID: `play1` set to `hsl(240, 100%, 88%)`
  - ID: `play2` set to `hsl(25, 88%, 73%)`
  - ID: `play3` set to `hsl(0, 100%, 75%)`
  - ID: `play4` set to `hsl(296, 86%, 86%)`
16. Each playbill section heading will also have a different font. For the `h1` headings within the four different playbills, create style rules to apply the following font stacks:
  - ID: `play1` set to Champagne, cursive
  - ID: `play2` set to Grunge, 'Times New Roman', Times, serif
  - ID: `play3` set to Impact, Charcoal, sans-serif
  - ID: `play4` set to Dobkin, cursive
17. Randall has put the author and the director of each play within a definition list. Format these definition lists now by going to the Definition List Styles section and creating a style rule for the `dt` element that sets the font size to 1.3em, the font weight to bold, and the font color to the semi-transparent value `hsla(0, 0%, 0%, 0.4)`.

18. Create a style rule for every `dd` element to set the font size to 1.3em, the left margin space to 0 pixels, and the bottom margin space to 10 pixels.
19. Save your changes to the file and then open the **ph\_plays.html** file in your browser. Verify that the typography and colors used in the document match those shown in Figure 2–54. Also, verify that, when you hover the mouse pointer over an item in the navigation lists for the entire page and for each play, the background color of the link becomes more opaque.

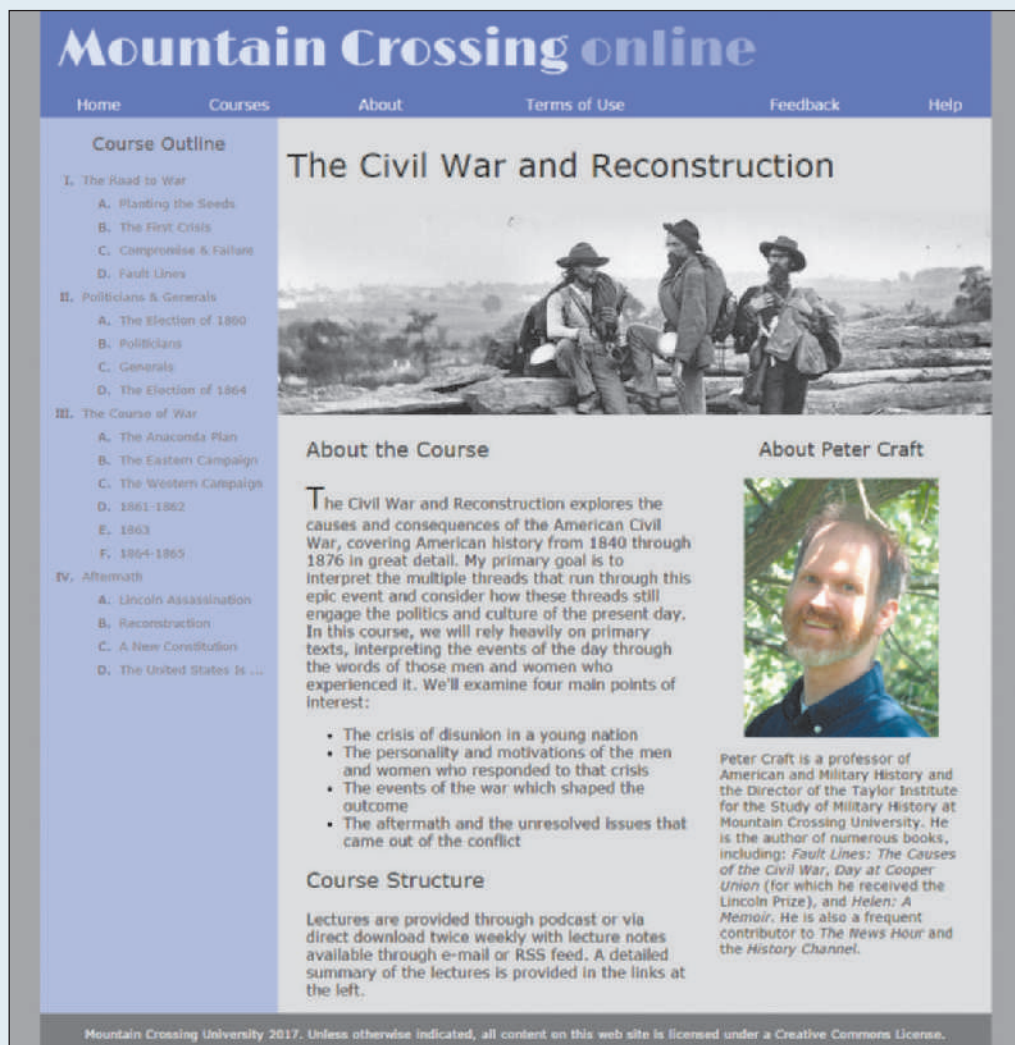
## CHALLENGE

## Case Problem 2

**Data Files needed for this Case Problem:** `cw_class_txt.html`, `cw_styles_txt.css`, 1 CSS file, 2PNG files

**The Civil War and Reconstruction** Peter Craft is a professor of military history at Mountain Crossing University. The university is offering a series of online courses, one of which is “The Civil War and Reconstruction” taught by Professor Craft. He has developed the online content and has had a colleague help with the page layout. You’ve been asked to complete the project by creating text and color styles. A preview of the sample page is shown in Figure 2–60.


Figure 2–60 Civil War History home page



Library of Congress, Prints & Photographs Division, Reproduction number LC-DIG-cwpb-01451 (digital file from original neg. of left half) LC-DIG-cwpb-01450 (digital file from original neg. of right half) LC-B8184-2288 (b&w film copy neg.); © Courtesy Patrick Carey

Complete the following:

1. Using your editor, open the **cw\_class.txt.html** and **cw\_styles.txt.css** files from the html02 ► case2 folder. Enter ***your name*** and ***the date*** in the comment section of each file, and save them as **cw\_class.html** and **cw\_styles.css** respectively.
2. Go to the **cw\_class.html** file in your HTML editor. Within the document head, create a link to the **cw\_styles.css** style sheet file.
- ✚ **Explore** 3. Using the Google Fonts website, locate the Limelight font. Copy the code for the `link` element to use this font and paste the copied code to the document head in the **cw\_class.html** file.
4. Study the content and structure of the **cw\_class.html** file and then close the file, saving your changes.
5. Go to the **cw\_styles.css** file in your editor. At the top of the file, define the character encoding as `utf-8`.
- ✚ **Explore** 6. On the next line, use the `@import` rule to import the contents of the **cw\_layout.css** file into the style sheet.
7. Go to the Structural Styles section. Within that section create a style rule to set the background color of the browser window to `rgb(151, 151, 151)`.
8. Create a style rule to set the background color of the page body to `rgb(180, 180, 223)` and set the body text to the font stack: `Verdana, Geneva, sans-serif`.
9. Display all `h1` and `h2` headings with normal weight.
10. Create a style rule for every hypertext link nested within a navigation list that removes underlining from the text.
11. Create a style rule for the `footer` element that sets the text color to white and the background color to `rgb(101, 101, 101)`. Set the font size to `0.8em`. Horizontally center the footer text, and set the top/bottom padding space to 1 pixel.
12. Next, you'll format the body header that displays the name of the university. Go to the Body Header Styles section and, for the `body > header` selector, create a style rule that sets the background color to `rgb(97, 97, 211)`.
13. The university name is stored in an `h1` heading. Create a style rule for the `h1` heading that is a direct child of the body header that sets the font size to `4vw` with the color value `rgba(255, 255, 255, 0.8)`. Display the text with the font stack: `Limelight, cursive`. Set the margin space to 0 pixels.
14. The last word of the `h1` heading text is enclosed within a `span` element. Create a style rule for the `span` element nested within the `h1` heading that is nested within the body header, setting the text color to `rgba(255, 255, 255, 0.4)`.
15. Go the Navigation Styles section. In this section, you format the navigation list that has the ID `mainLinks`. For hypertext links within this navigation list, set the top and bottom padding space to 5 pixels.
16. For previously visited and unvisited links within the `mainLinks` navigation list, create a style rule that displays the hypertext links in a white font.
17. For hovered or active links within the `mainLinks` navigation list, create a style rule that displays the hypertext links in white with an opacity of 0.8 and set the background color to the value `rgba(51, 51, 51, 0.5)`.
18. Go to the Outline Styles section. In this section, you'll format the course outline that appears on the page's left column. The navigation list in this outline has the ID `outline`. Create a style rule for this navigation list that sets the text color to `rgb(51, 51, 51)` and the font size to `0.8em`.
19. Horizontally center the `h1` headings within the outline navigation list.
20. For the first level `ol` elements that are a direct child of the outline navigation list, create a style rule that sets the line height to `2em`, the top/bottom margin to 0 pixels and the left/right margin to 5 pixels. Display the list marker as an upper-case Roman numeral.
21. Display the second level of `ol` elements nested within the outline navigation list with an upper-case letter as the list marker.

22. Display all previously visited and unvisited links in the outline navigation list using the color value `rgb(101, 101, 101)`.
23. Display hovered and active links in the outline navigation list using the color value `rgb(97, 97, 211)` with the text underlined.
24. Go to the Section Styles section. In this section, format the description of the course. Create a style rule that sets the background color of the `section` element to `rgb(220, 220, 220)`.
25. Format the heading of this section by creating a style rule for the `section header h1` selector that sets the font size of 2.2em and the left padding space to 10 pixels.
26. Go to the Article Styles section and create a style rule for h2 headings within the `article` element that sets the font size to 1.4em.
-  **Explore** 27. Display the first letter of the first paragraph within the `article` element with a font size of 2em and vertically aligned with the baseline of the surrounding text. (*Hint: Use the `first-of-type` pseudo-class and the `first-letter` pseudo-element.*)
28. Information about Peter Craft has been placed in an `aside` element. Go to the Aside Styles section and create a style rule that sets the font size of text in the `aside` element to 0.9em.
29. For h1 headings nested within the `aside` element, create a style rule that sets the font size to 1.4em and horizontally centers the text.
30. Save your changes to the file and then open the **`cw_class.html`** file in your browser. Verify that the appearance of the page resembles that shown in Figure 2–60. Confirm that when you change the width of the browser window, the size of the page heading text changes in response to setting the heading text using the vw unit.

## OBJECTIVES

## Session 3.1

- Create a reset style sheet
- Explore page layout designs
- Center a block element
- Create a floating element
- Clear a floating layout
- Prevent container collapse

## Session 3.2

- Use CSS grid styles
- Define a grid layout
- Place items within a grid
- Work with grid areas

## Session 3.3

- Explore positioning styles
- Work with relative positioning
- Work with absolute positioning
- Work with overflow content

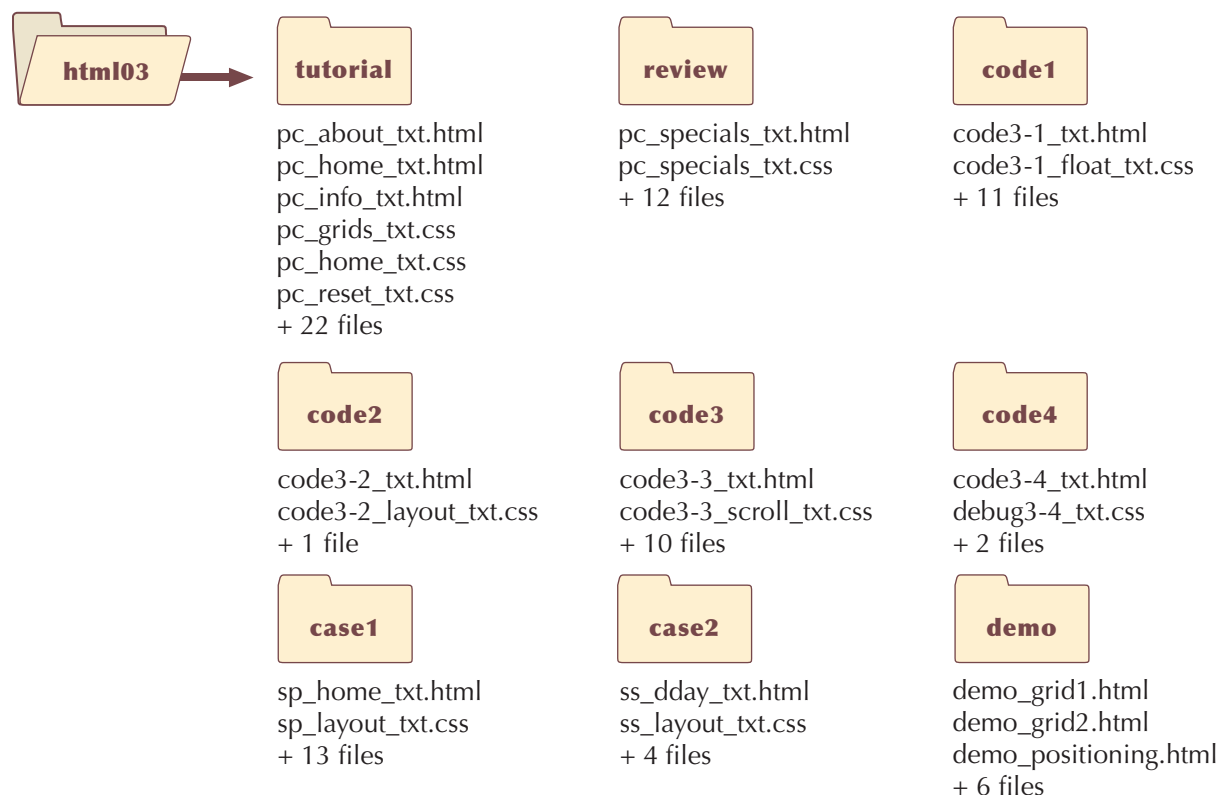
# Designing a Page Layout

## Creating a Website for a Chocolatier

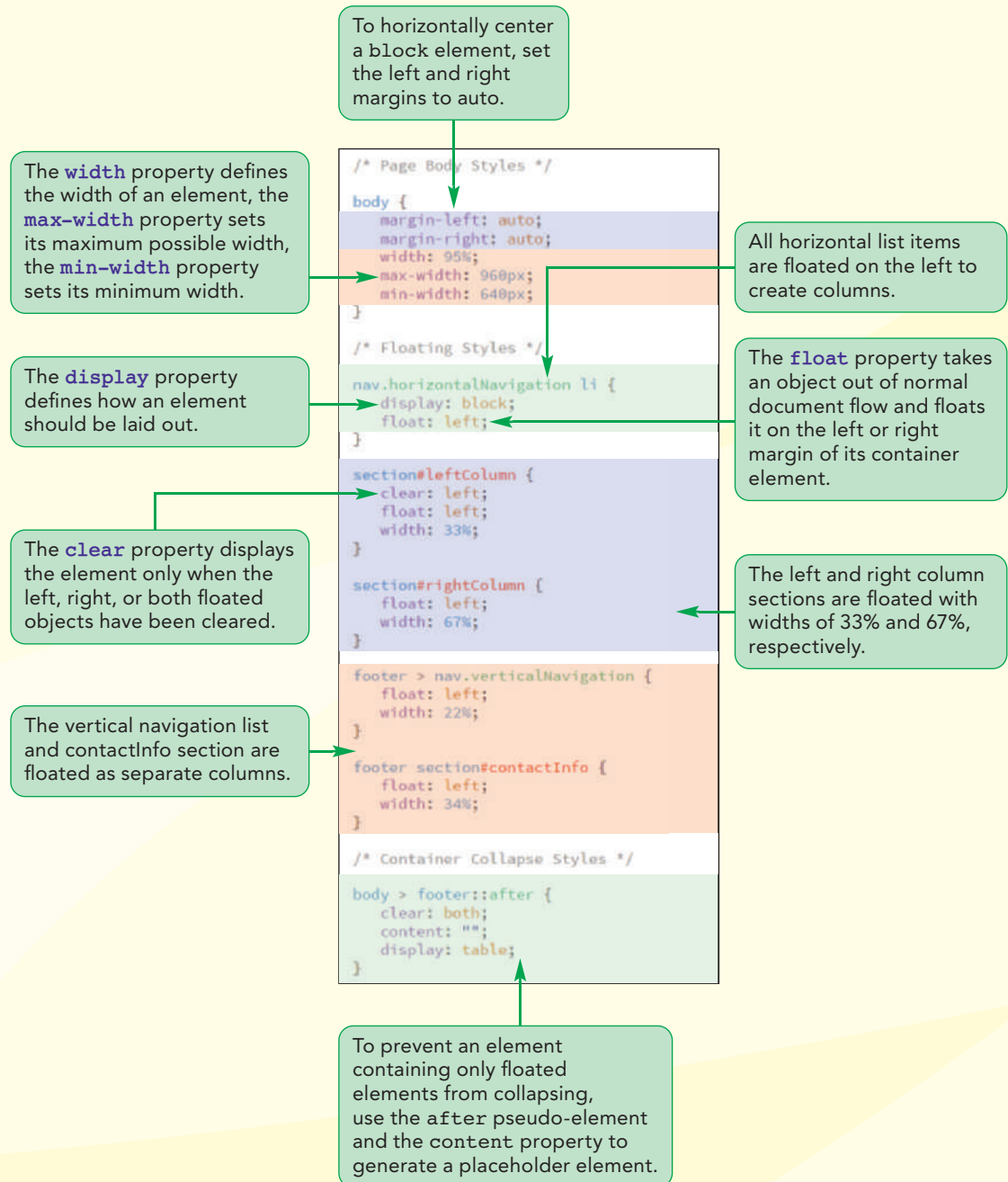
### Case | Pandaisia Chocolates

Anne Ambrose is the owner and head chocolatier of *Pandaisia Chocolates*, a chocolate shop located in Essex, Vermont. You have been asked to assist on the redesign of the company's website. Anne has provided you with three pages from the website to start your work. She has written all of the content, compiled the necessary images and graphics, and written some of the text and color styles. She needs you to complete the project by designing the page layout using the CSS layout properties.

#### STARTING DATA FILES



# Session 3.1 Visual Overview:



# Page Layout with Floating Elements

Page body is horizontally centered within the browser window.



Horizontal list items are floated into separate columns.

Left and right sections are floated into separate columns.

The contents of the page footer are floated into separate columns.

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## Introducing the display Style

The study of page layout starts with defining how an individual element is presented on the page. In the first tutorial, you learned that HTML elements are classified into block elements, such as paragraphs or headings, or into inline elements, such as emphasized text or inline images. However, whether an element is displayed as a block or as inline depends on the style sheet. You can define the display style for any page element with the following `display` property

```
display: type;
```

where *type* defines the display type. A few of the many *type* values are shown in Figure 3–1.

Figure 3–1

Some values of the display property

| Display Value | Appearance                                                                                                                                         |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| block         | Displayed as a block                                                                                                                               |
| table         | Displayed as a web table                                                                                                                           |
| inline        | Displayed inline within a block                                                                                                                    |
| inline-block  | Treated as a block placed inline within another block                                                                                              |
| run-in        | Displayed as a block unless its next sibling is also a block, in which case, it is displayed inline, essentially combining the two blocks into one |
| inherit       | Inherits the display property of the parent element                                                                                                |
| list-item     | Displayed as a list item along with a bullet marker                                                                                                |
| none          | Prevented from displaying, removing it from the rendered page                                                                                      |

For example, to supersede the usual browser style that displays images inline, you can apply the following style rule to display all of your images as blocks:

```
img {display: block;}
```

If you want to display all block quotes as list items, complete with list markers, you can add the following style rule to your style sheet:

```
blockquote {display: list-item;}
```

### TIP

You also can hide elements by applying the style `visibility: hidden;`, which hides the element content but leaves the element still occupying the same space in the page.

You can even prevent browsers from displaying an element by setting its `display` property to `none`. In that case, the element is still part of the document structure but it is not shown to users and does not occupy space in the displayed page. This is useful for elements that include content that users shouldn't see or have no need to see.

You'll use the `display` property in creating a reset style sheet.

## Creating a Reset Style Sheet

You learned in the last tutorial that your browser applies its own styles to your page elements unless those styles are superseded by your own style sheet. Many designers prefer to work with a “clean slate” and not have any browser style rules creep into the final design of their website. This can be accomplished with a **reset style sheet** that supersedes the browser's default styles and provides a consistent starting point for page design.

You'll create a reset style sheet for the Pandaisia Chocolates website. The first style rule in your sheet will use the `display` property to display all of the HTML 5 structural elements in your web page as blocks. While current browsers already do this, there are some older browsers that do not recognize or have predefined display styles for elements as such `header`, `article`, or `footer`. By including the `display` property in a reset style sheet, you add a little insurance that these structural elements will be rendered correctly.

### To create a reset style sheet:

1. Use the text editor or HTML editor of your choice to open the **pc\_reset\_txt.css** file from the `html03` ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save the document as **pc\_reset.css**.
2. Within the Structural Styles section, insert the following style rule to define the display properties of several HTML 5 structural elements:

```
article, aside, figcaption, figure,
footer, header, main, nav, section {
 display: block;
}
```

Figure 3–2 highlights the new style rule in the document.

Figure 3–2

### Displaying structural elements as blocks

```
/* Structural Styles */
article, aside, figcaption, figure,
footer, header, main, nav, section {
 display: block;
}
```

You will complete the reset style sheet by adding other style rules that set default padding and margins around commonly used page elements, define some basic typographic properties, and remove underlining from hypertext links found within navigation lists.

### To complete the reset style sheet:

1. Within the Typographic Styles section, insert the following style rule to define the typographic styles for several page elements:

```
address, article, aside, blockquote, body, cite,
div, dl, dt, dd, em, figcaption, figure, footer,
h1, h2, h3, h4, h5, h6, header, html, img,
li, main, nav, ol, p, section, span, ul {

 background: transparent;
 font-size: 100%;
 margin: 0;
 padding: 0;
 vertical-align: baseline;
}
```

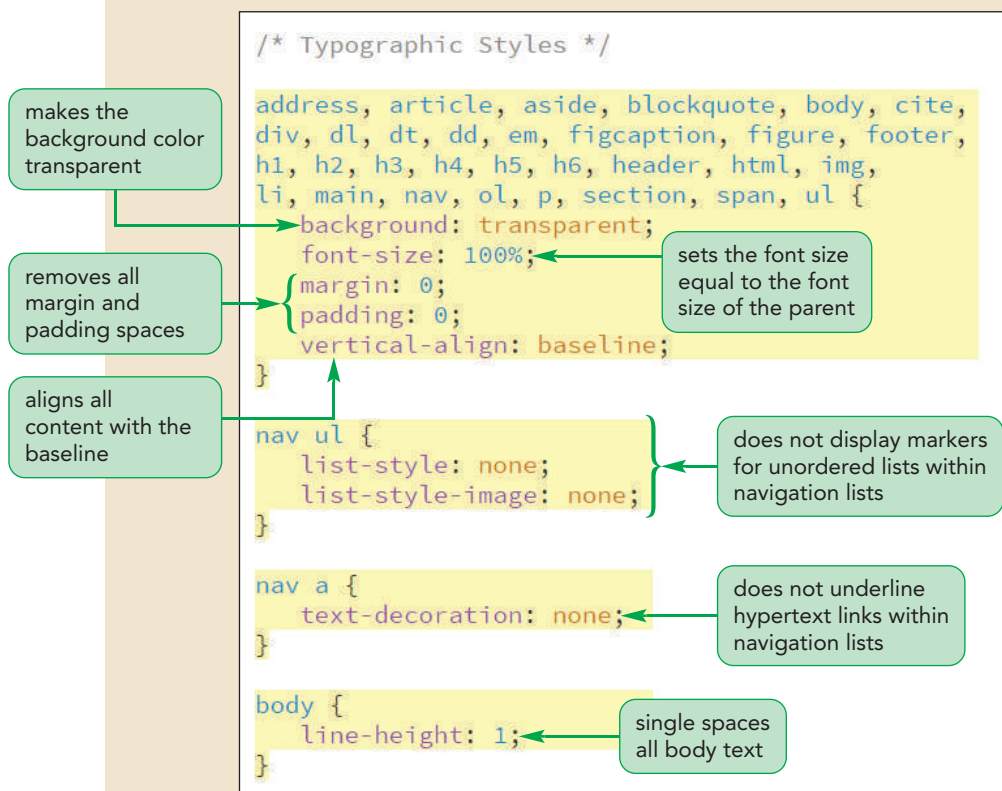
2. Add the following style rules to remove list markers from list items found within navigation lists:
 

```
nav ul {
 list-style: none;
 list-style-image: none;
}
```
3. Set the default line height to 1 (single-spaced) by applying the following style rule to the page body:
 

```
body {
 line-height: 1;
}
```

Figure 3–3 describes the new style rules in the document.

**Figure 3–3** Completing the reset style sheet



4. Save your changes to the file.

This is a very basic reset style sheet. There are premade reset style sheets freely available on the web that contain more style rules used to reconcile the various differences between browsers and devices. Before using any of these reset style sheets, you should study the CSS code and make sure that it meets the needs of your website. Be aware that some reset style sheets may contain more style rules than you actually need and you can speed up your website by paring down the reset sheet to use only the elements you need for your website.

The first page you will work on for Pandaisia Chocolates is the site's home page. Anne has already created a typographical style sheet in the `pc_styles1.css` file. Link to the style sheet file now as well as the `pc_reset.css` style sheet you just created and the `pc_home.css` style sheet that you will work on for the remainder of this session to design the page layout.

**TIP**

The reset style sheet should *always* be the first style sheet listed before any other style sheets to ensure that your default styles are applied first.

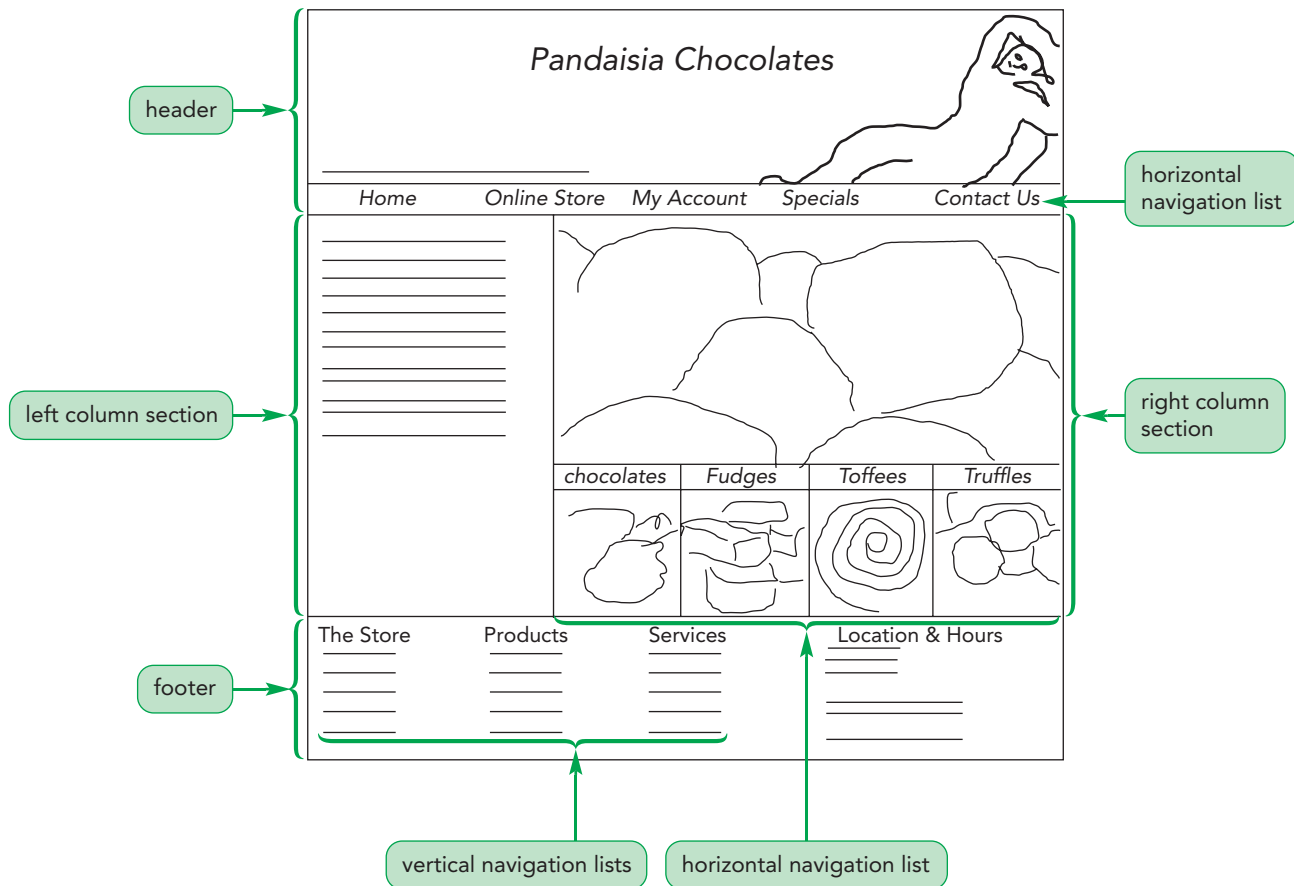
**To get started on the Pandaisia Chocolates home page:**

1. Use your editor to open the `pc_home_txt.css` file from the `html03 ► tutorial` folder. Enter **your name** and **the date** in the comment section of the file and save the document as `pc_home.css`.
2. Use your editor to open the `pc_home_txt.html` file from the same folder. Enter **your name** and **the date** in the comment section and save the file as `pc_home.html`.
3. Within the document head, directly after the `title` element, insert the following `link` elements to link the home page to the `pc_reset.css`, `pc_styles1.css` and `pc_home.css` style sheets:  

```
<link href="pc_reset.css" rel="stylesheet" />
<link href="pc_styles1.css" rel="stylesheet" />
<link href="pc_home.css" rel="stylesheet" />
```
4. Take some time to study the content and structure of the `pc_home.html` document. Pay particular attention to the use of ID and class names throughout the document.
5. Save your changes to the file. You might want to keep this file open as you work with the `pc_home.css` style sheet so that you can refer to its content and structure.

Anne has sketched the general layout she wants for the home page, shown in Figure 3–4. Compare the `pc_home.html` file content to the sketch shown in Figure 3–4 to get a better understanding of how the page content relates to Anne's proposed layout.

Figure 3–4 Proposed home page layout



Before creating the page layout that Anne has sketched out for you, you'll examine different types of layout designs.

## Exploring Page Layout Designs

One challenge of layout is that your document will be viewed on many different devices with different screen resolutions. When designing for the web, you're usually more concerned about the available screen width than screen height because users can scroll vertically down the length of the page, but it is considered bad design to make them scroll horizontally.

A page designer needs to cope with a wide range of possible screen widths ranging from wide screen monitors with widths of 1680 pixels or more, down to mobile devices with screen widths of 320 pixels and even less. Complicating matters even more is that a screen width represents the maximum space available to the user, but some space is always taken up by toolbars, sidebar panes, and other browser features. In addition, the user might not even have the browser window maximized to fill the entire screen. Thus, you need a layout plan that will accommodate a myriad of screen resolutions and browser configurations.

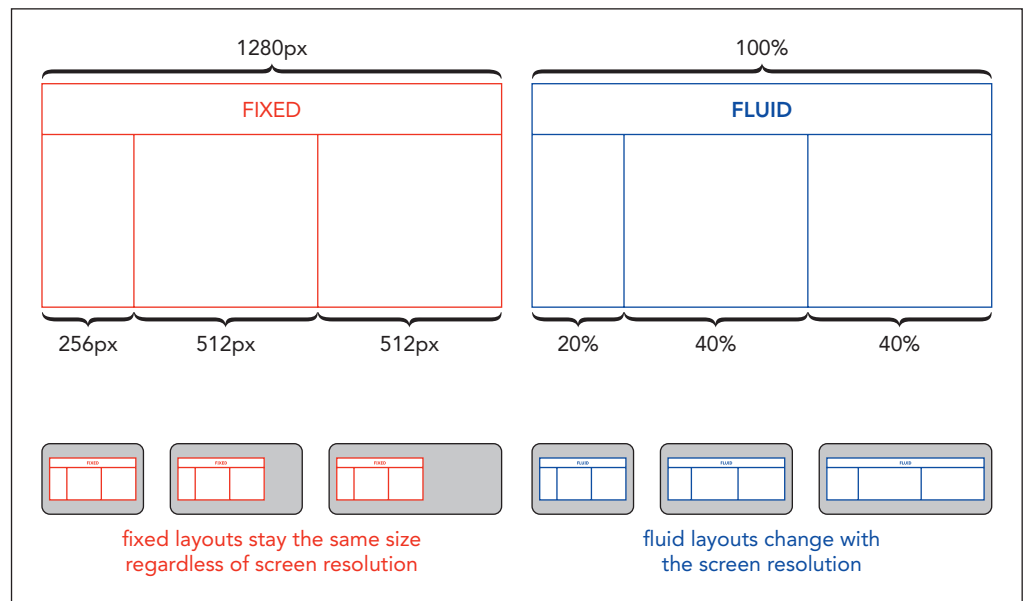
## Fixed, Fluid, and Elastic Layouts

Web page layouts fall into three general categories: fixed, fluid, and elastic. A **fixed layout** is one in which the size of the page and the size of the page elements are fixed, usually using pixels as the unit of measure. The page width might be set at 960 pixels and the

width of the company logo set to 780 pixels. These widths are set regardless of the screen resolution of the user's device and this can result in the page not fitting into the browser window if the device's screen is not wide enough.

By contrast, a **fluid layout** sets the width of page elements as a percent of the available screen width. For example, the width of the page body might be set to fill 90% of the screen and the width of the company logo might be set to fill 80% of that page body. Under a fluid layout, the page resizes automatically to match the screen resolution of the user's device. Figure 3–5 shows how a three-column layout might appear in both a fixed and a fluid design.

**Figure 3–5** Fixed layouts vs. fluid layouts



With different devices accessing your website, it's usually best to work with a fluid layout that is more adaptable to a range of screen resolutions. Fixed layouts should only be used when you have more control over the devices that will display your page, such as a web page created specifically for a digital kiosk at a conference.

Another layout design is an **elastic layout** in which all measurements are expressed in em units and based on the default font size used in the page. If a user or the designer increases the font size, then the width, height, and location of all of the other page elements, including images, change to match. Thus, images and text are always sized in proportion to each other and the layout never changes with different font sizes. The disadvantage to this approach is that, because sizing is based on the font size and not on the screen resolution, there is a danger that if a user sets the default font size large enough, the page will extend beyond the boundaries of the browser window.

Finally, the web is moving quickly toward the principles of **responsive design** in which the layout and design of the page change in response to the device that is rendering it. The page will have one set of styles for mobile devices, another for tablets, and yet another for laptops or desktop computers. You'll explore how to implement responsive design in Tutorial 5.

Because width is such an integral part of layout, you will start designing the Pandaisia Chocolates home page by defining the width of the page body and elements within the page.

## Working with Width and Height

The width and height of an element are set using the following width and height properties

```
width: value;
height: value;
```

where *value* is the width or height using one of the CSS units of measurement or as a percentage of the width or height of the parent element. For example, the following style rule sets the width of the page body to 95% of the width of its parent element (the browser window):

```
body {width: 95%;}
```

Usually, you do not set the height value because browsers automatically increase the height of an element to match its content. Note that all block elements, like the `body` element, have a default width of 100%. Thus, this style rule makes the `body` element width slightly smaller than it would be by default.

## Setting Maximum and Minimum Dimensions

You can set limits on the width or height of a block element by applying the following properties

```
min-width: value;
min-height: value;
max-width: value;
max-height: value;
```

where *value* is once again a length expressed in one of the CSS units of measure (usually pixels to match the measurement unit of the display device). For example, the following style rule sets the width of the page body to 95% of the browser window width but confined within a range of 640 to 1680 pixels:

```
body {
 width: 95%;
 min-width: 640px;
 max-width: 1680px;
}
```

Maximum and minimum widths are often used to make page text easier to read. Studies have shown that lines of text that are too wide are difficult to read because the eye has to scan across a long section of content and that lines of text that are too narrow with too many line returns break the flow of the material.

### Setting Widths and Heights

- To set the width and height of an element, use the styles

```
width: value;
height: value;
```

where *value* is the width or height in one of the CSS units of measurement or a percentage of the width or height of the parent element.

- To set the minimum possible width or height, use the styles

```
min-width: value;
min-height: value;
```

- To set the maximum possible width or height, use the styles

```
max-width: value;
max-height: value;
```

Set the width of the page body for the Pandaisia Chocolates home page to 95% of the browser window ranging from 640 pixels to 960 pixels. Also display the company logo image as a block with its width set to 100% so that it extends across the page body. You do not have to set the height of the logo because the browser will automatically scale the height to keep the original proportions of the image.

### To set the initial dimensions of the page:

1. Return to the **pc\_home.css** file in your editor and add the following style rule to the Body Styles section:

```
body {
 max-width: 960px;
 min-width: 640px;
 width: 95%;
}
```

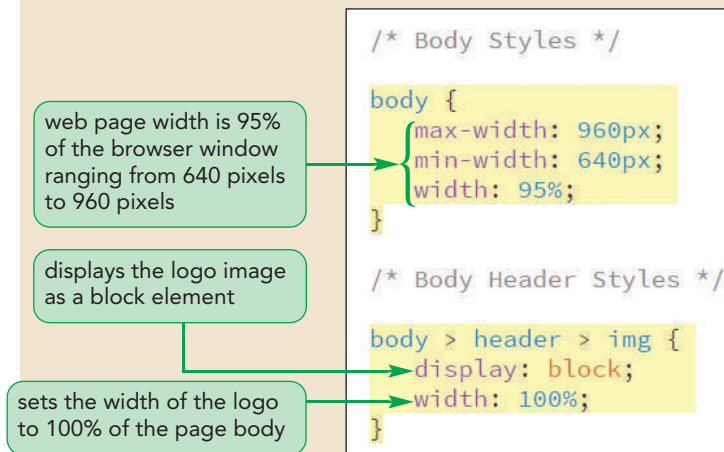
2. Within the Body Header Styles section, insert the following style rule to set the display type and width of the logo image:

```
body > header > img {
 display: block;
 width: 100%;
}
```

Figure 3–6 highlights the newly added style rules in the style sheet.

Figure 3–6

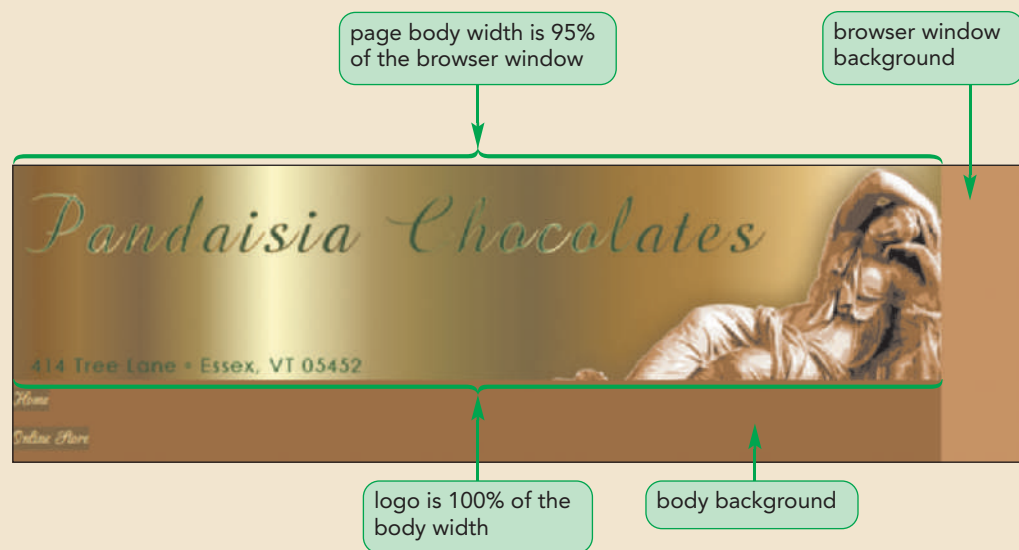
## Setting the width of the page body and logo



3. Save your changes to the file and then open the **pc\_home.html** file in your browser. Figure 3–7 shows the current layout of the page body and logo.

Figure 3–7

## Initial view of the body header



4. Change the width of your browser window and verify that the size of the page body and the size of the logo resize as needed within the range of 640 to 960 pixels.

The page body is currently placed on the left margin of the browser window. Anne would like it centered horizontally within the browser window.

## Centering a Block Element

Block elements can be centered horizontally within their parent element by setting both the left and right margins to `auto`. Thus, you can center the page body within the browser window using the style rule:

```
body {
 margin-left: auto;
 margin-right: auto;
}
```

Modify the style rule for the page body to center the Pandaisia Chocolates home page horizontally by setting the left and right margins to `auto`.

### To center the page body horizontally:

1. Return to the **pc\_home.css** file in your editor and, within the style rule for the body selector, insert the properties:

```
margin-left: auto;
margin-right: auto;
```

Figure 3–8 highlights the newly added styles.

Figure 3–8

### Centering the page body

```
body {
 margin-left: auto;
 margin-right: auto;
 max-width: 960px;
 min-width: 640px;
 width: 95%;
}
```

setting the left and right margins to `auto` forces block elements to be horizontally centered within their parent

2. Save your changes to the file and then reload the **pc\_home.html** file in your browser. Verify that the page body is now centered within the browser window.

## INSIGHT

### Working with Element Heights

The fact that an element's height is based on its content can cause some confusion. For example, the following style rule appears to set the height of the header to 50% of the height of the page body:

```
body > header {height: 50%;}
```

However, because the total height of the page body depends on the height of its individual elements, including the body header, there is circular reasoning in this style rule. You can't set the page body height without knowing the height of the body header and you can't set the body header height unless you know the height of the page body. Most browsers deal with this circularity by leaving the body header height undefined, resulting in no change in the layout.

Heights need to be based on known values, as in the following style rules where the body height is set to 1200 pixels and thus the body header is set to half of that or 600 pixels.

```
body {height: 1200px;}
body > header {height: 50%;}
```

It is common in page layout design to extend the page body to the height of the browser window. To accomplish this, you set the height of the `html` element to 100% so that it matches the browser window height (a known value defined by the physical properties of the screen) and then you set the minimum height of the page body to 100% as in the following style rules:

```
html {height: 100%;}
body {min-height: 100%;}
```

The result is that the height of the page body will always be at least equal to the height of the browser window, but it will extend beyond that if necessary to accommodate extra page content.

## Vertical Centering

Centering an element vertically within its parent element is not easily accomplished because the height of the parent element is usually determined by its content, which might not be a defined value. One solution is to display the parent element as a table cell with a defined height and then set the `vertical-align` property set to `middle`. For example, to vertically center the following `h1` heading within the `div` element

```
<div>
 <h1>Pandaisia Chocolates</h1>
</div>
```

you would apply the style rule:

```
div {
 height: 40px;
 display: table-cell;
 vertical-align: middle;
}
```

Using this style rule, the `h1` heading will be vertically centered.

To vertically center a single line of text within its parent element, set the line height of the text larger than the text's font size. The following style rule will result in an h1 heading with vertically centered heading text.

```
h1 {
 font-size: 1.4em;
 line-height: 2em;
}
```

Note that this approach will only work for a single line of text. If the text wraps to a second line, it will no longer be vertically centered. Vertical centering is a common design challenge and there are several other workarounds that have been devised over the years. The simplest approach is to use CSS grid styles, a topic that we'll discuss in the next session.

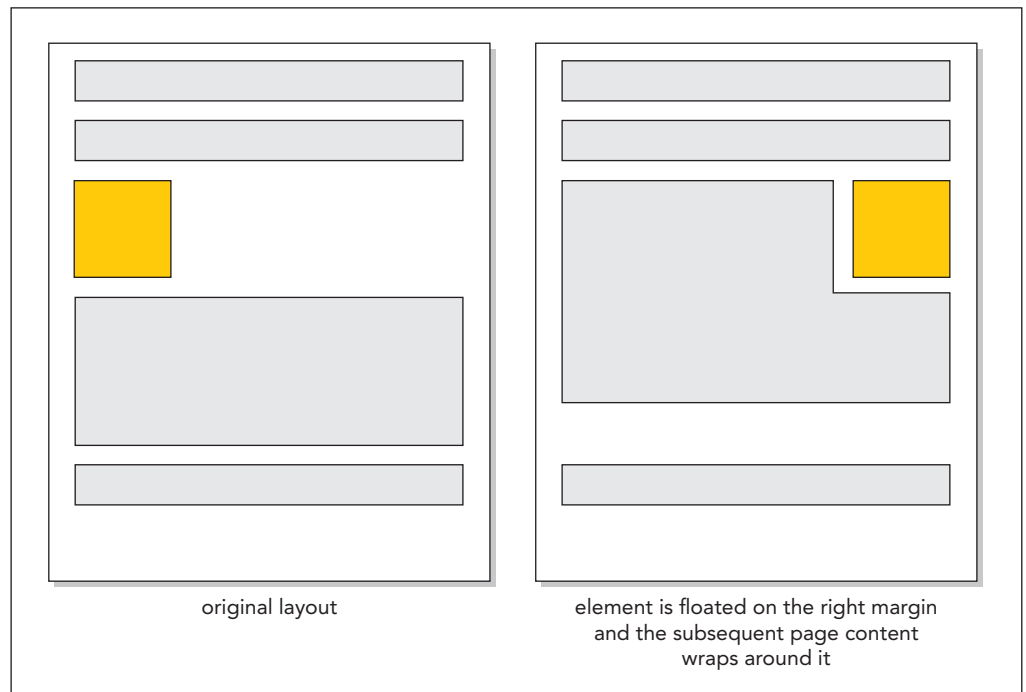
Next, you will lay out the links in the navigation list. Anne wants the links displayed horizontally rather than vertically. You can accomplish this using CSS floats.

## Floating Page Content

By default, content is displayed in the page in the order it appears within the HTML file as part of the normal document flow. **Floating** an element takes it out of position and places it along the left or right edge of its parent element. Subsequent content that is not floated occupies the space previously taken up by the floated element. Figure 3–9 shows a diagram of an element that is floated along the right margin of its container and its effect on the placement of subsequent content.

Figure 3–9

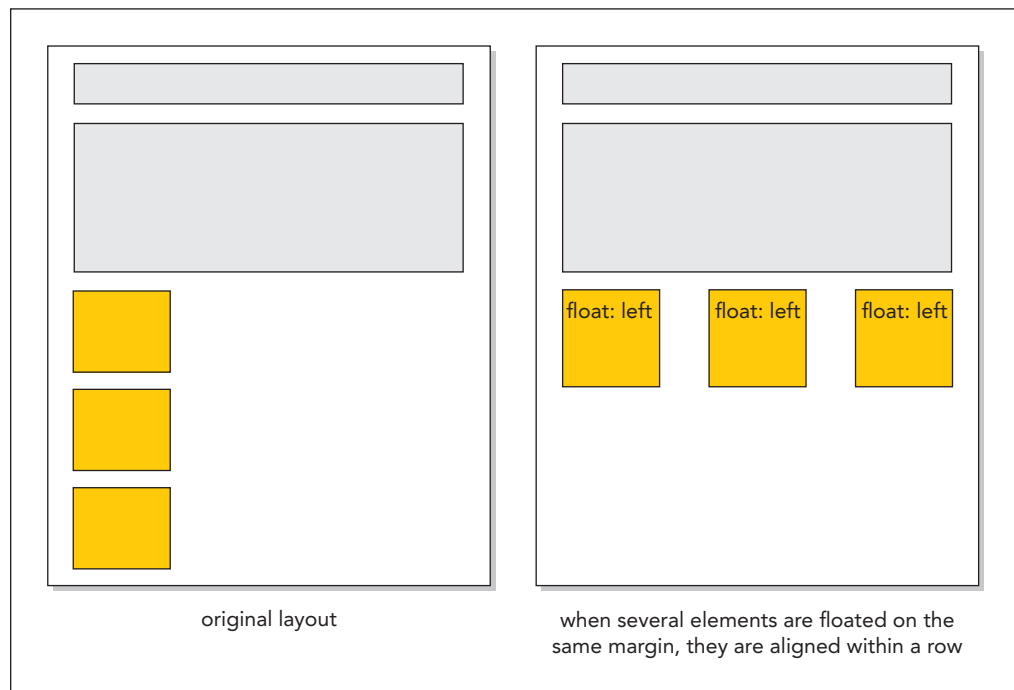
Floating an element



To float an element, apply the following `float` property

```
float: position;
```

where *position* is `none` (the default), `left` to float the object on the left margin, or `right` to float the object on the right margin. If sibling elements are floated along the same margin, they are placed alongside each other within a row as shown in Figure 3–10.

**Figure 3–10** Floating multiple elements in a row

Note that for the elements to be placed within a single row, the combined width of the elements cannot exceed the total width of their parent element, otherwise any excess content will automatically wrap to a new row.

## REFERENCE

### Floating an Element

- To float an element within its container, apply the style

```
float: position;
```

where *position* is none (the default), left, or right.

Anne wants you display the content of navigation lists belonging to the `horizontalNavigation` class within a single row. You will accomplish this by floating each item in those navigation lists on the left margin using the `float` property. Create this style rule now.

### To lay out horizontal navigation list items:

1. Return to the `pc_home.css` file in your editor and go to the Body Header Styles section.
2. Because there are five links in the navigation list, you'll make each list item 20% of the width of the navigation list by adding the following style rule:

```
body > header > nav.horizontalNavigation li {
 width: 20%;
}
```

To be confined to a single row, the total width of floated elements cannot exceed the width of the container.

3. Insert the following style rule within the Horizontal Navigation Styles section to display every list item within a horizontal navigation list as a block floated on the left.

```
nav.horizontalNavigation li {
 display: block;
 float: left;
}
```

Figure 3–11 highlights the styles used with list items.

Figure 3–11

## Floating items in the navigation list

sets the width of the list item to 20% of the width of the navigation list

```
/* Body Header Styles */
```

```
body > header > img {
 display: block;
 width: 100%;
}
```

```
body > header > nav.horizontalNavigation li {
 width: 20%;
}
```

```
/* Horizontal Navigation Styles */
```

```
nav.horizontalNavigation li {
 display: block;
 float: left;
}
```

floats the list item within every horizontal navigation list as a block on the left

4. Save your changes to the file and then reload the pc\_home.html file in your browser. Figure 3–12 shows the revised layout of the navigation list in the page header.

Figure 3–12

## Floating items in a horizontal navigation list

the width of each list item set to 20% and floated on the left margin



Anne doesn't like the appearance of the hypertext links in the navigation list. Because the links are inline elements, the background color extends only as far as the link text. She suggests you change the links to block elements and center the link text within each block.

### To change the display of the hypertext links:

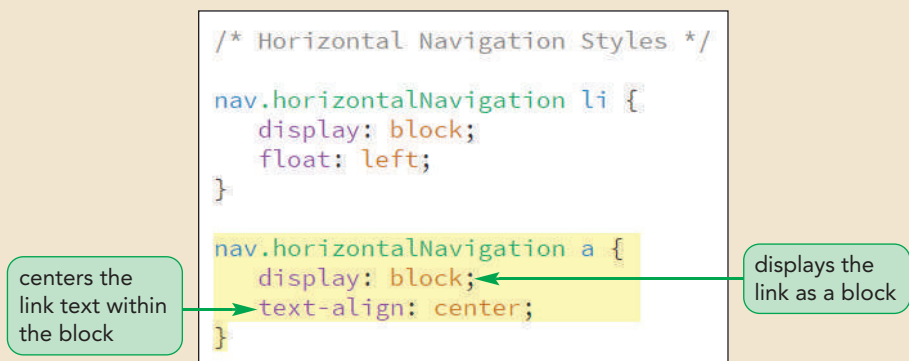
1. Return to the **pc\_home.css** file in your editor.
2. Within the Horizontal Navigation Styles section, insert the following style rule to format the appearance of the hypertext links within the horizontal navigation lists:

```
nav.horizontalNavigation a {
 display: block;
 text-align: center;
}
```

Figure 3–13 highlights the style rule for the hypertext links.

Figure 3–13

### Formatting hyperlinks in horizontal navigation lists



3. Save your changes to the file and then reload the **pc\_home.html** file in your browser.
4. Hover your mouse pointer over the links in the navigation list. Note that the link text is centered within its block and the background color extends fully across the block rather than confined to the link text. See Figure 3–14.

Figure 3–14

### Links in the body header

each hypertext link displayed as a block with the link text centered within the block



**Trouble?** Don't worry about the jumble of elements displayed after the body header. You'll straighten out those objects next.

You have completed the design of the body header. Next, you will lay out the middle section of the home page.

### Creating Drop Caps with CSS

A popular design element is the **drop cap**, which consists of an enlarged initial letter that drops down into a body of text. To create a drop cap, you increase the font size of an element's first letter and float it on the left margin. Drop caps also generally look better if you decrease the line height of the first letter, enabling the surrounding content to better wrap around the letter. Finding the best combination of font size and line height is a matter of trial and error, and unfortunately, what looks best in one browser might not look as good in another. The following style rule works well in applying a drop cap to the first paragraph element:

```
p:first-of-type::first-letter {
 font-size: 4em;
 float: left;
 line-height: 0.8;
}
```

For additional design effects, you can change the font face of the drop cap to a cursive or decorative font.

### Clearing a Float

In some layouts, you will want an element to be displayed on a new row, clear of previously floated objects. To ensure that an element is always displayed below your floated elements, apply the following `clear` property:

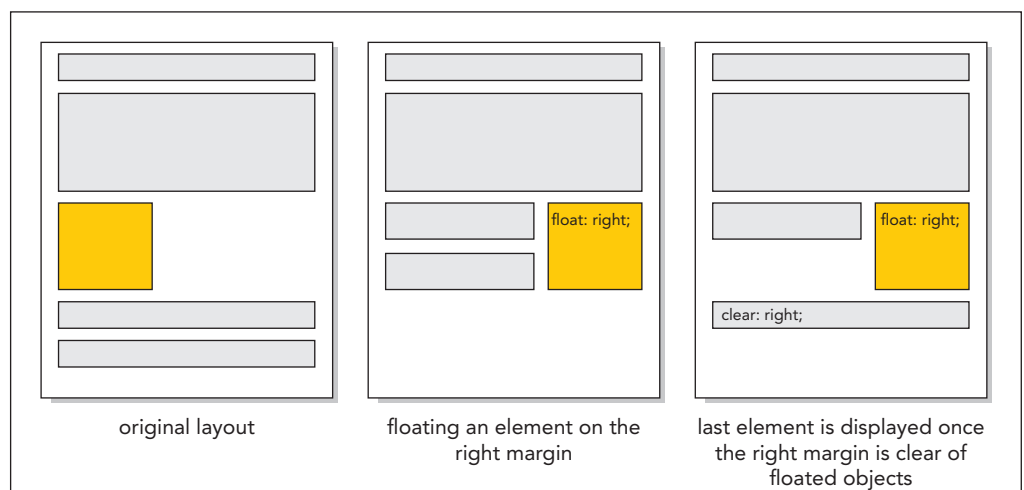
```
clear: position;
```

where *position* is `left`, `right`, `both`, or `none`. A value of `left` displays the element only when the left margin is clear of floating objects. A value of `right` displays the element only when the right margin is clear. A value of `both` displays the element only when both margins are clear of floats. The default clear value is `none`, which allows the element to be displayed alongside any floated objects.

Figure 3–15 shows how use of the `clear` property prevents an element from being displayed until the right margin is clear of floats. The effect on the page layout is that the element is shifted down and is free to use the entire page width since it is no longer displayed alongside a floating object.

Figure 3–15

Clearing a float



### Clearing a Float

- To display a non-floated element on a page with a floated element, use the following style so the non-floated element can clear the floated element

```
clear: position;
```

where *position* is none (the default), left, right, or both.

The next part of the Pandaisia Chocolates home page contains two `section` elements named `leftColumn` and `rightColumn`. Set the width of the left column to 33% of the body width and set the width of the right column to 67%. Float the sections side-by-side on the left margin, but only when the left margin is clear of all previously floated objects.

### To float the left and right column sections:

1. Return to the `pc_home.css` file in your editor. Go to the Left Column Styles section and insert the style rule:

```
section#leftColumn {
 clear: left;
 float: left;
 width: 33%;
}
```

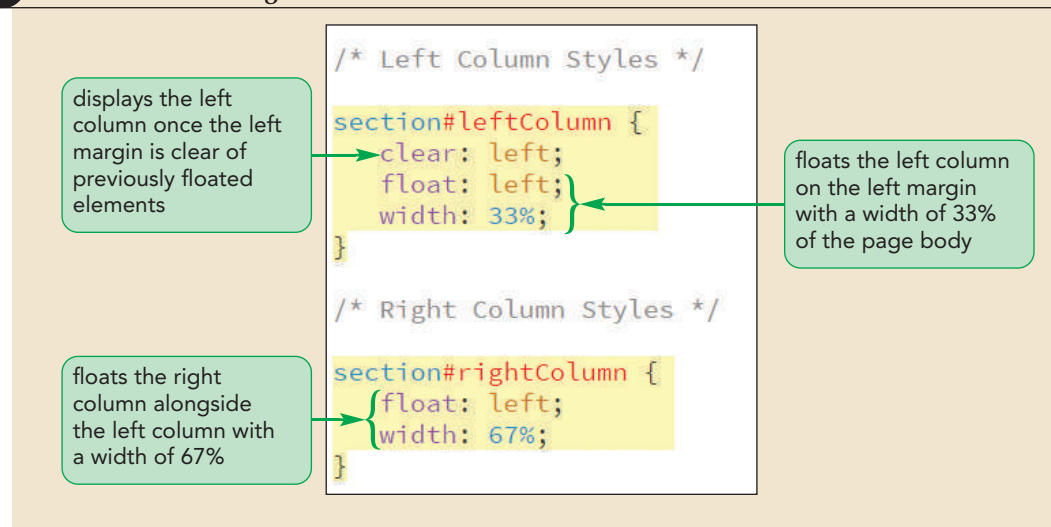
2. Within the Right Column Styles section, insert:

```
section#rightColumn {
 float: left;
 width: 67%;
}
```

Note that you do not apply the `clear` property to the right column because you want it to be displayed in the same row alongside the left column. Figure 3–16 highlights the style rules for the left and right columns.

Figure 3–16

Float the left and right column sections



The right column contains a horizontal navigation list containing four items, each consisting of an image and a label above the image. Anne wants the four items placed side-by-side with their widths set to 25% of the width of the navigation list. Anne also wants the images in the right column displayed as blocks with their widths set to 100% of their parent element.

### To complete the right column section:

1. Within the Right Column Styles section, insert the following style rules to format the inline images and list items:

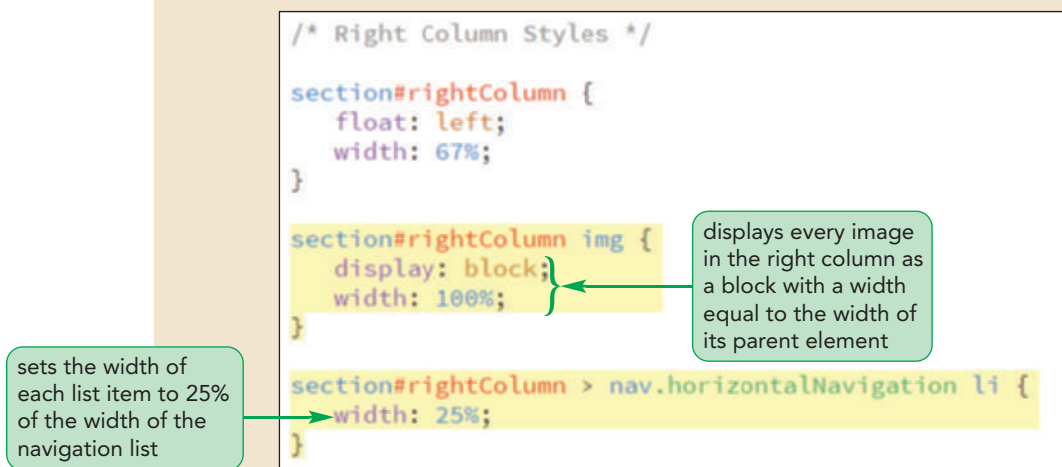
```
section#rightColumn img {
 display: block;
 width: 100%;
}
```

```
section#rightColumn > nav.horizontalNavigation li {
 width: 25%;
}
```

Note that you do not have to include a style rule to float the items in the horizontal navigation list because you have already created that style rule in Figure 3–11. Figure 3–17 describes the new style rules in the style sheet.

Figure 3–17

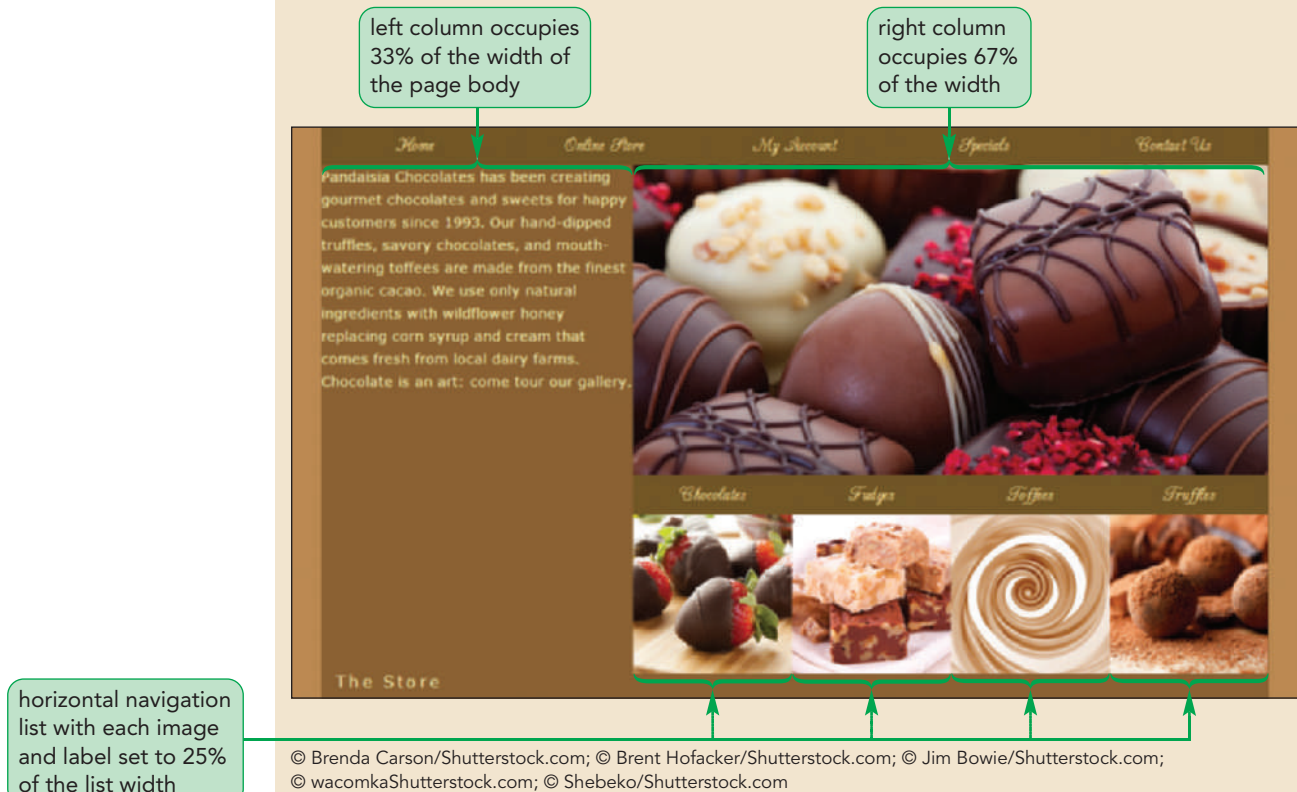
### Formatting the right column section



2. Save your changes to the file and then reload the pc\_home.html file in your browser. Figure 3–18 shows the layout of the left and right column sections.

Figure 3–18

Layout of the left and right columns



Anne doesn't like that the text in the left column crowds the right column and page boundary. She suggests that you provide more interior space by increasing the padding in the left column.

### To increase the left column padding:

1. Return to the **pc\_home.css** file in your editor and go to the Left Column Styles section.
2. Insert the property **padding: 1.5em;** into the **section#leftColumn** style rule as shown in Figure 3–19.

Figure 3–19

Increasing the padding of the left column

```
/* Left Column Styles */
section#leftColumn {
 clear: left;
 float: left;
 padding: 1.5em;
 width: 33%;
}
```

increases the interior padding to 1.5em

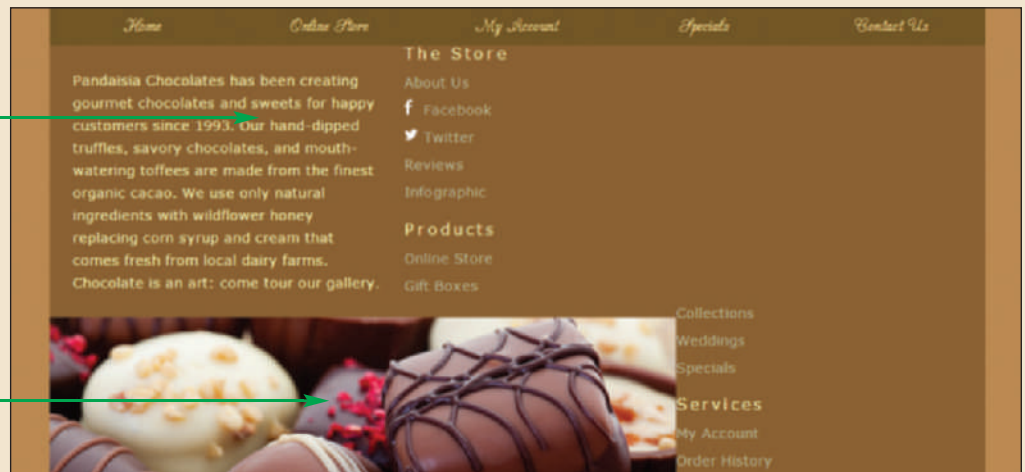
3. Save your changes to the style sheet and then reload the pc\_home.html file in your browser. Figure 3–20 shows the result of your change.

Figure 3–20

## Page layout crashes with increased padding

increased padding increases the width of the left column, making it bigger than 33% of the page body width

the right column is forced to wrap to a new row, ruining the page layout



© Brenda Carson/Shutterstock.com; Source: Facebook; Source: Twitter, Inc.

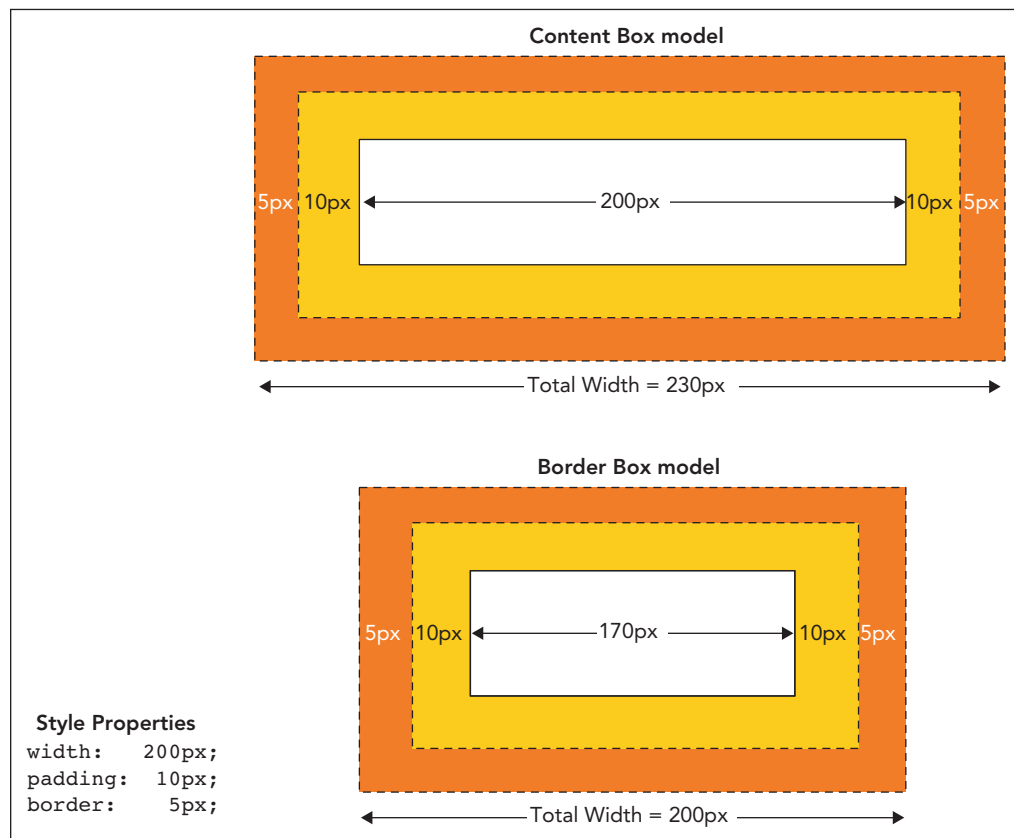
This simple change has caused the layout to crash. What went wrong?

## Refining a Floated Layout

When the total width of floated objects exceeds the width of their parent, excess content is automatically wrapped to a new row. The reason the layout for the Pandaisia Chocolates home page crashed is that increasing the padding in the left column, increased the column's width beyond its set value of 33%. Even this small increase caused the total width of the two columns to exceed 100% and, as a result, the right column moved to a new row.

To keep floats within the same row, you have to understand how CSS handles widths. Recall that block elements are laid out according to the box model, as illustrated previously in Figure 2–38, in which the content is surrounded by the padding space, the border space, and finally the margin space. By default, browsers measure widths using the **content box model** in which the `width` property only refers to the width of the element content and any padding or borders constitute added space.

CSS also supports the **border box model**, in which the `width` property is based on the sum of the content, padding, and border spaces and any space taken up by the padding and border is subtracted from space given to the content. Figure 3–21 shows how the two different models interpret the same width, padding, and border values.

**Figure 3–21** Comparing the content box and border box models**TIP**

Height values are similarly affected by the type of layout model used.

You can choose the layout model using the following `box-sizing` property

```
box-sizing: type;
```

where *type* is `content-box` (the default), `border-box`, or `inherit` (to inherit the property defined for the element's container). Many designers prefer to use the border box model in page layout so that there is no confusion about the total width of each element.

**REFERENCE****Defining How Widths Are Interpreted**

- To define what the width property measures, use the style:

```
box-sizing: type;
```

where *type* is `content-box` (the default), `border-box`, or `inherit` (to inherit the property defined for the element's container).

Add the `box-sizing` property to the reset style sheet and apply it to all block elements.

**To set the block layout model:**

1. Return to the **pc\_reset.css** file in your editor.
2. Add the following style property to the style rule for the list of block elements:

```
box-sizing: border-box;
```

Figure 3–22 highlights the revised style rule.

**Figure 3–22****Adding the border-box style to the reset style sheet**

applies border-box sizing to all of the listed block elements

```
address, article, aside, blockquote, body, cite,
div, dl, dt, dd, em, figcaption, figure, footer,
h1, h2, h3, h4, h5, h6, header, html, img,
li, main, nav, ol, p, section, span, ul {
 background: transparent;
 font-size: 100%;
 margin: 0;
 padding: 0;
 vertical-align: baseline;
 box-sizing: border-box;
}
```

3. Save your changes to the style sheet and then reload the **pc\_home.html** file in your browser. Verify that the layout of the left and right columns has been restored and additional padding has been added within the left column.

The final part of the Pandaisia Chocolates home page is the footer, which contains three vertical navigation lists and a `section` element with contact information for the store. Once the left margin is clear of previously floated objects, float these four elements on the left margin with the widths of the three navigation lists each set to 22% of the body width and the `section` element occupying the remaining 34%.

**To lay out the page footer:**

1. Return to the **pc\_home.css** file in your editor and scroll down to the Footer Styles section.
2. Insert the following style rules:

```
footer {
 clear: left;
}

footer > nav.verticalNavigation {
 float: left;
 width: 22%;
}

footer > section#contactInfo {
 float: left;
 width: 34%;
}
```

Figure 3–23 highlights the layout style rules for the page footer.

Figure 3–23

### Setting the layout of the page footer

displays the footer once the left margin is clear of floated objects

```
/* Footer Styles */
```

```
footer {
 clear: left;
}
```

sets the width of the verticalNavigation lists to 22% and floats them on the left

```
footer > nav.verticalNavigation {
 float: left;
 width: 22%;
}
```

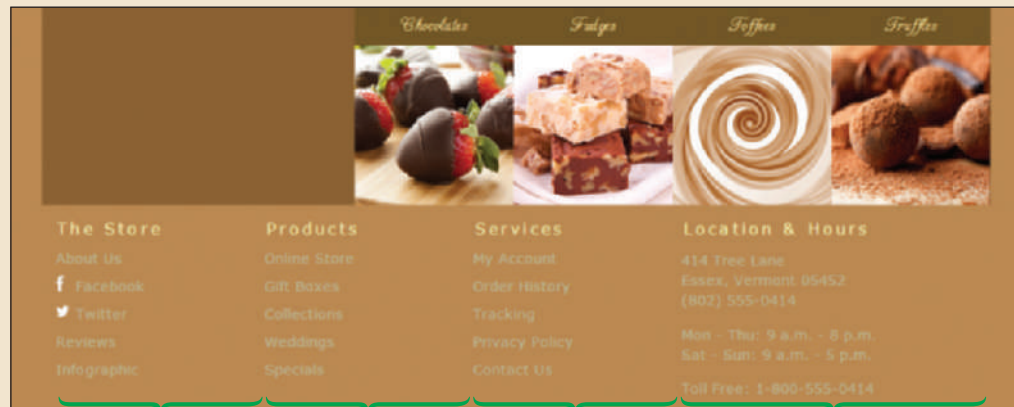
sets the width of the contactInfo section to 34% and floats it on the left

```
footer > section#contactInfo {
 float: left;
 width: 34%;
}
```

3. Save your changes to the style sheet and then reload pc\_home.html in your browser. Figure 3–24 shows the new layout of the footer.

Figure 3–24

### Page footer layout



each vertical navigation list set at 22% of the footer width and floated on the left

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width of the contactInfo section set at 34% of the footer width and floated on the left

Anne asks you to change the background color of the footer to a dark brown to better show the text content.

**To set the footer background color:**

1. Return to the **pc\_home.css** file in your editor and go to the Footer Styles section.
2. Insert the following property for the `footer` selector:

```
background-color: rgb(71, 52, 29);
```

Figure 3–25 highlights the footer background color style.

**Figure 3–25****Setting the footer background color**

footer background  
set to a dark brown

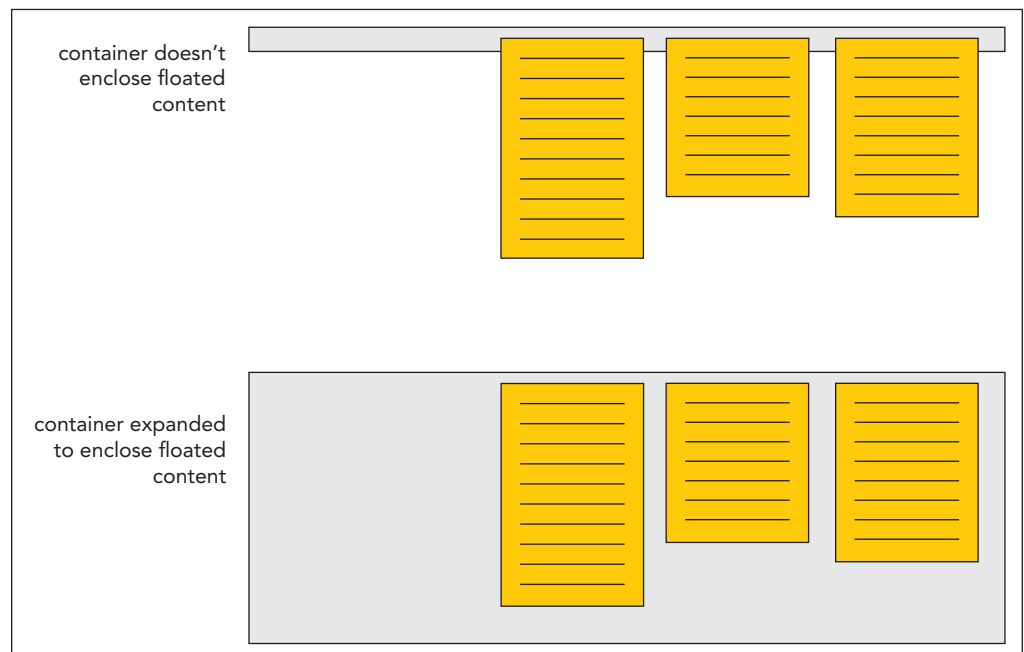
```
footer {
 background-color: rgb(71, 52, 29);
 clear: left;
}
```

3. Save your changes to the style sheet and then reload `pc_home.html` in your browser. Note that the background color is *not changed*.

Why didn't the change to the background color take effect? To help you understand why, you'll look once again at the nature of floated elements.

## Working with Container Collapse

Recall that a floated element is taken out of the document flow so that it is no longer “part” of the element that contains it. Literally it is floating free of its container. When every element in a container is floated, there is no content left. As far as the browser is concerned, the container is empty and thus has no height and no background to color, a situation known as **container collapse**. Figure 3–26 demonstrates container collapse for a container that has three floating objects that exceed the boundaries of their container.

**Figure 3–26****Container collapse**

What you usually want in your layout is to have the container expand to surround all of its floating content. One way this can occur is if the container is followed by another element that is displayed only when the margins are clear of floats. In that situation, the container's height will expand up to that trailing element and in the process surround its floating content.

The problem with the footer in the Pandaisia home page is that there is no trailing element—the footer is the last element in the page body. One way to fix that problem is to use the `after` pseudo-element to add a placeholder element after the footer. The general style rule is

```
container::after {
 clear: both;
 content: "";
 display: table;
}
```

### TIP

To find other ways to prevent container collapse, search the web using the keywords *CSS clearfix*.

where `container` is the selector for the element containing floating objects. The `clear` property keeps this placeholder element from being inserted until both margins are clear of floats. The element itself is a web table but contains only an empty text string so that no actual content is written to the web page. That's okay because the mere presence of this placeholder element is enough to keep the container from collapsing.

Add a style rule now to create a placeholder element that keeps the footer from collapsing around its floating content.

### To keep the footer from collapsing:

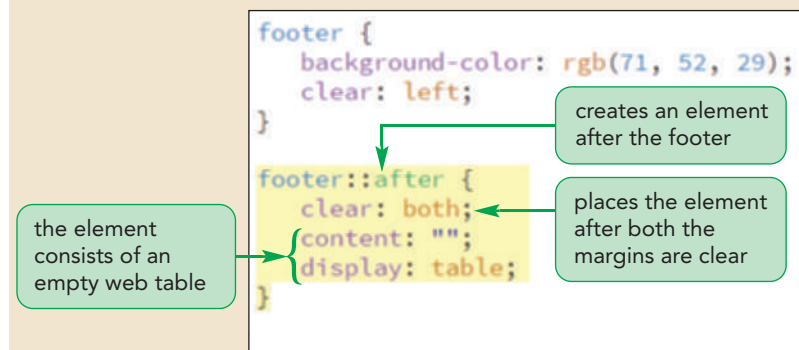
1. Return to Footer Styles section in the `pc_home.css` file and, after the style rule for the footer element, insert the following rule:

```
footer::after {
 clear: both;
 content: "";
 display: table;
}
```

Figure 3–27 highlights the new rule in the style sheet.

Figure 3–27

### Preventing the footer from collapsing



2. Save your changes to the style sheet and then reload `pc_home.html` in your browser. Figure 3–28 shows the completed layout of the Pandaisia Chocolates home page.

Figure 3–28

Final layout of the Pandaisia Chocolates home page



footer has expanded to contain all floated content

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Note that the footer now has a dark brown background because it has expanded in height to contain all of its floated content.

3. Close any of the documents you opened for this session.

## REFERENCE

### Keeping a Container from Collapsing

- To prevent a container from collapsing around its floating content, add the following style rule to the container

```
container::after {
 clear: both;
 content: "";
 display: table;
}
```

where *container* is the selector for the element containing the floating content.



## PROSKILLS

### Problem Solving: The Virtue of Being Negative

It's common to think of layout in terms of placing content, but good layout also must be concerned with placing emptiness. In art and page design, this is known as working with positive and negative space. Positive space is the part of the page occupied by text, graphics, borders, icons, and other page elements. Negative space, or white space, is the unoccupied area and provides balance and contrast to elements contained in positive space.

A page that is packed with content leaves the eye with no place to rest; which also means that the eye has no place to focus and maybe even no clear indication about where to start reading. Negative space is used to direct users to resting stops before moving on to the next piece of page content. This can be done by providing a generous margin between page elements and by increasing the padding within an element. Even increasing the spacing between letters within an article heading can alleviate eye strain and make the text easier to read.

White space also has an emotional aspect. In the early days of print advertising, white space was seen as wasted space, and thus, smaller magazines and direct mail advertisements would tend to crowd content together in order to reduce waste. By contrast, upscale magazines and papers could distinguish themselves from those publications with an excess of empty space. This difference carries over to the web, where a page with less content and more white space often feels more classy and polished, while a page crammed with a lot of content feels more commercial. Both can be effective; you should decide which approach to use based on your customer profile.

You've completed your work on the Pandaisia Chocolates home page. In the next session, you'll work on page layout using the technique of grids.

## REVIEW

### Session 3.1 Quick Check

1. To display an element as a block-level use:
  - a. `display: block-level;`
  - b. `display: block;`
  - c. `display: inline;`
  - d. `display: display-block;`
2. What are three types of layouts?
  - a. inline, fluid, static
  - b. fixed, floating, static
  - c. fixed, fluid, elastic
  - d. inline, block, scrolling
3. Provide a style rule to set the maximum width of an element to 960 pixels.
  - a. `maximum-width: 960px;`
  - b. `maxw: 960px;`
  - c. `width: 960px;`
  - d. `max-width: 960px;`

4. Provide a style rule to horizontally center a block element within its container with a top/bottom margin of 20 pixels.
  - a. `margin: 20px center;`
  - b. `margin: center 20px;`
  - c. `margin: auto 20px;`
  - d. `margin: 20px auto;`
5. Provide a style rule to place an object on the right margin of its container.
  - a. `margin: right;`
  - b. `text-align: right;`
  - c. `float: right;`
  - d. `padding: right;`
6. Provide a style rule to display an object only when all floating elements have cleared.
  - a. `clear: float;`
  - b. `clear: floats;`
  - c. `clear: both;`
  - d. `clear: all;`
7. Your layout has four floated elements in a row but unfortunately the last element has wrapped to a new line. What is the source of the layout mistake?
  - a. The widths of the floated elements exceed the available width of their container.
  - b. You cannot float more than one object within a row.
  - c. You have to clear the first three floating object to make room for the fourth.
  - d. You have to clear the fourth floating object to make room for the first three.
8. Provide a style rule to change the width property for the header element so that it measures the total width of the header content, padding, and border spaces.
  - a. `box-sizing: border-box;`
  - b. `box-sizing: content-box;`
  - c. `box-sizing: all;`
  - d. `box-sizing: complete;`
9. What causes container collapse?
  - a. The width of the child elements exceeds the width of the container.
  - b. The width of the container element is fixed at 0 pixels.
  - c. The height of the container element is fixed at 0 pixels.
  - d. All child elements are floating so that they are free of the container, leaving the container with no content.

# Session 3.2 Visual Overview:

The `grid-template-columns` property establishes the size and number of grid columns

To create a grid container, set the `display` property to `grid`.

A **fractional unit**, indicated by the unit abbreviation `fr`, expands or contracts to fill available space; these fractional units keep the columns widths in a 2:1 proportion.

The `grid-template-areas` property defines the areas in the grid

Use the `grid-row` and `grid-column` properties to place items at and across specified grid rows and columns.

Use the `grid-area` property to place items within grid areas.

```
body {
 display: grid;
 grid-template-columns: 2fr 1fr;
 grid-template-areas: "header header"
 "intro faq"
 "articles faq"
 "footer footer";
 grid-column-gap: 15px;
}

body > header {
 grid-row: 1;
 grid-column: 1/-1;
}

body > article {grid-area: intro;}
body > aside {grid-area: faq;}
body > section {grid-area: articles;}
body > footer {grid-area: footer;}

/* Grid Styles for Nested Grid */

section {
 display: grid;
 grid-template-columns: repeat(2, 1fr);
}

section > h1 {
 grid-area: 1/1/2/3;
}
```

The `grid-column-gap` property sets the interior space between grid columns.

# CSS Grid Layouts

Columns laid out in a proportion of 2:1

Page header covers the grid from column gridline 1 to -1 (the last gridline)



aside element placed in the FAQ grid area

footer element placed in the footer grid area

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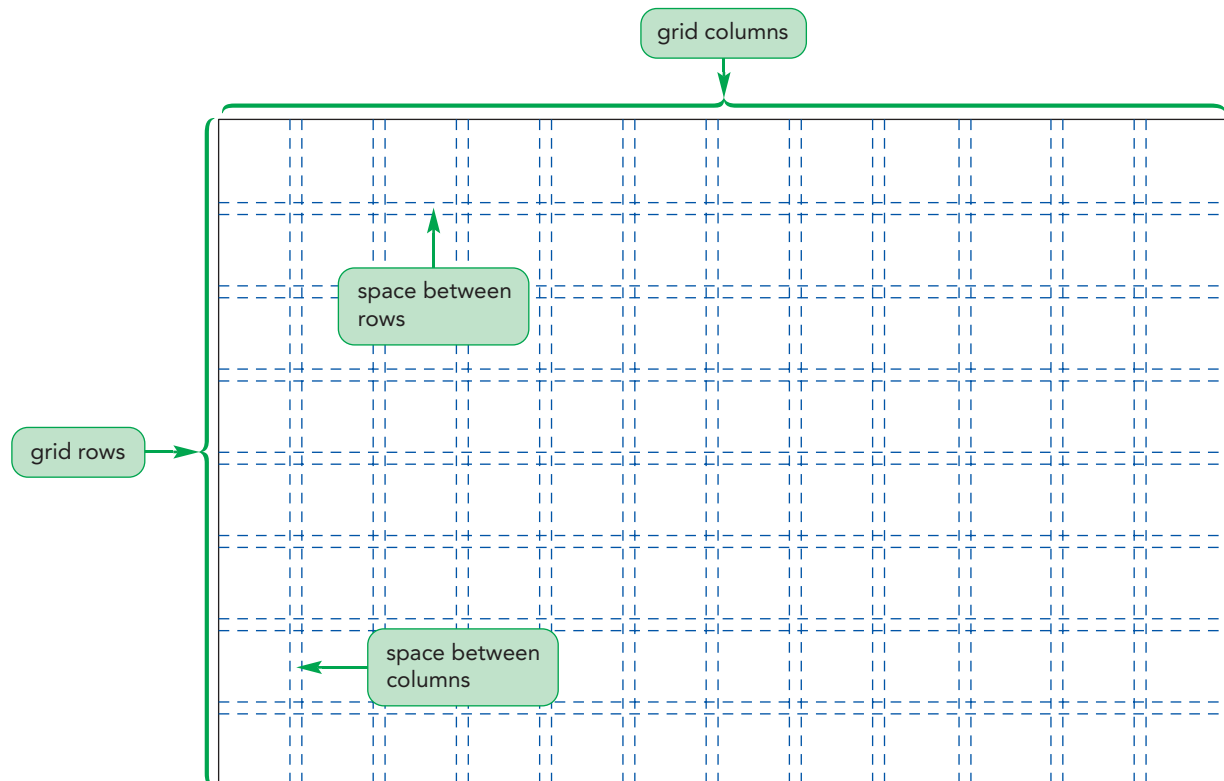
## Introducing Grid Layouts

In the previous session, you used the `float` property to lay out a page in sections that floated alongside each other like columns. In this session, you'll explore how to generalize this technique by creating a page layout based on a grid.

### Overview of Grid-Based Layouts

Grids are a classic layout technique that has been used in publishing for hundreds of years and, like many other publishing techniques, can be applied to web design. In a **grid layout**, the page is comprised of a system of intersecting rows and columns that form a grid. The rows are based on the page content. A long page with several articles might span several rows, or it could be a home page with introductory content that fits within a single row. The number of columns is based on the number that provides the most flexibility in laying out the page content. Many grid systems are based on 12 columns because 12 is evenly divisible by 2, 3, 4, and 6, but other sizes are also used. Figure 3–29 shows a 12-column grid layout.

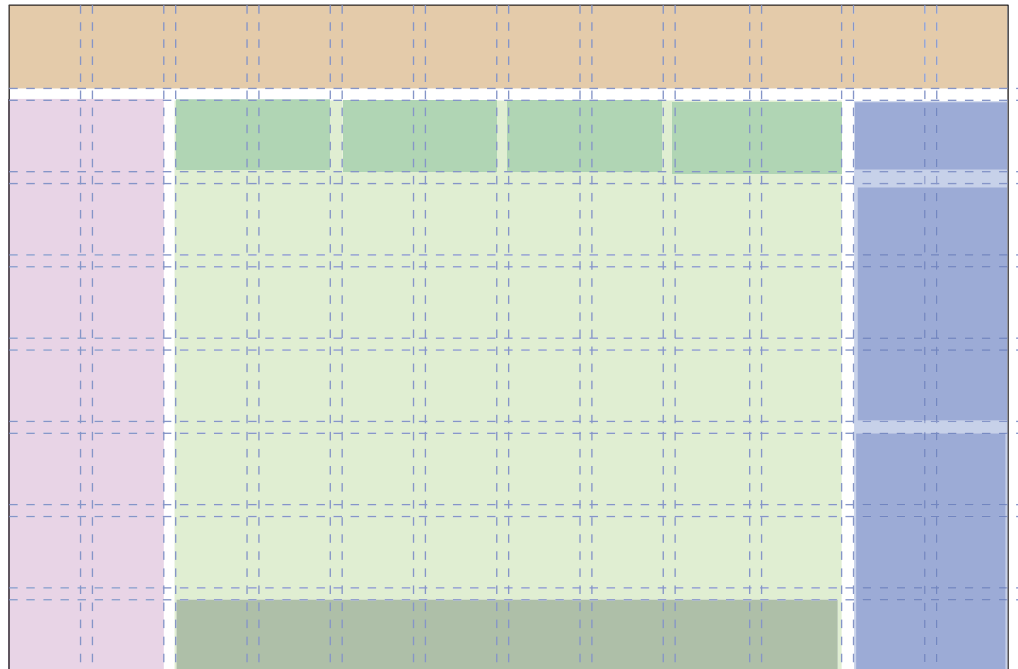
Figure 3–29 Page grid



The page designer then arranges the page elements within the chosen grid. Figure 3–30 shows one possible layout comprised of a main header element (the tan area), three major sections (the lavender, light green, and blue areas), as well as a navigation bar and a footer (the dark green areas). Some sections (like the dark green and blue areas) are further divided into small subsections.

Figure 3–30

## Layout based on a grid



It should be stressed that the grid is not part of the web page content. Instead, it's a systematic approach to visualizing how to best fit content onto the page. Working from a grid has several aesthetic and practical advantages, including

- Grids add order to the presentation of page content, adding visual rhythm, which is pleasing to the eye.
- A consistent logical design gives readers the confidence to find the information they seek.
- New content can be easily placed within a grid in a way that is consistent with previously entered information.
- A well designed grid is more easily accessible for users with disabilities and special needs.
- Grids speed up the development process by establishing a systematic framework for the page layout.

There are two basic types of grid layouts: fixed grids and fluid grids.

## Fixed and Fluid Grids

In a **fixed grid**, the widths of the columns and margins are specified in pixels, where every column has a fixed position. Many fixed grid layouts are based on a page width of 960 pixels because most desktop screen widths are at 1024 pixels (or higher) and a 960-pixel width leaves room for browser scrollbars and other features. The 960-pixel width is also easily divisible into halves, thirds, quarters, and so forth, making it easier to create evenly spaced columns.

The problem of course with a fixed grid layout is that it does not account for other screen sizes and thus, a **fluid grid**, in which column widths are expressed in percentages rather than pixels, is often used to provide more support across different devices. In the examples to follow, you'll base your layouts on a fluid grid system.

Grids are often used with responsive design in which one grid layout is used with mobile devices, another grid layout is used with tablets, and yet another layout is used with desktop computers. A layout for a mobile device is typically based on a 1-column grid, tablet layouts are based on grids of 4 to 12 columns, and desktop layouts are often based on layouts with 12 or more columns.

## CSS Frameworks

Designing your own grids can be time-consuming. To simplify the process, you can choose from the many CSS frameworks available on the web. A **framework** is a software package that provides a library of tools to design your website, including style sheets for grid layouts and built-in scripts to provide support for a variety of browsers and devices. Most frameworks include support for responsive design so that you can easily scale your website for devices ranging from mobile phones to desktop computers.

Some popular CSS frameworks include

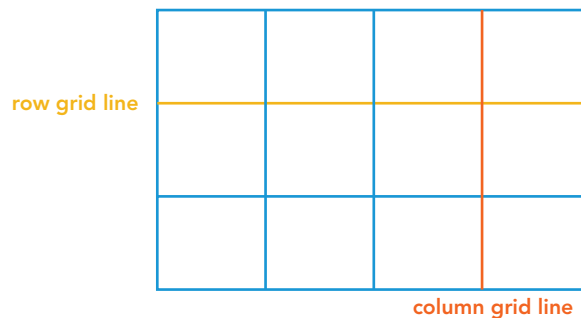
- **Bootstrap** ([getbootstrap.com](http://getbootstrap.com))
- **Neat** ([neat.bourbon.io](http://neat.bourbon.io))
- **Unsemantic** ([unsemantic.com](http://unsemantic.com))
- **Profound Grid** ([www.profoundgrid.com](http://www.profoundgrid.com))
- **HTML 5 Boilerplate** ([html5boilerplate.com](http://html5boilerplate.com))
- **Skeleton** ([getskeleton.com](http://getskeleton.com))

While a framework does a lot of the work in building the grid, you still need to understand how to interact with the underlying code, including the style sheets used to create a grid layout. In place of third-party frameworks, you can design your own grids using grid styles from CSS. Achieving Candidate Recommendation status by the W3C in December, 2017, the CSS grid styles are now widely supported by all major browsers on almost every device.

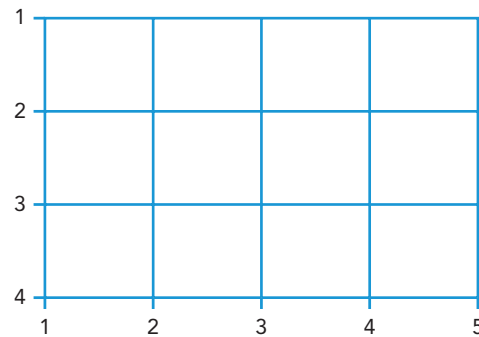
## Introducing CSS Grids

The **CSS grid model** is a set of CSS design styles used to create grid-based layouts. Before discussing the CSS styles, we should first explore the key terms and concepts associated with building a CSS grid. Each CSS grid is laid out in a set of row and column gridlines as shown in Figure 3–31.

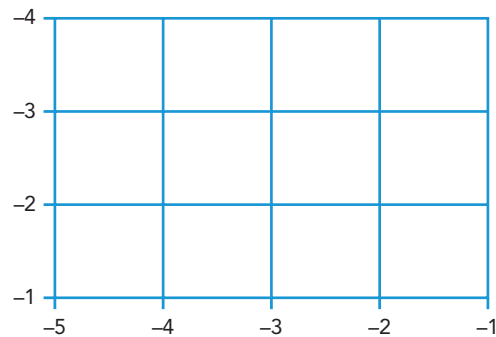
**Figure 3–31** Row and column gridlines



To reference positions within a grid, the CSS grid model numbers the gridlines in the horizontal and vertical directions, starting from the top-left corner of the grid with the row gridlines and then moving left to right with the column gridlines along the bottom. Both gridlines start with a value of “1” and increase in value down and across the grid (see Figure 3–32.)

**Figure 3–32**    **Numbering gridlines**

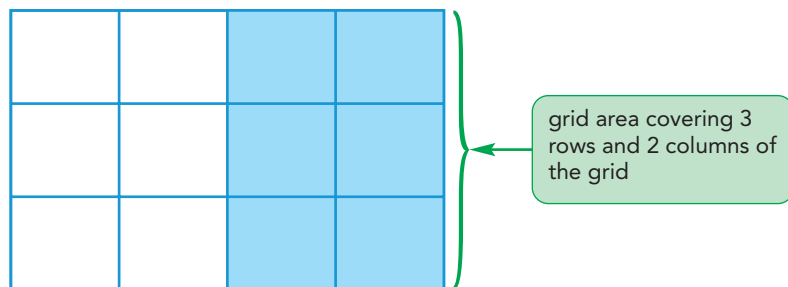
You can reference gridlines in the reverse order starting from the bottom-right corner with the first row and column gridlines in those directions are given a value of “–1” as shown in Figure 3–33.

**Figure 3–33**    **Numbering gridlines from right to left****TIP**

For countries and regions that read material right-to-left rather than left-to-right, the grid numbering system is reversed to reflect reading order.

The advantage of using both positive and negative gridline numbers is that you can always reference both the first gridline (1) and the last gridline (–1) no matter the size of the grid. This will become important later when placing items at specific locations within the grid or sizing those items to cover multiple rows and columns.

The cells that are created from the intersection of the horizontal and vertical gridlines will contain the elements from the web page. An element can be contained within a single cell or it can span several cells within a **grid area**. Figure 3–34 shows a grid area consisting of three rows and two columns. Note that grid areas must be rectangular; you cannot have an L-shaped grid area.

**Figure 3–34**    **Grid area within a CSS grid**

Rows and columns are also called **tracks** or **grid tracks**.

You will create a grid for a web page describing the Pandaisia Chocolates company. Anne has already written and marked up the content of the page. Open Anne's file now.

### To open the file containing information about the company:

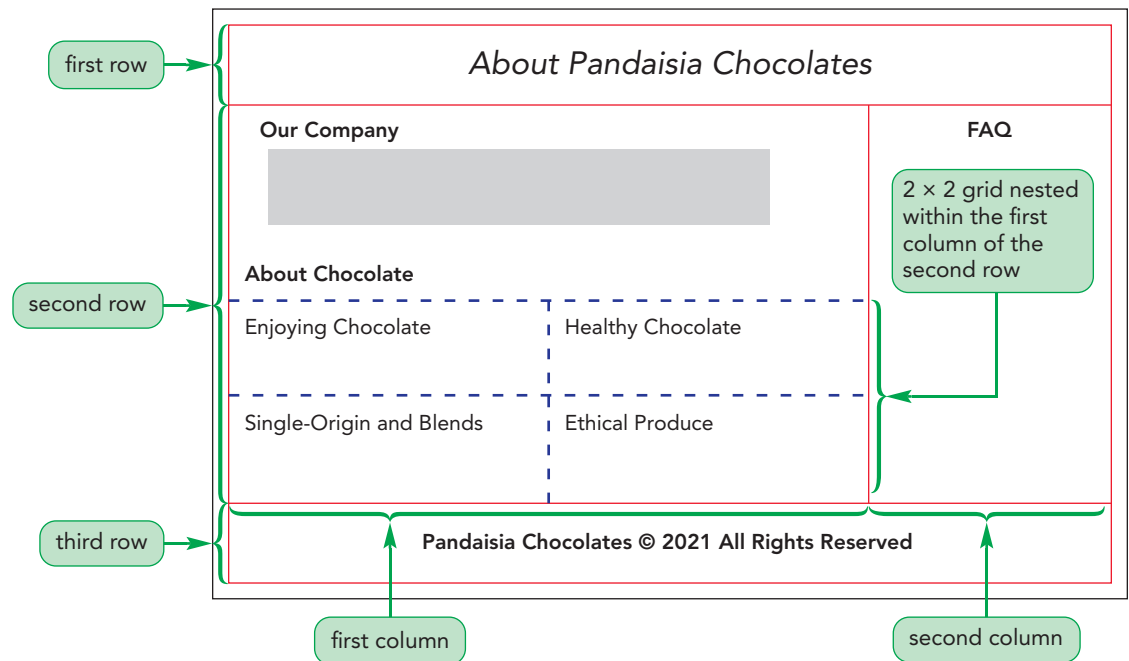
1. Use your editor to open the **pc\_about\_txt.html** file from the html03 ► tutorial folder. Enter **your name** and **the date** in the comment section and save the file as **pc\_about.html**.
2. Take some time to examine the contents of the page.
3. Open the pc\_about.html file in your browser. See Figure 3–35.

Figure 3–35

### Initial About Pandaisia Chocolates page



There is currently no layout for the page contents and all the structural elements appear stacked within a single column. Anne sketches her idea for a different page layout, shown in Figure 3–36.

**Figure 3–36** Proposed grid layout for the About Pandaisia Chocolates page

Anne's layout consists two grids: one nested within the other. The outer grid consists of three rows and two columns. The first and third rows contain the page header and page footer, with the header and footer both spanning an entire row. The second row displays information about the company in the first column and a list of frequently asked questions is displayed in the second column. Within the second row is a nested grid of two rows and two columns containing four articles about Pandaisia Chocolates, its operations, and products. You will use the CSS grid model to create this grid layout.

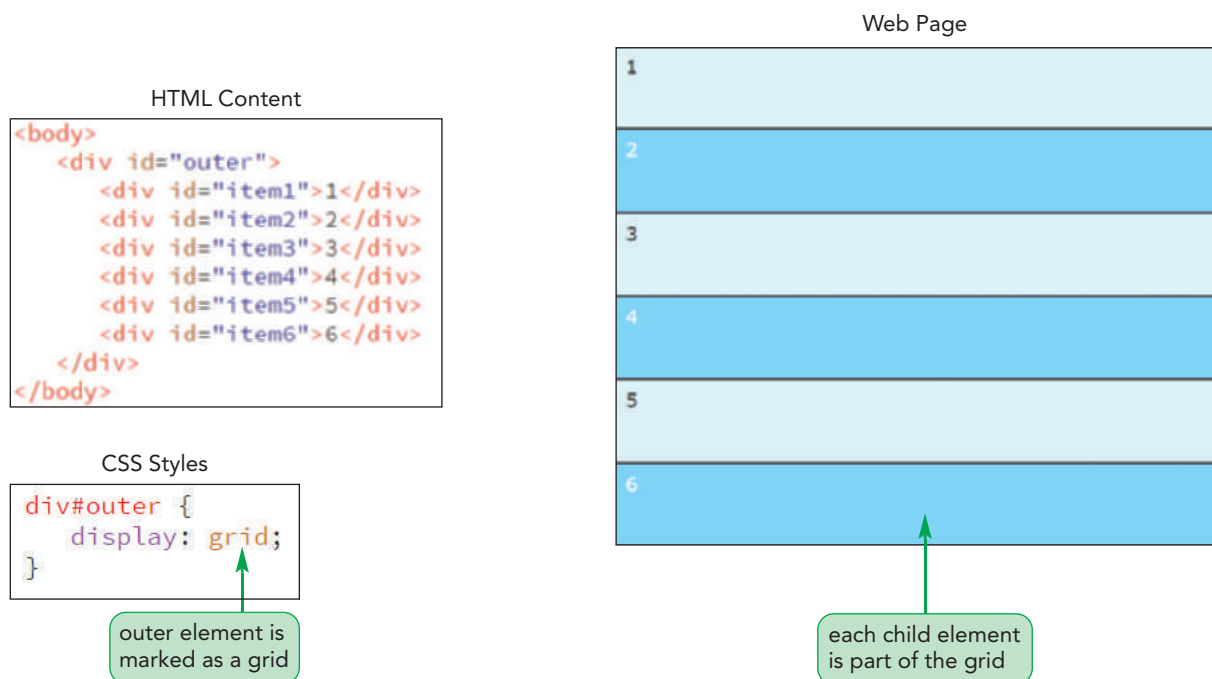
## Creating a CSS Grid

To create a CSS grid, you must first identify a page element as the grid container using the following `display` property:

```
display: grid;
```

Figure 3–37 shows a simple web page containing a `div` element with the id "outer" that contains six nested `div` elements. The outer element is displayed as a grid and each of the six child elements become items within that grid. The grid is limited to those six `div` elements. Any elements nested within those `div` elements are not part of the grid structure.

Figure 3–37 Using the display style



The six child `div` elements are now grid items, so they are no longer considered block-level elements because they are fixed within the grid structure. You couldn't, for example, float any of those elements because floating them would remove them from the grid and the CSS grid model doesn't allow that. The entire grid itself is considered a block-level element and thus could be floated or resized within the web page just like any other block-level element.

Grids can also be created as inline elements using the style:

```
display: inline-grid;
```

which creates the grid inline with other elements in the web page. In this session we will only examine grids as block-level elements, but be aware that any of the techniques introduced for setting up a grid can be applied to both the block-level and inline versions.

Use the `display` property now to define outer and inner grids described in Figure 3–36. You will place all your grid styles within a separate CSS file.

### To create the grid style sheet:

1. Use your editor to open the **pc\_grids\_txt.css** file from the **html03 ► tutorial** folder. Enter **your name** and **the date** in the comment section and save the file as **pc\_grids.css**.
2. Within the Grid Styles for Page Body section, insert the following style rule to define a grid for the entire page body:

```
body {
 display: grid;
}
```

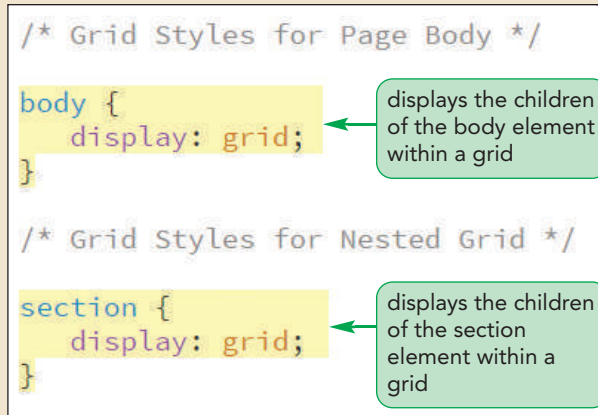
3. Within the Grid Styles for Nested Grid section, insert the following style rule to turn the `section` element into a grid:

```
section {
 display: grid;
}
```

Figure 3–38 highlights the newly added code.

Figure 3–38

### Creating two grids for the web page



4. Save your changes to the file and then return to the **pc\_about.html** file in your editor.
5. Within the head section, add the following `link` element to link the web page to the `pc_grids.css` style sheet.  

```
<link href="pc_grids.css" rel="stylesheet" />
```
6. Save your changes to the file.

Having set up the grids you will next use CSS to define the rows and columns of the grid structure.

## Working with Grid Rows and Columns

To define the number and size of grid columns, use the following `grid-template-columns` style:

```
grid-template-columns: width1 width2 ...;
```

### TIP

The number of columns in the grid is determined by the number of entries in the `grid-template-columns` property.

where `width1`, `width2`, etc. is a space-separated list that defines the width of the columns or tracks within the grid. For example, the following style rule creates two grid columns: the first 250 pixels in width and the second with a width of 100 pixels.

```
grid-template-columns: 250px 100px;
```

Column widths can be expressed using any CSS unit measures such as pixels, em units, and percentages. You can also use the keyword `auto` to allow the column width to be automatically set by the browser. The following style creates a three-column grid with the width of the first column fixed at 100 pixels, the third column at 50 pixels, and the center column occupying whatever space remains.

```
grid-template-columns: 100px auto 50px;
```

You might use such a layout in a page in which the first and third columns contain navigation lists that are fixed in size while the middle column contains an article that should expand to fill the remaining space.

Figure 3–39 shows a two-column grid with fixed widths of 250 pixels and 100 pixels. Notice that the number of rows is not defined, so that the browser automatically adds rows as needed to contain all page elements within the grid container. Because there are six grid items, this grid is arranged in a layout of three rows and two columns. If there were eight child elements the grid would be four rows by two columns, and so forth.

**Figure 3–39** Setting the grid columns

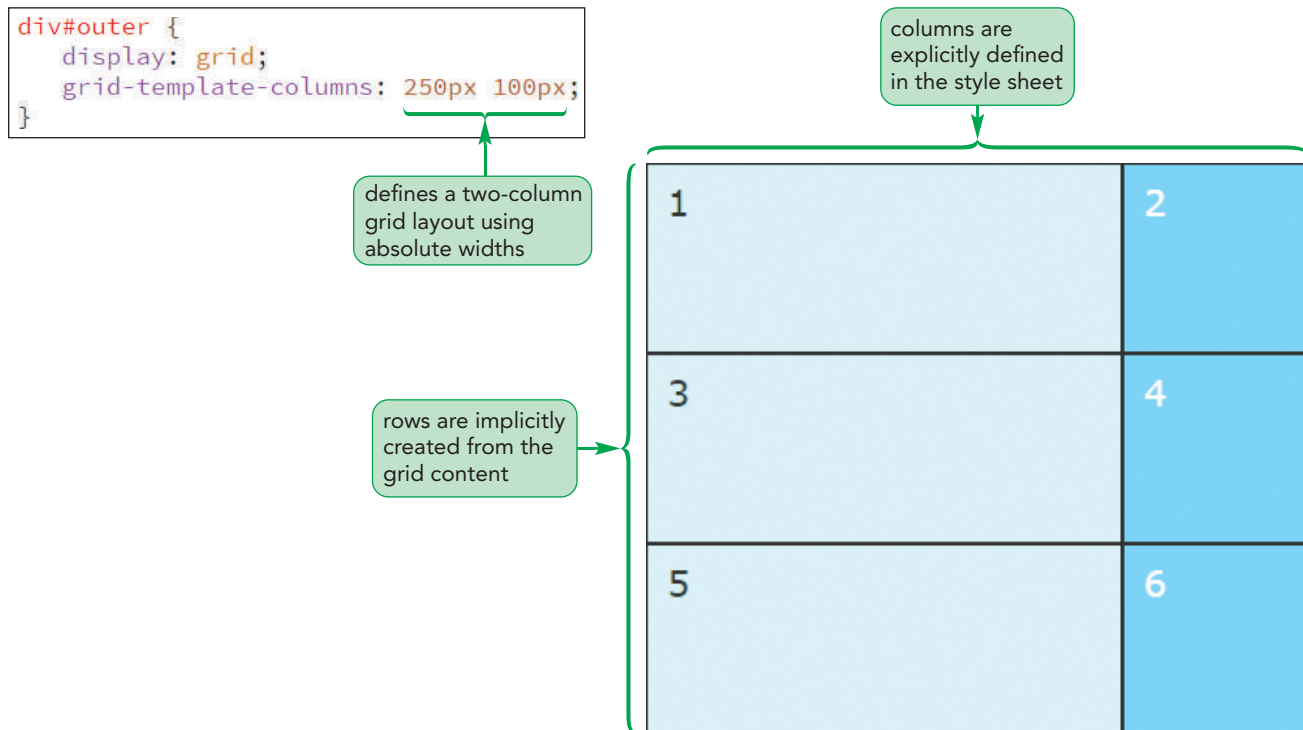


Figure 3–39 highlights an important contrast between explicit grids and implicit grids. An **explicit grid** completely defines the number and size of the grid rows and columns. An **implicit grid** contains rows and/or columns that are generated by the browser as it populates the grid with items from the grid container. In most grid layouts you will explicitly define the columns and let the browser fill out the grid rows drawn from the web page content.

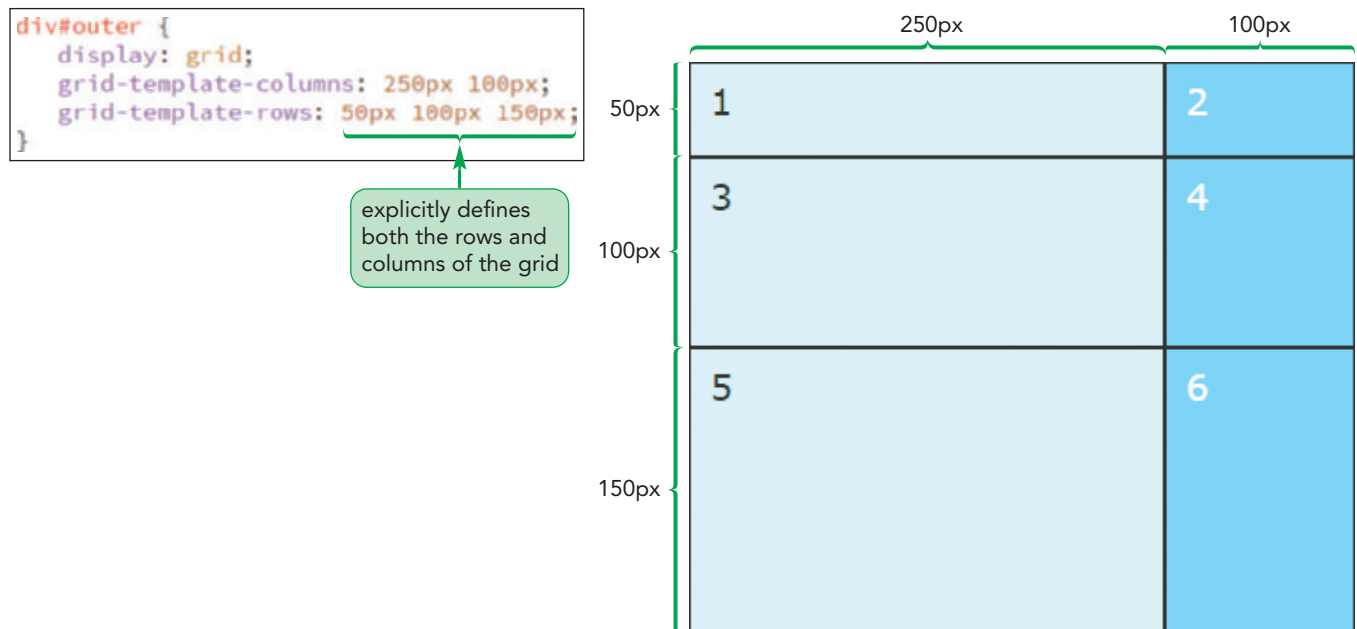
To explicitly define the number of rows and their height, use the following `grid-template-rows` property:

```
grid-template-rows: height1 height2 ...;
```

where *height1*, *height2*, etc. define the heights of the grid rows. Figure 3-40 shows an example of an explicit grid in which both the columns and rows are defined in the CSS style sheet.

Figure 3–40

## Explicitly defining grid columns and rows



In an implicit grid, the row heights are determined by the page element. You can also set the row heights in an implicit grid using the following `grid-auto-rows` property:

```
grid-auto-rows: height1 height2 ...;
```

where *height1*, *height2*, etc. are the heights of the rows with the sequence repeating for each new set of rows. For example, the style:

```
grid-auto-rows: 100px;
```

sets the height of each row to 100 pixels, while the style

```
grid-auto-rows: 100px 200px;
```

sets the height of the first row in the implicit grid to 100 pixels, the height of the second row to 200 pixels, and then repeats those heights for each subsequent set of two rows until the grid is filled.

**TIP**

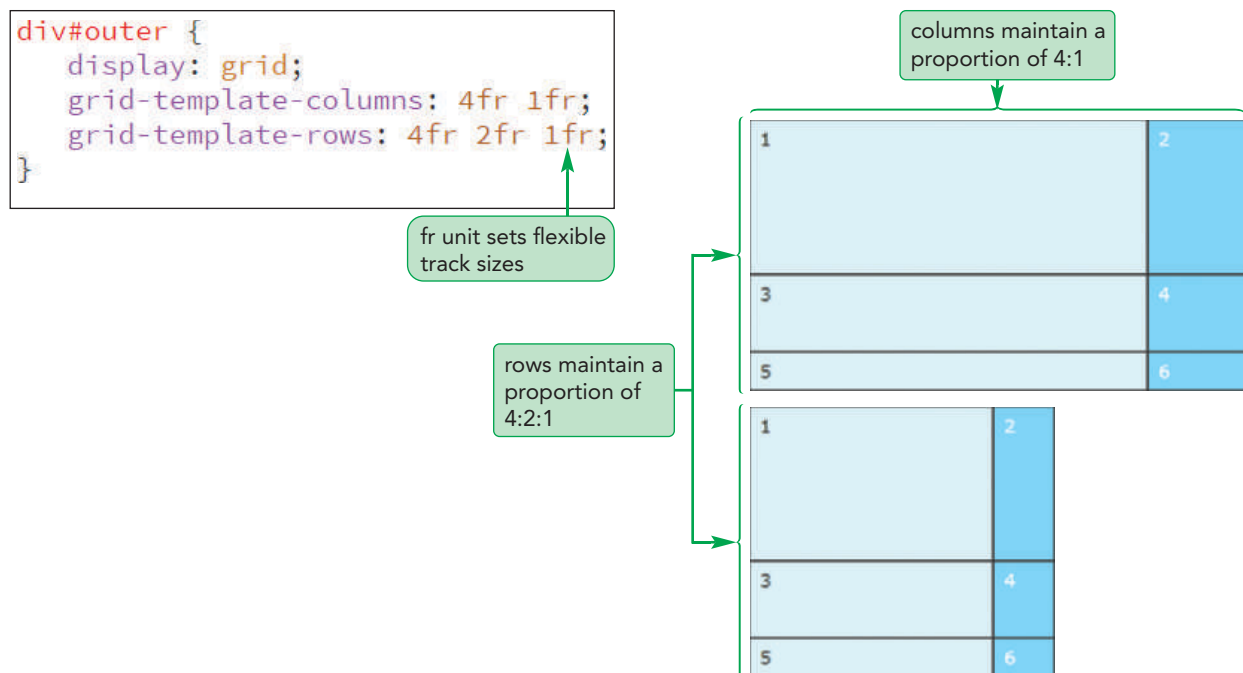
If the content of a grid item is greater than can be displayed within the allotted height, the browser will automatically increase the row height to match.

## Track Sizes with Fractional Units

A grid layout will often need to adapt to devices of various screen widths and sizes. One way of accomplishing this is with flexible units. A **fr (fractional) unit**, indicated by the unit abbreviation `fr`, creates grid tracks that expand or contract in size to fill available space while retaining their relative proportions to one another. The following is an example of a grid in which the track sizes of the columns and rows is set using fractional units:

```
grid-template-columns: 4fr 1fr;
grid-template-rows: 4fr 2fr 1fr;
```

As the size of the display window changes, the column widths maintain their proportions so that the first column is always four times wider than the second column and the row heights maintain their proportion of 4:2:1. See Figure 3–41.

**Figure 3–41** Using flexible units in a grid

Fractional units are often combined with absolute units to create grid layouts that are both fixed and flexible. The following style rule generates a grid in which the width of the first column is set to 250 pixels with the remaining space allotted to the other two columns in a proportion of 2 to 1.

```
grid-template-columns: 250px 2fr 1fr
```

Such a layout might be used in a web page in which the first column contains a navigation list whose width is fixed, the second column contains an article of primary importance, and the third column contains a sidebar of lesser importance. As the size of the display window changes, the width of the second and third columns automatically change, filling the screen while maintaining their 2:1 ratio.

## Repeating Columns and Rows

Some grid layouts involve 12 or 16 columns or more. With so many columns it's difficult to specify the size of each column. You can simplify the layout style by using the following `repeat()` function

```
repeat(repeat, tracks)
```

where *repeat* is the number of repetitions of the tracks specified in *tracks*. For example, the following expression creates a layout consisting of one fixed column 250 pixels in width followed by four sets of two columns in which the first column in each set is twice the width of the second column for a total of nine grid columns.

```
grid-template-columns: 250px repeat(4, 2fr 1fr);
```

In place of a *repeat* value, you can use the keyword `auto-fill` to fill up the grid with as many columns (or rows) that will fit within the grid container. The following style uses the `auto-fill` keyword to fill the grid with as many 100 pixel-wide columns that will fit within the container:

```
grid-template-columns: 250px repeat(auto-fill, 100px);
```

Any grid item that cannot fit within the grid container will be automatically wrapped to a new row. This type of layout could be used with an image gallery in which each

row contains as many 100 pixel-wide images that can fit within the display window, arranged in columns.

Finally, you can switch between fixed and flexible track sizes using the following `minmax()` function

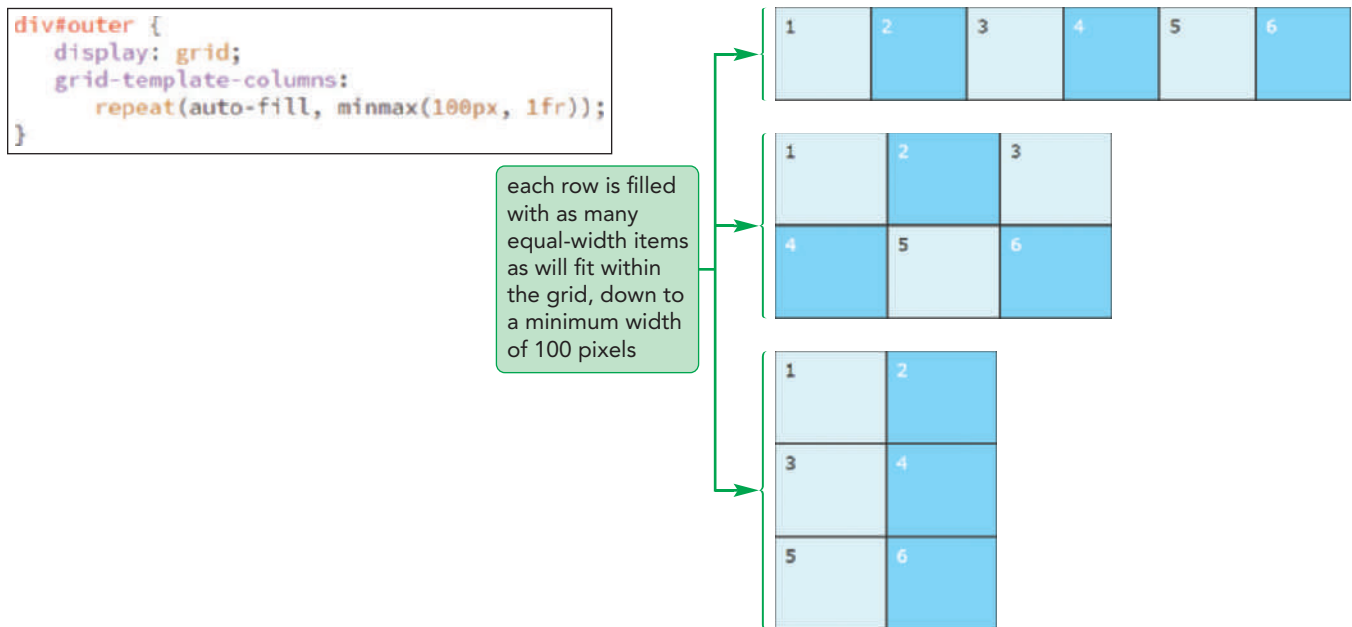
```
minmax(min, max)
```

where *min* is the minimum track size for a row and column and *max* is the maximum. Used in the following style rule, the grid will contain as many columns of equal width that can fit within a grid container down to a minimum width of 100 pixels:

```
grid-template-columns: repeat(auto-fill, minmax(100px, 1fr));
```

Figure 3–42 shows how such a layout would be applied to grid containers of different widths.

**Figure 3–42** Using the `minmax` function in a grid



As the grid container decreases in size, grid items are automatically wrapped to a new row. Under each layout, the columns are given equal widths down to a minimum width value of 100 pixels.

## Applying a Grid Layout

Now that you've seen how to set the size of rows and columns within a grid, you will apply your knowledge to the About Pandaisia web page. From Anne's proposed layout shown earlier in Figure 3–36, you've learned that the two columns in the outer grid should be displayed in a proportion of 2:1, while the four articles about chocolate in the nested grid should be displayed with columns of equal width. You will define the column widths for both the outer and nested grids using fractional units. You won't, however, explicitly define the number and height of the grid rows, leaving the browser to implicitly lay out that content.

### To define the grid columns:

1. Return to the `pc_grids.css` file in your editor.
2. Within the style rule for the `body` element, add the style:

```
grid-template-columns: 2fr 1fr;
```

3. Within the style rule for the `section` element, add:

```
grid-template-columns: repeat(2, 1fr);
```

Figure 3–43 highlights the newly added code.

Figure 3–43

## Creating two grids for the web page

```
/* Grid Styles for Page Body */
body {
 display: grid;
 grid-template-columns: 2fr 1fr;
}

/* Grid Styles for Nested Grid */
section {
 display: grid;
 grid-template-columns: repeat(2, 1fr);
}
```

creates two grid columns with the first column twice the width of the second

creates two grid columns of equal width

4. Save your changes to the file and then reload `pc_about.html` in your browser. Figure 3–44 shows part of the layout of the page under the current grid structure.

Figure 3–44

## Web page with the column layout



The page layout does not resemble the plan that Anne outlined in Figure 3–36 because we have not specified where each item should be placed within the grid. That will be the final step in designing the grid layout. Before doing that however, it would be helpful to view the page with gridlines superimposed on the web page. We can do that with outline styles.

## Outlining a Grid

Outlines are simply lines drawn around an element, enclosing the element content, padding, and border spaces. Unlike borders, which you'll study in the next tutorial, an outline doesn't add anything to the width or height of the object, it only indicates the extent of the element on the rendered page.

The width of the line used in the outline is defined by the following `outline-width` property

```
outline-width: value;
```

where *value* is expressed in one of the CSS units of length, or with the keywords `thin`, `medium`, or `thick`. The line color is set using the `outline-color` property

```
outline-color: color;
```

where *color* is a CSS color name or value. Finally, the design of the line can be set using the following `outline-style` property

```
outline-style: style;
```

where *style* is `none` (to display no outline), `solid` (for a single line), `double`, `dotted`, `dashed`, `groove`, `inset`, `ridge`, or `outset`. All the outline properties can be combined into the following **outline** shorthand property

```
outline: width style color;
```

where *width*, *style*, and *color* are the values for the line's width, design, and color. For example, the following style rule uses the wildcard selector along with the outline shorthand property to draw a 1 pixel dotted green line around every element on the web page:

```
* {
 outline: 1px dotted green;
}
```

### TIP

Outlines can also be applied to inline elements such as inline images, citations, quotations, and italicized text.

Note that there are no separate outline styles for the left, right, top, or bottom edge of the object. The outline always surrounds an entire element.

### REFERENCE

#### Adding an Outline to an Element

- To add an outline around an element, use the property

```
outline: width style color;
```

where *width*, *style*, and *color* are the outline width, outline design, and outline color respectively. These attributes can be listed in any order.

Use the `outline` property now to add an outline to each item in both the outer and inner grids.

**TIP**

Most browsers include developer tools for viewing the gridlines from a CSS grid. See your browser documentation for specific instructions.

**To define the grid columns:**

1. Return to the `pc_grids.css` file in your editor.
2. At the bottom of the style sheet, add the following style rule to place a red dashed outline around every child of the `body` element:

```
body > * {
 outline: 2px dashed red;
}
```

3. Add the following style rule to place a blue dashed outline around every child of the `section` element:

```
section > * {
 outline: 2px dashed blue;
}
```

Figure 3–45 highlights the code for the style rules.

**Figure 3–45****Adding outlines to grid items**

```
section {
 display: grid;
 grid-template-columns: repeat(2, 1fr);
}

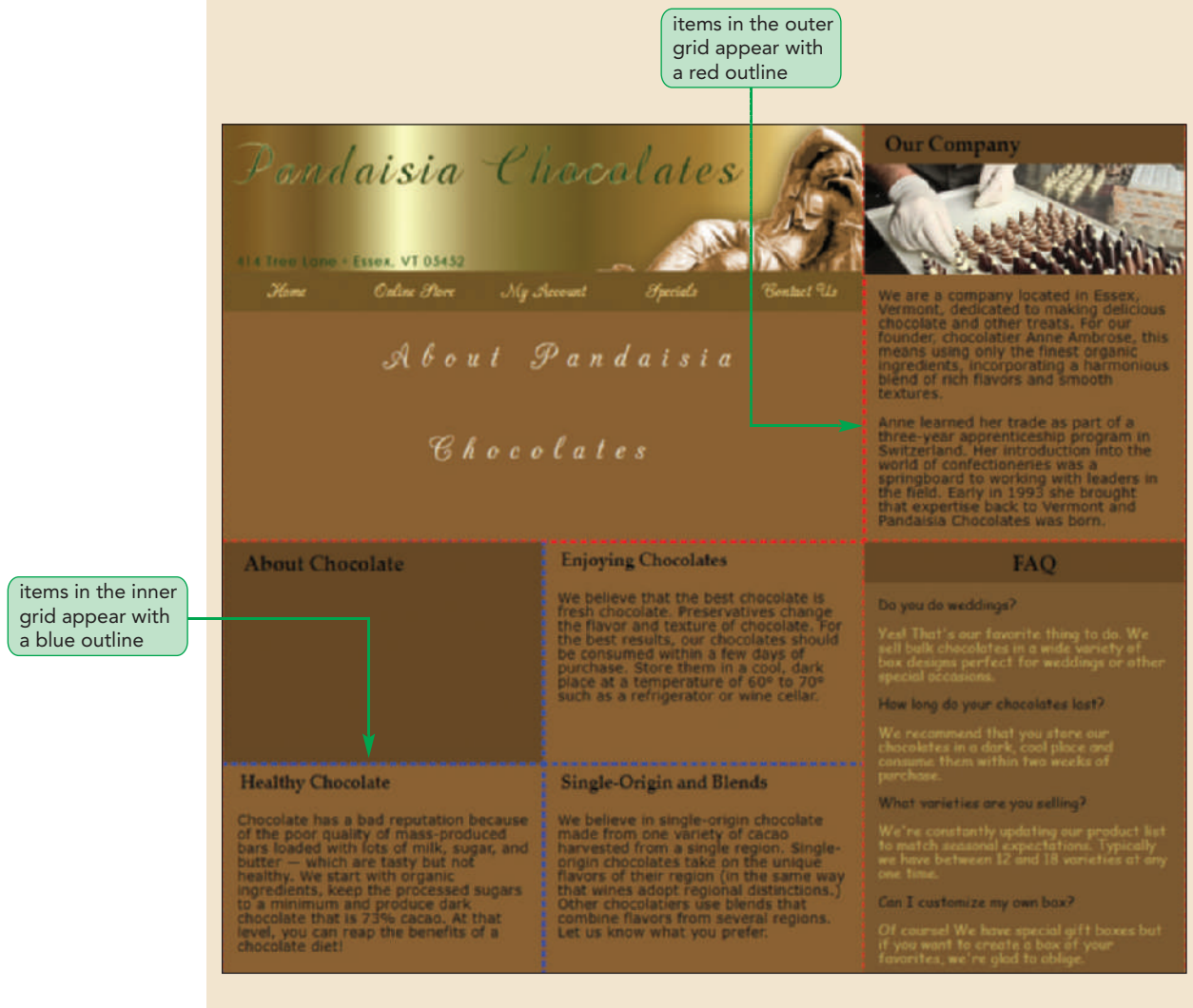
body > * {
 outline: 2px dashed red;
}

section > * {
 outline: 2px dashed blue;
}
```

4. Save your changes to the file and then reload `pc_about.html` in your browser. Figure 3–46 shows the outlines around both the outer and inner grids.

Figure 3–46

Web page with grid items outlined

Twin Design/  
Shutterstock.com

Adding an outline makes it clear how each item is placed within the grid. Next you will change the location and sizes of the grid items to match Anne's proposed layout.

## Placing Items within a Grid

By default, grid items are laid out in document order going from left to right and up to down, with each item placed within a single cell. Thus, the page header in Figure 3–46, being the first item in the grid, appears in the first row and column. The next item, an article about the company, occupies the cell in the second column of the first row. Subsequent items are placed in cells in the next rows filling the grid until the last item is reached, which in this case is the page footer. In many layouts however, you might want to move items around or have a single item occupy multiple rows and columns.

### Defining Grids with CSS

- To assign a CSS grid to an element, use the property  
`display: grid;`
- To define the number of rows and columns within the grid, use the properties  
`grid-template-rows: height1 height2 ...;`  
`grid-template-columns: width1 width2 ...;`  
 where *height1*, *height2*, *width1*, *width2*, etc. define the row heights or column widths.
- To place an element within a specific intersection of grid rows and columns, use the properties  
`grid-row-start: integer;`  
`grid-row-end: integer;`  
`grid-column-start: integer;`  
`grid-column-end: integer;`  
 where *integer* defines the starting and ending row or column that contains the content.
- To more compactly set the location of the element within the grid, use the properties  
`grid-row: start/end;`  
`grid-column: start/end;`  
 where *start* and *end* are the starting and ending coordinates of the row and columns containing the element.

## Placing Items by Row and Column

To move a grid item to a specific location within the grid, use the following `grid-row` and `grid-column` properties:

```
grid-row: row;
grid-column: column;
```

where *row* is the row number and *column* is the column number. Thus, to place the article element in a **grid cell** located in the first row and second column of the grid, apply the following style rule:

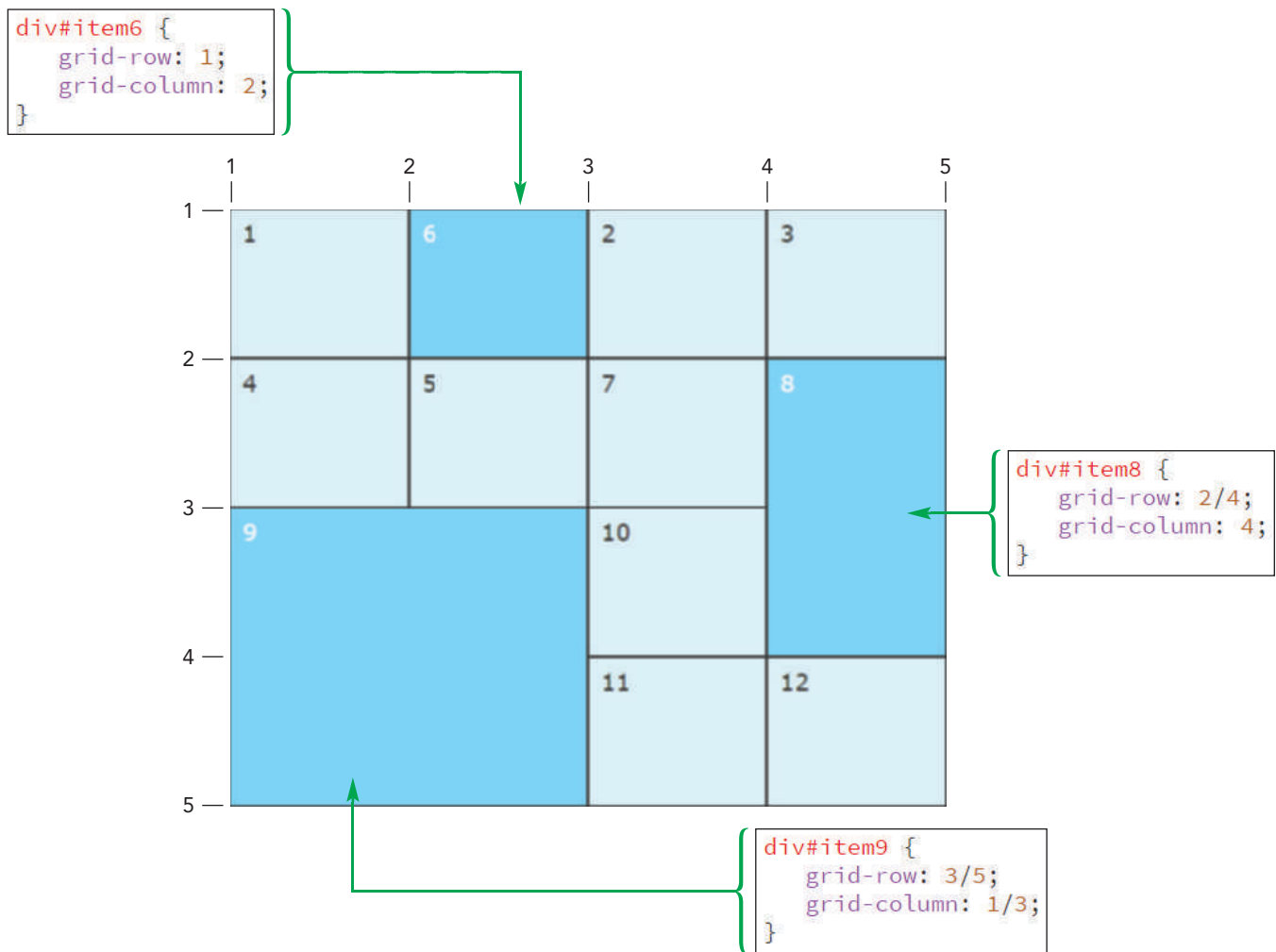
```
article {
 grid-row: 1;
 grid-column: 2;
}
```

To extend a grid item so that it covers multiple rows or multiple columns, include the starting and ending gridline in the style property as follows:

```
grid-row: start/end;
grid-column: start/end;
```

where *start* is the starting gridline and *end* is the ending gridline. Figure 3–47 shows a page layout in which grid items 6, 8, and 9 have been moved and resized using the `grid-row` and `grid-column` properties. For example, item 6 is moved to the first row and second column of the grid while items 8 and 9 have been resized to cover multiple rows and/or columns. The other items in the grid are placed in their default locations and sized to fit within a single grid cell.

Figure 3–47 Placing items within a grid layout



Starting and ending gridlines can also be expressed in the following four properties:

```
grid-column-start: integer;
grid-column-end: integer;
grid-row-start: integer;
grid-row-end: integer;
```

so that the style rule `grid-column: 2/5` is equivalent to:

```
grid-column-start: 2;
grid-column-end: 5;
```

Which approach you use is a matter of personal preference.

You can also use negative gridline numbers (shown earlier in Figure 3–33) to extend an item from the first gridline to the last. Recall that since the last column or row gridline has a value of `-1`, the expression

```
grid-column: 1/-1;
```

would extend the grid item across the entire row from the first gridline to the last. Similarly, the expression

```
grid-row: 1/-1;
```

would create a grid item that extends across an entire column. Note that this technique only works with explicit grids because in an implicit grid there is no defined last column or row.

## INSIGHT

### Naming Gridlines

Gridline numbers can be difficult and cumbersome to work with, so the CSS grid model also supports **gridline names**, which are descriptive names for row and column gridlines. Gridline names are created by adding a name enclosed within square brackets into the `grid-template-columns` or `grid-template-rows` style. For example, the following style creates a grid with three columns and four column gridlines named `row-start`, `main-start`, `main-end`, and `row-end`.

```
grid-template-columns: [row-start] 50px [main-start] 250px
 [main-end] 100px [row-end];
```

To extend a grid item across the entire row, you could apply the style:

```
grid-column: 1/4;
```

or

```
grid-column: row-start/row-end;
```

An article could be placed within the center grid column with the style:

```
grid-column: main-start/main-end;
```

Gridline names can make your CSS code easier to interpret and manage and can be more easily updated if you insert additional rows or columns within your grid layout.

## Using the span Keyword

Another way of setting the size of a grid cell is with the `span` keyword. The general syntax is:

```
grid-row: span value;
grid-column: span value;
```

where *value* is the number of rows or columns covered by the item. The following style rule extends the `article` element across 2 rows and 3 columns of the grid.

```
article {
 grid-row: span 2;
 grid-column: span 3;
}
```

To specify both the location and the size of the item, include the starting gridline in the style rule. The following style rule places the `article` element in the first row and fourth column of the grid while spanning two rows and three columns from that location.

```
article {
 grid-row: 1/span 2;
 grid-column: 4/span 3;
}
```

In Anne's proposed layout, the page header should occupy a single row, extending from the first column to the last. Use the `grid-column` style rule now to display the body header across the first row of the grid.

**To place the body header across the first row:**

1. Return to the **pc\_grids.css** file in your editor.
2. Directly below the style rule for the **body** element, insert the following style rule as shown in Figure 3–48.

```
body > header {
 grid-row: 1;
 grid-column: 1/-1;
}
```

**Figure 3–48****Spanning the body header across the grid row**

header placed in the first grid row

```
body {
 display: grid;
 grid-template-columns: 2fr 1fr;
}

body > header {
 grid-row: 1;
 grid-column: 1/-1;
}
```

body header extends from the first gridline to the last

number of the first gridline

number of the last gridline

3. Save your changes to the file and reload **pc\_about.html** in your browser. The body header extends across the first row of the grid (see Figure 3–49.)

**Figure 3–49****Body header in the first row**

body header occupies the first row

*Pandaisia Chocolates*

414 Tree Lane • Essex, VT 05452

*Home Online Store My Account Specials Contact Us*

*About Pandaisia Chocolates*

*Our Company About Chocolate Enjoying Chocolates*

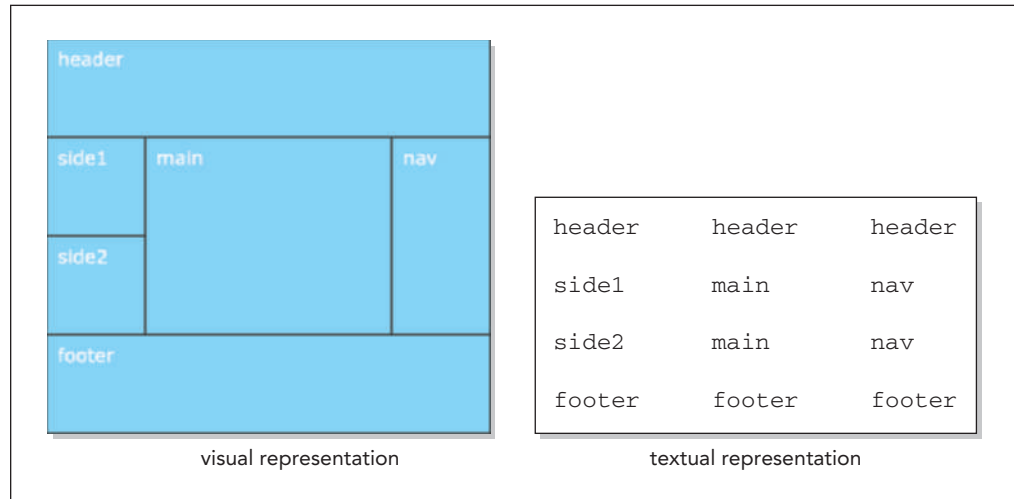
Gridlines are a quick and effective method of placing and sizing grid items, but they can be confusing when applied to a grid of several rows and columns. An easier and more intuitive approach is to use grid areas.

## Placing Grid Items by Area

In the grid areas approach to layout you identify sections of the grid with item names, creating a textual representation of the layout. Figure 3–50 shows a grid of four rows and three columns in which several items span multiple rows and columns, represented both visually as it would appear on the web page and textually.

Figure 3–50

### Mapping out grid areas



To create a textual representation in a style sheet, use the following `grid-template-areas` property:

```
grid-template-areas: "row1"
 "row2"
 ...;
```

where *row1*, *row2*, etc. are text strings containing the names of the areas for each row. Thus, to create the grid layout shown in Figure 3–50, you would enter the style:

```
grid-template-areas: "header header header"
 "side1 main nav"
 "side2 main nav"
 "footer footer footer";
```

You will add a `grid-template-areas` property to the style sheet, representing the layout Anne proposed in Figure 3–36.

### To place the body header across the first row:

1. Return to the `pc_grids.css` file in your editor.
2. Within the style rule for the body element, insert the following style:

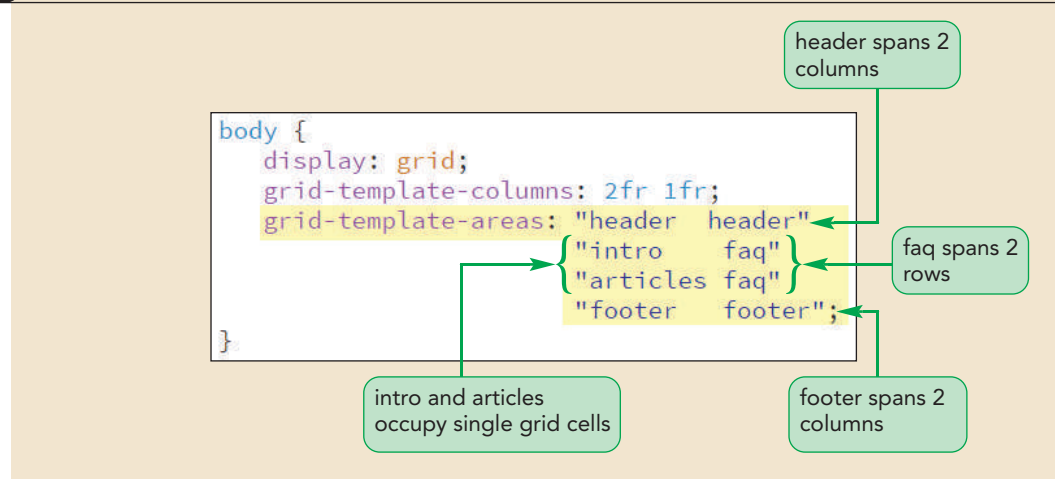
```
grid-template-areas: "header header"
 "intro faq"
 "articles faq"
 "footer footer";
```

See Figure 3–51.

Make sure you enclose each row of the grid layout within a set of quotation marks.

Figure 3–51

## Defining areas for the outer grid



To assign elements to grid areas, use the following `grid-area` property:

```
grid-area: area;
```

where *area* is the name of an area defined in the `grid-template-areas` property. Use the `grid-area` property now to assign elements from the web page to areas within the grid.

### To assign the page elements to grid areas:

1. Below the `body > header` style rule, add the following style to assign the `article` element to the `intro` grid area.  

```
body > article {grid-area: intro;}
```
2. Place the `aside` element in the `faq` grid area with the style:  

```
body > aside {grid-area: faq;}
```
3. Place the `section` element in the `articles` grid area with the style:  

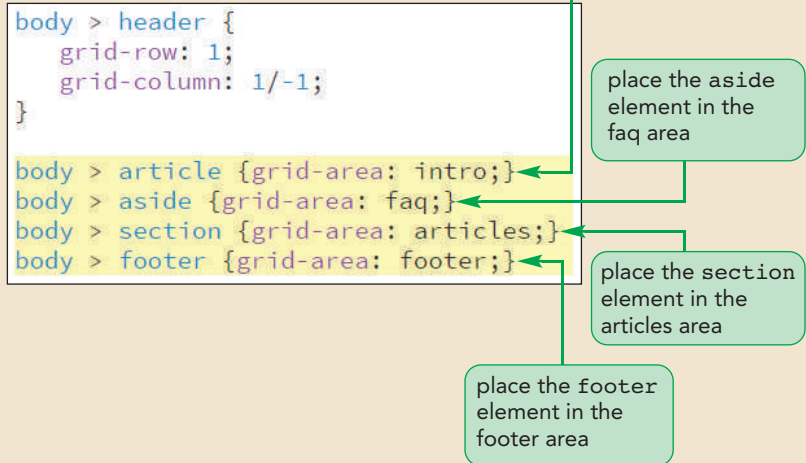
```
body > section {grid-area: articles;}
```
4. Place the `body footer` element in the `footer` grid area using the style:  

```
body > footer {grid-area: footer;}
```

Figure 3–52 highlights the newly added code.

Figure 5–52

## Assigning elements to grid areas



The `grid-area` property can also be used as a shorthand to place and size grid items using gridline numbers. The general syntax is:

```
grid-area: row-start/col-start/row-end/col-end;
```

where *row-start*, *col-start*, *row-end*, and *col-end* are the starting and ending gridline numbers from the grid's rows and columns. For example, the following expression places the grid item to extend from the first row gridline through the fourth and from the third column gridline through the fifth.

```
grid-area: 1/3/4/5;
```

The only remaining part of the About Pandaisia web page that needs to be placed within the layout is the “About Chocolate” `h1` heading that appears in the nested grid. Anne wants this heading to extend across two columns in the first row of that grid. Add a style rule to place the heading now.

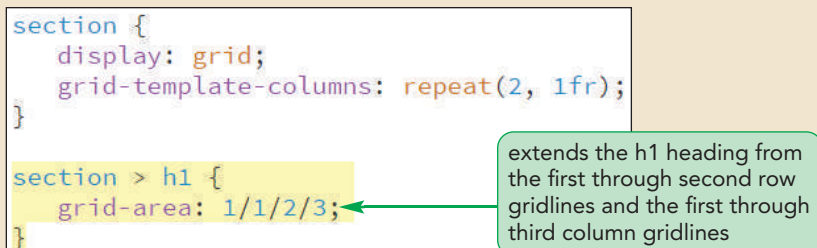
**To place the `h1` heading:**

1. Below the style rule for the `section` element, add the following rule to place the `h1` heading:

```
section > h1 {
 grid-area: 1/1/2/3;
}
```

See Figure 3–53.

Figure 3–53

Placing the `h1` heading

2. Save your changes to the `pc_grids.css` file and then reload the `pc_about.html` file in your browser. Figure 3–54 shows the complete layout of the page.

Figure 3–54

About Pandaisia web page

Twin Design/Shutterstock.com



3. Return to the `pc_grids.css` file in your text editor.
4. Remove the two style rules that create the red and blue dashed outlines and then save your changes to the file.
5. Reload the `pc_about.html` file in your browser and confirm that the grid outlines are removed from the rendered page.

Compare the appearance of the page content in Figure 3–54 with the schematic diagram shown earlier in Figure 3–36 to see how using a grid provided a unified layout for the page. As you become more experienced with setting up and applying grids, you can move to more intricate and dynamic page layouts.

## INSIGHT

### Generating Content with Lorem Ipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer nec odio. Praesent libero. Sed cursus ante dapibus diam. Sed nisi. Nulla quis sem at nibh elementum imperdiet. Duis sagittis ipsum. Vestibulum lacinia arcu eget nulla. Sed dignissim lacinia nunc.

That previous paragraph is an example of **lorem ipsum**, which is nonsensical, improper Latin commonly used in page design as filler text. Rather than creating large portions of sample text before you can view your layout, lorem ipsum is used to quickly generate sentences, lines, and paragraphs that resemble the structure and appearance of real text. Lorem ipsum is a particularly useful tool for web designers because they can begin working on page design without waiting for their clients to supply all the page content.

Many popular web editors include tools to generate lorem ipsum text strings in a wide variety of formats and styles. There are also lorem ipsum generators freely available on the web that supplement the lorem ipsum text with HTML markup tags.

## Defining the Grid Gap

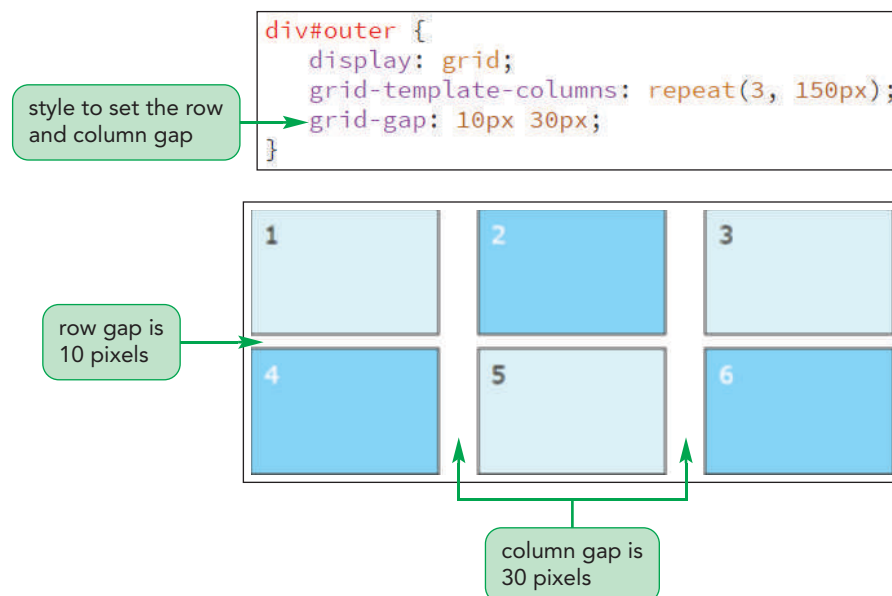
Another part of grid layout is defining the space between items in a grid. So far, all our layouts have assumed no spacing, but many layouts include interior spaces to allow each item “room to breathe.” The gap size is defined using the following `grid-gap` property:

```
grid-gap: row column;
```

where *row* is the internal space between grid rows and *column* is the internal space between grid columns. Figure 3–55 shows a grid layout in which the rows are separated by a 10-pixel space and the columns by a space of 30 pixels.

Figure 3–55

### Setting the grid gap



You can also set the grid gaps for rows and columns using the following properties:

```
grid-column-gap: value;
grid-row-gap: value;
```

where *value* is the size of the gap in one of the CSS units of measure. Anne wants you to add a 15-pixel column gap to the About Pandaisia web page but leave the row gap at its default value of 0 pixels.

### To set the size of the column gap:

1. Return to the **pc\_grids.css** file in your editor.
2. Within the style rule for the body element, add the following property to set the column gap size as shown in Figure 3–56.

```
grid-column-gap: 15px;
```

Figure 3–56

### Setting the size of the column gap

```
body {
 display: grid;
 grid-template-columns: 2fr 1fr;
 grid-template-areas: "header header"
 "intro faq"
 "articles faq"
 "footer footer";
 grid-column-gap: 15px;
}
```

interior space between  
columns set to 15 pixels

3. Save your changes to the file then reload the **pc\_about.html** file in your browser. As shown in Figure 3–57, the gap between the first and second columns is set to 15 pixels.

Figure 3–57

### Gap between the first and second columns



15-pixel gap  
between columns

4. You've completed your work on the web page. Close the **pc\_about.html** and **pc\_grids.css** files.

Note that, unlike margins, the gap size setting is applied only to the interior space between the grid items and not to the exterior space between the grid items and the edge of the grid container.

## Managing Space within a Grid

The `grid-gap` property allows you to define the space between grid items. CSS includes other properties to manage the space around the content of each grid cell. By default, there is no space between the grid cell borders and the grid cell content. However, you can position the content within the grid cell using the `align-items` and `justify-items` properties. The `align-items` property sets the vertical placement of the content, while the `justify-items` property sets the horizontal placement. The syntax of both properties is:

```
align-items: placement;
justify-items: placement;
```

where *placement* is:

- `stretch` to expand the content between the top/bottom or left/right edges, removing any spacing between the content and the cell border (the default)
- `start` to position the content with the top or left edge of the cell
- `end` to position the content with the bottom or right edge of the cell
- `center` to center the content vertically or horizontally within the cell

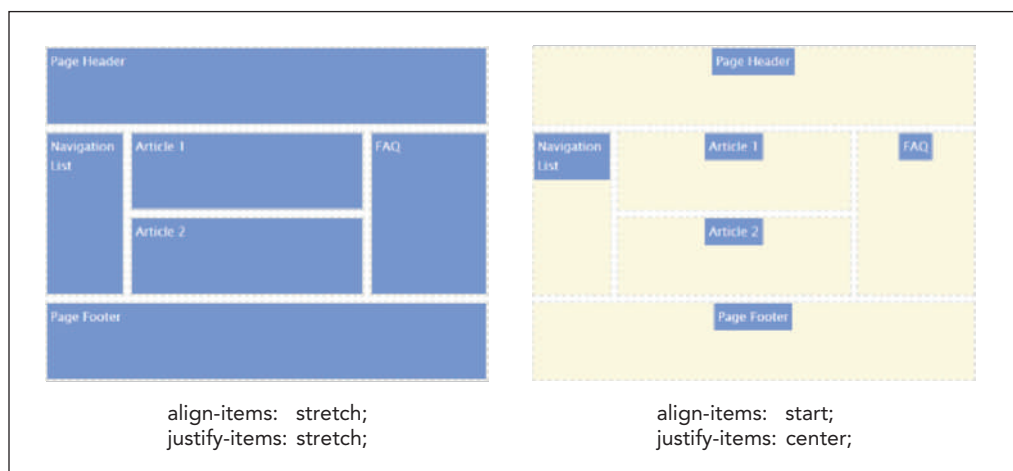
### TRY IT

You can explore the `align-items` and `justify-items` properties using the `demo_grid1.html` file from the `html03 ▶ demo` folder.

Figure 3–58 shows the impact of the `align-items` and `justify-items` properties on the placement of the content within each grid cell. By default, there is no spacing between the content and the cell border as the content “stretches” to fill the cell (shown in the grid on the left in the figure). In the grid on the right, the content is placed at the start (top) and horizontal center of the cell and spacing is added between the cell content and the cell borders.

Figure 3–58

Applying the `align-items` and `justify-items` properties



## Alignment for a Single Grid Cell

The `align-items` and `justify-items` properties apply to every cell in the grid. To align and justify only one cell, apply the `align-self` and `justify-self` properties to the content within the grid cell. The placement values are the same as for the `align-items` and `justify-items` properties. For example, the following style rule displays the content of the `article` element in both the horizontal and vertical center of the grid cell.

```
article {
 align-self: center;
 justify-self: center;
}
```

Using the `align-self` and `justify-self` properties is a quick and easy way of centering your content within the web page. Before the introduction of the CSS grid model, this was a difficult task involving a lot of CSS hacks, but now it can be accomplished by simply placing the item within a grid and centering the content both horizontally and vertically.

## Aligning the Grid

In some layouts involving fixed units, the space taken up by the items within the grid will be less than the total space allotted to the grid container itself, creating unused space in the container. By default, the grid will be positioned at the top-left corner of the container, but you can modify that position using the `align-content` and `justify-content` properties:

```
align-content: placement;
justify-content: placement;
```

where *placement* is:

- `start` to position the grid with the top or left edge of the container (the default)
- `end` to position the grid with the bottom or right edge of the container
- `center` to center the grid vertically or horizontally within the container
- `space-around` to insert an even amount of space between each grid item, with half-sized spaces on the far ends
- `space-between` to insert an even amount of space between each grid item, with no space at the far ends
- `space-evenly` to insert an even amount of space between each grid item, including the far ends

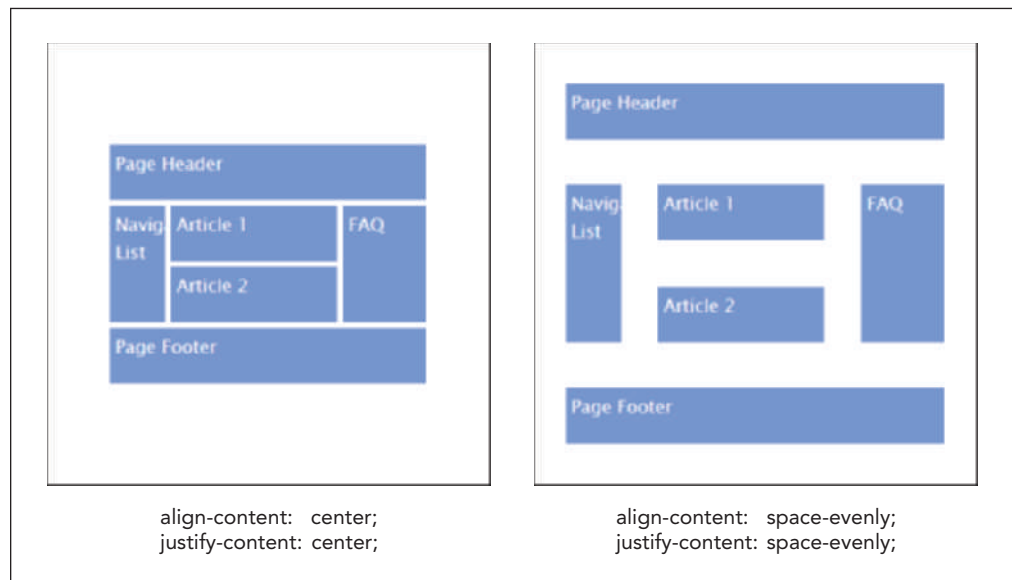
### TRY IT

You can explore the `align-content` and `justify-content` properties using the `demo_grid2.html` file from the `html03 ▶ demo` folder.

As with the other grid properties, the `align-content` property positions the grid vertically within the container and the `justify-content` property moves the grid horizontally. Figure 3–59 shows how the interior space within the grid container can be managed using the `align-content` and `justify-content` properties. In the left grid, the layout is centered both horizontally and vertically within the container. In the right grid, the grid items themselves are positioned evenly within the container.

Figure 3–59

## Applying the align-content and justify-content properties



The `align-content` and `justify-content` properties are useful when you want to center your entire layout within the web page in both the horizontal and vertical directions.



## PROSKILLS

## Written Communication: Getting to the Point with Layout

Page layout is one of the most important aspects of web design. A well-constructed layout naturally guides a reader's eyes to the most important information in the page. You should use the following principles to help your readers quickly get to the point:

- *Guide the eye.* Usability studies have shown that a reader's eye first lands in the top center of the page, then scans to the left, and then to the right and down. Arrange your page content so that the most important items are the first items a user sees.
- *Avoid clutter.* If a graphic or an icon is not conveying information or making the content easier to read, remove it.
- *Avoid overcrowding.* Focus on a few key items that will be easy for readers to locate while scanning the page, and separate these key areas from one another with ample white space. Don't be afraid to move a topic to a different page if it makes the current page easier to understand.
- *Make it manageable.* It's easier for the brain to process information when it's presented in smaller chunks. Break up long extended paragraphs into smaller paragraphs or bulleted lists.
- *Use a grid.* Users find it easier to digest content when it's aligned vertically and horizontally. Using a grid helps you line up your elements in a clear and consistent way.
- *Cut down on distractions.* If you're thinking about using blinking text or a cute animated icon, don't. The novelty of such features wears off very quickly and distracts users from the valuable content.

Always remember that your goal is to convey information to readers, and that an important tool in achieving that is to make it as easy as possible for readers to find that information. A thoughtfully constructed layout is a great aid to effective communication.

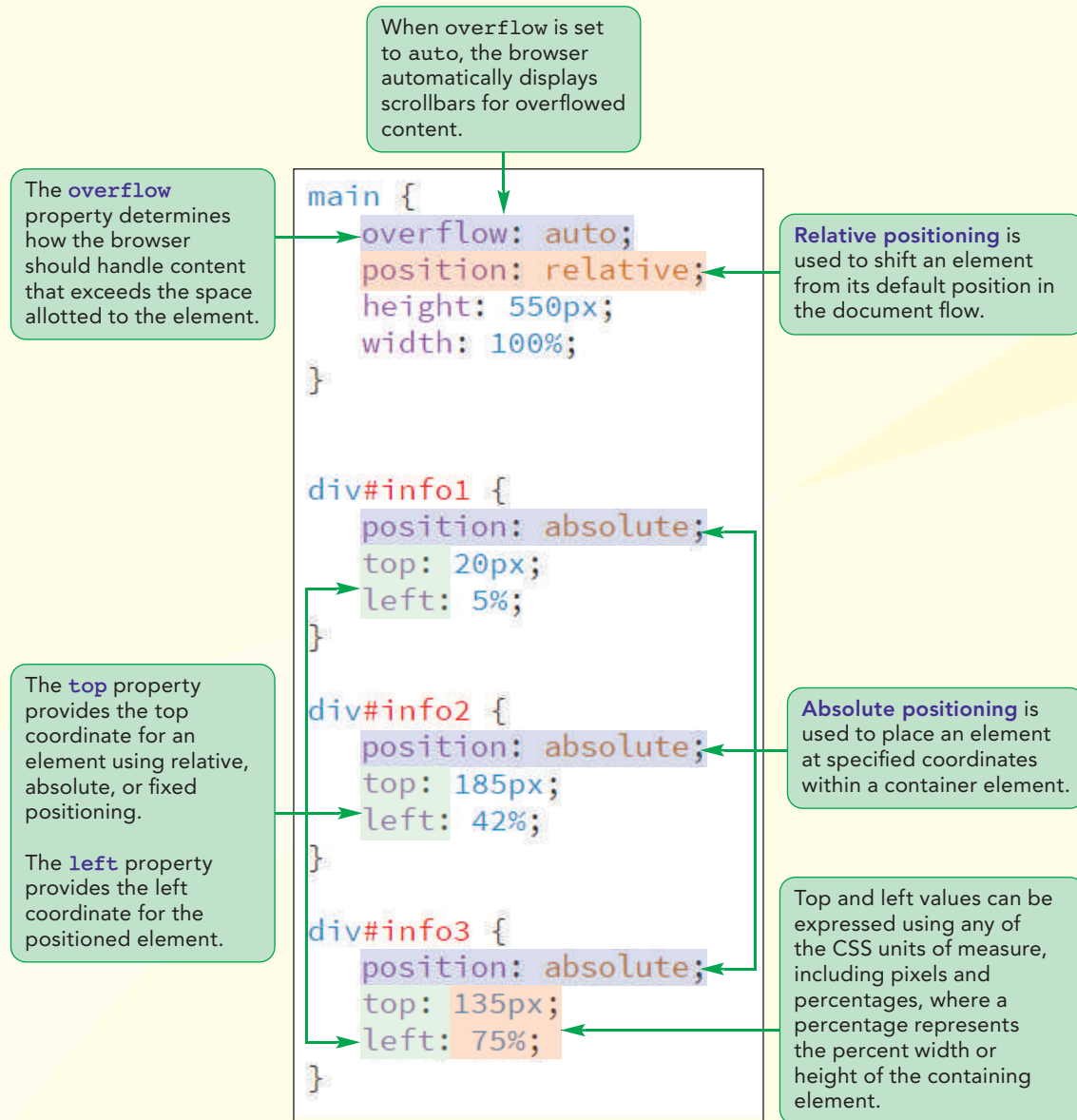
In the next session, you'll explore CSS positioning styles that allow you to place page elements anywhere within the rendered page.

## REVIEW

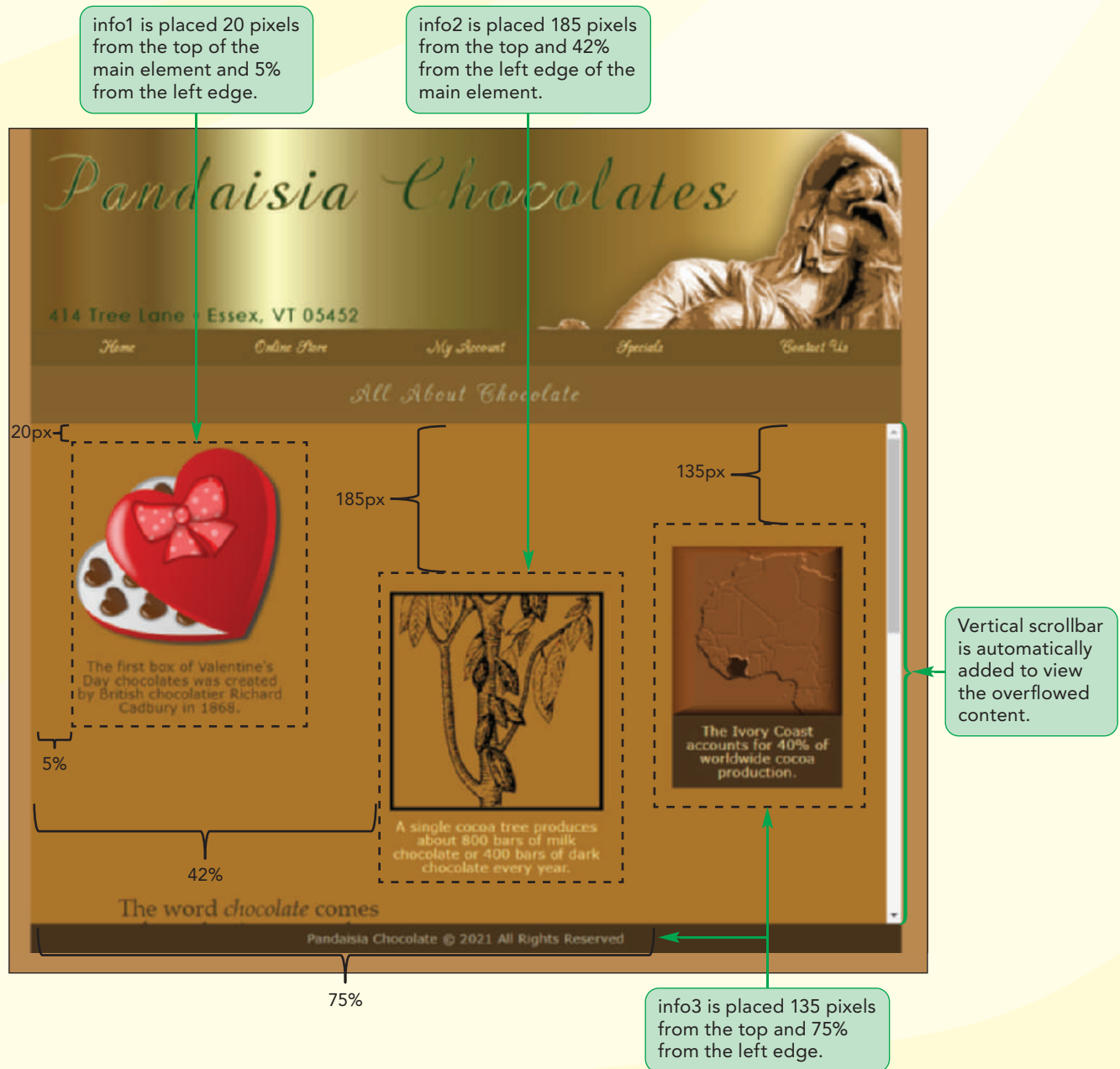
**Session 3.2 Quick Check**

1. To change an element into a grid container, apply the style:
  - a. `display: grid-container;`
  - b. `grid-template-columns: auto;`
  - c. `display: grid;`
  - d. All of the above
2. A fractional unit (fr) is:
  - a. part of a pixel
  - b. a fraction of an em unit
  - c. a fraction of any fixed unit
  - d. used to create elements that expand or contract to fill available space
3. To explicitly define the columns within a grid, use the CSS property:
  - a. `grid-template-columns`
  - b. `grid-columns`
  - c. `columns`
  - d. `grid-auto-columns`
4. To implicitly define the height of grid rows, use:
  - a. `grid-template-rows`
  - b. `grid-rows`
  - c. `rows`
  - d. `grid-auto-rows`
5. To position a grid item in the second row and cover the second and third column, apply the style(s):
  - a. `grid-row: 2;`  
`grid-column: 2/3;`
  - b. `grid-row: 2;`  
`grid-column: 2/4;`
  - c. `row: 2;`  
`column: 2/3;`
  - d. `grid-row: 2;`  
`column-span: 2/2;`
6. To define a grid layout with areas, use the property:
  - a. `grid-areas`
  - b. `grid-area`
  - c. `grid-template-areas`
  - d. `grid-areas-template`
7. To place an element in the grid area named "intro", apply the style:
  - a. `grid-area: intro;`
  - b. `grid-template-areas: "intro";`
  - c. `area: intro;`
  - d. All of the above
8. To set the space between grid columns to 15 pixels and the space between grid rows to 10 pixels, apply the style:
  - a. `gap: 10px 15px;`
  - b. `grid-gap: 10px 15px;`
  - c. `grid-gap: 15px/10px;`
  - d. `gap: 15px/10px;`
9. To horizontally center the content of a grid cell, apply the style:
  - a. `align-content: center;`
  - b. `align-self: center;`
  - c. `justify-self: center;`
  - d. `justify-content: center;`

## Session 3.3 Visual Overview:



# Layout with Positioning Styles



## Positioning Objects

In the last session, you developed a layout in which page objects were strictly aligned according to the rows and columns of a grid. While a grid layout gives a page a feeling of uniformity and structure, it does limit your freedom to place objects at different locations within the page. In this session, you'll explore how to "break out" of the grid using the CSS positioning styles.

### The CSS Positioning Styles

CSS supports several properties to place objects at specific coordinates within the page or within their container. To place an element at a specific position within its container, you use the following style properties

```
position: type;
top: value;
right: value;
bottom: value;
left: value;
```

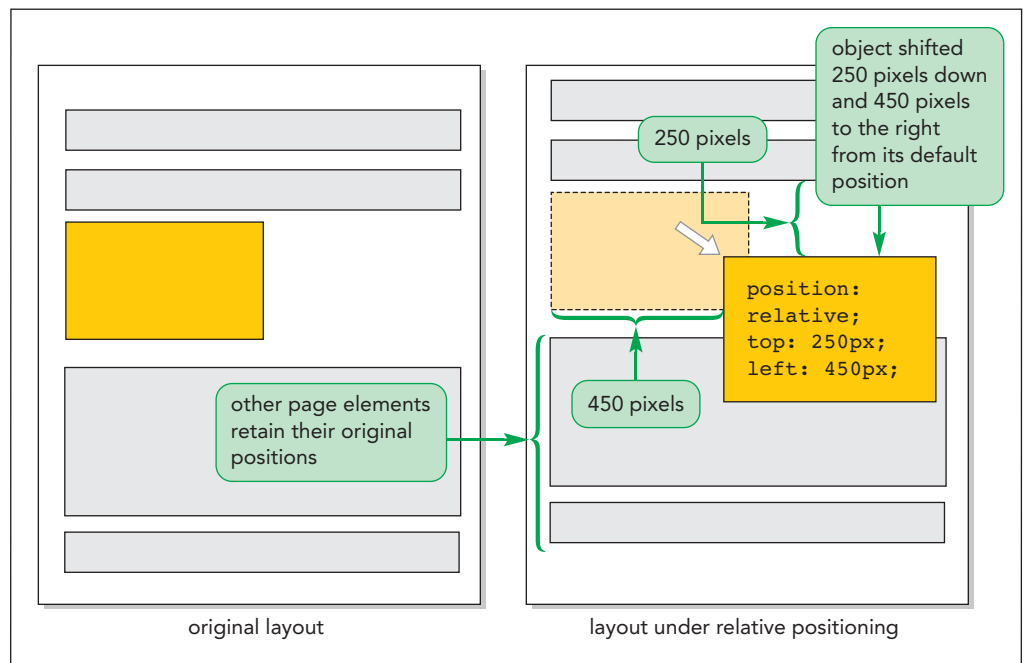
where *type* indicates the kind of positioning applied to the element, and the *top*, *right*, *bottom*, and *left* properties indicate the coordinates of the top, right, bottom, and left edges of the element, respectively. The coordinates can be expressed in any of the CSS measuring units or as a percentage of the container's width or height.

CSS supports five kinds of positioning: *static* (the default), *relative*, *absolute*, *fixed*, and *inherit*. In **static positioning**, the element is placed where it would have fallen naturally within the flow of the document. This is essentially the same as not using any CSS positioning at all. Browsers ignore any values specified for the *top*, *left*, *bottom*, or *right* properties under static positioning.

### Relative Positioning

Relative positioning is used to nudge an element out of its normal position in the document flow. Under relative positioning, the *top*, *right*, *bottom*, and *left* properties indicate the extra space that is placed alongside the element as it is shifted into a new position. For example, the following style rule adds 250 pixels of space to the top of the element and 450 pixels to the left of the element, resulting in the element being shifted down and to the right (see Figure 3–60):

```
div {
 position: relative;
 top: 250px;
 left: 450px;
}
```

**Figure 3–60** Moving an object using relative positioning

Note that the layout of the other page elements are not affected by relative positioning; they will still occupy their original positions on the rendered page, just as if the object had never been moved at all.

Relative positioning is sometimes used when the designer wants to “tweak” the page layout by slightly moving an object from its default location to a new location that fits the overall page design better. If no `top`, `right`, `bottom`, or `left` values are specified with relative positioning, their assumed values are 0 and the element will not be shifted at all.

## Absolute Positioning

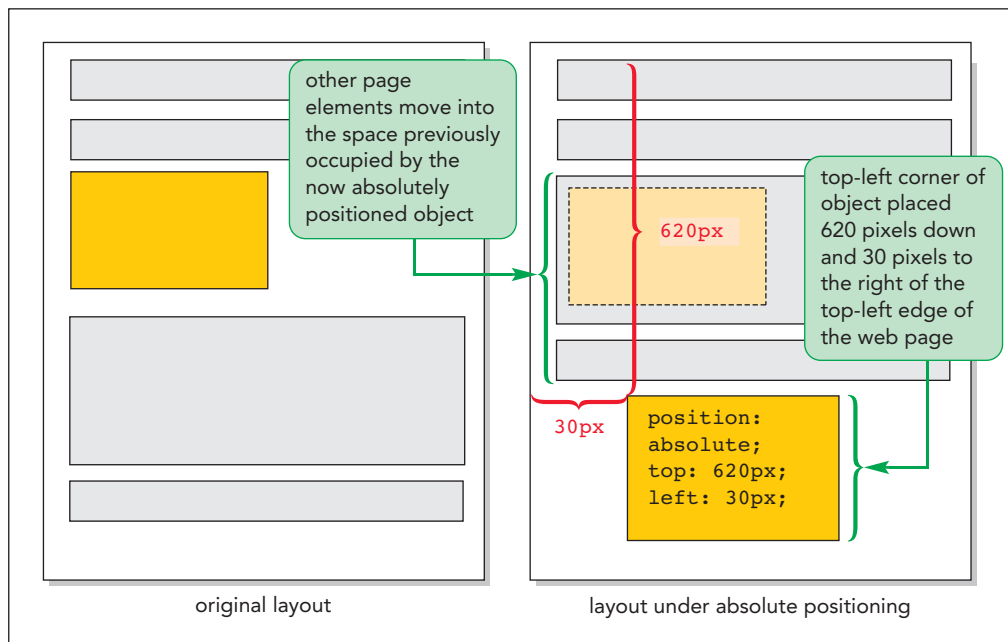
Absolute positioning places an element at specific coordinates within a container where the `top` property indicates the position of the element’s top edge, the `right` property sets the position of the right edge, the `bottom` property sets the bottom edge position, and the `left` property sets the position of the left edge.

For example, the following style rule places the `header` element 620 pixels from the top edge of its container and 30 pixels from the left edge (see Figure 3–61).

### TIP

To place an element at the bottom right corner of its container, use absolute positioning with the `right` and `bottom` values set to 0 pixels.

```
header {
 position: absolute;
 top: 620px;
 left: 30px;
}
```

**Figure 3–61** Moving an object using absolute positioning

To place an object with absolute positioning, you use either the top/left coordinates or the bottom/right coordinates, but you don't use all four coordinates at the same time because that would confuse the browser. For example an object cannot be positioned along both the left and right edge of its container simultaneously.

As with floating an element, absolute positioning takes an element out of normal document flow with subsequent elements moving into the space previously occupied by the element. This can result in an absolutely positioned object overlapping other page elements.

### TRY IT

You can explore positioning styles using the file `demo_positioning.html` from the `html04 ▶ demo` folder.

The interpretation of the coordinates of an absolutely positioned object are all based on the edges of the element's container. Thus the browser needs to "know" where the object's container is before it can absolutely position objects within it. If the container has been placed using a `position` property set to `relative` or `absolute`, the container's location is known and the coordinate values are based on the edges of the container. For example the following style rules place the `article` element at a coordinate that is 50 pixels from the top edge of the section element and 20 pixels from the left edge.

```
section {
 position: relative;
}
section > article {
 position: absolute;
 top: 50px;
 left: 20px;
}
```

Note that you don't have to define coordinates for the `section` element as long as you've set its position to `relative`.

The difficulty starts when the container has not been set using `relative` or `absolute` positioning. In that case, the browser has no context for placing an object within the container using absolute positioning. As a result, the browser must go up a level in the hierarchy of page elements, that is, to the container's container. If that container has been placed with absolute or relative positioning, then any object nested within it

can be placed with absolute positioning. For example, in the following style rule, the position of the `article` element is measured from the edges of the `body` element, not the `section` element:

```
body {position: absolute;}

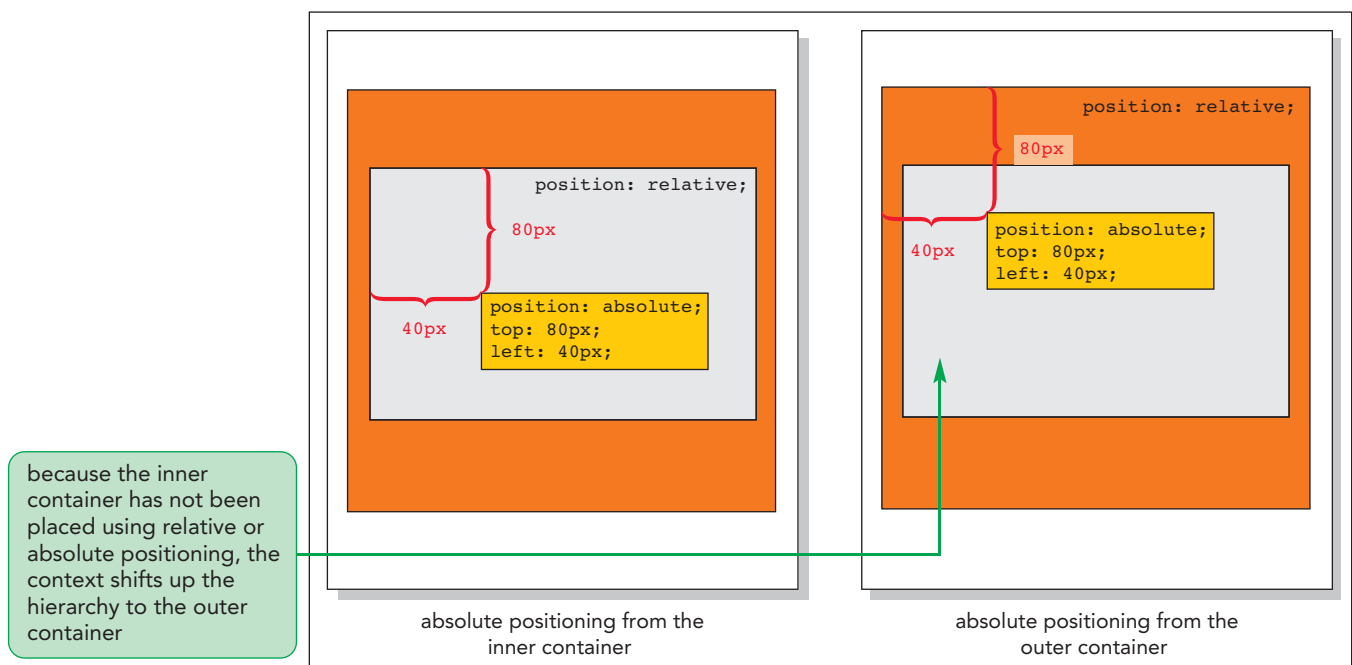
body > section {position: static;}

body > section > article {
 position: absolute;
 top: 50px;
 left: 20px;
}
```

**TIP**

If all of the objects within a container are placed using absolute positioning, the container will have no content and will collapse.

Proceeding in this fashion the browser will continue to go up the hierarchy of elements until it finds a container that has been placed with absolute or relative positioning or it reaches the root `html` element. If it reaches the `html` element, the coordinates of any absolutely positioned object are measured from the edges of the browser window itself. Figure 3–62 shows how the placement of the same object can differ based on which container supplies the context for the `top` and `left` values.

**Figure 3–62****Context of the top and left coordinates**

Coordinates can be expressed in percentages as well as pixels. Percentages are used for flexible layouts in which the object should be positioned in relation to the width or height of its container. Thus, the following style rule places the `article` element halfway down and 30% to the right of the top-left corner of its container.

```
article {
 position: absolute;
 top: 50%;
 left: 30%;
}
```

As the container of the article changes in width or height, the article's position will automatically change to match.

## Fixed and Inherited Positioning

When you scroll through a document in the browser window, the page content scrolls along. If you want to fix an object within the browser window so that it doesn't scroll, you can set its `position` property to `fixed`. For example, the following style rule keeps the footer element at a fixed location, 10 pixels up from the bottom of the browser window:

```
footer {
 position: fixed;
 bottom: 10px;
}
```

Note that a fixed object might cover up other page content, so you should use it with care in your page design.

Finally, you can set the `position` property to `inherit` so that an element inherits the position value of its parent element.

### REFERENCE

#### Positioning Objects with CSS

- To shift an object from its default position, use the properties

```
position: relative;
top: value;
left: value;
bottom: value;
right: value;
```

where *value* is the distance in one of the CSS units of measure that the object should be shifted from the corresponding edge of its container.

- To place an object at a specified coordinate within its container, use the properties

```
position: absolute;
top: value;
left: value;
bottom: value;
right: value;
```

where *value* is a distance in one of the CSS units of measure or a percentage of the container's width or height.

- To fix an object within the browser window so that it does not scroll with the rest of the document content, use the property

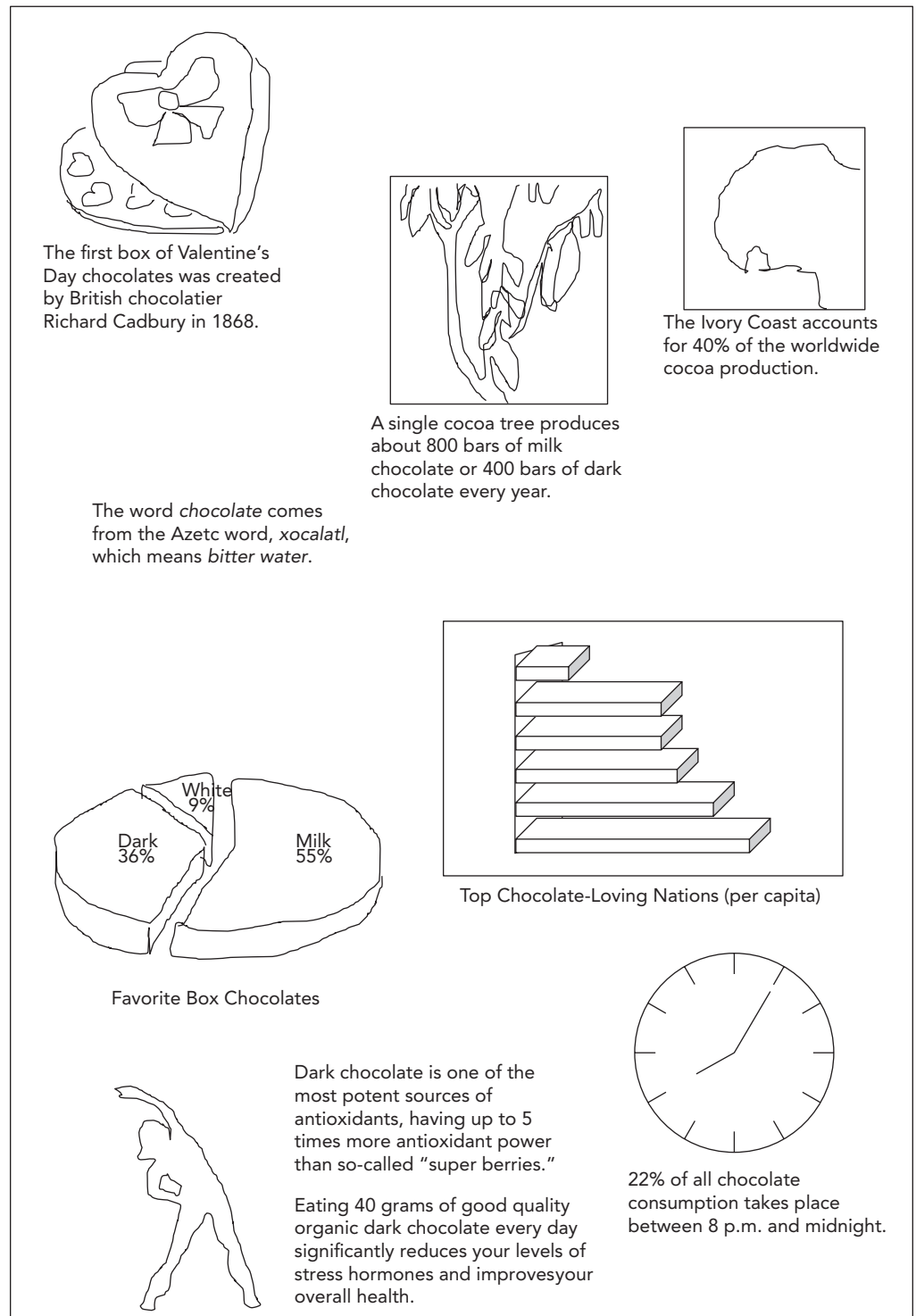
```
position: fixed;
```

## Using the Positioning Styles

Anne wants you to work on the layout for a page that contains an infographic on chocolate. She sketched the layout of the infographic page, as shown in Figure 3–63.

Figure 3–63

## Proposed layout of the chocolate infographic



Because the placement of the text and figures do not line up nicely within a grid, you'll position each graphic and text box using the CSS positioning styles. Anne has already created the content for this page and written the style sheets to format the appearance of the infographic. You will write the style sheet to layout the infographic contents using the CSS positioning styles.

### To open the infographic file:

1. Use your editor to open the **pc\_info\_txt.html** file from the html03 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save the document as **pc\_info.html**.
2. Directly after the `title` element, insert the following `link` elements to attach the file to the `pc_reset.css`, `pc_styles3.css`, and `pc_info.css` style sheets.
 

```
<link href="pc_reset.css" rel="stylesheet" />
<link href="pc_styles3.css" rel="stylesheet" />
<link href="pc_info.css" rel="stylesheet" />
```
3. Take some time to study the structure and content of the `pc_info.html` document. Note that Anne has placed eight information graphics, each within a separate `div` element with a class name of `infobox` and an `id` name ranging from `info1` to `info8`.
4. Close the file, saving your changes.

Next, you'll start working on the `pc_info.css` file, which will contain the positioning and other design styles for the objects in the infographic. You will begin by formatting the `main` element, which contains the infographics. Because you'll want the position of each infographic to be measured from the top-left corner of this container, you will place the `main` element with relative positioning and extend the height of the container to 1400 pixels so that it can contain all eight of the graphic elements.

### To format the main element:

1. Use your editor to open the **pc\_info\_txt.css** file from the html03 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save the document as **pc\_info.css**.
2. Go to the Main Styles section and insert the following style rule to format the appearance of the `main` element:

```
main {
 position: relative;
 height: 1400px;
 width: 100%;
}
```

It will be easier to see the effect of placing the different `div` elements if they are not displayed until you are ready to position them. Add a rule to hide the `div` elements, then as you position each element, you can add a style rule to redisplay it.

3. Directly before the Main Styles section, insert the following style rule to hide all of the `infoboxes`:
 

```
div.infobox {display:none;}
```

Figure 3–64 highlights the newly added code in the style sheet.

When you want to position objects in an exact or absolute position within a container, set the `position` property of the container to `relative`.

Figure 3–64

## Setting the display styles of the main element

hides the div elements of the infobox class

```
div.infobox {display:none;}
```

sets the height of the main element to 1400 pixels and makes it the width of the page body

```
/* Main Styles */

main {
 position: relative;
 height: 1400px;
 width: 100%;
}
```

places the main element using relative positioning

4. Save your changes to the file and then open the `pc_info.html` file in your browser. Verify that the browser shows an empty box, about 1400 pixels high, where the infographic will be placed.

Next, you will add a style rule for all of the information boxes so that they are placed within the `main` element using absolute positioning.

## To position the information boxes:

1. Return to the `pc_info.css` file in your editor and scroll down to the Infographic Styles section.
2. Add the following style rule to set the position type of all of the information boxes.

```
div.infobox {
 position: absolute;
}
```

3. Within the First Infographic section, add the following style rule to position the first information box 20 pixels from the top edge of its container and 5% from the left edge.

```
div#info1 {
 display: block;
 top: 20px;
 left: 5%;
}
```

Note that we set the `display` property to `block` so that the first information box is no longer hidden on the page. Figure 3–65 highlights the style rules for all of the information boxes and the placement of the first information box.

Figure 3–65

## Placing the first information box

```

/* Infographic Styles */

div.infobox {
 position: absolute;
}

/* First Infographic */

div#info1 {
 display: block;
 top: 20px;
 left: 5%;
}

```

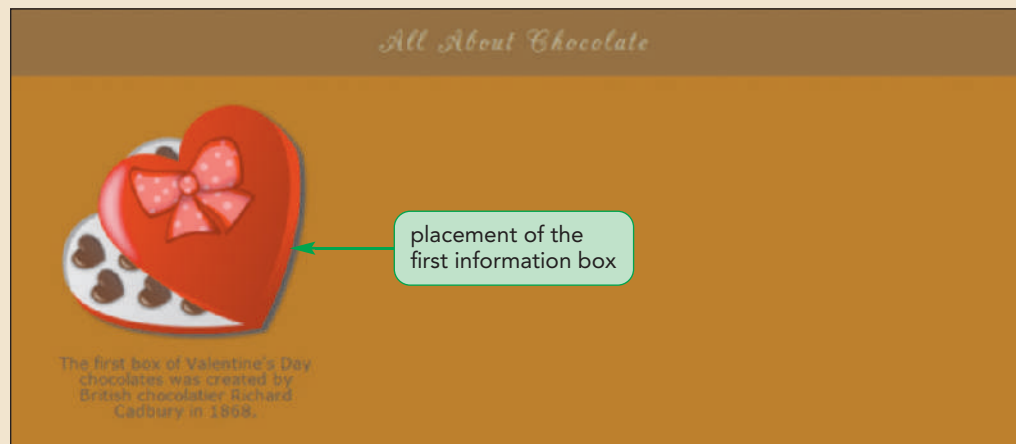
places every  
information box  
using absolute  
positioning

places the first box  
20 pixels from the  
top edge of the  
main element and  
5% from the left

4. Save your changes to the file and then reload the `pc_info.html` file in your browser. Figure 3–66 shows the placement of the first information box.

Figure 3–66

## Appearance of the first information box



Now place the second and third information boxes.

## To place the next two boxes:

1. Return to the `pc_info.css` file in your editor and go to the Second Infographic section.
2. Add the following style rule to place the second box 185 pixels down from the top of the container and 42% from the left edge.

```

div#info2 {
 display: block;
 top: 185px;
 left: 42%;
}

```

3. Within the Third Infographic section insert the following style rule to place the third box 135 pixels from the top edge and 75% of the width of its container from the left edge.

```
div#info3 {
 display: block;
 top: 135px;
 left: 75%;
}
```

Figure 3–67 highlights the style rules to position the second and third information boxes.

Figure 3–67

## Positions of the second and third boxes

places the second box 185 pixels from the top and 42% from the left

```
/* Second Infographic */
div#info2 {
 display: block;
 top: 185px;
 left: 42%;
}

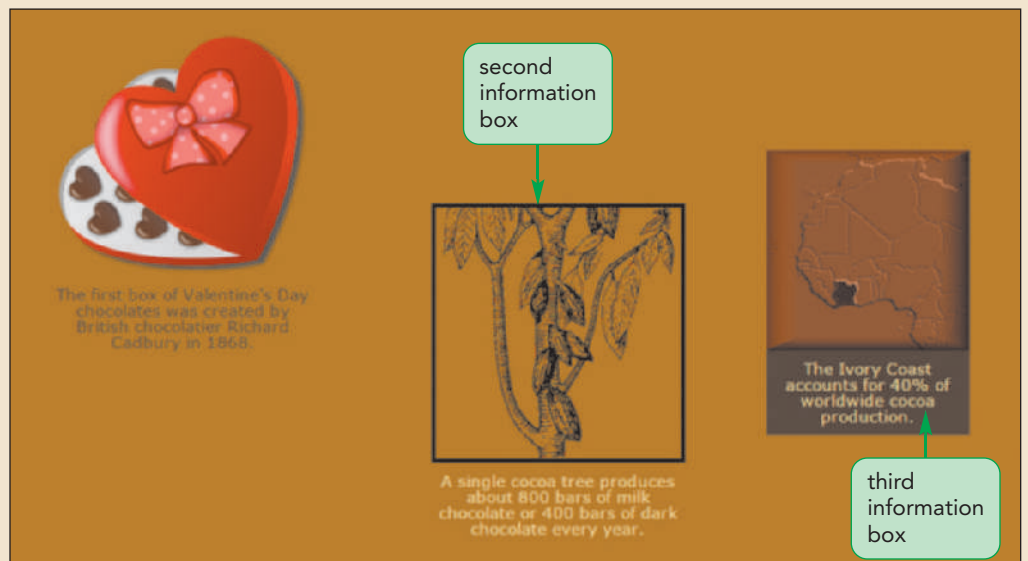
/* Third Infographic */
div#info3 {
 display: block;
 top: 135px;
 left: 75%;
}
```

places the third box 135 pixels from the top and 75% from the left

4. Save your changes to the file and reload pc\_info.html in your browser. Figure 3–68 shows the placement of the first three information boxes.

Figure 3–68

## Placement of the first three boxes



Place the next three information boxes.

### To place the next three boxes:

1. Return to the **pc\_info.css** file in your editor, go to the Fourth Infographic section and place the fourth box 510 pixels from the top edge and 8% from the left edge.

```
div#info4 {
 display: block;
 top: 510px;
 left: 8%;
}
```

2. Add the following style rule to the Fifth Infographic section to position the fifth box:

```
div#info5 {
 display: block;
 top: 800px;
 left: 3%;
}
```

3. Add the following style rule to the Sixth Infographic section to position the sixth box:

```
div#info6 {
 display: block;
 top: 600px;
 left: 48%;
}
```

Figure 3–69 highlights the positioning styles for the fourth, fifth, and sixth information boxes.

Figure 3–69

Positions of the fourth, fifth, and sixth boxes

places the fourth box 510 pixels from the top and 8% from the left

```
/* Fourth Infographic */
div#info4 {
 display: block;
 top: 510px;
 left: 8%;
}
```

places the fifth box 800 pixels from the top and 3% from the left

```
/* Fifth Infographic */
div#info5 {
 display: block;
 top: 800px;
 left: 3%;
}
```

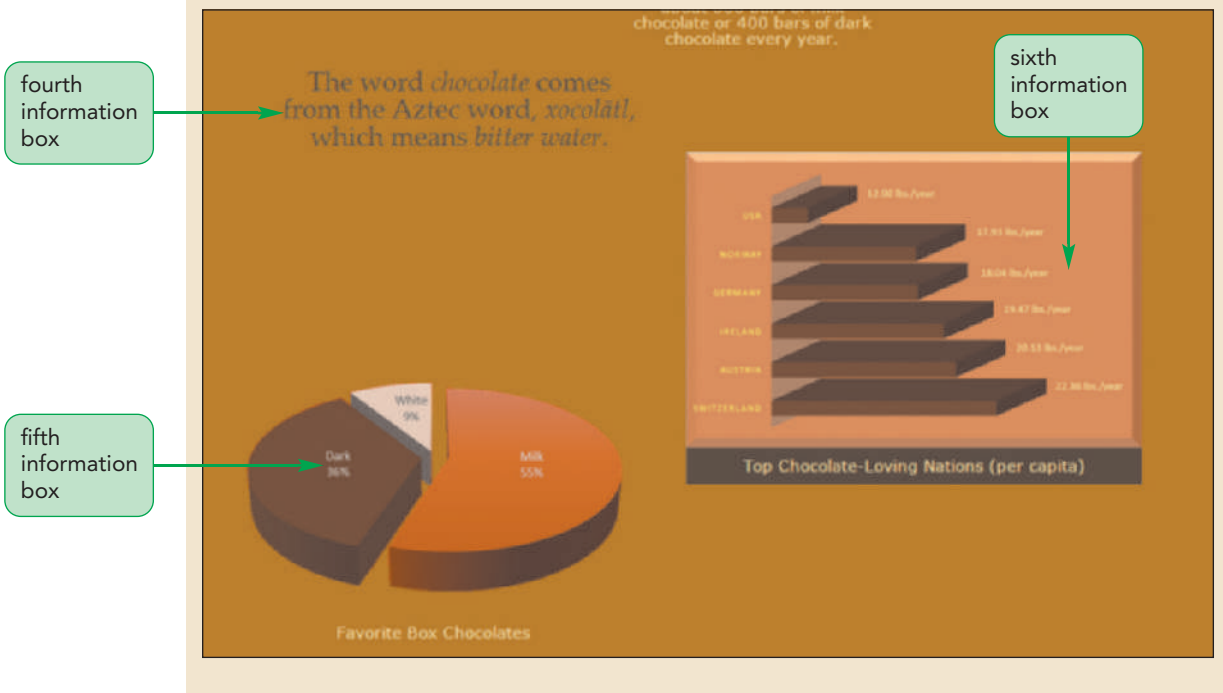
places the sixth box 600 pixels from the top and 48% from the left

```
/* Sixth Infographic */
div#info6 {
 display: block;
 top: 600px;
 left: 48%;
}
```

4. Save your changes to the file and reload pc\_info.html in your browser. Figure 3–70 shows the revised layout of the infographic.

Figure 3–70

Placement of the next three boxes



Complete the layout of the infographic by placing the final two boxes on the page.

### To place the last two boxes:

1. Return to the **pc\_info.css** file in your editor, go to the Seventh Infographic section and insert the following style rules:

```
div#info7 {
 display: block;
 top: 1000px;
 left: 68%;
}
```

2. Add the following style rules to the Eighth Infographic section:

```
div#info8 {
 display: block;
 top: 1100px;
 left: 12%;
}
```

Figure 3–71 highlights the style rules for the seventh and eighth information boxes.

Figure 3–71

Positioning the seventh and eighth boxes

places the seventh box 1000 pixels from the top and 68% from the left

```
/* Seventh Infographic */

div#info7 {
 display: block;
 top: 1000px;
 left: 68%;
}
```

places the eighth box 1100 pixels from the top and 12% from the left

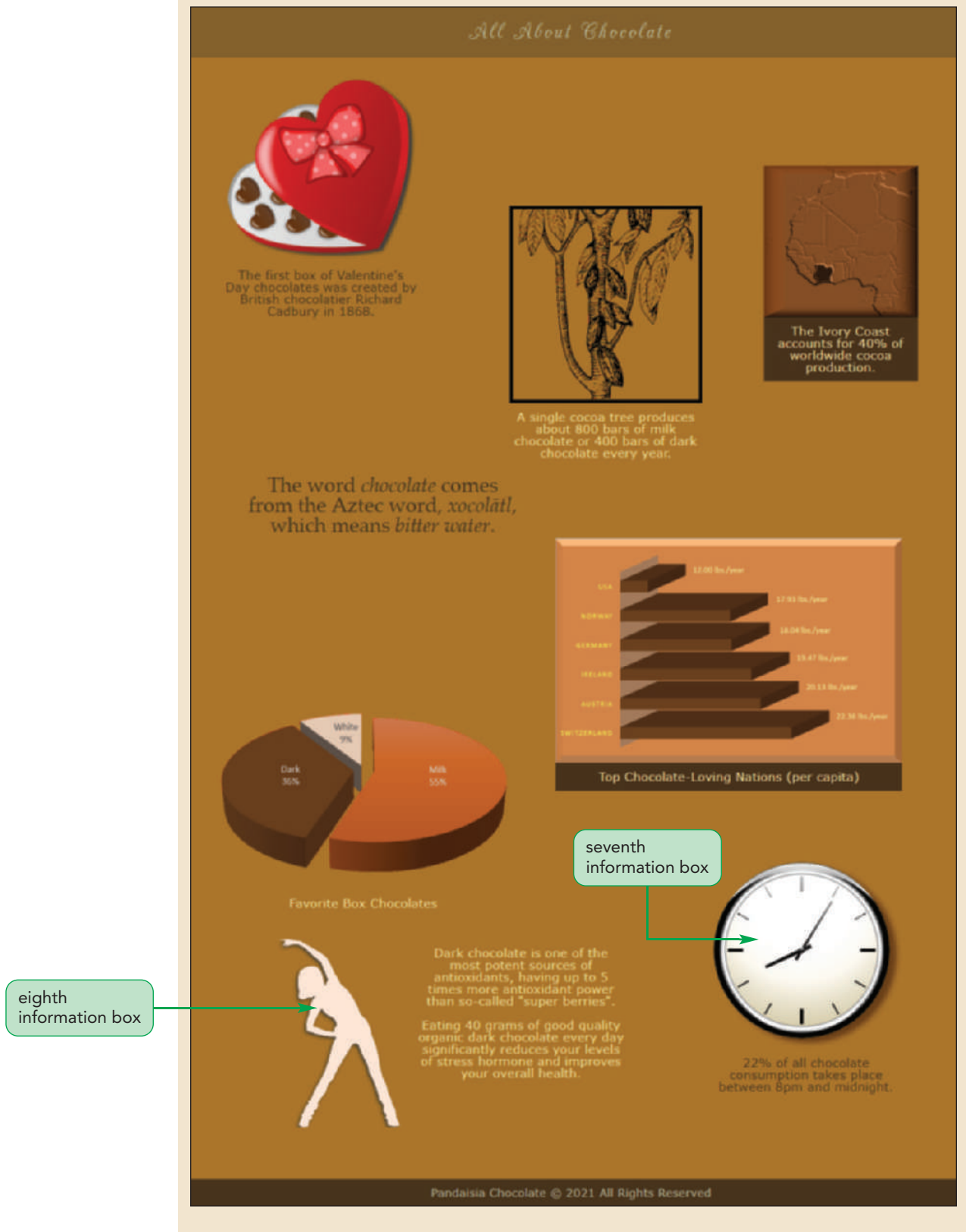
```
/* Eighth Infographic */

div#info8 {
 display: block;
 top: 1100px;
 left: 12%;
}
```

3. Scroll up to before the Main Styles section and delete the style rule `div.infobox {display: none;}` because you no longer need to hide any information boxes.
4. Save your changes to the file and reload `pc_info.html` in your browser. Figure 3–72 show the complete layout of the eight boxes in the infographic.

Figure 3–72

Final layout of the infographic



Anne likes the appearance of the infographic, but she is concerned about its length. She would like you to reduce the height of the infographic so that it appears within the boundaries of the browser window. This change will create overflow because the content is longer than the new height. You will read more about overflow and how to handle it now.

**INSIGHT**

### *Creating an Irregular Line Wrap*

Many desktop publishing and word-processing programs allow designers to create irregular line wraps in which the text appears to flow tightly around an image. This is not easily done in a web page layout because all images appear as rectangles rather than as irregularly shaped objects. However, with the aid of a graphics package, you can simulate an irregularly shaped image.

The trick is to use your graphics package to slice the image horizontally into several pieces and then crop the individual slices to match the edge of the image you want to display. Once you've edited all of the slices, you can use CSS to stack the separate slices by floating them on the left or right margin, displaying each slice only after the previous slice has been cleared. For example, the following style rule stacks all inline images that belong to the "slice" class on the right margin:

```
img.slice {
 clear: right;
 float: right;
 margin-top: 0px;
 margin-bottom: 0px;
}
```

Now any text surrounding the stack of images will tightly match the image's boundary, creating the illusion of an irregular line wrap. Note that you should always set the top and bottom margins to 0 pixels so that the slices join together seamlessly.

## Handling Overflow

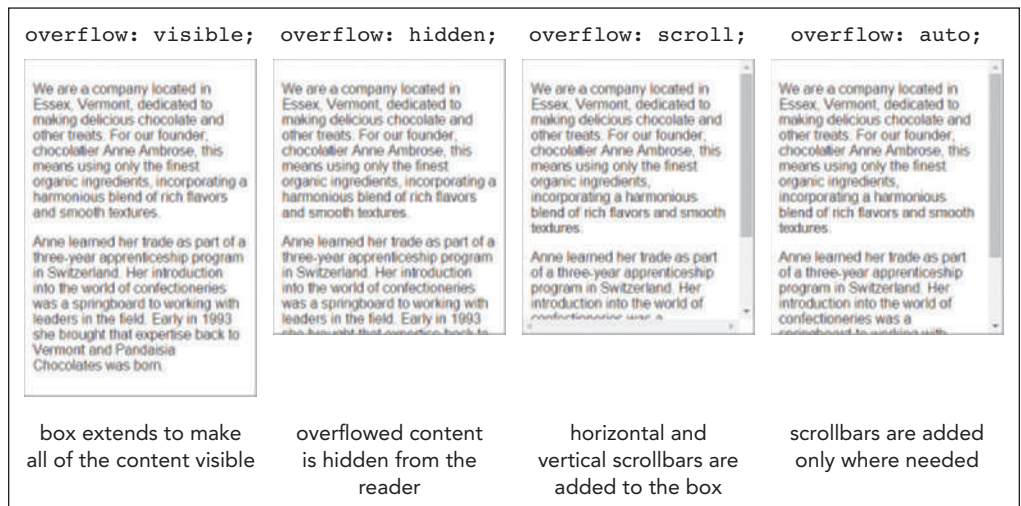
The infographic is long because it displays several information boxes. If you reduce the height of the infographic you run the risk of cutting off several of the boxes that will no longer fit within the reduced infographic. However you can control how your browser handles this excess content using the following `overflow` property

```
overflow: type;
```

where `type` is `visible` (the default), `hidden`, `scroll`, or `auto`. A value of `visible` instructs browsers to increase the height of an element to fit the overflow content. The `hidden` value keeps the element at the specified height and width, but cuts off excess content. The `scroll` value keeps the element at the specified dimensions, but adds horizontal and vertical scroll bars to allow users to scroll through the overflowed content. Finally, the `auto` value keeps the element at the specified size, adding scroll bars only as they are needed. Figure 3–73 shows examples of the effects of each overflow value on content that is too large for its space.

Figure 3–73

## Values of the overflow property



CSS also provides the `overflow-x` and `overflow-y` properties to handle overflow specifically in the horizontal and vertical directions.

## REFERENCE

*Working with Overflow*

- To specify how the browser should handle content that overflows the element's boundaries, use the property

```
overflow: type;
```

where *type* is `visible` (the default), `hidden`, `scroll`, or `auto`.

You decide to limit the height of the infographic to 450 pixels and to set the `overflow` property to `auto` so that browsers displays scroll bars as needed for the excess content.

**To apply the `overflow` property:**

1. Return to the **pc\_info.css** file in your editor and go to the Main Styles section.
2. Within the style rule for the `main` selector, insert the property **`overflow: auto;`**.
3. Reduce the height of the element from 1400px to **450px**.

Figure 3–74 highlights the revised code in the style rule.

Figure 3–74

## Setting the overflow property

displays scrollbars if the content overflows the allotted height

```
/* Main Styles */
main {
 overflow: auto;
 position: relative;
 height: 450px;
 width: 100%;
}
```

sets the height of the infographic to 450 pixels

4. Close the file, saving your changes.
5. Reload the pc\_info.html file in your browser. As shown in Figure 3–75, the height of the infographic has been reduced to 450 pixels and scrollbars have been added that you can use to view the entire infographic.

Figure 3–75

## Final layout of the infographic page



6. Close any open files now.

## INSIGHT

### Managing White Space with CSS

Scroll bars for overflow content are usually placed vertically so that you scroll down to view the extra content. In some page layouts, however, you may want to view content in a horizontal rather than a vertical direction. You can accomplish this by adding the following style properties to the element:

```
overflow: auto;
white-space: nowrap;
```

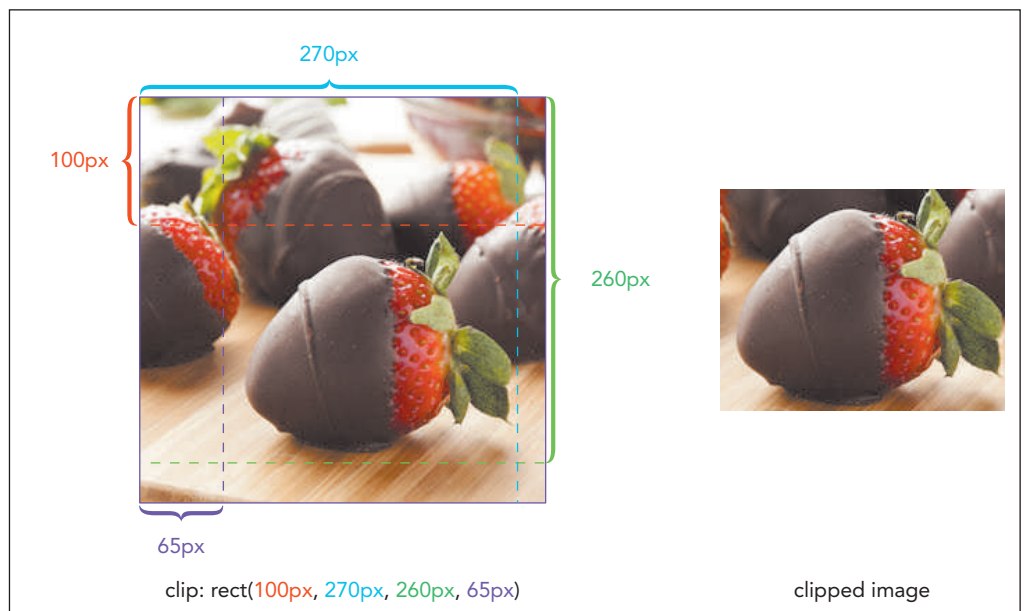
The `white-space` property defines how browsers should handle white space in the rendered document. The default is to collapse consecutive occurrences of white space into a single blank space and to automatically wrap text to a new line if it extends beyond the width of the container. However, you can set the `white-space` property of the element to `nowrap` to keep inline content on a single line, preventing line wrapping. With the content thus confined to a single line, browsers will display only horizontal scroll bars for the overflow content. Other values of the `white-space` property include `normal` (for default handling of white space), `pre` (to preserve all white space from the HTML file), and `pre-wrap` (to preserve white space but to wrap excess content to a new line).

## Clipping an Element

Closely related to the `overflow` property is the `clip` property, which defines a rectangular region through which an element's content can be viewed. Anything that lies outside the boundary of the rectangle is hidden. The syntax of the `clip` property is

```
clip: rect(top, right, bottom, left);
```

where *top*, *right*, *bottom*, and *left* define the coordinates of the clipping rectangle. For example, a clip value of `rect(100px, 270px, 260px, 65px)` defines a clip region whose top and bottom boundaries are 100 and 260 pixels from the top edge of the element, and whose right and left boundaries are 270 and 65 pixels from the element's left edge. See Figure 3–76.

**Figure 3–76****Clipping an image**

© Brent Hofacker/Shutterstock.com

The top, right, bottom, and left values also can be set to `auto`, which matches the specified edge of the clipping region to the edge of the parent element. A clip value of `rect(10, auto, 125, 75)` creates a clipping rectangle whose right edge matches the right edge of the parent element. To remove clipping completely, apply the style `clip: auto`. Clipping can only be applied when the object is placed using absolute positioning.

## REFERENCE

### Clipping Content

- To clip an element's content, use the property  

```
clip: rect(top, right, bottom, left);
```

where *top*, *right*, *bottom*, and *left* define the coordinates of the clipping rectangle.
- To remove clipping for a clipped object, use  

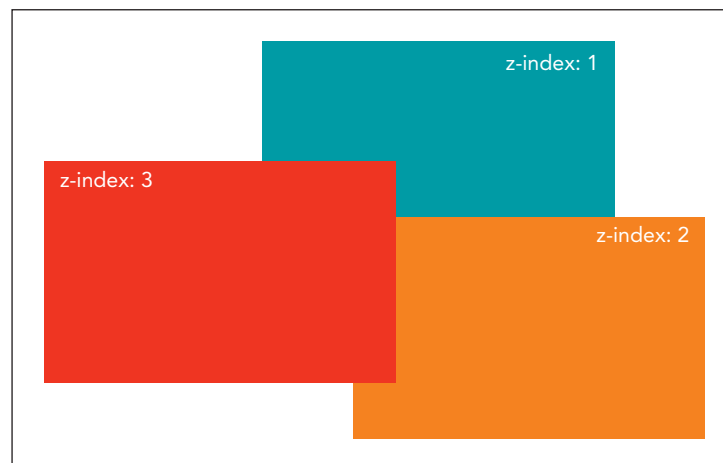
```
clip: auto;
```

## Stacking Elements

Positioning elements can sometimes lead to objects that overlap each other. By default, elements that are loaded later by the browser are displayed on top of elements that are loaded earlier. In addition, elements placed using CSS positioning are stacked on top of elements that are not. To specify a different stacking order, use the following `z-index` property:

```
z-index: value;
```

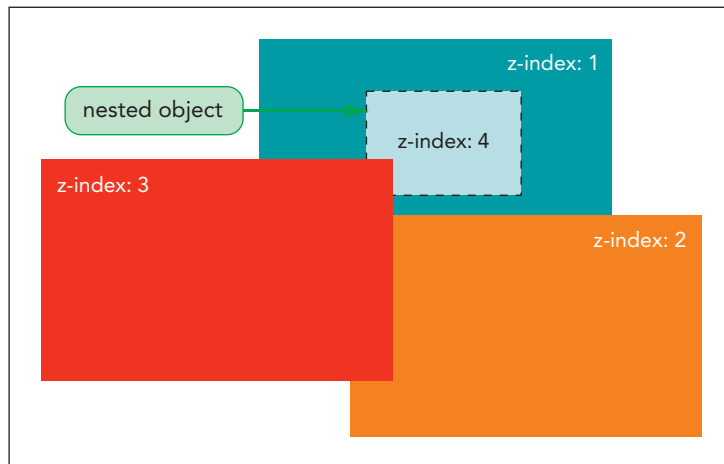
where *value* is a positive or negative integer, or the keyword `auto`. As shown in Figure 3–77, objects with the highest `z-index` values are placed on top of other page objects. A value of `auto` stacks the objects using the default rules.

**Figure 3–77****Using the `z-index` property to stack elements**

The `z-index` property works only for elements that are placed with absolute positioning. Also, an element's `z-index` value determines its position relative only to other elements that share a common parent; the style has no impact when applied to elements with different parents. Figure 3–78 shows a layout in which the object with a high `z-index` value of 4 is still covered because it is nested within another object that has a low `z-index` value of 1.

Figure 3–78

## Stacking nested objects



You do not need to include the `z-index` property in your style sheet because none of the elements in the infographic page are stacked upon another.



### Problem Solving: Principles of Design

Good web page design is based on the same common principles found in other areas of art, which include balance, unity, contrast, rhythm, and emphasis. A pleasing layout involves the application of most, if not all, of these principles, which are detailed below:

- **Balance** involves the distribution of elements. It's common to think of balance in terms of **symmetrical balance**, in which similar objects offset each other like items on a balance scale; but you often can achieve more interesting layouts through asymmetrical balance, in which one large page object is balanced against two or more smaller objects.
- **Unity** is the ability to combine different design elements into a cohesive whole. This is accomplished by having different elements share common colors, font styles, and sizes. One way to achieve unity in a layout is to place different objects close to each other, forcing your viewers' eyes to see these items as belonging to a single unified object.
- **Contrast** consists of the differences among all of the page elements. To create an effective design, you need to vary the placement, size, color, and general appearance of the objects in the page so that your viewers' eyes aren't bored by the constant repetition of a single theme.
- **Rhythm** is the repetition or alteration of a design element in order to provide a sense of movement, flow, and progress. You can create rhythm by tiling the same image horizontally or vertically across the page, by repeating a series of elements that progressively increase or decrease in size or spacing, or by using elements with background colors of the same hue but that gradually vary in saturation or lightness.
- **Emphasis** involves working with the focal point of a design. Your readers need a few key areas to focus on. It's a common design mistake to assign equal emphasis to all page elements. Without a focal point, there is nothing for your viewers' eyes to latch onto. You can give a page element emphasis by increasing its size, by giving it a contrasting color, or by assigning it a prominent position in the page.

Designers usually have an intuitive sense of what works and what doesn't in page design, though often they can't say why. These design principles are important because they provide a context in which to discuss and compare designs. If your page design doesn't feel like it's working, evaluate it in light of these principles to identify where it might be lacking.

Anne is pleased with the final design of the infographic page and all of the other pages you've worked on. She'll continue to develop the website and test her page layouts under different browsers and screen resolutions. She'll get back to you with future projects as she continues the redesign of the Pandaisia Chocolates website.

**REVIEW****Session 3.3 Quick Check**

1. To shift an object from its default placement in the document flow but keep it within the document flow, use:
  - a. absolute positioning
  - b. relative positioning
  - c. fixed positioning
  - d. static positioning
2. Provide a style to shift rule to shift an article element 15 pixels to the left of its default position in the document flow.
  - a. 

```
article {
 position: absolute;
 left: 15px;
}
```
  - b. 

```
article {
 position: relative;
 left: 15px;
}
```
  - c. 

```
article {
 position: absolute;
 left: -15px;
}
```
  - d. 

```
article {
 position: relative;
 left: -15px;
}
```
3. Provide a style to place an article element 15 pixels up from the top edge of its container element.
  - a. 

```
article {
 position: absolute;
 top: 15px;
}
```
  - b. 

```
article {
 position: relative;
 top: 15px;
}
```
  - c. 

```
article {
 position: absolute;
 top: -15px;
}
```
  - d. 

```
article {
 position: relative;
 top: -15px;
}
```
4. To place an object using absolute positioning within its container, the container:
  - a. must also have absolute positioning
  - b. must have absolute or relative positioning
  - c. must have statistic positioning
  - d. must not have any position property value

5. Provide a style property to display scrollbars when the element content exceeds the element's boundaries.
  - a. `overflow: auto;`
  - b. `overflow: scroll;`
  - c. `overflow: scrollbar;`
  - d. `overflow: true;`
6. An inline image is 400 pixels wide by 300 pixels high. Provide a style rule to clip this image by 10 pixels on each edge.
  - a. `clip: rect(10, 390, 290, 10);`
  - b. `clip: 10;`
  - c. `clip: -10;`
  - d. `clip: 10 390 290 10;`
7. If two elements overlap, the one displayed on top will:
  - a. be listed first in the document order
  - b. have the greater height and width
  - c. have the lower `z-index` value
  - d. have the higher `z-index` value

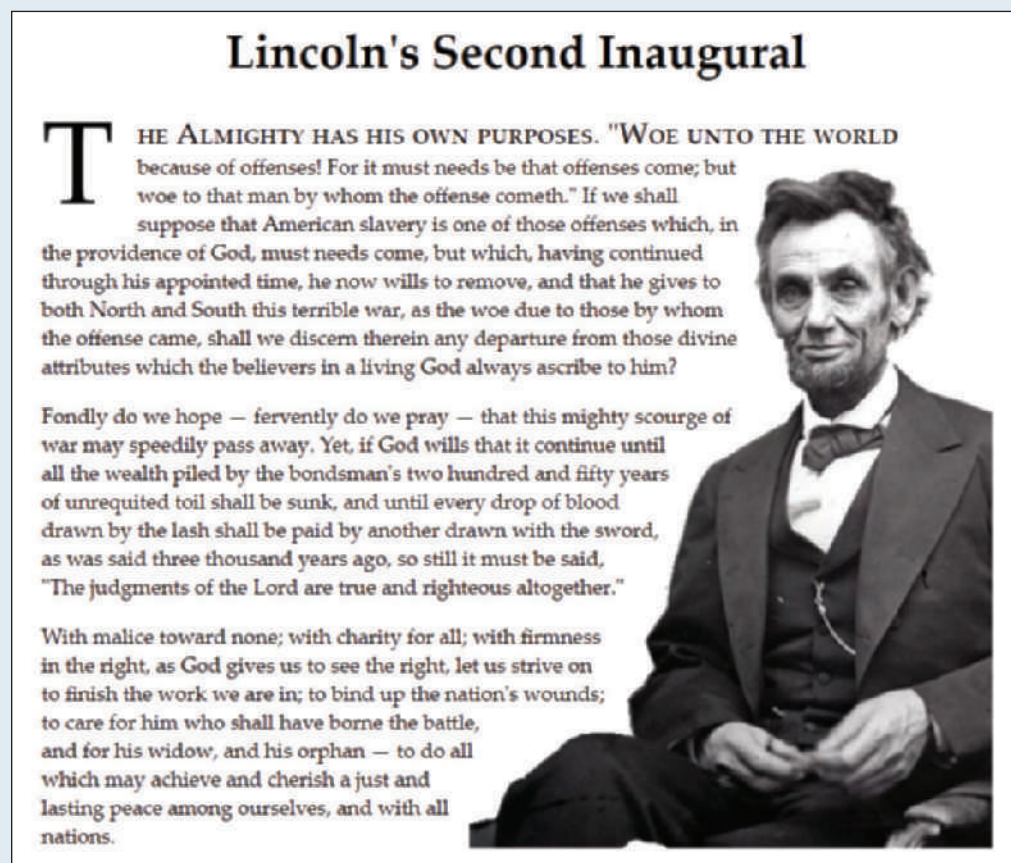
## Coding Challenge 1

Data Files needed for this Coding Challenge: `code3-1_txt.html`, `code3-1_float_txt.css`, `code3-1.css`, `lincoln01.png` - `lincoln10.png`

Figure 3–79 shows an example page containing two applications of floating objects. In the first line of Lincoln's second inaugural speech a drop capital is created by floating the first letter of the first paragraph next to the surrounding text. The text of the speech is wrapped around the image of Lincoln using an irregular line wrap. This effect is created by cutting the Lincoln image into separate strips which are floated and stacked on top of each other. In this Coding Challenge you will explore how to create both effects.

Figure 3–79

Coding Challenge 3-1 example page



Library of Congress, Prints & Photographs Division, Reproduction number LC-DIG-ppmsca-19469 (digital file from original)

Do the following:

1. Open the `code3-1_txt.html` and `code3-1_float_txt.css` files from the `html03 ► code1` folder. Enter **your name** and **the date** in each document and save the files as `code3-1.html` and `code3-1_float.css` respectively.
2. Go to the `code3-1.html` file in your editor. Within the head section insert a `link` element linking the page to the `code3-1_float.css` style sheet file. Take some time to study the content of the page and then save your changes to the file.
3. Go to the `code3-1_float.css` file in your editor.

4. To create a drop cap, insert a style rule for the selector `p:first-of-type:first-letter` and add the following styles:
  - a. Float the element on the left margin.
  - b. Set the font size to 4em and the line height to 0.8em.
  - c. Set the size of the right margin and padding space to 0.1em. Set the bottom padding to 0.2em.
5. Display the first line of the speech in small caps by adding a style rule for the selector `p:first-of-type:first-line` that changes the font variant to small-caps and the font size to 1.4em.
6. For all `img` elements create a style rule to set the height of the image to 3.3em and float the image on the right margin, but only when the page is cleared of floats.
7. Save your changes to the style sheet.
8. Open the page in your browser and verify the layout of the page resembles that shown in Figure 3-79.
9. Submit the completed file to your instructor.

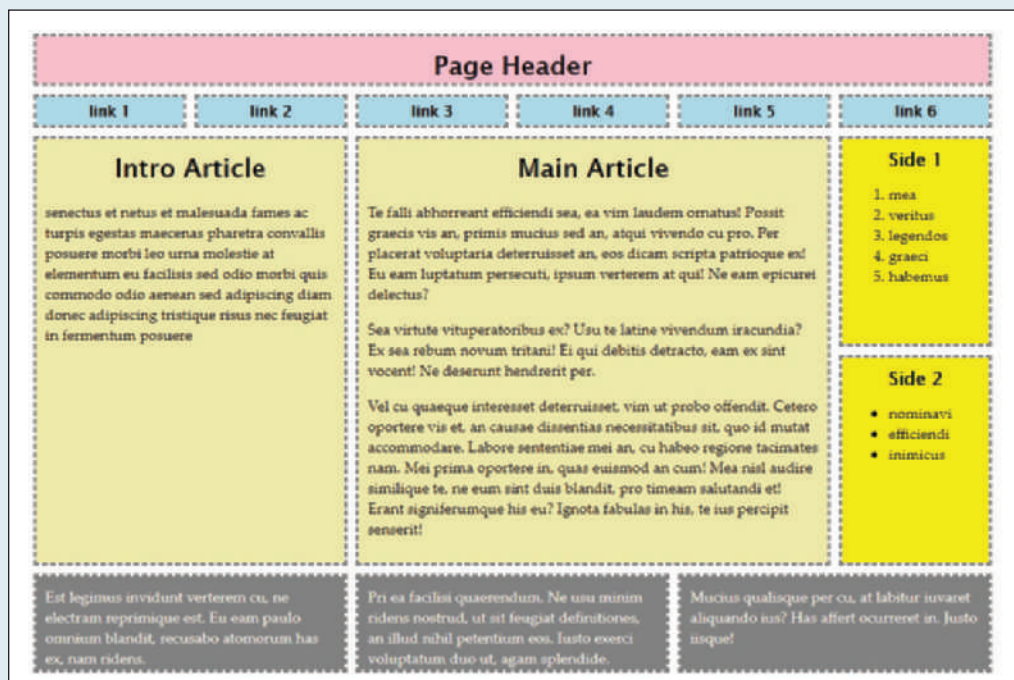
## CODE

## Coding Challenge 2

Data Files needed for this Coding Challenge: `code3-2_txt.html`, `code3-2_grad_txt.css`, `code3-2.css`, `landscape.png`

Figure 3–80 shows a proposed layout for a new web page. At this point the final content is not ready for the web page, so the layout is shown using lorem ipsum text. You’ve been given the HTML code for the page and your challenge is to create the page layout using CSS grid styles.

Figure 3–80 Coding Challenge 3-2 example page



Complete the following:

1. Open the `code3-2_txt.html` and `code3-2_layout_txt.css` files from the `html03 ► code2` folder. Enter **your name** and **the date** in each document and save the files as `code3-2.html` and `code3-2_layout.css` respectively.

2. Go to the **code3-2.html** file in your editor. Within the head section insert a `link` element linking the page to the `code3-2_layout.css` file. Study the contents of the file, taking note of the structure, element names, and element ids. Save your changes.
3. Go to the **code3-2\_layout.css** file. Create a style rule for the `header`, `footer`, `aside`, `article`, and `a` (hyperlink) elements to set the padding space to 10 pixels and add a 3-pixel gray dashed outline.
4. Create a style rule for the `body` element that:
  - a. Sets the width to 90% of the browser window, ranging from a minimum width of 640 pixels up to a maximum width of 1024 pixels.
  - b. Sets the top/bottom margin to 30 pixels and the left/right margin to `auto`.
  - c. Displays the body as a CSS grid.
  - d. Creates six grid columns each with a width of 1fr.
  - e. Creates five grid rows with widths of 50 pixels, 30 pixels, 1fr, 1fr, and 100 pixels.
  - f. Adds a grid gap of 15 pixels.
5. Display the `a` (hyperlink) element as a block.
6. Set the size of the grid items as follows:
  - a. Have the `header` element span from gridline 1 to gridline -1.
  - b. Have the `article#intro` element span two rows and two columns.
  - c. Have the `article#main` element two rows and three columns.
  - d. Have the `footer` element span two columns.
7. Save your changes to the style sheet.
8. Open the page in your browser and verify the layout of the page resembles that shown in Figure 3–80.
9. Submit the completed file to your instructor.

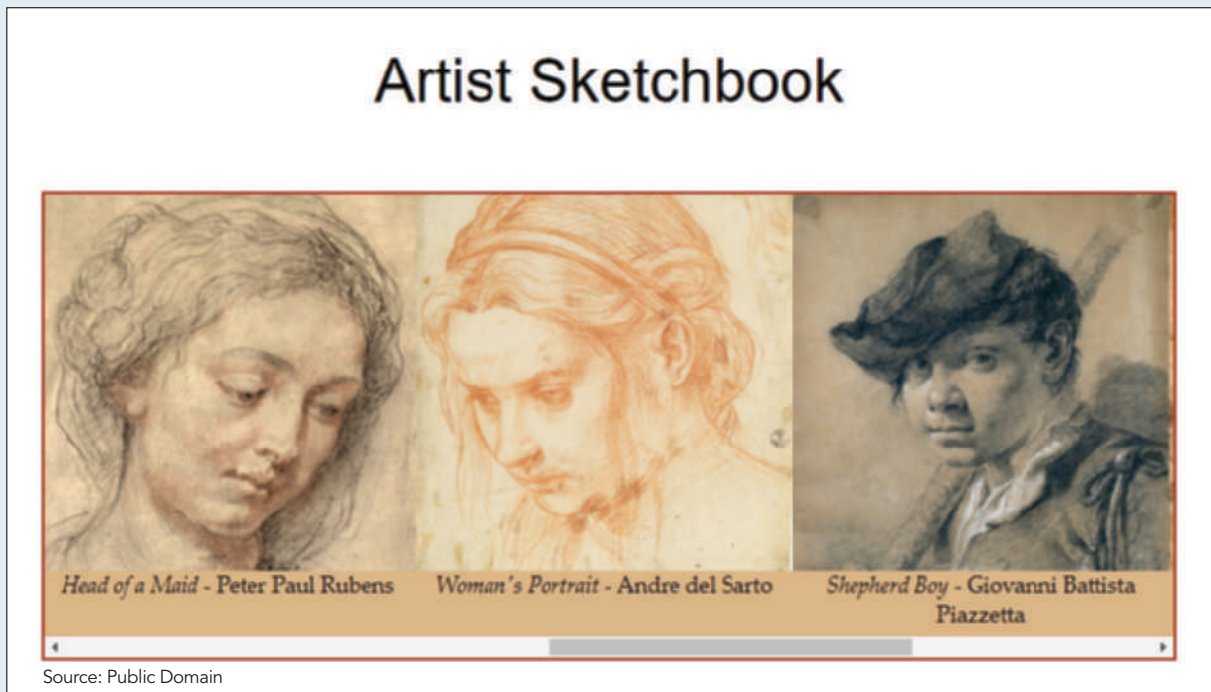
## CODE

### Coding Challenge 3

Data Files needed for this Coding Challenge: `code3-3_txt.html`, `code3-3_scroll_txt.css`, `code3-3_styles.css`, `image01.png` - `image09.png`

You can use the CSS positioning and overflow styles to create a scrolling slideshow. Figure 3–81 shows an example of a slideshow consisting of nine sketches by Renaissance masters. You've been given the HTML code for this document and you've been asked to write the style rules to generate the slideshow.

Figure 3–81 Coding Challenge 3-3 example page



Complete the following to create the web page:

1. Open the **code3-3\_txt.html** and **code3-3\_scroll\_txt.css** files from the html03 ► code3 folder. Enter **your name** and **the date** in each document and save the files as **code3-3.html** and **code3-3\_scroll.css** respectively.
2. Go to the **code3-3.html** file in your editor. Link the file to the code3-3\_scroll.css style sheet file. Review the contents of the document and then save your changes to the file.
3. Go to the **code3-3\_scroll.css** file in your editor. Create a style rule for the `section` element with the id "container" with the following styles:
  - a. Set the width of the element to 900 pixels and the height to 370 pixels.
  - b. Horizontally center the element by adding a 10-pixel top/bottom margin and set the left/right margin to `auto`.
  - c. Place the element with relative positioning, setting the top value to 30 pixels and the left value to 0 pixels.
  - d. Add a 2-pixel solid brown outline to the element.
  - e. Have the browser automatically display scrollbars for any overflow content.
4. Create a style rule for every `div` element, setting the width to 300 pixels and the height to 330 pixels. Position the element with absolute positioning.
5. Display every inline image as a block-level element with a width and height of 300 pixels.
6. There are nine `div` elements with ids ranging from "slide1" to "slide9". Set the left position of the elements in 300-pixel increments starting with 0 pixels for slide1, 300 pixels for slide2, 600 pixels for slide3, and so forth up to 2400 pixels for slide9.
7. Save your changes to the style sheet.
8. Open the page in your browser. Verify that the nine images are displayed within a scroll box and that you can using a horizontal scrollbar to scroll through the image list.
9. Submit the completed file to your instructor.

## Coding Challenge 4

Data Files needed for this Coding Challenge: `code3-4_txt.html`, `debug3-4_txt.css`, `code3-4_.css`, `redball.png`

Figure 3–82 shows a completed web page that uses CSS to design the page layout. You’ve been given the initial HTML and CSS code for this web page, but there are several errors in the CSS stylesheet. Use your knowledge of CSS to locate and fix the errors.

Figure 3–82 Coding Challenge 3-4 example page



Maxim Maksutov/ssutterstock.com; @Shebeko/Shutterstock.com

Do the following:

1. Open the `code3-4_txt.html` and `debug3-4_txt.css` files from the `html03 ► code4` folder. Enter **your name** and **the date** in each document and save the files as `code3-4.html` and `debug3-4.css` respectively.
2. Go to the `code3-4.html` file in your editor. Link the page to the `debug3-4.css` style sheet file. Study the contents of the file and then save your changes.
3. Go to the `debug3-4.css` file in your browser.
4. The `body` element should have a width that is 90% of the width of the browser window ranging from a minimum of 600 pixels up to a maximum of 1024 pixels. Fix the syntax errors in the `body` style rule that defines the width of the web page.
5. The style rule for the `body` element sets up a grid layout for the page. However, there are several errors in defining the grid areas, grid columns, and grid gaps. Fix the syntax errors in the style rule.
6. Go to the style rules in the Grid Areas section that assigns page elements to areas of the grid. Locate and fix the errors in assigning elements to grid areas.

- The style rules for the horizontal navigation list and the `section` element also define grid styles for those elements. Locate and fix errors in the code that set up the grid columns.
- The last paragraph within the `section div` selector should be placed with absolute positioning 1 pixel and 5 pixels from the bottom right corner of the container element. However, there is an error in defining the selector. Find and fix the error.
- Save your changes and open the **code3-4.html** file in your browser. Verify that design of the page resembles that shown in Figure 3–82.
- Submit the completed file to your instructor.

## PRACTICE

## Review Assignments

**Data Files needed for the Review Assignments:** `pc_specials_txt.html`, `pc_specials_txt.css`, 2 CSS files, 8 PNG files, 1 TTF file, 1 WOFF file

Anne wants you to work on another page for the Pandaisia Chocolates website. This page will contain information on some of the specials offered by the company in March; it will also display a list of some awards that the company has won. As you work on the page, you will use clip art images as placeholders until photographs of the awards are available. A preview of the completed page is shown in Figure 3–83.

Figure 3–83 March Specials web page



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© Alexander Chaikin/Shutterstock.com; © ESB Professional/Shutterstock.com

Anne has already created the page content and some of the design styles to be used in the page. Your job will be to come up with the CSS style sheet to set the page layout.

Complete the following:

1. Use your editor to open the **pc\_specials\_txt.html** and **pc\_specials\_txt.css** files from the `html03 ► review` folder. Enter **your name** and **the date** in the comment section of each file, and save them as **pc\_specials.html** and **pc\_specials.css** respectively.
2. Go to the **pc\_specials.html** file in your editor. Within the document head, create links to the `pc_reset2.css`, `pc_styles4.css`, and `pc_specials.css` style sheets.
3. Take some time to study the content and structure of the document, paying careful attention to the use of ids and class names in the file. Save your changes to the file.
4. Go to the **pc\_specials.css** file in your editor. Within the Page Body Styles section, add a style rule for the `body` element that sets the width of the page body to 95% of the browser window width within the range of 640 to 960 pixels. Horizontally center the page body within the window by setting the left and right margins to `auto`.
5. Go to the Image Styles section and create a style rule that displays all `img` elements as blocks with a width of 100%.
6. Anne wants the navigation list to be displayed horizontally on the page. Go to the Horizontal Navigation Styles section and create a style rule for every list item within a horizontal navigation list that displays the list item as a block floated on the left margin with a width of 16.66%.
7. Display every hypertext link nested within a navigation list item as a block.
8. Next, you will create the grid styles for the March Specials page. Go to the Grid Styles section and create a style rule for the `body` element that displays the element as a grid with two columns in the proportion of 2:1 (using `fr` units) with a column grid gap of 20 pixels.
9. Create a style rule for the `header` and `footer` elements that has both elements span the grid from the gridline number 1 to gridline number -1.
10. Create a style rule for the `section` element with the id “sub” that displays that element as a grid consisting of three columns of equal width by repeating the column width `1fr` three times.
11. Go to the Specials Styles section. In this section, you will create styles for the monthly specials advertised by the company. Create a style rule for all `div` elements of the `specials` class that sets the minimum height to 400 pixels and adds a 1 pixel dashed outline around the element with a color value of `rgb(71, 52, 29)`.
12. Go to the Award Styles section. In this section, you will create styles for the list of awards won by Pandaisia Chocolates. Information boxes for the awards are placed within an `aside` element. Create a style rule for the `aside` element that places it using relative positioning, sets its height to 650 pixels, and automatically displays scrollbars for any overflow content.
13. Every information box in the `aside` element is stored in a `div` element. Create a style rule that places these elements with absolute positioning and sets their width to 30%.
14. Position the individual awards within the `awardList` box by creating style rules for the `div` elements with id values ranging from `award1` to `award5` at the following (*top, left*) coordinates: `award1` (80px, 5%), `award2` (280px, 60%), `award3` (400px, 20%), `award4` (630px, 45%), and `award5` (750px, 5%). (Hint: In the `pc_specials.html` file, the five awards have been placed in a `div` element belonging to the `awards` class with id values ranging from `award1` to `award5`.)
15. Save your changes to the style sheet and then open the **pc\_specials.html** file in your browser. Verify that the layout and design styles resemble the page shown in Figure 3–83.

## Case Problem 1

Data Files needed for this Case Problem: `sp_home_txt.html`, `sp_layout_txt.css`, 2 CSS files, 11 PNG files

**Slate & Pencil Tutoring** Karen Cooke manages the website for *Slate & Pencil Tutoring*, an online tutoring service for high school and college students. Karen is overseeing the redesign of the website and has hired you to work on the layout of the site's home page. Figure 3–84 shows a preview of the page you'll create for Karen.

Figure 3–84 Slate & Pencil Tutoring home page



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© Courtesy Patrick Carey

Karen has supplied you with the HTML file and the graphic files. She has also given you a base style sheet to initiate your web design and a style sheet containing several typographic styles. Your job will be to write up a layout style sheet according to Karen's specifications.

Complete the following:

1. Using your editor, open the `sp_home_txt.html` and `sp_layout_txt.css` files from the `html03 ► case1` folder. Enter **your name** and **the date** in the comment section of each file, and save them as `sp_home.html` and `sp_layout.css` respectively.
2. Go to the `sp_home.html` file in your editor. Within the document head, create links to the `sp_base.css`, `sp_styles.css`, and `sp_layout.css` style sheet files. Study the content and structure of the file and then save your changes to the document.

3. Go to the `sp_layout.css` file in your editor. Go to the Window and Body Styles section. Create a style rule for the `html` element that sets the height of the browser window at 100%.
4. Create a style rule for the page body that sets the width to 95% of the browser window ranging from 640 pixels up to 960 pixels. Horizontally center the page body within the browser window. Finally, Karen wants to ensure that the height of the page body is always at least as high as the browser window itself. Set the minimum height of the browser window to 100%.
5. Add a style rule to display all inline images as blocks.
6. Within the CSS Grid Styles section create a style rule that displays the `body` element as a grid with four columns of length 1fr.
7. Create a style rule for the `img` element with id "logo" so that the logo image spans three columns and has a width of 100%.
8. For the horizontal navigation list and the `footer` element create a style rule so that those elements span four columns. Create a style for the `aside` element to span two columns.
9. Within the Horizontal Navigation List Styles section create a style rule for `li` elements nested within the horizontal navigation list that display each element as a block with a width of 12.5% and floated on the left margin.
10. Within the Section Styles section create a style rule for inline images within the `section` element that sets the width of the image to 50% and centers the image using a top/bottom margin of 0 and a left/right margin of `auto`.
11. Create a style rule for paragraphs within the `section` element that sets the width of the paragraph to 70% and centers the paragraph using a top/bottom margin of 0 and a left/right margin of `auto`.
12. Go to the Customer Comment Styles section and create a style rule for the `aside` element setting the width to 75% and the bottom padding to 30 pixels.
13. The six `aside` elements will be displayed in two columns. For odd-numbered `aside` elements, use the `justify-self` grid property to place the element on the end (right) margin. (Hint: Use the `nth-of-type(odd)` pseudo-class to select the odd-numbered `aside` elements.)
14. Float inline images nested within the `aside` element on the left with a width of 20%.
15. Float paragraphs nested within the `aside` element on the left with a width of 75% and a left margin of 5%.
16. Save your changes to the file and then open the `sp_home.html` file in your browser. Verify that the layout and appearance of the page elements resemble that shown in Figure 3–84.

## Case Problem 2

**Data Files needed for this Case Problem:** `ss_dday_txt.html`, `ss_layout_txt.css`, 1 CSS file, 3 PNG files

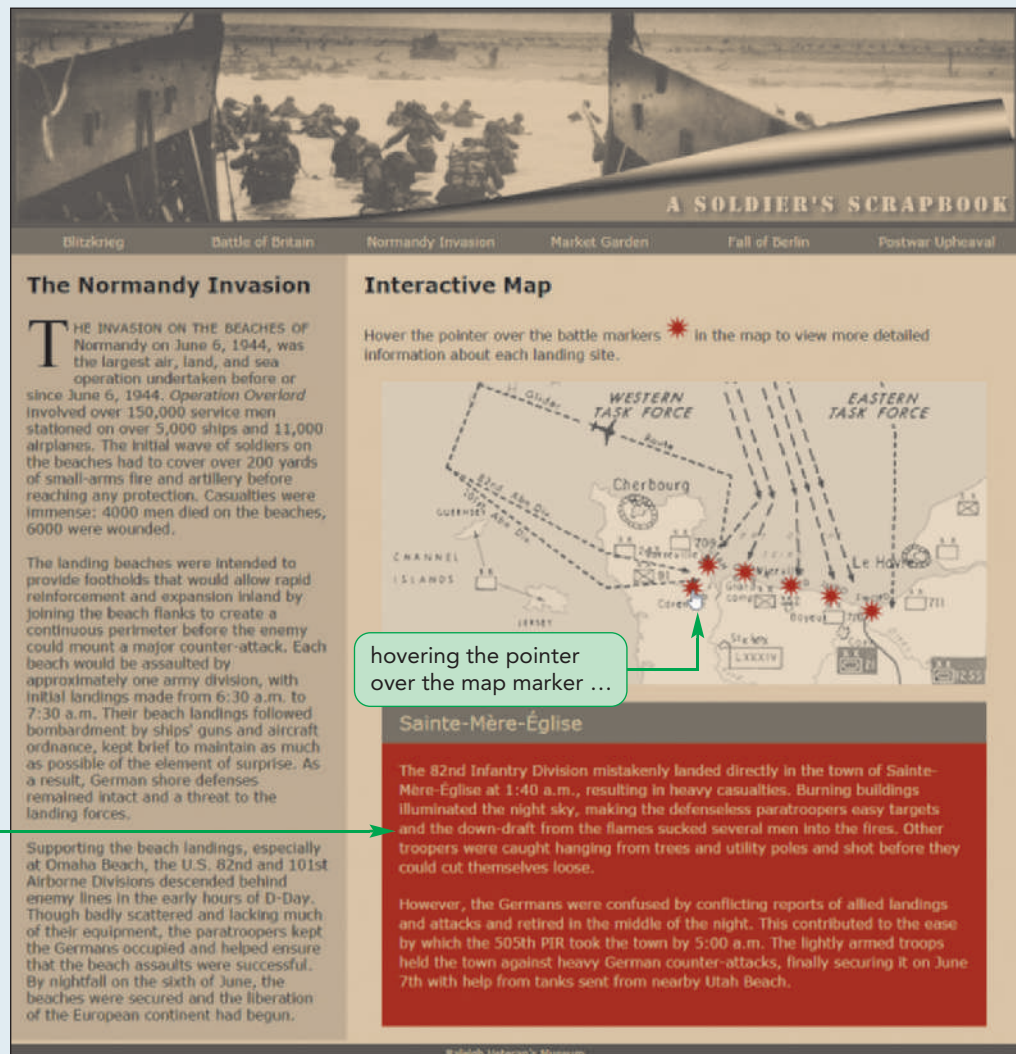
### CHALLENGE

**A Soldier's Scrapbook** Jakob Bauer is a curator at the Veteran's Museum in Raleigh, North Carolina. Currently he is working on an exhibit called *A Soldier's Scrapbook* containing mementos, artifacts, journals, and other historic items from the Second World War. You've been asked to work on a page for an interactive kiosk used by visitors to the exhibit. Jakob has already supplied much of the text and graphics for the kiosk pages but he wants you to complete the job by working on the page layout.

The page you will work on provides an overview of the Normandy beach landings on June 6<sup>th</sup>, 1944. Since this page will be displayed only on the kiosk monitor, whose screen dimensions are known, you'll employ a fixed layout based on a screen width of 1152 pixels.

Jakob also wants you to include an interactive map of the Normandy coast where the user can hover a mouse pointer over location markers to view information associated with each map point. To create this effect, you'll mark each map point as a hypertext link so that you can apply the `hover` pseudo-class to the location. In addition to the interactive map, Jakob wants you to create a drop cap for the first letter of the first paragraph in the article describing the Normandy invasion. Figure 3–85 shows a preview of the page you'll create.

Figure 3–85 Normandy Invasion kiosk page



Source: Chief Photographer's Mate (CPHOM) Robert F. Sargent, U.S. Coast Guard/National Archives and Records Administration;  
Source: U.S. Department of Defense/Wikimedia Commons; © Patrick Carey

Complete the following:

1. Using your editor, open the `ss_dday_txt.html` and `ss_layout_txt.css` files from the `html03 ► case2` folder. Enter **your name** and **the date** in the comment section of each file, and save them as `ss_dday.html` and `ss_layout.css` respectively.
2. Go to the `ss_dday.html` file in your editor. Within the document head, create links to the `ss_styles.css` and `ss_layout.css` style sheet files. Study the content and structure of the document. Note that within the `aside` element is an image for the battle map with the `id mapImage`. Also note that there are six marker images enclosed within hypertext links with `ids` ranging from `marker1` to `marker6`. After each marker image are `div` elements of the `mapInfo` class with `IDs` ranging from `info1` to `info6`. Part of your style sheet will include style rules to display these `div` elements in response to the mouse pointer hovering over each of the six marker images.
3. Save your changes to the file and then go to the `ss_layout.css` file in your editor.
4. Go to the Article Styles section. Within this section, you'll lay out the article describing the Normandy Invasion. Create a style rule to float the `article` element on the left margin and set its width to 384 pixels.

- ✚ **Explore** 5. Jakob wants the first line from the article to be displayed in small capital letters. Go to the First Line and Drop Cap Styles section and create a style rule for the first paragraph of the article element and the first line of that paragraph, setting the font size to 1.25em and the font variant to small-caps. (Hint: Use the `first-of-type` pseudo-class for the paragraph and the `first-line` pseudo-element for the first line of that paragraph.)
- ✚ **Explore** 6. Jakob also wants the first letter of the first line in the article's opening paragraph to be displayed as a drop cap. Create a style rule for the article's first paragraph and first letter that applies the following styles: (a) sets the size of the first letter to 4em in a serif font and floats it on the left, (b) sets the line height to 0.8em, and (c) sets the right and bottom margins to 5 pixels. (Hint: Use the `first-letter` pseudo-element for the first letter of that paragraph.)
- 7. The interactive map is placed within an `aside` element that Jakob wants displayed alongside the Normandy Invasion article. Go the Aside Styles section and create a style rule that sets the width of the aside element to 768 pixels and floats it on the left margin.
- 8. Next, you will lay out the interactive map. The interactive map is placed within a `div` element with the ID `battleMap`. Go to the Map Styles section and create a style rule for this element that sets its width to 688 pixels. Center the map by setting its top/bottom margins to 20 pixels and its left/right margins to `auto`. Place the map using relative positioning.
- 9. The actual map image is placed within an `img` element with the ID `mapImage`. Create a style rule for this element that displays it as a block with a width of 100%.
- 10. Go to the Interactive Map Styles section. Within this section, you'll create style rules that position each of the six map markers onto the battle map. The markers are placed within hypertext links. Create a style rule for every `a` element of the `battleMarkers` class that places the hypertext link using absolute positioning.
- 11. Create style rules for the six `a` elements with IDs ranging from `marker1` to `marker6`, placing them at the following (*top, left*) coordinates:
 

<code>marker1</code>	(220, 340)
<code>marker2</code>	(194, 358)
<code>marker3</code>	(202, 400)
<code>marker4</code>	(217, 452)
<code>marker5</code>	(229, 498)
<code>marker6</code>	(246, 544)
- 12. The information associated with each map marker has been placed in `div` elements belonging to the `mapInfo` class. Go to the Map Information Styles section and create a style rule that hides this class of elements so that this information is not initially visible on the page.
- ✚ **Explore** 13. To display the information associated with each map maker, you need to create a style rule that changes the map information's `display` property in response to the mouse pointer hovering over the corresponding map marker. Since the map information follows the map marker in the HTML file, use the following selector to select the map information corresponding to the hovered map marker: `a.battleMarkers:hover + div.mapInfo`. Write a style rule for this selector that sets its `display` property to `block`.
- 14. Save your changes to the style sheet and then load `ss_dday.html` in your browser. Verify that a drop cap appears for the first letter of the Normandy Invasion article and the first line of the first paragraph is displayed in small caps. Test the interactive map by first verifying that none of the information about the six battle locations appears on the page unless you hover your mouse pointer over the marker on the battle map. Further verify that when you are not hovering over the battle marker, the information is once again not visible on the page.

## OBJECTIVES

**Session 4.1**

- Create a figure box
- Add a background image
- Add a border to an element
- Create rounded borders
- Create a graphic border

**Session 4.2**

- Create a text shadow
- Create a box shadow
- Create linear and radial gradients
- Set the opacity of an element

**Session 4.3**

- Apply a 2D and 3D transformation
- Apply a CSS filter
- Create an image map

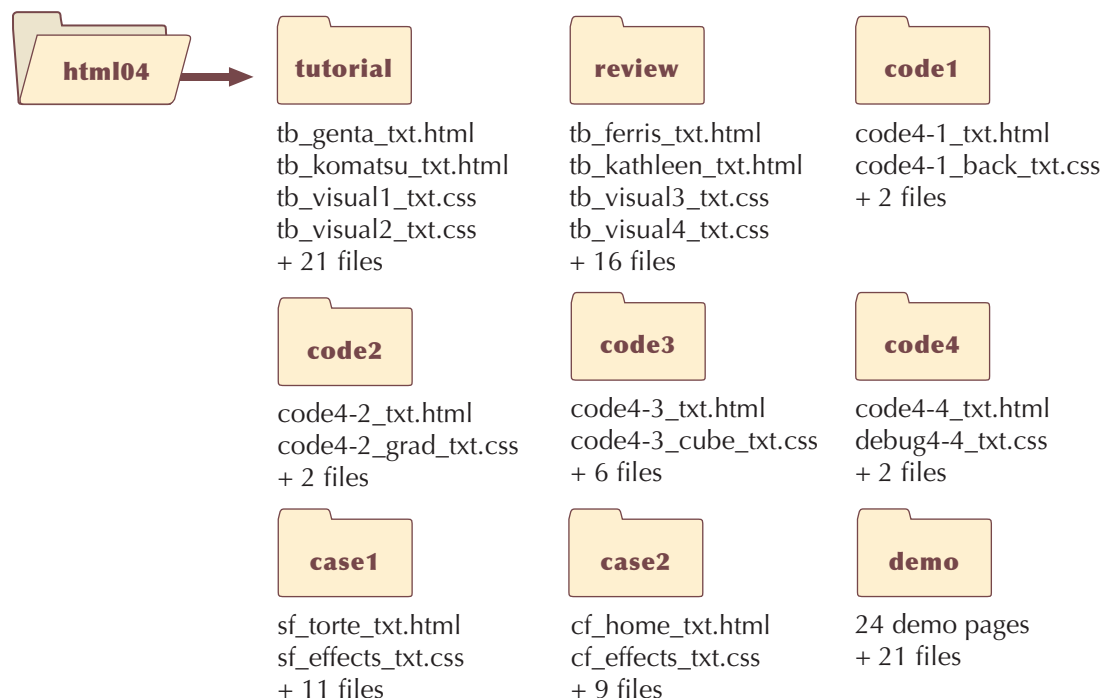
# Graphic Design with CSS

## *Creating a Graphic Design for a Genealogy Website*

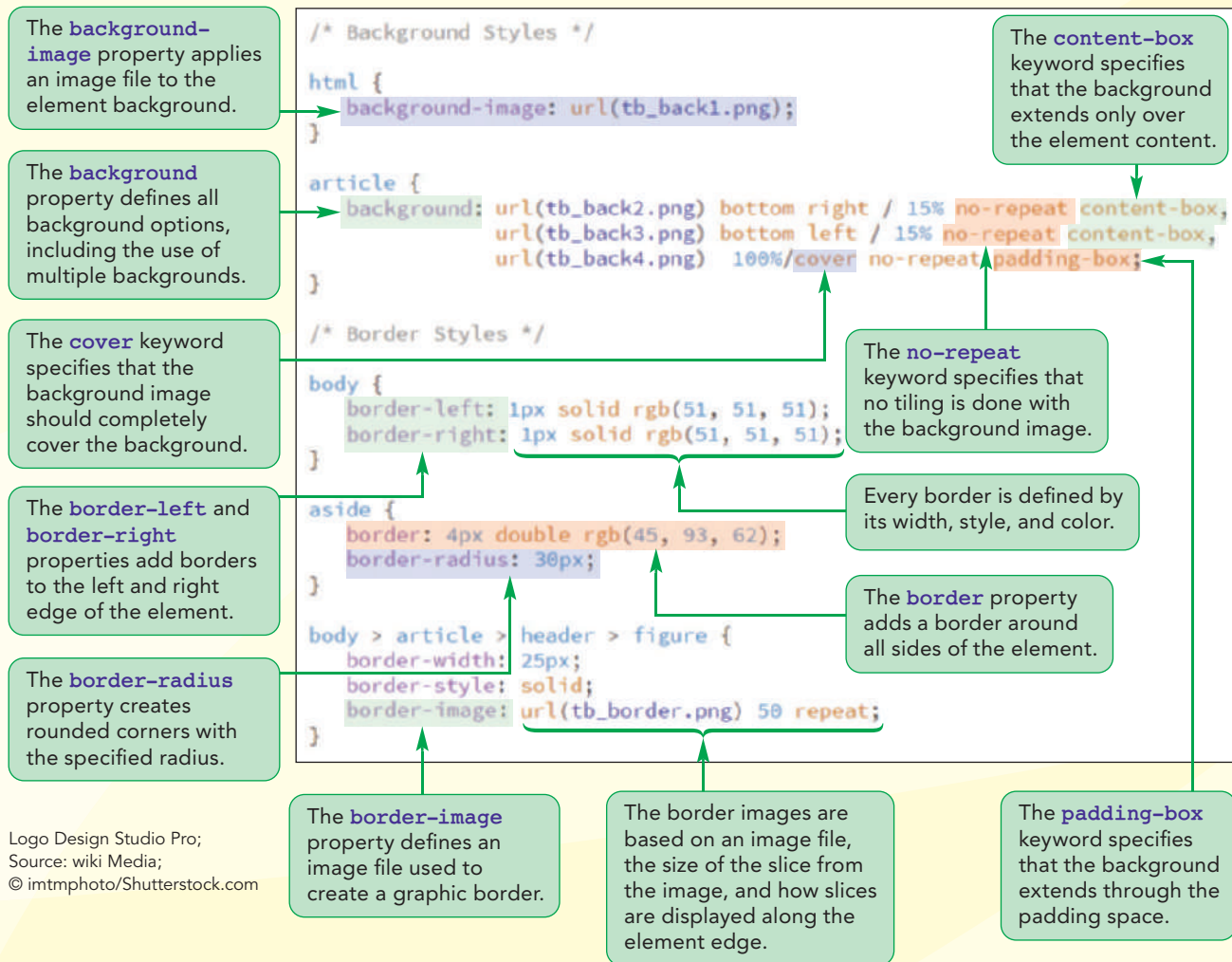
### Case | *Tree and Book*

Kevin Whitmore is the founder of *Tree and Book*, a social networking website for people interested in documenting their family histories, creating online photo albums, and posting stories and information about members of their extended families. He has come to you for help in upgrading the site's design. Kevin wants to take advantage of some of the CSS styles that can be used to add interesting visual effects to his site in order to give his website more impact and visual interest.

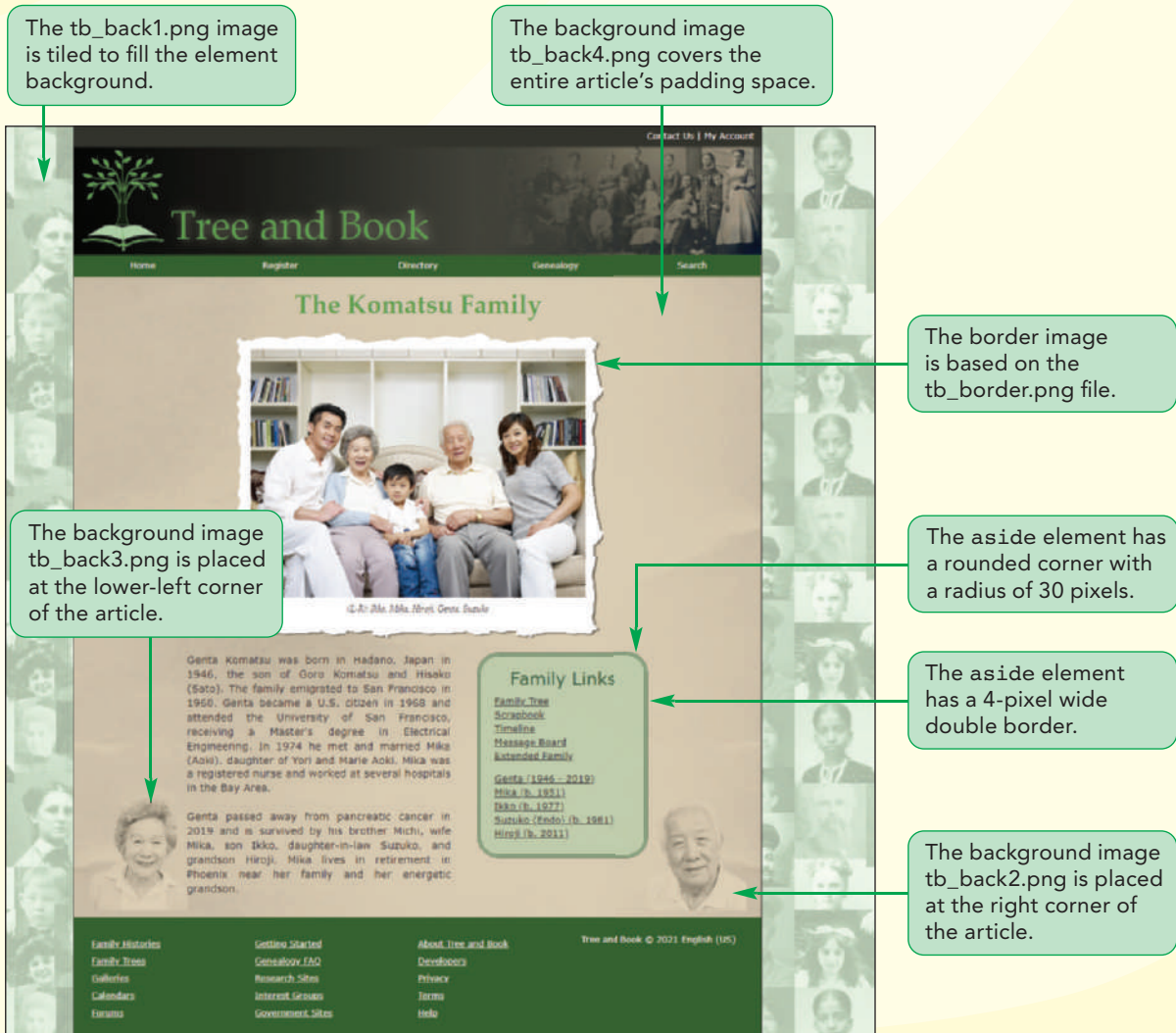
### STARTING DATA FILES



# Session 4.1 Visual Overview:



# Backgrounds and Borders



Source: Wikimedia Commons; Design Studio Pro; imtmphoto/Shutterstock.com; imtmphoto/Shutterstock.com

## Creating Figure Boxes

So far your work with CSS visual design styles has been limited to typographical styles and styles that modify the page's color scheme. In this tutorial, you'll explore other CSS styles that allow you to add figure boxes, background textures, background images, and three-dimensional effects to your web pages.

You'll start by examining how to work with figure boxes. In books and magazines, figures and figure captions are often placed within a separate box that stands apart from the main content of the article, using the following `figure` and `figcaption` elements:

```
<figure>
 content
 <figcaption>caption text</figcaption>
</figure>
```

where `content` is the content that will appear within the figure box and `caption text` is the description text that accompanies the figure. The `figcaption` element is optional and can be placed either directly before or directly after the figure box content. For example, the following code marks a figure box containing the `tb_komatsu.png` image file with the caption (L-R): *Ikko, Mika, Hiroji, Genta, Suzuko*.

```
<figure>

 <figcaption>(L-R): Ikko, Mika, Hiroji, Genta, Suzuko</figcaption>
</figure>
```

### TIP

The semantic difference between the `figure` and `aside` elements is that the `figure` element should be used for content that is directly referenced from within an article while the `aside` element is used for extraneous content.

While the `figure` element is used to contain an image file, it can also be used to mark any page content that you want to stand apart from the main content of an article. For instance, the `figure` element could contain a text excerpt, as the following code demonstrates:

```
<figure>
 <p>'Twas brillig, and the slithy toves

 Did gyre and gimble in the wabe;

 All mimsy were the borogoves,

 And the mome raths outgrabe.</p>
 <figcaption>
 <cite>Jabberwocky, Lewis Carroll, 1832-98</cite>
 </figcaption>
</figure>
```

Kevin plans on using figure boxes throughout the Tree and Book website to mark up family and individual photos along with descriptive captions. He's created a set of sample pages for the Komatsu family that you will work on to learn about HTML and CSS visual elements and styles. Open the family's home page and create a figure box displaying the family portrait along with a descriptive caption.

### To create a figure box:

1. Use your editor to open the **tb\_komatsu\_txt.html** file from the **html04** ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **tb\_komatsu.html**.

For this web page, you'll work with a new style sheet named `tb_visual1.css`. Kevin has already created a reset style sheet and a typographical style sheet in the `tb_reset.css` and `tb_styles1.css` files respectively.

2. Within the document head, insert the following `link` elements to link the page to the `tb_reset.css`, `tb_styles1.css`, and `tb_visual1.css` style sheet files.
 

```
<link href="tb_reset.css" rel="stylesheet" />
<link href="tb_styles1.css" rel="stylesheet" />
<link href="tb_visual1.css" rel="stylesheet" />
```
3. Scroll down to the `article` element and, directly after the `h1` element, insert the following code for the figure box displaying the Komatsu family portrait.
 

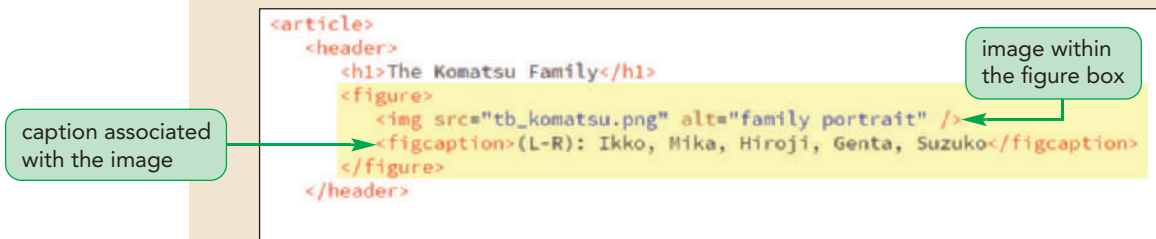
```
<figure>

 <figcaption>(L-R): Ikko, Mika, Hiroji,
 Genta, Suzuko
</figcaption>
</figure>
```

Figure 4–1 highlights the code for the family portrait figure box.

Figure 4–1

## Inserting a figure box



4. Take some time to review the content and structure of the rest of the document and then save your changes to the file.

Format the appearance of the figure box by adding new style rules to the `tb_visual1.css` style sheet file.

## To format and view the figure box:

1. Use your editor to open the **tb\_visual1.txt.css** files from the `html04` ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **tb\_visual1.css**.
2. Scroll down to the Figure Box Styles section at the bottom the document and insert the following style rule for the `figure` element:
 

```
figure {
 margin: 20px auto 0px;
 width: 80%;
}
```
3. Add the following style to format the appearance of the image within the figure box:
 

```
figure img {
 display: block;
 width: 100%;
}
```

4. Finally, insert the following rule for the figure caption:

```
figure figcaption {
 background-color: white;
 font-family: 'Palatino Linotype', Palatino,
 'Times New Roman', serif;
 font-style: italic;
 padding: 10px 0;
 text-align: center;
}
```

Figure 4–2 highlights the style rules for the figure box, image, and caption.

Figure 4–2

#### Formatting the figure box and caption

figure box is 80% of the width of the header and centered horizontally

figure image is displayed as a block with a width equal to the figure box

figure caption is centered and displayed in a serif italic font on a white background

/\* Figure Box Styles \*/

```
figure {
 margin: 20px auto 0px;
 width: 80%;
}
```

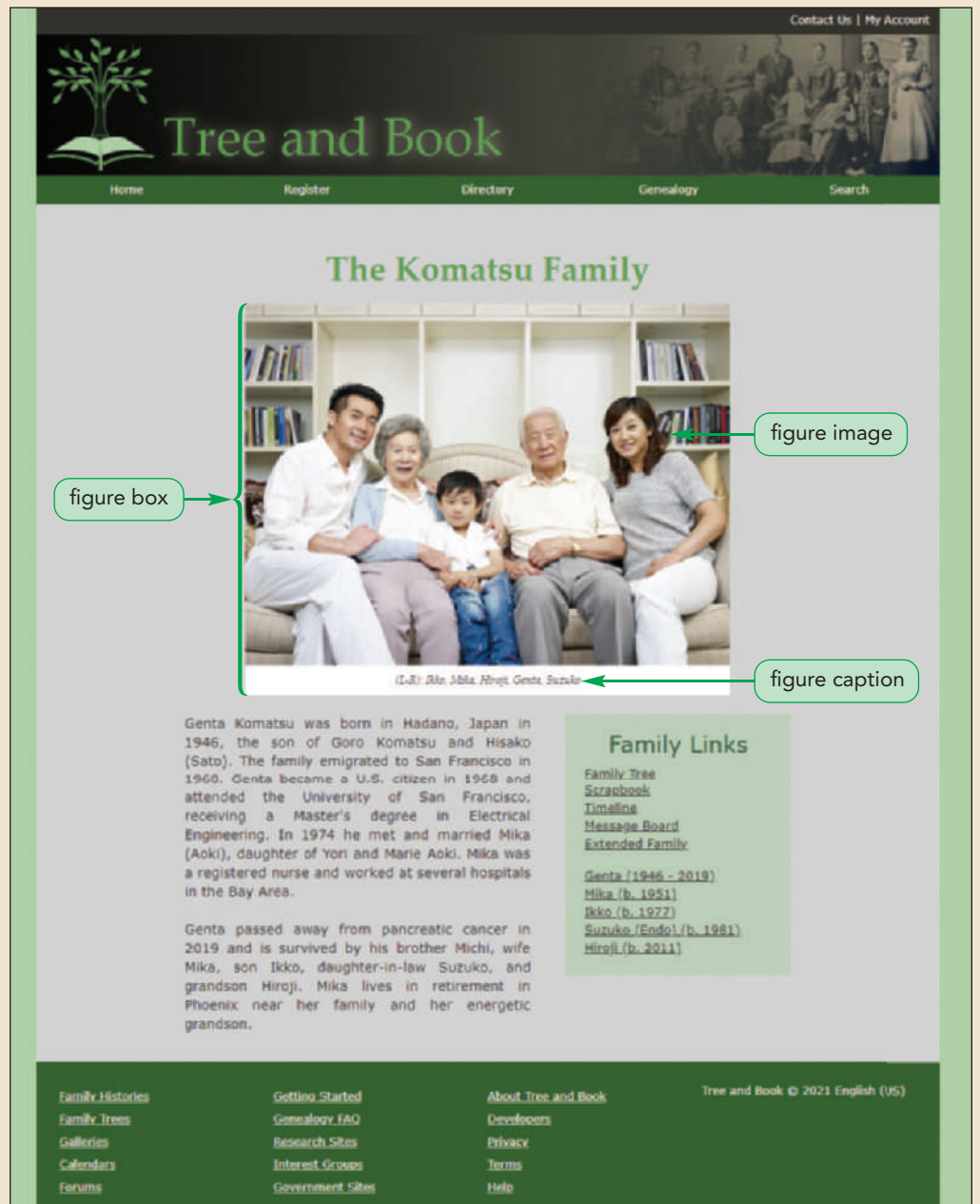
```
figure img {
 display: block;
 width: 100%;
}
```

```
figure figcaption {
 background-color: white;
 font-family: 'Palatino Linotype', Palatino, 'Times New Roman', serif;
 font-style: italic;
 padding: 10px 0;
 text-align: center;
}
```

5. Save your changes to the file and then open the **tb\_komatsu.html** file in your browser. Figure 4–3 shows the initial appearance of the page.

Figure 4–3

## Initial design of the Komatsu family page



Source: Design Studio Pro; Source: Wikimedia Commons; © intmphoto/Shutterstock.com

With all of the content for the Komatsu Family page now added, you will start working on enhancing the page's appearance, starting with the CSS background styles.

### Choosing your Graphic File Format

Graphic files on the web fall into two basic categories: vector images and bitmap images. A **vector image** is an image comprised of lines and curves that are based on mathematical functions. The great advantage of vector images is that they can be easily resized without losing their clarity and vector files tend to be compact in size. The most common vector format for the web is **SVG (Scalable Vector Graphics)**, which is an XML markup language that can be created using a basic text editor and knowledge of the SVG language.

A **bitmap image** is an image that is comprised of pixels in which every pixel is marked with a different color. Because a graphic file can be comprised of thousands of pixels, the file size of a bitmap image is considerably larger than the file size of a vector image. The most common bitmap formats on the web are GIF, JPEG, and PNG.

**GIF (Graphic Interchange Format)** is the oldest standard with a palette limited to 256 colors. GIF files, which tend to be large, have two advantages: first, GIFs support transparent colors and second, GIFs can be used to create animated images. Because GIFs have a limited color palette, they are unsuitable for photos. The most popular photo format is **JPEG (Joint Photographic Experts Group)**, which supports a palette of over 16 million colors. JPEGs also support file compression, allowing a bitmap image to be stored at a smaller file size than would be possible with other bitmap formats. JPEGs do not support transparent colors or animations.

The **PNG (Portable Network Graphics)** format was designed to replace GIFs with its support for several levels of transparent colors and palette of millions of colors. A PNG file can also be compressed, creating a file that is considerably smaller and, therefore, takes up considerably less space than its equivalent GIF file. PNG files also contain color correction information so that PNGs can be accurately rendered across a variety of display devices.

In choosing a graphic format for your website, the most important consideration is often file size; you want to choose the smallest size that still gives you an acceptable image. This combination means that users will view a quality image but they will not have to wait for the graphic file to download. In addition to file size, you want to choose a format that supports a large color palette. For these reasons, most graphics on the web are now in either JPEG or PNG format, though GIFs are still often found on legacy sites.

## Exploring Background Styles

Thus far, your design choices for backgrounds have been limited to color using either the RGB or HSL color models. CSS also supports the use of images for backgrounds through the following `background-image` style:

```
background-image: url(url);
```

where `url` specifies the name and location of the background image. For example, the following style rule uses the `trees.png` file as the background of the page body.

```
body {
 background-image: url(trees.png);
}
```

This code assumes that the `trees.png` file is in the same folder as the style sheet; if the figure is not in the same folder, then you will have to include path information pointing to the folder location in which the image file resides.

## Tiling a Background Image

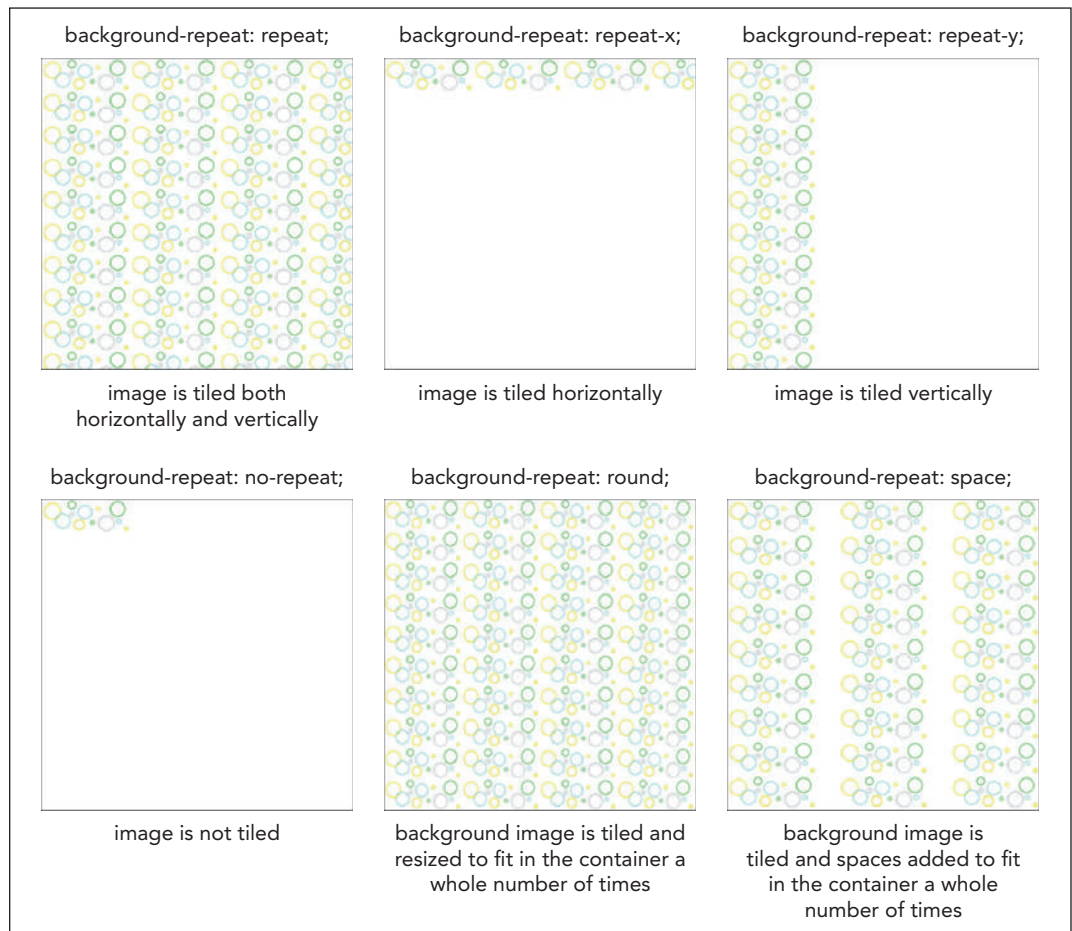
The default browser behavior is to place the background image at the top-left corner of the element and repeat the image in both the vertical and horizontal direction until the background is filled. This process is known as **tiling** because of its similarity to the process of filling up a floor or other surface with tiles.

You can specify the type of tiling to be applied to the background image, or even turn off tiling, by applying the following `background-repeat` style:

```
background-repeat: type;
```

where *type* is `repeat` (the default), `repeat-x`, `repeat-y`, `no-repeat`, `round`, or `space`. Figure 4–4 displays the effect of each `background-repeat` type.

**Figure 4–4** Examples of background-repeat types



## REFERENCE

### Adding a Background Image

- To add an image to the background, use the CSS style

```
background-image: url(url);
```

where *url* specifies the name and location of the background image.

- To specify how the image should be tiled, use

```
background-repeat: type;
```

where *type* is repeat (the default), repeat-x, repeat-y, no-repeat, round, or space.

Kevin has supplied you with an image file, `tb_back1.png` to fill the background of the browser window. Use the default option for tiling so that the image is displayed starting from the top-left corner of the window and repeating until the entire window is filled.

### To add a background image to the browser window:

1. Return to the `tb_visual1.css` file in your editor.
2. Go to the HTML Styles section and add the following style rule to change the background of the browser window:

```
html {
 background-image: url(tb_back1.png);
}
```

Note that because you are using the default setting for tiling the background image, you do not need to include the `background-repeat` style rule. Figure 4–5 highlights the new style rule.

Figure 4–5

### Defining a background image

tiles the `tb_back1.png` image file across the browser window background

```
/* HTML Styles */
html {
 background-image: url(tb_back1.png);
}
```

3. Save your changes to the file and then reload `tb_komatsu.html` in your browser. Figure 4–6 shows the tiled background in the browser window.

Figure 4–6

Tiled background image in the browser window



Note that the page body covers part of the tiled images in the browser window. However, even though the background images are hidden, the tiling still continues behind the page body.

## Attaching the Background Image

A background image is attached to its element so that as you scroll through the element content, the background image scrolls with it. You can change the attachment using the following background-attachment property

```
background-attachment: type;
```

where *type* is *scroll* (the default), *fixed*, or *local*. The *scroll* type sets the background to scroll with the element content. The *fixed* type creates a background that stays in place even as the element content is scrolled horizontally or vertically. Fixed backgrounds are sometimes used to create **watermarks**, which are translucent graphics displayed behind the content with a message that the content material is copyrighted or in draft form or some other message directed to the reader. The *local* type is similar to *scroll* except that it is used for elements, such as scroll boxes, to allow the element background to scroll along with the content within the box.

## Setting the Background Image Position

By default, browsers place the background image in the element's top-left corner. You can place the background image at a different position using the following background-position property:

```
background-position: horizontal vertical;
```

### TIP

Background coordinates are measured from the top-left corner of the background to the top-left corner of the image.

where *horizontal* and *vertical* provide the coordinates of the image within the element background expressed using one of the CSS units of measure or as a percentage of the element's width and height. For example, the following style places the image 10% of the width of the element from the left edge of the background and 20% of the element's height from the background's top edge.

```
background-position: 10% 20%;
```

If you specify a single value, the browser applies that value to both the horizontal and vertical position. Thus, the following style places the background image 30 pixels from the element's left edge and 30 pixels down from the top edge.

```
background-position: 30px;
```

You can also place the background image using the keywords `left`, `center`, and `right` for the horizontal position and `top`, `center`, and `bottom` for the vertical position. The following style places the background image in the bottom-right corner of the element.

```
background-position: right bottom;
```

Typically, the `background-position` property is only useful for non-tiled images because, if the image is tiled, the tiled image fills the background and it usually doesn't matter where the tiling starts.

## Defining the Extent of the Background

You learned in Tutorial 2 that every block element follows the Box Model in which the element content is surrounded by a padding space and beyond that a border space (see Figure 2-38). However, the element's background is defined, by default, to extend only through the padding space and not to include the border space. You can change this definition using the following `background-clip` property:

```
background-clip: type;
```

### TRY IT

You can explore the impact of different CSS background styles using the `demo_background.html` file in the `html04` demo folder.

where *type* is `content-box` (to extend the background only through the element content), `padding-box` (to extend the background through the padding space), or `border-box` (to extend the background through the border space). For example, the following style rule defines the background for the page body to extend only as far as the page content. The padding and border spaces would not be considered part of the background and thus would not show any background image.

```
body {
 background-clip: content-box;
}
```

Because the background extends through the padding space by default, all coordinates for the background image position are measured from the top-left corner of that padding space. You can choose a different context by applying the following `background-origin` property:

```
background-origin: type;
```

where *type* is once again `content-box`, `padding-box`, or `border-box`. Thus, the following style rule places the background image at the bottom-left corner of the page body content and not the bottom-left corner of the padding space (which would be the default).

```
body {
 background-position: left bottom;
 background-origin: content-box;
}
```

Based on this style rule, the padding space of page body would not have any background image or color, other than what would be defined for the browser window itself.

## Sizing and Clipping an Image

The size of the background image is equal to the size stored in the image file. To specify a different size, apply the following `background-size` property:

```
background-size: width height;
```

where *width* and *height* are the width and height of the image in one of the CSS units of length or as a percentage of the element's width and height. The following style sets the size of the background image to 300 pixels wide by 200 pixels high.

```
background-size: 300px 200px;
```

CSS also supports the sizing keywords `auto`, `cover`, and `contain`. The `auto` keyword tells the browser to automatically set the width or height value based on the dimensions of the original image. The following style sets the height of the image to 200 pixels and automatically scales the width to keep the original proportions of the image:

```
background-size: auto 200px;
```

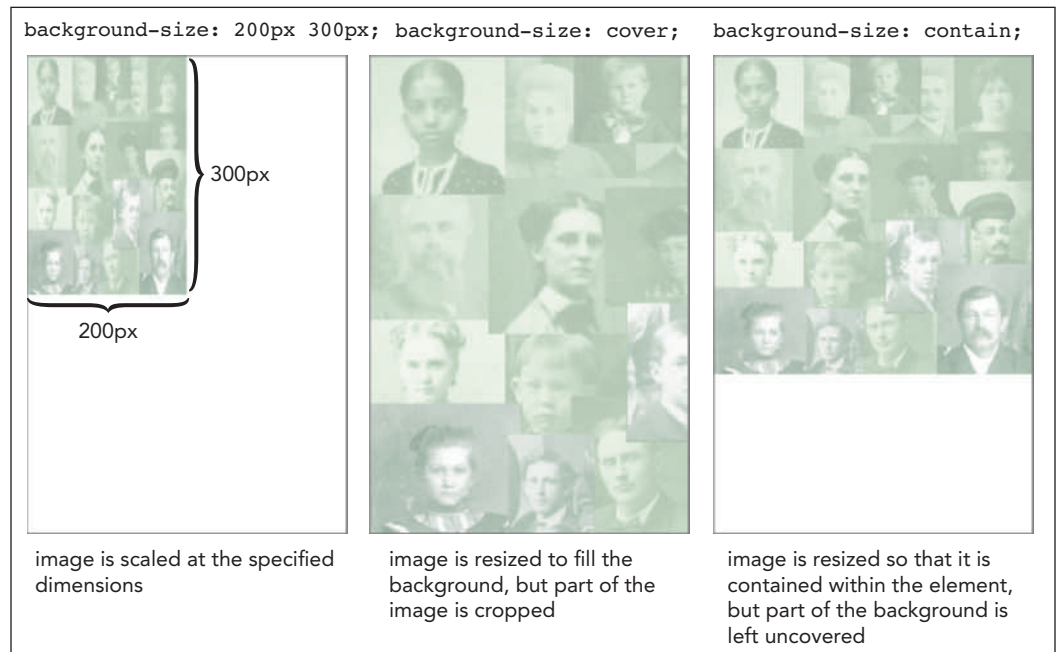
### TIP

If you specify only one size value, the browser applies it to the image width and scales the height proportionally.

The `cover` keyword tells the browser to resize the image to cover all of the element background while still retaining the image proportions. Depending on the size of the element, this could result in some of the background image being cropped. The `contain` keyword scales the image so that it's completely contained within the element, even if that means that not all of the element background is covered. Figure 4–7 displays examples of a background set to a specific size, as well as resized to either cover the background or to have the image completely contained within the background.

Figure 4–7

### Examples of background-size types



Source: Wikimedia Commons

## REFERENCE

### Setting Background Image Options

- To specify how the image is attached to the background, use  
`background-attachment: type;`  
 where *type* is *scroll* (the default), *fixed*, or *local*.
- To set the position of the background image, use  
`background-position: horizontal vertical;`  
 where *horizontal* and *vertical* provide the coordinates of the image within the element background.
- To define the extent of the background, use  
`background-clip: type;`  
 where *type* is *content-box*, *padding-box* (the default), or *border-box*.
- To define how position coordinates are measured, use  
`background-origin: type;`  
 where *type* is *content-box*, *padding-box* (the default), or *border-box*.

## The background Property

All of these different background options can be organized in the following `background` property:

```
background: color url(url) position / size repeat attachment
origin clip;
```

### TRY IT

You can explore the CSS background style using the `demo_background2.html` file in the `html04 ▶ demo` folder.

where *color* is the background color, *url* is the source of the background image, *position* is the image's position, *size* sets the image size, *repeat* sets the tiling of the image, *attachment* specifies whether the image scrolls with the content or is fixed, *origin* defines how positions are measured on the background, and *clip* specifies the extent over which the background is spread. For example, the following style rule sets the background color to ivory and then uses the `draft.png` file as the background image fixed at the horizontal and vertical center of the page body and sized at 10% of the body's width and height:

```
body {
 background: ivory url(draft.png)
 center center / 10% 10%
 no-repeat fixed content-box content-box;
}
```

The rest of the property sets the image not to repeat and to use the content box for defining the background origin and clipping. Note that the page body will have an ivory background color at any location where the `draft.png` image is not displayed. If you don't specify all of the option values, the browser will assume the default values for the missing options. Thus, the following style rule places the `draft.png` at the horizontal and vertical center of the page body without tiling:

```
body {
 background: ivory url(draft.png) center center no-repeat;
}
```

**TIP**

The background property includes the "/" character only when you need to separate the image position value from the image size value.

Since no *size*, *attachment*, *origin*, and *clip* values are specified, the size of the image will be based on the dimensions from the image file, the image will scroll with the body content, and the background origin and clipping will extend through the page body's padding space.

Kevin wants you to include a semi-transparent image of the family patriarch, Genta Komatsu, as a background image placed in the lower-right corner of the article on the Komatsu family. Add a style rule to the `tb_visual1.css` file to display the `tb_back2.png` image within that element without tiling.

### To add a background image to the page article:

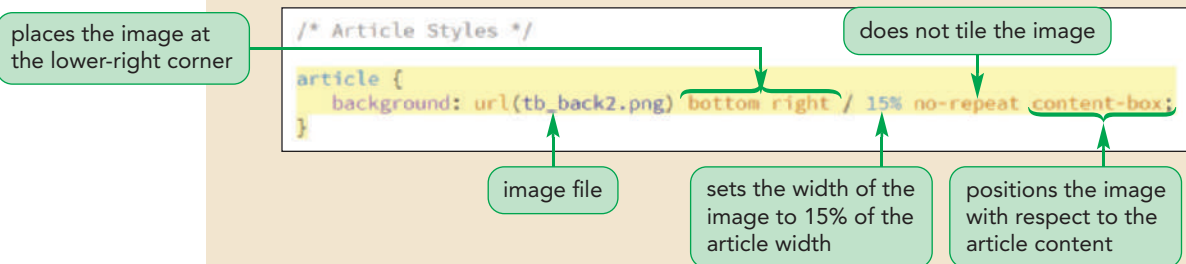
1. Return to the `tb_visual1.css` file in your editor and scroll down to the Article Styles section.
2. Add the following style rule:

```
article {
 background: url(tb_back2.png) bottom right / 15%
 no-repeat content-box;
}
```

Figure 4–8 highlights the style rule applied to the page article.

Figure 4–8

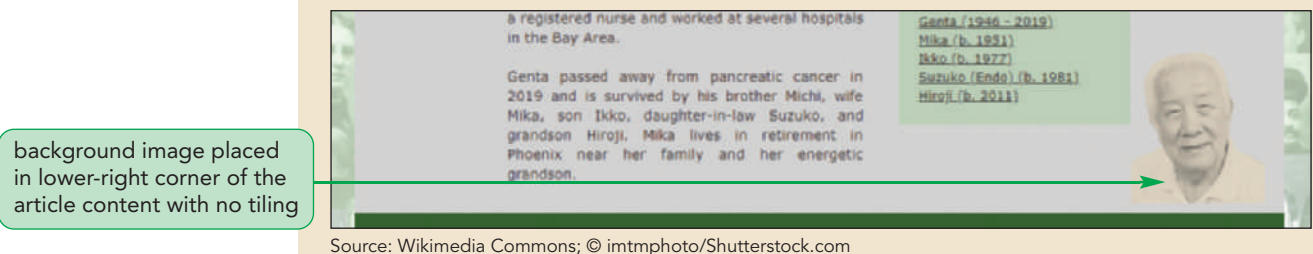
### Adding a background to the page article



3. Save your changes and then reload `tb_komatsu.html` in your browser. Figure 4–9 shows the placement of the background image.

Figure 4–9

### Placement of the background image



Kevin likes the addition of the image of Genta Komatsu and would like you to add another background image showing the family matriarch, Mika Komatsu, and a third image giving the article a paper-textured background.

## Adding Multiple Backgrounds

To add multiple backgrounds to the same element, you list the backgrounds in the following comma-separated list:

```
background: background1, background2, ...;
```

where *background1*, *background2*, and so on are the properties for each background. For example the following style rule applies three different backgrounds to the `header` element:

```
header {
 background: url(back2.png) top left no-repeat,
 url(back1.png) bottom right no-repeat,
 rgb(191, 191, 191);
}
```

### TIP

Always list the background color last so that it provides the foundation for your background images.

Backgrounds are added in the reverse order in which they're listed in the style rule. In this style rule, the background color is applied first, the `back1.png` background image is placed on top of that, and finally the `back2.png` background image is placed on top of those two backgrounds.

Individual background properties can also contain multiple options placed in a comma-separated list. The following style rule creates the same multiple backgrounds for the `header` element without using the `background` property:

```
header {
 background-image: url(back2.png), url(back1.png);
 background-position: top left, bottom right;
 background-repeat: no-repeat;
 background-color: rgb(191, 191, 191);
}
```

Note that if a background style is listed once, it is applied across all of the backgrounds. Thus the `background-color` and the `background-repeat` properties are used in all the backgrounds.

Revise the style rule for the `article` element to add two more backgrounds.

### To add a background image to the page article:

1. Return to the **tb\_visual1.css** file in your editor and return to the Article Styles section.
2. Type a comma after the first background listed for the `article` element and before the semicolon (;), then press **Enter**.
3. Be sure the insertion point is before the semicolon (;), then add the following code to display two more background images followed by a background color:

```
url(tb_back3.png) bottom left / 15% no-repeat content-box,
url(tb_back4.png) 100%/cover no-repeat,
rgb(211, 211, 211)
```

The background color acts as a fallback design element and will not be displayed except for browsers that are incapable of displaying background images. Figure 4–10 displays the code for the multiple backgrounds applied to the page article.

The properties for multiple backgrounds need to be separated by commas.

Figure 4–10

## Adding multiple background images

places the second background image at the lower-left corner of the article content with no tiling and a width of 15%

places the third background image, scaled to cover all of the padding box of the article without repeating

```
/* Article Styles */
article {
 background: url(tb_back2.png) bottom right / 15% no-repeat content-box,
 url(tb_back3.png) bottom left / 15% no-repeat content-box,
 url(tb_back4.png) 100%/cover no-repeat,
 rgb(211, 211, 211);
}
```

commas used to separate one background from the next

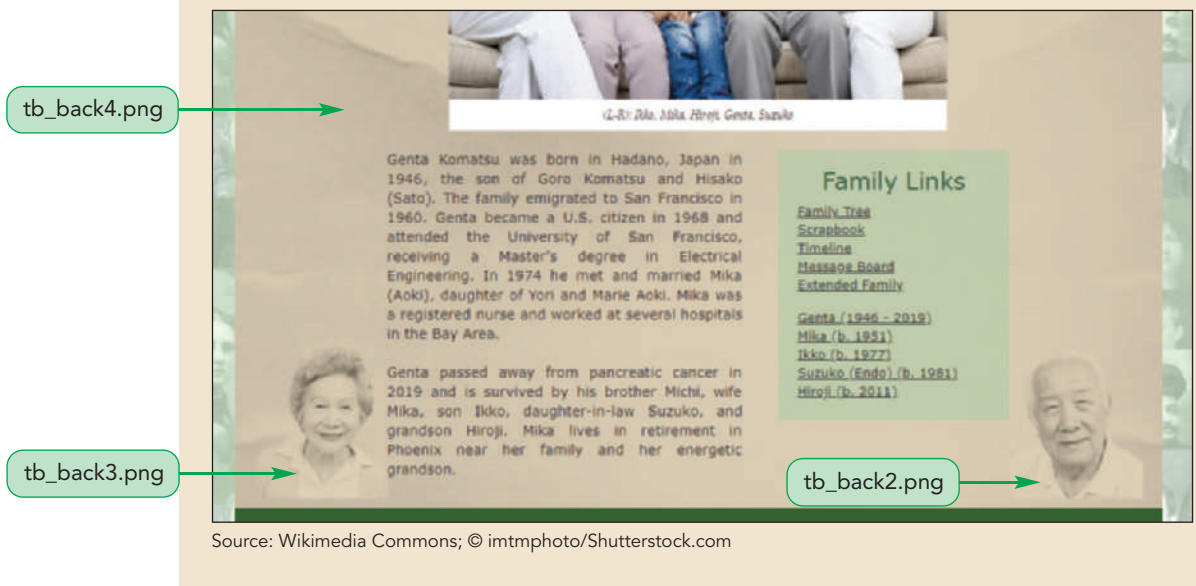
uses a gray color as the background if the browser doesn't support background images

**Trouble?** Be sure your code matches the code in Figure 4–10, including the commas used to separate the components in the list and the ending semicolon.

4. Save your changes and then reload tb\_komatsu.html in your browser. Figure 4–11 shows the three background images displayed with the article.

Figure 4–11

## Revised background for the page article



Kevin is pleased with the revised backgrounds for the browser window and the page article. Next, you will explore how to work with CSS border properties.

## INSIGHT

### Blending Backgrounds

Multiple backgrounds are stacked on top of each other, with the first background listed in the code placed on top of subsequent backgrounds. By default, the backgrounds on the top of the stack will obscure the lower-ordered backgrounds unless there is gap or a transparent color that allows the backgrounds at the bottom of the stack to appear. Thus, each background acts as its own background layer, separate in appearance from other backgrounds.

To combine multiple backgrounds into a single background, use the following `background-blend-mode` style:

```
background-blend-mode: type;
```

where *type* defines the method by which the backgrounds are combined. Possible *type* values include:

- `normal` backgrounds are stacked (the default)
- `multiply` background colors are multiplied, leading to a darker image combined of several colors
- `overlay` background colors are mixed to reflect the lightness and darkness of the colors
- `darken` backgrounds are replaced with the darkest of background colors
- `lighten` backgrounds are replaced with the lightest of the background colors

Several other *type* options are also available. You can specify a comma-separated list of blend values, so that each background layer is blended in a different way with all the other backgrounds.

**TRY IT**

To explore the impact of the `background-blend-mode` style on multiple backgrounds, open the `demo_blend.html` file in the `html04 ► demo` folder.

## Working with Borders

So far, you have only worked with the content, padding, and margin spaces from the CSS Box model. Now, you will examine the border space that separates the element's content and padding from its margins and essentially marks the extent of the element as it is rendered on the page.

### Setting Border Width and Color

CSS supports several style properties that are used to format the border around each element. As with the margin and padding styles, you can apply a style to the top, right, bottom, or left border, or to all borders at once. To define the thickness of a specific border, use the property

```
border-side-width: width;
```

where *side* is either `top`, `right`, `bottom`, or `left` and *width* is the width of the border in one of the CSS units of measure. For example, the following style sets the width of the bottom border to 10 pixels.

```
border-bottom-width: 10px;
```

Border widths also can be expressed using the keywords `thin`, `medium`, or `thick`; the exact application of these keywords depends on the browser. You can define the border widths for all sides at once using the `border-width` property

```
border-width: top right bottom left;
```

where *top*, *right*, *bottom*, and *left* are the widths of the matching border. As with the margin and padding properties, if you enter one value, it's applied to all four

borders; two values set the width of the top/bottom and left/right borders, respectively; and three values are applied to the top, left/right, and bottom borders, in that order. Thus, the following property sets the widths of the top/bottom borders to 10 pixels and the left/right borders to 20 pixels:

```
border-width: 10px 20px;
```

The color of each individual border is set using the property

```
border-side-color: color;
```

where *side* once again specifies the border side and *color* is a color name, color value, or the keyword *transparent* to create an invisible border. The color of the four sides can be specified using the following *border-color* property

```
border-color: top right bottom left;
```

where *top right bottom left* specifies the side to which the color should be applied. Thus, the following style uses gray for the top and left borders and black for the right and bottom borders:

```
border-color: gray black black gray;
```

If no border color is specified, the border will use the text color assigned to the element.

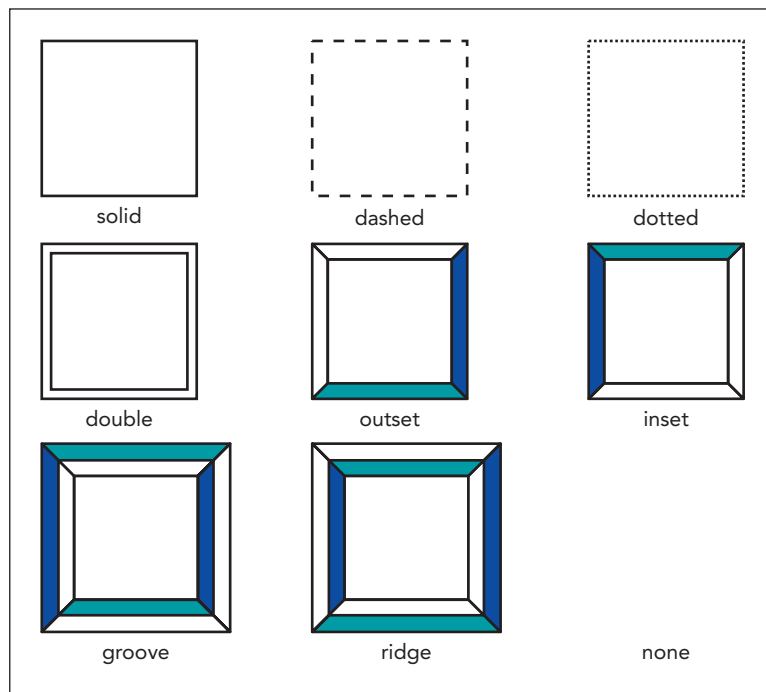
## Setting the Border Design

CSS allows you to further define the appearance of borders using the following border styles:

```
border-side-style: style;
```

where *side* once again indicates the border side and *style* specifies one of the nine border styles displayed in Figure 4–12.

**Figure 4–12** Examples of border styles



Or to specify styles for all four borders use the property:

```
border-style: top right bottom left;
```

As with the other border rules, you can modify the style of all borders or combinations of the borders. For example, the following style uses a double line for the top/bottom borders and a single solid line for the left/right borders.

```
border-style: double solid;
```

All of the border styles discussed above can be combined into the following property that formats the width, style, and color of all of the borders

```
border: width style color;
```

### TRY IT

You can explore the CSS border style using the `demo_border.html` file in the `html04 ▶ demo` folder.

where *width* is the thickness of the border, *style* is the style of the border, and *color* is the border color. The following style rule inserts a 2-pixel-wide solid blue border around every side of each `h1` heading in the document:

```
h1 {border: 2px solid blue;}
```

To modify the width, style, and color of a single border, use the property

```
border-side: width style color;
```

where *side* is either `top`, `right`, `bottom`, or `left`.

### REFERENCE

#### Adding a Border

- To add a border around every side of an element, use the CSS property

```
border: width style color;
```

where *width* is the width of the border, *style* is the design style, and *color* is the border color.

- To apply a border to a specific side, use

```
border-side: width style color;
```

where *side* is `top`, `right`, `bottom`, or `left` for the top, right, bottom, and left borders.

- To set the width, style, or color of a specific side, use the properties

```
border-side-width: width;
```

```
border-side-style: style;
```

```
border-side-color: color;
```

Kevin wants the page body to stand out better against the tiled images used as the background for the browser window. He suggests you add solid borders to the left and right edges of the page body and that you add a double border around the `aside` element containing links to other Komatsu family pages.

#### To add borders to the page elements:

1. Return to the `tb_visual1.css` file in your editor and go to the Page Body Styles section.
2. Add the following style rule for the page body:
 

```
body {
 border-left: 1px solid rgb(51, 51, 51);
 border-right: 1px solid rgb(51, 51, 51);
}
```
3. Go to the Aside Styles section and add the following style rule for the `aside` element:
 

```
aside {
 border: 4px double rgb(45, 93, 62);
}
```

Figure 4–13 highlights the style rules that create borders for the page body and aside element.

Figure 4–13

## Adding borders to the page body and aside element

adds a 1-pixel solid gray border to the left and right edges of the page body

adds a 4-pixel double medium green border to the aside element

```
/* Page Body Styles */
body {
 border-left: 1px solid rgb(51, 51, 51);
 border-right: 1px solid rgb(51, 51, 51);
}

/* Aside Styles */
aside {
 border: 4px double rgb(45, 93, 62);
}
```

4. Save your changes to the file and then reload `tb_komatsu.html` in your browser. Figure 4–14 shows the appearance of the page with the newly added borders. Note that the background color and other styles associated with the `aside` element are in the `tb_styles1.css` file.

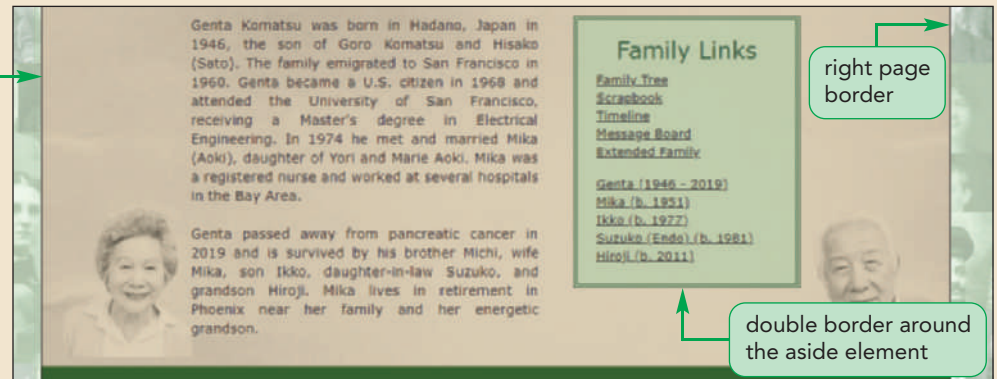
Figure 4–14

## Page design with borders

left page border

right page border

double border around the aside element



Source: Wikimedia Commons; © imtmphoto/Shutterstock.com

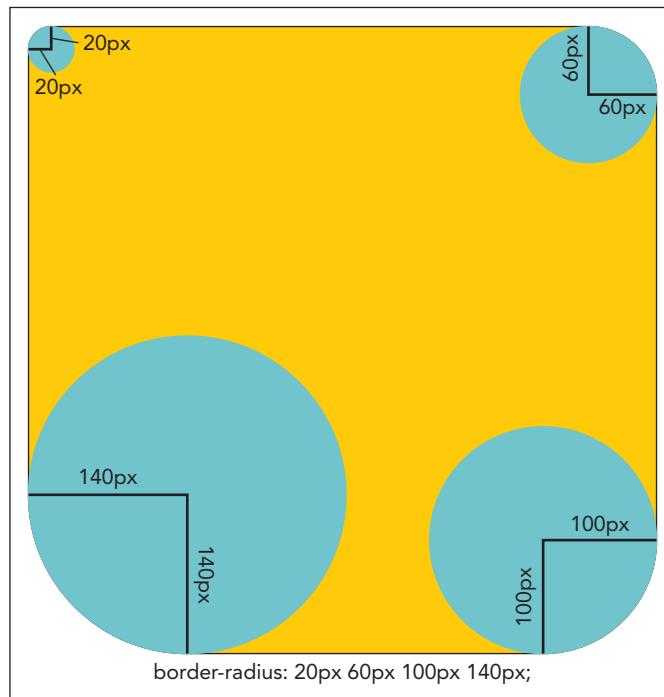
Kevin is concerned that the design of the page is too boxy and he wants you to soften the design by adding curves to some of the page elements. You can create this effect using rounded corners.

## Creating Rounded Corners

To round off any of the four corners of a border, apply the following `border-radius` property:

```
border-radius: top-left top-right bottom-right bottom-left;
```

where *top-left*, *top-right*, *bottom-right*, and *bottom-left* are the radii of the individual corners. The radii are equal to the radii of hypothetical circles placed at the corners of the box with the arcs of the circles defining the rounded corners (see Figure 4–15).

**Figure 4–15** Setting rounded corners based on corner radii**TRY IT**

You can explore the CSS border-radius style using the `demo_radius.html` file in the `html04 ▶ demo` folder.

If you enter only one radius value, it is applied to all four corners; if you enter two values, the first is applied to the top-left and bottom-right corners, and the second is applied to the top-right and bottom-left corners. If you specify three radii, they are applied to the top-left, top-right/bottom-left, and bottom-right corners, in that order. For example, the following style rule creates rounded corners for the `aside` element in which the radii of the top-left and bottom-right corners is 50 pixels and the radii of the top-right and bottom-left corners is 20 pixels.

```
aside {border-radius: 50px 20px;}
```

To set the curvature for only one corner, use the property:

```
border-corner-radius: radius;
```

where *corner* is either `top-left`, `top-right`, `bottom-right`, or `bottom-left`.

**REFERENCE****Creating a Rounded Corner**

- To create rounded corners for an element border, use

```
border-radius: top-left top-right bottom-right bottom-left;
```

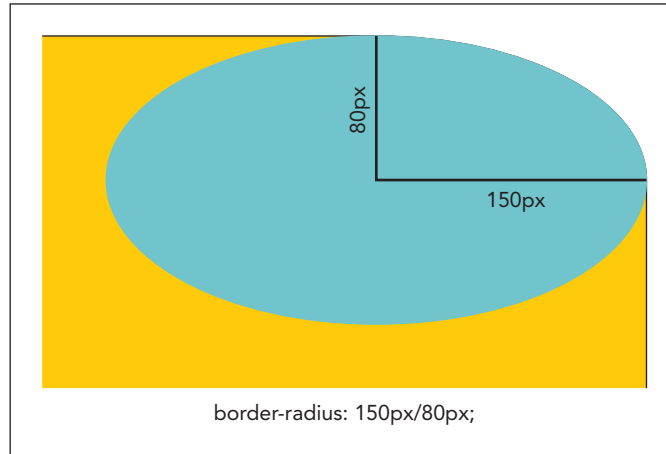
where *radius* is the radius of the rounded corner in one of the CSS units of measurement and *top-left*, *top-right*, *bottom-right*, and *bottom-left* are the radii of the individual corners.

The corners do not need to be circular. Elongated or elliptical corners are created by specifying the ratio of the horizontal radius to the vertical radius using the style:

```
border-radius: horizontal/vertical;
```

where *horizontal* is the horizontal radius of the corner and *vertical* is the vertical radius of the same corner (see Figure 4–16).

**Figure 4–16** Creating an elongated corner



Thus, the following style rule creates elongated corners in which the ratio of the horizontal to vertical radius is 50 pixels to 20 pixels.

```
border-radius: 50px/20px;
```

#### TIP

To create a circular border, use a square element with an equal width and height and the corner radii set to 50%.

Note that using percentages for the radius value can result in elongated corners if the element is not perfectly square. The following style rule sets the horizontal radius to 15% of element width and 15% of the element height. If the element is twice as wide as it is high for example, the corners will not be rounded but elongated.

```
border-radius: 15%;
```

When applied to a single corner, the format to create an elongated corner is slightly different. You remove the slash between the horizontal and vertical values and use the following syntax:

```
border-corner-radius: horizontal vertical;
```

For example, the following style creates an elongated bottom-left corner with a horizontal radius of 50 pixels and a vertical radius of 20 pixels.

```
border-bottom-left-radius: 50px 20px;
```

#### TRY IT

You can explore how to create elliptical corners using the `demo_ellipse.html` file in the `html04` demo folder.

Rounded and elongated corners do not clip element content. If the content of the element extends into the corner, it will still be displayed as part of the background. Because this is often unsightly, you should avoid heavily rounded or elongated corners unless you can be sure they will not obscure or distract from the element content.

Add rounded corners with a radius of 30 pixels to the `aside` element.

### To add rounded corners to an element:

1. Return to the **tb\_visual1.css** file in your editor and go to the Aside Styles section.
2. Add the following style to the style rule for the `aside` element:

```
border-radius: 30px;
```

Figure 4–17 highlights the style to create the rounded corners for the `aside` border.

Figure 4–17

### Adding rounded corners to the aside element border

sets the radius at each border corner to 30 pixels

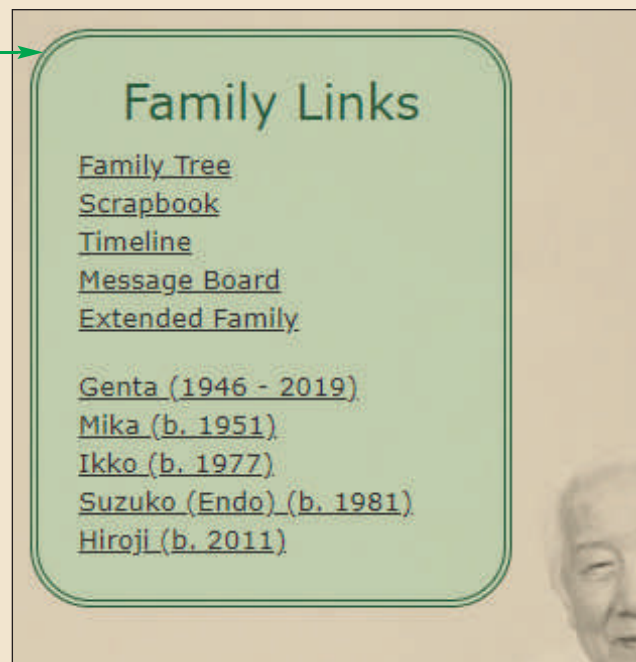
```
aside {
 border: 4px double rgb(45, 93, 62);
 border-radius: 30px;
}
```

3. Save your changes to the file and reload `tb_komatsu.html` in your browser. Figure 4–18 shows the rounded corners for the `aside` element border.

Figure 4–18

### Aside element border with rounded corners

rounded corner



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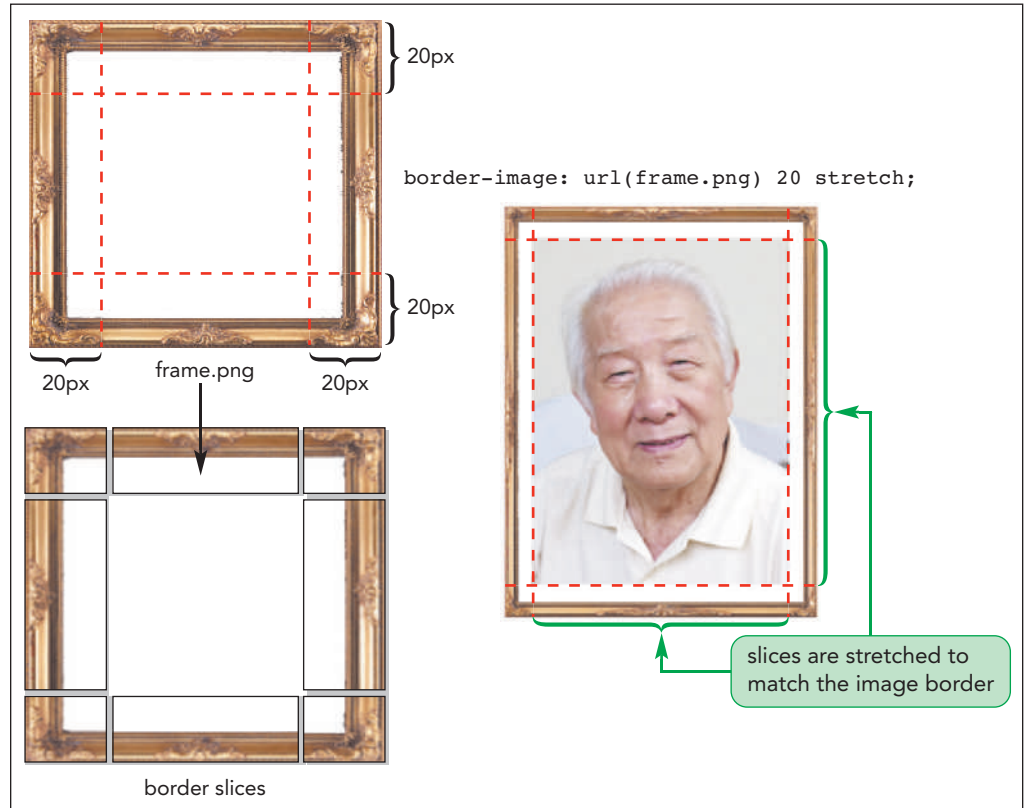
Kevin likes the revision to the border for the `aside` element. He also wants you to add a border to the family portrait on the Komatsu Family page. However, rather than using one of the styles shown in Figure 4–12, Kevin wants you to use a graphic border that makes it appear as if the figure box came from a torn piece of paper. You can create this effect using border images.

## Applying a Border Image

A border image is a border that is based on a graphic image. The graphic image is sliced into nine sections representing the four corners, the four sides, and the interior piece. The interior piece is discarded because that is where the content of the object will appear; the four corners become the corners of the border and the four sides are either stretched or tiled to fill in the border's top, right, bottom, and left sides. Figure 4–19 shows an example of an image file, `frame.png`, sliced into nine sections to create a border image.

Figure 4–19

Slicing a graphic image to create a border



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To apply a border image, use the following property

```
border-image: url(url) slice repeat fill;
```

where *url* is the source of the graphic image, *slice* is the width or height of the slices used to create the sides and corners, *repeat* indicates whether the side slices should be stretched or tiled to cover the border's four sides, and *fill* is an optional attribute that fills the image background with the graphic image file. The *repeat* option supports the following values:

- **stretch:** The slices are stretched to fill each side.
- **repeat:** The slices are tiled to fill each side.
- **round:** The slices are tiled to fill each side; if they don't fill the sides with an integer number of tiles, the slices are rescaled until they do.
- **space:** The slices are tiled to fill each side; if they don't fill the sides with an integer number of tiles, extra space is distributed around the tiles.

For example, the following style cuts 10-pixel-wide slices from the `frame.png` image file with the four side slices stretched to cover the length of the four sides of the object's border:

```
border-image: url(frame.png) 10 stretch;
```

The size of the slices is measured either in pixels or as a percentage of the image file width and height. A quirk of this property is that you should *not* specify the pixel unit if you want the slices measured in pixels but you must include the % symbol when slices are measured in percentages.

You can create slices of different widths or heights by entering the size values in a space-separated list. For instance, the following style slices the graphic image 5 pixels on the top, 10 pixels on the right, 15 pixels on the bottom, and 25 pixels on the left:

```
border-image: url(frame.png) 5 10 15 25 stretch;
```

### TRY IT

You can explore how to create a border image using the `demo_frame.html` file in the `html04` demo folder.

The slice sizes follow the same top/right/bottom/left syntax used with all of the CSS border styles. Thus, the following style slices 5% from the top and bottom sides of the graphic image, and 10% from the left and right sides:

```
border-image: url(frame.png) 5% 10% stretch;
```

You can also apply different repeat values to different sides of the border. For example, the following style stretches the border slices on the top and bottom but tiles the left and right slices:

```
border-image: url(frame.png) 10 stretch repeat;
```

### REFERENCE

#### Creating a Graphic Border

- To create a border based on a graphic image, use

```
border-image: url(url) slice repeat fill;
```

where *url* is the source of the border image file, *slice* is the size of the border image cut off to create the borders, *repeat* indicates whether the side borders should be either stretched or tiled to cover the object's four sides, and *fill* is an optional attribute that fills the image background with the graphic image file.

The torn paper image that Kevin wants to use is based on the graphic image file `tp_border.png` file. Use the `border-image` property to add a border image around the figure box on the Komatsu Family page, tiling the border slices to fill the sides. Note that in order for the border image to appear you must include values for the `border-width` and `border-style` properties.

#### To create a graphic border:

1. Return to the `tb_visual1.css` file in your editor and scroll to the Figure Box Styles at the top of the file.
2. Add the following style to the style rule for the figure box:

```
border-style: solid;
border-width: 25px;
border-image: url(tb_border.png) 50 repeat;
```

Figure 4–20 displays the styles used to create the graphic border.

Figure 4–20

## Adding a border image

border width and style values are required for the border image

slices 50 pixels from each side of the border image

```
figure {
border-style: solid;
border-width: 25px;
border-image: url(tb_border.png) 50 repeat;
margin: 20px auto 6px;
width: 80%;
}
```

uses the tb\_border.png file for the graphical border

tiles the side slices to fill the border sides

3. Save your changes and reload tb\_komatsu.html in your browser. Figure 4–21 shows the appearance of the border image.

Figure 4–21

## Figure box with border image

graphic image slices are tiled to fill the border sides



(L-R): Ikko, Mika, Hiroji, Genta, Suzuko

border image created from the tb\_border.png file

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Kevin appreciates the effect you created, making it appear as if the family portrait was torn from an album and laid on top of the web page.



### Problem Solving: Graphic Design and Legacy Browsers

Adding snazzy graphics to your page can be fun, but you must keep in mind that the fundamental test of your design is not how cool it looks but how usable it is. Any design you create needs to be compatible across several browser versions if you want to reach the widest user base. To support older browsers, your style sheet should use progressive enhancement in which the older properties are listed first, followed by browser extensions, and then by the most current CSS properties. As each property supersedes the previous properties, the browser will end up using the most current property that it supports.

For example, the following style rule starts with a basic 5-pixel blue border that will be recognized by every browser. It is followed by browser extensions for Opera, Mozilla, and WebKit to support older browsers that predate adoption of the CSS `border-image` property. Finally, the style list ends with the CSS `border-image` property, recognized by every current browser. In this way, every browser that opens the page will show some type of border.

```
border: 5px solid blue;
-o-border-image: url(paper.png) 30 repeat;
-moz-border-image: url(paper.png) 30 repeat;
-webkit-border-image: url(paper.png) 30 repeat;
border-image: url(paper.png) 30 repeat;
```

Be aware, however, that the syntax for an extension may not match the syntax for the final CSS specification. For example, the following list of styles creates a rounded top-right corner that is compatible across a wide range of browser versions:

```
-moz-border-radius-top-right: 15px;
-webkit-border-top-right-radius: 15px;
border-top-right-radius: 15px;
```

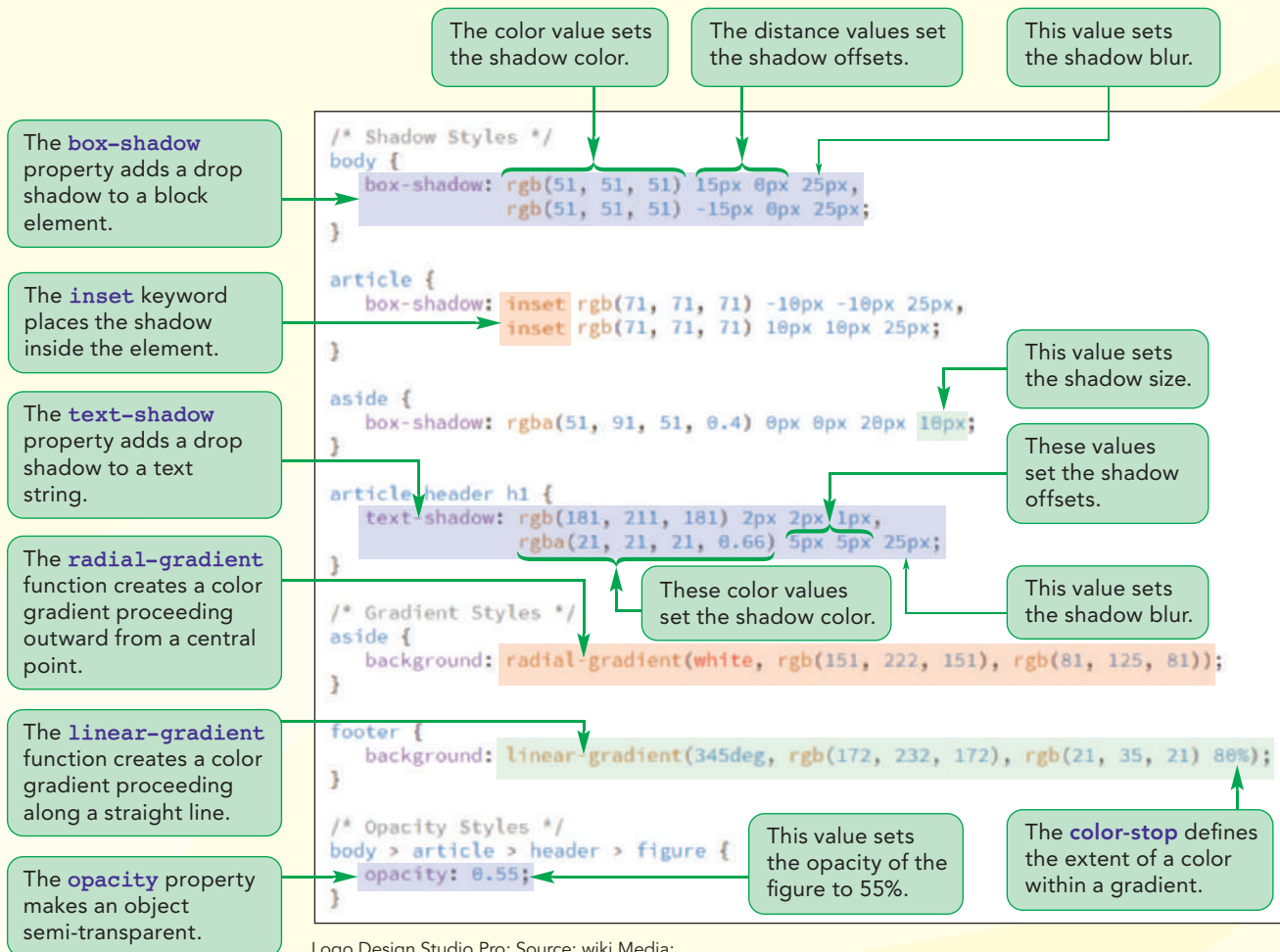
Note that the syntax for the Mozilla extension does not match the syntax for the WebKit extension or for the final CSS specification. As always, you need to do your homework to learn exactly how different browser versions handle these CSS design styles.

In the next session, you'll continue to work with the CSS graphic styles to add three-dimensional effects through the use of drop shadows and color gradients. If you want to take a break, you can close your open files and documents now.

### Session 4.1 Quick Check

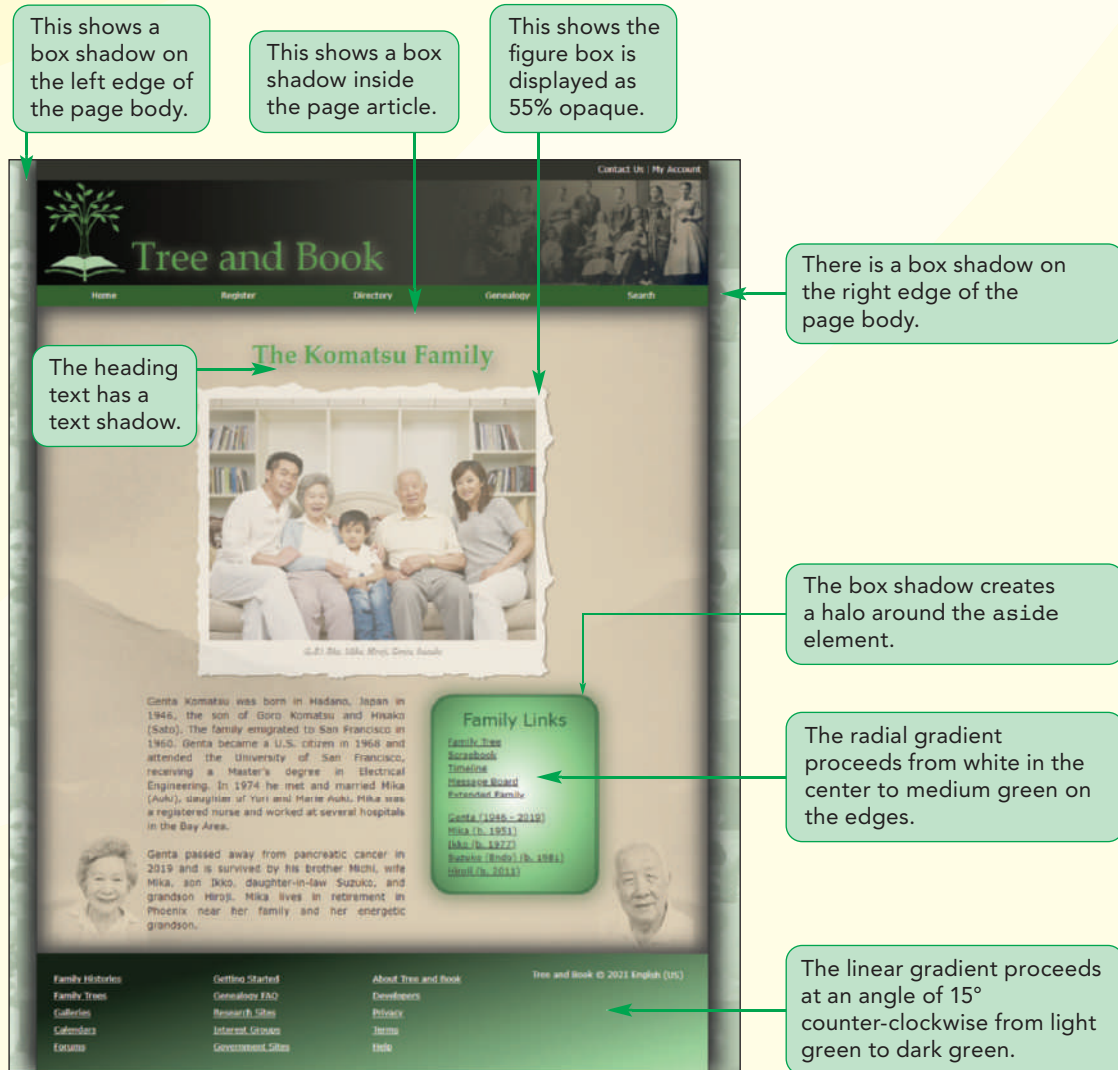
1. The element to create a figure caption is:
  - a. caption
  - b. figurecap
  - c. figcaption
  - d. alt
2. Lines and curves based on mathematical functions comprise a:
  - a. bitmap image
  - b. png image
  - c. figure image
  - d. vector image
3. To tile a background image in the horizontal direction only, use:
  - a. repeat-x
  - b. repeat-y
  - c. repeat-horizontal
  - d. repeat-h
4. To display the background image only within a content box, apply the style:
  - a. background-origin: content-box;
  - b. background: content-box;
  - c. background-display: content-box;
  - d. background-clip: content-box;
5. To create a 5-pixel wide brown border with a dotted line, apply the style:
  - a. border-style: 5px brown dotted;
  - b. border-type: brown 5px dotted;
  - c. border-outline: dotted brown 5px;
  - d. border: 5px brown dotted;
6. To use rounded corners with a radius of 15 pixels in a border, apply the style:
  - a. border-width: 15px;
  - b. border-radius: 15px;
  - c. border-arc: 15px;
  - d. corner-radius: 15px;
7. To create an elongated corner with a horizontal radius of 10 pixels and a vertical radius of 5 pixels, use:
  - a. border-radius: 10px 5px;
  - b. border-radius: 5px 10px;
  - c. border-radius: 10px/5px;
  - d. border-radius: 5px/10px;
8. To create a border image using the border.png file with a slice size of 30 pixels and the slices stretched along the borders, use:
  - a. border-image: url(border.png) 30 stretch;
  - b. border: url(border.png) 30 stretch;
  - c. border-img: url(border.png) 30 stretch;
  - d. border-slice: url(border.png) 30 stretch;

# Session 4.2 Visual Overview:



Logo Design Studio Pro; Source: wiki Media;  
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# Shadows and Gradients



Source: Design Studio Pro; Source: Wikimedia Commons; imtmphoto/Shutterstock.com

## Creating Drop Shadows

In this session, you will examine some design styles that create 3D effects, making the page content appear to jump out of the browser window. The first styles you'll explore are used to create drop shadows around text strings and element boxes.

### Creating a Text Shadow

To give the text on your page visual impact, you can use CSS to add a shadow using the following `text-shadow` property

```
text-shadow: color offsetX offsetY blur;
```

where *color* is the shadow color, *offsetX* and *offsetY* are the distances of the shadow from the text in the horizontal and vertical directions, and *blur* defines the amount by which the shadow spreads out, creating a blurred effect. The shadow offset values are expressed so that positive values push the shadow to the right and down while negative values move the shadow to the left and up. The default *blur* value is 0, creating a shadow with distinct hard edges; as the blur value increases, the edge of the shadow becomes less distinct and blends more in the text background.

The following style creates a red text shadow that is 10 pixels to the right and 5 pixels down from the text with blur of 8 pixels:

```
text-shadow: red 10px 5px 8px;
```

Multiple shadows can be added to text by including each shadow definition in the following comma-separated list.

```
text-shadow: shadow1, shadow2, shadow3, ...;
```

where *shadow1*, *shadow2*, *shadow3*, and so on are shadows applied to the text with the first shadow listed displayed on top of subsequent shadows when they overlap. The following style rule creates two shadows with the first red shadow placed 10 pixels to the left and 5 pixels up from the text and the second gray shadow is placed 3 pixels to the right and 4 pixels down from the text. Both shadows have a blur of 6 pixels:

```
text-shadow: red -10px -5px 6px,
 gray 3px 4px 6px;
```

#### TRY IT

You can explore the `text-shadow` style and creating multiple text shadows by using the `demo_text.html` file from the `html04 ► demo` folder.

Figure 4–22 shows examples of how the `text-shadow` style can be used to achieve a variety of text designs involving single and multiple shadows.

Figure 4–22

## Examples of text shadows



## REFERENCE

## Creating a Text Shadow

- To add a shadow to a text string, use the property

```
text-shadow: color offsetX offsetY blur;
```

where *color* is the shadow color, *offsetX* and *offsetY* are the distances of the shadow from the text in the horizontal and vertical directions, and *blur* defines the amount by which the shadow is stretched.

Kevin wants you to add two text shadows to the h1 heading *The Komatsu Family*. The first text shadow will be a light-green highlight with hard edges and the second shadow will be semi-transparent gray and blurred.

## To add a text shadow:

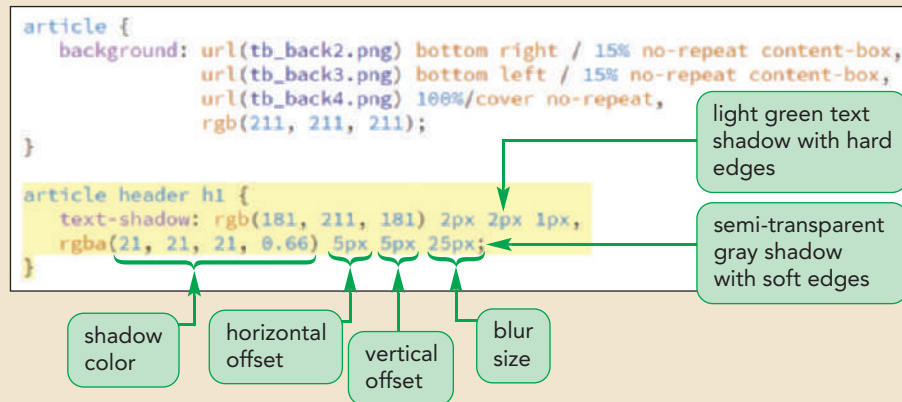
- If you took a break after the previous session, reopen or return to the **tb\_visual1.css** file in your editor and scroll to the Article Styles section.
- Add the following style for the h1 heading in the article header:

```
article header h1 {
 text-shadow: rgb(181, 211, 181) 2px 2px 1px,
 rgba(21, 21, 21, 0.66) 5px 5px 25px;
}
```

Figure 4–23 highlights the style to add text shadows to the h1 heading.

Figure 4–23

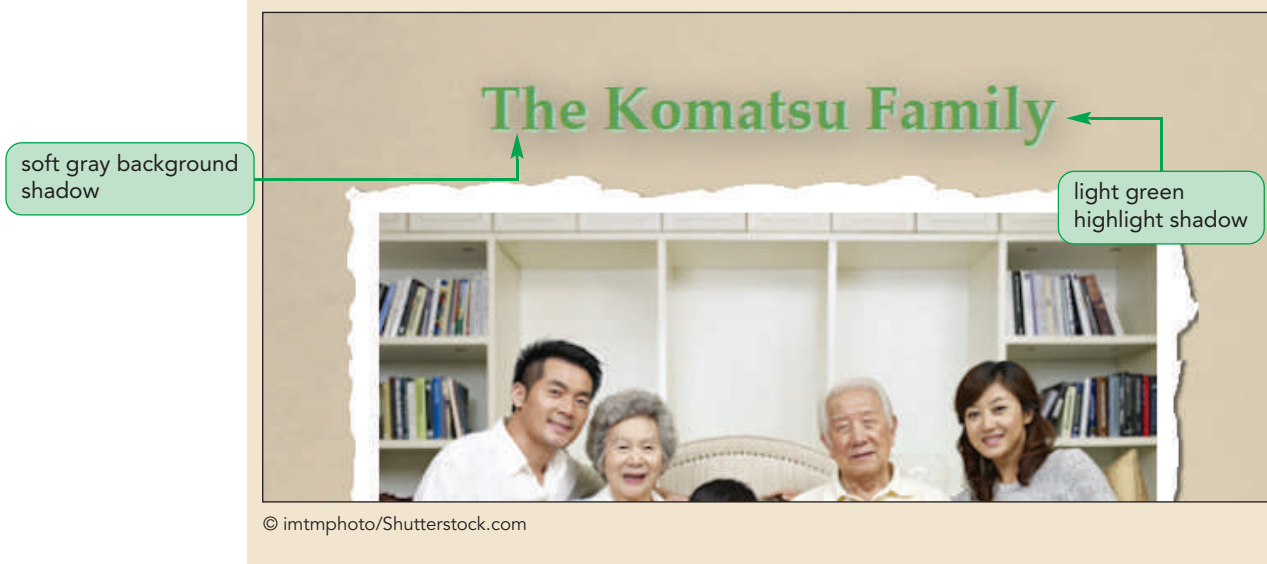
## Adding text shadows



3. Save your changes and reload `tb_komatsu.html` in your browser. Figure 4–24 shows the shadow effect added to the h1 heading.

Figure 4–24

## Article heading with text shadows



Kevin likes the shadow effect and the use of the light green shadow, which appears to give a highlight to the heading text. Next, he wants you to add shadows to other page objects.

## Creating a Box Shadow

Shadows can be added to any block element in the web page by using the `box-shadow` property

```
box-shadow: color offsetX offsetY blur;
```

### TIP

If no shadow color is provided, the browser uses black as the default color.

where `color`, `offsetX`, `offsetY`, and `blur` have the same meanings for box shadows as they do for text shadows. As with text shadows, you can add multiple shadows by including them in the following comma-separated list

```
box-shadow: shadow1, shadow2 ...;
```

where once again the first shadow listed is displayed on top of subsequent shadows.

In the last session, you used left and right borders to set off the page body from the browser window background. Kevin would like you to increase this visual distinction by adding drop shadows to the left and right sides of the page body.

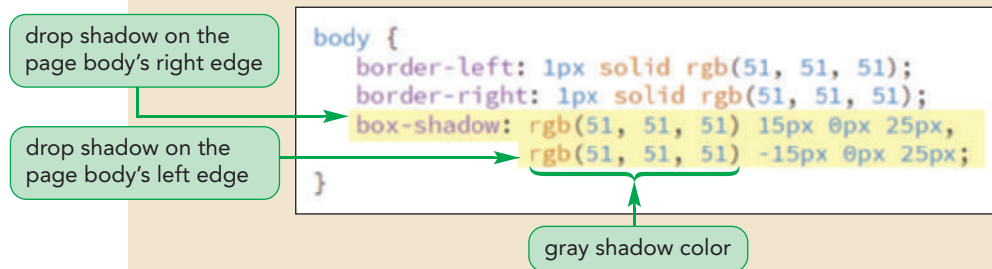
**To add a box shadow:**

1. Return to the **tb\_visual1.css** file in your editor and go to the Page Body Styles section.
2. Within the style rule for the **body** element, insert the following styles:

```
box-shadow: rgb(51, 51, 51) 15px 0px 25px,
 rgb(51, 51, 51) -15px 0px 25px;
```

Figure 4–25 highlights the style to add box shadows to the page body.

**Figure 4–25** Adding box shadows



3. Save your changes and reload **tb\_komatsu.html** in your browser. Figure 4–26 shows the drop shadows added to the page body.

**Figure 4–26** Page body with drop shadows



Source: Design Studio Pro; Source: Wikimedia Commons; © imtmphoto/Shutterstock.com

Box shadows can be placed inside the element as well as outside. By adding an interior shadow you can create the illusion of a beveled edge in which the object appears to rise out of its background. To create an interior shadow, add the **inset** keyword to the **box-shadow** property

```
box-shadow: inset color offsetX offsetY blur;
```

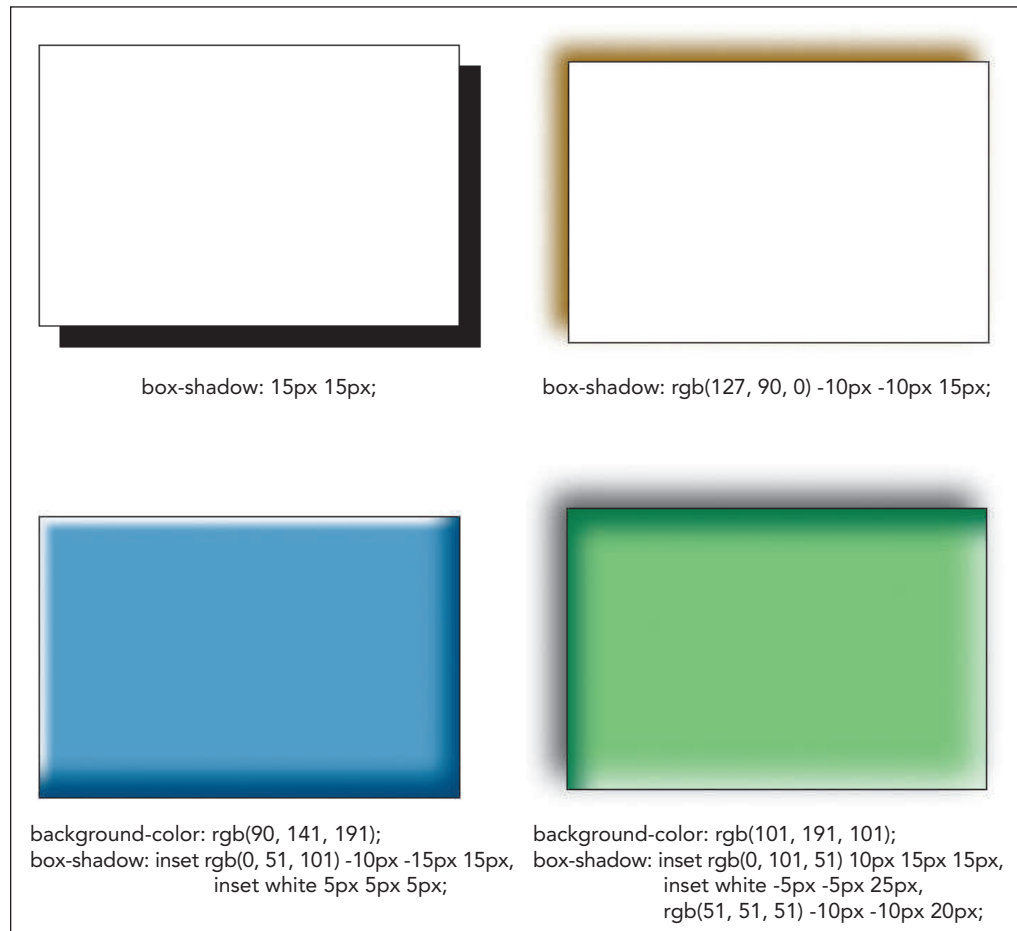
**TRY IT**

Explore multiple box shadows with the **demo\_box.html** file from the **html04 ▶ demo** folder.

where the meanings of the **offsetX** and **offsetY** values are switched when applied to interior shadowing so that positive **offsetX** and **offsetY** values move the shadow to the left and up within the box, while negative **offsetX** and **offsetY** values move the shadow to the right and down.

An object can contain a mixture of exterior and interior shadows. Figure 4–27 shows examples of box shadows, including one example that mixes both interior and exterior shadows.

**Figure 4–27** Examples of box shadows



Kevin suggests that you add inset shadows to the `article` element, placing medium gray shadows within the article to make it appear raised up from the surrounding page content.

### To add inset shadows:

1. Return to the **tb\_visual1.css** file in your editor and go to the Article Styles section.
2. Within the style rule for the `article` element, insert the following **box-shadow** style:

```
box-shadow: inset rgb(71, 71, 71) -10px -10px 25px,
 inset rgb(71, 71, 71) 10px 10px 25px;
```

Figure 4–28 highlights the newly added code for the inset box shadow.

Positive and negative offset values for interior shadows have the opposite meaning from positive and negative offset values for exterior shadows.

Figure 4–28

## Adding an inset shadow

places a medium-gray shadow in the lower-right interior corner

inset keyword places shadow inside the object

```
article {
 background: url(tb_back2.png) bottom right / 15% no-repeat content-box,
 url(tb_back3.png) bottom left / 15% no-repeat content-box,
 url(tb_back4.png) 100%/cover no-repeat,
 rgb(211, 211, 211);
 box-shadow: inset rgb(71, 71, 71) -10px -10px 25px,
 inset rgb(71, 71, 71) 10px 10px 25px;
}
```

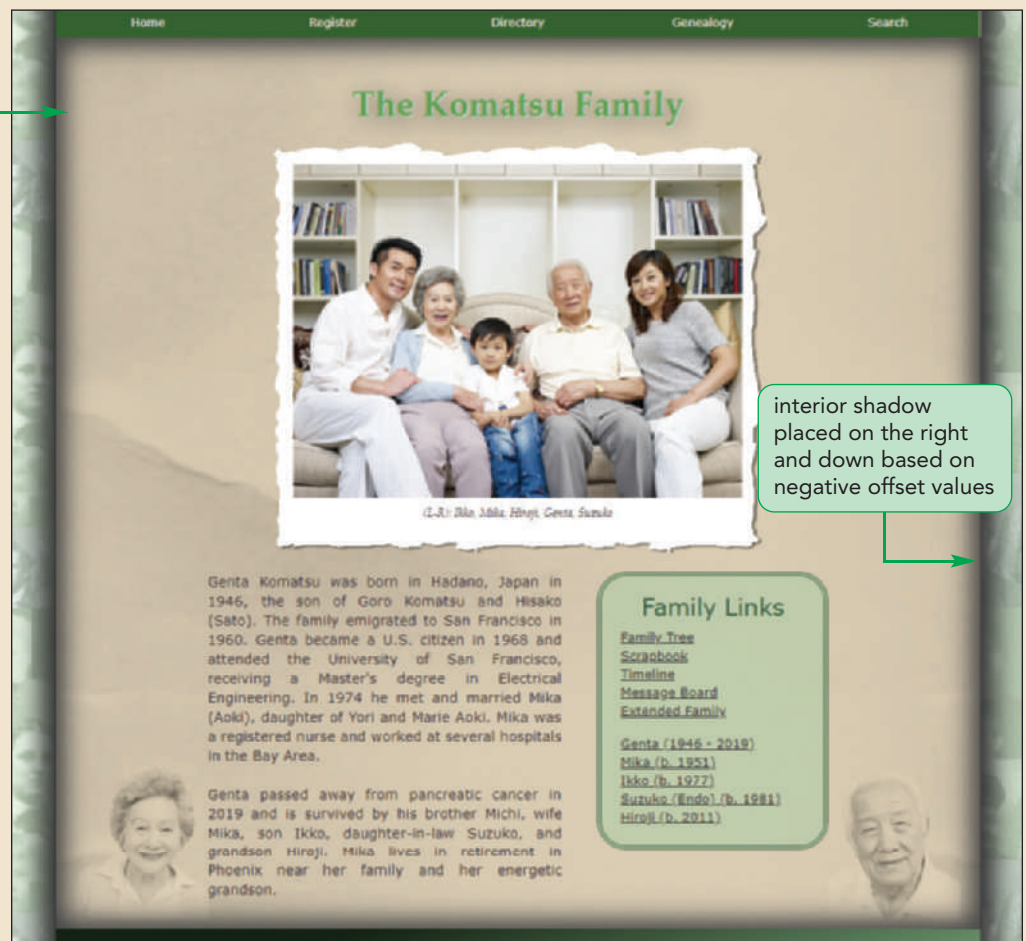
places a medium-gray shadow in the upper-left interior corner

3. Save your changes and reload tb\_komatsu.html in your browser. The inset shadow for the page body element is shown in Figure 4–29.

Figure 4–29

## Page article with interior shadowing

interior shadow placed on the left and up based on positive offset values



interior shadow placed on the right and down based on negative offset values

Source: Wikimedia Commons; © imtmphoto/Shutterstock.com

By default, a box shadow has the same size and dimensions as its page object offset in the horizontal and vertical direction. To change the shadow size, add the *spread* parameter to the *box-shadow* property, specifying the size of the shadow relative to the size of the page object. A positive value increases the size of the shadow, while a negative value decreases it. For example, the following style creates a gray shadow that is offset from the page object by 5 pixels in both the vertical and horizontal direction

with no blurring but with a shadow that is 15 pixels larger in the horizontal and vertical directions than the object:

```
box-shadow: gray 5px 5px 0px 15px;
```

On the other hand, the following style creates a shadow that is 15 pixels smaller than the page object:

```
box-shadow: gray 5px 5px 0px -15px;
```

## REFERENCE

### Creating a Box Shadow

- To add a shadow to a block element, use

```
box-shadow: color offsetX offsetY blur spread;
```

where *color* is the shadow color, *offsetX* and *offsetY* are the distances of the shadow from the element in the horizontal and vertical directions, *blur* defines the amount by which the shadow is stretched and *spread* sets the size of the shadow relative to the size of the block element. If no *spread* is specified, the shadow has the same size as the block element.

- To create an interior shadow, include the `inset` keyword

```
box-shadow: inset color offsetX offsetY blur spread;
```

- To create multiple shadows place them in a comma-separated list:

```
box-shadow: shadow1, shadow2, ...;
```

where *shadow1*, *shadow2*, and so on are definitions for individual shadows with the first shadows listed displayed on top of subsequent shadows.

One application of the *spread* parameter is to create a visual effect in which the object appears to be surrounded by a halo. This is achieved by setting the shadow offsets to 0 pixels while making the shadow larger than the page object itself. Kevin suggests that you use this technique to add a green halo to the `aside` element.

### To increase the shadow size:

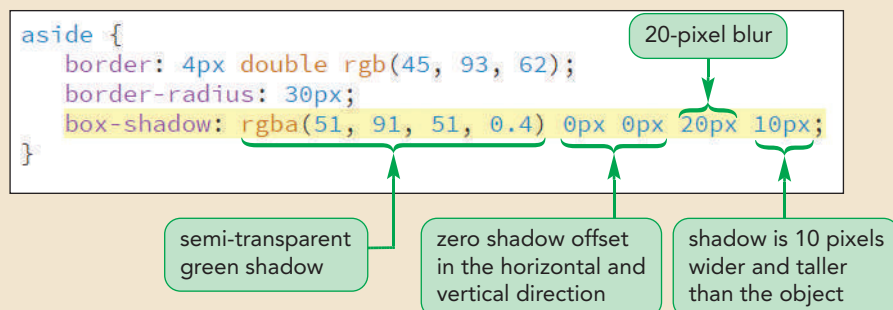
- Return to the `tb_visual1.css` file in your editor and go to the `Aside` Styles section.
- Within the style rule for the `aside` element, insert the following style:

```
box-shadow: rgba(51, 91, 51, 0.4) 0px 0px 20px 10px;
```

Figure 4–30 highlights the style to add a halo to the `aside` element.

Figure 4–30

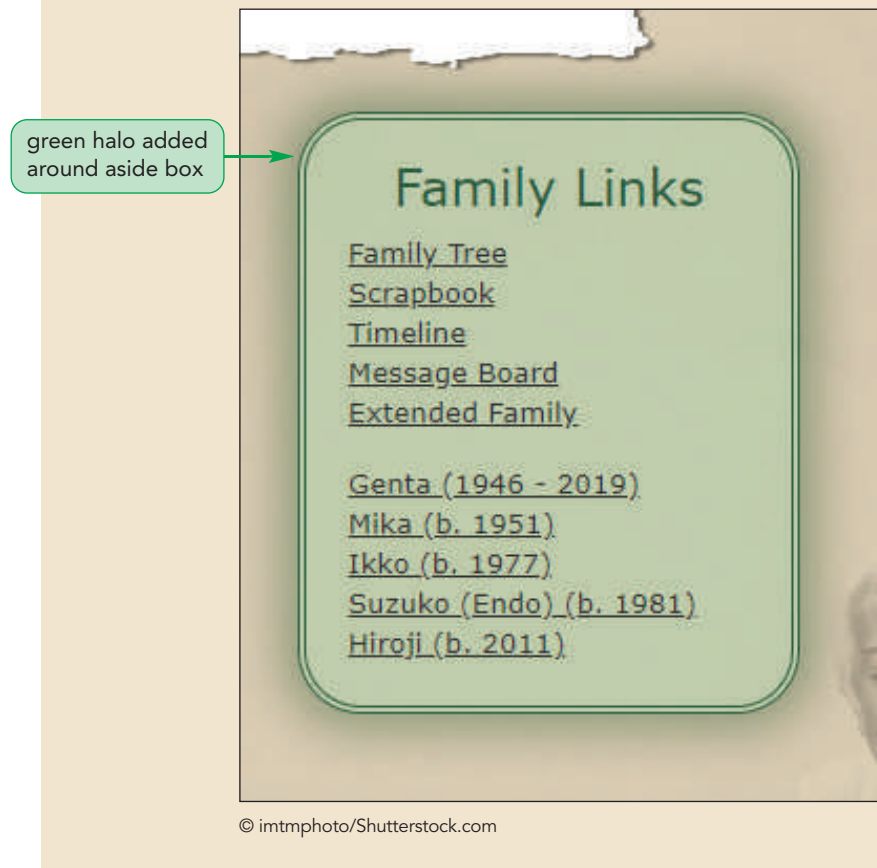
Creating a spreading shadow



3. Save your changes and reload tb\_komatsu.html in your browser. Figure 4–31 shows the revised appearance of the `aside` element with the glowing green shadow.

Figure 4–31

Aside element with glowing effect



## INSIGHT

### Creating a Reflection

WebKit, the rendering engine for Safari and Google Chrome, includes support for adding reflections to page objects through the following property

```
-webkit-box-reflect: direction offset mask-box-image;
```

where *direction* is the placement of the reflection using the keywords above, *below*, *left*, or *right*; *offset* is the distance of the reflection from the edge of the element box, and *mask-box-image* is an image that can be used to overlay the reflection. For example, the following style rule creates a reflection that is 10 pixels below the inline image:

```
img {
 -webkit-box-reflect: below 10px;
}
```

There is no equivalent `reflect` property in the official W3C CSS specifications. Before using the `reflect` property, you should view the current browser support for the `-webkit-box-reflect` property at [caniuse.com](http://caniuse.com).

## Applying a Color Gradient

So far you have worked with backgrounds consisting of a single color, though that color can be augmented through the use of drop shadows. Another way to modify the background color is through a **color gradient** in which one color gradually blends into another color or fades away if transparent colors are used. CSS supports linear gradients and radial gradients.

### Creating a Linear Gradient

A linear gradient is a color gradient in which the background color transitions from a starting color to an ending color along a straight line. Linear gradients are created using the `linear-gradient` function

```
linear-gradient(color1, color2, ...)
```

where *color1*, *color2*, and so on are the colors that blend into one another starting from *color1*, through *color2*, and onto the last color listed. The default direction for a linear color gradient is vertical, starting from the top of the object and moving to the bottom.

#### TIP

When using multiple backgrounds, gradients can be combined with solid colors and background images to create interesting visual effects; one gradient can also be overlaid on top of another.

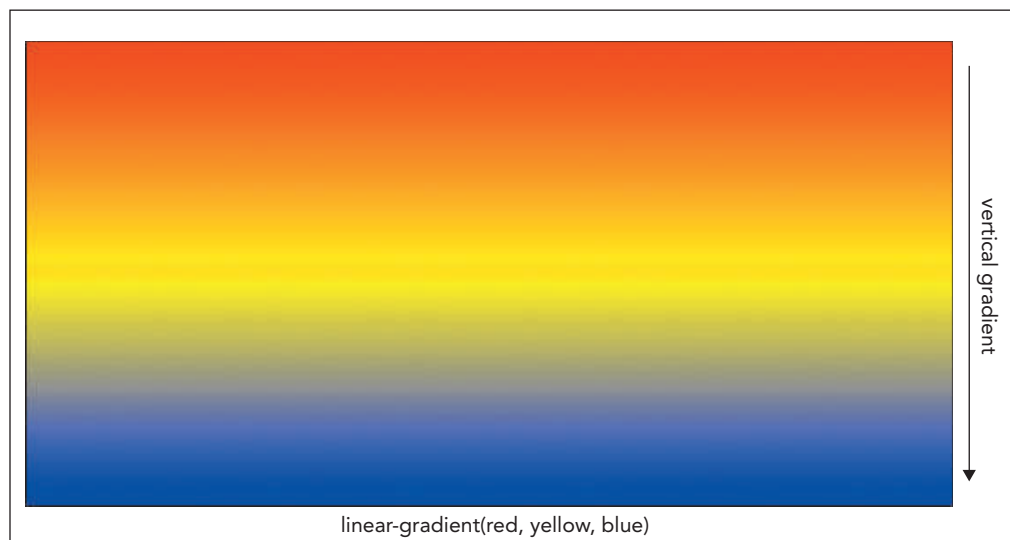
Gradients are treated like background images and thus can be used with any CSS property that accepts an image such as the `background`, `background-image`, and `list-style-image` properties. For example, to create a linear gradient as a background for the page body, you could apply the following style rule:

```
body {
 background: linear-gradient(red, yellow, blue);
}
```

Figure 4–32 shows the appearance of this vertical gradient as the background color transitions gradually from red down to yellow and then from yellow down to blue.

Figure 4–32

Linear gradient with three colors



To change from the default vertical direction, you add a *direction* value to the `linear-gradient` function

```
linear-gradient(direction, color1, color2, ...)
```

where *direction* is the direction of the gradient using keywords or angles. Direction keywords are written in the form *to position* where *position* is either a side of the

object or a corner. For example the following linear gradient moves in a straight line to the left edge of the object blending from red to yellow to blue:

```
background: linear-gradient(to left, red, yellow, blue);
```

To move toward the corner, include both corner edges. The following style moves the gradient in the direction of the object's bottom right corner:

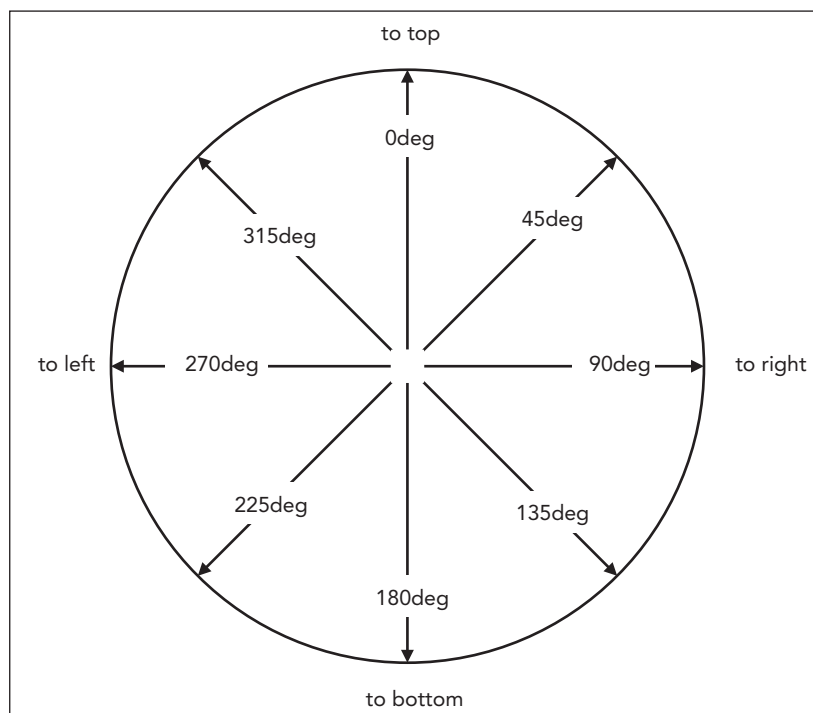
```
background: linear-gradient(to bottom right, red, yellow, blue);
```

### TIP

For square objects, a direction of 45deg is equivalent to a direction of to right top.

To move in a direction other than a side or corner, you can express the direction using an angle value. Angles are measured in degrees with 0deg equal to to top, 90deg equal to to right, 180deg equal to to bottom, and 270deg equal to to left (see Figure 4–33.)

**Figure 4–33** Linear gradient directions



For example, the following gradient points at a 60 degree angle:

```
background: linear-gradient(60deg, red, yellow, blue);
```

Figure 4–34 shows other examples of linear gradients moving in different directions using both syntaxes.

## INSIGHT

### Transparency and Gradients

Interesting gradient effects can be achieved using transparent colors so that the background color gradually fades away as it moves in the direction of the gradient. For example, the following style creates a linear gradient that gradually fades away from its initial solid red color:

```
linear-gradient(rgba(255, 0, 0, 1), rgba(255, 0, 0, 0))
```

Note that since the final color is completely transparent it will adopt the background color of the parent element.

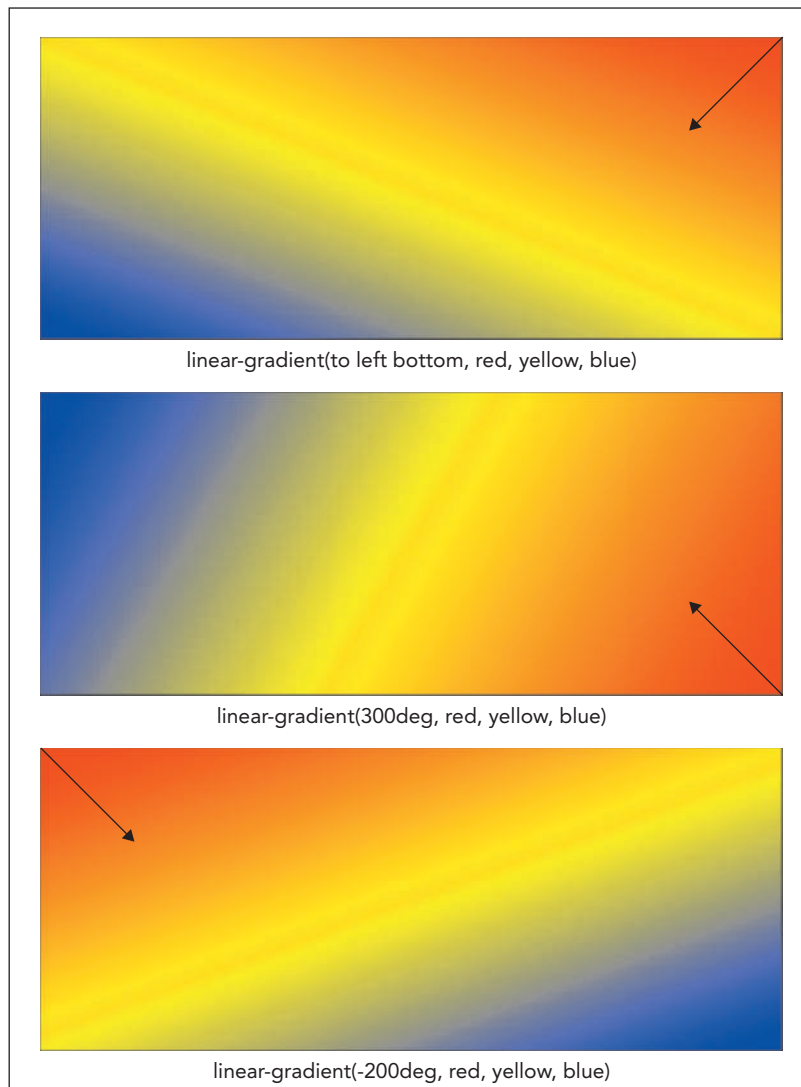
You can also use gradients to create background images that appear to fade by using multiple backgrounds in which the gradient appears on top of an image. For example, the following background style creates a fading background using the back.png image file:

```
background: linear-gradient(rgb(255, 255, 255, 0), rgb(255, 255, 255, 1)), url(back.png);
```

When rendered by the browser, the background image will start as solid but gradually fade to white as the linear gradient proceeds through the element background.

Figure 4–34

Directions of linear gradients



Note that the degree values can be negative in which case the direction is pointed counter-clockwise around the circle shown in Figure 4–33. A negative angle of  $-45\text{deg}$ , for example, would be equivalent to a positive angle of  $315\text{deg}$ , an angle of  $-200\text{deg}$  would be equal to  $160\text{deg}$ , and so forth.

## Gradients and Color Stops

The colors specified in a gradient are evenly distributed so that the following gradient starts with a solid red, solid green appears halfway through the gradient, and finishes with solid blue:

```
background: linear-gradient(red, green, blue);
```

To change how the colors are distributed, you define color stops, which represent the point at which the specified color stops and the transition to the next color begins. The `linear-gradient` function using color stops has the general form

```
linear-gradient(direction, color-stop1, color-stop2, ...)
```

where `color-stop1`, `color-stop2`, and so on are the colors and their stopping positions within the gradient. Stopping positions can be entered using any of the CSS units of measurement. For example, the following gradient starts with solid red up until 50 pixels from the starting point, red blends to solid green stopping at 60 pixels from the starting point and then blends into solid blue 80 pixels from the start. After 80 pixels, the gradient will remain solid blue to the end of the background.

```
linear-gradient(red 50px, green 60px, blue 80px)
```

### TRY IT

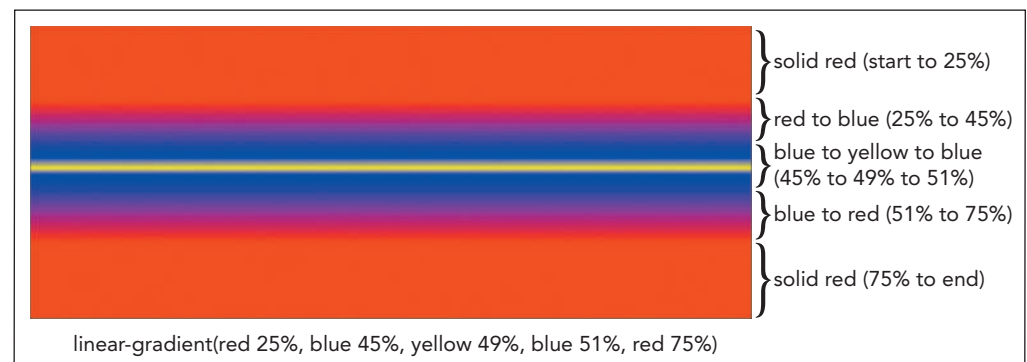
You can create your own linear gradients using the `demo_linear.html` file from the `html04 ► demo` folder.

Similarly, the following style rule sets the color stops using percentages with solid red for the first 25% of the background, transitioning to solid green from 25% to 75% of the background, and then transitioning to solid blue from 75% to 95% of the background size. From that point to the end, the background remains solid blue.

```
linear-gradient(red 25%, green 75%, blue 95%)
```

Figure 4–35 shows an example of a linear gradient in which color stops are used to create a narrow strip of yellow within a background of red blended into blue.

**Figure 4–35** Linear gradient color stops



Kevin suggests you use a linear gradient that transitions from light green to dark green as the background for the page footer.

### To apply a linear gradient:

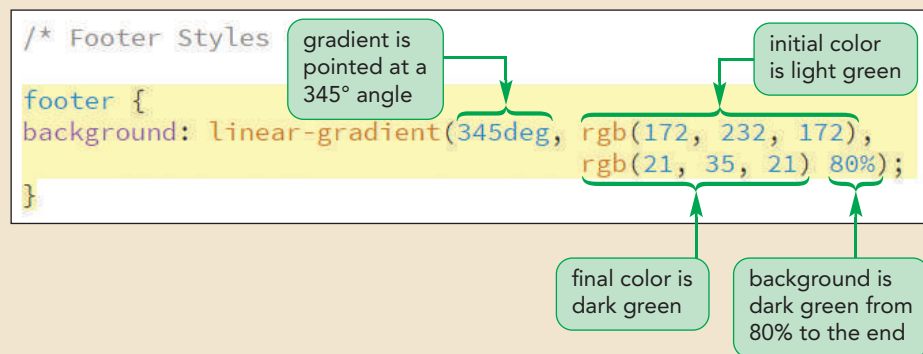
1. Return to the **tb\_visual1.css** file in your editor and go to the Footer Styles section.
2. Insert the following style rule for the `footer` element:

```
footer {
 background: linear-gradient(345deg, rgb(172, 232, 172),
 rgb(21, 35, 21) 80%);
}
```

Figure 4–36 highlights the style to create the linear gradient.

Figure 4–36

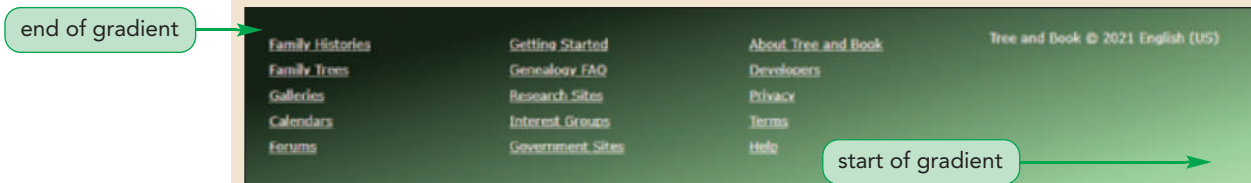
### Applying a linear gradient



3. Save your changes and reload `tb_komatsu.html` in your browser. Figure 4–37 shows the revised appearance of the page footer with a linear gradient.

Figure 4–37

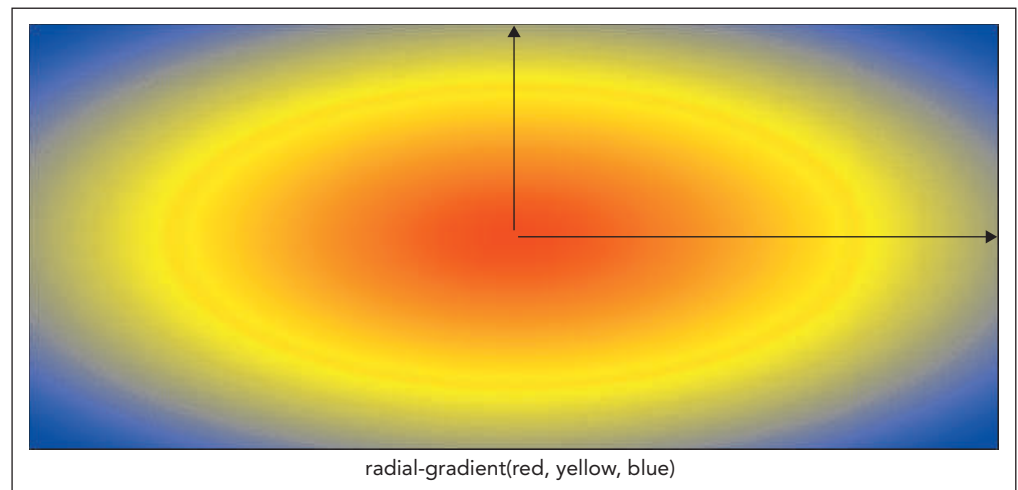
### Page footer with linear gradient background



The other color gradient supported in CSS is a radial gradient. You will explore how to create radial gradients now.

## Creating a Radial Gradient

A **radial gradient** is a color gradient that starts from a central point and proceeds outward in a series of concentric circles or ellipses. Figure 4–38 shows an example of a radial gradient consisting of a series of concentric ellipses radiating from a central red color to an ending blue color.

**Figure 4–38** A radial gradient of three colors

Radial gradients are created using the following `radial-gradient` function.

```
radial-gradient(shape size at position, color-stop1,
 color-stop2, ...)
```

The *shape* value defines the shape of the gradient and is either `ellipse` (the default) or `circle`. The *size* value defines the extent of the gradient as it radiates outward and can be expressed with a CSS unit of measure, a percentage of the background's width and height, or with one of the following keywords:

- `farthest-corner` (the default) Gradient extends to the background corner farthest from the gradient's center.
- `farthest-side` Gradient extends to background side farthest from the gradient's center.
- `closest-corner` Gradient extends to the nearest background corner.
- `closest-side` Gradient extends to the background side closest to the gradient's center.

The *position* defines where the gradient radiates from and can be expressed in coordinates using pixels, percentages of the element's width and height, or with the keywords: `left`, `center`, `right`, `top`, and `bottom`. The default is to place the gradient within the center of the background.

Finally the *color-stop1*, *color-stop2* ... values are the colors and their stopping positions within the gradient and have the same interpretation used for linear gradients except they mark stopping points as the gradient radiates outward. Note that the color stops are optional, just as they are in linear gradients. For example the following function defines a circular gradient radiating from the horizontal and vertical center of the background through the colors red, yellow, and blue:

```
radial-gradient(circle closest-corner at center center,
 red, yellow, blue)
```

The gradient ends when it reaches the closest background corner. Anything outside of the gradient will be a solid blue.

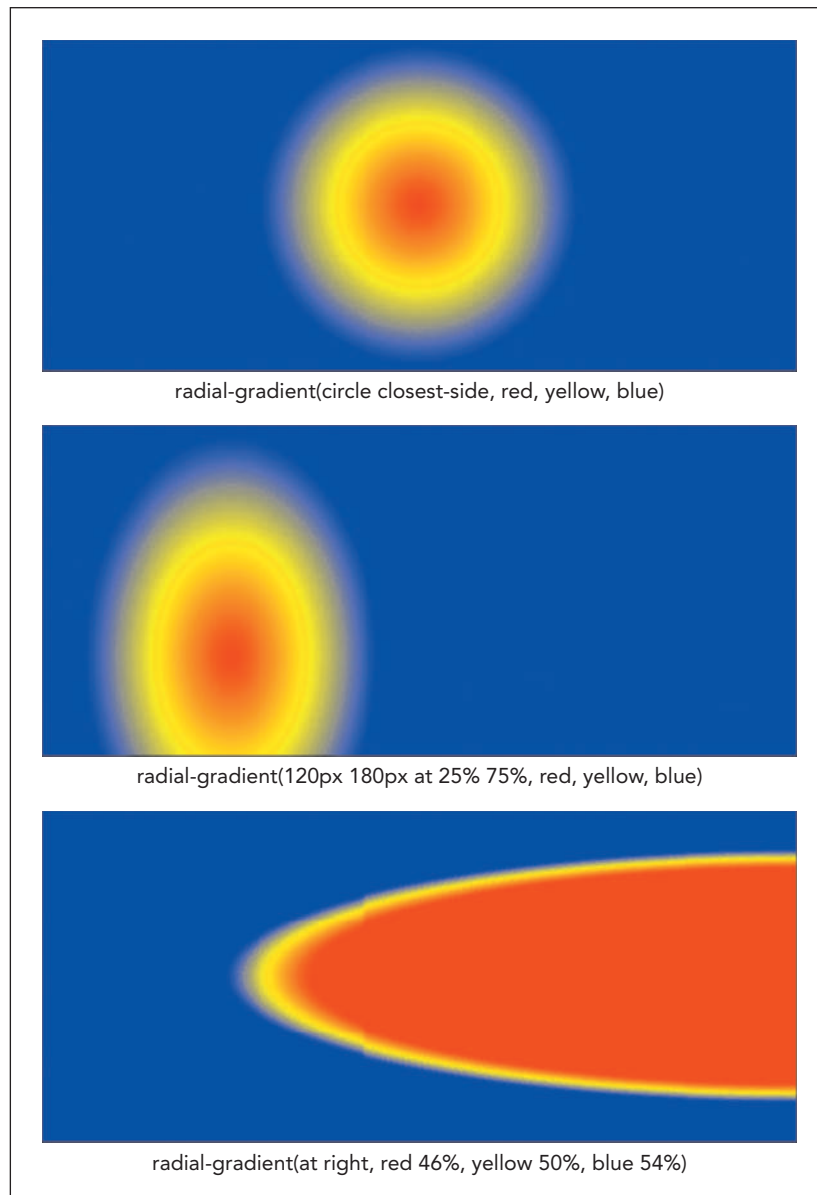
Figure 4–39 shows other examples of the different effects that can be accomplished using the `radial-gradient` function. Note that when parameters of the `radial-gradient` function are omitted they take their default values.

### TRY IT

You can explore how to create your own radial gradients using the `demo_radial.html` file from the `html04` ► demo folder.

Figure 4–39

Examples of radial gradients



Kevin would like you to apply a radial gradient to the background of the `aside` element. The gradient will start from a white center blending into to a medium green and then into a darker shade of green.

#### To apply a radial gradient:

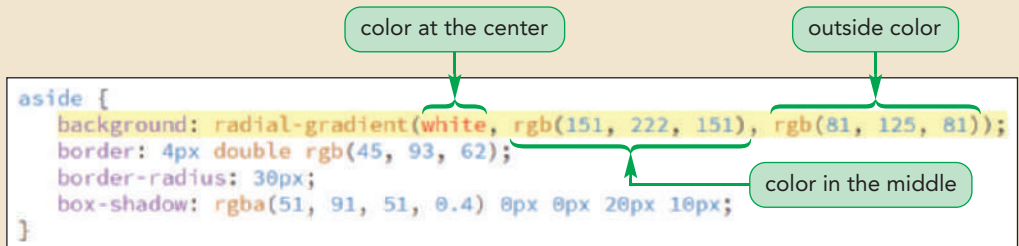
1. Return to the **tb\_visual1.css** file in your editor and go to the Aside Styles section.
2. Add the following style to the style rule for the `aside` element:

```
background:
 radial-gradient(white, rgb(151, 222, 151),
 rgb(81, 125, 81));
```

Note that this style supersedes the previous background style created in the `tb_styles1.css` style sheet. Figure 4–40 highlights the code to create the radial gradient.

Figure 4–40

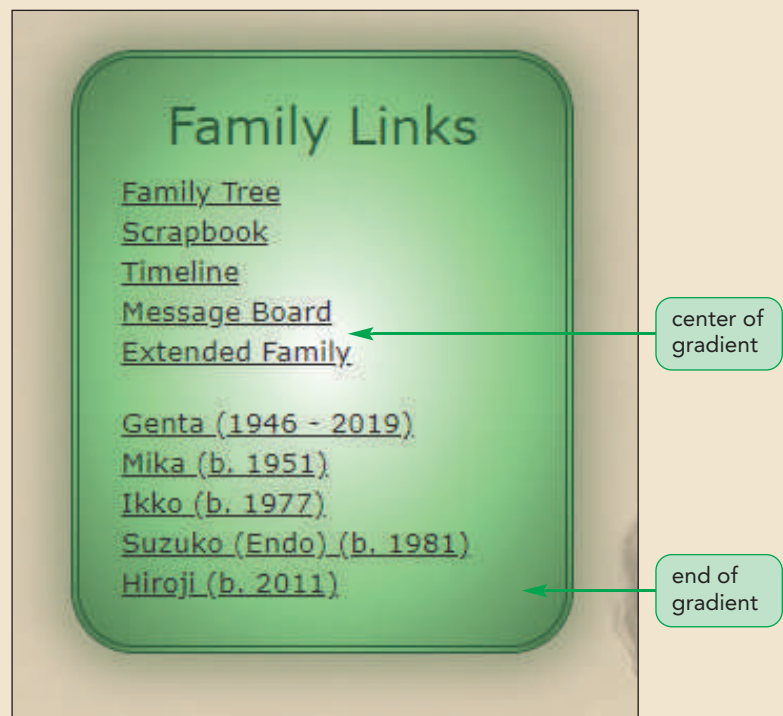
## Applying a radial gradient



3. Save your changes and reload `tb_komatsu.html` in your browser. Figure 4–41 shows the radial gradient within the `aside` element.

Figure 4–41

## Aside element with radial gradient background



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Kevin likes the effect of the radial gradient on the `aside` element and feels that it works well with the glowing effect you added earlier.

## INSIGHT

### Gradients and Browser Extensions

The gradient functions were heavily revised as they went from being browser-specific properties to the final syntax approved by the W3C. If you work with older browsers, you may need to accommodate their versions of these gradient functions. For example, the following linear gradient that blends red to blue going in the direction to the right edge of the background

```
linear-gradient(to right, red, blue)
```

would be expressed using the old WebKit gradient function as:

```
-webkit-gradient(linear, left, right, from(red), to(blue))
```

Other older versions of browsers such as Mozilla, Internet Explorer, and Opera have their own gradient functions with different syntax. You can study these functions using the online support at the browser websites or doing a search on the Web for CSS gradient functions.

Note that not all browser extensions support the same types of gradients, which means that it is difficult and sometimes impossible to duplicate a particular gradient background for every browser. Thus, you should not make gradients an essential feature of your design if you want to be compatible with older browsers.

## Repeating a Gradient

As you add more color stops, the gradient function can become unwieldy and overly complicated. One alternative is to repeat the gradient design. You can repeat linear and radial gradients using the functions

```
repeating-linear-gradient(params)
repeating-radial-gradient(params)
```

### TRY IT

You can create your own repeating gradients using the `demo_repeat_linear.html` and `demo_repeat_radial.html` files from the `html04 ► demo` folder.

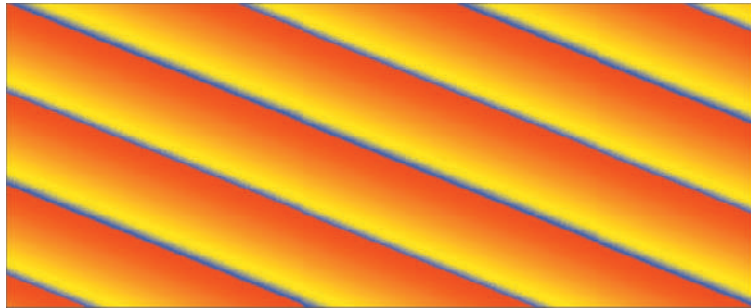
where *params* are the parameters of the `linear-gradient` or the `radial-gradient` functions already discussed. The only requirement for a repeating gradient is that a stopping position is required for the last color in the list that is less than the size of the object background. Once the last color in the color list is reached, the gradient starts over again. For example, the following function repeats a vertical gradient starting with white transitioning to black, transitioning back to white at 10% of the height of the object, and then repeating that pattern each time it reaches the next 10% of the height of the object:

```
repeating-linear-gradient(white, black 10%)
```

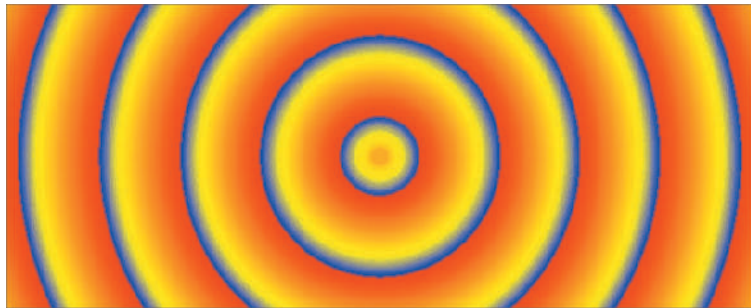
Figure 4–42 shows some other examples of repeating linear and radial gradients.

Figure 4–42

## Repeating a gradient



repeating-linear-gradient(to left bottom, red 5%, yellow 18%, blue 20%)



repeating-radial-gradient(circle, red 10%, yellow 25%, blue 30%)

## REFERENCE

## Creating a Gradient

- To create a linear gradient, use the function

```
linear-gradient(direction, color-stop1, color-stop2, ...)
```

where *direction* is the direction of the gradient and *color-stop1*, *color-stop2*, and so on are the colors and their stopping positions within the gradient.

- To create a radial gradient, use the function

```
radial-gradient(shape size at position, color-stop1,
color-stop2, ...)
```

where *shape* defines the shape of the gradient, *size* sets the gradient size, *position* places the center of the gradient, and *color-stop1*, *color-stop2*, and so on are the colors and their stopping positions within the gradient.

- To repeat a gradient, use the functions

```
repeating-linear-gradient(params)
repeating-radial-gradient(params)
```

where *params* are the parameters of the linear-gradient or the radial-gradient functions.

The last visual effect that Kevin wants you to add to the Komatsu Family page is to make the figure box semi-transparent so that it blends in better with its background.

## INSIGHT

### Gradients as Images

Gradients can be treated as images and thus can be tiled within a background or used with the `border-image` style. For example, the following style rule creates a background of radial gradients repeated in the horizontal and vertical directions:

```
background-size: 50% 50%;
background-image-repeat: repeat;
background-image: radial-gradient(circle, yellow, blue);
```

Note that setting the background size to 50% 50% sets the width and height of each radial gradient to half of the width and height of the object. By setting the `background-image-repeat` style to `repeat`, the entire background is filled with radial gradients, resulting in two rows of two gradient images.

The following code shows how to use a linear gradient as a border image:

```
border: 30px solid transparent;
border-image: (linear-gradient(yellow, blue)), 15);
```

with the image file replaced by the `linear-gradient()` function. The gradient is generated for the entire object but is trimmed with a slice width of 15px to form the gradient border.

**TRY IT**

You can explore gradients as backgrounds in the `demo_linear_image.html` and `demo_radial_image.html` files in the `html04` ► demo folder

**TRY IT**

You can explore gradient borders using the `demo_gradient_border.html` file in the `html04` ► demo folder.

## Creating Semi-Transparent Objects

In Tutorial 2, you learned that you could create semi-transparent colors that blend with the background color. You can also create whole page objects that are semi-transparent using the following `opacity` property:

```
opacity: value;
```

where *value* ranges from 0 (completely transparent) up to 1 (completely opaque).

For example, the following style rule makes the page body 70% opaque, allowing a bit of the browser window background to filter through

```
body {
 opacity: 0.7;
}
```

## REFERENCE

### Making a Semi-transparent Object

- To make a page object semi-transparent, use the property

```
opacity: value;
```

where *value* ranges from 0 (completely transparent) up to 1 (completely opaque).

Kevin suggests that you set the opacity of the figure box to 55% in order to blend the figure box with the paper texture background you added to the `article` element.

**To create a semi-transparent object:**

1. Return to the **tb\_visual1.css** file in your editor and scroll up to the Figure Box Styles section.
2. Within the style rule for the `figure` element, insert the following style:

`opacity: 0.55;`

Figure 4–43 highlights the code to make the figure box semi-transparent.

**Figure 4–43****Creating a semi-transparent object**

sets the opacity of the figure box to 55%

```
figure {
 border-style: solid;
 border-width: 25px;
 border-image: url(tb_border.png) 50 repeat;
 margin: 20px auto 0px;
 opacity: 0.55;
 width: 80%;
}
```

3. Save your changes and reload `tb_komatsu.html` in your browser. Figure 4–44 displays the semi-transparent figure box with part of the background paper texture showing through.

**Figure 4–44****Changing the opacity of the figure box**

part of the background page texture shows through in the figure box



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## PROSKILLS

### Written Communication: How to Use Visual Effects

The CSS visual styles can add striking effects to your website, but they might not be supported by older browsers. This leaves you with the dilemma of when and how to use these styles. Here are some tips to keep in mind when applying visual effects to your website:

- Because not every user will be able to see a particular visual effect, design your page so that it is still readable to users with or without the effect.
- Be aware that some visual effects that flicker or produce strobe-like effects can cause discomfort and even photo-epileptic seizures in susceptible individuals. Avoid clashing color combinations and optical illusions that can cause these conditions.
- If you need to create a cross-browser solution, use browser extensions and be aware that the browser extension syntax might not match the syntax of the CSS standard.
- Consider using graphic images to create your visual effects. For example, rather than using the CSS gradient functions, create a background image file containing the gradient effect of your choice.

No matter how you employ visual effects on your website, remember that the most important part of your site is its content. Do not let visual effects distract from your content and message.

At this point you've completed your work on the design of the Komatsu Family page. In the next session, you will learn how to use CSS to apply transformations and filters. You will also learn how to work with image maps to create linkable images. Close any open files now.

## REVIEW

### Session 4.2 Quick Check

1. Provide a style rule to create a red text shadow that is 5 pixels to the right and 10 pixels up from the text with a blur of 15 pixels.
  - a. `text-shadow: red 5px 10px 15px;`
  - b. `text-shadow: red -5px 10px 15px;`
  - c. `text-shadow: red 5px -10px 15px;`
  - d. `text-shadow: red -5px -10px 15px;`
2. Provide a style rule to add a blue drop shadow to a page object that is 2 pixels to the left, 5 pixels up and with a blur radius of 8 pixels.
  - a. `box-shadow: blue 2px 5px 8px;`
  - b. `box-shadow: blue -2px 5px 8px;`
  - c. `box-shadow: blue 2px -5px 8px;`
  - d. `box-shadow: blue -2px -5px 8px;`
3. Provide a style to add a green interior drop shadow that is 2 pixels to the left, 5 pixels up and a blur radius of 8 pixels.
  - a. `box-shadow: green 2px 5px 8px;`
  - b. `box-shadow: green 2px 5px 8px inset;`
  - c. `box-shadow: green -2px -5px 8px;`
  - d. `box-shadow: green -2px -5px 8px inset;`

4. Provide a style rule to create a red halo effect with no shadow offset, a blur of 15 pixels and a shadow size that is 10 pixels larger than the element.
  - a. `box-shadow: red 0px 0px 15px 10px;`
  - b. `box-shadow: red 0px 0px 10px 15px;`
  - c. `box-shadow: red 15px 10px 0px 0px;`
  - d. `box-shadow: red 10px 15px 0px 0px;`
5. Provide code for a linear gradient that moves in the direction of the lower-left corner of the element through the colors: orange, yellow, and green.
  - a. `linear-gradient(left bottom, orange, yellow, green)`
  - b. `linear-gradient(bottom left, orange, yellow, green)`
  - c. `linear-gradient(to left bottom, orange, yellow, green)`
  - d. `linear-gradient(from right top, orange, yellow, green)`
6. Create a linear gradient that moves at a 15 degree angle with the color orange stopping at 10% of the background, yellow stopping at 50%, and green stopping at 55%.
  - a. `linear-gradient(15deg, 10% orange, 50% yellow, 55% green)`
  - b. `linear-gradient(15deg, orange 10%, yellow 50%, green 55%)`
  - c. `linear-gradient(15deg, orange 10% yellow 50% green 55%)`
  - d. `linear-gradient(195deg, 10% orange, 50% yellow, 55% green)`
7. Create a radial gradient that extends to the farthest background corner, going through the colors orange, yellow, and green.
  - a. `radial(farthest-corner, orange, yellow, green)`
  - b. `radial-gradient(from farthest-corner, orange, yellow, green)`
  - c. `radial-gradient(farthest-corner, orange, yellow, green)`
  - d. `radial(farthest-corner, orange, yellow, green)`
8. Create a repeating circular gradient of orange, yellow, and green bands centered at the right edge of the element with the colors stopped at 10%, 20%, and 30% respectively.
  - a. `radial-gradient(circle at right center, orange 10%, yellow 20%, green 30%)`
  - b. `radial-gradient-repeat(circle at right center, orange 10%, yellow 20%, green 30%)`
  - c. `radial-gradient-repeat(circle at right center, orange 10% 10%, yellow 20% 20%, green 30% 30%)`
  - d. `repeating-radial-gradient(circle at right center, orange 10%, yellow 20%, green 30%)`
9. Create a style rule to set the opacity to 75%.
  - a. `transparency: 25%;`
  - b. `transparency: 0.25;`
  - c. `opacity: 75%;`
  - d. `transform: opacity(0.75);`

# Session 4.3 Visual Overview:

**Perspective** is used in 3D transformations to measure how rapidly objects appear to recede from or approach the viewer.

The **transform** property is used to rotate, rescale, skew, or shift a page object.

The **filter** property is used to modify an object's color, brightness, contrast, or general appearance.

The **grayscale** function displays the object in grayscale.

The **saturate** and **contrast** functions increase the color saturation by 50% and increase the color contrast by 20%.

```
/* Transformation and Filter Styles */
```

```
article {
 perspective: 600px;
}
```

The **rotateX** and **translateY** functions rotate the object 30° around the x-axis and move it 50 pixels toward the viewer.

```
figure#figure1 {
 transform: rotateX(30deg) translateY(50px);
 filter: sepia(0.8);
}
```

The **sepia** function displays the object in a sepia tone.

The **rotateZ** and **rotateY** functions rotate the object 30° around the z-axis and 60° around the y-axis.

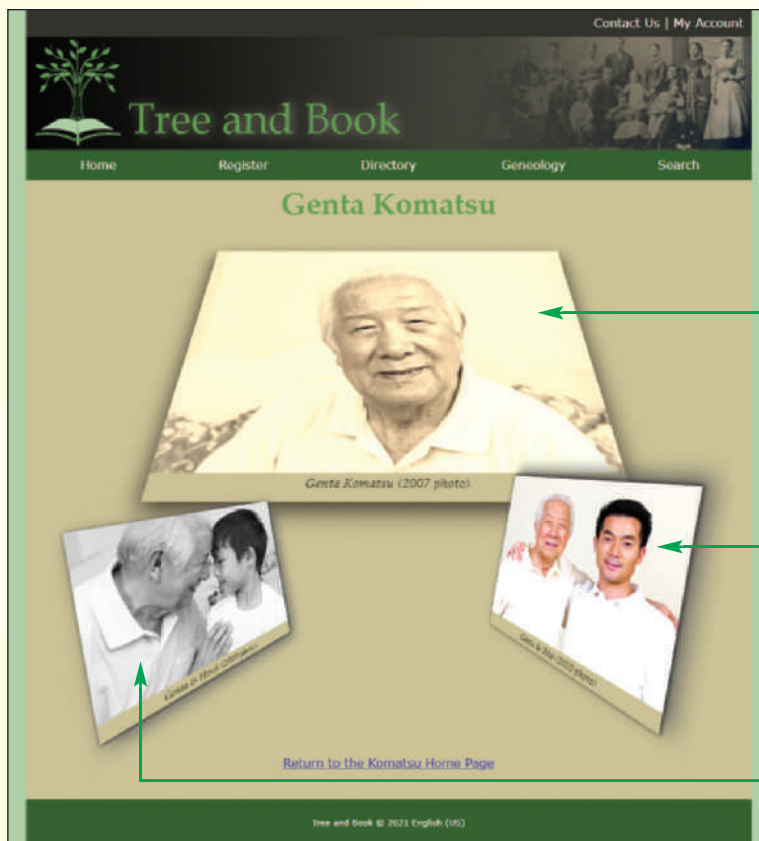
```
figure#figure2 {
 transform: rotate(-40deg) scale(0.8, 0.8) translate(20px, -100px)
 rotateZ(30deg) rotateY(60deg);
 filter: grayscale(1);
}
```

The **scale** function reduces the object to 90% of its default size.

```
figure#figure3 {
 transform: rotate(10deg) scale(0.9, 0.9)
 translateY(-120px) rotateY(-70deg) translateZ(-20px);
 filter: saturate(1.5) contrast(1.2);
}
```

Logo Design Studio Pro; Source: wiki Media;  
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# Transformations and Filters



The image uses a sepia tone and is rotated around the x-axis.

This shows a rescaled image with increased color saturation and contrast; it is rotated around the y-axis.

This shows the image in grayscale and rotated around the z and y axes.

Source: Design Studio Pro; Source: Wikimedia Commons; intmphoto/Shutterstock.com

## Transforming Page Objects

In this session, you will examine some CSS styles that can be used to transform the appearance of page objects through rotation, rescaling, and translation in space. To accomplish these transformations, you'll use the following `transform` property:

```
transform: effect(params);
```

where *effect* is a transformation function that will be applied to the page object and *params* are any parameters required by the function. Figure 4–45 describes some of the CSS transformation functions.

Figure 4–45

CSS 2D transformation functions

Function	Description
<code>translate(offsetX, offsetY)</code>	Moves the object <i>offsetX</i> pixels to the right and <i>offsetY</i> pixels down; negative values move the object to the left and up
<code>translateX(offsetX)</code>	Moves the object <i>offsetX</i> pixels to the right; negative values move the object to the left
<code>translateY(offsetY)</code>	Moves the object <i>offsetY</i> pixels down; negative values move the object up
<code>scale(x, y)</code>	Resizes the object by a factor of <i>x</i> horizontally and a factor of <i>y</i> vertically
<code>scaleX(x)</code>	Resizes the object by a factor of <i>x</i> horizontally
<code>scaleY(y)</code>	Resizes the object by a factor of <i>y</i> horizontally
<code>skew(angleX, angleY)</code>	Skews the object by <i>angleX</i> degrees horizontally and <i>angleY</i> degrees vertically
<code>skewX(angleX)</code>	Skews the object by <i>angleX</i> degrees horizontally
<code>skewY(angleY)</code>	Skews the object by <i>angleY</i> degrees vertically
<code>rotate(angle)</code>	Rotates the object by <i>angle</i> degrees clockwise; negative values rotate the object counter-clockwise
<code>matrix(n, n, n, n, n, n)</code>	Applies a 2D transformation based on a matrix of six values

For example, to rotate an object 30° clockwise, you would apply the following style using the `rotate` function:

```
transform: rotate(30deg);
```

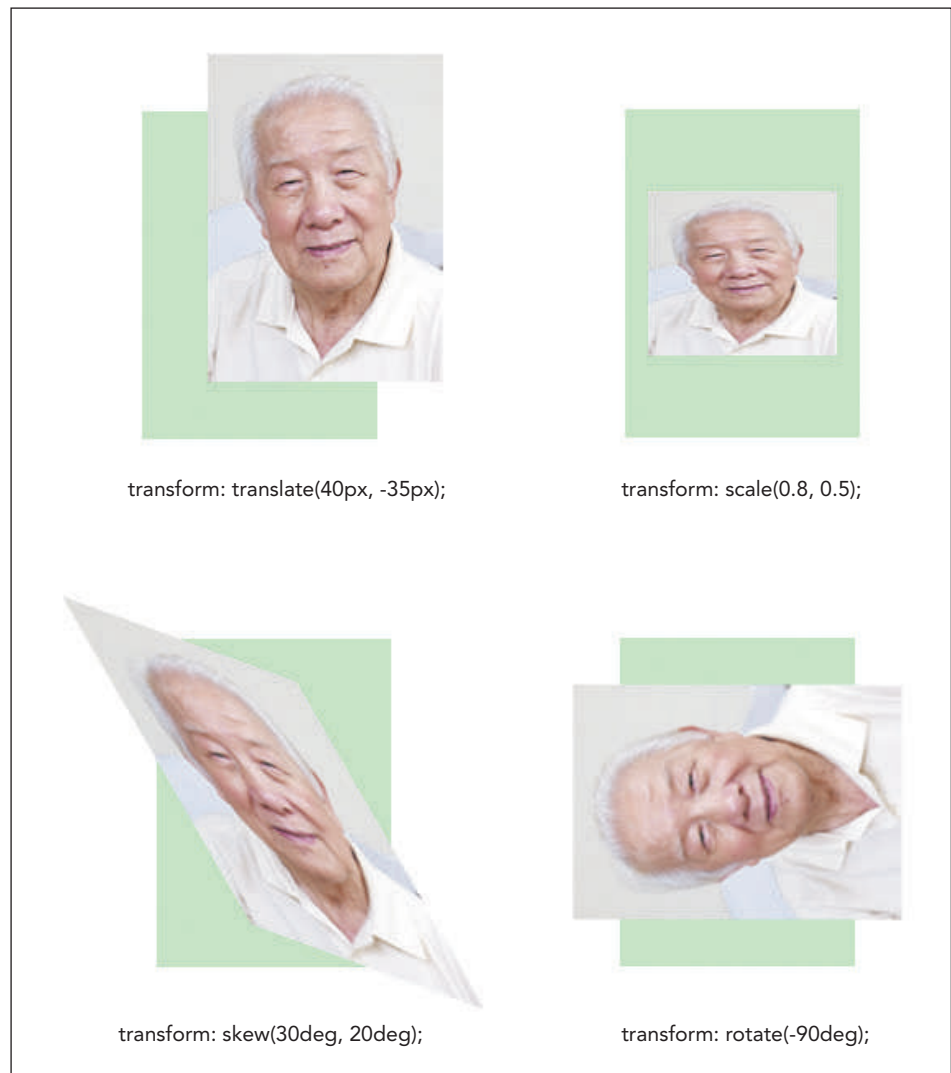
To rotate an object counter-clockwise, you would use a negative value for the angle of rotation. Thus, the following style rotates an object 60° counter-clockwise:

```
transform: rotate(-60deg);
```

Figure 4–46 displays the effects of other transformation functions on a sample page image.

Figure 4–46

## Examples of CSS Transformations



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**TRY IT**

You can explore different 2D CSS transformations using the demo pages `demo_transform2d.html` and `demo_transform2dm.html` from the `html04` demo folder.

Transforming an object has no impact on the page layout. All of the other page objects will retain their original positions.

You can apply multiple transformations by placing the effect functions in a space-separated list. In this situation, transformations are applied in the order listed. For example, the following style first rotates the object 30° clockwise and then shifts it 20 pixels to the right.

```
transform: rotate(30deg) translateX(20px);
```

**REFERENCE****Applying a CSS Transformation**

- To apply a transformation to a page object, use the property

```
transform: effect(params);
```

where *effect* is a transformation function that will be applied to the page object and *params* are any parameters required by the function.

The website has pages with photos for each individual in the Komatsu family. Kevin wants you to work on transforming the photos on Genta Komatsu's page. Kevin has already created the page content and a layout and typographical style sheet but wants you to work on the style sheet containing the visual effects. Open the Genta Komatsu page now.

### To open the Genta Komatsu page:

1. Use your editor to open the **tb\_genta\_txt.html** and **tb\_visual2\_txt.css** files from the html04 ► tutorial folder. Enter **your name** and **the date** in the comment section of both files and save them as **tb\_genta.html** and **tb\_visual2.css** respectively.
2. Return to the **tb\_genta.html** file in your editor. Within the document head, insert the following `link` elements to link the page to the `tb_reset.css`, `tb_styles2.css`, and `tb_visual2.css` style sheet files.

```
<link href="tb_reset.css" rel="stylesheet" />
<link href="tb_styles2.css" rel="stylesheet" />
<link href="tb_visual2.css" rel="stylesheet" />
```
3. Take some time to scroll through the contents of the file. Note that the document content consists mainly of three figure boxes each containing a different photo of Genta Komatsu.
4. Close the file, saving your changes.
5. Open the **tb\_genta.html** file in your browser. Figure 4–47 shows the initial layout and design of the page content.

Figure 4–47

Initial design of the Genta Komatsu page



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Kevin feels that the page lacks visual interest. He suggests you transform the bottom row of photos by rotating them and shifting them upward to partially cover the main photo, creating a collage-style layout. Apply the `transform` property now to make these changes.

### To apply the transform style:

1. Go to the **tb\_visual2.css** file in your editor and scroll as needed to the Transformation Styles section.
2. Insert the following style rule to rotate the figure2 figure box 40° counter-clockwise, reduce it to 80% of its former size, and shift it 20 pixels to the right and 100 pixels up. Also, add a style to create a drop shadow using the code that follows:

```
figure#figure2 {
 transform: rotate(-40deg) scale(0.8, 0.8)
 translate(20px, -100px);
 box-shadow: rgb(101, 101, 101) 10px 10px 25px;
}
```

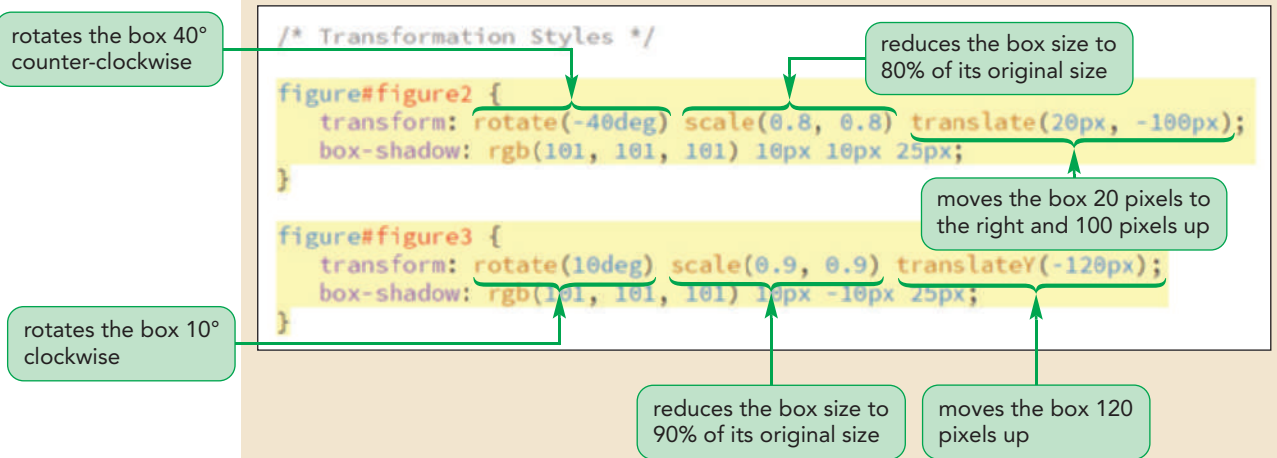
3. Add the following style rule to rotate the figure3 figure box 10° clockwise, resize it to 90% of its current size, and shift it 120 pixels upward. Also add a drop shadow to the figure box using the following style rule:

```
figure#figure3 {
 transform: rotate(10deg) scale(0.9, 0.9)
 translateY(-120px);
 box-shadow: rgb(101, 101, 101) 10px -10px 25px;
}
```

Figure 4–48 describes the newly added style rules.

Figure 4–48

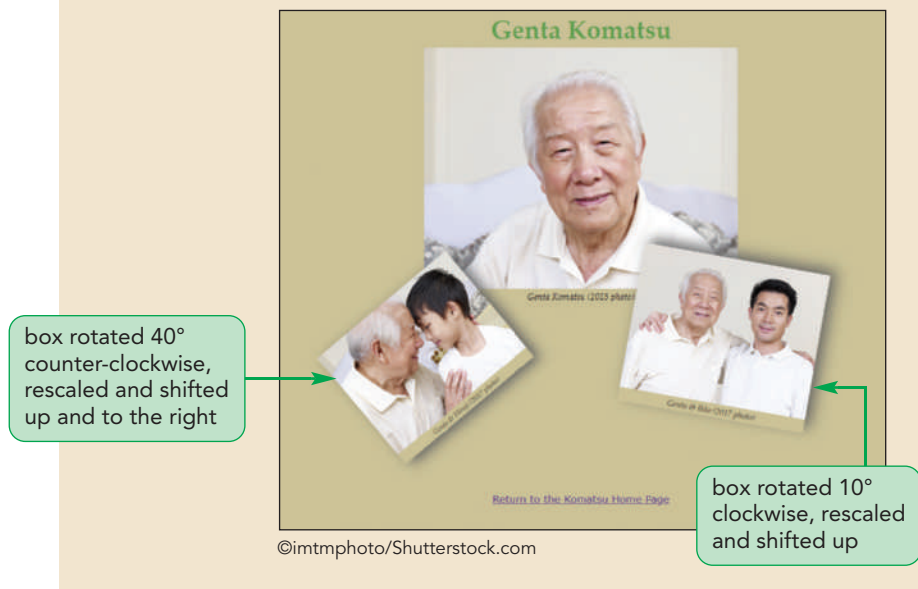
### Transforming the figure boxes



4. Save your changes to the file and then reload **tb\_genta.html** in your browser. Figure 4–49 shows the revised design of the page's content.

Figure 4-49

Viewing the transformed figure boxes



The transformations you applied rotated the figure boxes along a two-dimensional or 2D space that consisted of a horizontal and vertical axis. CSS also supports transformations that operate in a three-dimensional or 3D space.

### Setting the Transformation Origin

#### INSIGHT

By default, transformations originate in the center of the page object. When an object is rotated, for example, it rotates the specified number of degrees around its horizontal and vertical center. If you wish to rotate around a different point, such as the object's left edge or bottom-right corner, you can modify the transformation origin using the following `transform-origin` property:

#### TRY IT

You can explore the `transform-origin` property in the `demo_transform2d.html` and `demo_transform2dm.html` files from the `html04` ▶ demo folder.

```
transform-origin: horizontal vertical;
```

where *horizontal* and *vertical* specify the location of the origin of the transformation. For example, the following set of style rules used in conjunction will rotate an object 30 degrees clockwise around its bottom-right corner:

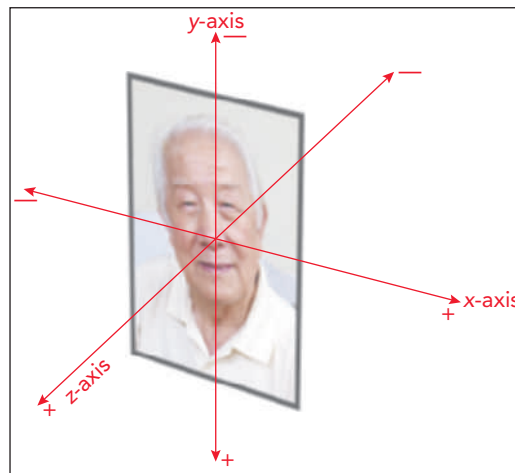
```
transform: rotate(30deg);
transform-origin: right bottom;
```

## Transformations in Three Dimensions

A **3D transformation** is a change that involves three spatial axes: an x-axis that runs horizontally across the page, a y-axis that runs vertically, and a z-axis that comes straight out of the page toward and away from the viewer. Positive values along the axes are to the right, down, and toward the reader; negative values are to the left, up, and away from the reader (see Figure 4-50.)

Figure 4–50

A page object viewed in 3D



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With the addition of a third spatial axis, you can create effects in which an object appears to zoom toward and away from users, or to rotate in three dimensional space. Figure 4–51 describes the 3D transformations supported by CSS.

Figure 4–51

CSS 3D transformation functions

Function	Description
<code>translate3d(offX, offY, offZ)</code>	Shifts the object <i>offX</i> pixels horizontally, <i>offY</i> pixels vertically, and <i>offZ</i> pixels along the z-axis
<code>translateX(offX)</code> <code>translateY(offY)</code> <code>translateZ(offZ)</code>	Shifts the object <i>offX</i> , <i>offY</i> , or <i>offZ</i> pixels along the specified axis
<code>rotate3d(x, y, z, angle)</code>	Rotates the object around the three-dimensional vector ( <i>x</i> , <i>y</i> , <i>z</i> ) at a direction of <i>angle</i>
<code>rotateX(angle)</code> <code>rotateY(angle)</code> <code>rotateZ(angle)</code>	Rotates the object around the specified axis at a direction of <i>angle</i>
<code>scale3d(x, y, z)</code>	Resizes the object by a factor of <i>x</i> horizontally, a factor of <i>y</i> vertically, and a factor of <i>z</i> along the z-axis
<code>scaleX(x)</code> <code>scaleY(y)</code> <code>scaleZ(z)</code>	Resizes the object by a factor of <i>x</i> , <i>y</i> , or <i>z</i> along the specified axis
<code>perspective(p)</code>	Sets the size of the perspective effect to <i>p</i>
<code>matrix3d(n, n, ..., n)</code>	Applies a 3D transformation based on a matrix of 16 values

For example the following style rotates the object 60° around the x-axis, making it appear as if the top of the object is farther from the viewer and the bottom is closer to the viewer.

```
transform: rotateX(60deg);
```

To truly create the illusion of 3D space however, you also need to set the perspective of that space.

### TRY IT

View 3D rotations and perspective values with the `demo_3dview.html` file in the `html04 ► demo` folder.

## Understanding Perspective

Perspective is a measure of how rapidly objects appear to recede from the viewer in a 3D space. You can think of perspective in terms of a pair of railroad tracks that appear to converge at a point, known as the **vanishing point**. A smaller perspective

value causes the tracks to converge over an apparently shorter distance while a larger perspective value causes the tracks to appear to go farther before converging.

You define the perspective of a 3D space using the `perspective` property

```
perspective: value;
```

where *value* is a positive value that measures the strength of the perspective effect with lower values resulting in more extreme distortion. For example, the following style rule sets the perspective of the space within the `div` element to 400 pixels.

```
div {
 perspective: 400px;
}
```

Any 3D transformations applied to children of that `div` element will assume a perspective value of 400 pixels. Perspective can also be set for individual transformations using the following `perspective` function:

```
transform: perspective(value);
```

Thus, the following style rule sets the perspective only for the `figure1` figure box within the `div` element as the figure box is rotated 60° around the x-axis.

```
div figure#figure1 {
 transform: perspective(400px) rotateX(60deg);
}
```

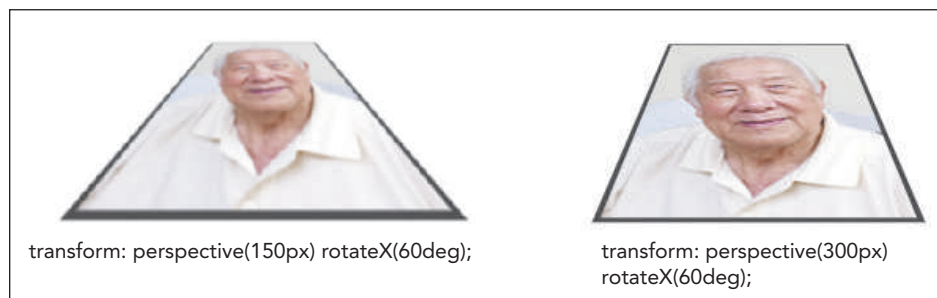
You use the `perspective` property when you have several transformed objects within a container that all need to appear within the same 3D space with a common perspective. You use the `perspective` function when you have only one object that needs to be transformed in the 3D space. Figure 4–52 compares two different perspective values for an object rotated 60° around the x-axis in 3D space.

Figure 4–52

Transformations in three dimensions

**TRY IT**

Explore multiple 3D transformations with the `demo_transform3dm.html` file in the `html04 ▶ demo` folder.



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Note that the smaller perspective value results in a more extreme distortion as the top of the object appears to more quickly recede from the viewer while the bottom appears to approach the viewer more rapidly.

**REFERENCE****Setting Perspective in 3D**

- To set the perspective for a container and the objects it contains, use the property

```
perspective: value;
```

where *value* is a positive value that measures the strength of the perspective effect with lower values resulting in more extreme distortion.

- To set the perspective of a single object or to set the perspective individually of objects within a group of objects, use the `perspective` function

```
transform: perspective(value);
```

Add a 3D transformation to each of the three figure boxes in the Genta Komatsu page, making it appear that they have been rotated in three dimensional space along the x-, y-, and z-axes, setting the perspective value to 600 pixels for all of the objects in the page article.

### To apply the 3D transformations:

1. Return to the **tb\_visual2.css** file in your editor.
2. Directly after the Transformation Styles comment, insert the following style rule to set the perspective of the 3D space of the `article` element.
 

```
article {
 perspective: 600px;
}
```
3. Next, insert the following style rule for the `figure1` figure box to rotate it 30° around the x-axis, shift it 50 pixels along the z-axis, and add a drop shadow.
 

```
figure#figure1 {
 transform: rotateX(30deg) translateZ(50px);
 box-shadow: rgb(51, 51, 51) 0px 10px 25px;
}
```
4. Add the following functions to the `transform` property for the `figure2` figure box to rotate the box 30° around the z-axis and 60° around the y-axis:
 

```
rotateZ(30deg) rotateY(60deg)
```
5. Add the following functions to the `transform` property for the `figure3` figure box to rotate the box counter-clockwise 70° around the y-axis and shift it 20 pixels away from the user along the z-axis:
 

```
rotateY(-70deg) translateZ(-20px)
```

Figure 4–53 highlights the 3D transformations styles in the style sheet.

Figure 4–53 Applying 3D transformations

The diagram illustrates the application of 3D transformations in CSS. It shows a code block with the following styles:

```
/* Transformation Styles */

article {
 perspective: 600px;
}

figure#figure1 {
 transform: rotateX(30deg) translateZ(50px);
 box-shadow: rgb(51, 51, 51) 0px 10px 25px;
}

figure#figure2 {
 transform: rotate(-40deg) scale(0.8, 0.8)
 translate(20px, -100px)
 rotateZ(30deg) rotateY(60deg);
 box-shadow: rgb(101, 101, 101) 10px 10px 25px;
}

figure#figure3 {
 transform: rotate(10deg) scale(0.9, 0.9)
 translateY(-120px)
 rotateY(-70deg) translateZ(-20px);
 box-shadow: rgb(101, 101, 101) 10px -10px 25px;
}
```

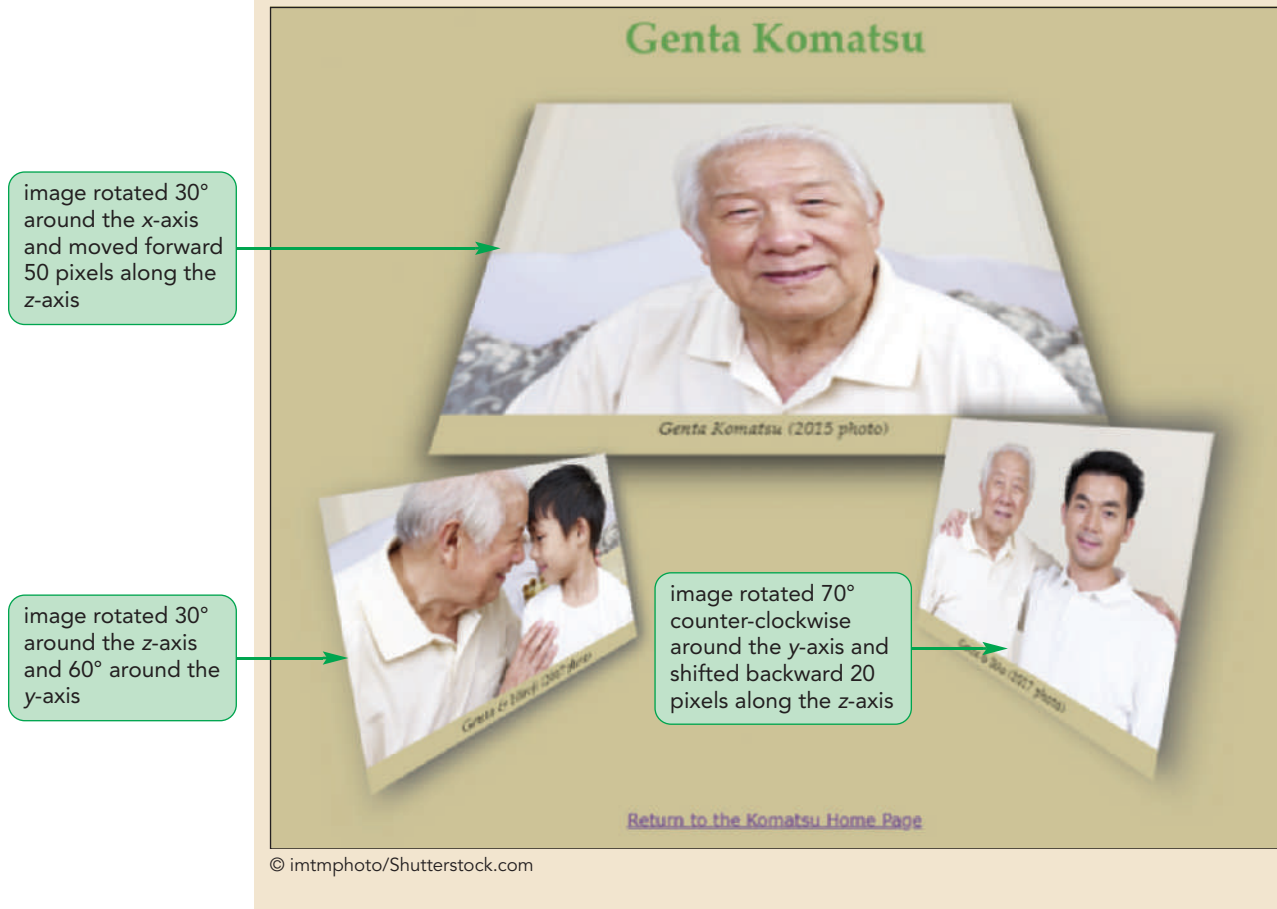
Callouts explain the following properties:

- perspective: 600px;** sets the perspective of the article space to 600 pixels
- transform: rotateX(30deg) translateZ(50px);** rotates the box 30° around the x-axis and shifts it forward 50 pixels along the z-axis
- box-shadow: rgb(51, 51, 51) 0px 10px 25px;** adds a box shadow on the box's bottom border
- transform: rotate(-40deg) scale(0.8, 0.8) translate(20px, -100px) rotateZ(30deg) rotateY(60deg);** rotates the box 30° around the z-axis and 60° around the y-axis
- transform: rotate(10deg) scale(0.9, 0.9) translateY(-120px) rotateY(-70deg) translateZ(-20px);** rotates the box 70° counter-clockwise around the y-axis and shifts it backward 20 pixels along the z-axis

6. Save your changes to the file and then reload `tb_genta.html` in your browser. Figure 4–54 shows the result of applying 3D transformations to each of the figure boxes on the page.

Figure 4–54

Figure boxes in 3D space



You have only scratched the surface of what can be done using transformations. For example, you can create a mirror image of an object by rotating it 180° around the y-axis. You can create virtual 3D objects like cubes that can be viewed from any angle or spun. You are only limited by your imagination.

## INSIGHT

### Managing a 3D Space

You might want to have several objects that coexist within the same 3D space. You can do this by creating a container for all those objects, allowing them to share a common 3D perspective using the following `transform-style` property:

```
transform-style: type;
```

where *type* is either `preserve-3d` to preserve the 3D space for all nested elements or `flat` to allow the nested elements to exist within their own separate 3D spaces. For example, the following style rules will pass the same 3D space to all elements nested within the container, including any value assigned to the `perspective` property.

```
#container {
 transform-style: preserve-3d;
}
```

**TRY IT**

Explore managing multiple objects within a 3D space in the `demo_preserve3d.html`, `demo_cards.html`, and `demo_cube.html` files from the `html04 ▶ demo` folder.

An object in a 3D space is considered to have a front and a back. The default behavior is to allow any text or images on the front to “bleed through” to the back (thus appearing in reverse when the object is rotated around the x or y axes.) You can turn off this feature setting the `backface-visibility` property to `hidden`, which prevents text and images on the front face of the object from appearing on the back face. Setting `backface-visibility` to `visible` restores the default.

## Exploring CSS Filters

A final way to alter an object is through a CSS filter. Filters adjust how the browser renders an image, a background, or a border by modifying the object’s color, brightness, contrast, or general appearance. For example, a filter can be used to change a color image to grayscale, increase the image’s color saturation, or add a blurring effect. Filters are applied using the `filter` property

```
filter: effect(params);
```

where *effect* is a filter function and *params* are the parameters of the function. Figure 4–55 describes the different filter functions supported by most current browsers.

Figure 4–55

## CSS filter functions

Function	Description
<code>blur(<i>length</i>)</code>	Applies a blur to the image where <i>length</i> defines the size of blur in pixels
<code>brightness(<i>value</i>)</code>	Adjusts the brightness where values from 0 to 1 decrease the brightness and values greater than 1 increase the brightness
<code>contrast(<i>value</i>)</code>	Adjusts the contrast where values from 0 to 1 decrease the contrast and values greater than 1 increase the contrast
<code>drop-shadow(<i>offsetX</i> <i>offsetY</i> <i>blur</i> <i>color</i>)</code>	Adds a drop shadow to the image where <i>offsetX</i> and <i>offsetY</i> are horizontal and vertical distances of the shadow, <i>blur</i> is the shadow blurring, and <i>color</i> is the shadow color
<code>grayscale(<i>value</i>)</code>	Displays the image in grayscale from 0, leaving the image unchanged, up to 1, displaying the image in complete grayscale
<code>hue-rotate(<i>angle</i>)</code>	Adjusts the hue by <i>angle</i> in the color wheel where 0deg leaves the hue unchanged, 180deg displays the complimentary colors and 360deg again leaves the hue unchanged
<code>invert(<i>value</i>)</code>	Inverts the color from 0 (leaving the image unchanged), up to 1 (completely inverting the colors)
<code>opacity(<i>value</i>)</code>	Applies transparency to the image from 0 (making the image transparent), up to 1 (leaving the image opaque)
<code>saturate(<i>value</i>)</code>	Adjusts the color saturation where values from 0 to 1 decrease the saturation and values greater than 1 increase the saturation
<code>sepia(<i>value</i>)</code>	Displays the color in a sepia tone from 0 (leaving the image unchanged), up to 1 (image completely in sepia)
<code>url(<i>url</i>)</code>	Loads an SVG filter file from <i>url</i>

Figure 4–56 shows the impact of some of the filter functions on a sample image.

Figure 4–56

## CSS filter examples



©imtmphoto/Shutterstock.com

**TRY IT**

Explore the CSS filter styles with the `demo_filter.html` file in the `html04 ▶ demo` folder.

Filter functions can be combined in a space-separated list to create new effects. For example, the following style reduces the object's color contrast and applies a sepia tone.

```
filter: contrast(75%) sepia(100%);
```

With multiple filter effects, the effects are applied in the order they are listed. Thus, a style in which the sepia effect is applied first followed by the contrast effect will result in a different image than if the order is reversed.

**REFERENCE****Applying a CSS Filter**

- To apply a CSS filter to a page object, use the property

```
filter: effect(params);
```

where *effect* is a filter function and *params* are the parameters of the function.

Kevin wants you to apply filters to the photos in the Genta Komatsu page. He wants a sepia tone applied to the first photo, a grayscale filter applied to the second photo, and a color enhancement applied to the third photo.

**To apply the CSS filters:**

1. Return the `tb_visual2.css` file in your editor and go down to the Filter Styles section.
2. Change the figure1 figure box to a sepia tone by adding the following style rule:
 

```
figure#figure1 {
 filter: sepia(0.8);
}
```
3. Change the figure2 figure box to grayscale by adding the style rule:
 

```
figure#figure2 {
 filter: grayscale(1);
}
```
4. Increase the saturation and contrast for the figure3 figure box with the style rule:
 

```
figure#figure3 {
 filter: saturate(1.5) contrast(1.2);
}
```

Figure 4–57 highlights the CSS filters added to the style sheet.

Figure 4-57

## Applying the filter property

provides more cross-browser support by adding the WebKit browser extension

```
/* Filter Styles */
```

```
figure#figure1 {
 filter: sepia(0.8);
}
```

displays the figure1 figure box in sepia

```
figure#figure2 {
 filter: grayscale(1);
}
```

displays the figure2 figure box in grayscale

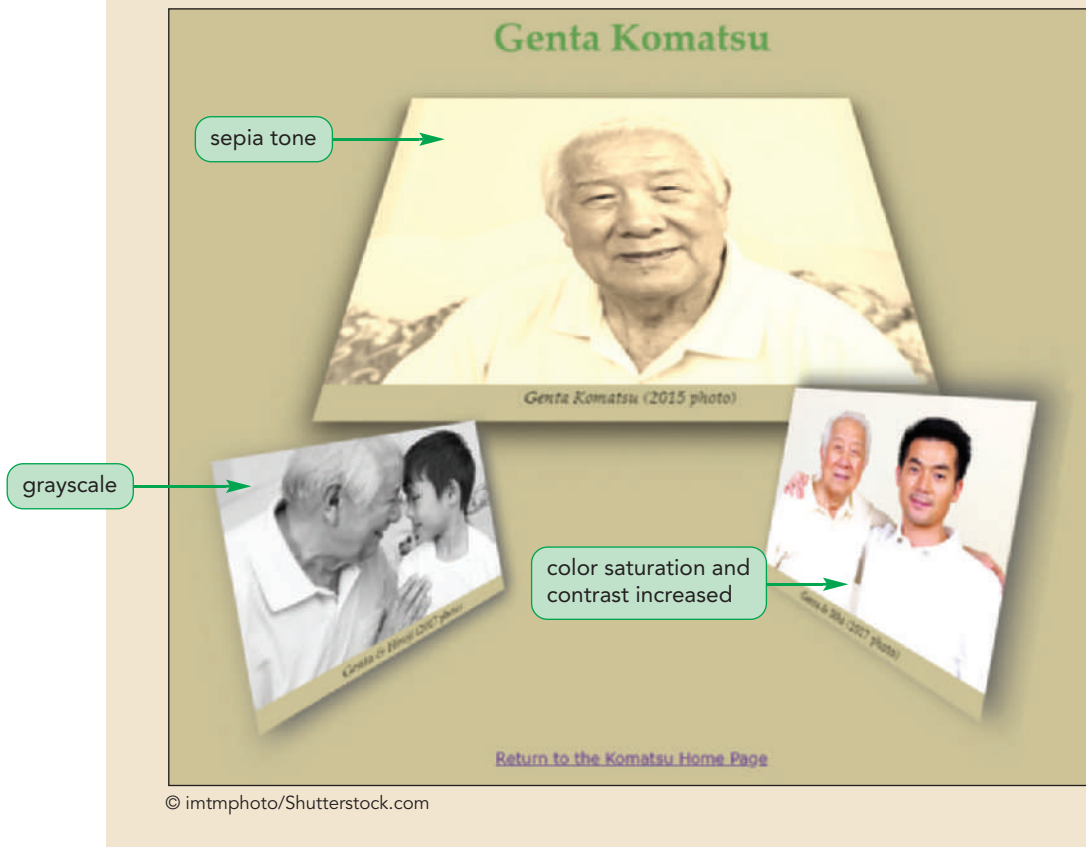
increases the color saturation and contrast in the figure3 figure box

```
figure#figure3 {
 filter: saturate(1.5) contrast(1.2);
}
```

5. Save your changes to the file and then reload tb\_genta.html in your browser. Figure 4-58 shows the final design of the Genta Komatsu page.

Figure 4-58

## Filters applied to the web page photos



### Box Shadows and Drop Shadows

You may wonder why you need a `drop-shadow` filter if you already have the `box-shadow` property. While they both can be used to add shadowing to a page object, one important difference is that the `drop-shadow` filter creates a shadow that traces the shape of the object, while the `box-shadow` property always applies a rectangular shadow. Another important difference is that you can only change the size of a shadow using the `box-shadow` property. Thus, if you want to apply a drop shadow around objects such as text or a circular shape, use the `drop-shadow` filter. However, if you need to create an internal shadow or change the size of the drop shadow shadow, use the `box-shadow` property.

You've completed your redesign of the Genta Komatsu page by adding transformation and filter effects to make a more visually striking page. Kevin now wants to return to the page for the Komatsu family. He wants you to edit the family portrait on the page so that individual pages like the Genta Komatsu page can be accessed by clicking the person's face on the family portrait. You can create this effect using an image map.

## Working with Image Maps

When you mark an inline image as a hyperlink, the entire image is linked to the same file; however, HTML also allows you to divide an image into different zones, or **hotspots**, which can then be linked to different URLs through information provided in an **image map**. HTML supports two kinds of image maps: client-side image maps and server-side image maps. A **client-side image map** is an image map that is defined within the web page and handled entirely by the web browser, while a **server-side image map** relies on a program running on the web server to create and administer the map. Generally client-side maps are easier to create and do not rely on a connection to the server in order to run.

### Defining a Client-Side Image Map

Client-side image maps are defined with the following `map` element

```
<map name="text">
 hotspots
</map>
```

where `text` is the name of the image map and `hotspots` are defined regions within an image that are linked to different URLs. Client-side image maps can be placed anywhere within the body of a web page because they are not actually displayed by browsers but are simply used as references for mapping the locations of the hotspots within the image. The most common practice is to place a `map` element below the corresponding inline image.

Each hotspot within the `map` element is defined using the following `area` element:

```
<area shape="shape" coords="coordinates"
 href="url" alt="text" />
```

where `shape` is the shape of the hotspot region, `coordinates` are the list of points that define the boundaries of that region, `url` is the URL of the hypertext link, and `text` is alternate text displayed for non-graphical browsers.

**TIP**

Do not overlap the hotspots to avoid confusing the user about which hotspot is associated with which URL.

Hotspots can be created as rectangles, circles, or polygons (multisided figures) using *shape* values of *rect*, *circle*, and *poly* respectively. A fourth possible *shape* value, *default*, represents the remaining area of the inline image not covered by any hotspots. There is no limit to the number of hotspots you can add to an image map.

For rectangular hotspots, the *shape* and *coords* attributes have the general form:

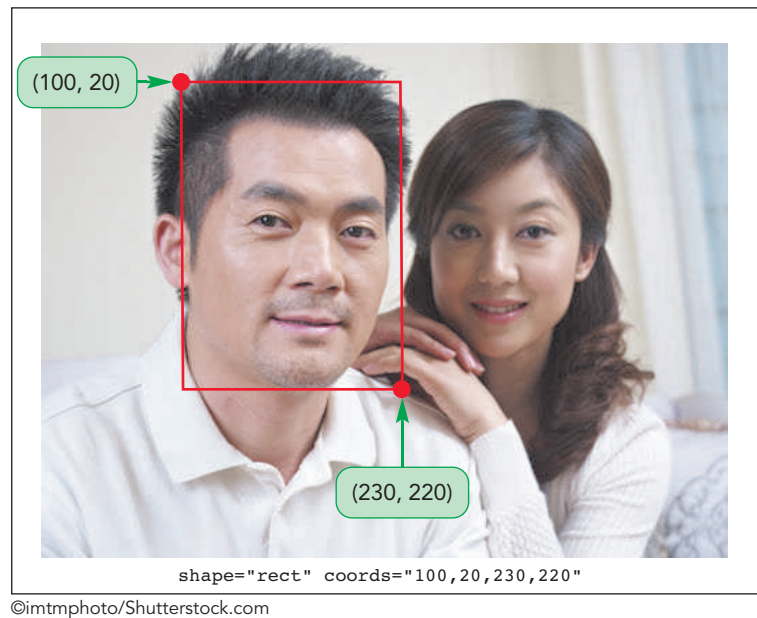
```
shape="rect" coords="left,top,right,bottom"
```

where *left*, *top* are the coordinates of the top-left corner of the rectangle and *right*, *bottom* are the coordinates of the bottom-right corner. Coordinates for hotspot shapes are measured in pixels and thus, the following attributes define a rectangular hotspot with the left-top corner at the coordinates (100, 20) and the right-bottom corner at (230, 220):

```
shape="rect" coords="100,20,230,220"
```

To determine the coordinates of a hotspot, you can use either a graphics program such as Adobe Photoshop or image map software that automatically generates the HTML code for the hotspots you define. Note that coordinates are always expressed relative to the top-left corner of the image, regardless of the position of the image on the page. For example, in Figure 4–59, the top-left corner of this rectangular hotspot is 100 pixels right of the image's left border and 20 pixels down from the top border.

**Figure 4–59** Defining a rectangular hotspot

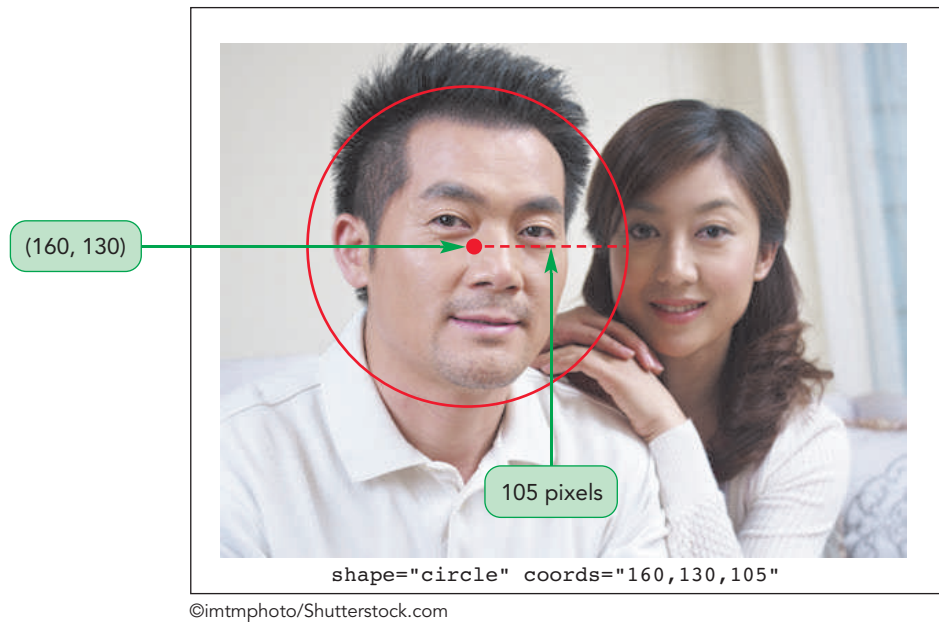


Circular hotspots are defined using the attributes

```
shape="circle" coords="x,y,radius"
```

where *x* and *y* are the coordinates of the center of the circle and *radius* is the circle's radius. Figure 4–60 shows the coordinates for a circular hotspot where the center of the circle is located at the coordinates (160, 130) with a radius of 105 pixels.

Figure 4–60 Defining a circular hotspot

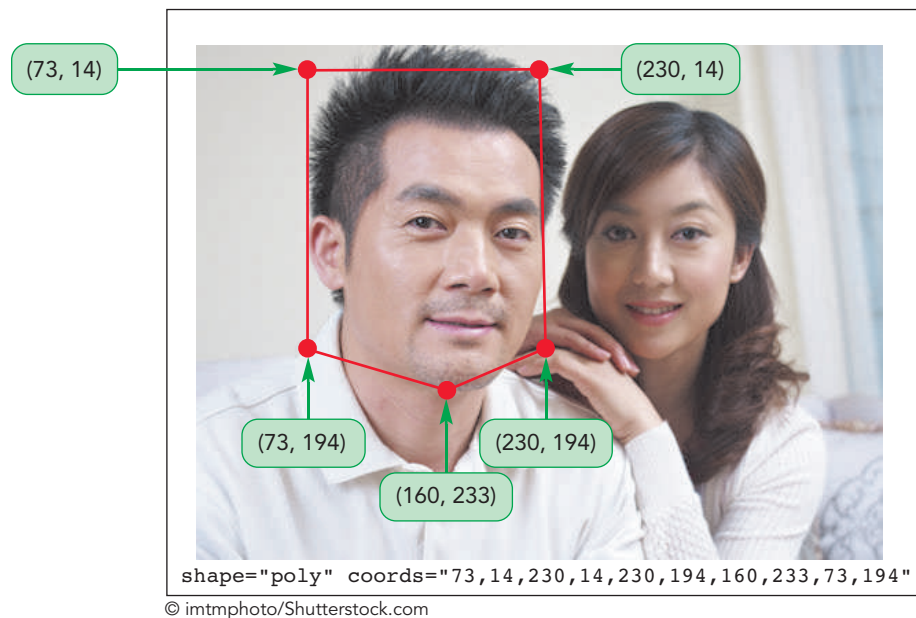


Polygonal hotspots have the attributes

```
shape="poly" coords="x1,y1,x2,y2,..."
```

where (x1, y1), (x2, y2), ... set the coordinates of each vertex in the shape. Figure 4–61 shows the coordinates for a 5-sided polygon.

Figure 4–61 Defining a polygonal hotspot



### TIP

Default hotspots should always be listed last.

To define the default hotspot for an image, create the following hotspot:

```
shape="default" coords="0,0,width,height"
```

where *width* is the width of the image in pixels and *height* is the image's height. Any region in the image that is not covered by another hotspot activates the default hotspot link.

### Creating an Image Map

- To create an image map, use

```
<map name="text">
 hotspots
</map>
```

where *text* is the name of the image map and *hotspots* are the hotspots within the image.

- To define each hotspot, use

```
<area shape="shape" coords="coordinates" href="url" alt="text" />
```

where *shape* is the shape of the hotspot region, *coordinates* list the points defining the boundaries of the region, *url* is the URL of the hypertext link, and *text* is alternate text that is displayed for non-graphical browsers.

- To define a rectangular hotspot, use the *shape* and *attribute* values

```
shape="rect" coords="left,top,right,bottom"
```

where *left*, *top* are the coordinates of the top-left corner of the rectangle and *right*, *bottom* are the coordinates of the bottom-right corner.

- To define a circular hotspot, use

```
shape="circle" coords="x,y,radius"
```

where *x* and *y* are the coordinates of the center of the circle and *radius* is the circle's radius.

- To define a polygonal hotspot, use

```
shape="poly" coords="x1,y1,x2,y2,..."
```

where (*x1*, *y1*), (*x2*, *y2*), and so on provide the coordinates of each vertex in the multisided shape.

- To define the default hotspot link, use

```
shape="default" coords="0,0,width,height"
```

where *width* and *height* is the width and height of the image.

Kevin has provided you with the coordinates for five rectangular hotspots to cover the five faces on the Komatsu family portrait. Add an image map named "family\_map" to the `tb_komatsu.html` page with rectangular hotspots for each of the faces in the family portrait.

### To create an image map:

1. Open or return to the **tb\_komatsu.html** file in your editor.
2. Directly below the figure box, insert the following HTML code:

```
<map name="family_map">
 <area shape="rect" coords="74,74,123,141"
 href="tb_ikko.html" alt="Ikko Komatsu" />
 <area shape="rect" coords="126,109,177,172"
 href="tb_mika.html" alt="Mika Komatsu" />
 <area shape="rect" coords="180,157,230,214"
 href="tb_hiroji.html" alt="Hiroji Komatsu" />
```

```

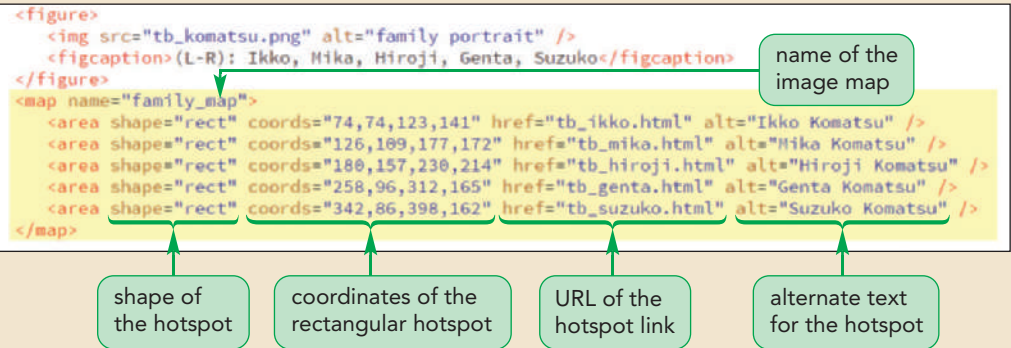
<area shape="rect" coords="258,96,312,165"
 href="tb_genta.html" alt="Genta Komatsu" />
<area shape="rect" coords="342,86,398,162"
 href="tb_suzuko.html" alt="Suzuko Komatsu" />
</map>

```

Figure 4–62 highlights the HTML code for the image map and hotspots.

Figure 4–62

### Inserting an image map



### 3. Save your changes to the file.

With the image map defined, your next task is to apply that map to the image in the figure box.

## Applying an Image Map

To apply an image map to an image, you add the following `usemap` attribute to the `img` element

```

```

where `map` is the name assigned to the image map within the current HTML file.

### REFERENCE

#### Applying an Image Map

- To apply an image map to an image, add the `usemap` attribute to the `img` element

```

```

where `map` is the name assigned to the image map.

Apply the `family_map` image map to the figure box and then test it in your web browser.

### To apply an image map:

1. Add the attribute `usemap="#family_map"` to the `img` element for the family portrait.

Figure 4–63 highlights the code to apply the image map.

Figure 4–63

### Applying an image map

Applies the family\_map image map to the image

```
<figure>

 <figcaption>(L-R): Ikko, Mika, Hiroji, Genta, Suzuko</figcaption>
</figure>
```

2. Save your changes to the file and then reload `tb_komatsu.html` in your browser.
3. Click the five faces in the family portrait and verify each face is linked to a separate HTML file devoted to that individual. Use the link under the image of each individual to return to the home page.

Kevin likes the addition of the image map and plans to use it on other photos in the website.



## PROSKILLS

### Problem Solving: Image Maps with Flexible Layouts

Image maps are not easily applied to flexible layouts in which the size of the image can change based on the size of the browser window. The problem is that, because hotspot coordinates are expressed in pixels, they don't resize and will not point to the correct region of the image if the image is resized.

One way to deal with flexible layouts is to create hotspots using hypertext links that are sized and positioned using relative units. The image and the hypertext links would then be nested within a `figure` element as follows:

```
<figure class="map">

 ...
</figure>
```

The figure box itself needs to be placed using relative or absolute positioning and the image should occupy the entire figure box. Each hypertext link should be displayed as a block with width and height defined using percentages instead of pixels and positioned absolutely within the figure box, also using percentages for the coordinates. As the figure box is resized under the flexible layout, the hotspots marked with the hypertext links will automatically be resized and moved to match. The opacity of the hotspot links should be set to 0 so that the links do not obscure the underlying image file. Even though the hotspots will be transparent to the user, they will still act as hypertext links.

This approach is limited to rectangular hotspots. To create a flexible layout for other shapes, you need to use a third-party add-in that automatically resizes the shape based on the current size of the image.

You've completed your work on the Komatsu Family pages for *Tree and Book*. Kevin will incorporate your work and ideas with other family pages as he continues on the site redesign. He'll get back to you with more projects in the future. For now you can close any open files or applications.

## REVIEW

## Session 4.3 Quick Check

- Provide the transformation to shift a page object 5 pixels to the right and 10 pixels up.
  - `transform: translate(5px, 10px);`
  - `transform: translate(5px, -10px);`
  - `transform: translate(-5px, -10px);`
  - `translate: -5px 10px;`
- Provide the transformation to reduce the horizontal and vertical size of an object by 50%.
  - `scale: 0.5, 0.5;`
  - `transform: scale(0.5, 0.5);`
  - `transform: rescale(0.5, 0.5);`
  - `transform: resize(0.5, 0.5);`
- Provide the transformation to rotate an object 30° counter-clockwise around the x-axis.
  - `transform: rotate(-30deg);`
  - `transform: rotate(30deg);`
  - `transform: rotateX(30deg);`
  - `transform: rotateX(-30deg);`
- Provide the filter to increase the brightness of an object by 20%.
  - `filter: brightness(20%);`
  - `filter: brightness(0.2);`
  - `filter: brightness(1.2);`
  - `brightness: 0.2;`
- Provide the filter to decrease the contrast of an object by 30%.
  - `filter: contrast(0.3);`
  - `filter: contrast(0.7);`
  - `filter: contrast(30%);`
  - `filter: contrast(-0.3);`
- Provide the code to create a triangular hotspot with vertices at (200, 5), (300, 125), and (100, 125), linked to the info.html file.
  - `<area type="poly" coords="200, 5, 300, 125, 100, 125" href="info.html" />`
  - `<area type="triangle" coords="200, 5, 300, 125, 100, 125" href="info.html" />`
  - `<area type="draw" coords="200, 5, 300, 125, 100, 125" href="info.html" />`
  - `<area type="poly" coords="5, 200, 125, 300, 125, 100" href="info.html" />`
- Provide code to attach the logo.png image to the mapsites image map:
  - ``
  - ``
  - ``
  - ``
- Provide a style rule to transfer 3D space from a container element to its nested elements.
  - `transform-style: perspective;`
  - `preserve-3d: true;`
  - `transfer-style: preserve-3d;`
  - `transform-style: preserve-3d;`

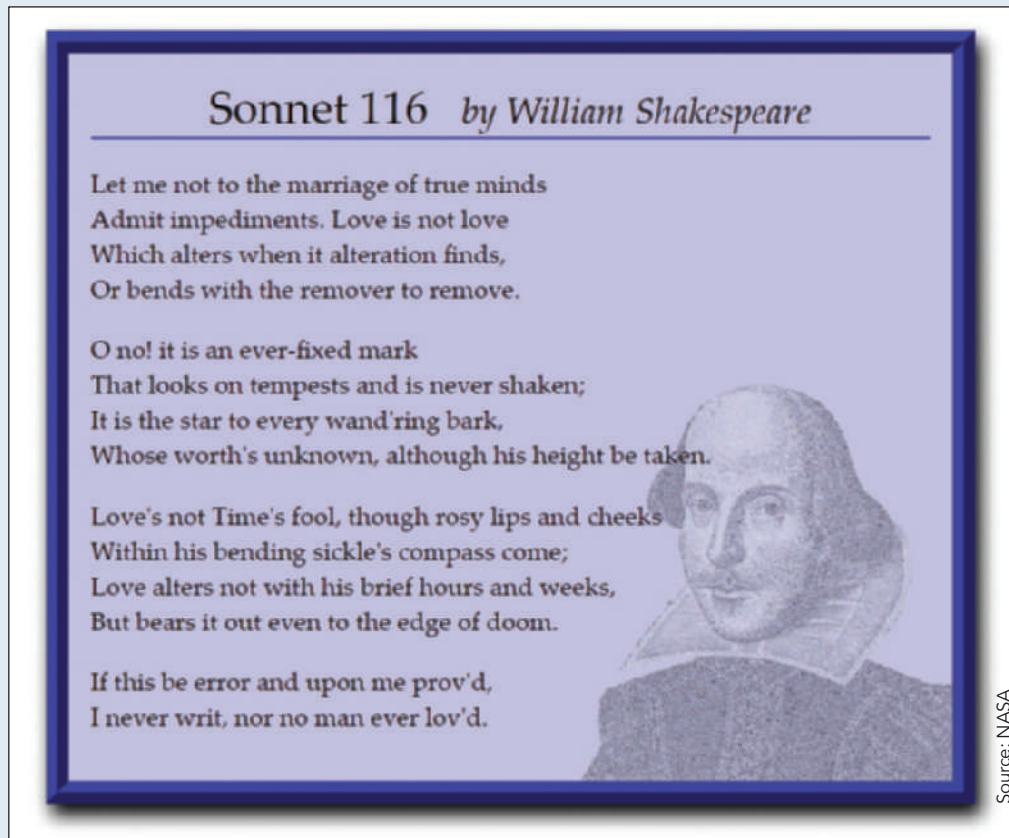
## Coding Challenge 1

Data Files needed for this Coding Challenge: `code4-1_txt.html`, `code4-1_back_txt.css`, `code4-1.css`, `ws.png`

Figure 4–64 shows a web page containing text from a Shakespearean sonnet. In this Coding Challenge you will augment the text of the poem with background colors and images and add a graphic border.

Figure 4–64

Coding Challenge 4-1 example page



Do the following:

1. Open the `code4-1_txt.html` and `code4-1_back_txt.css` files from the `html04 ► code1` folder. Enter **your name** and **the date** in each document and save the files as `code4-1.html` and `code4-1_back.css` respectively.
2. Go to the `code4-1.html` file in your editor. Within the head section insert a link element linking the page to the `code4-1_back.css` style sheet file.
3. Enclose the content of the sonnet within a `figure` element. At the top of the `figure` element insert a figure caption containing the HTML code `Sonnet 116 <cite>by William Shakespeare</cite>`.
4. Save your changes to the file and return to the `code4-1_back.css` file in your editor.
5. Create a style rule for the `figure` element that:
  - a. Sets the padding space to 20 pixels.
  - b. Adds a 20-pixel border in the ridge style with the color value `rgb(52, 52, 180)`.
  - c. Has a background consisting of the image file `ws.png` placed in the bottom right corner of the figure box and set to 45% of the width of the figure box with no tiling. Be sure to separate the

- position of the image and its size with the / character. Add a second background containing the color `rgba(52, 52, 180, 0.3)`. Enter both background properties within a single style rule separated by a comma.
- d. Has a black box shadow that is 5 pixels to the right, 10 pixels down with a blur size of 15 pixels.
  6. Create a style rule for the figure caption that:
    - a. Sets the font size to 1.8em.
    - b. Centers the text of the caption.
    - c. Adds a 2-pixel bottom solid bottom border of the color value `rgb(52, 52, 180)`.
  7. Save your changes to the style sheet.
  8. Open the page in your browser and verify that the design resembles that shown in Figure 4–64.
  9. Submit the completed file to your instructor.

## CODE

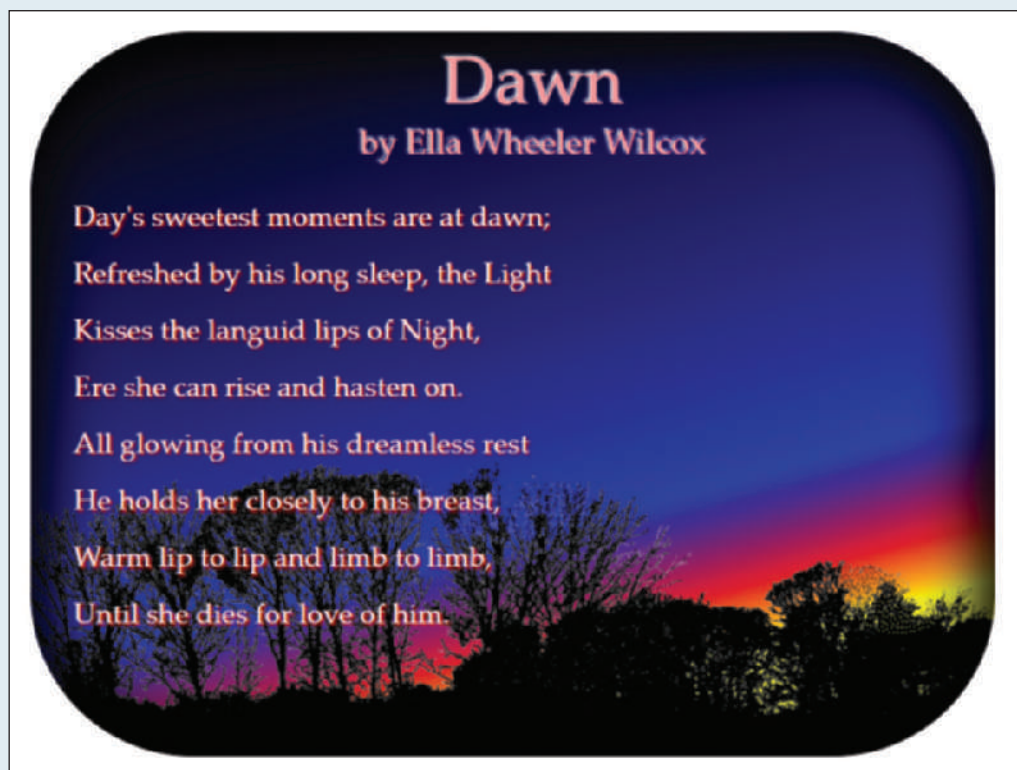
## Coding Challenge 2

Data Files needed for this Coding Challenge: `code4-2_txt.html`, `code4-2_grad_txt.css`, `code4-2.css`, `landscape.png`

Figure 4–65 shows a web page containing text of a poem by Ella Wheeler Wilcox entitled “Dawn.” To augment the poem, a background image containing a linear gradient has been added to the web page. In addition, text shadows have been added to bring the text of the poem out of the page.

Figure 4–65

Coding Challenge 4-2 example page



OpenClipArt

Complete the following:

1. Open the **code4-2\_txt.html** and **code4-2\_grad\_txt.css** files from the html04 ► code2 folder. Enter **your name** and **the date** in each document and save the files as **code4-2.html** and **code4-2\_grads.css** respectively.
2. Go to the **code4-2.html** file in your editor. Within the head section insert a `link` element linking the page to the **code4-2\_grad.css** file. Save your changes to the file.
3. Go to the **code4-2\_grad.css** file. Create a style rule for `h1` and `h2` elements that adds a white text shadow 2 pixels above and to the left of the text with a blur radius of 3 pixels.
4. Create a style rule for paragraphs that adds a red text shadow 2 pixels down and to the right of the text with a blur radius of 3 pixels.
5. Create a style rule for the `article` element that adds a black inset box shadow with a horizontal and vertical offset of 0 pixels, a blur radius of 50 pixels and a size of 20 pixels.
6. Create a style rule for the `article` element that sets the radius of the border corners to 150 pixels.
7. Create a style rule for the `article` element that adds the following multiple backgrounds:
  - a. A background containing the image file **landscape.png** placed with no tiling at the bottom right corner of the element with a size of 100%.
  - b. A linear gradient at an angle of 165 degrees that goes from black to the color value `rgb(0, 0, 200)` with a color stop of 65%, to `rgb(211, 0, 55)` with a color stop of 75%, to orange with a color stop of 80%, and finally to yellow with a color stop of 82%.
8. Save your changes to the style sheet.
9. Open the page in your browser and verify that the design resembles that shown in Figure 4–65.
10. Submit the completed file to your instructor.

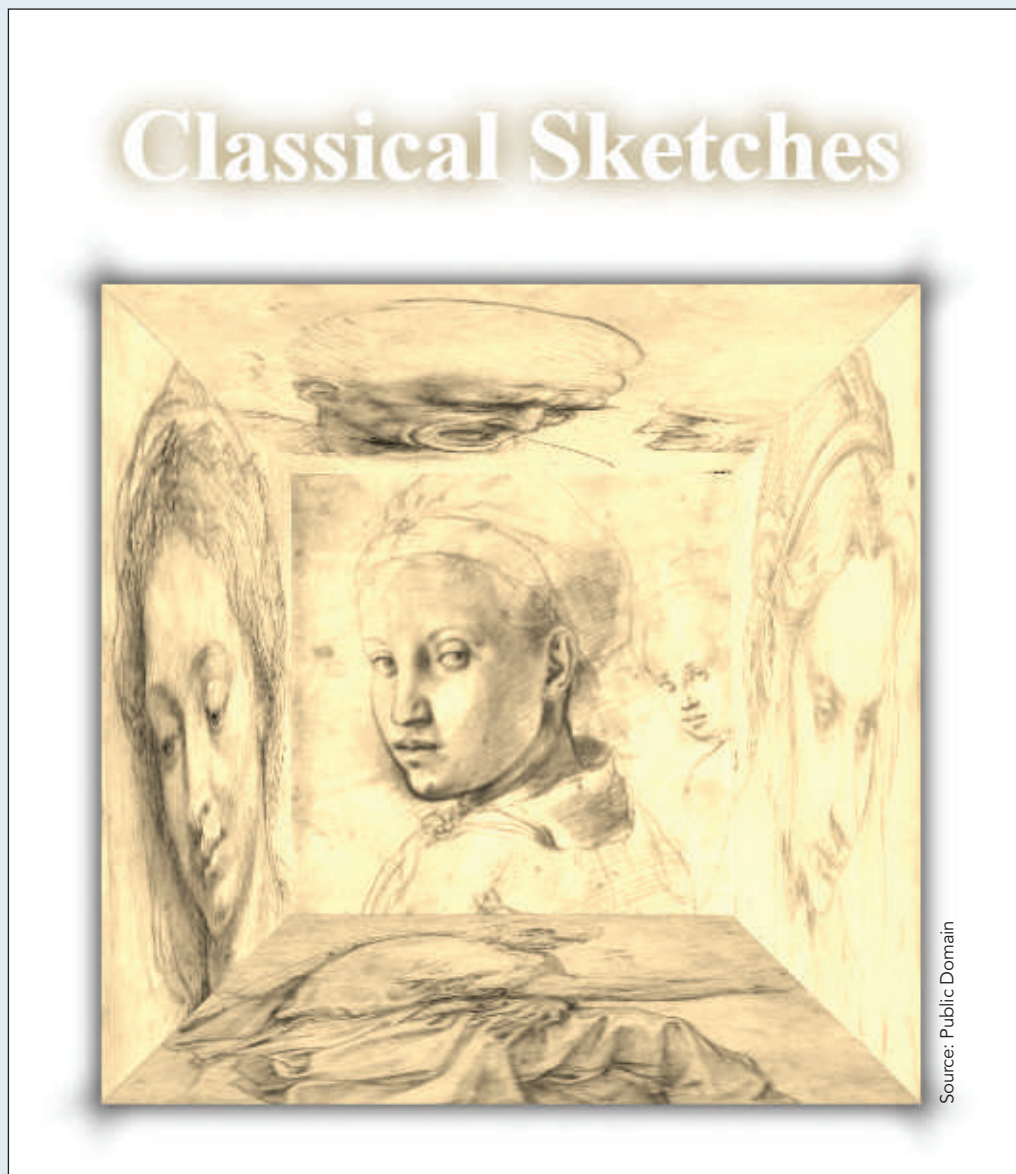
### Coding Challenge 3

Data Files needed for this Coding Challenge: **code4-3\_txt.html**, **code4-3\_cube\_txt.css**, **code4-3.css**, **image01.png** - **image05.png**

Figure 4–66 shows a web page in which five faces of the cube are displayed in a 3D view. You can create this effect using the CSS 3D transformation styles. The page also contains CSS styles for box shadows and text shadows that you will have to add.

Figure 4–66

Coding Challenge 4-3 example page



Complete the following to create the web page:

1. Open the **code4-3\_txt.html** and **code4-3\_cube\_txt.css** files from the `html04 ► code3` folder. Enter **your name** and **the date** in each document and save the files as **code4-3.html** and **code4-3\_cube.css** respectively.
2. Go to the **code4-3.html** file in your editor. Within the head section insert a `link` element that links the page to the `code4-3_cube.css` style sheet file. Note that within the web page the five images are contained with a `div` element with the ID value "cube". The images are given ID values of `img1` through `img5`. Save your changes to the file.
3. Go to the **code4-3\_cube.css** file in your editor. Create a style rule for the `h1` element that changes the font color to white and adds a text shadow with horizontal and vertical offsets of 0 pixels, a blur radius of 20 pixels and a shadow color value of `rgb(120, 85, 0)`.
4. Create a style rule for a `div` element with the id "cube" that sets the perspective size of the 3D space to 500 pixels. Use the `transform-style` property to preserve the 3D setting for the children of this element so that the cube and its children exist in the same 3D space.

5. For all `img` elements create a style rule that applies a sepia filter with a value of 1. Add a black box shadow with horizontal and vertical offsets of 0 pixels and a blur radius of 20 pixels.
6. Create the following style rules for the five image elements:
  - a. For the `img1` image, translate the image -150 pixels along the z-axis.
  - b. For the `img2` image, rotate the image 90 degrees around the x-axis and translate the image -150 pixels along the z-axis.
  - c. For the `img3` image, rotate the image -90 degrees around the y-axis and translate the image 150 pixels along the z-axis.
  - d. For the `img4` image, rotate the image 90 degrees around the y-axis and translate the image 150 pixels along the z-axis.
  - e. For the `img5` image, rotate the image -90 degrees around the x-axis and translate the image -150 pixels along the z-axis.
7. Save your changes to the style sheet.
8. Open the page in your browser and verify that the design resembles that shown in Figure 4–66.
9. Submit the completed file to your instructor.

## Coding Challenge 4

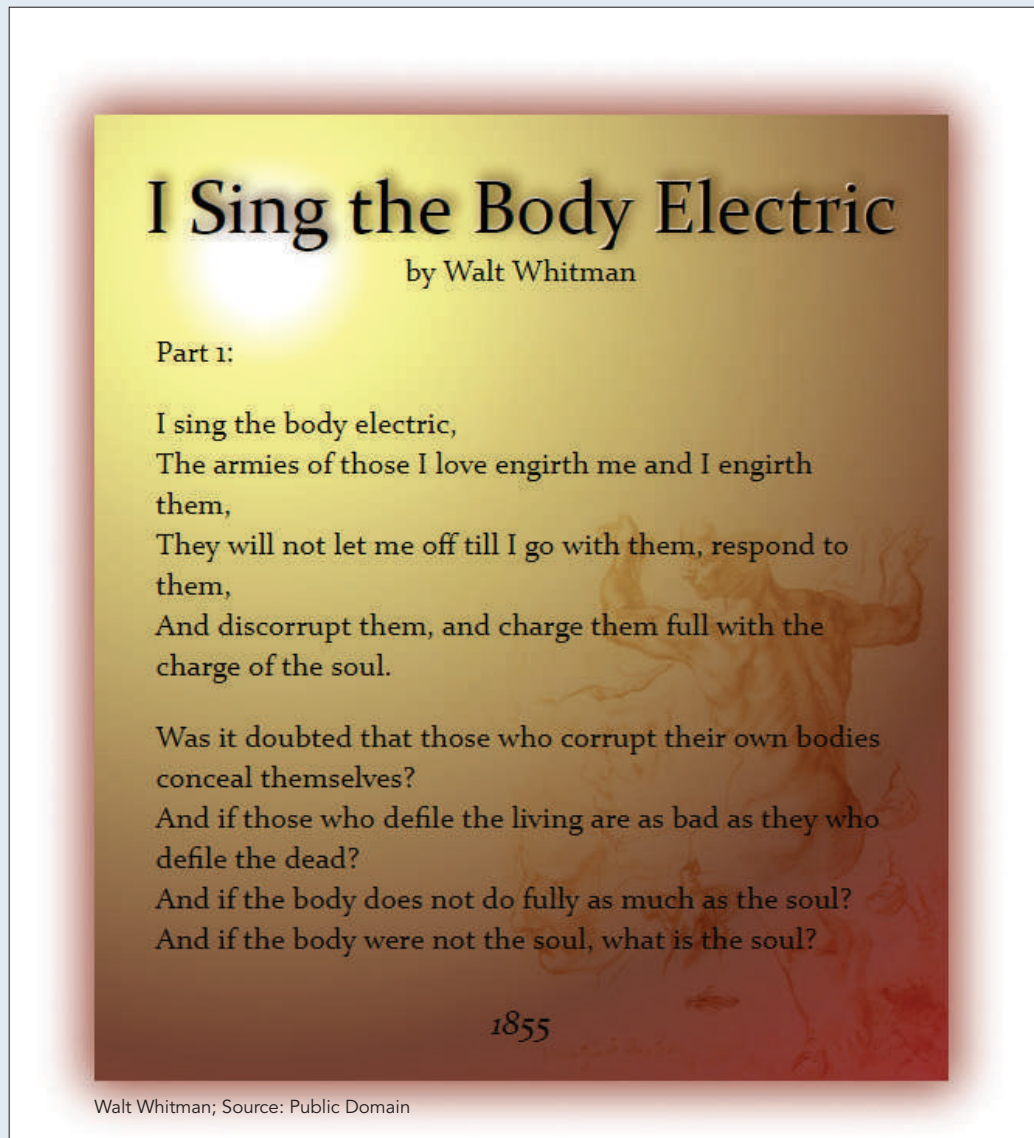
**Data Files needed for this Coding Challenge:** `code4-4_txt.html`, `debug4-4_txt.css`, `code4-4_.css`, `Michelangelo.png`

Figure 4–67 shows a completed web page that uses CSS design elements to enhance the appearance of a poem by Walt Whitman. You’ve been given a copy of the files for this web page, but there are several syntax errors in the CSS stylesheet. Use your knowledge of CSS to fix the stylesheet code and complete the page.

DEBUG

Figure 4–67

Coding Challenge 4-4 example page



Do the following:

1. Open the **code4-4\_txt.html** and **debug4-4\_txt.css** files from the html04 ► code4 folder. Enter **your name** and **the date** in each document and save the files as **code4-4.html** and **debug4-4.css** respectively.
2. Go to the **code4-4.html** file in your editor. Within the head section insert a `link` element that links the page to the `code4-4_debug.css` style sheet file. Study the contents of the file and then save your changes.
3. Go to the **debug4-4.css** file in your browser. The first style rule adds two text shadows to the `h1` heading: a dark brown shadow and a white highlight. The shadows are not appearing in the web page. Locate and fix the syntax error in this style rule.
4. The next style rule was written to add a box shadow to the `article` element that has an offset of 0 pixels in the horizontal and vertical directions, blur radius of 30 pixels and size value of 5 pixels. Fix the syntax errors in this style rule.
5. The next style rule creates a border image for the `article` element using a linear gradient for the image. Fix the syntax error in this style rule.
6. The final style rule defines the background for the `article` element consisting of:
  - a. A radial gradient going from white circle located near the top left corner of the background, to semi-transparent yellow, semi-transparent brown, and semi-transparent ochre,

- b. A sketch by Michelangelo located in the lower right corner sized at 75% of the width of the element, and
  - c. An ivory-colored background fill. There are several syntax errors in the code. Locate and fix all of the errors.
7. Save your changes and open the **code4-4.html** file in your browser. Verify that design of the page resembles that shown in Figure 4–67.
  8. Submit the completed file to your instructor.

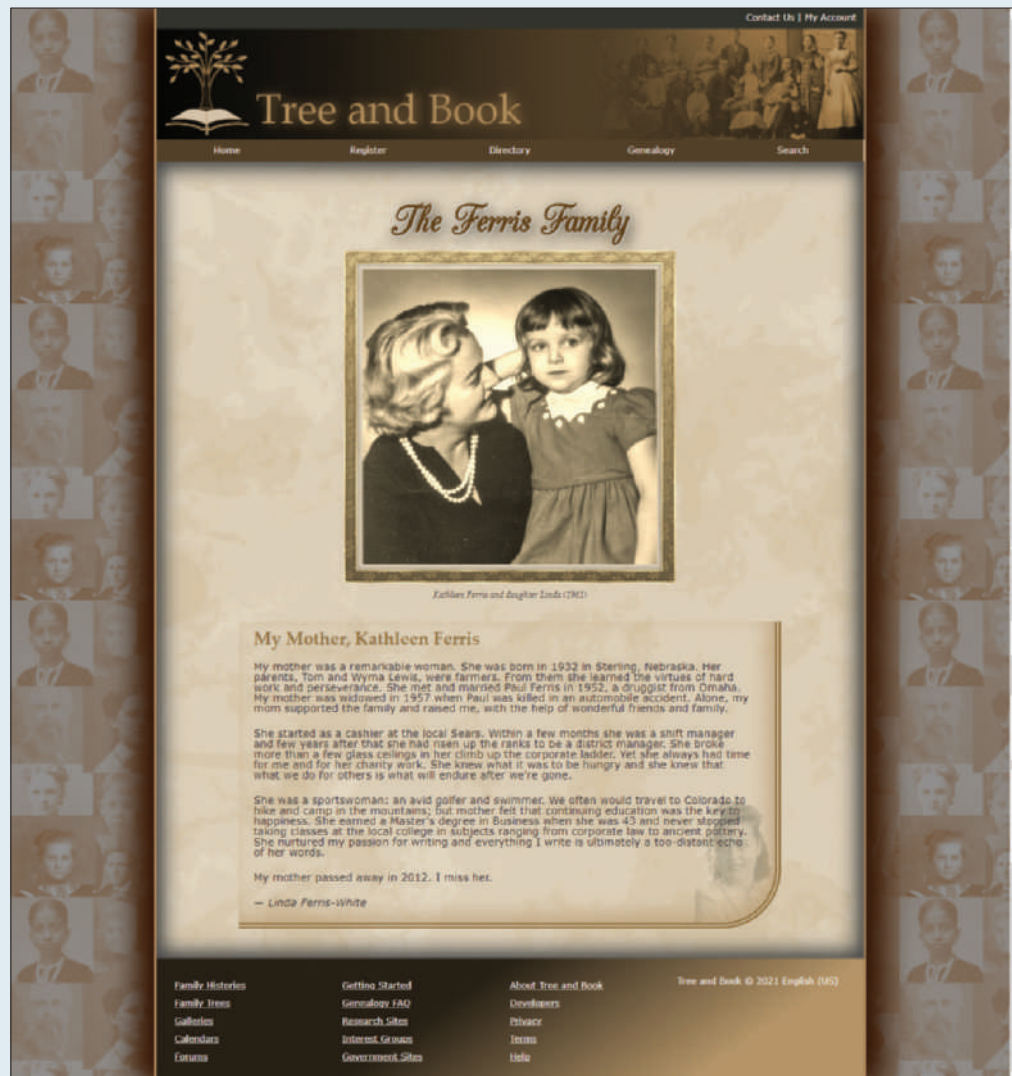
## Review Assignments

**Data Files needed for the Review Assignments:** `tb_ferris_txt.html`, `tb_kathleen_txt.html`, `tb_visual3_txt.css`, `tb_visual4_txt.css`, 3 CSS files, 1 HTML file, 10 PNG files, 1 TTF file, 1 WOFF file

Kevin wants you to work on another family page for the Tree and Book website. The page was created for the Ferris family with content provided by Linda Ferris-White. Kevin is examining a new color scheme and design style for the page. A preview of the design you'll create is shown in Figure 4–68.

Figure 4–68

Ferris Family page



Source: Design Studio Pro; Source: Wikimedia Commons;  
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All of the HTML content and the typographical and layout styles have already been created for you. Your task will be to complete the work by writing the visual style sheet to incorporate Kevin's suggestions.

Complete the following:

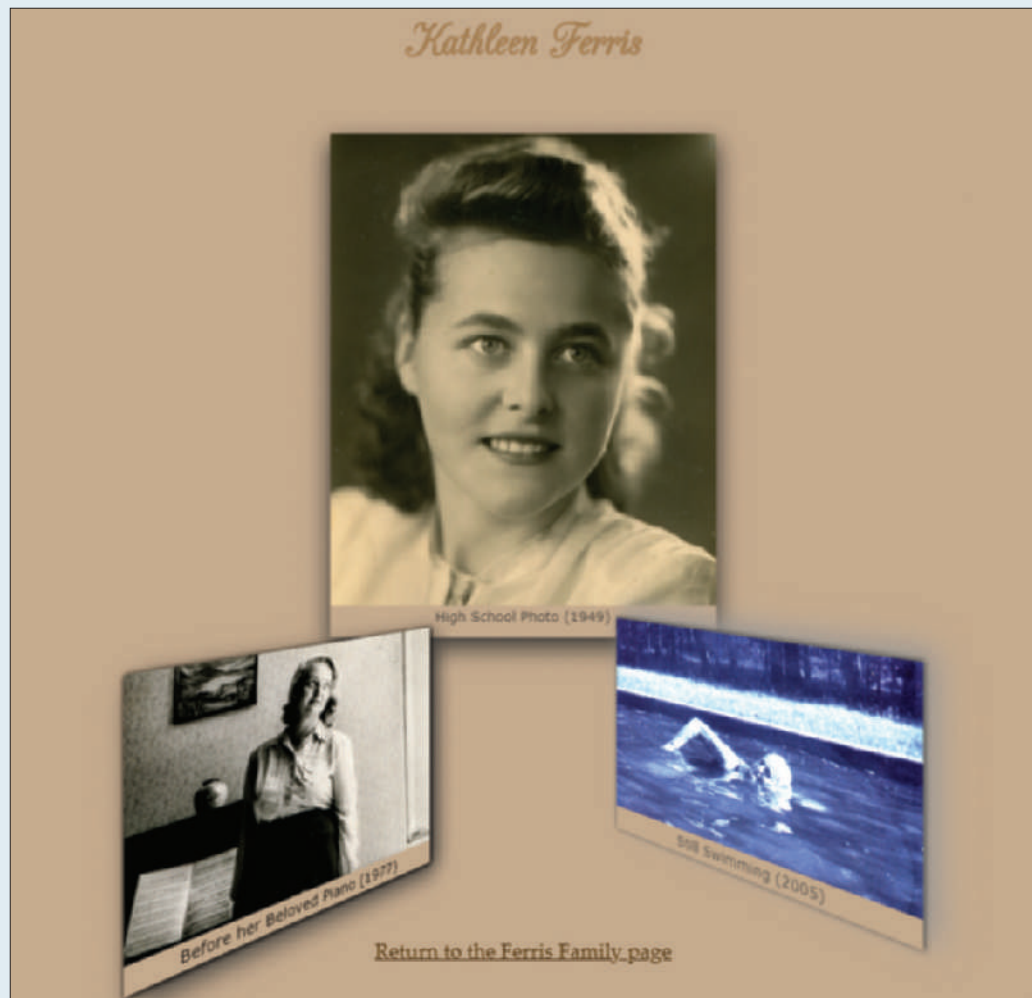
1. Use your HTML editor to open the **tb\_visual3\_txt.css**, **tb\_visual4\_txt.css**, **tb\_ferris\_txt.html** and **tb\_kathleen\_txt.html** files from the html04 ► review folder. Enter *your name* and *the date* in the comment section of each file, and save them as **tb\_visual3.css**, **tb\_visual4.css**, **tb\_ferris.html**, and **tb\_kathleen.html** respectively.
2. Go to the **tb\_ferris.html** file in your editor. Add links to the **tb\_base.css**, **tb\_styles3.css**, and **tb\_visual3.css** style sheets in the order listed.
3. Scroll down and, within the `main` element header and after the `h1` heading, insert a figure box containing: a) the **tb\_ferris.png** inline image with the alternate text *Ferris Family* using the image map named *portrait\_map* and b) a figure caption with the text *Kathleen Ferris and daughter Linda (1961)*.
4. Directly below the figure box, create the *portrait\_map* image map containing the following hotspots: a) a rectangular hotspot pointing to the **tb\_kathleen.html** file with the left-top coordinate (10, 50) and the right-bottom coordinate (192, 223) and alternate text, "Kathleen Ferris" and b) a circular hotspot pointing to the **tb\_linda.html** file with a center point at (264, 108) and a radius of 80 pixels and the alternate text, *Linda Ferris-White*.
5. Take some time to study the rest of the page content and structure and then save your changes to the file.
6. Go to the **tb\_visual3.css** file in your editor. In this file, you'll create the graphic design styles for the page.
7. Go to the HTML Styles section and create a style rule for the `html` element to use the image file **tb\_back5.png** as the background.
8. Go to the Page Body Styles section and create a style rule for the `body` element that: a) adds a left and right 3-pixel solid border with color value `rgb(169, 130, 88)`, b) adds a box shadow to the right border with a horizontal offset of 25 pixels, a vertical offset of 0 pixels and a 35-pixel blur and a color value of `rgb(53, 21, 0)`, and then adds the mirror images of this shadow to the left border.
9. Go to the Main Styles section. Create a style rule for the `main` element that: a) applies the **tb\_back7.png** file as a background image with a size of 100% covering the entire background with no tiling and positioned with respect to the padding box and b) adds two inset box shadows, each with a 25-pixel blur and a color value of `rgb(71, 71, 71)`, and then one with offsets of -10 pixels in the horizontal and vertical direction and the other with horizontal and vertical offsets of 10 pixels.
10. Create a style rule for the `h1` heading within the main header that adds the following two text shadows: a) a shadow with the color value `rgb(221, 221, 221)` and offsets of 1 pixels and no blurring and b) a shadow with the color value `rgba(41, 41, 41, 0.9)` and offsets of 5 pixels and a 20-pixel blur.
11. Go to the Figure Box Styles section. Create a style rule for the `figure` element that sets the top/bottom margin to 10 pixels and the left/right margin to `auto`. Set the width of the element to 70%.
12. Next, you'll modify the appearance of the figure box image. Create a style rule for the image within the figure box that: a) sets the border width to 25 pixels, b) sets the border style to solid, c) applies the **tb\_frame.png** file as a border image with a slice size of 60 pixels stretched across the sides, d) displays the image as a block with a width of 100%, and e) applies a sepia tone to the image with a value of 80% (include the WebKit browser extension in your style sheet).
13. Create a style rule for the figure caption that: a) displays the text using the font stack 'Palatino Linotype', Palatino, 'Times New Roman', serif, b) sets the style to italic, c) sets the top/bottom padding to 10 pixels and the left/right padding to 0 pixels, and d) centers the text.
14. Go to the Article Styles section. Here you'll create borders and backgrounds for the article that Linda Ferris-White wrote about her mother. Create a style rule for the `article` element that: a) displays the background image file **tb\_back6.png** placed at the bottom-right corner of the element with a size of 15% and no tiling, b) adds an 8-pixel double border with color value `rgb(147, 116, 68)` to the right and bottom sides of the `article` element, c) creates a curved bottom-right corner with a

radius of 80 pixels, and d) adds an interior shadow with horizontal and vertical offsets of –10 pixels, a 25-pixel blur, and a color value of `rgba(184, 154, 112, 0.7)`.

15. Kevin wants a gradient background for the page footer. Go to the Footer Styles section and create a style rule for the footer that adds a linear gradient background with an angle of 325°, going from the color value `rgb(180, 148, 104)` with a color stop at 20% of the gradient length to the value `rgb(40, 33, 23)` with a color stop at 60%.
16. Save your changes to the style sheet and then open **tb\_ferris.html** in your browser. Verify that the colors and designs resemble that shown in Figure 4–68.

Next, you will create the design styles for individual pages about Kathleen Ferris and Linda Ferris-White. A preview of the content of the Kathleen Ferris page is shown in Figure 4–69.

**Figure 4–69** Kathleen Ferris page



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17. Go to the **tb\_kathleen.html** file in your editor and create links to the `tb_base.css`, `tb_styles4.css`, and `tb_visual4.css` files. Study the contents of the file and then close it, saving your changes.
18. Go to the **tb\_visual4.css** file in your editor. Scroll down to the Transformation Styles section and add a style rule for the `article` element to set the size of the perspective space to 800 pixels.
19. Create a style rule for the `figure1` figure box to translate it –120 pixels along the z-axis.
20. Create a style rule for the `figure2` figure box to translate it –20 pixels along the y-axis and rotate it 50° around the y-axis.
21. Create a style rule for the `figure3` figure box to translate it –30 pixels along the y-axis and rotate it –50° around the y-axis.

22. Go to the Filter Styles section to apply CSS filters to the page elements. Create a style rule for the figure1 figure box that applies a saturation filter with a value of 1.3.
23. Create a style rule for the figure2 figure box that sets the brightness to 0.8 and the contrast to 1.5.
24. Create a style rule for the figure3 figure box that sets the hue rotation to 170°, the saturation to 3, and the brightness to 1.5.
25. Save your changes to the file and then return to the **tb\_ferris.html** file in your browser. Verify that you can display the individual pages for Kathleen Ferris and Linda Ferris-White by clicking on their faces in the family portrait. Further verify that the appearance of the Kathleen Ferris page resembles that shown in Figure 4–69. (Note: Use the link under the pictures to return to the home page.)

## Case Problem 1

**Data Files needed for this Case Problem:** sf\_torte\_txt.html, sf\_effects\_txt.css, 2 CSS files, 9 PNG files

**Save your Fork** Amy Wu has asked for your help in redesigning her website, *Save your Fork*, a baking site for people who want to share dessert recipes and learn about baking in general. She has prepared a page containing a sample dessert recipe and links to other pages on the website. A preview of the page you'll create is shown in Figure 4–70.

Figure 4–70 Save your Fork sample recipe page



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Amy has already created a style sheet for the page layout and typography, so your work will be focused on enhancing the page with graphic design styles.

Complete the following:

1. Using your editor, open the **sf\_torte.txt.html** and **sf\_effects.txt.css** files from the html04 ► case1 folder. Enter **your name** and **the date** in the comment section of each file, and save them as **sf\_torte.html** and **sf\_effects.css** respectively.
2. Go to the **sf\_torte.html** file in your editor. Within the document head create links to the **sf\_base.css**, **sf\_layout.css**, and **sf\_effects.css** style sheet files in that order. Take some time to study the structure of the document and then close the document, saving your changes.
3. Go to the **sf\_effects.css** file in your editor. Within the Body Header Styles section, create a style rule for the **body** element to add drop shadows to the left and right border of the page body with an offset of 10 pixels, a blur of 50 pixels, and the color **rgb(51, 51, 51)**. Note that the right border is a mirror image of the left border.
4. Go to the Navigation Tabs List Styles section. Amy has created a navigation list with the class name **tabs** that appears at the top of the page with the body header. Create a style rule for the **body > header nav.tabs** selector that changes the background to the image file **sf\_back1.png** with no tiling, centered horizontally and vertically within the element and sized to cover the entire navigation list.
5. Amy wants the individual list items in the tabs navigation list to appear as tabs in a recipe box. She wants each of these “tabs” to be trapezoidal in shape. To create this effect, you’ll create a style rule for the **body > header nav.tabs li** selector that transforms the list item by setting the perspective of its 3D space to 50 pixels and rotating it 20° around the x-axis.
6. As users hover the mouse pointer over the navigation tabs, Amy wants a rollover effect in which the tabs appear to come to the front. Create a style rule for the **body > header nav.tabs li** selector that uses the pseudo-element **hover** that changes the background color to **rgb(231, 231, 231)**.
7. Go to the Left Section Styles section. Referring to Figure 4–70, notice that in the left section of the page, Amy has placed two vertical navigation lists. She wants these navigation lists to have rounded borders. For the vertical navigation lists in the left section, create a style rule for the **section#left nav.vertical** selector that adds a 1-pixel solid border with color value **rgb(20, 167, 170)** and has a radius of 25 pixels at each corner.
8. The rounded corner also has to apply to the **h1** heading within each navigation list. Create a style rule for **h1** elements nested within the left section vertical navigation list that sets the top-left and top-right corner radii to 25 pixels.
9. Go to the Center Article Styles section. The **article** element contains an image and brief description of the Apple Bavarian Torte, which is the subject of this sample page. Create a style rule for the **section#center article** selector that adds the following: a) a radial gradient to the background with a white center with a color stop of 30% transitioning to **rgb(151, 151, 151)**, b) a 1-pixel solid border with color value **rgb(151, 151, 151)** and a radius of 50 pixels, and c) a box shadow with horizontal and vertical offsets of 10 pixels with a 20-pixel blur and a color of **rgb(51, 51, 51)**.
10. Go to the Blockquote Styles section. Amy has included three sample reviews from users of the Save your Fork website. Amy wants the text of these reviews to appear within the image of a speech bubble. For every **blockquote** element, create a style rule that does the following: a) sets the background image to the **sf\_speech.png** file with no tiling and a horizontal and vertical size of 100% to cover the entire block quote, and b) uses the **drop-shadow** filter to add a drop shadow around the speech bubble with horizontal and vertical offsets of 5 pixels, a blur of 10 pixels and the color **rgb(51, 51, 51)**.
11. Amy has included the photo of each reviewer registered on the site within the citation for each review. She wants these images to appear as circles rather than squares. To do this, create a style rule for the selector **cite img** that sets the border radius to 50%.
12. Save your changes to the style sheet file and then open **sf\_torte.html** in your browser. Verify that the design of your page matches that shown in Figure 4–70. Confirm that when you hover the mouse over the navigation tabs the background color changes to match the page color.

## Case Problem 2

Data Files needed for this Case Problem: `cf_home_txt.html`, `cf_effects_txt.css`, 2 CSS files, 7 PNG files

**Chupacabra Music Festival** Debra Kelly is the director of the website for the *Chupacabra Music Festival*, which takes place every summer in San Antonio, Texas. Work is already underway on the website design for the 15<sup>th</sup> annual festival and Debra has approached you to work on the design of the home page.

Debra envisions a page that uses semi-transparent colors and 3D transformations to make an attractive and eye-catching page. A preview of her completed design proposal is shown in Figure 4–71.

Figure 4–71 Chupacabra 15 home page





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Debra has provided you with the HTML code and the layout and reset style sheets. Your job will be to finish her work by inserting the graphic design styles.

Complete the following:

1. Using your editor, open the `cf_home_txt.html` and `cf_effects_txt.css` files from the `html04 ► case2` folder. Enter **your name** and **the date** in the comment section of each file, and save them as `cf_home.html` and `cf_effects.css` respectively.
2. Go to the `cf_home.html` file in your HTML editor. Within the document head, create a link to the `cf_reset.css`, `cf_layout.css`, and `cf_effects.css` style sheets. Take some time to study the content and structure of the document. Pay special note to the nested `div` elements in the center section of the page; you will use these to create a 3D cube design. Close the file, saving your changes.
3. Return to the `cf_effects.css` file in your editor and go to the HTML Styles section. Debra wants a background displaying a scene from last year's festival. Add a style rule for the `html` element that displays the `cf_back1.png` as a fixed background, centered horizontally and vertically in the browser window and covering the entire window.

4. Go to the Body Styles section and set the background color of the page body to `rgba(255, 255, 255, 0.3)`.
5. Go to the Body Header Styles section and change the background color of the body header to `rgba(51, 51, 51, 0.5)`.
6. Debra has placed useful information for the festival in `aside` elements placed within the left and right `section` elements. Go to the Aside Styles section and create a style rule for the `section aside` selector that adds a 10-pixel double border with color `rgba(92, 42, 8, 0.3)` and a border radius of 30 pixels.
7. Debra wants a curved border for every `h1` heading within an `aside` element. For the selector `section aside h1`, create a style rule that sets the border radius of the top-left and top-right corners to 30 pixels.
8. Define the perspective of the 3D space for the left and right sections by creating a style rule for those two sections that sets their perspective value to 450 pixels.
9. Create a style rule that rotates the `aside` elements within the left section 25° around the *y*-axis. Create another style rule that rotates the `aside` elements within the right section -25° around the *y*-axis.
-  **Explore** 10. Go to the Cube Styles section. Here you'll create the receding cube effect that appears in the center of the page. The cube has been constructed by creating a `div` element with the id `cube` containing five `div` elements belonging to the `cube_face` class with the ids `cube_bottom`, `cube_top`, `cube_left`, `cube_right`, and `cube_front`. (There will be no back face for this cube.) Currently the five faces are superimposed upon each other. To create the cube you have to shift and rotate each face in 3D space so that they form the five faces of the cube. First, position the cube on the page by creating a style rule for the `div#cube` selector containing the following styles:
  - a. Place the element using relative positioning.
  - b. Set the top margin to 180 pixels, the bottom margin to 150 pixels, and the left/right margins to `auto`.
  - c. Set the width and height to 400 pixels.
  - d. Set the perspective of the space to 450 pixels.
11. For each `div` element of the `cube_face` class, create a style rule that places the faces with absolute positioning and sets their width and height to 400 pixels.
-  **Explore** 12. Finally, you'll construct the cube by positioning each of the five faces in 3D space so that they form the shape of a cube. Add the following style rules for each of the five faces to transform their appearance.
  - a. Translate the `cube_front` `div` element -50 pixels along the *z*-axis.
  - b. Translate the `cube_left` `div` element -200 pixels along the *x*-axis and rotate it 90° around the *y*-axis.
  - c. Translate the `cube_right` `div` element 200 pixels along the *x*-axis and rotate it 90° counter-clockwise around the *y*-axis.
  - d. Translate the `cube_top` `div` element -200 pixels along the *y*-axis and rotate it 90° counter-clockwise around the *x*-axis.
  - e. Translate the `cube_bottom` `div` element 200 pixels along the *y*-axis and rotate it 90° around the *x*-axis.
13. Save your changes to style sheet file and open `cf_home.html` in your browser. Verify that the layout of your page matches Figure 4-71 including the center cube with the five faces of photos and text.

## OBJECTIVES

## Session 5.1

- Create a media query
- Work with the browser viewport
- Apply a responsive design
- Create a pulldown menu with CSS

## Session 5.2

- Create a flexbox
- Work with flex sizes
- Explore flexbox layouts

## Session 5.3

- Create a print style sheet
- Work with page sizes
- Add and remove page breaks

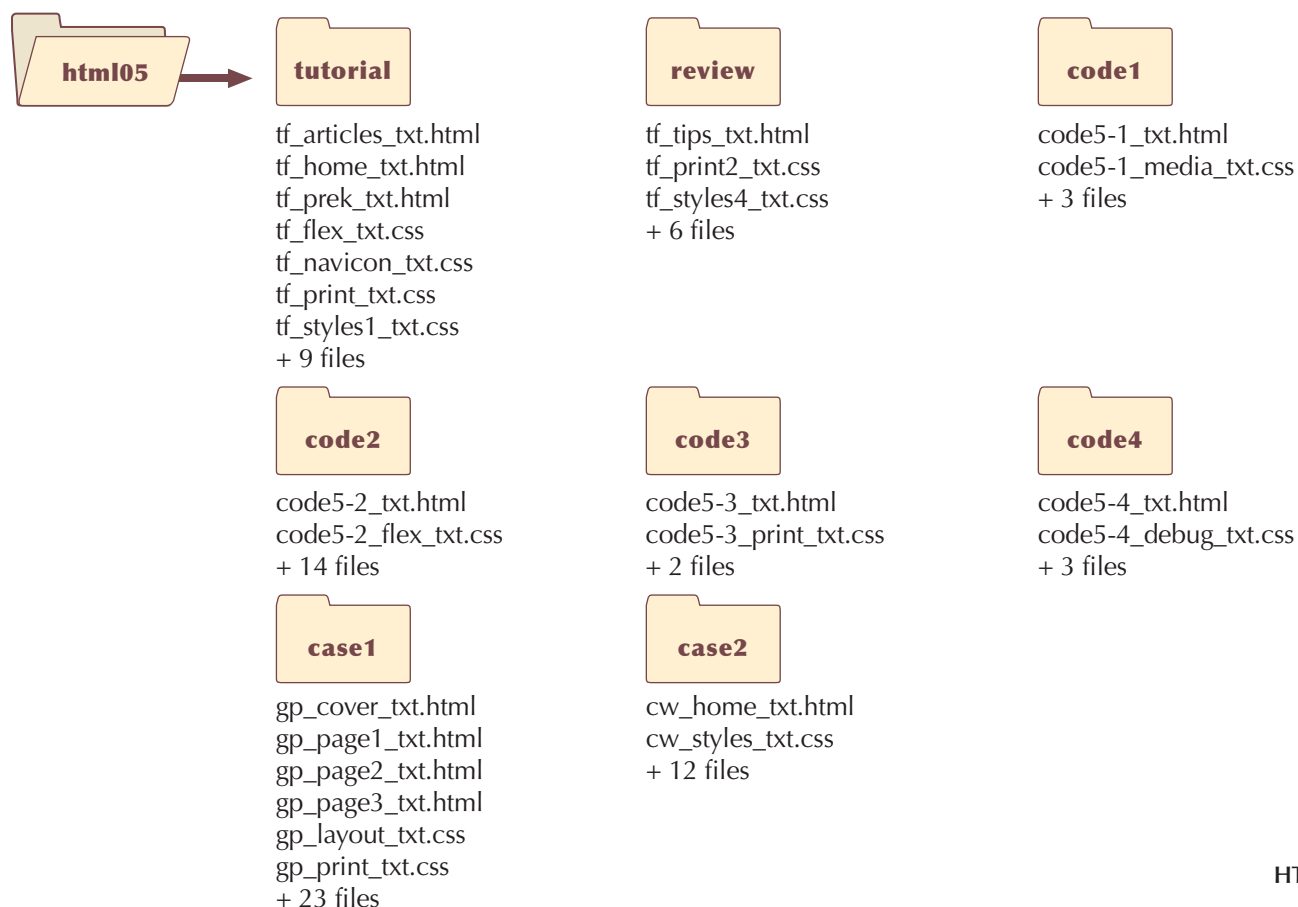
# Designing for the Mobile Web

## Creating a Mobile Website for a Daycare Center

### Case | *Trusted Friends Daycare*

Marjorie Kostas is the owner of *Trusted Friends Daycare*, an early childhood education and care center located in Carmel, Indiana. You've been hired to help work on the redesign of the company's website. Because many of her clients access the website from their mobile phones, Marjorie is interested in improving the site's appearance on mobile devices. However, your design still has to be compatible with tablet devices and desktop computers. Finally, the site contains several pages that her clients will want to print, so your design needs to meet the needs of printed media.

### STARTING DATA FILES



# Session 5.1 Visual Overview:

The **viewport meta** tag is used to set the properties of the layout viewport.

This sets the width of the layout viewport equal to the width of the visual viewport.

This sets the initial scale of the viewport to 1.0.

```
<meta name="viewport" content="width=device-width, initial-scale=1" />
```

Responsive designs should start with base styles that apply to all devices, followed by mobile styles, tablet styles, and then desktop styles.

A **media query** is used to apply specified style rules to a device based on the device type and the device features.

```
/* =====
Base Styles
=====
*/

style rules

/* =====
Mobile Styles: 0 to 480 pixels
=====
*/

@media only screen and (max-width: 480px) {

style rules

}

/* =====
Tablet Styles: 481px and greater
=====
*/

@media only screen and (min-width: 481px) {

style rules

}

/* =====
Desktop Styles: 769px and greater
=====
*/

@media only screen and (min-width: 769px) {

style rules

}
```

Within a media query are style rules that are only applied to devices that match the query.

This media query matches screens with a maximum width of 480 pixels.

This media query matches screens with a minimum width of 481 pixels.

This media query matches screens with a minimum width of 769 pixels.

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# Media Queries



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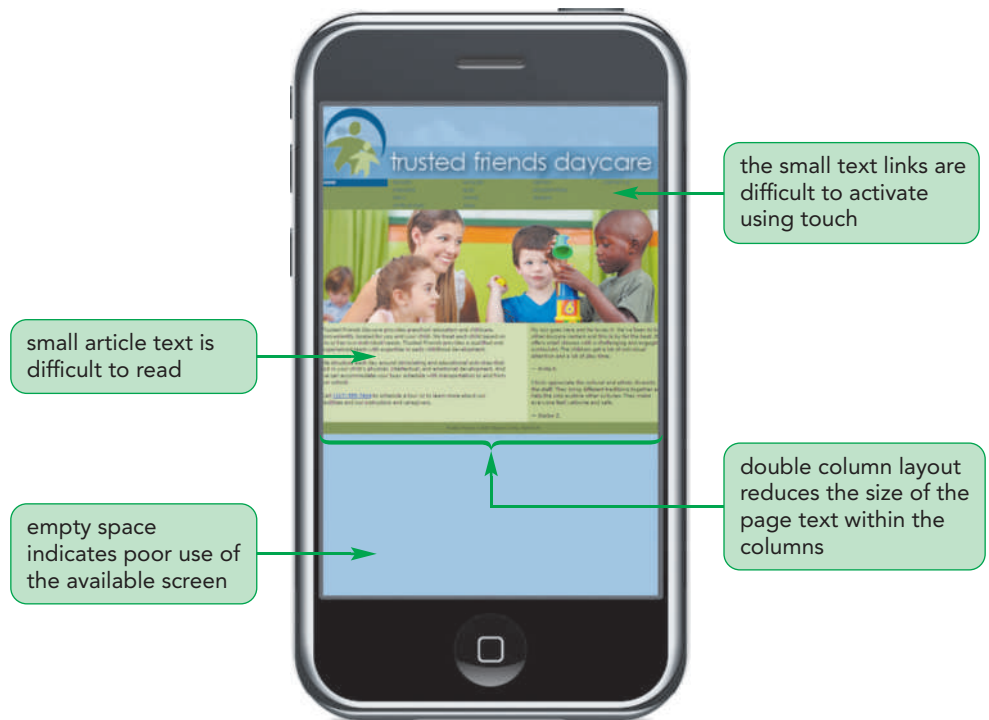
## Introducing Responsive Design

In the first four tutorials, you created a single set of layout and design styles for your websites without considering what type of device would be rendering the site. However, this is not always a practical approach and with many users increasingly accessing the web through mobile devices, a web designer must take into consideration the needs of those devices. Figure 5–1 presents some of the important ways in which designing for the mobile experience differs from designing for the desktop experience.

**Figure 5–1** Designing for mobile and desktop devices

User Experience	Mobile	Desktop
Page Content	Content should be short and to the point.	Content can be extensive, giving readers the opportunity to explore all facets of the topic.
Page Layout	Content should be laid out within a single column with no horizontal scrolling.	With a wider screen size, content can be more easily laid out in multiple columns.
Hypertext Links	Links need to be easily accessed via a touch interface.	Links can be activated more precisely using a cursor or mouse pointer.
Network Bandwidth	Sites tend to take longer to load over cellular networks and thus overall file size should be kept small.	Sites are quickly accessed over high-speed networks, which can more easily handle large file sizes.
Lighting	Pages need to be easily visible in outdoor lighting through the use of contrasting colors.	Pages are typically viewed in an office setting, allowing a broader color palette.
Device Tools	Mobile sites often need access to devices such as phone dialing, messaging, mapping, and built-in cameras and video.	Sites rarely have need to access desktop devices.

Viewing a web page on a mobile device is a fundamentally different experience than viewing the same web page on a desktop computer. As a result, these differences need to be taken into account when designing a website. Figure 5–2 shows the current home page of the Trusted Friends website as it appears on a mobile device.

**Figure 5–2** Trusted Friends home page displayed on a mobile device

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Notice that the mobile device has automatically zoomed out to display the complete page width resulting in text that is difficult to read and small hypertext links that are practically unusable with a touch interface. While the design might be fine for a desktop monitor in landscape orientation, it's clear that it is ill-suited to a mobile device.

### TIP

For more information on the development of responsive design, refer to *Responsive Web Design* by Ethan Marcotte (<http://alistapart.com/article/responsive-web-design>).

What this website requires is a design that is not only specifically tailored to the needs of her mobile users but also is easily revised for tablet and desktop devices. This can be accomplished with responsive design in which the design of the document changes in response to the device rendering the page. An important leader in the development of responsive design is Ethan Marcotte, who identified three primary components of responsive design theory:

- **flexible layout** so that the page layout automatically adjusts to screens of different widths
- **responsive images** that rescale based on the size of the viewing device
- **media queries** that determine the properties of the device rendering the page so that appropriate designs can be delivered to specific devices

In the preceding tutorials, you've seen how to create grid-based fluid layouts and you've used images that scaled based on the width of the browser window and web page. In this session, you'll learn how to work with media queries in order to create a truly responsive website design.

## Introducing Media Queries

Media queries are used to associate a style sheet or style rule with a specific device or list of device features. To create a media query within an HTML file, add the following `media` attribute to either the `link` or `style` element in the document head

```
media="devices"
```

where *devices* is a comma-separated list of supported media types associated with a specified style sheet. For example, the following `link` element accesses the `output.css` style sheet file but only when the device is a printer or projection device:

```
<link href="output.css" media="print, projection" />
```

If any other device accesses this web page, it will not load the `output.css` style sheet file. Figure 5–3 lists other possible media type values for the `media` attribute.

Figure 5–3

Media types

Media Type	Used For
all	All output devices (the default)
braille	Braille tactile feedback devices
embossed	Paged Braille printers
handheld	Mobile devices with small screens and limited bandwidth
print	Printers
projection	Projectors
screen	Computer screens
speech	Speech and sound synthesizers, and aural browsers
tty	Fixed-width devices such as teletype machines and terminals
tv	Television-type devices with low resolution, color, and limited scrollability

When no `media` attribute is used, the style sheet is assumed to apply to all devices accessing the web page.

## The @media Rule

Media queries can also be used to associate specific style rules with specific devices by including the following `@media` rule in a CSS style sheet file

```
@media devices {
 style rules
}
```

where *devices* are supported media types and *style rules* are the style rules associated with those devices. For example, the following style sheet is broken into three sections: an initial style rule that sets the font color of all `h1` headings regardless of device, a second section that sets the font size for `h1` headings on screen or television devices, and a third section that sets the font size for `h1` headings that are printed:

```
h1 {
 color: red;
}
@media screen, tv {
 h1 {font-size: 2em;}
}
@media print {
 h1 {font-size: 16pt;}
}
```

Note that in this style sheet, the font size for screen and television devices is expressed using the relative `em` unit but the font size for print devices is expressed using points, which is a more appropriate sizing unit for that medium.

Finally, you can specify media devices when importing one style sheet into another by adding the media type to the `@import` rule. Thus, the following CSS rule imports the `screen.css` file only when a screen or projection device is being used:

```
@import url("screen.css") screen, projection;
```

The initial hope was that media queries could target mobile devices using the `handheld` device type; however, as screen resolutions improved to the point where the cutoff between mobile, tablet, laptop, and desktop was no longer clear, media queries began to be based on what features a device supported and not on what the device was called.

## Media Queries and Device Features

To target a device based on its features, you add the feature and its value to the `media` attribute using the syntax:

```
media="devices and | or (feature:value)"
```

where *feature* is the name of a media feature and *value* is the feature's value. The `and` and `or` keywords are used to create media queries that involve different devices or different features, or combinations of both.

The `@media` and `@import` rules employ similar syntax:

```
@media devices and|or (feature:value) {
 style rules
}
```

and

```
@import url(url) devices and|or (feature:value);
```

For example, the following media query applies the style rules only for screen devices with a width of 320 pixels.

```
@media screen and (device-width: 320px) {
 style rules
}
```

Figure 5–4 provides a list of the device features supported by HTML and CSS.

Figure 5–4

Media features

Feature	Description
<code>aspect-ratio</code>	The ratio of the width of the display area to its height
<code>color</code>	The number of bits per color component of the output device; if the device does not support color, the value is 0
<code>color-index</code>	The number of colors supported by the output device
<code>device-aspect-ratio</code>	The ratio of the <code>device-width</code> value to the <code>device-height</code> value
<code>device-height</code>	The height of the rendering surface of the output device
<code>device-width</code>	The width of the rendering surface of the output device
<code>height</code>	The height of the display area of the output device
<code>monochrome</code>	The number of bits per pixel in the device's monochrome frame buffer
<code>orientation</code>	The general description of the aspect ratio: equal to <code>portrait</code> when the height of the display area is greater than the width; equal to <code>landscape</code> otherwise
<code>resolution</code>	The resolution of the output device in pixels, expressed in either <code>dpi</code> (dots per inch) or <code>dpcm</code> (dots per centimeter)
<code>width</code>	The width of the display area of the output device

All of the media features in Figure 5–4, with the exception of *orientation*, also accept *min-* and *max-* prefixes, where *min-* provides a minimum value for the specified feature, and *max-* provides the feature's maximum value. Thus, the following media query applies style rules only for screen devices whose width is at most 700 pixels:

```
@media screen and (max-width: 700px) {
 style rules
}
```

Similarly, the following media query applies style rules only to screens that are at least 400 pixels wide:

```
@media screen and (min-width: 400px) {
 style rules
}
```

You can combine multiple media features using logical operators such as *and*, *not*, and *or*. The following query applies the enclosed styles to all media types but only when the width of the output devices is between 320 and 480 pixels (inclusive):

```
@media all and (min-width: 320px) and (max-width: 480px) {
 style rules
}
```

Some media features are directed toward devices that do not have a particular property or characteristic. This is done by applying the *not* operator, which negates any features found in the expression. For example, the following query applies only to media devices that are not screen or do not have a maximum width of 480 pixels:

```
@media not screen and (max-width: 480px) {
 style rules
}
```

### TIP

If you specify a feature without specifying a device, the media query will apply to all devices.

For some features, you do not have to specify a value but merely indicate the existence of the feature. The following query matches any screen device that also supports color:

```
@media screen and (color) {
 style rules
}
```

Finally, for older browsers that do not support media queries, CSS provides the *only* keyword to hide style sheets from those browsers. In the following code, older browsers will interpret *only* as an unsupported device name and so will not apply the enclosed style rules, while newer browsers will recognize the keyword and continue to apply the style rules.

```
@media only screen and (color) {
 style rules
}
```

All current browsers support media queries, but you will still see the *only* keyword used in many website style sheets.

### Creating a Media Query

- To create a media query that matches a device in a link or style element within an HTML file, use the following media attribute

```
media="devices and|or (feature:value) "
```

where *devices* is a comma-separated list of media types, *feature* is the name of a media feature, and *value* is the feature's value

- To create a media query, create the following @media rule within a CSS style sheet

```
@media devices and|or (feature:value) {
 style rules
}
```

where *style rules* are the style rules applied for the specified device and feature.

- To import a style sheet based on a media query, apply the following @import rule within a CSS style sheet

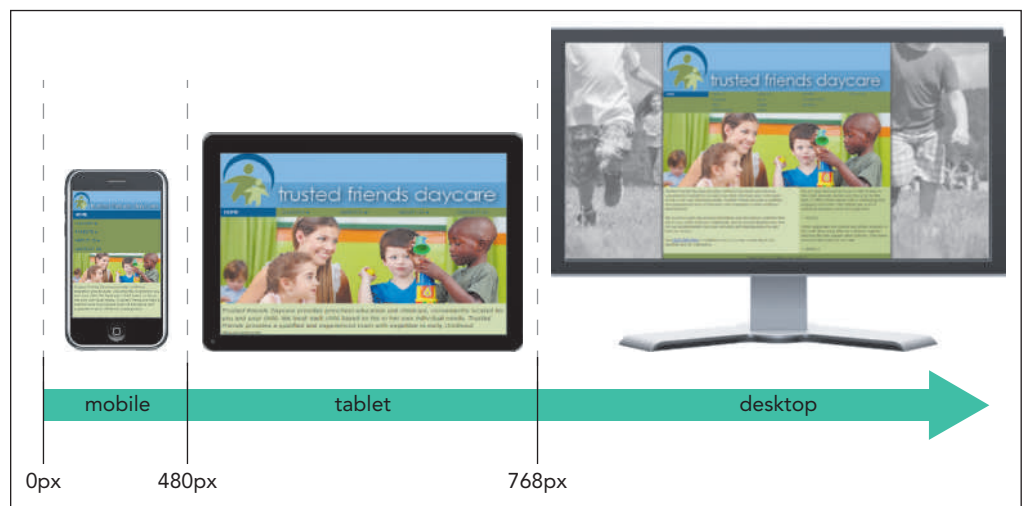
```
@import url(url) devices and|or (feature:value);
```

## Applying Media Queries to a Style Sheet

You meet with Marjorie to discuss her plans for the home page redesign. She envisions three designs: one for mobile devices, a different design for tablets, and finally a design for desktop devices based on the current appearance of the site's home page (see Figure 5–5).

Figure 5–5

Trusted Friends home page for different screen widths



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The mobile design will be used for screen widths up to 480 pixels, the tablet design will be used for widths ranging from 481 pixels to 768 pixels, and the desktop design will be used for screen widths exceeding 768 pixels. To apply this approach, you'll create a style sheet having the following structure:

```
/* Base Styles */
style rules

/* Mobile Styles */
@media only screen and (max-width: 480px) {
 style rules
}

/* Tablet Styles */
@media only screen and (min-width: 481px) {
 style rules
}

/* Desktop Styles */
@media only screen and (min-width: 769px) {
 style rules
}
```

Note that this style sheet applies the principle **mobile first** in which the overall page design starts with base styles that apply to all devices followed by style rules specific to mobile devices. Tablet styles are applied when the screen width is 481 pixels or greater, and desktop styles build upon the tablet styles when the screen width exceeds 768 pixels. Thus, as your screen width increases, you add on more features or replace features found in smaller devices. In general, with responsive design, it is easier to add new styles through progressive enhancement than to replace styles.

Marjorie has supplied you with the HTML code and initial styles for her website's home page. Open her HTML file now.

### To open the site's home page:

1. Use your editor to open the **tf\_home\_txt.html** and **tf\_styles1\_txt.css** files from the html05 ► tutorial folder. Enter **your name** and **the date** in the comment section of each file and save them as **tf\_home.html** and **tf\_styles1.css** respectively.
2. Return to the **tf\_home.html** file in your editor and, within the document head, create links to the **tf\_reset.css** and **tf\_styles1.css** style sheet files.
3. Take some time to scroll through the contents of the document to become familiar with its contents and structure and then save your changes to the file, but do not close it.

Next, you'll insert the structure for the responsive design styles in the **tf\_styles1.css** style sheet, adding sections for mobile, tablet, and desktop devices.

### To add media queries to a style sheet:

1. Return to the **tf\_styles1.css** file in your editor.
2. Marjorie has already inserted the base styles that will apply to all devices at the top of the style sheet file. Take time to review those styles.

3. Scroll to the bottom of the document and add the following code and comments after the New Styles Added Below comment.

```
/* =====
 Mobile Styles: 0px to 480px
 =====
*/
@media only screen and (max-width: 480px) {

}

/* =====
 Tablet Styles: 481px and greater
 =====
*/
@media only screen and (min-width: 481px) {

}

/* =====
 Desktop Styles: 769px and greater
 =====
*/
@media only screen and (min-width: 769px) {

}
```

Figure 5–6 highlights the media queries in the style sheet file.

Figure 5–6

Creating media queries for different screen widths

media query matching  
screen devices with a  
maximum width of 480 pixels

media query matching  
screen devices with a  
minimum width of 481 pixels

media query matching  
screen devices with a  
minimum width 769 pixels

```
/* New Styles Added Below */

/* =====
 Mobile Styles: 0px to 480px
 =====
*/
@media only screen and (max-width: 480px) {

}

/* =====
 Tablet Styles: 481px and greater
 =====
*/
@media only screen and (min-width: 481px) {

}

/* =====
 Desktop Styles: 769px and greater
 =====
*/
@media only screen and (min-width: 769px) {

}
```

4. Save your changes to the file.

The media queries you've written are based on the screen width. However, before you can begin writing styles for each media query, you have to understand how those width values are interpreted by your browser.

## Exploring Viewports and Device Width

Web pages are viewed within a window called the viewport. For desktop computers, the viewport is the same as the browser window; however, this is not the case with mobile devices. Mobile devices have two types of viewports: a **visual viewport** displaying the web page content that fits within a mobile screen and a **layout viewport** containing the entire content of the page, some of which may be hidden from the user.

The two viewports exist in order to accommodate websites that have been written with desktop computers in mind. A mobile device will automatically zoom out of a page in order to give users the complete view of the page's contents, but as shown earlier in Figure 5–2, this often results in a view that is too small to be usable. While the user can manually zoom into a page to make it readable within the visual viewport, this is done at the expense of hiding content, as shown in Figure 5–7.

Figure 5–7 Comparing the visual and layout viewports



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Notice in the figure how the home page of the Trusted Friends website has been zoomed in on a mobile device so that only part of the page is displayed within the visual viewport and the rest of the page, which is hidden from the user, extends into the layout viewport.

Widths in media queries are based on the width of the layout viewport, not the visual viewport. Thus, depending on how the page is scaled, a width of 980 pixels might match the physical width of the device as shown in Figure 5–2 or it might extend beyond it as shown in Figure 5–7. In order to correctly base a media query on the

physical width of the device, you have to tell the browser that you want the width of the layout viewport matched to the device width by adding the following meta element to the HTML file:

```
<meta name="viewport" content="properties" />
```

where *properties* is a comma-separated list of viewport properties and their values, as seen in the example that follows:

```
<meta name="viewport"
content="width=device-width, initial-scale=1" />
```

In this meta element, the *device-width* keyword is used to set the width of the layout viewport to the physical width of the device's screen. For a mobile device, this command sets the width of the layout viewport to the width of the device. The line *initial-scale=1* is added so that the browser doesn't automatically zoom out of the web page to fit the page content within the width of the screen. We want the viewport to match the device width, which is what the above meta element tells the browser to do.

## REFERENCE

### Configuring the Layout Viewport

- To configure the properties of the layout viewport for use with media queries, add the following meta element to the HTML file

```
<meta name="viewport" content="properties" />
```

where *properties* is a comma-separated list of viewport properties and their values.

- To size the layout viewport so that it matches the width of the device without rescaling, use the following viewport meta element

```
<meta name="viewport"
content="width=device-width, initial-scale=1" />
```

Add the viewport meta element to the `tf_home.html` file now, setting the width of the layout viewport to match the device width and the initial scale to 1.

### To define the visual viewport:

1. Return to the **tf\_home.html** file in your editor.
2. Below the meta element that defines the character set, insert the following HTML tag:

```
<meta name="viewport"
content="width=device-width, initial-scale=1" />
```

Figure 5–8 highlights the code for the viewport meta element.

Figure 5–8

## Setting the properties of the viewport

page does not automatically zoom out when the page is initially opened by the browser

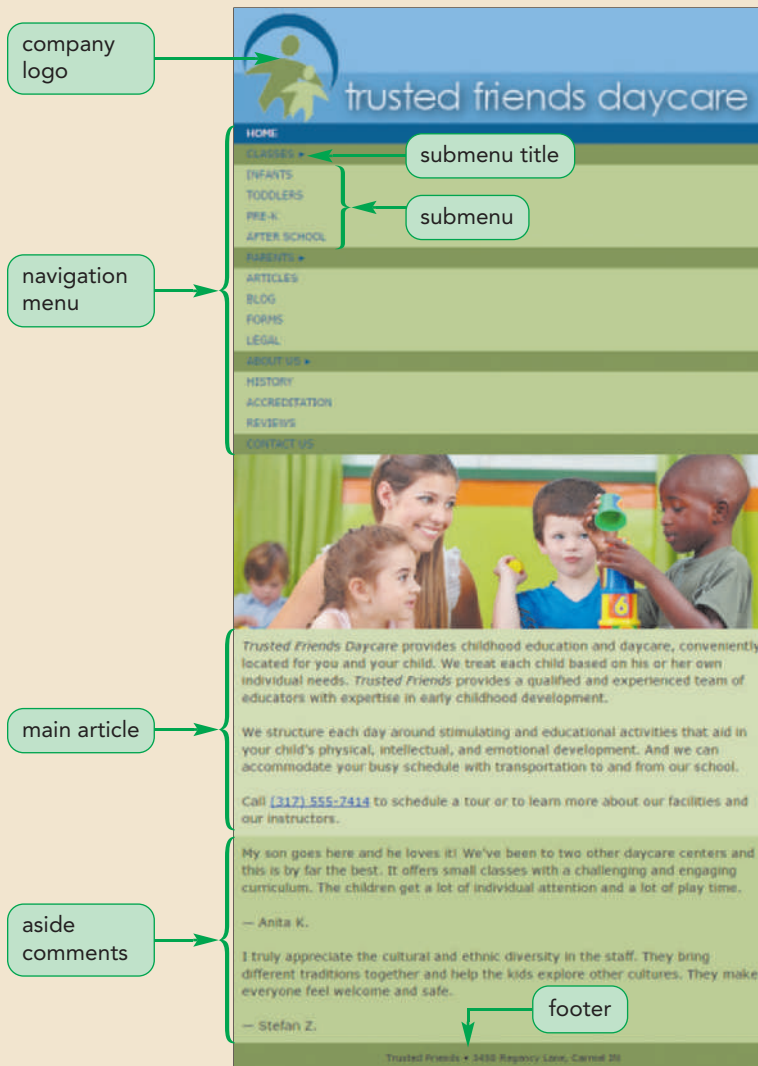
sets the width of the layout viewport to the width of the device

```
<title>Trusted Friends Daycare</title>
<meta charset="utf-8" />
<meta name="viewport" content="width=device-width, initial-scale=1" />
<link href="tf_reset.css" rel="stylesheet" />
<link href="tf_styles1.css" rel="stylesheet" />
</head>
```

4. Save your changes to the file.
5. Open the **tf\_home.html** file in your browser. Figure 5–9 shows the initial design of the page.

Figure 5–9

## Mobile layout of the Trusted Friends home page



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Now that you've set up the media queries and configured the viewport, you can work on the design of the home page. You'll start by designing for mobile devices.

## INSIGHT

### Not All Pixels Are Equal

While pixels are a basic unit of measurement in web design, there are actually two types of pixels to consider as you design a website. One is a **device pixel**, which refers to the actual physical pixel on a screen. The other is a **CSS pixel**, which is the fundamental unit in CSS measurements. The difference between device pixels and CSS pixels is easiest to understand when you zoom into and out of a web page. For example, the following style creates an `aside` element that is 300 CSS pixels wide:

```
aside: {width: 300px;}
```

However, the element is not necessarily 300 device pixels. If the user zooms into the web page, the apparent size of the article increases as measured by device pixels but remains 300 CSS pixels wide, resulting in 1 CSS pixel being represented by several device pixels.

The number of device pixels matched to a single CSS pixel is known as the **device-pixel ratio**. When a page is zoomed at a factor of 2x, the device-pixel ratio is 2, with a single CSS pixel represented by a 2x2 square of device pixels.

One area where the difference between device pixels and CSS pixels becomes important is in the development of websites optimized for displays with high device-pixel ratios. Some mobile devices are capable of displaying images with a device pixel ratio of 3, resulting in free crisp and clear images. Designers can optimize their websites for these devices by creating one set of style sheets for low-resolution displays and another for high-resolution displays. The high-resolution style sheet would load extremely detailed, high-resolution images, while the low-resolution style sheet would load lower resolution images better suited to devices that are limited to smaller device-pixel ratios. For example, the following media query

```
<link href="retina.css" rel="stylesheet"
media="only screen and (-webkit-min-device-pixel-ratio: 2) " />
```

loads the `retina.css` style sheet file for high-resolution screen devices that have device-pixel ratios of at least 2. Note that currently the `device-pixel-ratio` feature is a browser-specific extension supported only by WebKit.

## Creating a Mobile Design

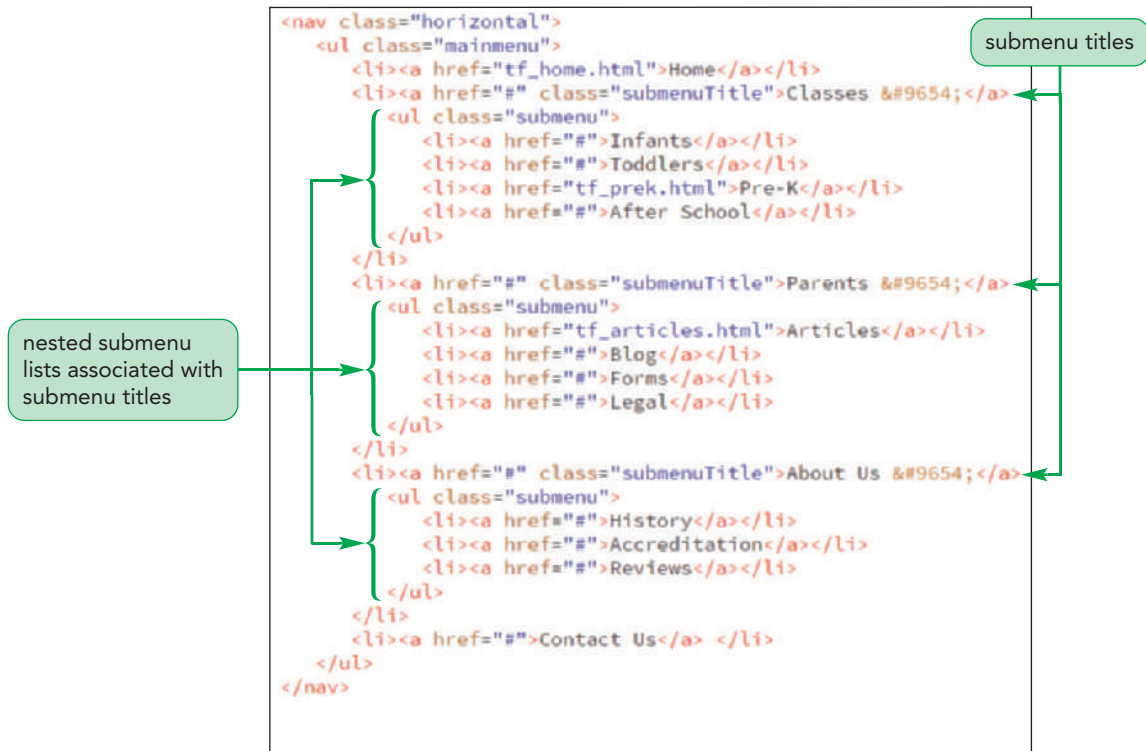
A mobile website design should reflect how users interact with their mobile devices. Because your users will be working with a small handheld touchscreen device, one key component in your design is to have the most important information up-front and easily accessible, which means your home page on a mobile device needs to be free of unnecessary clutter. Another important principle of designing for mobile devices is that you should limit the choices you offer to your users. Ideally, there should only be a few navigation links on the screen at any one time.

With these principles in mind, consider the current layout of the Trusted Friends home page shown in Figure 5–9. The content is arranged within a single column providing the maximum width for the text and images, but an area of concern for Marjorie is the long list of hypertext links, which forces the user to scroll vertically down the page to view information about the center. Most mobile websites deal with this issue by hiding extensive lists of links in pulldown menus, appearing only in response to a tap of a major heading in the navigation list. You'll use this technique for the Trusted Friends home page.

## Creating a Pulldown Menu with CSS

Marjorie has already laid the foundation for creating a pulldown menu in her HTML code. Figure 5–10 shows the code used to mark the contents of the navigation list in the body header.

Figure 5–10 Submenus in the navigation list



Marjorie has created a navigation bar that includes topical areas named Classes, Parents, and About Us. Within each of these topical areas are nested lists containing links to specific pages on the Trusted Friends website. Marjorie has put each of these nested lists within a class named *submenu*. So, first you'll hide each of these submenus to reduce the length of the navigation list as it is rendered within the user's browser. You'll place this style rule in the section for Base Styles because it will be used by both mobile and tablet devices (but not by desktop devices as you'll see later).

### To hide a submenu:

1. Return to the **tf\_styles1.css** file in your editor.
2. Scroll to the Pulldown Menu Styles section and add the following style rule:

```

ul.submenu {
 display: none;
}

```

Figure 5–11 highlights the styles to hide the navigation list submenus.

Figure 5–11

## Hiding the navigation list submenus

prevents the submenu unordered lists from being displayed

```
/* Pulldown Menu Styles */
ul.submenu {
 display: none;
}
```

3. Save your changes to the file and then reload the tf\_home.html file in your browser. Verify that the navigation list no longer shows the contents of the submenus but only the Home, Classes, Parents, About Us, and Contact Us links. See Figure 5–12.

Figure 5–12

## Navigation list with hidden submenus

submenu lists are hidden



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Next, you want to display a nested submenu only when the user hovers the mouse pointer over its associated submenu title, which for this page are the Classes, Parents, and About Us titles. Because the submenu follows the submenu title in the HTML file (see Figure 5–10), you can use the following selector to select the submenu that is immediately preceded by a hovered submenu title:

```
a.submenuTitle:hover+ul.submenu
```

However, this selector is not enough because you want the submenu to remain visible as the pointer moves away from the title and hovers over the now-visible submenu. So, you need to add `ul.submenu:hover` to the selector:

```
a.submenuTitle:hover+ul.submenu, ul.submenu:hover
```

To make the submenu visible, you change its display property back to `block`, resulting in the following style rule:

```
a.submenuTitle:hover+ul.submenu, ul.submenu:hover {
 display: block;
}
```

You may wonder why you don't use only the `ul.submenu:hover` selector. The reason is that you can't hover over the submenu until it's visible and it won't be visible until you first hover over the submenu title. Add this rule now to the `tf_styles1.css` style sheet and test it.

### To redisplay the navigation submenus:

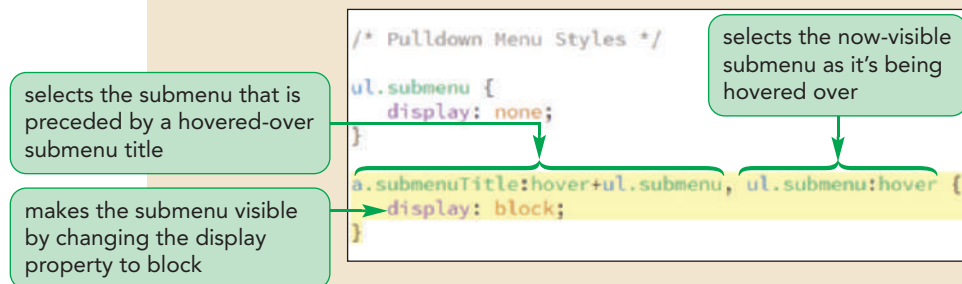
1. Return to the **tf\_styles1.css** file in your editor.
2. Add the following style rule to the Pulldown Menu Styles section:

```
a.submenuTitle:hover+ul.submenu, ul.submenu:hover {
 display: block;
}
```

Figure 5–13 highlights the styles to display the navigation list submenus.

Figure 5–13

### Displaying the hidden submenus



3. Save your changes to the file and then reload the `tf_home.html` file in your browser. Hover your mouse pointer over each of the submenu titles and verify that the corresponding submenu becomes visible and remains visible as you move the mouse pointer over its contents.

Figure 5–14 shows the revised appearance of the navigation list using the pulldown menus.

Figure 5–14

## Displaying the contents of a pulldown menu

hovering over the submenu title displays the corresponding submenu list



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The hover event is used with mouse pointers on desktop computers, but it has a different interpretation when applied to mobile devices. Because almost all mobile devices operate via a touch interface, there is no hovering. A mobile browser will interpret a hover event as a tap event in which the user taps the page object. When the hover event is used to hide an object or display it (as we did with the submenus), mobile browsers employ a double-tap event in which the first tap displays the page object and a second tap, immediately after the first, activates any hypertext links associated with the object. To display the Trusted Friends submenus, the user would tap the submenu title and to hide the submenus the user would tap elsewhere on the page.

To test the hover action, you need to view the Trusted Friends page on a mobile device or a mobile emulator.

## Testing Your Mobile Website

The best way to test a mobile interface is to view it directly on a mobile device. However, given the large number of mobile devices and device versions, it's usually not practical to do direct testing on all devices. An alternative to having the physical device is to emulate it through a software program or an online testing service. Almost every mobile phone company provides a software development kit or SDK that developers can use to test their programs and websites. Figure 5–15 lists some of the many **mobile device emulators** available on the web at the time of this writing.

Figure 5–15

## Popular device emulators

Mobile Emulator	Description
Android SDK	Software development kit for Android developers ( <a href="http://developer.android.com/sdk">developer.android.com/sdk</a> )
iOS SDK	Software development kit for iPhone, iPad, and other iOS devices ( <a href="http://developer.apple.com">developer.apple.com</a> )
Mobile Phone Emulator	Online emulation for a variety of mobile devices ( <a href="http://www.mobilephoneemulator.com">www.mobilephoneemulator.com</a> )
Mobile Test Me	Online emulation for a variety of mobile devices ( <a href="http://mobiletest.me">mobiletest.me</a> )
Opera Mobile SDK	Developer tools for the Opera Mobile browser ( <a href="http://www.opera.com/developer">www.opera.com/developer</a> )

Browsers are also starting to include device emulators as part of their developer tools. You will examine the device emulator that is supplied with the Google Chrome browser and use it to view the Trusted Friends home page under a device of your choosing. If you don't have access to the Google Chrome browser, review the steps that follow and apply them to the emulator of your choice.

## Viewing the Google Chrome device emulator:




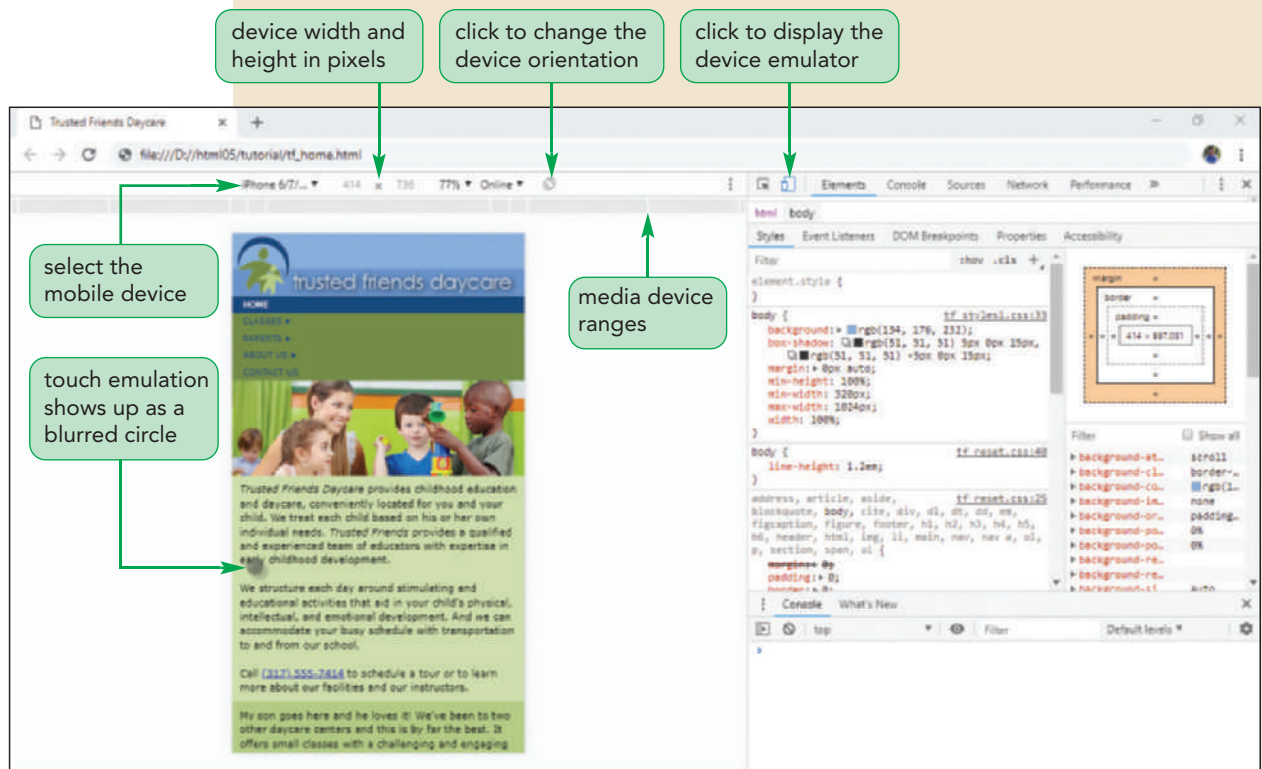
1. Return to the **tf\_home.html** file in the Google Chrome browser and press **F12** to open the developer tools pane.
2. If necessary, click the **device** icon  located at the top of the developer pane to display the device toolbar.
3. Select a device of your choosing from the drop-down list of devices on the developer toolbar.
4. Refresh or reload the web page to ensure that the display parameters of your selected device are applied to the rendered page.  
  
The emulator also allows you to view the effect of changing the orientation of the phone from portrait to landscape.
5. Click the **rotate** button  located on the device toolbar to switch to landscape orientation. Click the **rotate** button again to switch back to portrait mode.  
  
Google Chrome's device emulator can also emulate the touch action. The touch point is represented by a semitransparent circle .
6. Move the touch point over Classes, Parents, or About Us and verify that when you click (tap) the touch point on a submenu title the nested submenu contents are displayed.
7. Verify that you when you click elsewhere in the page the submenu contents are hidden.

Figure 5–16 shows the effect of opening a submenu with the touch emulator.

Figure 5-16 Using the Google Chrome device emulator tool



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8. Continue to explore Google Chrome's device emulators, trying out different combinations of devices and screen orientations. Press **F12** again to close the developer window.

An important aspect of mobile design is optimizing your site's performance under varying network conditions. Thus, in addition to emulating the properties of the mobile device, Google Chrome's device emulator can also emulate network connectivity.

Marjorie wants to increase the font size of the links in the navigation list to make them easier to access using touch. She also wants to hide the customer comments that have been placed in the `aside` element (because she doesn't feel this will be of interest to mobile users). Because these changes only apply to the mobile device version of the page, you'll add the style rules within the media query for mobile devices.

### To hide the customer comments:

1. Return to the `tf_styles1.css` file in your editor and go to the Mobile Styles section.
2. Within the media query for screen devices with a maximum width of 480 pixels, add the following style rule to increase the font size of the hypertext links in the navigation list. Indent the style rule to offset it from the braces around the media query.

```
nav.horizontal a {
 font-size: 1.5em;
 line-height: 2.2em;
}
```

The styles rules for a media query must always be placed within curly braces to define the extent of the query.

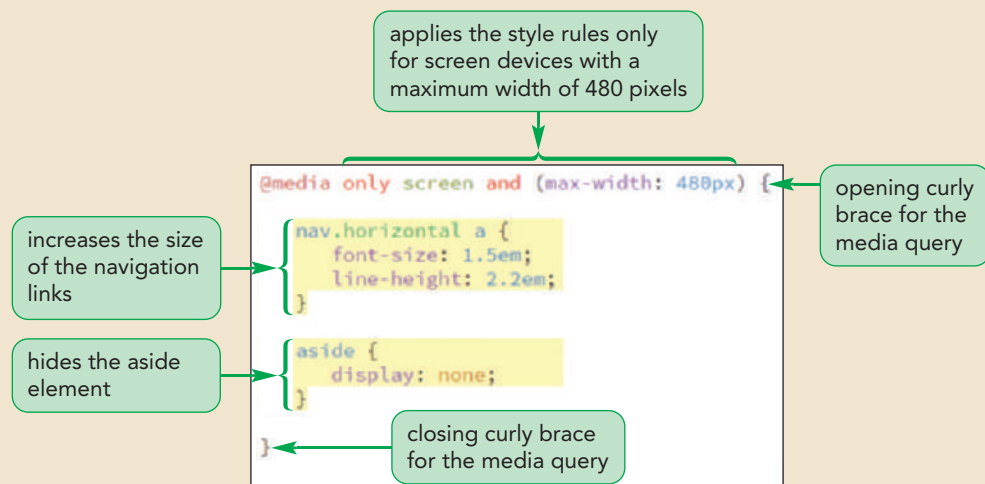
3. Add the following style rule to hide the `aside` element (once again indented from the surrounding media query):

```
aside {
 display: none;
}
```

Figure 5–17 highlights the style rules in the media query for mobile devices.

Figure 5–17

### Hiding the aside element for mobile devices

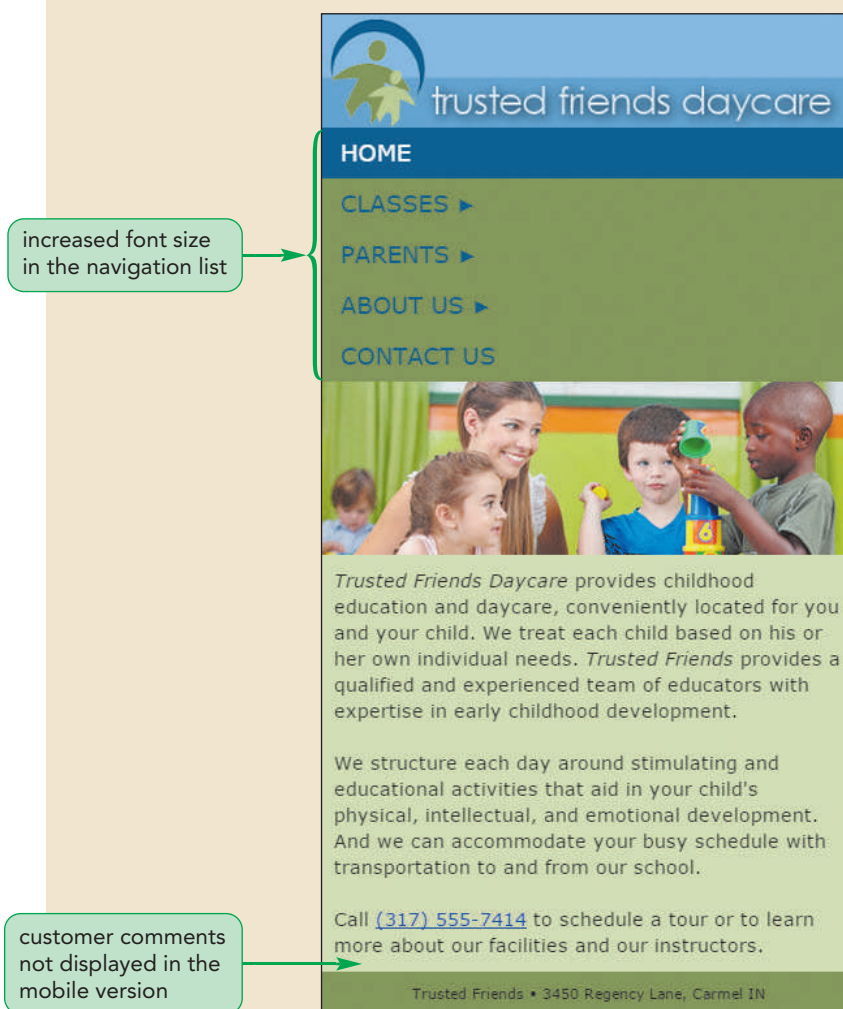


4. Save your changes to the file and then reload the `tf_home.html` file in your browser. Reduce the width of the browser window to 480 pixels or below (or view the page in your mobile emulator). Verify that the customer comments are no longer displayed on the web page and that the size of the navigation links has been increased.

Figure 5–18 shows the final design of the mobile version.

Figure 5–18

Final design of the mobile version of the home page



Now that you've completed the mobile design of the page, you'll start to work on the design for tablet devices.

## Creating a Tablet Design

Under the media query you've set up, your design for tablet devices will be applied for screen widths greater than 480 pixels. The pulldown menu you created was part of the base styles, so it is already part of the tablet design; however, with the wider screen, Marjorie would like the submenus displayed horizontally rather than vertically. You can accomplish this by adding a style rule to the tablet media query to float the submenus side-by-side.

### To begin writing the tablet design:

1. Return to the **tf\_styles1.css** file in your editor and scroll down to the media query for the tablet styles.

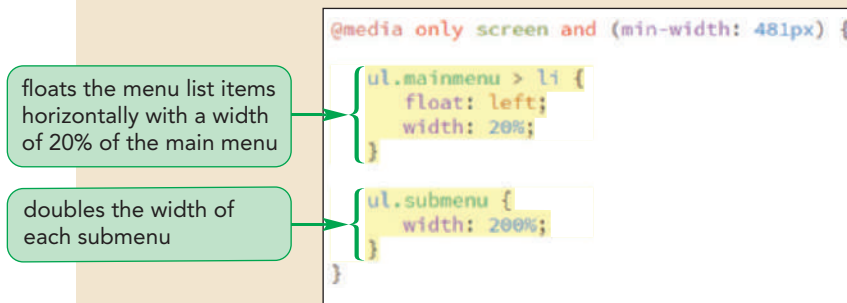
2. Within the media query, add the following style to float the five list items, which are direct children of the main menu, side-by-side. Set the width of each list item to 20% of the total width of the main menu.

```
ul.mainmenu > li {
 float: left;
 width: 20%;
}
```

3. Double the widths of the submenus so that they stand out better from the main menu titles by adding the following style rule.

```
ul.submenu {
 width: 200%;
}
```

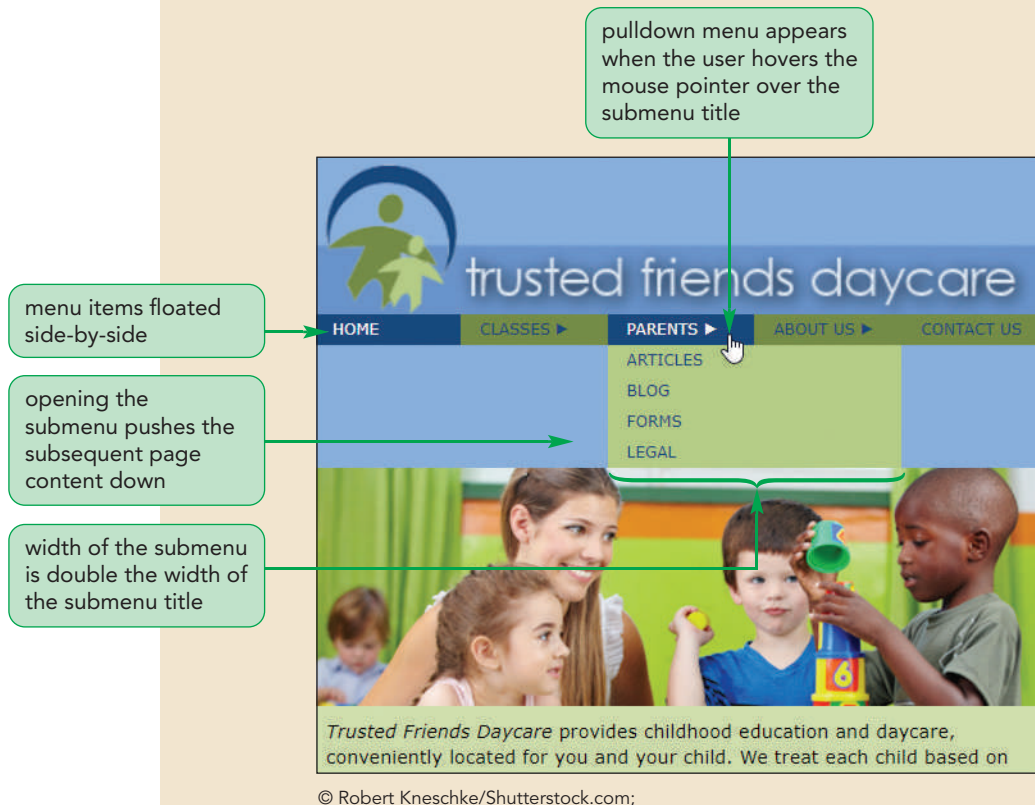
Figure 5–19 highlights the style rule within the media query for tablet devices.

**Figure 5–19****Formatting the navigation menus for tablet devices**

4. Save your changes to the style sheet and then reload the tf\_home.html file in your web browser.
5. Increase the width of the browser window beyond 480 pixels to switch from the mobile design to the tablet design. Verify that the submenu titles are now laid out horizontally and that if you hover your mouse pointer over the submenu titles, the contents of the submenu are made visible on the screen. See Figure 5–20.

Figure 5–20

## Pulldown menus for the tablet layout



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6. Scroll down as needed and note that the customer comments now appear at the bottom of the page because they were only hidden for the mobile version of this document.

Marjorie notices that opening the submenus pushes the subsequent page content down to make room for the submenu. She prefers the submenus to overlay the page content. You can accomplish this by placing the submenus with absolute positioning. Remember that objects placed with absolute positioning are removed from the document flow and thus, will overlay subsequent page content. To keep the submenus in their current position on the page, you'll make each main list item a container for its submenu by setting its `position` property to `relative`. Thus, each submenu will be placed using absolute positioning with its main list item. You will not need to set the `top` and `left` coordinates for these items because you'll use the default value of 0 for both. Because the submenus will overlay page content, Marjorie suggests you add a drop shadow so, when a submenu is opened, it will stand out more from the page content.

### To position the navigation submenus:

1. Return to the `tf_styles1.css` style sheet in your editor.
2. Locate the style rule for the `ul.mainmenu > li` selector in the Tablet Styles section and add the following style:

```
position: relative;
```

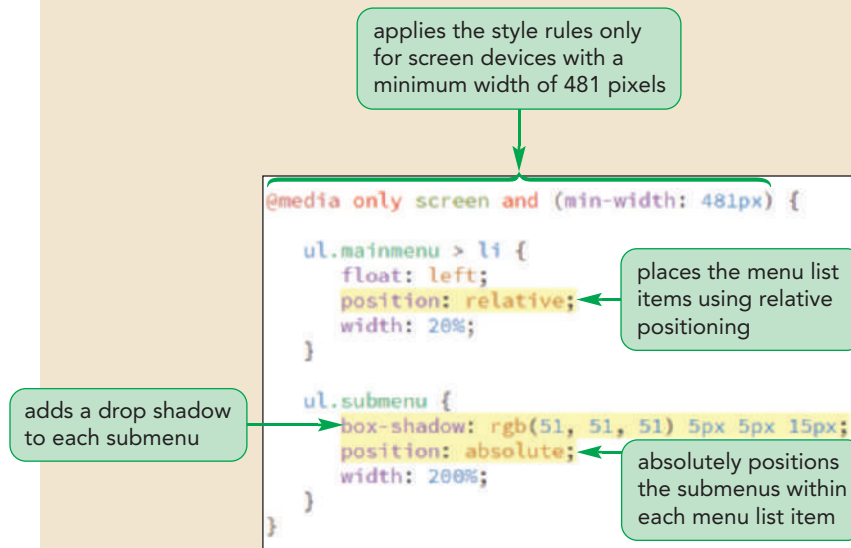
3. Add the following style to the `ul.submenu` selector in the Tablet Styles section:

```
box-shadow: rgb(51, 51, 51) 5px 5px 15px;
position: absolute;
```

Figure 5–21 highlights the new styles.

Figure 5–21

## Placing the pulldown menus with absolute positioning



4. Save your changes to the style sheet and then reload the `tf_home.html` file in your web browser.
5. Verify that when you open the pulldown menus, the subsequent page content is not shifted downward. Figure 5–22 highlights the final design for the tablet version of the home page.

Figure 5–22

## Revised design of the pulldown menus



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You'll complete your work on the home page by creating the desktop version of the page design.

## Creating a Desktop Design

Some of the designs that will be used in the desktop version of the page have already been placed in the Base Styles section of the `tf_styles1.css` style sheet. For example, the maximum width of the web page has been set to 1024 pixels. For browser windows that exceed that width, the web page will be displayed on a fixed background image of children playing. Other styles are inherited from the style rules for tablet devices. For example, desktop devices will inherit the style rule that floats the navigation submenus alongside each other within a single row. All of which illustrates an important principle in designing for multiple devices: *don't reinvent the wheel*. As much as possible allow your styles to build upon each other as you move to wider and wider screens.

However, there are some styles that you will have to implement only for desktop devices. With the wider screen desktop screens, you don't need to hide the submenus in a pulldown menu system. Instead you can display all of the links from the navigation list. You'll change the submenu background color to transparent so that it blends in with the navigation list and you'll remove the drop shadows you created for the tablet design. The submenus will always be visible, so you'll change their `display` property from `none` to `block`. Finally, you'll change their position to `relative` because you no longer want to take the submenus out of the document flow and you'll change their width to 100%. Apply the styles now to modify the appearance of the submenus.

### To start working on the desktop design:

1. Return to the `tf_styles1.css` style sheet in your editor and within the media query for devices with screen widths 769 pixels or greater insert the following style rule to format the appearance of the navigation submenus.

```
ul.submenu {
 background: transparent;
 box-shadow: none;
 display: block;
 position: relative;
 width: 100%;
}
```

2. The navigation list itself needs to expand so that it contains all of its floated content. Add the following style rule to the media query for desktop devices:

```
nav.horizontal::after {
 clear: both;
 content: "";
 display: table;
}
```

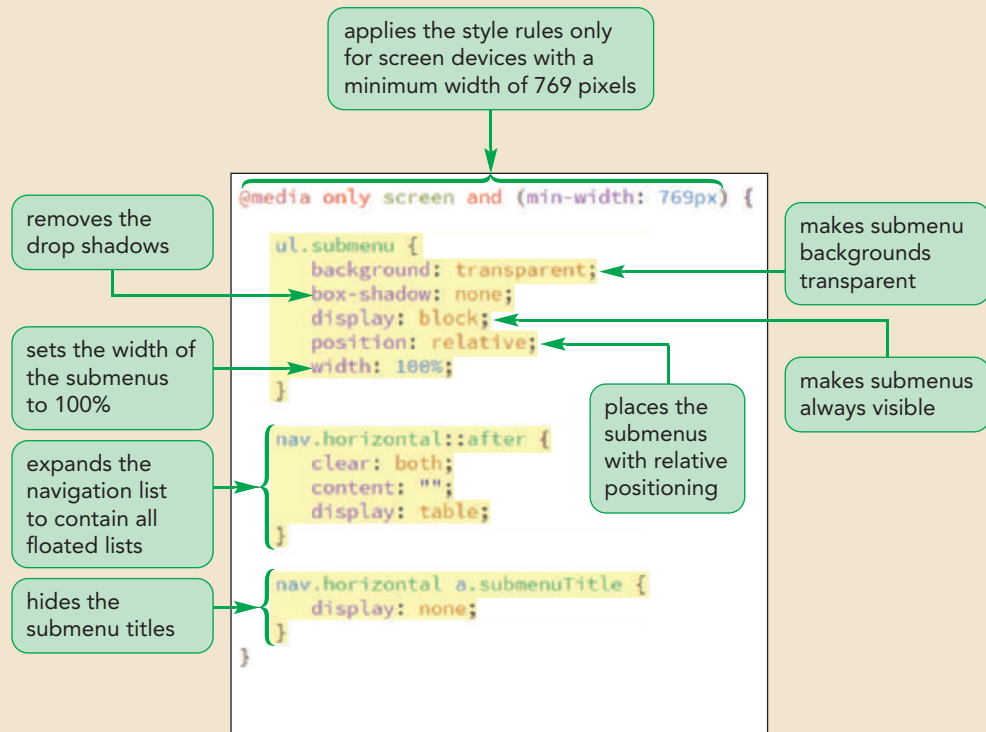
3. Finally with no hidden submenus, there is no reason to have a submenu title. Add the following style rule to remove the submenu titles:

```
nav.horizontal a.submenuTitle {
 display: none;
}
```

Figure 5–23 highlights the new style rules in the desktop media query.

Figure 5–23

## Adding design styles for the browser background and page body



With a wider screen, you want to order to avoid long lines of text, which are difficult to read. Modify the layout of the desktop design so that the main article and the customer comments are floated side-by-side within the same row.

### To change the layout of the article and aside elements:

1. Within the media query for desktop devices, add the following style rules to float the article and aside elements:

```

article {
 float: left;
 margin-right: 5%;
 width: 55%;
}
aside {
 float: left;
 width: 40%;
}

```

Figure 5–24 highlights the final style rules in the desktop media query.

Figure 5–24

## Styles for the article and aside elements

floats the main article with a width of 55% and a right margin of 5%

floats the aside element with a width of 40%

```
nav.horizontal a.submenuTitle {
 display: none;
}

article {
 float: left;
 margin-right: 5%;
 width: 55%;
}

aside {
 float: left;
 width: 40%;
}
```

2. Save your changes to the style sheet and then reload tf\_home.html in your browser.

Figure 5–25 shows the final appearance of the desktop design.

Figure 5–25

## Final desktop design for the Trusted Friends daycare



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3. Resize your web browser and verify that as you change the browser window width, the layout changes from the mobile to the tablet to the desktop design.

You show the final design of the home page to Marjorie. She is pleased by the changes you've made and likes that the page's content and layout will automatically adapt to different screen widths.



## PROSKILLS

### *Problem Solving: Optimizing Your Site for the Mobile Web*

The mobile browser market is a rapidly evolving and growing field with more new devices and apps introduced each month. Adapting your website for the mobile web is not a luxury, but a necessity.

A good mobile design matches the needs of consumers. Mobile users need quick access to main sources of information without a lot of the extra material often found in the desktop versions of their favorite sites. Here are some things to keep in mind as you create your mobile designs:

- *Keep it simple.* To accommodate the smaller screen sizes and slower connection speeds, scale down each page to a few key items and articles. Users are looking for quick and obvious information from their mobile sites.
- *Resize your images.* Downloading several images can bring a mobile device to a crawl. Reduce the number of images in your mobile design, and use a graphics package to resize the images so they are optimized in quality and sized for a smaller screen.
- *Scroll vertically.* Readers can more easily read your page when they only have to scroll vertically. Limit yourself to one column of information in portrait orientation and two columns in landscape.
- *Make your links accessible.* Clicking a small hypertext link is extremely difficult to do on a mobile device with a touch screen interface. Create hypertext links that are easy to locate and activate.

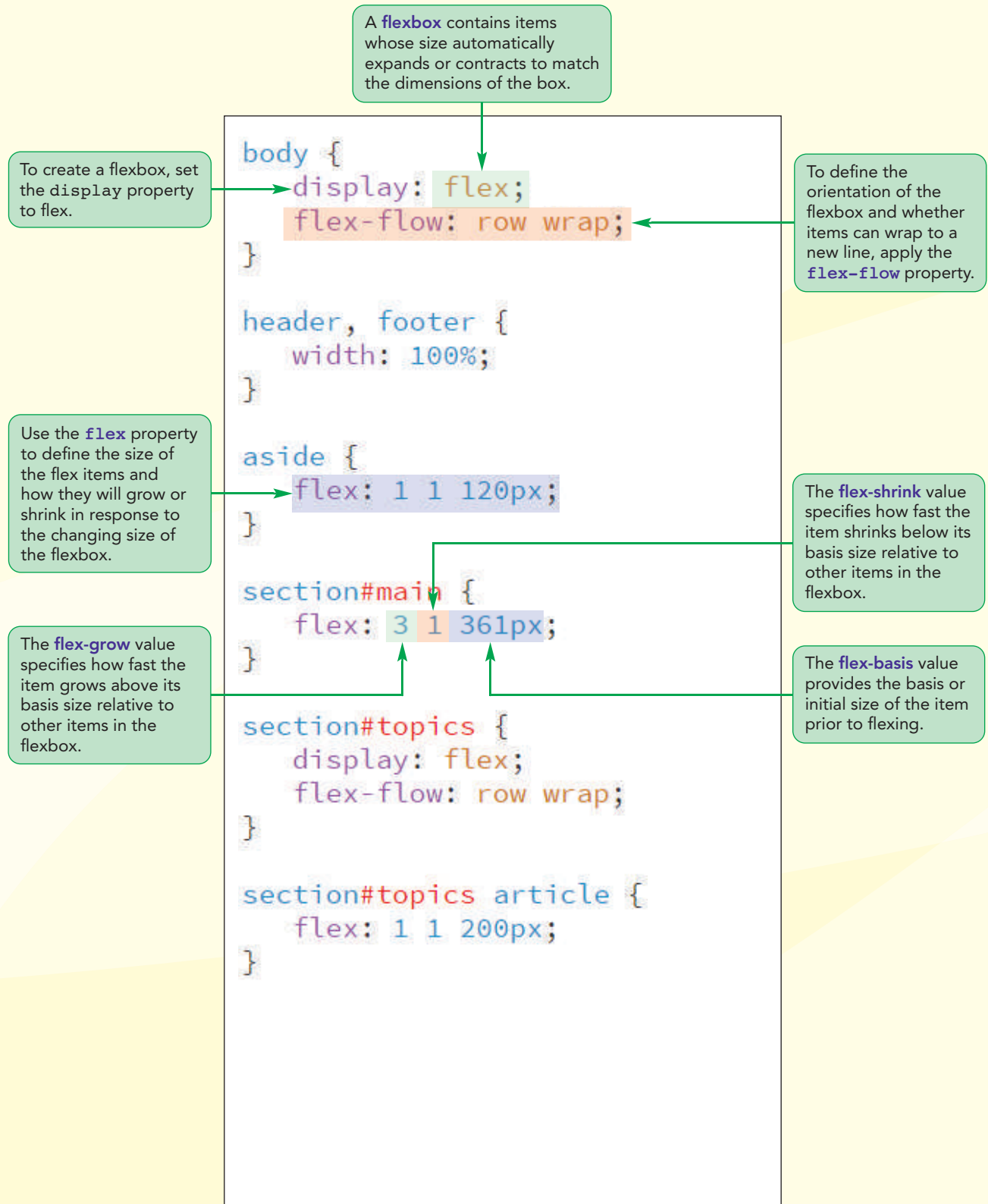
Above all, test your site on a variety of devices and under different conditions. Mobile devices vary greatly in size, shape, and capability. What works on one device might fail utterly on another. Testing your code on a desktop computer is only the first step; you may also need access to the devices themselves. Even emulators cannot always capture the nuances involved in the performance of an actual mobile device.

You've completed your work on the design of the Trusted Friends home page with a style sheet that seamlessly transitions between mobile, tablet, and desktop devices. In the next session, you'll explore how to use flexible boxes to achieve a responsive design.

### Session 5.1 Quick Check

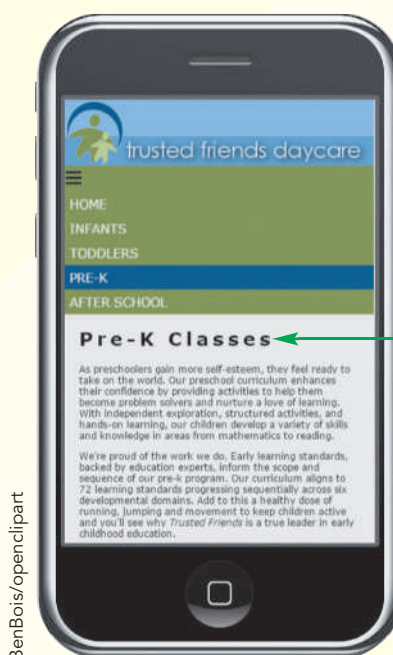
1. Which of the following is *not* a part of responsive design theory?
  - a. flexible layouts
  - b. pulldown menus
  - c. image rescaling
  - d. media queries
2. Which attribute do you add to a link element for aural browsers?
  - a. `media = "aural"`
  - b. `type = "aural"`
  - c. `media = "speech"`
  - d. `type = "speech"`
3. What @rule do you use for braille device?
  - a. `@media braille`
  - b. `@braille true`
  - c. `@type braille`
  - d. `@media nonscreen`
4. What @rule loads style rules for screen devices up to a maximum width of 780 pixels?
  - a. `@screen: 780px`
  - b. `@media screen and (width: 780px)`
  - c. `@screen and (width <= 780px)`
  - d. `@media screen and (max-width: 780px)`
5. What attribute would you add to a link element for screen devices whose width ranges from 480 pixels up to 780 pixels (inclusive)?
  - a. `media="screen" min-width="480px" min-width="480px"`
  - b. `media="screen and (width=480px - 780px)"`
  - c. `minScreenWidth = "480px" maxScreenWidth = "780px"`
  - d. `media="screen and (min-width: 480px and max-width: 780px)"`
6. In general, what media rules should be listed first in your media queries if you want to support mobile, tablet, laptop, and desktop devices?
  - a. mobile
  - b. tablet
  - c. laptop
  - d. desktop
7. Which viewport displays the web page content that fits within mobile screen?
  - a. layout
  - b. visual
  - c. webpage
  - d. browser
8. Which viewport contains the entire content of the page, some of which may be hidden from the user?
  - a. layout
  - b. visual
  - c. webpage
  - d. browser

# Session 5.2 Visual Overview:



© dotshock/Shutterstock.com; BenBois/openclipart; JMLevick/openclipart

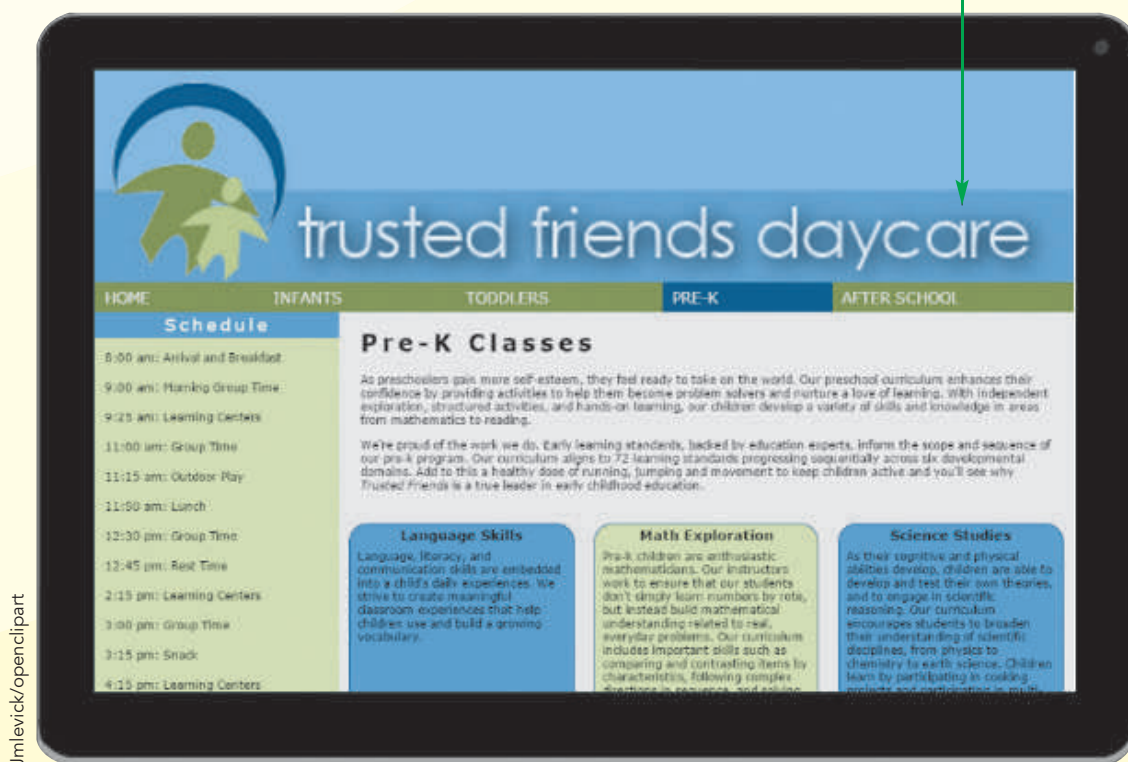
# Flexible Layouts



BenBois/opencolipart

With narrower screens, a flexbox layout automatically places items within a single column.

With wider screens, the items are free to expand, automatically placing themselves into multiple columns.



Jmlevick/opencolipart

## Introducing Flexible Boxes

So far our layouts have been limited to a grid system involving floating elements contained within a fixed or fluid grid of rows and columns. One of the challenges of this approach under responsive design is that you need to establish a different grid layout for each class of screen size. It would be much easier to have a single specification that automatically adapts itself to the screen width without requiring a new layout design. One way of achieving this is with flexible boxes.

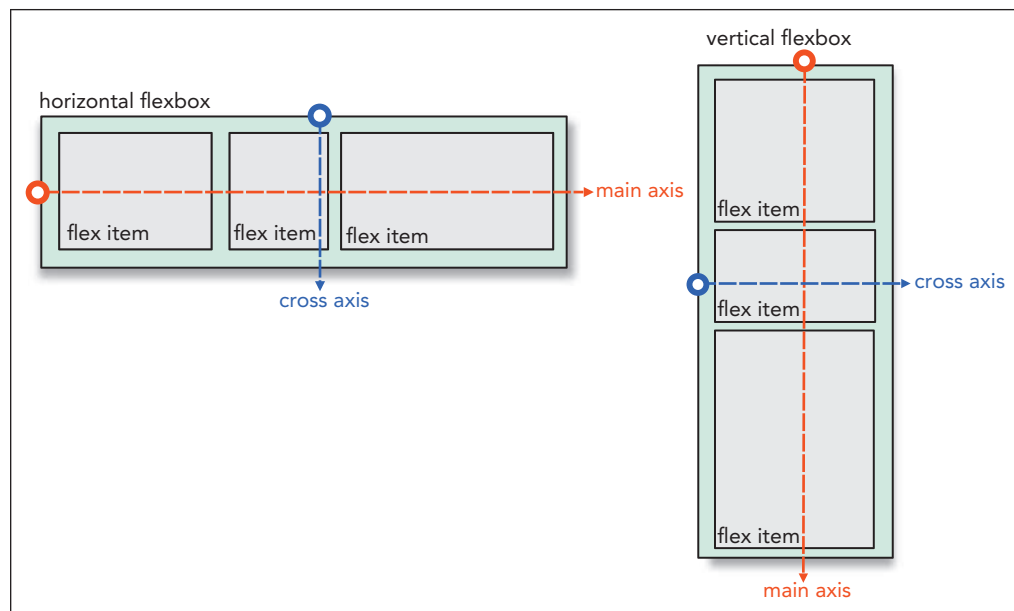
### Defining a Flexible Box

A flexible box or flexbox is a box containing items whose sizes can shrink or grow to match the boundaries of the box. Thus, unlike a grid system in which each item has a defined size, flexbox items adapt themselves automatically to the size of their container. This makes flexboxes a useful tool for designing layouts that can adapt to different page sizes.

Items within a flexbox are laid out along a **main axis**, which can point in either the horizontal or vertical direction. Perpendicular to the main axis is the **cross axis**, which is used to define the height or width of each item. Figure 5–26 displays a diagram of two flexboxes with items arranged either horizontally or vertically along the main axis.

Figure 5–26

Horizontal and vertical flexboxes



To define an element as a flexbox, apply either of the following `display` styles

```
display: flex;
```

or

```
display: inline-flex;
```

where a value of `flex` starts the flexbox on a new line (much as a block element starts on a new line) and a value of `inline-flex` keeps the flexbox in-line with its surrounding content.

## Cross-Browser Flexboxes

The syntax for flexboxes has gone through major revisions as it has developed from the earliest drafts to the latest specifications. Many older browsers employ a different flexbox syntax, in some cases replacing the word *flex* with *box* or *flexbox*. The complete list of browser extensions that define a flexbox would be entered as:

```
display: -webkit-box;
display: -moz-box;
display: -ms-flexbox;
display: -webkit-flex;
display: flex;
```

To simplify the code in the examples that follow, you will limit your code to the W3C specification. This will cover the current browsers at the time of this writing. However, if you need to support older browsers, you may have to include a long list of browser extensions for each flex property.

## Setting the Flexbox Flow

By default, flexbox items are arranged horizontally starting from the left and moving to the right. To change the orientation of the flexbox, apply the following `flex-direction` property

```
flex-direction: direction;
```

where *direction* is `row` (the default), `column`, `row-reverse`, or `column-reverse`. The `row` option lays out the flex items from left to right, `column` creates a vertical layout starting from the top and moving downward, and the `row-reverse` and `column-reverse` options lay out the items bottom-to-top and right-to-left respectively.

Flex items will all try to fit within a single line, either horizontally or vertically. But if they can't, those items can wrap to a new line as needed by applying the following `flex-wrap` property to the flexbox

```
flex-wrap: type;
```

where *type* is either `nowrap` (the default), `wrap` to wrap the flex items to a new line, or `wrap-reverse` to wrap flex items to a new line starting in the opposite direction from the current line. For example, the following style rules create a flexbox in which the items are arranged in a column starting from the top and going down with any flex items that wrap to the second column starting from the bottom and moving up.

```
display: flex;
flex-direction: column;
flex-wrap: wrap-reverse;
```

### TIP

Some older browsers do not support the `flex-flow` property, so for full cross-browser support, you might use the `flex-direction` and `flex-wrap` properties instead.

Additional items in this flexbox will continue to follow a snake-like curve with the third column starting at the top, moving down, and so forth.

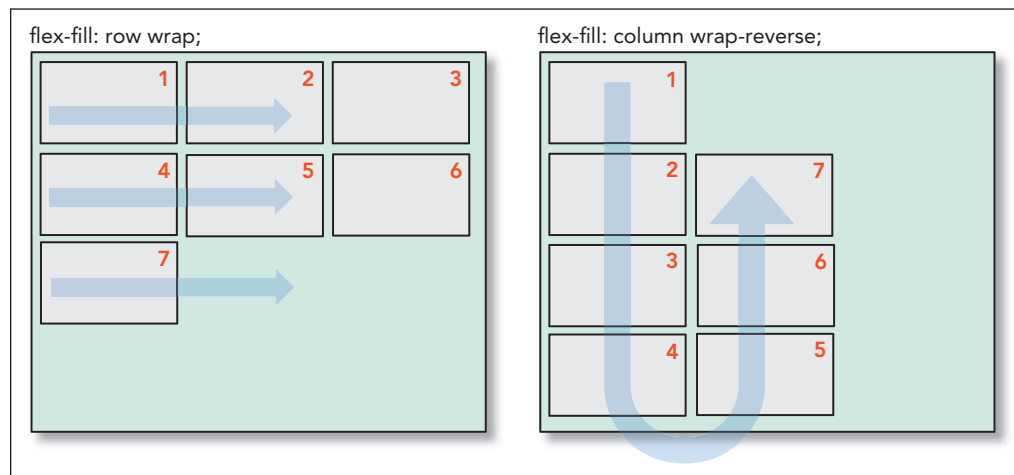
Both the `flex-direction` and `flex-wrap` properties can be combined into the following `flex-flow` style

```
flex-flow: direction wrap;
```

where *direction* is the direction of the flex items and *wrap* defines whether the items will be wrapped to a new line when needed. Figure 5–27 shows an example of flexboxes laid out in rows and columns in which the flex items are forced to wrap to a new line. Note that the column-oriented flexbox uses `wrap-reverse` to start the new column on the bottom rather than the top.

Figure 5–27

## Flexbox layouts



## REFERENCE

*Defining a Flexbox*

- To display an element as a flexbox, apply the `display` style
 

```
display: flex;
```
- To set the orientation of the flexbox, apply the style
 

```
flex-direction: direction;
```

 where *direction* is `row` (the default), `column`, `row-reverse`, or `column-reverse`.
- To define whether or not flex items wrap to a new line, apply the style
 

```
flex-wrap: type;
```

 where *type* is either `nowrap` (the default), `wrap` to wrap flex items to a new line, or `wrap-reverse` to wrap flex items to a new line starting in the opposite direction from the current line.
- To define the flow of items within a flexbox, apply the style
 

```
flex-flow: direction wrap;
```

 where *direction* is the direction of the flex items and *wrap* defines whether the items will be wrapped to a new line when needed.

Marjorie wants you to use flexboxes to design a page she's created describing the pre-k classes offered by Trusted Friends. She has already created the content of the page and several style sheets to format the appearance of the page elements. You'll create a style sheet that lays out the page content drawing from a library of flexbox styles.

**To open the pre-k page and style sheet:**

1. Use your editor to open the **tf\_prek\_txt.html** and **tf\_flex\_txt.css** files from the **html05 ► tutorial** folder. Enter **your name** and **the date** in the comment section of each file and save them as **tf\_prek.html** and **tf\_flex.css** respectively.
2. Return to the **tf\_prek.html** file in your editor and, within the document head, create links to the **tf\_reset.css**, **tf\_styles2.css**, and **tf\_flex.css** style sheets in that order.

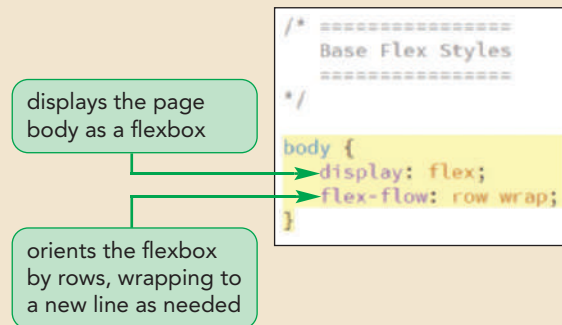
3. Take some time to scroll through the contents of the document to become familiar with its contents and structure and then save your changes to the file, leaving it open.
4. Go to the **tf\_flex.css** file in your editor.
5. Go to the Base Flex Styles section and insert the following style rules to display the entire page body as a flexbox oriented horizontally with overflow flex items wrapped to a new row as needed:

```
body {
 display: flex;
 flex-flow: row wrap;
}
```

Figure 5–28 highlights the new flexbox styles in the style sheet.

Figure 5–28

### Setting the flex display style



6. Save your changes to the file.

Now that you’ve defined the page body as a flexbox, you’ll work with styles that define how items within a flexbox expand and contract to match the flexbox container.

## Working with Flex Items

Flex items behave a lot like floated objects though with several advantages, including that you can float them in either the horizontal or vertical direction and that you can change the order in which they are displayed. While the size of a flex item can be fixed using the CSS `width` and `height` properties, they don’t have to be. They can also be “flexed”—automatically adapting their size to fill the flexbox. A flex layout is fundamentally different from a grid layout and requires you to think about sizes and layout in a new way.

### TIP

Because flexboxes can be aligned horizontally or vertically, the `flex-basis` property sets either the initial width or the initial height of the flex item depending on the orientation of the flexbox.

### Setting the Flex Basis

When items are allowed to “flex” their rendered size is determined by three properties: the basis size, the growth value, and the shrink value. The basis size defines the initial size of the item before the browser attempts to fit it to the flexbox and is set using the following `flex-basis` property

```
flex-basis: size;
```

where *size* is one of the CSS units of measurement, a percentage of the size of the flexbox, or the keyword `auto` (the default), which sets the initial size of the flex item based on its content or the value of its `width` or `height` property. For example, the following style rule sets the initial size of the `aside` element to 200 pixels:

```
aside {
 flex-basis: 200px;
}
```

The `flex-basis` property should not be equated with the `width` and `height` properties used with grid layouts; rather, it serves only as a starting point. The actual rendered size of the `aside` element in this example is not necessarily 200 pixels but will be based on the size of the flexbox, as well as the size of the other items within the flexbox.

## Defining the Flex Growth

Once the basis size of the item has been defined, the browser will attempt to expand the item into its flexbox. The rate at which a flex item grows from its basis size is determined by the following `flex-grow` property

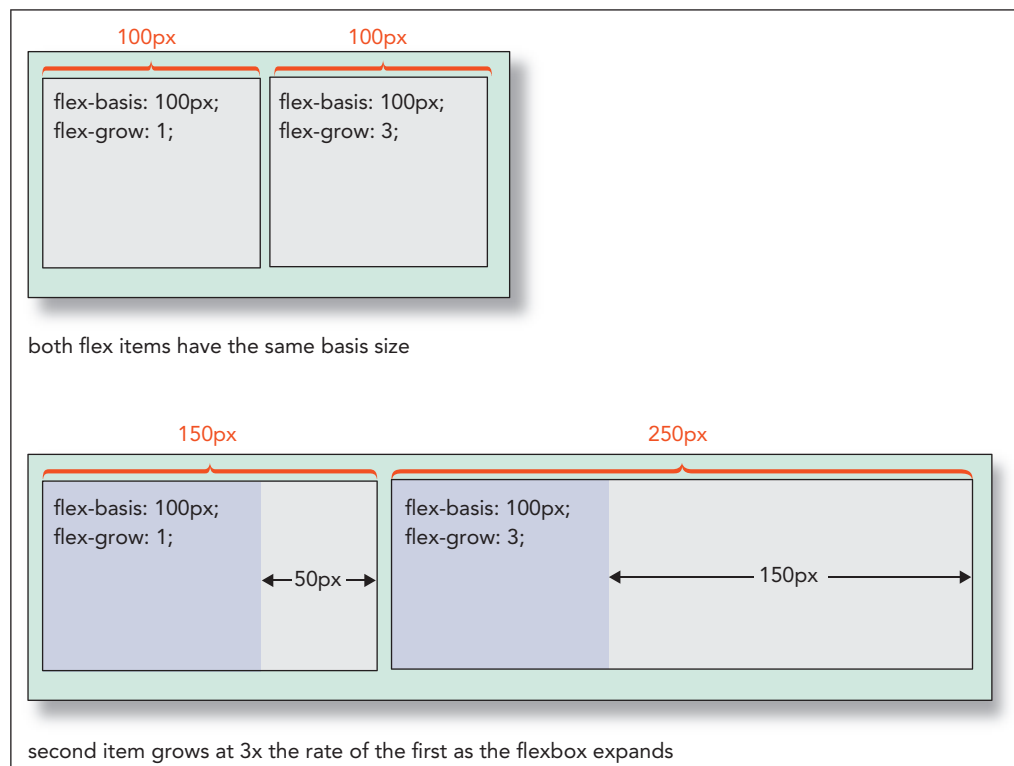
```
flex-grow: value;
```

where *value* is a non-negative value that expresses the growth of the flex item relative to the growth of the other items in the flexbox. The default `flex-grow` value is 0, which is equivalent to not allowing the flex item to grow but to remain at its basis size. Different items within a flexbox can have different growth rates and the growth rate largely determines how much of the flexbox is ultimately occupied by each item.

Figure 5–29 shows an example of how changing the size of a flexbox alters the size of the individual flexbox items.

Figure 5–29

Growing flex items beyond their basis size



In the figure, the basis sizes of the two items are 100 pixels each with the growth of the first item set to 1 and the growth of the second item set to 3. The growth values indicate that as the flex items expand to fill the flexbox, item1 will increase 1 pixel for every 3 pixels that item2 increases. Thus, to fill up the remaining 200 pixels of a 400-pixel wide flexbox, 50 pixels will be allotted to the first item and 150 pixels will be allotted to the second item, resulting in final sizes of 150 pixels and 250 pixels respectively. If the width of the flexbox were to increase to 600 pixels, item1 and item2 will divide the extra 400 pixels once again in a ratio of 1 to 3. Item1 will have a total size of 200 pixels (100px + 100px) and item2 will expand to a size of 400 pixels (100px + 300px).

### TIP

If all items have `flex-grow` set to 1 and an equal flex basis, they will always have an equal size within the flexbox.

Notice that unlike a grid layout, the relative proportions of the items under a flex layout need not be constant. For the layout shown in Figure 5–29, the two items share the space equally when the flexbox is 200 pixels wide, but at 400 pixels the first item occupies 37.5% of the box while the second item occupies the remaining 62.5%.

To keep a constant ratio between the sizes of the flex items, set their basis sizes to 0 pixels. For example, the following style rules will result in a flexbox in which the first item is always half the size of the second item no matter how wide or tall the flexbox becomes.

```
div#item1 {
 flex-basis: 0px;
 flex-grow: 1;
}
div#item2 {
 flex-basis: 0px;
 flex-grow: 2;
}
```

One of the great advantages of the flexible box layout is that you don't need to know how many items are in the flexbox to keep their relative proportions the same. The following style rule creates a layout for a navigation list in which each list item is assigned an equal size and grows at the same rate.

```
nav ul {
 display: flex;
}
nav ul li {
 flex-basis: 0px;
 flex-grow: 1;
}
```

If there are four items in this navigation list, each will be 25% of the total list size and if at a later date a fifth item is added, those items will then be allotted 20% of the total size. Thus, unlike a grid layout, there is no need to revise the percentages to accommodate new entries in the navigation list; a flexible box layout handles that task automatically.

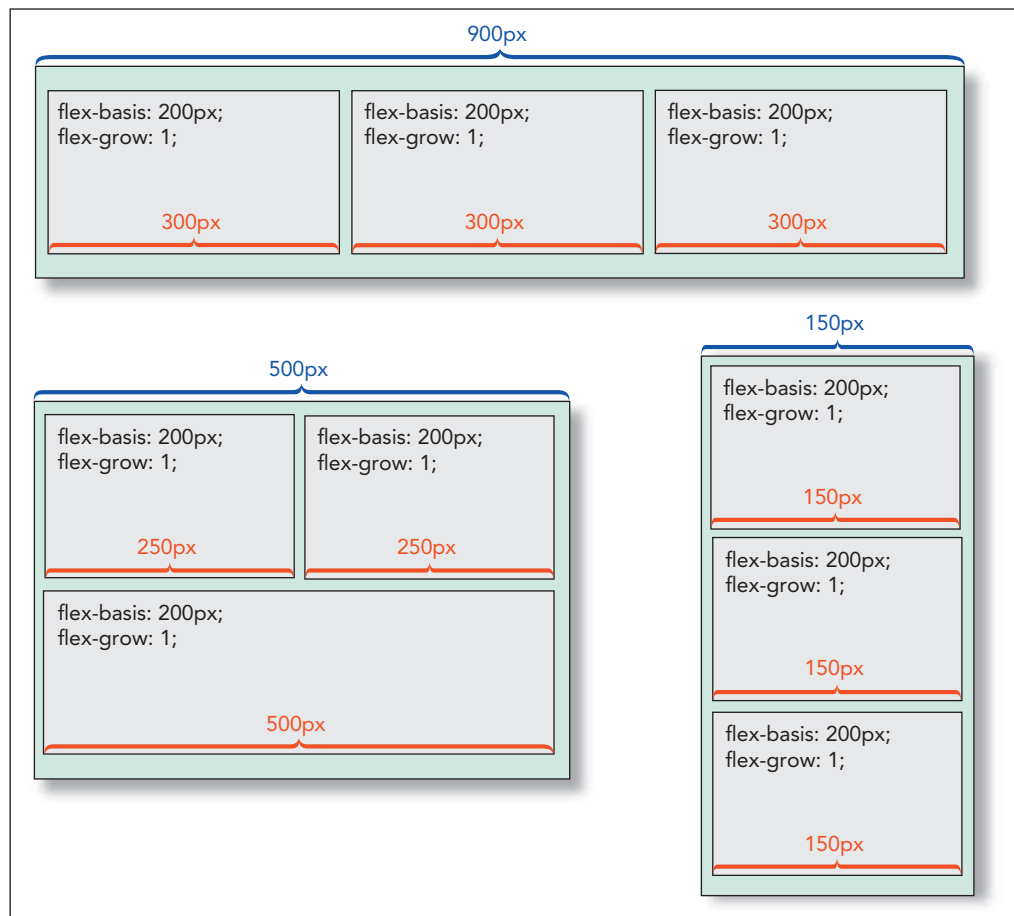
Note that if the `flex-grow` value is set to 0, the flex item will not expand beyond its basis size, making that basis value the maximum width or height of the item.

## Defining the Shrink Rate

What happens when the flexbox size falls below the total space allotted to its flex items? There are two possibilities depending on whether the flexbox is defined to wrap its contents to a new line. If the `flexbox-wrap` property is set to `wrap`, one or more of the flex items will be shifted to a new line and expanded to fill in the available space on that line. Figure 5–30 shows a flexbox layout in which three items each have a basis size of 200 pixels with the same growth value of 1.

Figure 5–30

## Shrinking flex items smaller than their basis size



As shown in the figure, as long as the flexbox is at least 600 pixels wide, the items will equally share a single row. However, once the flexbox size falls below 600 pixels, the three items can no longer share that row and the last item is wrapped to a new row. Once on that new row, it's free to fill up the available space while the first two items equally share the space on the first row. As the flexbox continues to contract, falling below 400 pixels, the first two items can no longer share a row and the second item now wraps to its own row. At this point the three items fill separate rows and as the flexbox continues to shrink, their sizes also shrink.

If the flexbox doesn't wrap to a new line as it is resized, then the flex items will continue to shrink, still sharing the same row or column. The rate at which they shrink below their basis size is given by the following `flex-shrink` property

```
flex-shrink: value;
```

where *value* is a non-negative value that expresses the shrink rate of the flex item relative to the shrinkage of the other items in the flexbox. The default `flex-shrink` value is 1. For example, in the following style rules, item1 and item2 will share the flexbox equally as long as the width of the flexbox is 400 pixels or greater.

```
div {
 display: flex;
 flex-wrap: nowrap;
}
div #item1 {
 flex-basis: 200px;
 flex-grow: 1;
 flex-shrink: 3;
}
```

```
div #item2 {
 flex-basis: 200px;
 flex-grow: 1;
 flex-shrink: 1;
}
```

However, once the flexbox falls below 400 pixels, the two items begin to shrink with item1 losing 3 pixels for every 1 pixel lost by item2. Note that if the `flex-shrink` value is set to 0, then the flex item will not shrink below its basis value, making that basis value the minimum width or height of the item.

## The flex Property

All of the size values described above are usually combined into the following `flex` property

```
flex: grow shrink basis;
```

where *grow* defines the growth of the flex item, *shrink* provides its shrink rate, and *basis* sets the item's initial size. The default `flex` value is

```
flex: 0 1 auto;
```

which automatically sets the size of the flex item to match its content or the value of its width and height property. The flex item will not grow beyond that size but, if necessary, it will shrink as the flexbox contracts.

The `flex` property supports the following keywords:

- **auto** Use to automatically resize the item from its default size (equivalent to `flex: 1 1 auto;`)
- **initial** The default value (equivalent to `flex: 0 1 auto;`)
- **none** Use to create an inflexible item that will not grow or shrink (equivalent to `flex: 0 0 auto;`)
- **inherit** Use to inherit the flex values of its parent element

As with other parts of the flex layout model, the `flex` property has gone through several syntax changes on its way to its final specification. To support older browsers, use the browser extensions: `-webkit-box`, `-moz-box`, `-ms-flexbox`, `-webkit-flex`, and `flex` in that order.

### REFERENCE

#### Sizing Flex Items

- To set the initial size of a flex item, apply the style

```
flex-basis: size;
```

where *size* is measured in one of the CSS units of measurement or as a percentage of the size of the flexbox or the keyword `auto` (the default).

- To define the rate at which a flex item grows from its basis size, apply the style

```
flex-grow: value;
```

where *value* is a non-negative value that expresses the growth of the flex item relative to the growth of the other items in the flexbox (the default is 0).

- To define the rate at which a flex item shrinks below its basis value, apply

```
flex-shrink: value;
```

where *value* is a non-negative value that expresses the shrink rate of the flex item relative to other items in the flexbox (the default is 0).

- To define the overall resizing of a flex item, apply

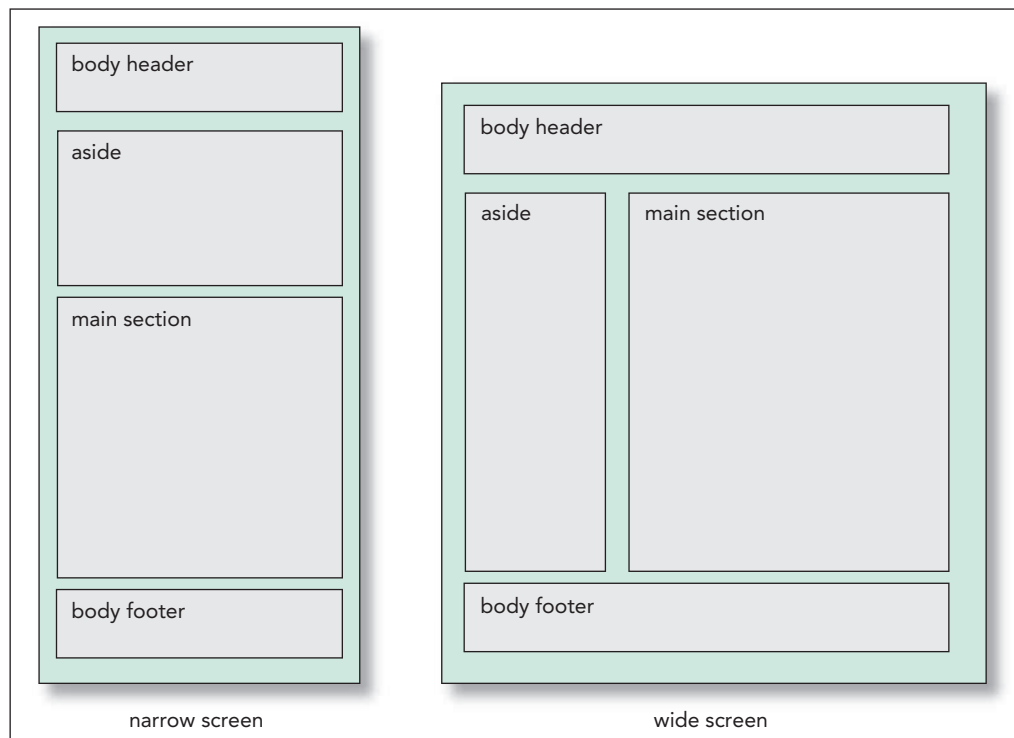
```
flex: grow shrink basis;
```

where *grow* defines the growth of the flex item, *shrink* provides its shrink rate, and *basis* sets the item's initial size.

## Applying a Flexbox Layout

Now that you've seen how to size items within a flexbox, you can return to the layout for the Pre-K Classes page at Trusted Friends Daycare. The `body` element, which you already set up as a flexbox, has four child elements: the page header, an `aside` element describing the daily class schedule, a `section` element describing the classes, and the page footer. Marjorie wants the header and the footer to always occupy a single row at 100% of the width of the page body. For wide screens, she wants the `aside` and `section` elements displayed side-by-side with one-fourth of the width assigned to the `aside` element and three-fourths to the `section` element. For narrow screens, she wants the `aside` and `section` elements displayed within a single column. Figure 5–31 displays the flex layout that Marjorie wants you to apply.

**Figure 5–31** Proposed flex layout for the Pre-K page



Using the techniques of the first session, this would require media queries with one grid layout for narrow screens and a second grid layout for wide screens. However, you can accomplish the same effect with a single flex layout. First, you set the width of the body header and footer to 100% because they will always occupy their own row:

```
header, footer {
 width: 100%;
}
```

Then, you set the basis size of the `aside` and `section` elements to 120 and 361 pixels respectively. As long as the screen width is 481 pixels or greater, these two elements will be displayed side-by-side; however, once the screen width drops below 481 pixels, the elements will wrap to separate rows as illustrated in the narrow screen image in Figure 5–31. Because you want the main `section` element to grow at a rate three times faster than the `aside` element (in order to maintain the 3:1 ratio in their sizes), you set the `flex-growth` values to 1 and 3 respectively. The flex style rules are

```
aside {
 flex: 1 1 120px;
}
```

```
section#main {
 flex: 3 1 361px;
}
```

Note that you choose 481 pixels as the total initial size of the two elements to match the cutoff point in the media query between mobile and tablet/desktop devices. Generally, you want your flex items to follow the media query cutoffs whenever possible. Add these style rules to the `tf_flex.css` style sheet now.

### To define the flex layout:

1. Within the **tf\_flex.css** file in your editor, add the following style rules to the Base Flex Styles section:

```
header, footer {
 width: 100%;
}

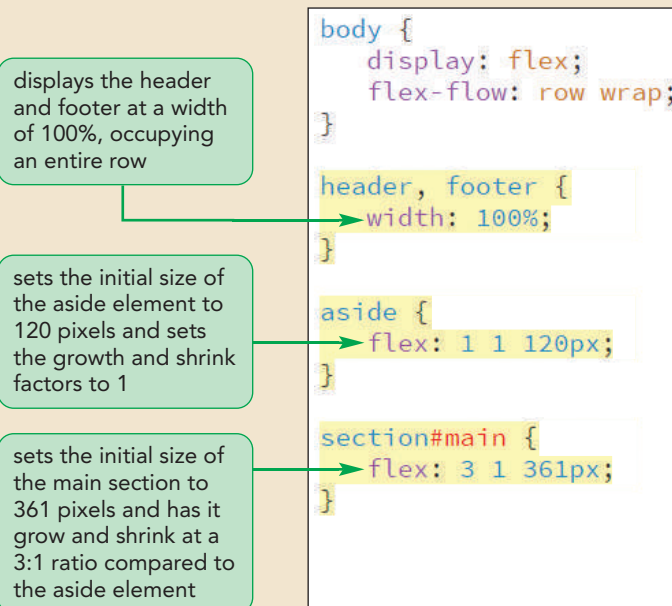
aside {
 flex: 1 1 120px;
}

section#main {
 flex: 3 1 361px;
}
```

Figure 5–32 highlights the newly added style rules to define the flex item sizes.

Figure 5–32

### Set the flex properties of the flex items in the page body



2. Save your changes to the file and then open the `tf_prek.html` file in your web browser.
3. Change the size of the browser window or use the device emulator tools in your browser to view the page under different screen widths. As shown in Figure 5–33, the layout of the page changes as the screen narrows and widens.

Figure 5–33

Flex layout under different screen widths



Flexboxes can be nested within one another and a flex item can itself be a flexbox for its child elements. Within the topics section, Marjorie has created six articles describing different features of the center's pre-k curriculum. She wants these articles to share equal space within a row-oriented flexbox, with each article given a basis size of 200 pixels. The style rules are:

```
section#topics {
 display: flex;
 flex-flow: row wrap;
}

section#topics article {
 flex: 1 1 200px;
}
```

Marjorie also wants the items in the navigation list to appear in a row-oriented flexbox for tablet and desktop devices by adding the following style rules to the media query for screen devices whose width exceeds 480 pixels:

```
nav.horizontal ul {
 display: flex;
 flex-flow: row nowrap;
}

nav.horizontal li {
 flex: 1 1 auto;
}
```

The navigation list items will appear in a single row with no wrapping and the width of each item will be determined by the item's content so that longer entries are given more horizontal space. With the growth and shrink values set to 1, each list item will grow and shrink at the same rate, keeping the layout consistent across different screen widths.

Add these style rules now.

### To lay out the topic articles and navigation list:

1. Return to the **tf\_flex.css** file in your editor and go to the Base Flex Styles section.
2. Add the following style rules to create a flex layout for the page articles.

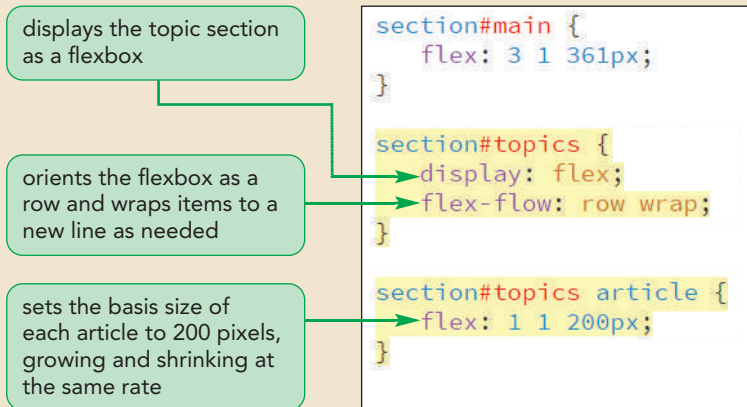
```
section#topics {
 display: flex;
 flex-flow: row wrap;
}

section#topics article {
 flex: 1 1 200px;
}
```

Figure 5–34 highlights the style rules for the article topics layout.

Figure 5–34

### Creating a flex layout for articles in the topics section



3. Scroll down to the media query for tablet and desktop devices and add the following style rule to create a flex layout for the navigation list. (Indent your code to set it off from the media query braces.)

```
nav.horizontal ul {
 display: flex;
 flex-flow: row nowrap;
}

nav.horizontal li {
 flex: 1 1 auto;
}
```

Figure 5–35 highlights the style rules for the navigation list and list items.

Figure 5–35

Creating a flex layout for the navigation list

orients the flexbox in the row direction with no wrapping

bases the size of each item on its content and has them grow and shrink at the same rate

```
@media only screen and (min-width: 481px) {
 nav.horizontal ul {
 display: flex;
 flex-flow: row nowrap;
 }
 nav.horizontal li {
 flex: 1 1 auto;
 }
}
```

displays the unordered list as a flexbox

4. Save your changes to the file and reload the `tf_prek.html` file in your web browser.
5. View the page under different screen widths and verify that, for tablet and desktop screen widths, the navigation list entries appear in a single row. Also, verify that the articles in the topics section flex from a single column layout to two or more rows of content. See Figure 5–36.

Figure 5–36

Flex layout under a desktop screen width

navigation list appears in a single row for tablet and desktop devices

articles flex in layout from a single column to a 2 × 3 grid, depending on the screen width



Marjorie likes how using flexboxes has made it easy to create layouts that match a wide variety of screen sizes. However, she is concerned that under the single column layout used for mobile devices the daily schedule appears first before any description of the classes. She would like the daily schedule to appear at the bottom of the page. She asks if you can modify the layout to achieve this.

## Reordering Page Content with Flexboxes

One of the principles of web page design is to, as much as possible, separate the page content from page design. However, a basic feature of any design is the order in which the content is displayed. Short of editing the content of the HTML file, there is not an easy way to change that order.

That at least was true before flexboxes. Under the flexbox model you can place the flex items in any order you choose using the following `order` property

```
order: value;
```

where *value* is an integer where items with smaller `order` values are placed before items with larger `order` values. For example, the following style arranges the `div` elements starting first with `item2`, followed by `item3`, and ending with `item1`. This is true regardless of how those `div` elements have been placed in the HTML document.

```
div#item1 {order: 100;}
div#item2 {order: -1;}
div#item3 {order: 5;}
```

### TIP

If flex items have the same `order` value, they are arranged in document order.

Note that `order` values can be negative. The default `order` value is 0.

For complete cross-browser support, you can apply the following browser extensions with flex item ordering:

```
-webkit-box-ordinal-group: value;
-moz-box-ordinal-group: value;
-ms-flex-order: value;
-webkit-order: value;
order: value;
```

Most current browsers support the CSS specifications, so you will limit your code to those properties.

### REFERENCE

#### Reordering a Flex Item

- To reorder a flex item, apply the style

```
order: value;
```

where *value* is an integer where items with smaller `order` values are placed before items with larger `order` values.

For mobile devices, Marjorie wants the page header displayed first, followed by the main section, the `aside` element, and ending with the page footer. Add style rules now to the mobile device media query in the `tf_flex.css` style sheet to reorder the flex items.

### To lay out the topic articles and navigation list:

1. Return to the **tf\_flex.css** file in your editor and go to the Mobile Devices media query.
2. Add the following style rules, indented to offset them from the braces in the media query:

```
aside {
 order: 99;
}
footer {
 order: 100;
}
```

Note that the other flex items will have a default order value of 0 and thus will be displayed in document order before the `aside` and `footer` elements.

Figure 5–37 highlights the style rules to set the order of the `aside` and `footer` elements.

Figure 5–37

### Setting the order of a flex item

places the aside element before the body footer

places the body footer at the end of the flexbox

```
/* =====
Mobile Styles: 0 to 480px
===== */

@media only screen and (max-width: 480px) {

 aside {
 order: 99;
 }

 footer {
 order: 100;
 }

}
```

3. Save your changes to the file and then reload the `tf_prek.html` file in your web browser.
4. Reduce the width of the browser window below 480 pixels to show the mobile layout. Verify that the class schedule now appears at the bottom of the file directly before the body footer.

You've completed the ordering and flex layout of the Pre-K Classes page. You'll conclude your review of flexboxes by examining how flex items can be arranged within the flexbox container.

## Exploring Flexbox Layouts

You can control how flex items are laid out using the `justify-content`, `align-items`, and `align-content` properties. You examine each property to see how flexboxes can be used to solve layout problems that have plagued web designers for many years.

### Aligning Items along the Main Axis

Recall from Figure 5–26 that flexboxes have two axes: the main axis along which the flex items flow and the cross axis, which is perpendicular to the main axis. By default, flex items are laid down at the start of the main axis. To specify a different placement, apply the following `justify-content` property

```
justify-content: placement;
```

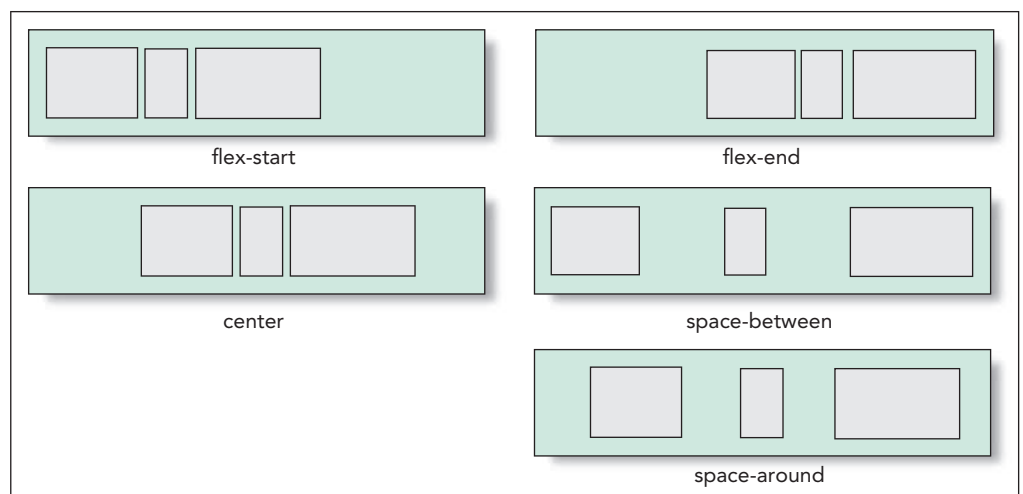
where *placement* is one of the following keywords:

- `flex-start` Items are positioned at the start of the main axis (the default).
- `flex-end` Items are positioned at the end of the main axis.
- `center` Items are centered along the main axis.
- `space-between` Items are distributed evenly with the first and last items aligned with the start and end of the main axis.
- `space-around` Items are distributed evenly along the main axis with equal space between them and the ends of the flexbox.

Figure 5–38 shows the impact of different `justify-content` values on a flexbox oriented horizontally.

Figure 5–38

Values of the `justify-content` property



Remember that, because items can flow in any direction within a flexbox, these diagrams will look different for flexboxes under column orientation or when the content flows from the right to the left. Note that the `justify-content` property has no impact when the items are flexed to fill the entire space. It is only impactful for flex items with fixed sizes that do not fill in the entire flexbox.

## Aligning Flex Lines

The `align-content` property is similar to the `justify-content` property except that it arranges multiple lines of content along the flexbox's cross axis. The syntax of the `align-content` property is:

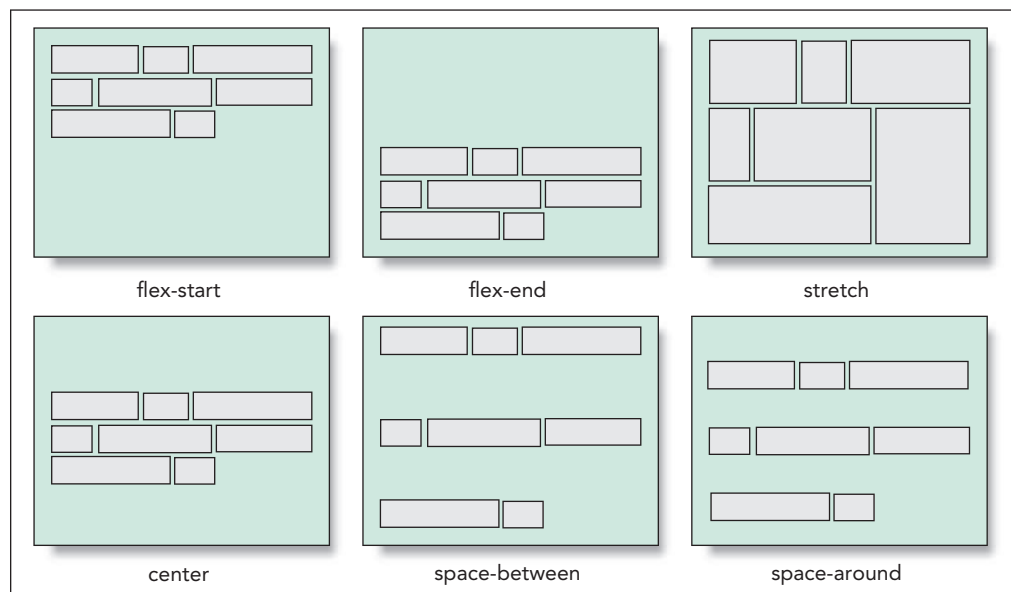
```
align-content: value;
```

where `value` is one of the following keywords:

- `flex-start` Lines are positioned at the start of the cross axis.
- `flex-end` Lines are positioned at the end of the cross axis.
- `stretch` Lines are stretched to fill up the cross axis (the default).
- `center` Lines are centered along the cross axis.
- `space-between` Lines are distributed evenly with the first and last lines aligned with the start and end of the cross axis.
- `space-around` Lines are distributed evenly along the cross axis with equal space between them and the ends of the cross axis.

Figure 5–39 displays the effect of the `align-content` values on three lines of flex items arranged within a flexbox.

**Figure 5–39** Values of the `align-content` property



Note that the `align-content` property only has an impact when there is more than one line of flex items, such as occurs when wrapping is used with the flexbox.

## Aligning Items along the Cross Axis

Finally, the `align-items` property aligns each flex item about the cross axis, having the syntax

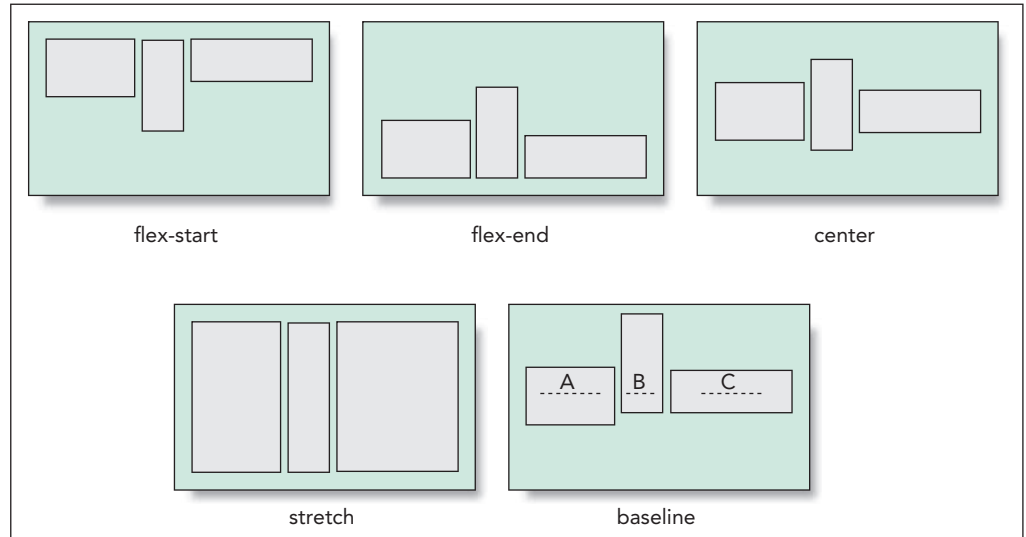
```
align-items: value;
```

where `value` is one of the following keywords:

- `flex-start` Items are positioned at the start of the cross axis.
- `flex-end` Items are positioned at the end of the cross axis.
- `center` Items are centered along the cross axis.
- `stretch` Items are stretched to fill up the cross axis (the default).
- `baseline` Items are positioned so that the baselines of their content align.

Figure 5–40 displays the effect of the `align-items` values on three flex items placed within a single line.

Figure 5–40

Values of the `align-items` property

Note that the `align-items` property is only impactful when there is a single line of flex items. With multiple lines, you use the `align-content` property to layout the flexbox content. To align a single item out of a line of flex items, use the following `align-self` property

```
align-self: value;
```

where *value* is one of the alignment choices supported by the `align-items` property. For example, the following style rule places the footer at the end of the flexbox cross axis, regardless of the placement of the other flex items.

```
footer {
 align-self: flex-end;
}
```

Both the `align-content` and `align-items` properties have a default value of `stretch` so that the flex items are stretched to fill the space along the cross-axis. The effect is that all flex items within a row will share a common height. This can be observed earlier in Figure 5–36 in which all of the article boxes have the same height, regardless of their content. It's difficult to achieve this simple effect in a grid layout unless the height of each item is explicitly defined, but flexboxes do it automatically.

## INSIGHT

### Solving the Centering Problem with Flexboxes

One of the difficult layout challenges in web design is vertically centering an element within its container. While there are many different fixes and “hacks” to create vertical centering, it has not been easily achieved until flexboxes. By using the `justify-content` and `align-items` properties, you can center an object or group of objects within a flexbox container. For example, the following style rule centers the child elements of the `div` element both horizontally and vertically:

```
div {
 display: flex;
 justify-content: center;
 align-content: center;
}
```

For a single object or a group of items on a single line within a container, use the `align-items` property as follows:

```
div {
 display: flex;
 justify-content: center;
 align-items: center;
}
```

You can also use the `align-self` property to center one of the items in the flexbox, leaving the other items to be placed where you wish.

## Creating a Navicon Menu

A common technique for mobile websites is to hide navigation menus but to indicate their presence with a **navicon**, which is a symbol usually represented as three horizontal lines ☰. When the user hovers or touches the icon, the navigation menu is revealed.

Marjorie has supplied you with a navicon image that she wants you to use with the mobile layout of the Pre-K Classes page. Add this image to the Pre-K Classes web page within the navigation list in the body header.

### To insert the navicon image:

1. Return to the **tf\_prek.html** file in your editor.
2. Directly after the opening `<nav>` tag in the body header, insert the following hypertext link and inline image.

```



```

Figure 5–41 highlights the code to create the navicon.

Figure 5–41

## Inserting the navicon

```

<nav class="horizontal">

 Home
 Infants
 Toddlers
 Pre-K
 After School

</nav>

```

navicon image

Next, you'll insert the styles to hide and display the contents of the navigation list in a style sheet named `tf_navicon.css`. You'll apply the same styles for navicon that you used in the last session to hide and display the navigation submenus in the Trusted Friends home page. As with those menus, you'll use the hover pseudo-class to display the navigation list links whenever the user hovers over the navicon, or in the case of mobile devices, touches the navicon. Add these styles now.

## To add styles for the navicon image:

1. Within the document head of the `tf_prek.html` file, add a link to the **tf\_navicon.css** style sheet file after the link for the `tf_flex.css` file. Save your changes to the file.
2. Use your editor to open the **tf\_navicon\_txt.css** files from the `html05` ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **tf\_navicon.css**.
3. By default, the navicon will be hidden from the user. Go to the Base Styles section and add the following style rule:
 

```

a#navicon {
 display: none;
}

```
4. The navicon will be displayed only for mobile devices. Go to the media query for mobile devices and add the following style rule to display the navicon.
 

```

a#navicon {
 display: block;
}

```
5. When the navicon is displayed, you want the contents of the navigation list to be hidden. Add the following style rule within the mobile device media query:
 

```

nav.horizontal ul {
 display: none;
}

```

- 6. Finally, add the following style rule to the mobile device query that displays the contents of the navigation list when the user hovers over the navicon or the contents of the navigation list.

```
a#navicon:hover+ul, nav.horizontal ul:hover {
 display: block;
}
```

Figure 5–42 highlights the style rules for the navicon hypertext link.

Figure 5–42

#### Style rules for the navicon image

```
a#navicon {
 display: none;
}

/* =====
 Mobile Devices: 0 to 480px
 =====
*/

@media only screen and (max-width: 480px) {

 a#navicon {
 display: block;
 }

 nav.horizontal ul {
 display: none;
 }

 a#navicon:hover+ul, nav.horizontal ul:hover {
 display: block;
 }

}
```

- 7. Save your changes to the file and then reload the tf\_prek.html file in your browser or mobile devices. Resize the viewport as needed to display the mobile layout.
- 8. Verify that as you hover over or touch the navicon, the navigation list appears, as shown in Figure 5–43.

Figure 5–43

## Action of the navicon for mobile devices



BenBois/openclickart

9. Verify that hovering over or touching other parts of the page hides the navigation list.

The methods you used in this tutorial to create pulldown menus and navicon menus represent what you can accomplish when limited to CSS and the hover pseudo-class. As you increase your skill and knowledge of HTML, you'll learn other, more efficient ways of creating mobile navigation menus using program scripts and web frameworks. If you want to explore how to take advantage of these tools, search the web for navicon libraries of prewritten code that can be inserted into your website.



## PROSKILLS

### Written Communication: Speeding Up Your Website by Minifying and Compressing

Once your website is working and you are ready to distribute it to the web, you have one task remaining: minifying your code. **Minifying** refers to the process of removing unnecessary characters that are not required for your site to execute properly. For example, the following text in a CSS file contains comments and line returns and blank spaces, which makes the text easy to read, but these features are not required and have no impact on how the browser renders the page:

```
/* Tablet Styles */

nav.horizontal > ul > li {
 display: block;
}
```

A minified version of this code removes the comment and the extraneous white-space characters leaving the following compact version:

```
nav.horizontal>ul>li{display:block;}
```

Minifying has several important advantages:

- Minifying reduces the amount of bandwidth required to retrieve the website because the files are smaller.
- The smaller minified files load faster and are faster to process because extraneous code does not need to be parsed by the browser.
- A faster site provides a better user experience.
- Smaller files means less server space required to host the website.
- Search engines, such as Google, evaluate your website based on page load speed and will downgrade sites with bloated code that take too long to load.

There are several free tools available on the web to automate the minification process including CSS Minifier, Compress HTML, HTML Minifier, and CSS Compressor. Also, many HTML editors include built-in minifying tools. Remember, a minified file is still a text file and can be read (though with difficulty) in a text editor.

To further reduce your file sizes, consider compressing your files using utilities like Gzip. A compressed file is no longer in text format and must be uncompressed before it is readable. All modern browsers support Gzip compression for files retrieved from a server. Make sure you know how to properly configure your web server to serve Gzip-compressed file in a readable format to the browser.

The process of minifying your files is irreversible, so make sure you retain the version with the text in a readable format and all of your comments preserved. Most minifying and compression tools will make a backup of your original files.

You've completed your work on the design of the Pre-K Classes page for Trusted Friends Daycare. In the next session, you'll explore other uses of media queries by designing a page for printed output. You may close your files now.

### Session 5.2 Quick Check

1. Which of the following is *not* a style to display an element as a flexbox?
  - a. `display: -chrome-flex;`
  - b. `display: -webkit-flex;`
  - c. `display: -webkit-box`
  - d. `display: -ms-flexbox;`
2. To display items within a flexbox in a column filled from the bottom upward, use:
  - a. `flex-direction: column up;`
  - b. `flex-direction: column-bottom;`
  - c. `flex-direction: column-reverse;`
  - d. `flex-direction: column-to-top;`
3. To set the initial size of a flexbox item to 250 pixels, use:
  - a. `flex-size: 250px;`
  - b. `flex-basis: 250px;`
  - c. `flex: 250px;`
  - d. `flex-from: 250px;`
4. To set the growth rate of a flexbox item to a rate of 4, use:
  - a. `flex-rate: 4;`
  - b. `flex: 4x;`
  - c. `flex-growth: 4;`
  - d. `flex-grow: 4;`
5. Which of the following sets the `div` element to be equal in size regardless of the size of the flexbox container?
  - a. `div {flex: equal;}`
  - b. `div {flex: 1 1 100px;}`
  - c. `div {flex: 1 1 0px;}`
  - d. `div {flex: 0 0 0px}`
6. To reorder of the placement of a flex item within its flexbox, use:
  - a. `flex-reorder`
  - b. `flex-move`
  - c. `flex-basis;`
  - d. `order`
7. To center flex items along the flexbox's main axis, use:
  - a. `justify-content: center;`
  - b. `align-content: center;`
  - c. `flex-position: center;`
  - d. `flex-main: center;`
8. To center flex items along the flexbox's cross axis, use:
  - a. `justify-content: center;`
  - b. `align-content: center;`
  - c. `flex-position: center;`
  - d. `flex-main: center;`

# Session 5.3 Visual Overview:

```
nav.horizontal, aside, footer {
 display: none;
}
```

The `display` property is set to `none` for objects you don't want printed.

The `@page` rule defines the size and margins of the printed page.

```
@page {
 size: 8.5in 11in portrait;
 margin: 0.5in;
}
```

For print layouts, fonts should be sized in points and widths and heights expressed in inches or centimeters.

```
h1 {
 font-size: 28pt;
 line-height: 30pt;
 margin: 0.3in 0in 0.2in;
}
```

Use the `after` pseudo-element along with the `content` property to display the text of all hypertext URLs.

```
a::after {
 content: " (" attr(href) ") ";
 font-weight: bold;
 word-wrap: break-word;
}
```

Use the `page-break-inside` property to prohibit page breaks within an element.

```
article:nth-of-type(n+2) {
 page-break-before: always;
}
```

Use the `page-break-before` property to insert page breaks before elements.

```
img, ol, ul {
 page-break-inside: avoid;
}
```

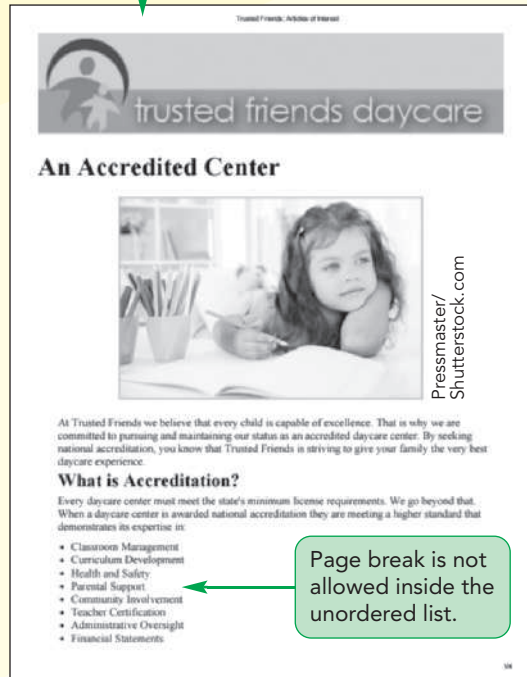
Use the `widows` property to limit the number of lines stranded at the top of a page.

```
p {
 orphans: 3;
 widows: 3;
}
```

Use the `orphans` property to limit the number of lines stranded at the bottom of a page.

# Print Styles

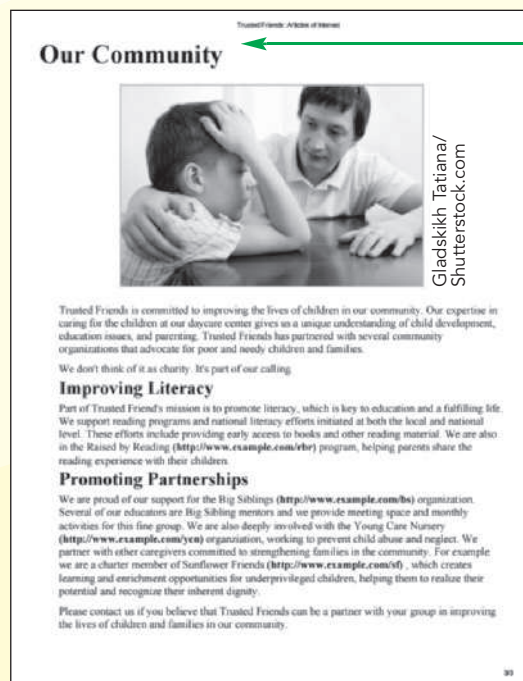
Page size is set at 8.5 inches by 11 inches with a 0.5 inch margin in portrait orientation.



page 1



page 2



page 3

## Designing for Printed Media

So far your media queries have been limited to screens of different widths. In this session you'll explore how to apply media queries to print devices and work with several CSS styles that apply to printed output. To do this you'll create a **print style sheet** that formats the printed version of your web document.

### Previewing the Print Version

Marjorie has created a page containing articles of interest for parents at Trusted Friends Daycare. She has already written the page content and the style sheets for mobile, tablet, and desktop devices. Open the articles document now.

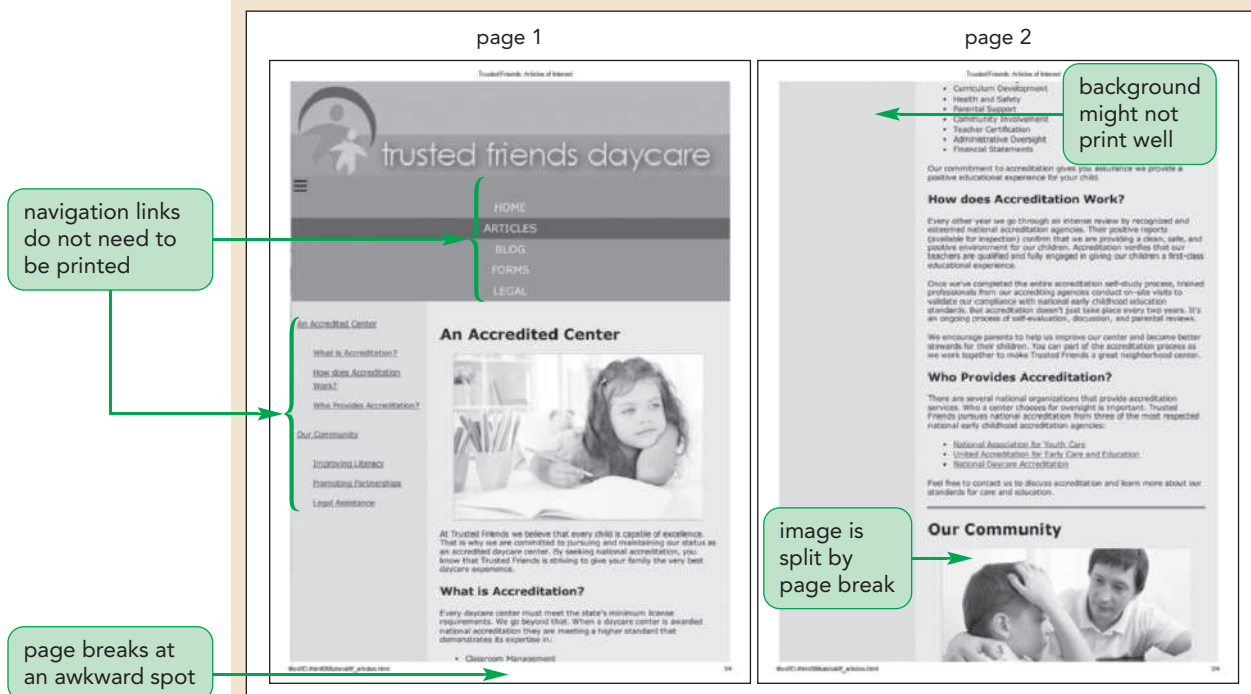
#### To open the Articles of Interest page:

1. Use your editor to open the **tf\_articles.txt.html** file from the html05 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **tf\_articles.html**.
2. Within the document head, create links to the **tf\_reset.css** and **tf\_styles3.css** style sheet files in that order.
3. Scroll through the document to become familiar with its contents and then save your changes to file, but do not close it.
4. Open the **tf\_articles.html** file in your web browser.
5. Take some time to view the contents of the page under different screen resolutions, noting how Marjorie has used responsive design to create different page layouts based on the screen width.
6. Use the Print Preview command within your browser to preview how this page will appear when printed. Figure 5–44 shows a preview of the first two pages of the print version using a black and white printer.

Now, you'll examine how Marjorie's page will appear when printed.

Figure 5–44

Print version of the Articles of Interest page



**Trouble?** Depending on your browser and printer, your print preview might appear different from the preview shown in Figure 5–44.

Browsers support their own internal style sheet to format the print versions of the web pages they encounter. However, their default styles might not always result in the best printouts. Marjorie points out that the print version of her page has several significant problems:

- The printed version includes two navigation lists, neither of which have a purpose in a printout.
- Page breaks have been placed in awkward places, splitting paragraphs and images in two.
- Background colors, while looking good on a screen, might not print well.

Marjorie would like you to design a custom print style sheet that fixes these problems by removing unnecessary page elements and choosing page breaks more intelligently.

## Applying a Media Query for Printed Output

To apply a print style sheet, you use the `media` attribute in your `link` elements to target style sheets to either screen devices or print devices. Modify the `tf_articles.html` file now to access a new style sheet named `tf_print.css` into which you include your print styles.

### To access a print style sheet:

1. Use your editor to open the `tf_print.txt.css` file from the `html05 ► tutorial` folder. Enter **your name** and **the date** in the comment section and save it as `tf_print.css`.
2. Return to the `tf_articles.html` file in your editor. Add the attribute `media="all"` to the `link` element for the `tf_reset.css` style sheet to apply it to all devices.
3. Add the attribute `media="screen"` to the `link` element for the `tf_styles3.css` style sheet to apply it only to screen devices.
4. Add the following `link` element for print styles:

```
<link href="tf_print.css" rel="stylesheet" media="print" />
```

Figure 5–45 highlights the revised `link` elements in the file.

To avoid mixing screen styles with print styles, identify styles common to both devices with the media type `all`.

Figure 5–45

### Style sheets for different devices



5. Save your changes to the file and close it.

You'll start designing the print version of this page by hiding those page elements that should not be printed, including the navigation list, the `aside` element, and the body footer.

### To hide elements in the print version:

1. Return to the `tf_print.css` file in your editor.
2. Go to the Hidden Objects section and add the following style rule:

```
nav.horizontal, aside, footer {
 display: none;
}
```

Figure 5–46 highlights the style rule to hide page elements.

Figure 5–46

### Hiding page elements for printing

sets the display of the navigation list, aside element, and body footer to do not display

```
/* Hidden Objects */
nav.horizontal, aside, footer {
 display: none;
}
```

3. Save your changes to the file and then reload the `tf_articles.html` file in your browser and preview the printed output. Verify that the navigation lists, `aside` elements, and body footer are not displayed in the printed version.

Next, you'll define the page size of the print version of this document.

## Working with the @page Rule

In CSS every printed page is defined as a **page box**, composed of two areas: the **page area**, which contains the content of the document, and the **margin area**, which contains the space between the printed content and the edges of the page.

Styles are applied to the page box using the following `@page` rule

```
@page {
 style rules
}
```

where *style rules* are the styles applied to the page. The styles are limited to defining the page size and the page margin. For example, the following `@page` rule sets the size of the page margin to 0.5 inches:

```
@page {
 margin: 0.5in;
}
```

The page box does not support all of the measurement units you've used with the other elements. For example, pages do not support the `em` or `ex` measurement units. In general, you should use measurement units that are appropriate to the dimensions of your page, such as inches or centimeters.

## Setting the Page Size

Because printed media can vary in size and orientation, the following `size` property allows web authors to define the dimensions of the printed page

```
size: width height;
```

### TIP

Users can override the page sizes and orientations set in `@page` rule by changing the options in their print dialog box.

where *width* and *height* are the width and height of the page. Thus to define a page that is 8.5 inches wide by 11 inches tall with a 1-inch margin, you would apply the following style rule:

```
@page {
 size: 8.5in 11in;
 margin: 1in;
}
```

You can replace the *width* and *height* values with the keyword `auto` (to let browsers determine the page dimensions) or `inherit` (to inherit the page size from the parent element). If a page does not fit into the dimensions specified in the `@page` rule, browsers will either rotate the page or rescale it to fit within the defined page size.

## Using the Page Pseudo-Classes

By default, the `@page` rule is applied to every page of the printed output. However, if the output covers several pages, you can define different styles for different pages by adding the following pseudo-class to the `@page` rule:

```
@page:pseudo-class {
 style rules
}
```

where *pseudo-class* is `first` for the first page of the printout, `left` for the pages that appear on the left in double-sided printouts, or `right` for pages that appear on the right in double-sided printouts. For example, if you are printing on both sides of the paper, you might want to create mirror images of the margins for the left and right pages of the printout. The following styles result in pages in which the inner margin is set to 5 centimeters and the outer margin is set to 2 centimeters:

```
@page:left {margin: 3cm 5cm 3cm 2cm;}
@page:right {margin: 3cm 2cm 3cm 5cm;}
```

## Page Names and the Page Property

To define styles for pages other than the first, left, or right, you first must create a page name for those styles as follows

```
@page name {
 style rules
}
```

where *name* is the label given to the page. The following code defines a page style named `wideMargins` used for pages in which the page margin is set at 10 centimeters on every side:

```
@page wideMargins {
 margin: 10cm;
}
```

Once you define a page name, you can apply it to any element in your document. The content of the element will appear on its own page, with the browser automatically

inserting page breaks before and after the element if required. To assign a page name to an element, you use the following *page* property

```
selector {
 page: name;
}
```

where *selector* identifies the element that will be displayed on its own page, and *name* is the name of a previously defined page style. Thus the following style rule causes all block quotes to be displayed on separate page(s) using the styles previously defined as the *wideMargins* page:

```
blockquote {
 page: wideMargins;
}
```

## REFERENCE

### Creating and Applying Page Styles

- To define a page box for the printed version of a document, use the CSS rule

```
@page {
 size: width height;
}
```

where *width* and *height* are the width and height of the page.

- To define the page styles for different output pages, use the rule

```
@page:pseudo-class {
 style rules
}
```

where *pseudo-class* is *first* for the first page of the printout, *left* for the pages that appear on the left in double-sided printouts, or *right* for pages that appear on the right in double-sided printouts.

- To create a named page for specific page styles, apply the rule

```
@page name {
 style rules
}
```

where *name* is the label assigned to the page style.

- To apply a named page style, use the rule

```
selector {
 page: name;
}
```

where *selector* identifies the element that will be displayed on its own page, and *name* is the name of a previously defined page style.

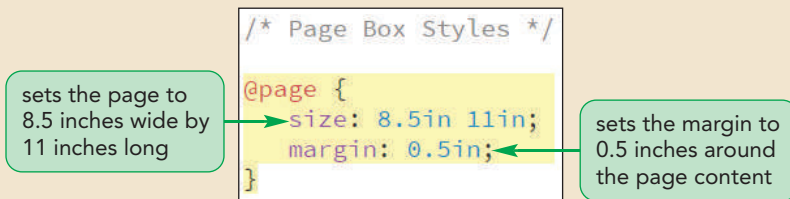
You'll use the *@page* rule to define the page size for the printed version of the Articles of Interest document. Marjorie suggests that you set the page size to 8.5 × 11 inches with 0.5-inch margins.

**To define the printed page size:**

1. Return to the **tf\_print.css** file in your editor.
2. Go to the Page Box Styles section and add the following rule:

```
@page {
 size: 8.5in 11in;
 margin: 0.5in;
}
```

Figure 5–47 highlights the rule to set the page size.

**Figure 5–47****Setting the page size**

3. Save your changes to the file.

With printed output, widths and heights are measured not in pixels but in inches or centimeters. Font sizes are not measured in pixels but rather in points. With that in mind, create styles to format the sizes of the text and graphics on the page.

**To format the printed text:**

1. Go to the Typography Styles section and insert the following styles to format the appearance of h1 and h2 headings and paragraphs:

```
h1 {
 font-size: 28pt;
 line-height: 30pt;
 margin: 0.3in 0in 0.2in;
}

h2 {
 font-size: 20pt;
 margin: 0.1in 0in 0.1in 0.3in;
}

p {
 font-size: 12pt;
 margin: 0.1in 0in 0.1in 0.3in;
}
```

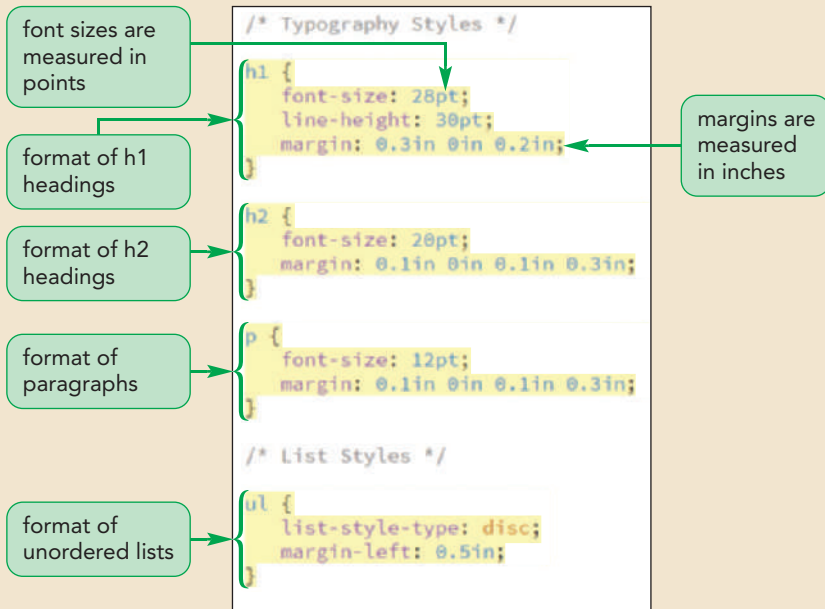
2. Within the List Styles section, add the following style rules to format the appearance of unordered lists:

```
ul {
 list-style-type: disc;
 margin-left: 0.5in;
}
```

Figure 5–48 shows the typography and list styles in the print style sheet.

Figure 5–48

### Typographical formats



Next, you'll format the appearance of images on the page.

### To format the printed images:

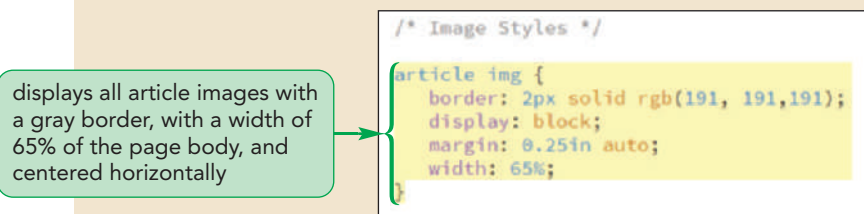
1. Within the Image Styles section, add the following style rule to format the appearance of inline images within each `article` element:

```
article img {
 border: 2px solid rgb(191, 191,191);
 display: block;
 margin: 0.25in auto;
 width: 65%;
}
```

Figure 5–49 shows the style rule for inline images on the printed page.

Figure 5–49

### Image formats



2. Save your changes to the style sheet and then reload the `tf_articles.html` file in your browser and preview the appearance of the printed page. Figure 5–50 shows the appearance of the first page printed using a black and white printer.

Figure 5–50

Preview of the first printed page

print version  
of the images

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Marjorie notices that all of the hyperlinks in the document appear in blue and underlined as determined by the default browser style. While this identifies the text as a hypertext link, it doesn't provide the reader any information about that link. She asks you to modify the style sheet to fix this problem.

## Formatting Hypertext Links for Printing

Because printouts are not interactive, it's more useful for the reader to see the URL of a hypertext link so that he or she can access that URL at another time. To append the text of a link's URL to the linked text, you can apply the following style rule:

```
a::after {
 content: " (" attr(href) ") ";
}
```

### TIP

Be sure to include blank spaces around the href value so that the URL does not run into the surrounding text.

This style rule uses the `after` pseudo-element along with the `content` property and the `attr()` function to retrieve the text of the `href` attribute and add it to the contents of the `a` element.

You should be careful when using this technique. Appending the text of a long and complicated URL will make your text difficult to read and might break your page layout if the text string extends beyond the boundaries of its container. One way to solve this problem is to apply the following `word-wrap` property to the URL text:

```
word-wrap: type;
```

where `type` is either `normal` (the default) or `break-word`. A value of `normal` breaks a text string only at common break points such as the white space between words. A value of `break-word` allows long text to be broken at arbitrary points, such as within a word, if that is necessary to make the text string fit within its container. Because a URL has no common break points such as blank spaces, applying the `break-word` option ensures that the text string of the URL will be kept to a manageable length by breaking it as needed to fit within the page layout.

### REFERENCE

#### Formatting Hypertext for Printing

- To add the URL after a hypertext link, apply the style rule:

```
a::after {
 content: " (" attr(href) ") ";
}
```

- To automatically wrap the text of long URLs as needed, add the following style to the link text:

```
word-wrap: break-word;
```

Format the appearance of hypertext links in the document to display each link's URL and to display the hypertext links in a black bold font with no underlining, then use the `word-wrap` property to keep long URLs from extending beyond the boundaries of their container.

### To format the hypertext links:

1. Return to the **tf\_print.css** file in your editor and go to Hypertext Styles section, inserting the following styles to format the appearance of all hypertext links, appending the URL of each link:

```
a {
 color: black;
 text-decoration: none;
}

a::after {
 content: " (" attr(href) ") ";
 font-weight: bold;
 word-wrap: break-word;
}
```

Figure 5–51 describes the style rules used to format printed hypertext links.

Figure 5–51

### Formatting printed hypertext links

displays hypertext links in black with no underlining

adds the URL of the hypertext link in a bold font

```
/* Hypertext Styles */

a {
 color: black;
 text-decoration: none;
}

a::after {
 content: " (" attr(href) ") ";
 font-weight: bold;
 word-wrap: break-word;
}
```

allows the URL to wrap in order to preserve page layout

2. Save your changes to the style sheet and then reload the **tf\_articles.html** file in your browser and preview the page printout. Figure 5–52 shows the appearance of the printed hypertext links found on the second page of Marjorie's printout.

Figure 5–52

Preview of the hypertext links on page 2

Trusted Friends: Articles of Interest

## How does Accreditation Work?

Every other year we go through an intense review by recognized and esteemed national accreditation agencies. Their positive reports (available for inspection) confirm that we are providing a clean, safe, and positive environment for our children. Accreditation verifies that our teachers are qualified and full engaged in giving our children a first-class educational experience.

Once we've completed the entire accreditation self-study process, trained professionals from our accrediting agencies conduct on-site visits to validate our compliance with national early childhood education standards. But accreditation doesn't just take place every two years. It's an ongoing process of self-evaluation, discussion, and parental reviews. We encourage our parents to help us improve our center and become better stewards for their children.

## Who Provides Accreditation?


Trusted Friends pursues national accreditation from three of the most respected national early childhood accreditation agencies:

- National Association for Youth Care (<http://www.example.com/nayc>)
- United Accreditation for Early Care and Education (<http://www.example.com/uaece>)
- National Daycare Accreditation (<http://www.example.com/nda>)

Feel free to contact us to discuss accreditation and learn more about our standards for care and education.

URL of each hypertext link

## Our Community



Trusted Friends is committed to improving the lives of children in our community. Our expertise in caring for the children at our daycare center gives us a unique understanding of child development, education issues, and parenting. Trusted Friends has partnered with several community organizations that advocate for poor and needy children and families. We don't think of it as charity. It's part of our calling.

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You can search the web for several free scripting tools that give you more options for how your URLs should be printed, including scripts that automatically append all URLs as footnotes at the end of the printed document.

## Working with Page Breaks

When a document is sent to a printer, the browser determines the location of the page breaks unless that information is included as part of the print style sheet. To manually insert a page break either directly before or directly after an element, apply the following `page-break-before` or `page-break-after` properties:

```
page-break-before: type;
page-break-after: type;
```

where `type` has the following possible values:

- `always` Use to always place a page break before or after the element
- `avoid` Use to never place a page break
- `left` Use to place a page break where the next page will be a left page
- `right` Use to place a page break where the next page will be a right page
- `auto` Use to allow the printer to determine whether or not to insert a page break
- `inherit` Use to insert the page break style from the parent element

For example, if you want each `h1` heading to start on a new page, you would apply the following style rule to insert a page break before each heading:

```
h1 {
 page-break-before: always;
}
```

### REFERENCE

#### Adding a Page Break

- To set the page break style directly before an element, apply the property  
`page-break-before: type;`  
 where `type` is `always`, `avoid`, `left`, `right`, `auto`, or `inherit`.
- To set the page break style directly after an element, apply  
`page-break-after: type;`

After the first article, Marjorie wants each subsequent article to start on a new page. To select every article after the initial article, use the selector

```
article:nth-of-type(n+2)
```

which selects the second, third, fourth, and so on `article` elements in the document (see “Exploring the `nth-of-type` Pseudo-class” in Tutorial 2.) To ensure that each of the selected articles starts on a new page, insert the page break before the article using the following style rule:

```
article:nth-of-type(n+2) {
 page-break-before: always;
}
```

Add this style rule to the print style sheet now.

### To print each article on a new page:

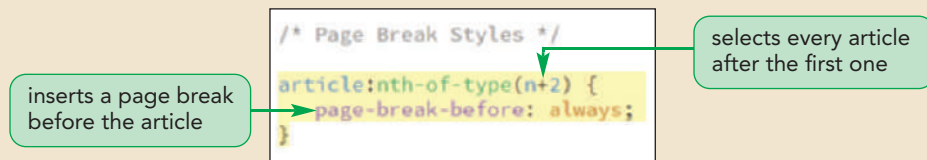
1. Go to the Page Break Styles section and insert the following style rule:

```
article:nth-of-type(n+2) {
 page-break-before: always;
}
```

Figure 5–53 highlights the style rule to insert the article page breaks.

Figure 5–53

### Adding page breaks before the document articles



2. Save your changes to the file and then reload the tf\_articles.html file in your browser and preview the printed page. Verify that the second article in the document on Community Involvement starts on a new page.

Next, you'll explore how to remove page breaks from the printed version of your web page.

### INSIGHT

#### How Browsers Set Automatic Page Breaks

Browsers establish page breaks automatically, unless you manually specify the page breaks with a print style sheet. By default, browsers insert page breaks using the following guidelines:

- Insert all of the manual page breaks as indicated by the `page-break-before`, `page-break-after`, and `page-break-inside` properties
- Break the pages as few times as possible
- Make all pages that don't have a forced page break appear to have the same height
- Avoid page breaking inside page elements that have a border
- Avoid page breaking inside a web table
- Avoid page breaking inside a floating element

Other styles from the print style sheet are applied only after attempting to satisfy these constraints. Note that different browsers apply page breaks in different ways, so while you can apply general rules to your print layout, you cannot, at the current time, make the print versions completely consistent across browsers.

## Preventing Page Breaks

You can prevent a page break by using the keyword `avoid` in the `page-break-after` or `page-break-before` properties. For example, the following style rule prevents page breaks from being added after any heading.

```
h1, h2, h3, h4, h5, h6 {
 page-break-after: avoid;
}
```

Unfortunately in actual practice, most current browsers don't reliably support prohibiting page breaks in this fashion. Thus, to prevent page breaks after an element, you will usually have to manually insert a page break before the element so that the element is moved to the top of the next page.

For other print layouts, you will want to prevent page breaks from being placed inside an element. This usually occurs when you have a long string of text that you don't want broken into two pages. You can prevent printers from inserting a page break by using the following `page-break-inside` property

```
page-break-inside: type;
```

where `type` is `auto`, `inherit`, or `avoid`. Thus, to prevent a page break from appearing within any image you can apply the following style rule:

```
img {
 page-break-inside: avoid;
}
```

Unlike the `page-break-before` and `page-break-after` properties, almost all current browsers support the use of the `avoid` keyword for internal page breaks.

## REFERENCE

### Preventing Page Breaks Inside an Element

- To prevent a page break from occurring within an element, apply the style:

```
page-break-inside: avoid;
```

Marjorie asks you to revise the print style sheet to prevent page breaks from occurring within images, ordered lists, and unordered lists.

### To avoid page breaks:

- Return to the `tf_print.css` file in your editor and go to the Page Break Styles section and insert the following style rule:

```
img, ol, ul {
 page-break-inside: avoid;
}
```

Figure 5–54 highlights the style rule to avoid page breaks in lists and images.

Figure 5–54

### Avoiding line breaks within lists and images

avoids line breaks within lists and images

```
/* Page Break Styles */
article:nth-of-type(n+2) {
 page-break-before: always;
}
img, ol, ul {
 page-break-inside: avoid;
}
```

- Save your changes to the file.

Note that the `avoid` type does not guarantee that there will never be a page break within the element. If the content of an element exceeds the dimensions of the sheet of paper on which it's being printed, the browser will be forced to insert a page break.

## Working with Widows and Orphans

Page breaks within block elements, such as paragraphs, can often leave behind widows and orphans. A widow is a fragment of text left dangling at the top of page, while an orphan is a text fragment left at the bottom of a page. Widows and orphans generally ruin the flow of the page text, making the document difficult to read. To control the size of widows and orphans, CSS supports the following properties:

```
widows: value;
orphans: value;
```

where *value* is the number of lines that must appear within the element before a page break can be inserted by the printer. The default value is 2, which means that a widow or orphan must have at least two lines of text before it can be preceded or followed by a page break.

If you wanted to increase the size of widows and orphans to three lines for the paragraphs in a document, you could apply the style rule

```
p {
 widows: 3;
 orphans: 3;
}
```

and the browser will not insert a page break if fewer than three lines of a paragraph would be stranded at either the top or the bottom of the page.

### REFERENCE

#### Controlling the Size of Widows and Orphans

- To set the minimum size of widows (lines stranded at the top of a page), apply the property

```
widows: value;
```

where *value* is the number of lines that must appear at the top of the page before the page break.

- To set the minimum size of orphans (lines stranded at the bottom of a page), apply the property

```
orphans: value;
```

where *value* is the number of lines that must appear at the bottom of the page before the page break.

Use the `widows` and `orphans` properties now, setting their size to 3 for paragraphs in the printed version of the Articles of Interest page.

## To avoid widows and orphans:

1. Within the Page Break Styles section of the **tf\_print.css** file, add the following style rule.

```
p {
 orphans: 3;
 widows: 3;
}
```

Figure 5–55 highlights the style rule for setting the size of widows and orphans.

Figure 5–55

## Setting the size of widows and orphans

widows and orphans  
set to a minimum of  
3 lines each

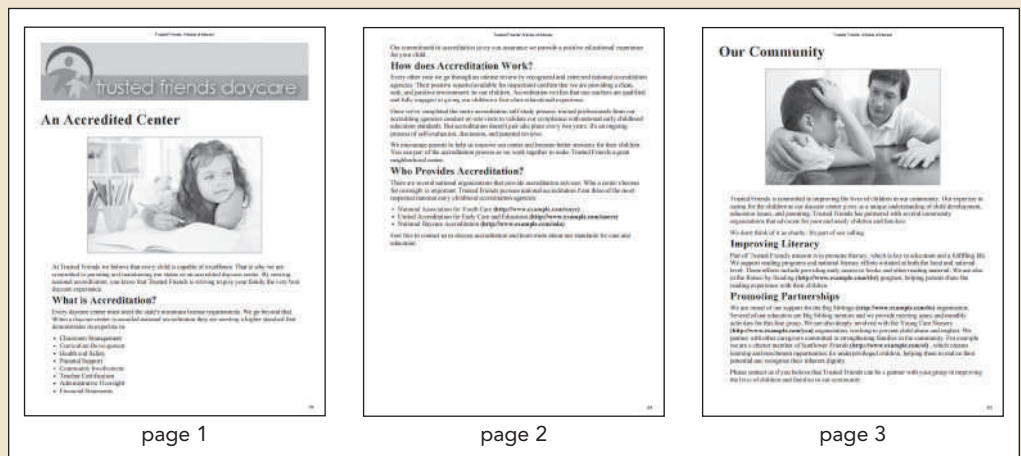
```
img, ol, ul {
 page-break-inside: avoid;
}

p {
 orphans: 3;
 widows: 3;
}
```

2. Save your changes to the file and then reload the **tf\_articles.html** file in your browser. Preview the appearance of the printed document. Figure 5–56 shows the final appearance of the printed version of this document.

Figure 5–56

## Final print version of the document



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**Trouble?** Depending on your browser and your default printer, your printed version may look slightly different from the one shown in Figure 5–56.

You've completed your work on the print styles for the Articles of Interest page. By modifying the default style sheet, you've created a printout that is easier to read and more useful to the parents and customers of Trusted Friends Daycare.



## PROSKILLS

### Written Communication: Tips for Effective Printing

One challenge of printing a web page is that what works very well on the screen often fails when transferred to the printed page. For example, some browsers suppress printing background images, so that white text on a dark background, which appears fine on the computer monitor, is unreadable when printed. Following are some tips and guidelines you should keep in mind when designing the printed version of your web page:

- *Remove the clutter.* A printout should contain only information that is of immediate use to the reader. Page elements such as navigation lists, banners, and advertising should be removed, leaving only the main articles and images from your page.
- *Measure for printing.* Use only those measuring units in your style sheet that are appropriate for printing, such as points, inches, centimeters, and millimeters. Avoid expressing widths and heights in pixels because those can vary with printer resolution.
- *Design for white.* Because many browsers suppress the printing of background images and some users do not have access to color printers, create a style sheet that assumes black text on a white background.
- *Avoid absolute positioning.* Absolute positioning is designed for screen output. When printed, an object placed at an absolute position will be displayed on the first page of your printout, potentially making your text unreadable.
- *Give the user a choice.* Some readers will still want to print your web page exactly as it appears on the screen. To accommodate them, you can use one of the many JavaScript tools available on the web that allows readers to switch between your screen and print style sheets.

Finally, a print style sheet is one aspect of web design that works better in theory than in practice. Many browsers provide only partial support for the CSS print styles, so you should always test your designs on a variety of browsers and browser versions. In general, you will have the best results with a basic style sheet rather than one that tries to implement a complicated and involved print layout.

In this tutorial you've learned how to apply different styles to different types of devices and output formats. Marjorie appreciates the work you've done and will continue to rely on your knowledge of media queries, flexible layouts, and print styles as she redesigns the Trusted Friends website. You can close any open files or applications now.

### Session 5.3 Quick Check

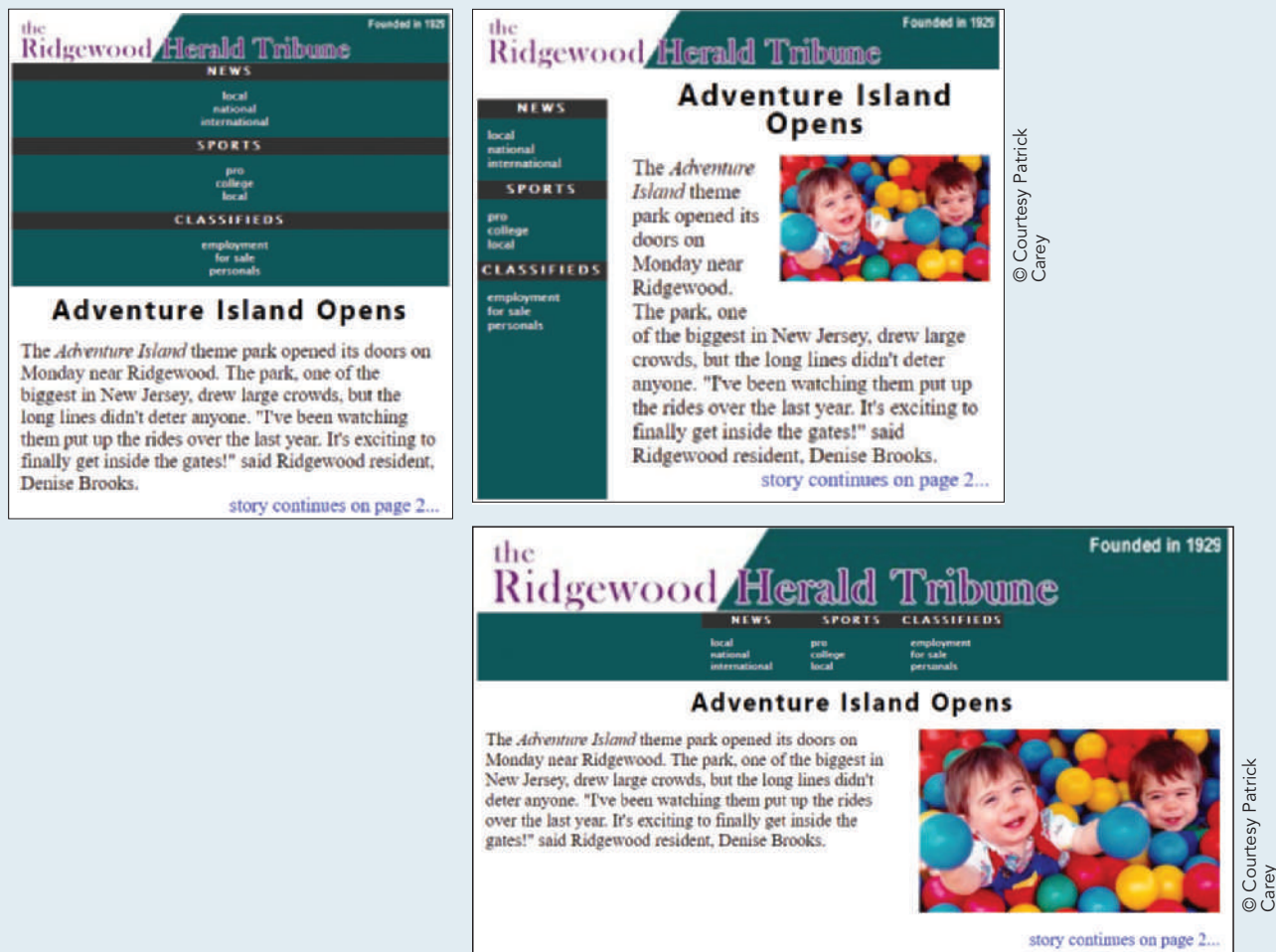
1. What attribute do you add to a link element to indicate that the style sheet is used for printed media?
  - a. `rel="print"`
  - b. `type="print"`
  - c. `media="print"`
  - d. `print="yes"`
2. What @rule is used for setting the properties of the printed page box?
  - a. `@page`
  - b. `@print`
  - c. `@margin`
  - d. `@printout`
3. To set the right-side printed page to have a 3 centimeter top/bottom margin and a 5 centimeter left/right margin, use:
  - a. `@page:right {margin: 3cm 5cm;}`
  - b. `@page:right {margin: 5cm 3cm;}`
  - c. `@page {side: right; margin: 5cm 3cm;}`
  - d. `@page.right {margin: 5cm 3cm;}`
4. To apply a page break before every section element, use:
  - a. `section {break: before;}`
  - b. `section {page-break: before;}`
  - c. `section {break-before: true;}`
  - d. `section {break-before: always;}`
5. To prevent a page break from being placed within any header element, use:
  - a. `header {break: never;}`
  - b. `header {page-break-inside: avoid;}`
  - c. `header {inside-break: never;}`
  - d. `header {break: none;}`
6. What style do you apply to allow the browser to wrap long strings of text to a new line whenever needed?
  - a. `word-break: auto;`
  - b. `word-wrap: true;`
  - c. `word-wrap: break-word;`
  - d. `word-inside-break: always;`
7. To limit the size of widows for all article elements to 3 lines or more, use:
  - a. `article {widows: 2;}`
  - b. `article {widows: 3;}`
  - c. `article {widows: 3+;}`
  - d. `article {widows: >2;}`
8. To display the URL of a hypertext link, use the property:
  - a. `attr(link)`
  - b. `attr(url)`
  - c. `attr(hypertext)`
  - d. `attr(href)`

## Coding Challenge 1

Data Files needed for this Coding Challenge: `code5-1_txt.html`, `code5-1_media_txt.css`, `code5-1_layout.css`, `code5-1_logo.jpg`, `code5-1_photo.jpg`

Use media queries to create a responsive design for the menu shown in Figure 5–57. You will need to create three menu layouts: one for screen widths 500 pixels or less, another for screen widths of 501 pixels to 710 pixels, and a third for screen widths greater than 710 pixels.

Figure 5–57 Coding Challenge 5-1 example page



Do the following:

1. Open the `code5-1_txt.html` and `code5-1_media_txt.css` files from the `html05 ► code1` folder. Enter **your name** and **the date** in each document and save the files as `code5-1.html` and `code5-1_media.css` respectively.
2. Go to the `code5-1.html` file in your editor. Within the head section insert `link` elements linking the page to the `code5-1_layout.css` and `code5-1_media.css` files.
3. Add a viewport meta tag to the document head to set the width of the layout viewport equal to the width of the device and set the initial scale of the viewport to 1.0. Review the contents of the file and then save your changes.
4. Go to the `code5-1_media.css` file in your editor.

5. Create a media query for devices with a maximum width of 500 pixels. Within the query do the following:
  - a. Set the display of the `img` element within the article element to none.
  - b. Center the text contained within the `ul` element belonging to the submenu class.
6. Create a media query for devices with a minimum width of 501 pixels. Within the query do the following:
  - a. Float the `nav` element on the left page margin.
  - b. Set the width of the `nav` element to 130 pixels and the height to 400 pixels.
  - c. Set the top margin of the `nav` element to 30 pixels, the right margin to 25 pixels, and the bottom and left margins to 0 pixels.
7. Create a media query for devices with a minimum width of 710 pixels. Within the query do the following:
  - a. Set the `float` property of the `nav` element to none, its width to 100% and its height to auto. Set the `nav` element margins to 0.
  - b. Set the display of `ul` elements of the mainmenu class to `flex` with the flex flow in the row direction with no wrapping; justify the contents of the flexbox in the center.
  - c. Set the `flex` property of `li` elements with the `ul.mainmenu` element to have a growth factor of 0, a shrink factor of 1, and a basis value of 120 pixels.
8. Save your changes to the file and then view the page under different screen widths, verifying that the menu format changes as the screen width changes as shown in Figure 5–57.
9. Submit the completed file to your instructor.

## CODE

## Coding Challenge 2

Data Files needed for this Coding Challenge: `code5-2_txt.html`, `code5-2_flex_txt.css`, `code5-2_layout.css`, and 13 image files

Figure 5–58 shows the layout of a page that displays cards containing social media icons. Create this page using CSS flex styles so that the icons are always laid out in rows and columns for any screen width.

Figure 5–58 Coding Challenge 5-2 example page



Do the following:

1. Open the **code5-2\_txt.html** and **code5-2\_flex\_txt.css** files from the `html05 ► code2` folder. Enter **your name** and **the date** in each document and save the files as **code5-2.html** and **code5-2\_flex.css** respectively.
2. Go to the **code5-2.html** file in your editor. Within the head section insert `link` elements linking the page to the `code5-2_layout.css` and `code5-2_flex.css` files. Review the contents of the file and then save your changes.
3. Go to the **code5-2\_flex.css** file in your editor.
4. Display the `section` element as a flexbox. Set the flow of items within the flexbox to go in row order with reverse wrapping so that the first item (Facebook) appears in the bottom-left corner and the last item (E-mail) appears in the top-right corner.
5. Set the growth and shrink rate of the `div` elements of the card class to 1 and 1. Set the flex basis of those elements to 200 pixels.
6. Display each `div` element of the card class itself as a flexbox.
7. Apply the following flex layout to the items within the card `div` elements:
  - a. Lay out the items in column order with no wrapping.
  - b. Justify the content of the items within the flexbox with space between.
  - c. Center each of the items with respect to the cross axis.
8. Save your changes to the style sheet file and then open **code5-2.html** in your browser. Test the layout under different screen widths, verifying that the `div` cards always fill up the page grid and that for a width small enough, the contents are laid out in a single column.
9. Submit the completed file to your instructor.

## CODE

### Coding Challenge 3

Data Files needed for this Coding Challenge: **code5-3\_txt.html**, **code5-3\_print\_txt.css**, **code5-3\_layout.css**, and 1 image file

A list of the top 15 travel sites on the web is shown in Figure 5–59. The style sheet code for the screen version has already been written, but you have been tasked to create the style sheet for the print version. Complete the web page by writing the print styles and linking them to the web page.

Figure 5–59 Coding Challenge 5-3 example page

## Travel Sites on the Web

It's easier than ever to find great deals on airfare, hotels, and car rentals using the travel sites available on the Web.

The following are the top 15 most popular travel sites on the Web as rated by eBizMBA [ <http://www.ebizmba.com/articles/travel-websites> ].

1. Booking [ <http://www.booking.com> ]
2. TripAdvisor [ <http://www.tripadvisor.com> ]
3. Yahoo! Travel [ <http://www.travel.yahoo.com> ]
4. Expedia [ <http://www.expedia.com> ]
5. Priceline [ <http://www.priceline.com> ]
6. Hotels [ <http://www.hotels.com> ]
7. Travelocity [ <http://www.travelocity.com> ]
8. Kayak [ <http://www.kayak.com> ]
9. Orbitz [ <http://www.orbitz.com> ]
10. Hotwire [ <http://www.hotwire.com> ]
11. HomeAway [ <http://www.homeaway.com> ]
12. TravelZoo [ <http://www.travelzoo.com> ]
13. AirBnB [ <http://www.airbnb.com> ]
14. LonelyPlanet [ <http://www.lonelyplanet.com> ]
15. Viator [ <http://www.viator.com> ]

Do the following:

1. Open the **code5-3\_txt.html** and **code5-3\_print\_txt.css** files from the html05 ► code3 folder. Enter **your name** and **the date** in each document and save the files as **code5-3.html** and **code5-3\_print.css** respectively.
2. Go to the **code5-3.html** file in your editor. Within the head section insert `link` elements linking the page to the `code5-3_layout.css` and `code5-3_print.css` files. Use the `code5-3_layout.css` file for screen output and the `code5-3_print.css` file for printed output. Review the contents of the file and then save your changes.
3. Go to the **code5-3\_print.css** file in your editor.
4. Set the printed page size to 8.5 by 11 inches with a 1-inch margin.
5. Remove all underlining from hypertext links.
6. Prevent the browser from inserting page breaks within any `nav` element.
7. Set the line height of every `li` element nested within a `nav` and `ol` element to 0.3 inches.
8. Use the `after` pseudo-element to display printed hypertext link in the following format: *link* [ *url* ] and add the following styles to the `after` pseudo-element:
  - a. Display the *url* text as an inline block.
  - b. Set the left margin of the *url* text to 20 pixels.
  - c. Set the value of the `word-wrap` property to "break-word".
9. Save your changes to the file.
10. View the printed version of the page in your browser to verify that it resembles Figure 5–59.
11. Submit the completed file to your instructor.

## Coding Challenge 4

Data Files needed for this Coding Challenge: `code5-4_txt.html`, `code5-4_debug_txt.css`, `code5-4_layout.css`, `code5-4_logo.jpg`, `code5-4_photo.jpg`

You have been asked to revise a website involving responsive design that contains several errors. A preview of the page under different screen widths is shown in Figure 5–60. Fix the errors in the code for the HTML and CSS file.

Figure 5–60 Coding Challenge 5-4 example page



Do the following:

1. Open the `code5-4_txt.html` and `code5-4_debug_txt.css` files from the `html05 > code4` folder. Enter **your name** and **the date** in each document and save the files as `code5-4.html` and `code5-4_debug.css` respectively.
2. Go to the `code5-4.html` file in your editor. Within the head section insert `link` elements linking the page to the `code5-4_layout.css` and `code5-4_debug.css` files. Review the contents of the file.
3. There is a single error within the head section of the page. Locate the error and fix it. Save your changes to the file.
4. Go to the `code5-4_debug.css` file in your editor. There are 8 separate syntax errors in the stylesheet. Locate and correct all eight errors and then save your changes.
5. Test both the `code5-4.html` and `code5-4_debug.css` files in a validator to confirm that both pass validation with no errors or warnings reported.
6. View the `code5-4.html` file in your browser under different screen widths and compare your page to Figure 5–60, confirming that your page layout matches the one shown in the figure.
7. Submit the completed file to your instructor.

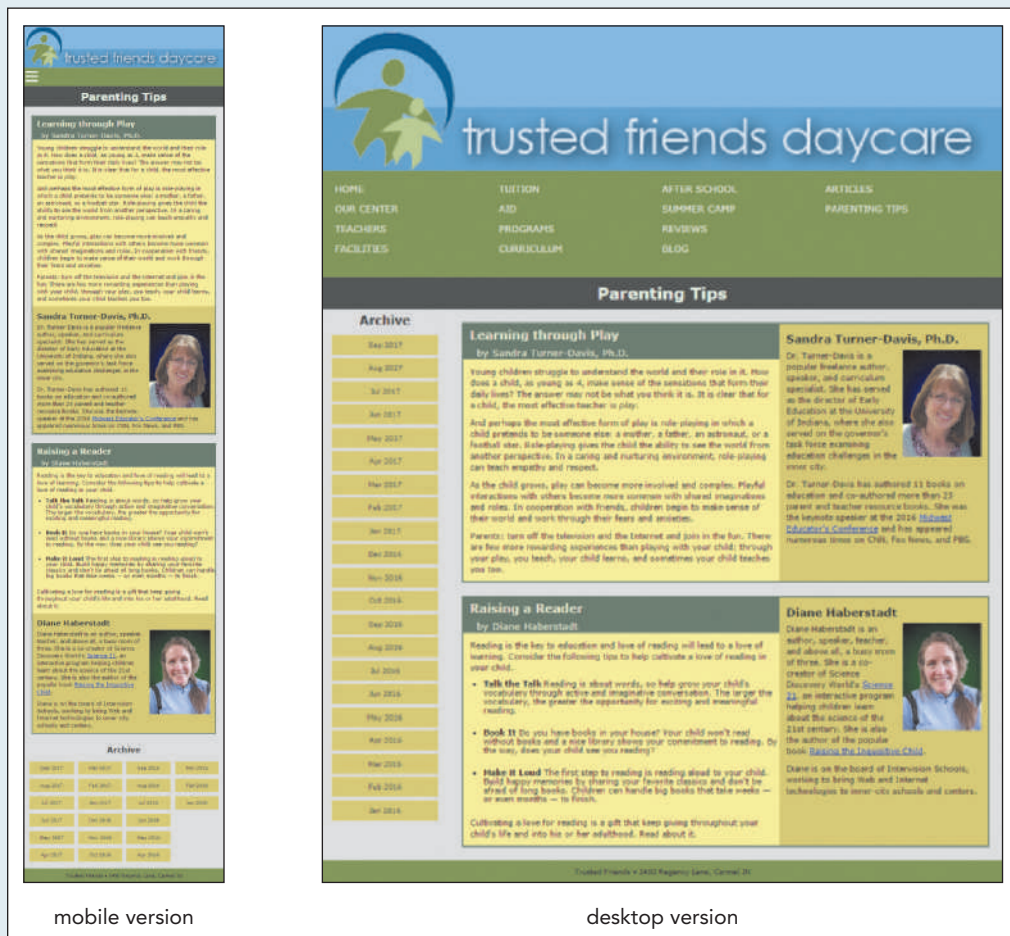
## Review Assignments

Data Files needed for the Review Assignments: `tf_print2_txt.css`, `tf_styles4_txt.css`, `tf_tips_txt.html`, 2 CSS files, 4 PNG files

Marjorie meets with you to discuss the redesign of the blog page showing parenting tips. As with the other pages you've worked on, she wants this page to be compatible with mobile devices, tablet and desktop devices, and printers. Marjorie has already written the page content and has done much of the initial design work. She needs you to complete the project by writing media queries for the different display options. Figure 5–61 shows a preview of the mobile design and the desktop design.

Figure 5–61

Parenting Tips page



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You'll use several flexboxes to create the layout for these two designs so that the page content automatically rescales as the screen width changes.

Complete the following:

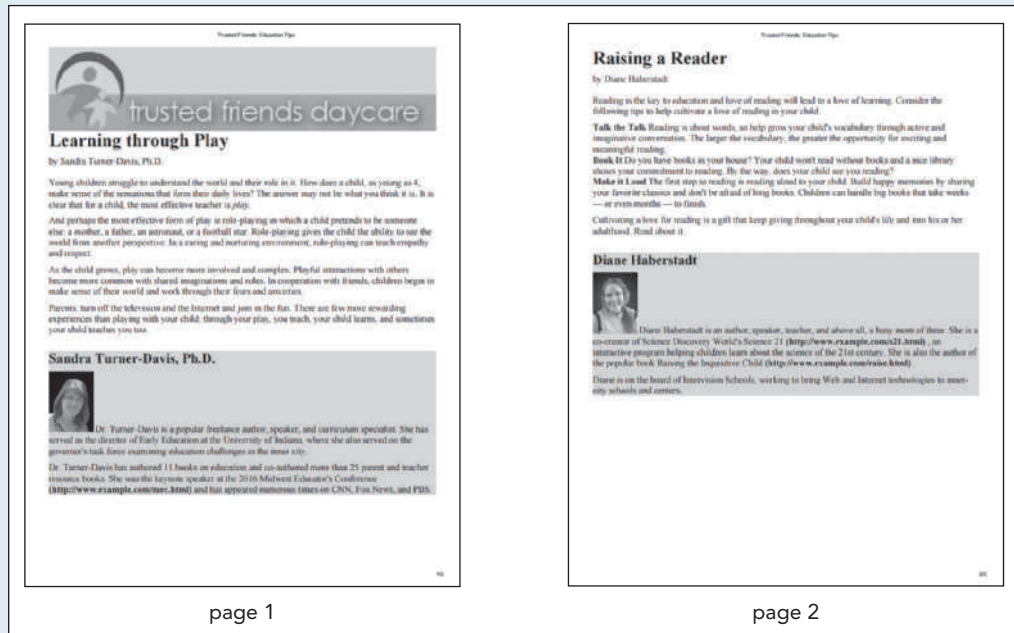
1. Use your HTML editor to open the `tf_tips_txt.html`, `tf_styles4_txt.css`, and `tf_print2_txt.css` files from the `html05 ► review` folder. Enter **your name** and **the date** in the comment section of each file, and save them as `tf_tips.html`, `tf_styles4.css`, and `tf_print2.css` respectively.
2. Go to the `tf_tips.html` file in your editor. Add a viewport meta tag to the document head to set the width of the layout viewport equal to the width of the device and set the initial scale of the viewport to 1.0.

3. Create links to the following style sheets: a) the `tf_base.css` file to be used with all devices, b) the `tf_styles4.css` file to be used with screen devices, and c) the `tf_print2.css` file to be used for printed output.
4. Take some time to study the contents and structure of the document, paying special attention to the IDs and class names of the elements, and then save your changes.
5. Go to the **tf\_styles4.css** file in your editor. Note that Marjorie has placed all of her styles in the `tf_designs.css` file and imported them into this style sheet. You will not need to edit that style sheet file, but you might want to view it to become familiar with her style rules.
6. Go to the General Flex Styles section. Within this section, you'll create a flexible layout that varies in response to changing screen widths.
7. In the General Flex Styles section create a style rule for the `body` element that displays the page body as a flexbox flowing in the row direction, wrapping content to a new line as needed.
8. The page content is divided into two `section` elements with IDs of `left` and `right`. The left section does not need as much of the screen width. Create a style rule for the left section that sets its flex growth and shrink rates to 1 and 8 respectively and sets its flex basis size to 130 pixels.
9. The right section requires more screen width. Create a style rule for the right section that sets its flex growth and shrink values to 8 and 1 and sets its flex basis size to 351 pixels.
10. Next, set the display of the section element with class ID of `tips` as a flexbox. Have the content of the flexbox flow in the row direction with row wrapping enabled.
11. Create a style rule for the `article` element that lays it out with a flex growth value of 2, flex shrink value of 1, and a flex basis size of 351 pixels.
12. The biographical asides within each tips section need to occupy less screen space. Create a style rule for the `aside` element that lays it out with a flex growth value of 1, flex shrink value of 2, and a flex basis size of 250 pixels.
13. Finally, the horizontal navigation list at the top of the page will also be treated as a flexbox. Create a style rule for the `nav.horizontal ul` selector that displays it as a flexbox in column orientation with wrapping.
14. Go to the Mobile Devices section and create a media query for screen devices with a maximum width of 480 pixels.
15. For mobile devices, the vertical list of links to archived parenting tips should be displayed in several columns at the bottom of the page. Within the media query you created in the last step, add the following style rules:
  - a. for the `nav.vertical ul` selector, create a style rule that displays it as a flexbox in column orientation with wrapping. Set the height of the element to 240 pixels.
  - b. to give the `section` element with an ID of `left` a flex order value of 99 to place it near the bottom of the page.
  - c. to give the `body > footer` selector an order value of 100 to put it at the page bottom.
16. Marjorie wants to hide the navigation list at the top of the page when viewed on a mobile device unless the user hovers (or taps) a `navicon`. Using the technique shown in this tutorial, add the following style rules to set the behavior of the `navicon` within the media query for mobile devices:
  - a. Display the `navicon` by creating a style rule for the `a#navicon` selector to display it as a block.
  - b. Set the display property of the `nav.horizontal ul` selector to `none`.
  - c. Display the navigation list contents in response to a hover or touch by creating a style rule for the `a#navicon: hover+ul, nav.horizontal ul: hover` selector that sets its display value to block.
17. Go to the Tablets and Desktop Devices section. Create a media query for screen devices with a width of at least 481 pixels. Under the wider screens, the contents of the horizontal navigation list at the top of the page should be displayed in several columns. In order to have the list items wrap to a new column, add a style rule to the media query that sets the height of the `ul` element within the horizontal navigation list to 160 pixels.

18. Save your changes to the style sheet and then open the **tf\_tips.html** file in your browser or device emulator. Verify that as you change the screen width the layout of the page automatically changes to match the layout designs shown in Figure 5–61.

Next, you'll create the print styles for the Parenting Tips page. Figure 5–62 shows a preview of the output on a black and white printer.

**Figure 5–62** Parenting Tips print version



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19. Go to the **tf\_print2.css** file in your editor. Go to the Hidden Objects section and hide the display of the following page elements: all navigation lists, the h1 heading in the body header, the left section element, and the body footer.
20. Go to the Page Box Styles section and set the page size to 8.5 inches by 11 inches with a margin of 0.5 inches.
21. Go the Header Styles section and add a style rule that displays the logo image as a block with a width of 100%.
22. Go to the Typography Styles section and add the following style rules for the text in the printed pages:
  - a. For headers within the `article` element, set the bottom margin to 0.2 inches.
  - b. For h1 headings within the `article` element, set the font size to 24 points and the line height to 26 points.
  - c. For the `aside` element, set the background color to `rgb(211, 211, 211)` and add a top margin of 0.3 inches.
  - d. For h1 headings in `aside` elements, set the font size to 18 points and the line height to 20 points.
  - e. For images within `aside` elements, set the width to 0.8 inches.
  - f. For paragraphs, set the font size to 12 points with a top and bottom margin of 0.1 inches.
23. Go to the Hypertext Styles section and add style rules to display all hypertext links in black with no underline. Also, insert a style rule that adds the text of the URL after the hypertext link in bold with the `word-wrap` property set to `break-word`.

24. Go to the Page Break Styles section and add the following style rules to
  - a. insert page breaks after every `aside` element.
  - b. never allow a page break within an `ol`, `ul`, or `img` element.
  - c. set the size of widows and orphans within paragraphs to 3 lines each.
25. Save your changes to the file.
26. Reload the `tf_tips.html` file in your browser and preview its printed version. Verify that your pages resemble those shown in Figure 5–62 (there may be differences depending on your browser and your printer).

## APPLY

## Case Problem 1

**Data Files needed for this Case Problem:** `gp_cover_txt.html`, `gp_page1_txt.html`, `gp_page2_txt.html`, `gp_page3_txt.html`, `gp_layout_txt.css`, `gp_print_txt.css`, 2 CSS files, 21 PNG files

**Golden Pulps** Devan Ryan manages the website *Golden Pulps*, where he shares tips on collecting and fun stories from the “golden age of comic books”—a period of time covering 1938 through the early 1950s. Devan wants to provide online versions of several classic comic books, which are now in the public domain.

He’s scanned the images from the golden age comic book, *America’s Greatest Comics 001*, published in March, 1941, by Fawcett Comics and featuring Captain Marvel. He’s written the code for the HTML file and wants you to help him develop a layout design that will be compatible with mobile and desktop devices. Figure 5–63 shows a preview of the mobile and desktop version of a page you’ll create.

Figure 5–63 Golden Pulps sample page



© Courtesy Patrick Carey; Source: Comic Book Plus

Complete the following:

1. Using your editor, open the **gp\_cover\_txt.html**, **gp\_page1\_txt.html**, **gp\_page2\_txt.html**, **gp\_page3\_txt.html**, **gp\_layout\_txt.css**, and **gp\_print\_txt.css** files from the **html05 ▶ case1** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **gp\_cover.html**, **gp\_page1.html**, **gp\_page2.html**, **gp\_page3.html**, **gp\_layout.css**, and **gp\_print.css** respectively.
2. Go to the **gp\_cover.html** file in your editor. Add a viewport meta tag to the document head, setting the width of the layout viewport to the device width and setting the initial scale of the viewport to 1.0.
3. Create links to the following style sheets: a) the **gp\_reset.css** file to be used with all devices, b) the **gp\_layout.css** file to be used with screen devices, and c) the **gp\_print.css** file to be used for printed output.
4. Take some time to study the contents and structure of the file. Note each panel from the comic book is stored as a separate inline image with the class name *panel* along with class names of *size1* to *size4* indicating the size of the panel. Size1 is the largest panel down to size4, which is the smallest panel. Close the file, saving your changes.
5. Repeat Steps 2 through 4 for the **gp\_page1.html**, **gp\_page2.html**, and **gp\_page3.html** files.
6. Go to the **gp\_layout.css** file in your editor. In this style sheet, you'll create the layout styles for mobile and desktop devices. Note that Devan has used the `@import` rule to import the **gp\_designs.css** file, which contains several graphical and typographical style rules.
7. Go to the Flex Layout Styles section and insert a style rule to display the `body` element as a flexbox oriented as rows with wrapping.
8. The page body content has two main elements. The `section` element with the ID *sheet* contains the panels from the comic book page. The `article` element contains information about the comic book industry during the Golden Age. Devan wants more of the page width to be given to the comic book sheet. Add a style rule that sets the flex growth and shrink rate of the `section#sheet` selector to 3 and 1 respectively and set its flex basis size to 301 pixels.
9. Less page width will be given to the `article` element. Create a style rule to set its flex growth and shrink values to 1 and 3 respectively and set its flex basis size to 180 pixels.
10. Go to the Mobile Devices section and create a media query for screen devices with a maximum width of 480 pixels.
11. With mobile devices, Devan wants each comic book panel image to occupy a single row. Create a style rule that sets the width of `img` elements belonging to the `panel` class to 100%.
12. For mobile devices, Devan wants the horizontal navigation links to other pages on the Golden Pulp website to be displayed near the bottom of the page. Within the media query, set the flex order of the `nav.horizontal` selector to 99.
13. Create a style rule to set the flex order of the `body > footer` selector to 100.
14. Go to the Tablet and Desktop Devices: Greater than 480 pixels section and create a media query that matches screen devices with widths greater than 480 pixels.
15. For tablet and desktop devices, you'll lay out the horizontal navigation list as a single row of links. Within the media query, create a style rule for the `nav.horizontal ul` selector that displays that element as a flexbox, oriented in the row direction with no wrapping. Set the height of the element to 40 pixels.
16. For the `nav.horizontal ul li` selector set the flex growth shrink, and basis size values to 1, 1, and auto respectively so that each list items grows and shrinks at the same rate.
17. With wider screens, Devan does not want the panels to occupy their own rows as is the case with mobile devices. Instead, within the media query create style rules, define the width of the different classes of comic book panel images as follows:
  - a. Set the width of `size1 img` elements to 100%.
  - b. Set the width of `size2 img` elements to 60%.
  - c. Set the width of `size3 img` elements to 40%.
  - d. Set the width of `size4 img` elements to 30%.
18. Save your changes to the file and then open the **gp\_cover.html** file in your browser or device emulator. Click the navigation links to view the contents of the cover and first three pages. Verify

that with a narrow screen the panels occupy their own rows and with a wider screen the sheets are laid out with several panels per row. Further verify that the horizontal navigation list is placed at the bottom of the page for mobile devices.

19. Devan also wants a print style that displays each comic book sheet on its own page and with none of the navigation links. Go to the **gp\_print.css** style sheet in your editor. Add style rules to
  - a. hide the `nav`, `footer`, and `article` elements.
  - b. set the width of the element referenced by the `section#sheet` selector to 6 inches. Set the top/bottom margin of that element to 0 inches and the left/right margin to `auto` in order to center it within the printed page.
  - c. set the width of `img` elements belong to the `size1` class to 5 inches, `size2` images to 3 inches, `size3` images to 2 inches, and `size4` images to 1.5 inches.
20. Save your changes to the file and then reload the contents of the comic book pages in your browser and preview the printed pages. Verify that the printed page displays only the website logo, the name of the comic book, and the comic book panels.

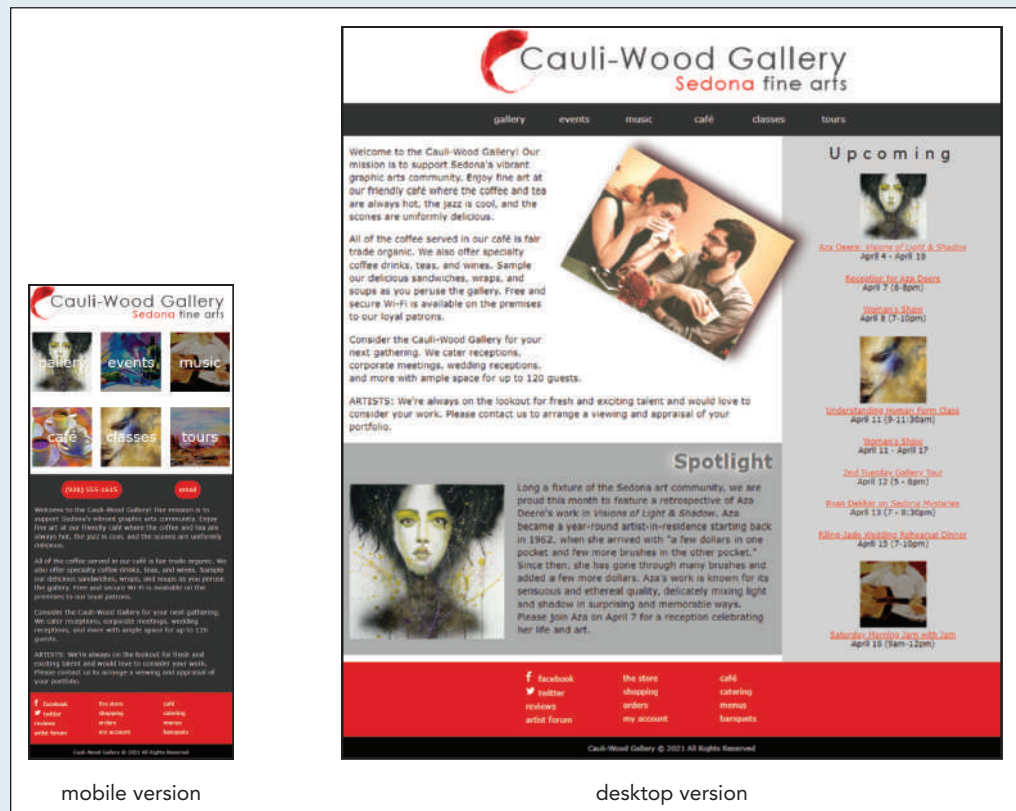
## Case Problem 2

**Data Files needed for this Case Problem:** `cw_home_txt.html`, `cw_styles_txt.css`, 2 CSS files, 10 PNG files

**Cauli-Wood Gallery** Sofia Fonte is the manager of the *Cauli-Wood Gallery*, an art gallery and coffee shop located in Sedona, Arizona. She has approached you for help in redesigning the gallery's website to include support for mobile devices and tablets. Your first project will be to redesign the site's home page following the principles of responsive design. A preview of the mobile and desktop versions of the website's home page is shown in Figure 5–64.

Figure 5-64

Cauli-Wood Gallery home page





Right: © Tischenko Irina/Shutterstock.com; © re\_bekka/Shutterstock.com; © Boyan Dimitrov/Shutterstock.com; © rubtsov/Shutterstock.com; © Fotocrisis/Shutterstock.com; © Anna Ismagilova/Shutterstock.com; © DeepGreen/Shutterstock.com; Source: Facebook; Source: Twitter, Inc.  
 Left: © Tischenko Irina/Shutterstock.com; © Courtesy Patrick Carey; © re\_bekka/Shutterstock.com; © Anna Ismagilova/Shutterstock.com; © rubtsov/Shutterstock.com; Source: Facebook; Source: Twitter, Inc.

Sofia has already written much of the HTML code and some of the styles to be used in this project. Your job will be to finish the redesign and present her with the final version of the page.

Complete the following:

1. Using your editor, open the **cw\_home\_txt.html** and **cw\_styles\_txt.css** files from the html05 ► case2 folder. Enter **your name** and **the date** in the comment section of each file, and save them as **cw\_home.html** and **cw\_styles.css** respectively.
2. Go to the **cw\_home.html** file in your editor. Within the document head, insert a meta element that sets the browser viewport for use with mobile devices. Also, create links to **cw\_reset.css** and **cw\_styles.css** style sheets. Take some time to study the contents and structure of the document and then close the file saving your changes.
3. Return to the **cw\_styles.css** file in your editor. At the top of the file, use the **@import** rule to import the contents of the **cw\_designs.css** file, which contains several style rules that format the appearance of different page elements.
- ✚ **Explore** 4. At the bottom of the home page is a navigation list with the ID **bottom** containing several ul elements. Sofia wants these ul elements laid out side-by-side. Create a style rule for the **nav#bottom** selector displaying its element as a flexbox row with no wrapping. Set the **justify-content** property so that the flex items are centered along the main axis.
5. For the **nav#bottom ul** selector, create a style rule to set the flex growth rate to 0, the shrink rate to 1, and the basis value to 150 pixels.

6. Sofia wants more highly contrasting colors when the page is displayed in a mobile device. Create a media query for mobile screen devices with maximum widths of 480 pixels. Within that media query, insert a style rule that sets the font color of the `body` element to `rgb(211, 211, 211)` and sets the body background color to `rgb(51, 51, 51)`.
7. Sofia also wants to reduce the clutter in the mobile version of the home page. Hide the following elements for mobile users: the `aside` element, any `img` element within the `article` element, and the spotlight section element.
8. At the top of the web page is a navigation list with the ID `top`. For mobile devices, create a style rule for the `nav#top ul` selector, displaying the element as a flexbox row with wrapping. For each list item within the `nav#top ul` selector, set the font size to 2.2em. Size the list items by setting their flex values to 1 for the growth and shrink rates and 130 pixels for the basis value.
9. Under the mobile layout, the six list items in the top navigation list should appear as square blocks with different background images. Using the selector `nav#top ul li:nth-of-type(1)` for the first list item, create a style rule that changes the background to the background image `cw_image01.png`. Center the background image with no tiling and size it so that the entire image is contained within the background.
10. Repeat the previous step for the next five list items using the same general format. Use the `cw_image02.png` file for background of the second list item, the `cw_image03.png` file for the third list item background, and so forth up through the `nav#top ul li:nth-of-type(6)` selector.
-  **Explore 11.** Sofia has placed hypertext links for the gallery's phone number and e-mail address in a paragraph with the ID `links`. For mobile users, she wants these two hypertext links spaced evenly within the paragraph that is displayed below the top navigation list. To format these links, create a style rule that displays the element referenced by the `p#links` selector as a flexbox row with no wrapping, then add a style that sets the value of the `justify-content` property to `space-around`.
12. She wants the telephone and e-mail links to be prominently displayed on mobile devices. For each `p#links a` selector, apply the following style rule that: a) displays the link text in white on the background color `rgb(220, 27, 27)`, b) sets the border radius around each hypertext to 20 pixels with 10 pixels of padding, and c) removes any underlining from the hypertext links.
13. Next, you'll define the layout for tablet and desktop devices. Create a media query for screen devices whose width is 481 pixels or greater. Within this media query, display the `body` element as a flexbox in row orientation with wrapping.
14. The page body has four children: the header, the footer, the `article` element, and the `aside` element. The `article` and `aside` elements will share a row with more space given to the `article` element. Set the flex growth, shrink, and basis values of the `article` element to 2, 1, and 400 pixels. Set those same flex values for the `aside` element to 1, 2, and 200 pixels.
-  **Explore 15.** For tablet and desktop devices, the top navigation list should be displayed as a horizontal row with no wrapping. Enter a style rule for the `nav#top ul` selector to display that element as a flexbox with a background color of `rgb(51, 51, 51)` and a height of 50 pixels. Use the `justify-content` and `align-items` property to center the flex items within that flexbox both horizontally and vertically.
16. For the `nav#top ul li` selector, create a style rule for those list items, setting the flex growth rate to 0, the flex shrink rate to 1, and the basis value to 80 pixels.
17. Sofia doesn't want the links paragraph displayed for tablet and desktop devices. Complete the media query for tablet and desktop devices by creating a style rule for the `p#links` selector to hide the paragraph.
18. Save your changes to the style sheet and then open the `cw_home.html` file in your browser or device emulator. Verify that the layout and contents of the page switch between the mobile version and the tablet/desktop version shown in Figure 5-64 as the screen width is increased and decreased.

## OBJECTIVES

## Session 6.1

- Explore the structure of a web table
- Create table heading and data cells
- Apply CSS styles to a table
- Create cells that span multiple rows and columns
- Add a caption to a table

## Session 6.2

- Create row and column groups
- Apply styles to row and column groups
- Display page elements in table form
- Create a multi-column layout

# Working with Tables and Columns

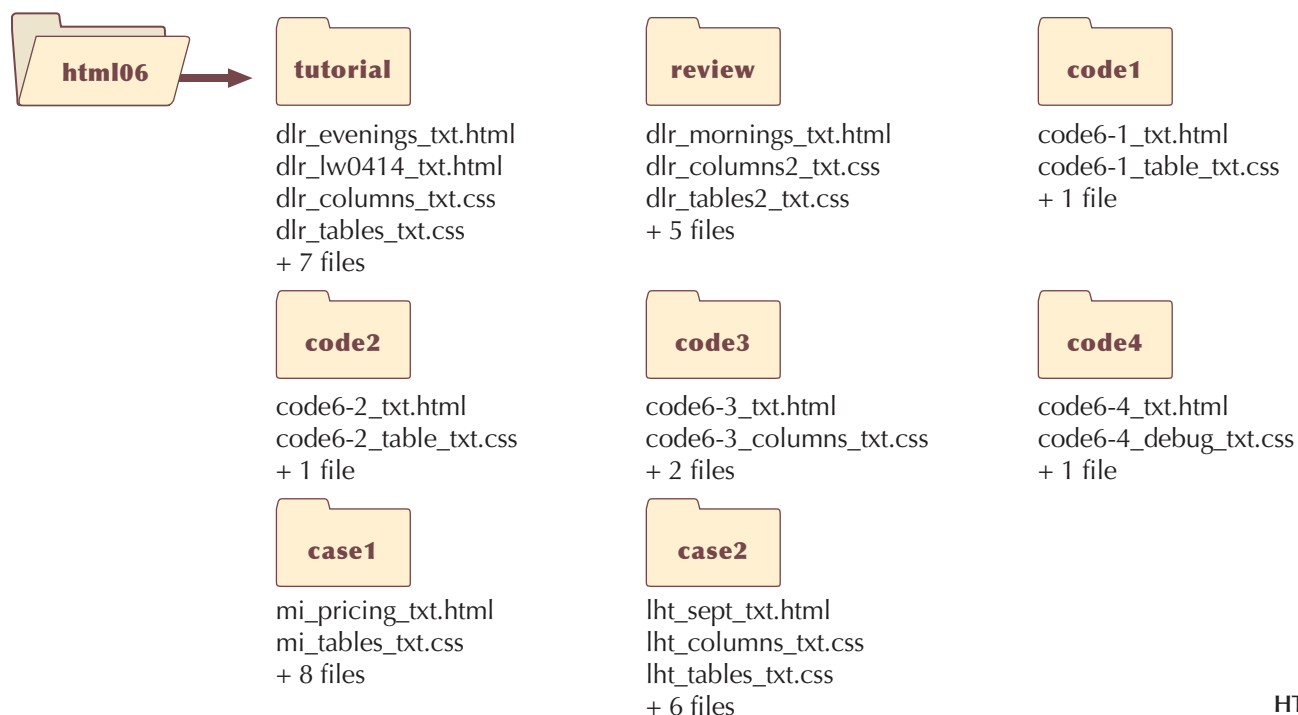
## Creating a Program Schedule for a Radio Station

### Case | *Dakota Listener Radio*

Kyle Mitchell is the program director at *DLR (Dakota Listener Radio)*, a public radio station broadcasting out of Bismarck, North Dakota. Kyle has begun upgrading the DLR website to provide listeners with more information about the station's programs and policies.

The new website will include pages listing the DLR morning, afternoon, and evening schedules. Kyle believes that this information is best conveyed to the listener in a table, with days arranged in separate table columns and times within each day placed in separate table rows. Kyle has never created a web table, so he has come to you for help. He wants the table to be informative and easy to read, so you enhance the appearance of the web page with CSS styles.

### STARTING DATA FILES



# Session 6.1 Visual Overview:

The `table` element encloses a web table.

The `caption` element identifies the table caption.

The `th` element encloses the table header cells.

The `tr` element encloses a table row.

The `td` element encloses the cells that contain table data.

Cells that cover several columns are indicated by the `colspan` attribute.

Cells that cover several rows are indicated by the `rowspan` attribute.

```
<table class="schedule">
 <caption>All Times Central</caption>
 <tr>
 <th>Time</th>
 <th>Mon</th>
 <th>Tue</th>
 <th>Wed</th>
 <th>Thu</th>
 <th>Fri</th>
 <th>Sat</th>
 <th>Sun</th>
 </tr>
 <tr>
 <th>6:00 PM</th>
 <td colspan="7">National News</td>
 </tr>
 <tr>
 <th>6:30 PM</th>
 <td colspan="7">World News</td>
 </tr>
 <tr>
 <th>7:00 PM</th>
 <td rowspan="2">Opera Fest</td>
 <td rowspan="2">Radio U</td>
 <td rowspan="2">Science Week</td>
 <td rowspan="2">The Living World</td>
 <td>Word Play</td>
 <td>Agri-Week</td>
 <td rowspan="2">Folk Fest</td>
 </tr>
 <tr>
 <th>7:30 PM</th>
 <td>Brain Stew</td>
 <td>Bismarck Forum</td>
 </tr>
</table>
```

# Structure of a Web Table

The first table row is made up of all header cells.

The browser renders the web table with bold headers and spanning cells.

The two data cells span seven columns.

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	

These four data cells span two rows each.

The table caption is placed at the bottom-right corner of the table.

All Times Central

The **border-collapse** property determines which table borders are separated or collapsed into each other.

```
table.schedule {
 background: white;
 border: 10px outset rgb(153, 0, 153);
 border-collapse: collapse;
 font-size: 0.75em;
 width: 100%;
}
```

The **caption-side** property places the table caption at either the top or bottom of the web table.

```
table.schedule caption {
 caption-side: bottom;
 text-align: right;
}
```

## Introducing Web Tables

In this tutorial, you explore how to use HTML to mark table data in the form of a web table. A **web table** is an HTML structure consisting of multiple table rows with each row containing one or more table cells. The cells themselves can contain additional HTML elements such as headings, paragraphs, inline images, and navigation lists. Thus, a web table is an effective tool for organizing and classifying your web page content.

### Marking Tables and Table Rows

Each web table consists of a `table` element containing a collection of table rows marked using the `tr` (table row) element in the following general structure

```
<table>
 <tr>
 table cells
 </tr>
 <tr>
 table cells
 </tr>
 ...
</table>
```

where *table cells* are the cells within each row. Tables are considered block-level elements appearing by default on a new line within the web page. The dimension or size of the table is defined by the number of table rows and the number of cells within those rows.

#### TIP

Sketch your tables beforehand so that you can visualize the placement of the table rows and cells.

To see how table content can be created using the `table` and `tr` elements, you meet with Kyle in his office at DLR to discuss the design for his page describing DLR's evening schedule. He wants you to place the schedule in a table, similar to the one shown in Figure 6–1.

Figure 6–1

DLR nightly schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday			
6:00	National News	National News	National News	National News	National News	National News	National News			
6:30	World News	World News	World News	World News	World News	World News	World News			
7:00	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest			
7:30					Brain Stew	Bismarck Forum				
8:00	The Classical Music Connection				Old Time Radio	Saturday Nite Jazz	The Indie Connection			
8:30					The Inner Mind					
9:00					Open Mike Nite					
9:30										
10:00	World News Feed	World News Feed	World News Feed	World News Feed	World News Feed	World News Feed	World News Feed			

Kyle's proposed table contains 10 rows: the first row contains headings for each of the table columns and the remaining rows list the DLR programs airing from 6:00 p.m. to 10:30 p.m. in half-hour intervals. Notice that some programs last longer than one-half hour and thus will cover multiple rows. Kyle has already created that web page that will contain this table and written style sheets for the page's layout, graphics, and typography.

## REFERENCE

### Marking a Web Table and Table Rows

- To mark a web table and the table rows, enter

```
<table>
 <tr>
 table cells
 </tr>
 <tr>
 table cells
 </tr>
 ...
</table>
```

where `<table>` marks the table element, `<tr>` marks each table row, and `table cells` are the cells within each row.

You start working on his page by adding the first three rows of his proposed table within a `table` element. You also include a `class` attribute, placing the table in the schedule class to distinguish it from other tables that may exist on the DLR website.

### To start working on the evening schedule page:

1. Use your editor to open the **dlr\_evenings\_txt.html** file from the **html06** ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **dlr\_evenings.html**.
2. Scroll down the document to the `section` element with the `id` "main" and add the following `table` and `tr` elements after the initial paragraph in the section.

```
<table class="schedule">
 <tr>
 </tr>
 <tr>
 </tr>
 <tr>
 </tr>
</table>
```

Figure 6–2 shows the placement of the `table` and `tr` elements in the document.

Figure 6–2

## Marking a table and table rows

table element marks the web table

tr element marks each table row

```
<section id="main">

 <h2>DLR Nightly Schedule</h2>
 <p>DLR airs listener-supported public radio in Bismarck,
 North Dakota from 5:00 a.m. to 10:30 p.m.
 You can Listen Live to streaming audio
 of our broadcast. Please refer below for our current
 nightly schedule.</p>
 <table class="schedule">
 <tr>
 </tr>
 <tr>
 </tr>
 <tr>
 </tr>
 </table>
</section>
```

class attribute with a value of "schedule" sets this table in its own class

3. Take some time to scroll through the rest of the document to become familiar with its content and structure and then save your changes to the file, but do not close it.

At this point, you have a table with three rows but no content. Your next task is to add table cells to each of those rows.

## Marking Table Headings and Table Data

Web tables support two types of table cells: header cells that contain content usually placed at the top of a column or the beginning of a row and data cells that contain content within those columns and rows. A header cell is marked using the `th` element. The default browser style for header cells is to display the text of the header in bold font and centered horizontally within the cell.

Kyle wants you to mark the cells in the first row of the radio schedule as header cells because those cells contain information describing the contents of each table column. He also wants the first cell in each of the remaining rows to be marked as a header cell because those cells identify the time of day in which each program airs. You start by adding header cells to the first three rows of the schedule table.

### To mark table header cells:

1. In the first row of the table you just created in the `dlr_evenings.html` file, create header cells by inserting the following `th` elements:

```
<th>Time</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
```

Note that since these header cells are nested within a `tr` element, they will all appear within the same table row.

2. In the second row of the table, insert the following `th` element:

```
<th>6:00 PM</th>
```

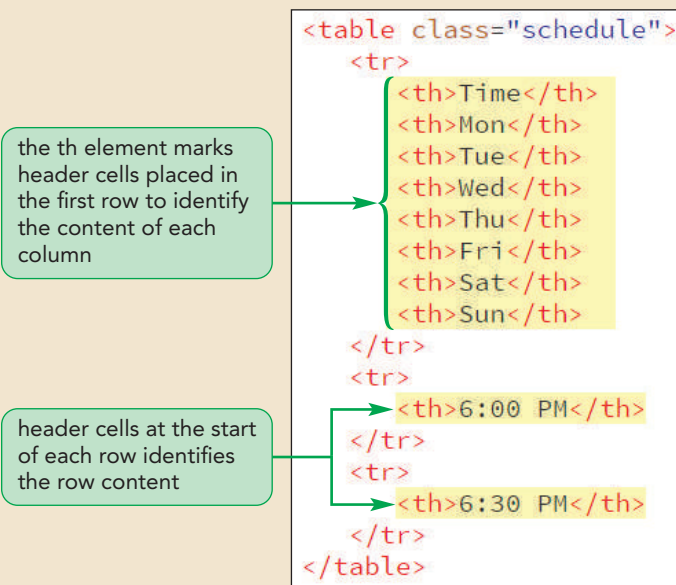
3. In the third table row, insert the header cell:

```
<th>6:30 PM</th>
```

These cells are the headers for your table rows. Figure 6–3 highlights the newly added header cells in the table.

Figure 6–3

### Marking table header cells



4. Save your changes to the file and then load **dlr\_evenings.html** in your browser. Verify that the table shows three rows: the first row contains the text "Time" followed by the days of the week. The second and third rows display the 6:00 PM and 6:30 PM times. All text is displayed in a bold font.

Data cells that do not function as headers for table rows or columns are marked using the `td` element. The default browser style for data cells is to display data cell text as unformatted text, left-aligned within the cell.

## REFERENCE

### Marking Header Cells and Data Cells

- To mark a header cell, enter

```
<th>content</th>
```

where *content* is the content of the header cell, such as text or images.

- To mark a data cell, enter

```
<td>content</td>
```

DLR airs national and world news at 6:00 and 6:30, respectively, every night of the week. You use table data cells to mark the names of these DLR programs.

### To mark table data cells:

1. Within the second row of the table, add the following seven `td` elements after the initial `th` element:  

```
<td>National News</td>
<td>National News</td>
<td>National News</td>
<td>National News</td>
<td>National News</td>
<td>National News</td>
<td>National News</td>
```

2. Within the third table row, insert another seven `td` elements listing the World News program after the initial `th` element:  

```
<td>World News</td>
<td>World News</td>
<td>World News</td>
<td>World News</td>
<td>World News</td>
<td>World News</td>
<td>World News</td>
```

Figure 6–4 highlights the newly added data cells in the second and third rows of the table.

Figure 6–4

### Marking table data cells

the `td` element marks table cell content that is not considered the head of a row or column

```
<tr>
 <th>6:00 PM</th>
 <td>National News</td>
 <td>National News</td>
 <td>National News</td>
 <td>National News</td>
 <td>National News</td>
 <td>National News</td>
 <td>National News</td>
</tr>
<tr>
 <th>6:30 PM</th>
 <td>World News</td>
 <td>World News</td>
 <td>World News</td>
 <td>World News</td>
 <td>World News</td>
 <td>World News</td>
 <td>World News</td>
</tr>
</table>
```

3. Save your changes to the file and then open the **dlr\_evenings.html** file in your browser. Figure 6–5 shows the current appearance of the program schedule table.

Figure 6–5

Initial layout of the program schedule table

DLR Nightly Schedule

DLR airs listener-supported public radio in Bismarck, North Dakota from 5:00 a.m. to 10:30 p.m. You can [Listen Live](#) to streaming audio of our broadcast. Please refer below for our current nightly schedule.

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News	National News	National News	National News	National News	National News	National News
6:30 PM	World News	World News	World News	World News	World News	World News	World News

© Courtesy Patrick Carey

Note that the header cells are displayed in a bold font while the data cells are not because of the default table styles employed by the browser.

**Trouble?** If your table looks different from the one shown in Figure 6–5, you might have inserted an incorrect number of table cells. Check your code against the code shown in Figure 6–4.

The table you created for Kyle has three rows and eight columns. The number of columns is determined by the row with the most cells. Thus, if one row has four cells and another row has five, the table will have five columns. The row with only four cells will have an empty space at the end, where the fifth cell should be.

The structure of the program schedule table is a bit difficult to see because there are no borders around the table, table rows, or table cells. You can modify the table's appearance through the use of a CSS style sheet. You start creating this style sheet now, first focusing on adding borders to the table.

## Adding Table Borders with CSS

Using the CSS `border` property, borders can be added to any part of a web table, including the table itself, table rows, and individual table cells. The borders need not be the same styles, for example, you can have one set of borders for the table rows and a different set of borders for individual cells within those rows.

Kyle would like you to add a 10-pixel purple border in the outset style around the entire program schedule table. He also wants the table background color changed to white, the font size of the table text set to 0.75em, and the width set to 100% so that it extends through the entire width of the main page section. Finally, Kyle wants you to add a 1-pixel solid gray border around each table cell. Add these style rules to the `dlr_tables.css` style sheet file, which you create now.

### To add borders to a table:

1. Use your editor to open the **dlr\_tables\_txt.css** file from the html06 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **dlr\_tables.css**.
2. Within the Table Styles section, add the following style rule to place a border around tables belonging to the schedule class:

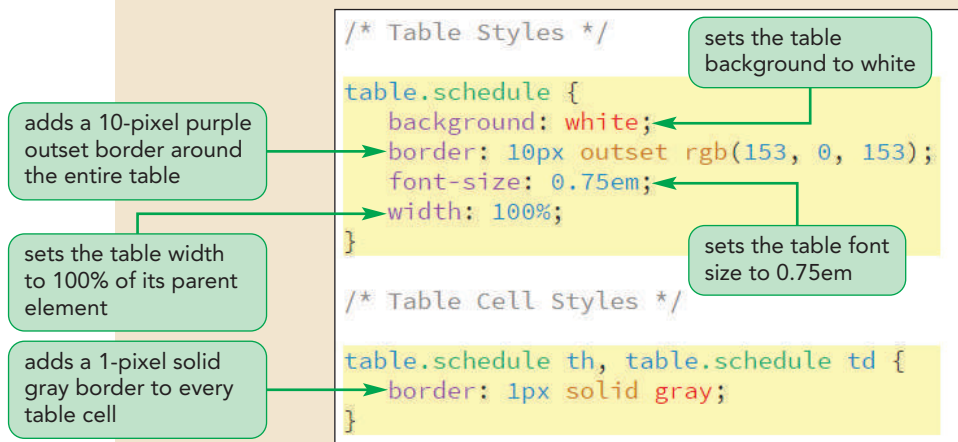
```
table.schedule {
 background: white;
 border: 10px outset rgb(153, 0, 153);
 font-size: 0.75em;
 width: 100%;
}
```

3. Within the Table Cells Styles section, add the following style rule to place a border around each header cell and data cell within tables belonging to the schedule class.

```
table.schedule th, table.schedule td {
 border: 1px solid gray;
}
```

Figure 6–6 highlights the newly added styles to create the table borders.

**Figure 6–6** Adding styles to the table and table cells



4. Save your changes to the style sheet and then reload the dlr\_evenings.html file in your editor.
5. Within the document head and directly before the closing `</head>` tag, add the following `link` element to link the document to the dlr\_tables.css style sheet:

```
<link href="dlr_tables.css" rel="stylesheet" />
```

6. Save your changes to the file and then reload the dlr\_evenings.html file in your browser.

Figure 6–7 shows the revised appearance of the table with the newly added borders.

Figure 6-7

Program schedule with borders

border around the entire table

borders around table cells

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News	National News	National News	National News	National News	National News	National News
6:30 PM	World News	World News	World News	World News	World News	World News	World News

The default browser style is to separate the border around the entire table from the borders around individual table cells, creating additional space in the table layout. Another style choice is to collapse the borders into each other. Figure 6-8 shows the impact of both style choices.

Figure 6-8

Separate and collapsed borders

separate borders

collapsed borders

**TIP**

If a doctype is not included in the HTML code, the `border-collapse` property can produce unexpected results in versions of Internet Explorer 8 or earlier.

To choose between the separate or collapsed borders model, apply the following `border-collapse` property to the `table` element

```
border-collapse: type;
```

where *type* is either `separate` (the default) or `collapse`. If the separate borders model is used, the spacing between the borders is set by adding the following `border-spacing` property to the `table` element

```
border-spacing: value;
```

where *value* is the space between the borders in one of the CSS units of measure. For example, the following style rule specifies that all borders within the table should be separated by a distance of 10 pixels:

```
table {
 border-collapse: separate;
 border-spacing: 10px;
}
```

In the collapsed borders model, borders from adjacent elements are merged together to form a single border, but the borders are not simply moved together, instead they are joined in a new style that combines features of both borders. For example, if

two adjacent 1-pixel-wide borders are collapsed together, the resulting border is not 2-pixels wide, but only 1-pixel wide.

The situation is more complicated when adjacent borders have different widths, styles, or colors that cannot be easily combined. For example, how would you combine an outset red border and a solid blue border into a single border of only one color and style? To reconcile the differences between adjacent borders, CSS employs the following five rules, listed in order of decreasing precedence:

1. If either border has a border style of `hidden`, the collapsed border is hidden.
2. A border style of `none` is overridden by any other border style.
3. If neither border is hidden, the style of the wider border takes priority over the narrower border.
4. If the two borders have the same width but different styles, the border style with the highest priority is used. Double borders have the highest priority, followed by solid, dashed, dotted, ridge, outset, groove, and finally, inset borders.
5. If the borders differ only in color, the color of the element in the table with the higher priority takes precedence. Precedence is given first to borders around individual table cells, followed by borders for table rows, row groups, columns, and column groups; and finally, the border around the entire table. You will learn about row groups, columns, and column groups later in this tutorial.

Any situation not covered by these rules is left to browsers to determine which border dominates when collapsing the two borders. Figure 6–9 provides an example of the first rule in action. In this example, the border around the entire table is hidden but a 1-pixel blue border is assigned to the cells within the table. As shown in the image on the right, when collapsed, any cell borders adjacent to the table border adopt the hidden border property.

**Figure 6–9** Reconciling hidden borders

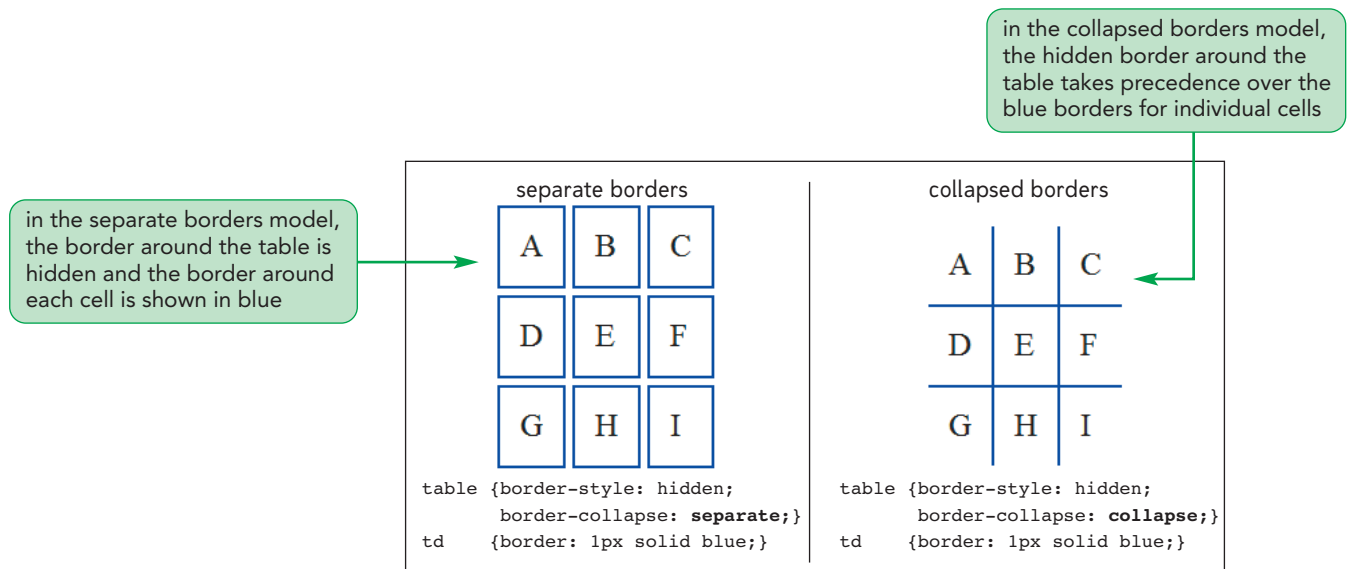
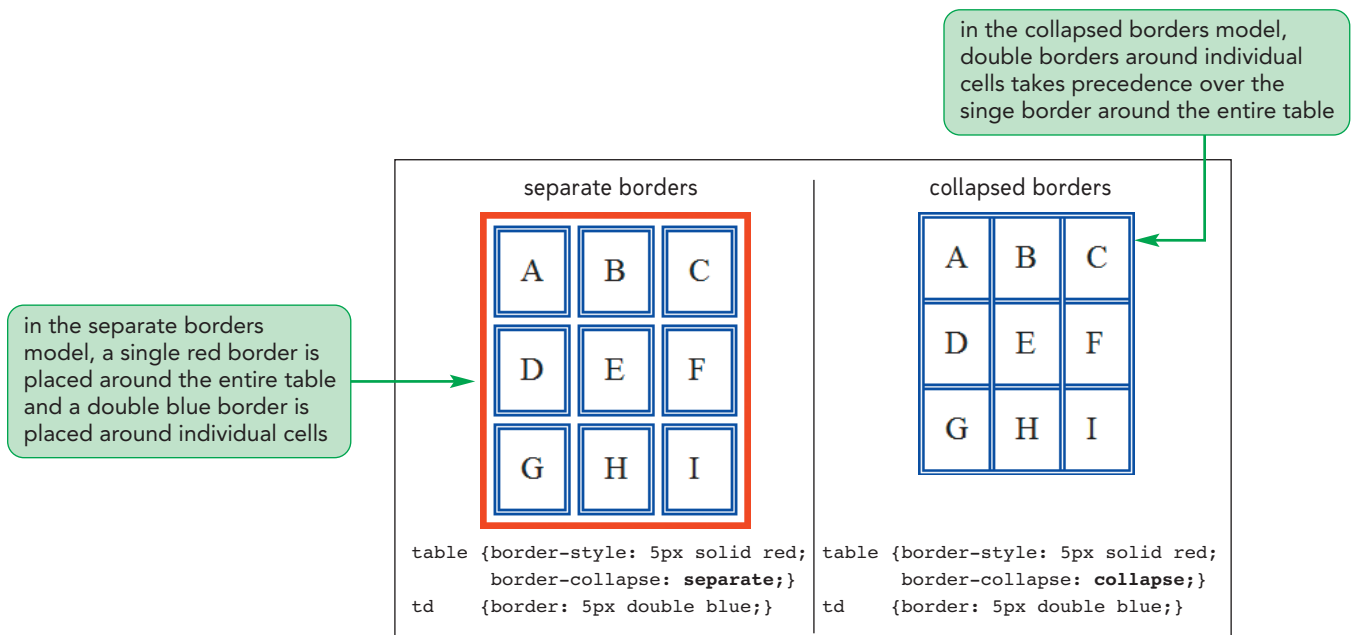


Figure 6–10 shows what happens when two borders of the same width but different styles meet. In this case, because of Rule 4, the table cell borders with the double blue lines take precedence over the solid red line of the table border when the two borders are collapsed into one.

Figure 6–10 Reconciling different border styles



Although the collapsed borders model appears more complicated at first, the rules are reasonable and allow for a wide variety of border designs.

## REFERENCE

### Styling Table Borders

- To define the table borders model, apply the style

```
border-collapse: type;
```

where *type* is *separate* (the default) to create separate borders or *collapse* to merge all adjacent borders.

- To set the space between separated borders, apply the style

```
border-spacing: value;
```

where *value* is the space between the borders in any of the CSS units of measure.

For the DLR evening program schedule, Kyle thinks the table would look better with collapsed borders and asks you to modify the table style sheet.

### To collapse the table borders:

1. Return to the **dlr\_tables.css** file in your editor.
2. Add the style **border-collapse: collapse;** to the style rule for the schedule table. Figure 6–11 highlights the newly added style.

Figure 6–11

## Setting the border collapse style

sets the borders within the table to collapse into one another

```
table.schedule {
 background: white;
 border: 10px outset rgb(153, 0, 153);
 border-collapse: collapse;
 font-size: 0.75em;
 width: 100%;
}
```

3. Save your changes to the style sheet and then reload the dlr\_evenings.html file in your browser.

Figure 6–12 shows the appearance of the table with the collapsed borders.

Figure 6–12

## Program schedule with collapsed borders

spacing between the borders has been removed

DLR Nightly Schedule							
DLR airs listener-supported public radio in Bismarck, North Dakota from 5:00 a.m. to 10:30 p.m. You can <a href="#">Listen Live</a> to streaming audio of our broadcast. Please refer below for our current nightly schedule.							
Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News	National News	National News	National News	National News	National News	National News
6:30 PM	World News	World News	World News	World News	World News	World News	World News

Kyle remarks that the schedule information for the 6:00 p.m. and 6:30 p.m. timeslots is highly redundant because the *National News* and *World News* programs always air at those times every day of the week. He thinks that the schedule would be easier to read if those programs are entered only once with the table cell text extending across the week. You can achieve this effect using spanning cells.

## Spanning Rows and Columns

A spanning cell is a single cell that occupies more than one cell row and/or column. Spanning cells are created by adding either or both of the following `rowspan` and `colspan` attributes to either `td` or `th` elements

```
rowspan="rows" colspan="cols"
```

where `rows` is the number of rows that the cell will occupy and `cols` is the number of columns. The spanning starts in the cell where you put the `rowspan` and `colspan` attributes, and goes to the right and downward from that location. For example, to create a data cell that spans three rows and two columns, enter the following `td` element:

```
<td rowspan="3" colspan="2" > ... </td>
```

It is important to remember that when a cell spans multiple rows or columns, it pushes other cells to the right or down. If you want to maintain the same number of rows and columns in your table, you must adjust the number of cells in a row or column that includes a spanning cell. To account for a column-spanning cell, you

have to reduce the number of cells in the current row. For example, if a table covers five columns, but one of the cells in a row spans three columns, you need only three table cells in that row: two cells that occupy a single column each and the one cell that spans the other three columns.

## REFERENCE

### Creating Cells that Span Rows and Columns

- To create a cell that spans several columns, add the following attribute to `td` or `th` element

```
colspan="cols"
```

where *cols* is the number of columns covered by the cell.

- To create a cell that spans several rows, add the following attribute to `td` or `th` element

```
rowspan="rows"
```

where *rows* is the number of rows covered by the cell.

To see how column-spanning cells work, you replace the cells for the *National News* and *World News* programs that currently occupy seven cells each with a single cell spanning seven columns in each row.

### To create a column-spanning cell:

1. Return to the `dlr_evenings.html` file in your editor.
2. Go to the schedule table and for the second table cell in both the second and third rows of the table, add the attribute

```
colspan="7"
```

to the opening `<td>` tag.

3. Delete the remaining six table cells in both the second and third table rows to keep the size of those rows at eight total columns.

Figure 6–13 highlights the revised code for the schedule table.

You must remove cells from the table row when you add a column-spanning cell to ensure that the cell content aligns properly into columns.

Figure 6–13

## Spanning several columns with a single cell

remaining six td elements removed from the second and third rows to keep the size at 8 total columns

```
<table class="schedule">
 <tr>
 <th>Time</th>
 <th>Mon</th>
 <th>Tue</th>
 <th>Wed</th>
 <th>Thu</th>
 <th>Fri</th>
 <th>Sat</th>
 <th>Sun</th>
 </tr>
 <tr>
 <th>6:00 PM</th>
 <td colspan="7">National News</td>
 </tr>
 <tr>
 <th>6:30 PM</th>
 <td colspan="7">World News</td>
 </tr>
</table>
```

sets each cell to span 7 columns within its row

4. Save your changes to the file and then reload the dlr\_evenings.html file in your browser.

Figure 6–14 shows the revised appearance of the table with column-spanning cells in the second and third rows.

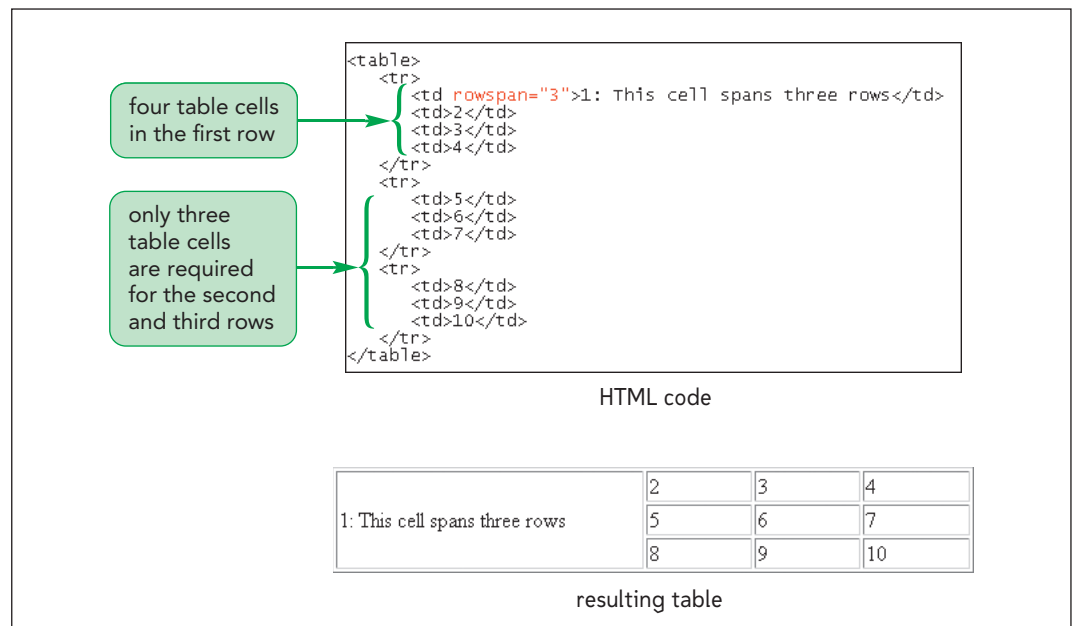
Figure 6–14

## Column-spanning cells

the second cell in both rows 2 and 3 spans seven columns

DLR Nightly Schedule							
DLR airs listener-supported public radio in Bismarck, North Dakota from 5:00 a.m. to 10:30 p.m. You can <a href="#">Listen Live</a> to streaming audio of our broadcast. Please refer below for our current nightly schedule.							
Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						

The rest of the evening schedule shown earlier in Figure 6–1 includes programs that last longer than 30 minutes and thus will need to span several rows. To maintain a row layout with row-spanning cells, you need to remove extra cells from the rows below the spanning cell. Consider the table shown in Figure 6–15, which covers three rows and four columns. The first cell from the first row spans three rows. You need four table cells in the first row, but only three in the second and third rows. This is because the spanning cell from the first row occupies the position of the first cell in the second and third rows.

**Figure 6–15** Row-spanning cells

The 7:00 p.m. to 8:00 p.m. section of the DLR schedule contains several programs that run for an hour. To insert these programs, you create row-spanning cells that span two rows in the schedule table. To keep the columns lined up, you must reduce the number of cells entered in the subsequent row. Enter the next two rows of the program schedule table now.

### To create row-spanning cells:

1. Return to the **dlr\_evenings.html** file in your editor.
2. Directly above the closing **</table>** tag, insert the following table row:

```
<tr>
 <th>7:00 PM</th>
 <td rowspan="2">Opera Fest</td>
 <td rowspan="2">Radio U</td>
 <td rowspan="2">Science Week</td>
 <td rowspan="2">The Living World</td>
 <td>Word Play</td>
 <td>Agri-Week</td>
 <td rowspan="2">Folk Fest</td>
</tr>
```

3. Add the following row for the programs that start at 7:30 p.m.:

```
<tr>
 <th>7:30 PM</th>
 <td>Brain Stew</td>
 <td>Bismarck Forum</td>
</tr>
```

Figure 6–16 highlights the revised code for the schedule table.

Figure 6–16

## Inserting cells that span two rows

cells span two rows

```

<tr>
 <th>6:30 PM</th>
 <td colspan="7">World News</td>
</tr>
<tr>
 <th>7:00 PM</th>
 <td rowspan="2">Opera Fest</td>
 <td rowspan="2">Radio U</td>
 <td rowspan="2">Science Week</td>
 <td rowspan="2">The Living World</td>
 <td>Word Play</td>
 <td>Agri-Week</td>
 <td rowspan="2">Folk Fest</td>
</tr>
<tr>
 <th>7:30 PM</th>
 <td>Brain Stew</td>
 <td>Bismarck Forum</td>
</tr>
</table>

```

4. Save your changes to the file and then reload the dlr\_evenings.html file in your browser.

Figure 6–17 shows the schedule for programs airing at 7:00 p.m. and 7:30 p.m.

Figure 6–17

## Program schedule through 7:30 p.m.

DLR Nightly Schedule							
DLR airs listener-supported public radio in Bismarck, North Dakota from 5:00 a.m. to 10:30 p.m. You can <a href="#">Listen Live</a> to streaming audio of our broadcast. Please refer below for our current nightly schedule.							
Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	

cells spanning two rows

## TIP

You can create even more complex layouts by nesting tables inside table cells.

The final part of the evening schedule includes the program *The Classical Musical Connection*, which spans two hours on Monday through Thursday. Like the news programs, you don't want to repeat the name of the show each day; and like the five hour-long programs you just entered, you don't want to repeat the name of the show in each half-hour cell. Kyle suggests that you use both the `rowspan` and `colspan` attributes to create a table cell that spans four rows and four columns.

Other programs in the 8:00 to 10:00 time slots, such as *Saturday Nite Jazz* and *The Indie Connection*, also span four rows, but only one column. The last program aired before KPAF signs off is the *World News Feed*, which is played every night from 10:00 to 10:30. You add these and the other late evening programs to the schedule table now.

### To enter the remaining programs:

1. Return to the **dlr\_evenings.html** file in your editor and, directly above the closing `</table>` tag, add the following table row for programs airing at 8:00 p.m.:
 

```
<tr>
 <th>8:00 PM</th>
 <td rowspan="4" colspan="4">The Classical Music
Connection</td>
 <td>Old Time Radio</td>
 <td rowspan="4">Saturday Nite Jazz</td>
 <td rowspan="4">The Indie Connection</td>
</tr>
```
2. The *Inner Mind* is the only program starting at 8:30 p.m. during the week. Add the 8:30 p.m. starting time and the program listing as a new row in the schedule table:
 

```
<tr>
 <th>8:30 PM</th>
 <td>The Inner Mind</td>
</tr>
```
3. The only program that starts at 9:00 p.m. is the hour-long *Open Mike Nite* program. Add the following row to the table to display this program in the schedule:
 

```
<tr>
 <th>9:00 PM</th>
 <td rowspan="2">Open Mike Nite</td>
</tr>
```
4. There are no programs that start at 9:30 p.m. during the week. However, you still need to include this starting time in the schedule because the nightly schedule is broken down into half-hour increments. Add the following table row:
 

```
<tr>
 <th>9:30 PM</th>
</tr>
```
5. Complete the table by adding the last row, which lists the *World News Feed* program that airs every night starting at 10:00 p.m.:
 

```
<tr>
 <th>10:00 PM</th>
 <td colspan="7">World News Feed</td>
</tr>
```

Figure 6–18 highlights the newly added rows in the schedule table.

Figure 6–18

## Adding the remaining DLR programs

program covers 4 half-hour slots on 4 consecutive days

programs cover 4 half-hour slots

only one program starts at 8:30 p.m.

program covers 2 half-hour slots

no program starts at 9:30 p.m.

program airs every night starting at 10:00 p.m.

```

</tr>
<tr>
 <th>8:00 PM</th>
 <td rowspan="4" colspan="4">The Classical Music Connection</td>
 <td>Old Time Radio</td>
 <td rowspan="4">Saturday Nite Jazz</td>
 <td rowspan="4">The Indie Connection</td>
</tr>
<tr>
 <th>8:30 PM</th>
 <td>The Inner Mind</td>
</tr>
<tr>
 <th>9:00 PM</th>
 <td rowspan="2">Open Mike Nite</td>
</tr>
<tr>
 <th>9:30 PM</th>
</tr>
<tr>
 <th>10:00 PM</th>
 <td colspan="7">World News Feed</td>
</tr>
</table>

```

6. Save your changes to the file and then reload the dlr\_evenings.html file in your browser.

Figure 6–19 shows the complete schedule for all of the DLR evening programs during the week.

Figure 6–19

## The complete DLR evening schedule

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	
8:00 PM	The Classical Music Connection				Old Time Radio	Saturday Nite Jazz	The Indie Connection
8:30 PM					The Inner Mind		
9:00 PM					Open Mike Nite		
9:30 PM							
10:00 PM	World News Feed						

The web table you created matches the printout of DLR's evening schedule. Kyle likes the clear structure of the table. He notes that many DLR listeners tune into the station over the Internet, listening to DLR's streaming audio feed. Because those listeners might be located in different time zones, Kyle suggests that you add a caption to the table indicating that all times in the schedule are based on the Central time zone.

### Defining Borders in HTML

If you work with legacy websites, you might encounter web tables in which tables are formatted using HTML attributes. One such attribute is the following `border` attribute

```
<table border="value">
...
</table>
```

where *value* is the width of the table border in pixels. Adding a table border in this fashion also adds a border around individual table cells. HTML also supports two attributes, `frame` and `rules`, that allow you to specify exactly which table cells receive borders and which sides of those table cells are bordered.

These attributes are not supported in HTML 5, but most browsers still support them for older websites. You should use CSS border styles whenever possible to format the appearance of your web table.

## Creating a Table Caption

Table captions are another part of the basic table structure and are marked using the following `caption` element

```
<caption>content</caption>
```

where *content* is the content contained within the caption. Captions can contain additional text-level elements. For example, the following code marks the text Program Schedule using the `em` element, which marks it as emphasized text:

```
<caption>Program Schedule</caption>
```

Only one caption is allowed per web table, and the `caption` element must be listed directly after the opening `<table>` tag.

Add a caption to the program schedule.

### To add a table caption:

1. Return to the `dlr_evenings.html` file in your editor.
2. Directly after the opening `<table>` tag, insert the following `caption` element:

```
<caption>All Times Central</caption>
```

Figure 6–20 highlights the table caption element.

Figure 6–20

## Adding a caption to a web table

```
<table class="schedule">
 <caption>All Times Central</caption>
 <tr>
 <th>Time</th>
 <th>Mon</th>
 <th>Tue</th>
 <th>Wed</th>
 <th>Thu</th>
 <th>Fri</th>
 <th>Sat</th>
 <th>Sun</th>
 </tr>
```

3. Save your changes to the file.

By default, browsers place captions above the table, but you can specify the caption location using the `caption-side` property

```
caption-side: position;
```

where *position* is either `top` (the default) or `bottom` to place the caption below the table.

To align the caption text horizontally, you use the CSS `text-align` property. Thus, to place the schedule caption in the bottom-right corner of the table, you would enter the following CSS styles:

```
caption-side: bottom;
text-align: right;
```

## REFERENCE

**Creating a Table Caption**

- To create a table caption, add the following `caption` element directly below the opening `<table>` tag

```
<caption>content</caption>
```

where *content* is the content of the table caption.

- To position a table caption, apply the CSS property

```
caption-side: position;
```

where *position* is `top` or `bottom`.

- To horizontally align a caption, apply the CSS `text-align` property

```
text-align: position;
```

where *position* is `left`, `center`, or `right`.

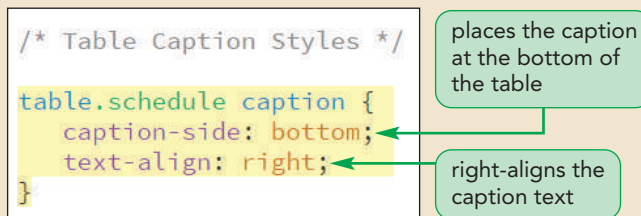
Add styles to the `dlr_tables.css` style sheet to place the caption of the program schedule table to the bottom and right of the table.

**To format the table caption:**

1. Return to the `dlr_tables.css` file in your editor.
2. Go to the Table Caption Styles section and insert the following style rule:

```
table.schedule caption {
 caption-side: bottom;
 text-align: right;
}
```

Figure 6–21 highlights the style rule for the table caption.

**Figure 6–21****Formatting a caption**

3. Save your changes to the file and then reload the `dlr_evenings.html` file in your browser. Figure 6–22 shows the placement of the table caption below and to the right of the schedule table.

**Figure 6–22****Placement of the table caption**

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	
8:00 PM					Old Time Radio		
8:30 PM	The Classical Music Connection				The Inner Mind	Saturday Nite Jazz	The Indie Connection
9:00 PM					Open Mike Nite		
9:30 PM							
10:00 PM	World News Feed						

table caption → All Times Central

Table captions inherit the text styles associated with the table. For example, if you create a style for the `table` element that sets the font color to red, the caption text will also be displayed in a red font.



### Problem Solving: Make Your Tables Accessible

It is a challenge to make web tables accessible to users who rely on screen readers to access online content. Screen readers read table content linearly by moving left-to-right from the cells within each row and then down row-by-row through the table. To make the table content accessible, you must first structure the content so that it is easily interpreted even when read in a linear order.

Many screen readers include the ability to announce the row and column headers associated with each data cell, so you should always identify your row and column headers using the `th` element. You can also use the following `scope` attribute to explicitly associate a header cell with a row or column

```
<th scope="type">...</th>
```

where `type` is either `row`, `column`, `rowgroup` (for a group of rows), or `colgroup` (for a group of columns). For example, the following code explicitly associates the header cell with the content of its table row

```
<th scope="row">7:30 PM</th>
```

A screen reader encountering the `scope` attribute can use it to aurally identify a data cell with its row and column headers, making it easier for users to interpret the cell content.

Appendix D provides more information on making the web more accessible for users with special needs, including examples of other HTML attributes that can make your web tables more accessible.

You have completed your work on setting up the program schedule in a web table. In the next session, you will refine the table structure by grouping the rows and columns of the table. You will also further explore CSS styles designed specifically for tables and table data.

### Session 6.1 Quick Check

1. How is the number of columns in a table determined?
  - a. By the `cols` attribute
  - b. By the `columns` attribute
  - c. By the maximum number of cells placed within the table rows
  - d. By the maximum number of `th` elements within the table rows
2. To mark a cell as a table header, use:
  - a. `td`
  - b. `th`
  - c. `thead`
  - d. `theader`
3. To mark a cell as containing table data, use:
  - a. `td`
  - b. `tdata`
  - c. `cell`
  - d. `celldata`
4. To display all table elements with collapsed borders, use:
  - a. `table-collapse: collapse;`
  - b. `border: collapse;`
  - c. `border: auto;`
  - d. `border-collapse: collapse;`
5. Two table cells have adjacent borders. One cell has a 5-pixel-wide double border and the other cell has a 6-pixel-wide solid border. If the table borders are collapsed, what type of border will the two cells share?
  - a. 6-pixel solid border
  - b. 5-pixel solid border
  - c. 5-pixel double border
  - d. 6-pixel double border
6. To span a cell across two rows and three columns, use the attribute:
  - a. `span = "2 3"`
  - b. `span = "3 2"`
  - c. `rows = "2" cols = "3"`
  - d. `rowspan = "2" colspan = "3"`
7. How do you keep table columns aligned when a cell spans multiple rows?
  - a. Reduce the number of cells in the rows below the spanning cell
  - b. Use the `align` attribute
  - c. Use the `rows="align"` attribute
  - d. Use the `cols="align"` attribute
8. How do you keep table columns aligned when a cell spans multiple columns?
  - a. Reduce the number of cells in the current row after the spanning cell
  - b. Use the `align` attribute
  - c. Use the `rows="align"` attribute
  - d. Use the `cols="align"` attribute
9. To display a table caption in the lower-corner of the table, use:
  - a. `caption: bottom left`
  - b. `caption left bottom`
  - c. `caption-side: bottom; text-align: left;`
  - d. `caption: bottom; align: left;`

# Session 6.2 Visual Overview:

The `colgroup` element identifies groups of columns in the web table.

The `thead` element identifies the row(s) in the table header.

The `tbody` element identifies the row(s) in the table body.

The `tfoot` element identifies the row(s) in the table footer.

```
<table class="schedule">
 <caption>All Times Central</caption>
 <colgroup>
 <col id="firstCol" />
 <col class="dayCols" span="5" />
 </colgroup>
 <thead>
 <tr>
 <th>Time</th>
 <th>Mon</th>
 <th>Tue</th>
 <th>Wed</th>
 <th>Thu</th>
 <th>Fri</th>
 </tr>
 </thead>
 <tbody>
 <tr>
 <th>6:00 PM</th>
 <td colspan="5">National News</td>
 </tr>
 <tr>
 <th>6:30 PM</th>
 <td colspan="5">World News</td>
 </tr>
 <tr>
 <th>7:00 PM</th>
 <td rowspan="2">Opera Fest</td>
 <td rowspan="2">Radio U</td>
 <td rowspan="2">Science Week</td>
 <td rowspan="2">The Living World</td>
 <td>Word Play</td>
 </tr>
 <tr>
 <th>7:30 PM</th>
 <td>Brain Stew</td>
 </tr>
 </tbody>
 <tfoot>
 <tr>
 <td colspan="6">DLR ends its broadcast day at 10:30 p.m.</td>
 </tr>
 </tfoot>
</table>
```

Individual columns are identified with the `col` element.

# Rows and Column Groups

The firstCol column lists the times.

The dayCols columns list the days of the week.

The table header consists of six columns.

Time	Mon	Tue	Wed	Thu	Fri
6:00 PM	National News				
6:30 PM	World News				
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play
7:30 PM					Brain Stew
DLR ends its broadcast day at 10:30 p.m.					

All Times Central

The table footer text is left-aligned.

The table body includes rows and columns, some of which span multiple columns or multiple rows.

```

table.schedule thead {
 background: rgb(153, 0, 153); color: white;
}

table.schedule tfoot {
 background: black; color: white;
}

table.schedule thead tr {height: 30px;}
table.schedule tbody tr {height: 40px;}

col#firstCol {
 background: rgb(218, 210, 218); width: 20%;
}

col.dayCols {
 background: rgb(255, 220, 255); width: 16%;
}

```

This style rule sets the background and text color of the table header.

This style rule sets the background and text color of the table footer.

This style rule sets the height of rows in the table header.

This style rule sets the height of rows in the table body.

This style rule defines the background color and width of the first table column.

This style rule defines the background color and width of the remaining table columns.

## Creating Row Groups

The table you created in the first session made no distinction between rows that you used to contain column headers and rows that contained table data. To add this information into the structure of the table you can create row groups in which each row group contains specific table information. HTML supports three row groups, which define rows that belong to the table head, table body, or table footer and which are marked using the `thead`, `tbody`, and `tfoot` elements. A web table that is divided into row groups has the following general structure:

```
<table>
 <thead>
 table rows
 </thead>
 <tbody>
 table rows
 </tbody>
 <tfoot>
 table rows
 </tfoot>
</table>
```

where *table rows* are rows from the table. For example, the following code marks two rows as belonging to the table head:

```
<thead>
 <tr>
 <th colspan="2">DLR Programs</th>
 </tr>
 <tr>
 <th>Time</th>
 <th>Program</th>
 </tr>
</thead>
```

### TIP

The `thead`, `tbody`, and `tfoot` elements don't change the appearance of the table rows, instead, they are used to indicate the structure of the table itself.

Order is important. The `thead` element must appear first, followed by the `tbody` element, and finally the `tfoot` element (if it exists). A table can contain only one `thead` element and one `tfoot` element, but it can include any number of `tbody` elements to mark row groups that contain several topical sections.

## REFERENCE

**Marking Row Groups**

- To mark row groups in the table head, use

```
<thead>
 table rows
</thead>
```

where *table rows* are the rows in the table head.

- To mark row groups in the table body, use

```
<tbody>
 table rows
</tbody>
```

where *table rows* are the rows in the table body.

- To mark row groups in the table footer, use

```
<tfoot>
 table rows
</tfoot>
```

where *table rows* are the rows in the table footer.

To indicate the structure of the schedule table, you decide to use the `thead` element to mark the head row in the program schedule, the `tbody` element to mark the rows for the broadcast times of each program, and the `tfoot` element to add a table footer.

**To create table row groups:**

1. If you took a break after the last session, make sure the **dlr\_evenings.html** file is open in your editor.
2. Enclose the first table row within an opening and closing set of `<thead>` tags to mark that row as the table header. Indent the HTML code for the row to make it easier to read.
3. Enclose the remaining table rows within an opening and closing set of `<tbody>` tags to mark those rows as belonging to the table body. Indent the HTML code for those rows to make them easier to read.
4. Directly below the closing `</tbody>` tag, insert the following table footer consisting of a single row with one data cell spanning eight columns:

```
<tfoot>
 <tr>
 <td colspan="8">DLR ends its broadcast day at
10:30 p.m.</td>
 </tr>
</tfoot>
```

Figure 6–23 highlights the newly added code in the schedule table.

The table footer row group should be placed after row groups marked with the `tbody` element.

Figure 6–23

## Marking row groups

The **thead** element marks the row group for the table header

The **tbody** element marks the row group for the table body

The **tfoot** element marks the row group for the table footer

```
<table class="schedule">
 <caption>All Times Central</caption>
 <thead>
 <tr>
 <th>Time</th>
 <th>Mon</th>
 <th>Tue</th>
 <th>Wed</th>
 <th>Thu</th>
 <th>Fri</th>
 <th>Sat</th>
 <th>Sun</th>
 </tr>
 </thead>
 <tbody>
 <tr>
 <th>6:00 PM</th>
 <td colspan="7">National News</td>
 </tr>

 <tr>
 <th>10:00 PM</th>
 <td colspan="7">World News Feed</td>
 </tr>
 </tbody>
 <tfoot>
 <tr>
 <td colspan="8">DLR ends its broadcast day at 10:30 p.m.</td>
 </tr>
 </tfoot>
</table>
```

5. Save your changes to the file.

## TIP

Row groups also are used for applications in which table body content is imported from external data sources, such as databases or XML documents.

One purpose of row groups is to allow you to create different styles for groups of rows in your table. Any style that you apply to the `thead`, `tbody`, or `tfoot` element is inherited by the rows those elements contain.

Kyle wants the rows within the table header to be displayed in a white font on a purple background. He wants the rows within the table footer to be displayed in a white font on a black background. Add these style rules to the `dlr_tables.css` file now.

## To format the table row groups:

1. Return to the `dlr_tables.css` file in your editor.
2. Go to the Row Group Styles section and add the following style rule to format the content of the table header row group:

```
table.schedule thead {
 background: rgb(153, 0, 153);
 color: white;
}
```

3. Add the following style rule for the table footer row group:

```
table.schedule tfoot {
 background: black;
 color: white;
}
```

Figure 6–24 highlights the newly added style rules.

Figure 6–24

## Formatting row groups

displays the rows from the table header row group in a white font on a purple background

displays the rows from the table footer row group in a white font on a black background

```
/* Row Group Styles */

table.schedule thead {
 background: rgb(153, 0, 153);
 color: white;
}

table.schedule tfoot {
 background: black;
 color: white;
}
```

4. Save your changes to the style sheet and then reopen the **dlr\_evenings.html** file in your browser. Figure 6–25 shows the new appearance of the web table with the formatted row groups.

Figure 6–25

## Row groups in the schedule table

table header

table body

table footer

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	
8:00 PM	The Classical Music Connection				Old Time Radio	Saturday Nite Jazz	The Indie Connection
8:30 PM					The Inner Mind		
9:00 PM					Open Mike Nite		
9:30 PM							
10:00 PM	World News Feed						
DLR ends its broadcast day at 10:30 p.m.							

All Times Central

Next, Kyle wants to format the appearance of some of the columns in the table. You can define the appearance of a table column through the use of column groups.

## Creating Column Groups

There is no HTML tag to mark table columns—the columns are determined implicitly based on the number of cells within the table rows. However, you can still reference those columns for the purposes of creating design styles through the following `colgroup` element

```
<table>
 <colgroup>
 columns
 </colgroup>
 table rows
</table>
```

where *columns* are the individual columns defined within the group and *table rows* are the table rows. The columns within the `colgroup` element are identified by the following `col` element:

```
<col span="value" />
```

where *value* is the number of columns spanned by the `col` element. If no `span` attribute is included, the `col` element references a single column. Thus, the following column structure defines a group of three columns with the first two columns grouped together:

```
<colgroup>
 <col span="2" />
 <col />
</colgroup>
```

### TIP

The `span` attribute can also be added to the `colgroup` element to create column groups that span multiple columns.

Once you have defined your columns using the `colgroup` and `col` elements, you can identify individual columns using `id` and/or `class` attributes for the purposes of applying CSS styles to specific columns. For example, the following code defines a column group consisting of three columns, with the first two columns belonging to the `firstCols` class and the third column belonging has the ID `lastCol`.

```
<colgroup>
 <col span="2" class="firstCols" />
 <col id="lastCol" />
</colgroup>
```

### REFERENCE

#### Identifying a Column Group

- To identify a group of columns from the web table, use

```
<colgroup>
 columns
</colgroup>
```

where *columns* are the individual columns defined within the group.

- To identify a column within a column group, use

```
<col span="value" />
```

where *value* is the number of columns spanned by the `col` element.

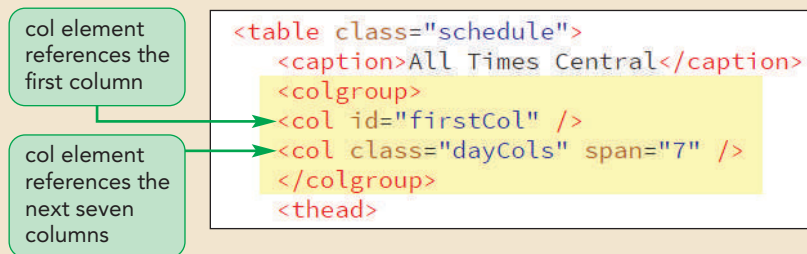
Create a column group for the program schedule table with one `col` element used for the first column containing the list of broadcast times and the second `col` element used for the remaining seven columns containing the names of the DLR programs.

**To define a column group:**

1. Return to the **dlr\_evenings.html** file in your editor.
2. Directly after the table caption, insert the following code to create a column group consisting of a first column with the ID firstCol followed by seven columns belonging to the dayCols class.

```
<colgroup>
 <col id="firstCol" />
 <col class="dayCols" span="7" />
</colgroup>
```

Figure 6–26 highlights the newly added style rules.

**Figure 6–26****Defining a column group**

3. Save your changes to the file.

Once the column groups have been defined, you can create styles to format the appearance of the columns. The following style rule uses the class and id values defined in the previous example to set the background color of the column with the ID firstCol to red and the columns belonging to the dayCols class to yellow.

```
col#firstCol {background-color: red;}
col.dayCols {background-color: yellow;}
```

Note that columns and column groups accept only CSS style properties to modify the column borders, background, width, and visibility. Other styles are not supported. You cannot, for example, set the font size for all of the text within a particular column or column group.

Modify the **dlr\_tables.css** style sheet to change the background color of the first column to gray and the background of the remaining columns (belonging to the dayCols class) to pink.

**To format a column group:**

1. Return to the **dlr\_tables.css** file in your editor.
2. Go to the Column Group Styles section and insert the following style rules to format the appearance of the schedule table columns:

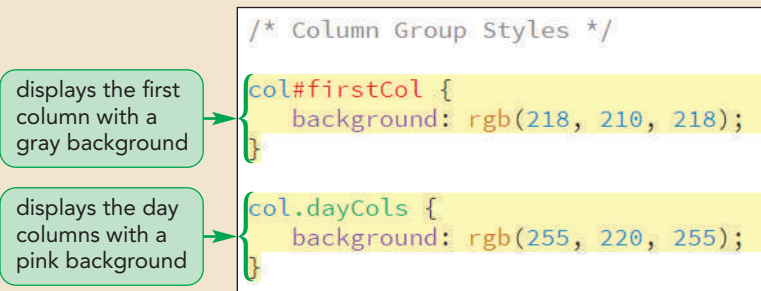
```
col#firstCol {
 background: rgb(218, 210, 218);
}

col.dayCols {
 background: rgb(255, 220, 255);
}
```

Figure 6–27 highlights the style rules for the two column groups.

Figure 6–27

### Formatting the table columns



3. Save your changes to the file and then reload the dlr\_evenings.html file in your browser.

Figure 6–28 shows the appearance of the formatted columns.

Figure 6–28

### Column groups in the schedule table

firstCol column

dayCols columns

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	
8:00 PM	The Classical Music Connection				Old Time Radio	Saturday Nite Jazz	The Indie Connection
8:30 PM					The Inner Mind		
9:00 PM					Open Mike Nite		
9:30 PM							
10:00 PM	World News Feed						
DLR ends its broadcast day at 10:30 p.m.							

All Times Central

You may have noticed that the new background colors have not been applied to all columns of the schedule table. The columns in the table header, for example, are still displayed on a medium purple background. To understand why, you need to explore how CSS handles style precedence for different parts of the table structure.

## INSIGHT

### Creating Banded Rows and Columns

A popular table design is to create table rows of alternating background colors to make it easier for users to locate table data. You can create banded rows using the `nth-of-type` pseudo-class. For example, to create a table in which the background colors alternate between yellow on the odd-numbered rows and gray on the even-numbered rows, apply the following style rules:

```
tr:nth-of-type(odd) {
 background: yellow;
}
```

```
tr:nth-of-type(even) {
 background: gray;
}
```

The same technique can be used to create banded columns of different background colors. The following style rules create odd-numbered columns that have a yellow background and even-numbered columns with a gray background:

```
colgroup col:nth-of-type(odd) {
 background: yellow;
}
```

```
colgroup col:nth-of-type(even) {
 background: gray;
}
```

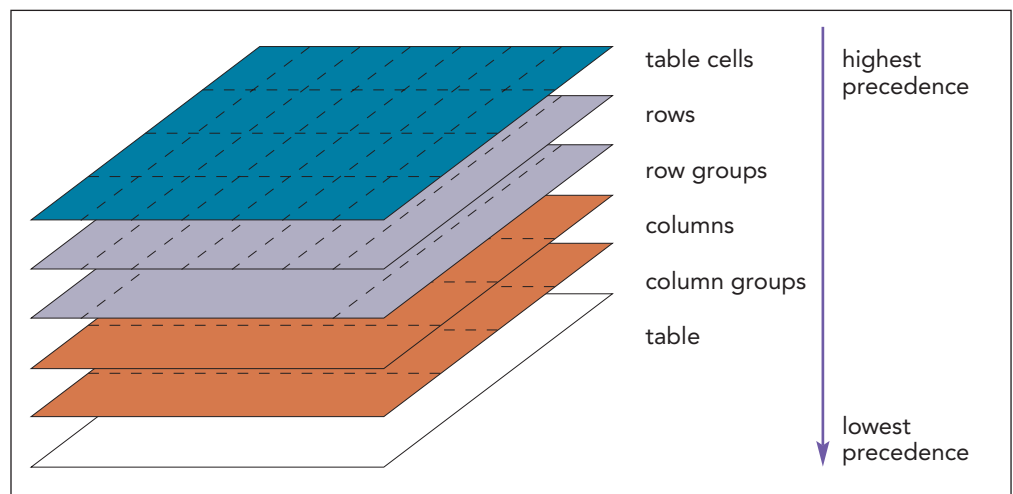
Note that this technique assumes that none of the table `row` or `col` elements span more than one row or column.

## Exploring CSS Styles and Web Tables

Table objects have different levels of precedence with styles for more specific table objects taking precedence over styles for less specific objects. Figure 6–29 diagrams the different levels of precedence in the table structure.

Figure 6–29

Levels of precedence in the table styles



The style rules with the highest precedence are those applied to individual table cells. Next are the style rules applied to table rows and table row groups, followed by the style rules applied to columns and column groups. Finally, the style rules applied to the entire web table are the ones with the lowest precedence.

The order of precedence explains why the cells in the table header retained their medium purple background. That background color was defined in the style rule for the table header row group and thus took precedence over any background styles defined for a column or column group.

## Working with Width and Height

By default, browsers will attempt to fit the most content possible within each column before wrapping the cell text to a new line. The result is that columns containing cells with more text are wider than those with less text. If the width of the entire table is set to be larger than the width required for individual columns, the extra space is divided equally among the columns. You can set the column widths to a different value by applying the `width` property to columns or column groups.

Kyle suggests you set the width of the first column to 16% of the width of the entire table and the widths of the remaining seven columns to 12% each, resulting in a total width of 100% divided among the eight columns. Add these styles to the style rules for the schedule table columns.

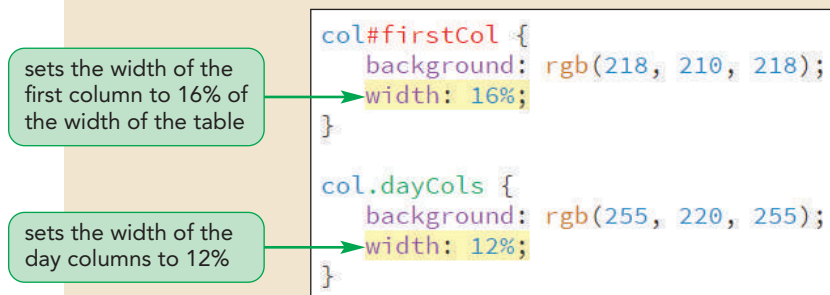
### To set the width of a column:

1. Return to the `dlr_tables.css` file in your editor and go to the Column Group Styles section.
2. Add the style `width: 16%;` to the style rule for the `firstCol` column.
3. Add the style `width: 12%;` to the style rule for the columns of the `dayCols` class.

Figure 6–30 highlights the width styles for the two column selectors.

Figure 6–30

### Setting the column width



Next, you explore how to work with row heights.

## INSIGHT

### Creating Narrow Tables

As the width of a table decreases, the amount of space allotted to each column decreases proportionally. However, the column widths can be decreased only so far. Because browsers do not hyphenate words by default, the minimum column width is equal to the width of the longest word within the column. To allow the column widths to decrease below this limit, you can apply the following style rule to the `table` element:

```
table {table-layout: fixed;}
```

A `table-layout` value of `fixed` tells the browser to ignore cell content when reducing the width of the table columns. As the column width decreases, eventually the cell text will extend beyond the borders of the cell. To prevent this from happening, you can force the browser to insert line breaks within the individual words in your table cells by applying the following style rule:

```
th, td {word-wrap: break-word;}
```

By setting the `table-layout` property to `fixed` and allowing line breaks within words in the cell, your column widths can be reduced below the default limits set by the browser.

## TIP

If the row height is not set large enough to contain the cell content, the height will automatically increase to accommodate the overflow content.

The height of each table row is based on the height of the tallest cell within the row. Because the cell height itself will increase as necessary to enclose its content, the result will be row heights that are not uniform across the table. You can define a uniform row height by applying the `height` style to table rows within each row group. Kyle suggest that you set the height of the table header row to 30 pixels and the height of each row in the table body to 40 pixels.

### To set the height of the table rows:

1. In the **dlr\_tables.css** file, scroll up to the Row Group Styles section.
2. Add the following style rule to set the row height within the table header to 30 pixels:

```
table.schedule thead tr {
 height: 30px;
}
```

3. Add the following style rule to set the row height in the table body to 40 pixels:

```
table.schedule tbody tr {
 height: 40px;
}
```

Note that you don't apply the `height` property to the row groups themselves because that would set the height of the entire group and not the individual rows within the group.

Figure 6–31 highlights the height styles for the table rows.

Figure 6–31

## Setting the row height

sets the height of the row in the table header to 30 pixels

sets the height of the rows in the table body to 40 pixels

```
table.schedule tfoot {
 background: black;
 color: white;
}

table.schedule thead tr {
 height: 30px;
}

table.schedule tbody tr {
 height: 40px;
}
```

4. Save your changes to the file and then refresh the dlr\_evenings.html file in your browser.

Figure 6–32 shows the revised appearance of the table with the resized columns and rows.

Figure 6–32

## Schedule table with resized columns and rows

column width set to 16%

each column width set to 12%

row height set to 30 pixels

each row height set to 40 pixels

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Agri-Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	
8:00 PM	The Classical Music Connection				Old Time Radio	Saturday Nite Jazz	The Indie Connection
8:30 PM					The Inner Mind		
9:00 PM					Open Mike Nite		
9:30 PM							
10:00 PM	World News Feed						

DLR ends its broadcast day at 10:30 p.m.

All Times Central

With the increased row height, Kyle would like all of the program names in the schedule to be vertically aligned with the tops of the cell borders. You can move the cell text using the `vertical-align` property introduced in Tutorial 2. Kyle also wants to increase the padding within each cell to add more space between the program names and the cell borders.

**To set the padding and cell alignment:**

1. Return to the **dlr\_tables.css** file in your editor and go to the Table Cell Styles section.
2. Add the following styles to the style rule for the header and data cells in the schedule table:

```
padding: 5px;
vertical-align: top;
```

Figure 6–33 highlights the new styles in the style sheet.

**Figure 6–33****Formatting the table cells**

adds 5 pixels of padding space to each table cell

aligns the content with the top of each table cell

```
/* Table Cell Styles */
```

```
table.schedule th, table.schedule td {
 border: 1px solid gray;
 padding: 5px;
 vertical-align: top;
}
```

3. Close the file, saving your changes.
4. Reload the **dlr\_evenings.html** file in your browser.

Figure 6–34 shows the completed design of the nightly schedule page.

**Figure 6–34****Completed design of the DLR Nightly Schedule page**

5 pixels of padding with each table cell

content aligned with the top of the table cell

The screenshot shows the DLR Nightly Schedule page. The main content area features a table with the following structure:

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
6:00 PM	National News						
6:30 PM	World News						
7:00 PM	Opera Fest	Radio U	Science Week	The Living World	Word Play	Appl Week	Folk Fest
7:30 PM					Brain Stew	Bismarck Forum	
8:00 PM	The Classical Music Connection				Old Time Radio	Saturday Night Jazz	The Indie Connection
8:30 PM					The Inner Mind		
9:00 PM					Open Mike Night		
9:30 PM							
10:00 PM	World News Feed						

Below the table, it states: "DLR ends its broadcast day at 10:30 p.m." and "All Times Central".

The sidebar on the right contains two sections:

- On the Air Now:** Folk Fest. Featuring the best of traditional and modern folk music.
- Coming Up on DLR:**
  - April 11-14: The Classical Music Connection** - Peter Thiessen shares his eclectic selection from the world of classical music.
  - April 11: Opera Fest** - Excerpts from Turandot by Giacomo Puccini.
  - April 12: Radio U** - SF author Karen Gravas reads selections from her latest work, *Hellion of Troy*.
  - April 13: Science Week** - Prof. Thomas Glass from UND discusses String Theory and Spooky Action at a Distance.
  - April 14: The Living World** - Tim Unger explores the economic impact of driverless cars and presents the latest in eco-news.

© Courtesy Patrick Carey

You have completed work on DLR's nightly schedule page. However, you will continue to explore other issues that surround the use of web tables and table designs in the remainder of this session.

## Applying Table Styles to Other Page Elements

Tables are useful for displaying information in an organized structure of rows and columns, but you are not limited to applying a table design only to web tables. Using the CSS `display` property, you can apply a table layout to other HTML elements, such as paragraphs, block quotes, or lists. Figure 6–35 lists different CSS display styles and their equivalent HTML elements.

**Figure 6–35** Table display styles

Display Style	Equivalent HTML Element
<code>display: table;</code>	table (treated as a block-level element)
<code>display: table-inline;</code>	table (treated as an inline element)
<code>display: table-row;</code>	tr
<code>display: table-row-group;</code>	tbody
<code>display: table-header-group;</code>	thead
<code>display: table-footer-group;</code>	tfoot
<code>display: table-column;</code>	col
<code>display: table-column-group;</code>	colgroup
<code>display: table-cell;</code>	td or th
<code>display: table-caption;</code>	caption

For example, the following definition list contains definitions of two networking terms:

```
<dl>
 <dt>bandwidth</dt>
 <dd>A measure of data transfer speed over a network</dd>
 <dt>HTTP</dt>
 <dd>The protocol used to communicate with web servers</dd>
</dl>
```

Rather than accepting the default browser layout for this list, it might be useful to display the text in a table. However, you don't want to lose the meaning of the markup tags. After all, HTML is designed to mark content, but not indicate how browsers should render that content. To display this definition list as a table, you could enclose each set of terms and definitions within a `div` element as follows:

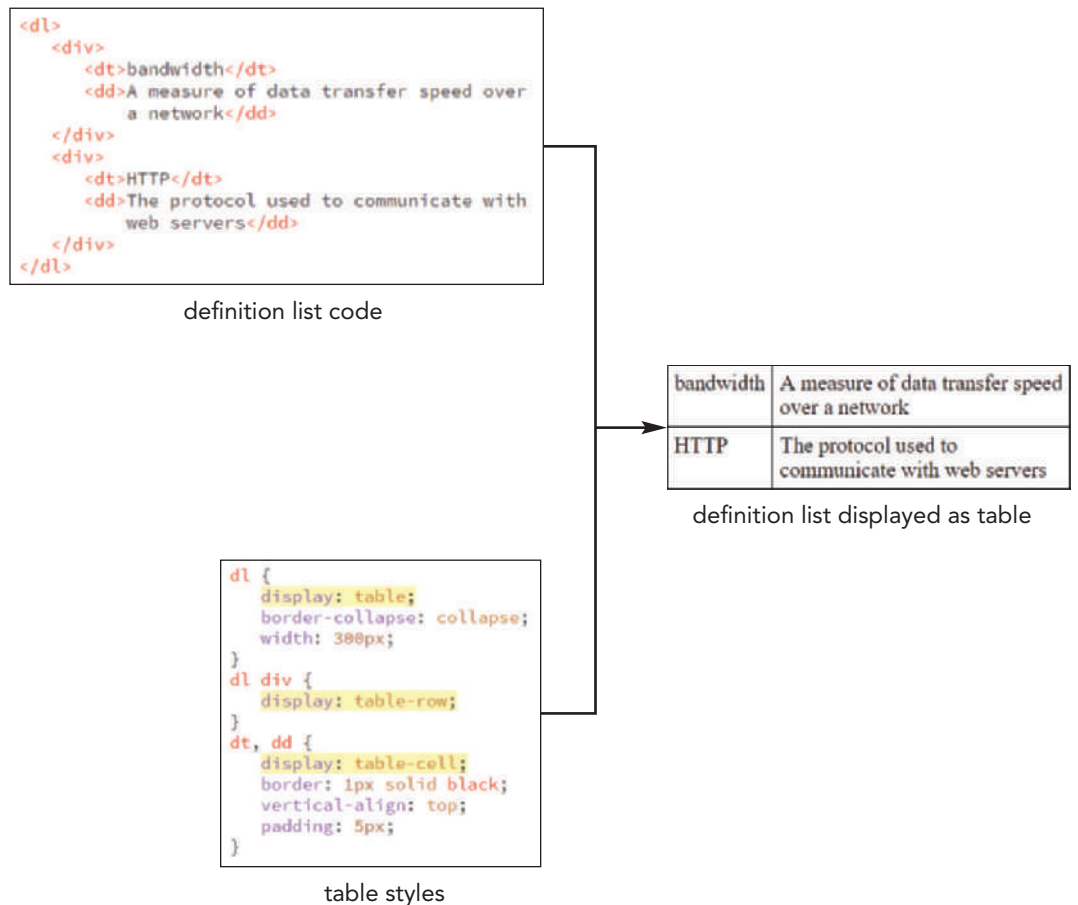
```
<dl>
 <div>
 <dt>bandwidth</dt>
 <dd>A measure of data transfer speed over a network</dd>
 </div>
 <div>
 <dt>HTTP</dt>
 <dd>The protocol used to communicate with web servers</dd>
 </div>
</dl>
```

You could then apply the following style sheet to the list, treating the entire definition list as a table—the `div` elements act as table rows, and the definition terms and descriptions act as table cells within those rows:

```
dl {display: table; border-collapse: collapse; width: 300px;}
dl div {display: table-row;}
dt, dd {display: table-cell; border: 1px solid black;
 vertical-align: top; padding: 5px;}
```

As Figure 6–36 shows, when viewed in a web browser, the definition list looks exactly as if it were created using HTML table elements.

**Figure 6–36** Applying table styles to a definition list



In the same way, you can display other page elements in table form, as long as the markup tags are nested in a way that mimics a table structure.

### Formatting a Table using HTML Attributes

If you work with legacy web pages, you might encounter web tables that use attributes to style the appearance of the table. For example, the width of the table can be set using the following width attribute

```
<table width="value"> ... </table>
```

where *value* is the width of the table in pixels or as a percent of the width of the parent element.

The height of table rows can be set using the following height attribute

```
<tr height="value"> ... </tr>
```

where *value* is the table row height in pixels.

The padding space within each table cell is set using the following cellpadding attribute

```
<table cellpadding="value"> ... </table>
```

where *value* is the size of the padding space in pixels.

Finally, the space between table cells is set using the following cellspacing attribute

```
<table cellspacing="value"> ... </table>
```

where *value* is the size of the space in pixels. The cellspacing attribute essentially sets the width of the borders around individual table cells.

Each of these attributes has been replaced by CSS styles; however, you may still see them employed in older websites and if you are tasked with upgrading those sites you will need to understand those attribute's meaning and purpose.

## Tables and Responsive Design

Tables do not scale well to mobile devices. Users will often be confronted with one of the following: (a) a table in which the cell content is too small to be readable, (b) a table that extends beyond the boundaries of the visual viewport, or (c) table columns that are so narrow that the cell content is unreadable (see Figure 6–37).

Figure 6–37 Web tables on mobile devices



complete table  
is too small to  
read

table is easier to read but  
does not fit within the  
viewport

table fits within the viewport  
but columns are too narrow  
to read comfortably

BenBois/openclipart

What is often required is a new layout of the table data for mobile screens in which several table columns are reduced to two: one column containing all of the data labels and a second column containing the data associated with each label. Figure 6–38 shows an example of a mobile layout for the same table data shown in Figure 6–37.

Figure 6–38 Two-column layout for a mobile device



BenBois/openclipart

There are several scripts and frameworks available on the web to design a table for use with mobile devices or you can use CSS to restructure the web table, which is based on an idea suggested by Chris Coyier at <https://css-tricks.com/responsive-data-tables/>.

The first step in creating a responsive web table that relies only on CSS is to add the text of data labels as attributes of all of the `td` elements in the table body. You can store these data labels using a **data attribute**, which is an attribute introduced in HTML 5 that stores customized data. The general format of a data attribute is

```
data-text="value"
```

where `text` is the name of the data attribute and `value` is its value. Data attributes are often used for database applications that read the contents of HTML files. There are no standard names for data attributes, instead those names are specified by whatever application happens to be reading the HTML content.

For example, the following table uses a data attribute named `data-label` to store the text of the labels associated with each data cell.

```
<tr>
 <td data-label="Date">April 2, 2021</td>
 <td data-label="Program Title">Memories and Music</td>
 <td data-label="Featuring">Kelsey MacGraw, Mandy Dee,
 Young Irish
</td>
 <td data-label="Venue">Folk City, Boise ID</td>
 <td data-label="Description">It's all about new music this
 week on Folk Fest. Scott Dirkens will preview new releases
 from Kelsey MacGraw and Mandy Dee. And then join us for
 a set from the always-popular group, Young Irish, from
 their recent tour.
</td>
</tr>
```

Once you have assigned data labels to each `td` element, you need to change the table layout so that each table object is rendered as a block element. Because a responsive table design doesn't use a table header or footer, you hide those table features. Thus, within a media query for mobile devices, you establish the following style rules:

```
table, tbody, tr, td, th {
 display: block;
}

thead, tfoot {
 display: none;
}
```

Each data cell in the table body then needs to be placed using relative positioning with a large left padding space into which you insert the text of the data label. The following style rule creates a padding space that is 40% of the width of the data cell.

```
tbody td {
 position: relative;
 padding-left: 40%;
}
```

Finally, you need to insert the content of the `data-label` attribute directly before the data cell value. To accomplish that, you use the `before` pseudo-element along with the `content` property. The data label will be placed using absolute positioning at the top-left corner of the block. You can include some padding to offset the column

heading from edges of the block. The width should be equal to the left padding space you set in the style rule for the `td` element. A basic style rule would appear as

```
td::before {
 content: attr(data-label);
 position: absolute;
 top: 0px;
 left: 0px;
 padding: 5px;
 width: 40%;
}
```

As shown earlier in Figure 6–38, the result is a list of data cells that are aligned as block elements and then, within each block element, the data label is followed by the data cell content. Note that the text of this web table is easier to read in the smaller viewport of the mobile device.

You can supplement these style rules with other styles to create a more pleasing design, but the goal is the same: to transform a table with multiple columns into a simpler two-column layout. Note that this approach doesn't work for more complex table layouts with cells spanning multiple rows and/or columns.



## PROSKILLS

### Written Communication: Designing Effective Web Tables

The primary purpose of a web table is to convey data in a compact and easily-interpreted way. You can apply several design principles to your web tables to make them more effective at presenting data to interested readers:

- *Contrast the data cells from the header cells.* Make it easy for readers to understand your data by highlighting the header column or row in a different color or font size.
- *Avoid spanning rows and columns unless necessary.* Usability studies have shown that information can be gleaned quickly when presented in a simple grid layout; don't break the grid by unnecessarily spanning a cell across rows and columns.
- *Break the monotony with icons.* If you are repeating the same phrase or word within a single row or column, consider replacing the text with an icon that conveys the same message. For example, in a table that describes the features of a product, use a check mark to indicate whether a particular feature is supported, rather than text.
- *Alternate the row colors.* A large table with dozens of rows can be difficult for readers to scan and interpret. Consider using alternative background colors for the table rows to break the monotony and reduce eye strain.
- *Don't overwhelm the eye with borders.* Cell borders should be used only when they aid users by separating one cell from another. If they're not needed for this purpose, they actually can distract from the data. Rather than using borders, apply ample spacing to your cells to differentiate the table's rows and columns.
- *Keep it brief.* A table should not extend beyond what will fit compactly within the user's browser window. If your table is too extensive, consider breaking it into several tables that focus on different areas of information.

A web table is judged primarily by its readability. This can best be accomplished by using a simple design whose features convey relevant information to readers, giving them the data they want as quickly as possible and making it easy to compare one value with another.

## Designing a Column Layout

Tables are not the only way to add data columns to your web page. Starting with CSS, web page designers were given the ability to create column layouts in which content is displayed side-by-side in the page. Column layouts differ from layouts that use floating elements or flexboxes in that content from a single element can flow from one column to the next in the same way that article text flows from one column to the next in a newspaper layout. If the page is resized, the flow of the content adjusts to match the new page width, retaining the column layout.

### Setting the Number of Columns

The size of a column layout is established using the following `column-count` property

```
column-count: value;
```

where *value* is the number of columns in the layout. For example, the following style rule will lay out the content of the `article` element in three columns:

```
article {
 column-count: 3;
}
```

If you need to ensure compatibility with older browsers, you can include the following browser extensions in the style rule:

```
article {
 -moz-column-count: 3;
 -webkit-column-count: 3;
 column-count: 3;
}
```

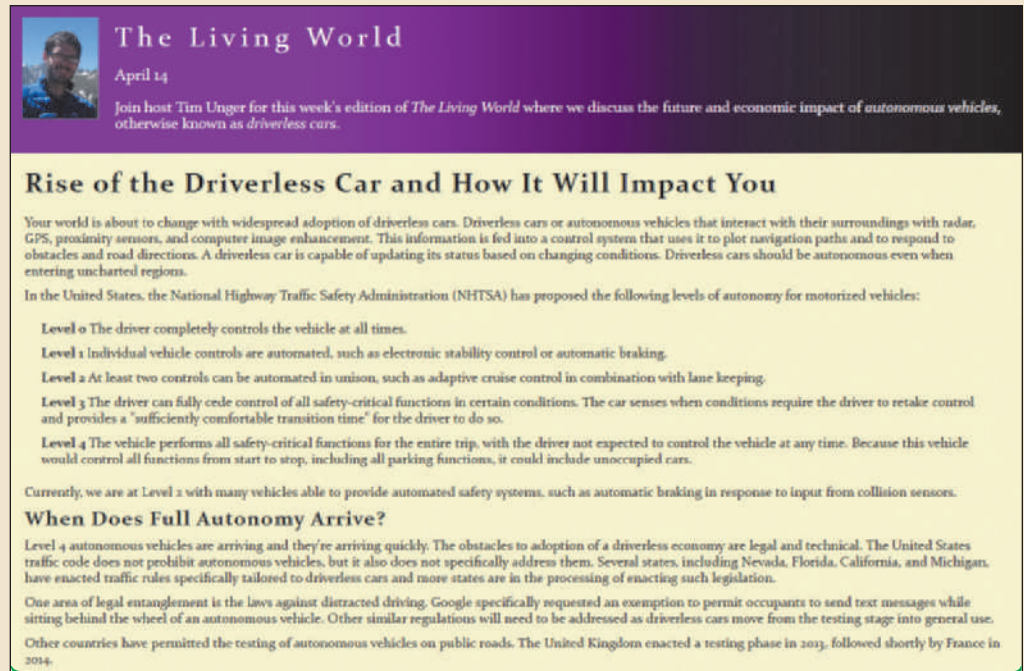
For each program aired by DLR, Kyle has created a page describing an upcoming episode. Kyle wants to apply a column layout to these pages. One of the pages that Kyle has created provides details of an upcoming episode of *The Living World*. Open that page now to view its current content and design.

#### To view the episode page:

1. Use your editor to open the **dlr\_lw0414\_txt.html** file from the html06 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **dlr\_lw0414.html**.
2. Take some time to study the content and structure of the document.
3. Use your browser to open the **dlr\_lw0414.html** file. Figure 6–39 shows the current layout of the page article on a desktop device.

Figure 6–39

Current layout of the driverless car article



© Courtesy Patrick Carey

long lines of text  
are difficult to read

Kyle is concerned that the article is difficult to read due to the long lines of text. In general, the optimal line of text should have about 60 characters or 12 words. However, the article on driverless cars averages about 140 characters and 24 words per line. He suggests you make the page a bit easier to read on desktop devices by splitting the article into two columns.

### To apply a column layout:

1. Use your editor to open the **dlr\_columns\_txt.css** file from the html06 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **dlr\_columns.css**.
2. Within the Column Styles section, insert the following media query to create column layout for the **article** element for devices with a minimum screen width of 641 pixels.

```
@media only screen and (min-width: 641px) {
 article {
 column-count: 2;
 }
}
```

Figure 6–40 highlights the media query in the style sheet.

Figure 6-40

## Applying a 2-column layout to the article element

applies the column style only to screen devices wider than 640 pixels

```
/* Column Styles */
```

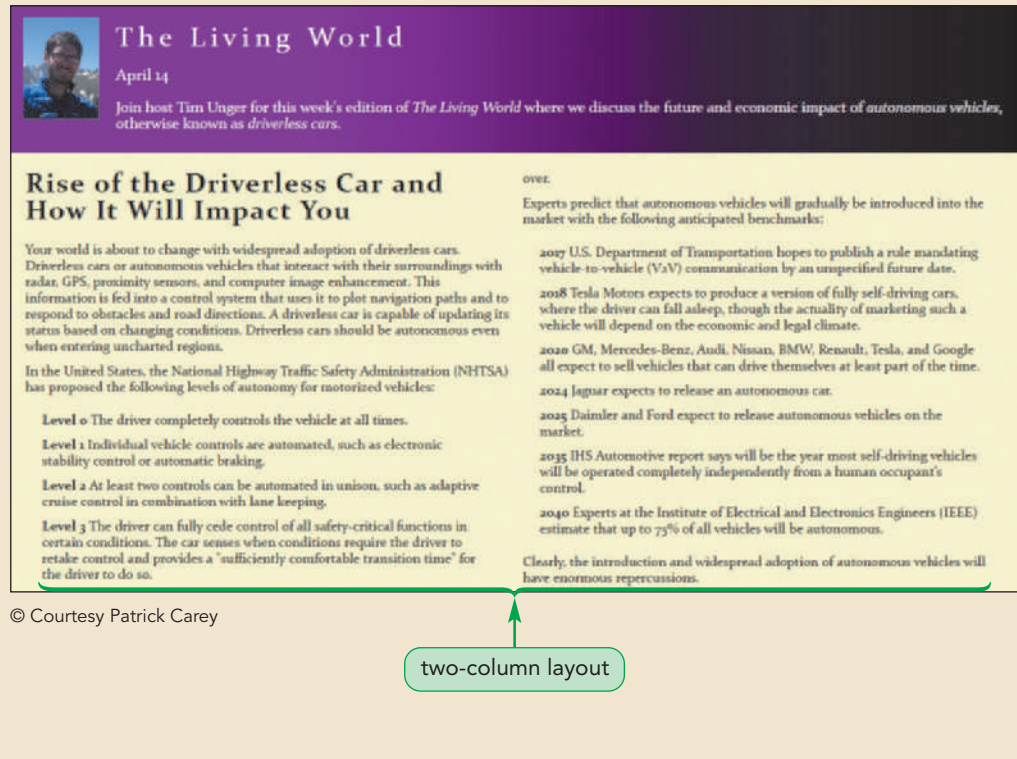
```
@media only screen and (min-width: 641px) {
 article {
 column-count: 2;
 }
}
```

displays the article content across 2 columns

3. Save your changes to the file.
4. Return to the **dlr\_lw0414.html** file in your editor.
5. Within the document head, add a link to the **dlr\_columns.css** style sheet.
6. Close the file, saving your changes.
7. Reload the dlr\_lw0414.html file in your browser. Figure 6-41 shows the two-column layout of the page article.

Figure 6-41

## Article displayed across two columns



By splitting the page article across two columns, you have made the text easier to read.

## Defining Column Widths and Gaps

By default, columns are laid out evenly across the width of the parent element. Thus, with a 2-column layout, each column will occupy approximately half of the parent element width. Another way to define your column layout is to explicitly set the width of the columns and then allow the number of columns to be determined by what can

fit within the allotted space. To set the column width, use the following `column-width` property

```
column-width: size;
```

where *size* is the minimum width of the column in one of the CSS units of measure. For example, the following style rule creates a column layout in which each column is at least 250-pixels wide:

```
article {
 column-width: 250px;
}
```

### TIP

For responsive design, set the column widths rather than the number of columns to allow the column layout to match the width of the device.

Column widths act like the basis value for items in a flexbox. The width is the initial size of each column, which will expand to match the available space. For example, if the parent element has a width of 500 pixels, this style rule will result in a 2-column layout. If the width is 750 pixels, the result is a 3-column layout. Between 500 and 750 pixels, the article will be laid out in 2-columns with increasing widths assigned to each column to fill up the parent element.

The `column-width` and `column-count` properties can be combined into the following shorthand `columns` property

```
columns: width count;
```

where *width* is the minimum width of each column and *count* is the maximum number of columns that will be fit into the allotted space. The following style rule creates a layout of 3 columns with a minimum width of 250 pixels each:

```
article {
 columns: 250px 3;
}
```

If the allotted space is larger than 750 pixels, the columns will increase in width to fill up the space. If the space is smaller than 750 pixels, the column count will decrease to 2.

These calculations assume that there is no space between the columns. However, by default browsers will create a gap of 1em between each column. To set a different gap size, apply the following `column-gap` property

```
column-gap: size;
```

where *size* is the width of the gap in one of the CSS units of measure. The following style rule creates a column layout in which each column is 250 pixels wide and the gap between the columns is 20 pixels:

```
article {
 column-gap: 20px;
 column-width: 250px;
}
```

Thus, to fit two columns under this style rule, the parent element must be at least 520-pixels wide. To fit three columns, the parent element must be at least 790-pixels wide (because there are two gaps of 20 pixels within the three columns), and so forth.

Kyle suggests you increase the width of the gap between the columns in his page to 30 pixels.

### To set the column gap size:

1. Return to the `dlr_columns.css` file in your editor.
2. Within the style rule for the `article` element, add the following style:

```
column-gap: 30px;
```

Figure 6–42 highlights the new code in the style rule.

Figure 6–42

## Setting the size of the column gap

sets the size of the gap between the columns to 30 pixels

```
@media only screen and (min-width: 641px) {
 article {
 column-count: 2;
 column-gap: 30px;
 }
}
```

3. Save your changes to the file and then reload `dlr_lw0414.html` in your browser. Verify that the gap between the two columns has increased from its default gap size.

Another way to separate one column from the next is with a graphic dividing line, created using the following `column-rule` property

```
column-rule: border;
```

where `border` defines the style of the dividing line using the same CSS syntax employed to create borders around page elements. For example, the following style adds a 1-pixel solid red dividing line between the columns in a column layout:

```
column-rule: 1px solid red;
```

Like the `border` property you can break the `column-rule` property into the individual properties `column-rule-width`, `column-rule-style`, and `column-rule-color` to set the dividing line's width, style, and color.

Kyle suggests that you add a 2-pixel solid gray dividing line to the column layout.

## To create a column rule:

1. Return to the `dlr_columns.css` file in your editor and within the style rule for the `article` element add the following style:

```
column-rule: 2px solid gray;
```

Figure 6–43 highlights the code to create the gray dividing line between the columns.

Figure 6–43

## Add a dividing line to the columns

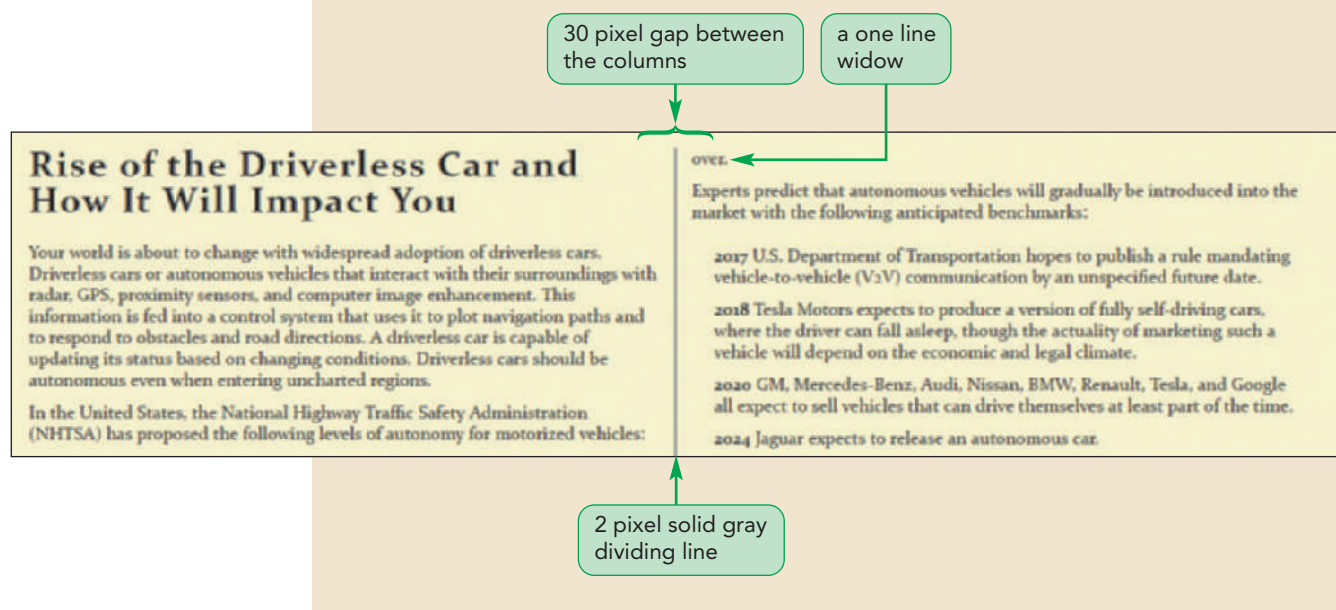
adds a 2-pixel solid gray dividing line between the columns

```
/* Column Styles */
@media only screen and (min-width: 641px) {
 article {
 column-count: 2;
 column-gap: 30px;
 column-rule: 2px solid gray;
 }
}
```

2. Save your changes to the file and then reload `dlr_lw0414.html` in your browser. Figure 6–44 shows the revised appearance of the column layout.

Figure 6-44

## Dividing line in the column layout



Column rules don't take up any space in the layout; if they are wider than the specified gap, they will overlap the column content. Kyle notices that the column break in Google Chrome appears at an inconvenient location, leaving a single line and word at the start of the new column, making the text awkward to read. He would like you to revise the location of the column break.

## Managing Column Breaks

By default, browsers automatically break the content within a column layout to keep the columns roughly the same height. As shown in Figure 6-44, this behavior can result in column breaks that make the text difficult to read. You can control the placement of column breaks through several CSS properties. As with page break styles discussed in Tutorial 5, you can control the size of column orphans (a line of text stranded at the bottom of a column) using the following `orphans` property:

```
orphans: value;
```

where *value* is the minimum number of lines stranded before a column break. Similarly, to control the size of column widows (a line of text placed at the top of a column), use the following `widows` property:

```
widows: value;
```

where *value* is the minimum number of lines placed after the column break. For example, the following style sets the column breaks within paragraphs to leave a minimum of 2 lines at the bottom and a minimum of 3 lines at the top of each column:

```
article p {
 orphans: 2;
 widows: 3;
}
```

Another way to define a column break before or after an element is to use the properties

```
break-before: type;
break-after: type;
```

### TIP

Proposed specifications for the `break-before` and `break-after` properties also include `type` value of `left`, `right`, `page`, `column`, `avoid-page`, and `avoid-column` in order to define different break styles for columns and printed pages.

where `type` is one of the following: `auto` (to allow the browser to automatically set the column break), `always` (to always place a column break), or `avoid` (to avoid placing a column break). To control the placement of column breaks within an element use the property

```
break-inside: type;
```

where `type` is either `auto` or `avoid`. For example, the following style rule always inserts a column break directly before any `h2` heading that appears within an `article`:

```
article h2 {
 break-before: always;
}
```

You can achieve the most cross-browser support for this property by using the following browser extensions:

```
-webkit-column-break-inside: type;
page-break-inside: type;
break-inside: type;
```

The extensions for the `break-before` and `break-after` properties follow a similar pattern.

Kyle asks you to add styles that limit the size of orphans and widows around the column break in the `article` element to at least three lines each.

### To set the widows and orphans around the column breaks:

1. Return to the `dlr_columns.css` file in your editor and add the following styles to the style rule for the `article` element:

```
widows: 3;
orphans: 3;
```

Figure 6–45 highlights the code to define the size of the widows and orphans.

Figure 6–45

### Defining widows and orphans around column breaks

keeps at least three lines together after the column break

keeps at least three lines together before the column break

```
@media only screen and (min-width: 641px) {
 article {
 column-count: 2;
 column-gap: 30px;
 column-rule: 2px solid gray;
 widows: 3;
 orphans: 3;
 }
}
```

2. Save your changes to the file and then reload the `dlr_lw0414.html` file in your browser. Verify that the widows and orphans around the column break in the `article` are at least three lines apiece.

**Trouble?** At the time of this writing, some browsers, such as the Firefox desktop browser, do not support the `orphans` and `widows` style properties as applied to column breaks.

The final edit that Kyle wants to make to the article is to have the article heading appear above the columns, rather than within the first column of the layout.

## Spanning Cell Columns

For some layouts, you will want to have element content extend across all of the columns. You can create column-spanning content by applying the following `column-span` property

```
column-span: span;
```

where *span* is either *none* to prevent spanning or *all* to enable the content to span across all of the columns.

### REFERENCE

#### Creating a Column Layout

- To specify the number of columns in the layout, use  
`column-count: value;`  
where *value* is the number of columns in the layout.
- To specify the width of the columns, use  
`column-width: size;`  
where *size* is the minimum width of the columns expressed in one of the CSS units of measure or as a percentage of the width of the element.
- To set the size of the gap between columns, use  
`column-gap: size;`  
where *size* is the width of the gap.
- To add a dividing line between the columns, use  
`column-rule: border;`  
where *border* is the format of the border.
- To specify the width and number of columns in a single style property, use  
`columns: width count;`  
where *width* is the minimum width of each column and *count* is the total number of columns in the layout.
- To control the size of orphans or widows around a column break, use  
`orphans: value;`  
`widows: value;`  
where *value* is the number of lines in the column break orphan or widow.

Add a style rule so that the h1 heading, which currently appears in the first column of the article layout, spans across the columns.

#### To create a column-spanning heading:

1. Return to the **dlr\_columns.css** file in your editor and, within the media query for desktop devices, add the following style rule for the h1 heading in the `article` element:

```
article h1 {
 column-span: all;
}
```

Figure 6–46 highlights the new style rule to create a column-spanning heading.

Figure 6–46

## Creating a column-spanning heading

sets the heading so that it extends across all columns

```
widows: 3;
orphans: 3;
}

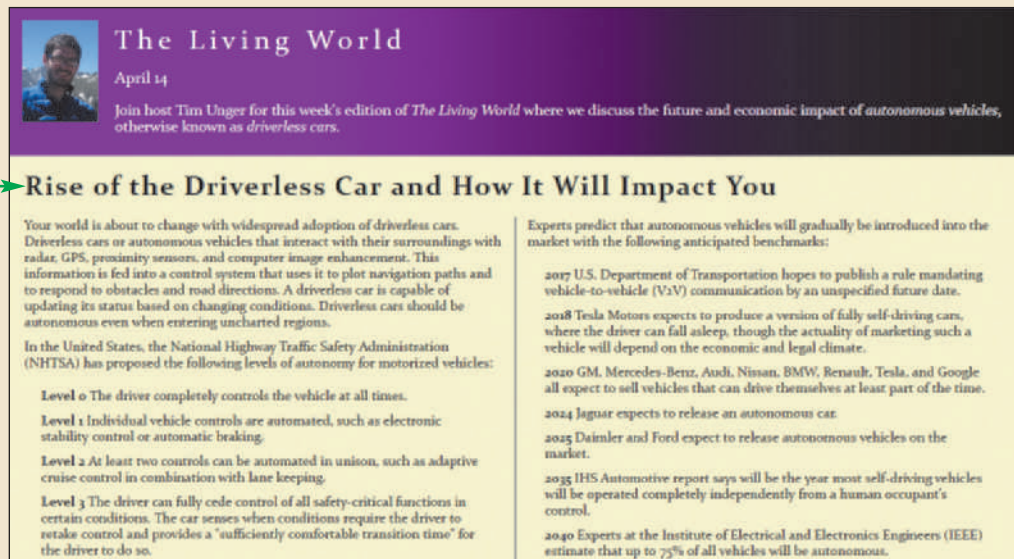
article h1 {
 column-span: all;
}
```

2. Save your changes to the file and then reload dlr\_lw0414.html in your browser. Figure 6–47 shows the final layout of page article.

Figure 6–47

## Final column layout of the article

heading spans the two columns in the layout



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**Trouble?** At the time of this writing, the `column-span` property is not supported by the Firefox browser.

Kyle is pleased with the layout you created for the driverless car article. He'll continue to develop the new layout for the DLR website and get back to you for help on his future projects.

## Session 6.2 Quick Check

1. What are the three row group elements?
  - a. head, footer, body
  - b. theader, tfooter, tbody
  - c. thead, tfoot, tbody
  - d. tablehead, tablefoot, tablebody
2. What element do you use to create a column group?
  - a. col
  - b. colgroup
  - c. tcol
  - d. tablecol
3. Which of the following properties *cannot* be changed within a column group?
  - a. font-size
  - b. border
  - c. width
  - d. background
4. In the case of conflicting styles, how does HTML resolve the styles of the row group and the column group?
  - a. The row group has precedence.
  - b. The column group has precedence.
  - c. Whichever is listed first has precedence.
  - d. Whichever is listed last has precedence.
5. To set the height of the table header row to 25 pixels, use:
  - a. `table thead {height: 25px;}`
  - b. `table head {height: 25px;}`
  - c. `table head tr {height: 25px;}`
  - d. `table thead tr {height: 25px;}`
6. To display an unordered list as a table, use:
  - a. `ul {display: table;}`
  - b. `ul li {display: table;}`
  - c. `ul table {display: all;}`
  - d. You can't display an unordered list as a table.
7. To set the column width of an element to 25 pixels, use:
  - a. `width: 25px;`
  - b. `column: 25px;`
  - c. `column-width: 25px;`
  - d. `columnWidth: 25px;`
8. To limit the number of lines stranded at the bottom of a column, use the:
  - a. widow property
  - b. orphan property
  - c. column-gap property
  - d. column-height property
9. To put a column break before every h1 heading, use:
  - a. `h1 {column-break: always;}`
  - b. `h1 {break-before: always;}`
  - c. `h1 {break: yes;}`
  - d. `h1 {break: true;}`

## Coding Challenge 1

Data Files needed for this Coding Challenge: `code6-1_txt.html`, `code6-1_layout.css`, `code6-1_table_txt.css`

The Orangeville Public Library has four conference rooms that it makes available for public use daily. You've been asked to create a web page showing the room reservations for February 5, 2021. Use HTML table elements and CSS table styles to create the table shown in Figure 6–48.

Figure 6–48

Coding Challenge 6-1 example page

Orangeville Library Conference Room									
February 5, 2021									
Conference Room	8:00am	9:00am	10:00am	11:00am	12:00pm	1:00pm	2:00pm	3:00pm	4:00pm
Rose Room	Retirement Planning Seminar				Free	Friends of the Library Meeting		Algebra II Tutoring	
Lilac Room	Free	Scrapbooking Club			Library Luncheon	Reading Club	Job Interview Workshop		Free
Lavender Room	Free			Private Use	Free	Webinar Reservation		Chemistry Tutoring	
Olive Room	City Planning Meeting				City Planning Lunch	City Planning Meeting			Private Use

Do the following:

1. Open the `code6-1_txt.html` and `code6-1_table_txt.css` files from the `html06 ► code1` folder. Enter **your name** and **the date** in each document and save the files as `code6-1.html` and `code6-1_table.css` respectively.
2. Go to the `code6-1.html` file in your editor. Within the head section insert `link` elements linking the page to the `code6-1_layout.css` and `code6-1_table.css` files.
3. Below the body header, create a table using the `table` element. Add the following features to the table:
  - a. Insert a caption containing the text **February 5, 2021**.
  - b. Insert a column group containing a column with the id `firstCol` and a column with the id `hourCols` that spans 9 columns.
  - c. Insert a table head group that contains a single row with `th` elements containing the text **Conference Room** and the times **8:00am** through **4:00pm** in one-hour increments.
  - d. Insert a table body group that contains the four rows shown in Figure 6–48 for each of the four conference rooms. Within each row insert a `th` element containing the name of the conference room. Following that `th` cell insert the groups reserving the room in `td` elements. If a group has reserved a room for longer than an hour, have the `td` cell span the number of columns for that reservation.
4. Save your changes and go to the `code6-1_table.css` file in your editor.
5. Create the following style rules for the indicated elements:
  - a. For the `table` element: Add a 20-pixel grooved gray border and collapse the table borders.
  - b. For the `th` and `td` elements: Add a 1-pixel solid gray border, set the padding space to 5 pixels, and align the cell content with the top-left corner of the cell.
  - c. For the `caption` element: Display the caption at the top-left of the table and set the font size of the caption text to 1.5em.

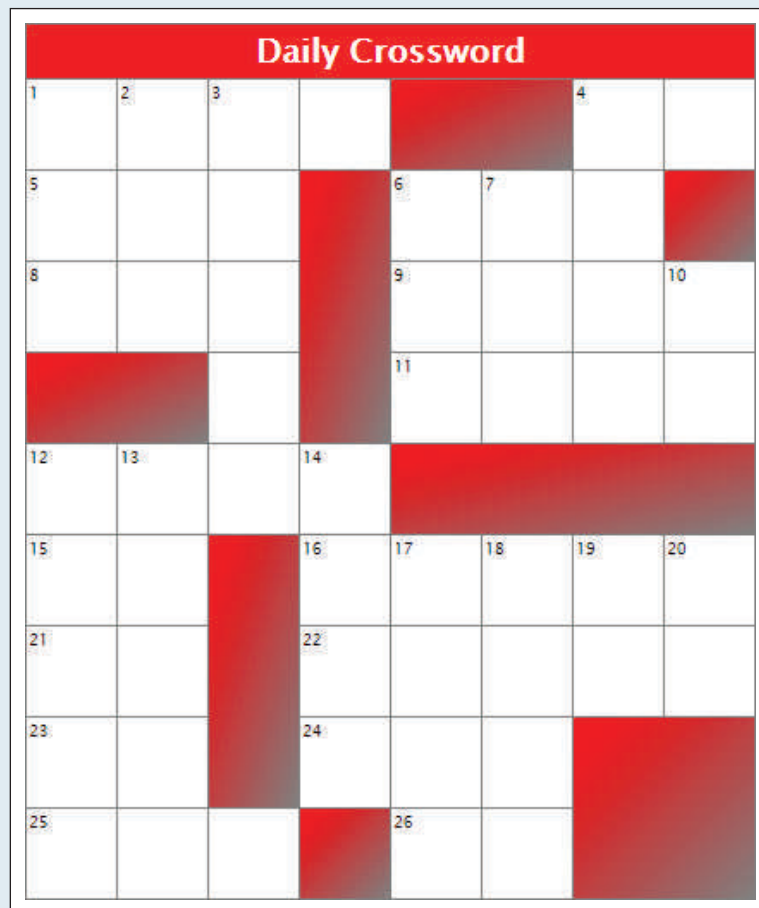
- d. For `col` element with the id `firstCol`: Change the background color to yellow and set the column width to 150 pixels.
  - e. For `col` element with the id `hourCols`: Set the column width to 75 pixels.
  - f. Change the background color of the `thead` element to aqua.
6. Save your changes to the file and then reload the `code6-1.html` file in your browser. Verify that the layout of the table resembles that shown in Figure 6–48.
  7. Submit the completed file to your instructor.

## Coding Challenge 2

Data Files needed for this Coding Challenge: `code6-2_txt.html`, `code6-2_table_txt.css`, `code6-2_layout.css`

You've been tasked to create a crossword puzzle web page. The first step is to create the layout of the crossword puzzle table, including the numbering of the clues and the shading of the blank spaces. Figure 6–49 shows a preview of the completed table.

Figure 6–49 Coding Challenge 6-2 example page



Do the following:

1. Open the `code6-2_txt.html` and `code6-2_table_txt.css` files from the `html06 ► code2` folder. Enter *your name* and *the date* in each document and save the files as `code6-2.html` and `code6-2_table.css` respectively.

- Go to the **code6-2.html** file in your editor. Within the head section insert `link` elements linking the page to the `code6-2_layout.css` and `code6-2_table.css` files.
- Within the page body insert a `table` element.
- Add a table header row group containing one row. Within that row insert a table heading cell that spans 8 columns and contains the text **Daily Crossword**.
- Add the table body section and within the table body, create the layout of the crossword puzzle subject to the following conditions:
  - The table will contain 9 rows and 8 columns.
  - Within each row will be a number of table data cells. If the cell is a blank cell shown in Figure 6–49, assign it the class name **blank**. If a blank cell covers multiple rows and/or columns, make that cell a spanning cell and adjust the number of cells in subsequent rows and columns accordingly to preserve the table layout.
  - Several cells contain numbers that will be used as crossword puzzle clues. Number the appropriate cells from 1 up to 26 to match the layout in Figure 6–49.
- Save your changes to the file and then go to **code6-2\_table.css** in your editor.
- Create the following style rules for the indicated elements:
  - For the `table` element: Add a 20-pixel margin around the table and collapse the table borders.
  - For the `th` element nested within the table row of the table header row group: Set the font color to white, the background color to red, and the font size to 1.5em. Add a 1-pixel solid gray border around the element.
  - For every `td` element: Set the width and height to 50 pixels, the font size to 0.7em, the border to a 1-pixel solid gray, and align the text with the top-left corner of the cell.
  - For every `td` element of the blank class: Change the background to a linear gradient going toward the bottom-right corner of the element and transitioning from red to gray.
- Save your changes to the file and then reload the `code6-2.html` file in your browser. Verify that the layout of the crossword puzzle resembles that shown in Figure 6–49.
- Submit the completed file to your instructor.

## Coding Challenge 3

Data Files needed for this Coding Challenge: `code6-3_txt.html`, `code6-3_columns_txt.css`, `code6-3_layout.css`, `code6-3_image.jpg`

You've been handed a web page that will display the opening chapter of the Charles Dickens novel, *Great Expectations*. You will lay out the text of the chapter in three columns as shown in Figure 6–50, with a divided line separating the columns. Write the code for the style sheet.

Figure 6–50

Coding Challenge 6-3 example page



Source: Public Domain

Do the following:

1. Open the **code6-3\_txt.html** and **code6-3\_columns\_txt.css** files from the `html06 ► code3` folder. Enter **your name** and **the date** in each document and save the files as **code6-3.html** and **code6-3\_columns.css** respectively.
2. Go to the **code6-3.html** file in your editor. Within the head section insert `link` elements linking the page to the `code6-3_layout.css` and `code6-3_columns.css` files. Review the contents of the file and then save your changes.
3. Go to the **code6-3\_columns.css** file in your editor.
4. Create a style rule for the `article` element to: Display the contents in a 3-column layout with a minimum column width of 350 pixels, separate the columns with a 5-pixel border in the ridge style and using the color value `rgb(231, 231, 231)`, and set the space between the columns to 20 pixels.
5. Create a style rule for the `h1` element within the `article` element to: Span the heading across all columns, center the heading text, and set the font size to 3.5em with a letter spacing of 0.15em.
6. Create a style rule for paragraphs within the `article` element to set the minimum size of widows and orphans to 4 lines.
7. Save your changes to the file and then view the page in your browser to verify the contents match that shown in Figure 6–50.
8. Submit the completed file to your instructor.

## DEBUG

### Coding Challenge 4

Data Files needed for this Coding Challenge: **code6-4\_txt.html**, **code6-4\_debug\_txt.css**, **code6-4\_layout.css**

You have been given a web page containing the class schedule shown in Figure 6–51; however, there are several mistakes in the HTML file and the CSS style sheet. Find and fix the errors in both documents now.

Figure 6–51 Coding Challenge 6-4 example page

Midwest University					
Class Schedule					
Hour	Mon	Tue	Wed	Thu	Fri
8:00am	Calculus 201	History 218	Calculus 201	History History 281	Calculus 201 Discussion
9:00am	Open	German 201	Open	German 201	
10:00am	Ethnic Studies 120	Open	Ethnic Studies 120	Open	Ethnic Studies 120
11:00am	Open				
12:00am	Chem Lab 210	Open	Chem Discussion	Open	Chem Discussion
1:00pm		Art History 110	Open	Art History 110	Open
2:00pm	Open				
3:00pm	Open		Writing Lab	Open	
4:00pm				Statistics 120	
First Semester, 2021					

Do the following:

1. Open the **code6-4\_txt.html** and **code6-4\_txt\_debug.css** files from the `html06 ► code4` folder. Enter **your name** and **the date** in each document and save the files as **code6-4.html** and **code6-4\_debug.css** respectively.
2. Go to the **code6-4.html** file in your editor. Within the head section insert `link` elements linking the page to the `code6-4_layout.css` and `code6-4_debug.css` files.

- There are five errors in the HTML file. Locate the errors and fix them. Use a validator to confirm that your file passes validation and that there is the correct number of cells within each table row.
- Go to the **code6-4\_debug.css** file in your editor. There are seven separate syntax errors in the stylesheet. Locate and correct all seven and then save your changes.
- Test the **code6-4\_debug.css** file in a validator to confirm that it passes validation with no errors or warnings reported.
- View the **code6-4.html** file in your browser under different screen widths and compare your page to Figure 6–51, confirming that your page layout matches the one shown in the figure.
- Submit the completed file to your instructor.

## Review Assignments

**Data Files needed for the Review Assignments: dlr\_mornings\_txt.html, dlr\_tables2\_txt.css, dlr\_columns2\_txt.css, 2 CSS files, 3 PNG files**

Kyle has reviewed your work on the DLR nightly schedule page. He wants you to make a few changes to the layout and apply those changes to a new page that describes the DLR morning schedule. Kyle already has entered much of the web page content and style. He wants you to complete his work by creating and designing the web table listing the times and programs for the morning schedule. Figure 6–52 shows a preview of the morning schedule page.

Figure 6–52 DLR Morning Schedule

Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun
5:00	Dawn Air					Dawn Air Weekends	Sunday Magazine
5:30							Weekend Reflections
6:00							
6:30							
7:00	Local News					Weekend Wrap	Radio U
7:30	World News Feed						
8:00	Classical Roots					What Can You Say?	University on the Air
8:30							
9:00						Animal Talk	
9:30							
10:00	Symphony City						Word Play
10:30							Brain Stew
11:00						Opera Live from the East Coast	The Inner Mind
11:30							Grammar Rules!!
12:00	Book Club						Weekend Wrap

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Complete the following:

- Use your HTML editor to open the **dlr\_mornings\_txt.html**, **dlr\_tables2\_txt.css** and **dlr\_columns2\_txt.css** files from the **html06 ▶ review** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **dlr\_mornings.html**, **dlr\_tables2.css** and **dlr\_columns2.css** respectively.

2. Go to the **dlr\_mornings.html** file in your editor. Insert links to the `dlr_tables2.css` and `dlr_columns2.css` style sheets.
3. Scroll down the file and directly below the paragraph element, insert a web table with the class name **programs**.
4. Add a table caption containing the text **All Times Central**.
5. Below the caption, insert a `colgroup` element containing three columns. The first `col` element should have the `class` name **timeColumn**. The second `col` element should have the `class` name **wDayColumns** and span five columns in the table that will contain the weekday programs. The last `col` element should have the `class` name **wEndColumns** and span the last two columns containing the weekend programming.
6. Add the `thead` row group element containing a single table row with `th` elements containing the text shown in Figure 6–52.
7. Add the `tbody` row group element containing the times and names of the different DLR programs from 5:00 a.m. to 12:00 p.m., Monday through Sunday, in half-hour intervals. The times should be placed in `th` elements and the program names in `td` elements. Create row- and column-spanning cells to match the layout of the days and times shown in Figure 6–52.
8. Add the `tfoot` row group element containing a single row with a single `td` element that spans 8 columns and contains the text **Support your Public Radio Station**.
9. Close the `dlr_mornings.html` file, saving your changes.
10. Return to the **dlr\_tables2.css** file in your editor and go to the Table Styles section. Create a style rule for the programs table that: (a) sets the width of the table to 100%, (b) adds a 15-pixel outset border with a color value of `rgb(151, 151, 151)`, (c) defines the borders so that they are collapsed around the table, and (d) sets the font family to the font stack: Arial, Verdana, and sans-serif.
11. Create a style rule that sets the height of every table row to 25 pixels.
12. Create a style rule for every `th` and `td` element that: (a) adds a 1-pixel solid gray border, (b) aligns the cell content with the top of the cell, and (c) sets the padding space 5 pixels.
13. Go to the Table Caption Styles section and create a style rule that places the `caption` element at the bottom of the table and centered horizontally.
14. Go to the Table Column Styles section. For `col` elements belonging to the `timeColumn` class, create a style rule that sets the column width to 10% and the background color to the value `rgb(215, 205, 151)`.
15. For `col` elements of the `wDayColumns` class, create a style rule that sets the column width to 11% and the background color to `rgb(236, 255, 211)`.
16. For `col` elements of the `wEndColumns` class, create a style rule that sets the column width to 17% and the background color to `rgb(255, 231, 255)`.
17. Kyle wants you to format the table heading cells from the table header row. Go to the Table Header Styles section and create a style rule to set the font color of the text within the `thead` element to white and the background color to a medium green with the value `rgb(105, 177, 60)`.
18. The different cells in the table header row should be formatted with different text and background colors. Using the `first-of-type` pseudo-class, create a style rule that changes the background color of the first `th` element with the `thead` element to `rgb(153, 86, 7)`.
19. Using the `nth-of-type` pseudo-class, create style rules that change the background color of the 7<sup>th</sup> and 8<sup>th</sup> `th` elements within the `thead` element to `rgb(153, 0, 153)`.
20. Kyle wants the table footer to be formatted in a different text and background color from the rest of the table. Go to the Table Footer Styles section. Create a style rule for the `tfoot` element that sets the font color to white and the background color to black.
21. Save your changes to the `dlr_tables2.css` style sheet.
22. Return to the **dlr\_columns2.css** file in your editor. Kyle wants the introductory paragraph to appear in a three column layout for desktop devices. Within the Column Styles section, create a media query for screen devices with minimum widths of 641 pixels.
23. Within the media query, create a style rule for the paragraph element that: (a) sets the column count to 3, (b) sets the column gap to 20 pixels, and (c) adds a 1-pixels solid black dividing line between columns.
24. Save your changes to the `dlr_columns2.css` style sheet and then open the **dlr\_mornings.html** file in your browser and verify that the table layout and design resemble that shown in Figure 6–52.

## Case Problem 1

**Data Files needed for this Case Problem:** `mi_pricing_txt.html`, `mi_tables_txt.css`, 2 CSS files, 3 PNG files, 1 TXT file, 1 TTF file, 1 WOFF file

**Marlin Internet** Luis Amador manages the website for Marlin Internet, an Internet service provider located in Crystal River, Florida. You have recently been hired to assist in the redesign of the company's website. Luis has asked you to complete work he's begun on a page describing different pricing plans offered by Marlin Internet. A preview of the page is shown in Figure 6–53.

Figure 6–53 Marlin Internet Pricing page



The image shows a preview of the Marlin Internet website's pricing page. The header features the 'Marlin Internet' logo and a navigation bar with links: Internet, Home Networking, My Account, Shop, and Support. The main heading is 'Accelerate with No Speed Traps'. Below this is a paragraph describing the service. A table lists four pricing plans: Starter, Prime, Prime Plus, and Ultra. The table includes columns for price, download/upload speeds, cloud storage, email accounts, 24/7 support, and a summary of benefits for each plan. The footer contains links for About Us, Careers, News, Parental Controls, Our Locations, Internet services, and Web Mail.

select a plan	Starter	Prime	Prime Plus	Ultra
	\$19.95 per month	\$29.95 per month	\$49.95 per month	\$69.95 per month
Download Speed	15 Mbps	30 Mbps	50 Mbps	100 Mbps
Upload Speed	3 Mbps	6 Mbps	10 Mbps	20 Mbps
Cloud Storage	2 GB	5 GB	15 GB	40 GB
E-mail Accounts	2 Accounts	3 Accounts	5 Accounts	10 Accounts
24/7 Support	Yes	Yes	Yes	Yes
Summary	Just the speed you need to send emails, download map directions, and search the Internet for restaurant reviews.	A great speed at a great price for the family: kids can play games, adults can pay bills, and everyone can surf at the same time.	Super speeds for multiple tasks that require more broadband capacity; ideal for gamers who need fast response times.	Perfect for a small business running multiple media streams, demanding reduced lag time and fast data delivery.

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Luis has already finished most of the page design. Your job will be to add a web table describing the different service plans and to write the CSS code to format the table's appearance.

Complete the following:

1. Using your editor, open the **mi\_pricing\_txt.html** and **mi\_tables\_txt.css** files from the `html06 ▶ case1` folder. Enter **your name** and **the date** in the comment section of each file, and save them as **mi\_pricing.html** and **mi\_tables.css** respectively.
2. Go to the **mi\_pricing.html** file in your editor. Add a link to the `mi_tables.css` style sheet file to the document head.
3. Directly after the paragraph in the `article` element insert a web table with the ID **pricing**.
4. Add a `colgroup` element to the web table containing two `col` elements. The first `col` element should have the ID **firstCol**. The second `col` element should belong to the class **dataCols** and span 4 columns.
5. Add a `thead` row group element containing two rows. In the first row, insert five `th` elements containing the text shown in Figure 6–53. The first heading cell should span two rows. In the second row, add four headings cells containing the prices of the plans shown in Figure 6–53. Use a `br` element to display the price information on two separate lines.
6. Add a `tbody` row group element. In each row within the row group, add a `th` element containing the text shown in Figure 6–53 and four `td` elements containing the data values for each plan.
7. Add a `tfoot` row group element containing a single table row with a heading `th` element displaying the text **Summary**. Add four data `td` elements containing a description of each of the service plans. (Note: You can copy the summary text for each service plan from the `mi_data.txt` file in the `html06/case1` folder.)
8. Save your changes to the file and then return to the **mi\_tables.css** file in your editor.
9. Go to the Table Styles section and add a style rule for the `table` element that: (a) sets the background color to a linear gradient that goes to the bottom of the table background starting from `rgb(190, 215, 255)` and ending in black and (b) adds a 5-pixel solid gray border.
10. For every `th` and `td` element in the table, create a style rule that: (a) adds a 3-pixel solid gray border, (b) sets the line height to 1.4em, and (c) sets the padding space to 8 pixels.
11. For every `th` element, create a style rule that: (a) sets the background color to black, (b) sets the font color to `rgb(130, 210, 255)`, and (c) sets the font weight to normal.
12. For every `td` element, create a style rule that: (a) sets the font color to white, (b) sets the font size to 0.9em, and (c) aligns the cell text with the top of the cell.
13. Go to the Column Styles section. Create a style rule for `col` elements with the ID `firstCol` that sets the column width to 24%.
14. Create a style rule for `col` elements belonging to the `dataCols` class that sets the column width to 19%.
15. Go to the Table Header Styles section. Create a style rule for the table header row group including every row within that row group that sets the row height to 60 pixels.
16. For the first `th` element in the first row of the table header row group, create a style rule that sets its font size to 2em. (Hint: Use the `first-of-type` pseudo-class to select the first table row and first heading cell.)
17. For `th` elements in the first row of the table header row group that are not the first heading cell, create a style rule that sets the background color to transparent and the font color to black. (Hint: use the `not` selector with the `first-of-type` pseudo-class to select headings that are not first in the table row.)
18. Save your changes to the style sheet and then open the **mi\_pricing.html** file in your browser and verify that the table layout and design resemble that shown in Figure 6–53.

## Case Problem 2

Data Files needed for this Case Problem: `lht_sept_txt.html`, `lht_tables_txt.css`, `lht_columns_txt.css`, 2 CSS files, 3 PNG files, 1 TXT file

**The Lyman Hall Theater** Lewis Kern is an events manager at the Lyman Hall Theater in Brookhaven, Georgia. The theater is in the process of updating its website, and Lewis has asked you to work on the pages detailing events in the upcoming year. He's asked you to create a calendar page that lists the upcoming events for September. A list of the events is stored in the `lht_schedule.txt` file.

Lewis wants a responsive design so that the calendar is readable for both mobile and desktop users. In addition to the calendar, Lewis wants the article describing the September events displayed in column layout. He suggests that you set the width of the columns, allowing the number of columns to be determined based on the width of the display screen. Figure 6–54 shows a preview of the page you will create for the theater viewed using mobile and desktop devices.

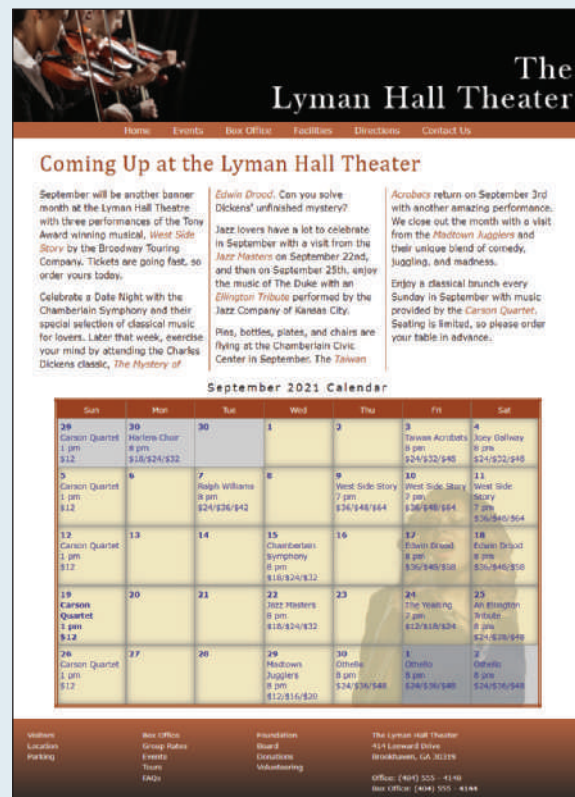
Figure 6–54 The Lyman Hall Theater September Calendar



The mobile version of the calendar is a single-column layout. It features a header with the theater's name and a hamburger menu icon. The calendar title is "September 2021 Calendar". The events are listed in a single column, alternating between light yellow and white background colors for each day. Each entry includes the date, the event name, the time, and the ticket prices.

September 2021 Calendar	
Sun, Aug 29, 2021	Carson Quartet 1 pm \$12
Mon, Aug 30, 2021	Harlem Choir 8 pm \$18/\$24/\$32
Tue, Aug 31, 2021	
Wed, Sep 1, 2021	
Thu, Sep 2, 2021	
Fri, Sep 3, 2021	Taiwan Acrobats 8 pm \$24/\$32/\$48
Sat, Sep 4, 2021	Joey Galloway 8 pm \$24/\$32/\$48
Sun, Sep 5, 2021	Carson Quartet 1 pm \$12
Mon, Sep 6, 2021	
Tue, Sep 7, 2021	Ralph Williams 8 pm \$24/\$36/\$42

mobile version



The desktop version of the calendar is a multi-column layout. It features a header with the theater's name and a navigation bar with links: Home, Events, Box Office, Facilities, Directions, and Contact Us. Below the header is a section titled "Coming Up at the Lyman Hall Theater" with three columns of text describing upcoming events. The calendar itself is a grid with columns for each day of the week. Each cell in the grid contains the date, the event name, the time, and the ticket prices. The grid is styled with alternating light yellow and white background colors for each day.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
29 Carson Quartet 1 pm \$12	30 Harlem Choir 8 pm \$18/\$24/\$32		1	2	3 Taiwan Acrobats 8 pm \$24/\$32/\$48	4 Joey Galloway 8 pm \$24/\$32/\$48
5 Carson Quartet 1 pm \$12	6	7 Ralph Williams 8 pm \$24/\$36/\$42	8	9 West Side Story 7 pm \$36/\$48/\$64	10 West Side Story 7 pm \$36/\$48/\$64	11 West Side Story 7 pm \$36/\$48/\$64
12 Carson Quartet 1 pm \$12	13	14	15 Chamberlain Symphony 8 pm \$16/\$24/\$32	16	17 Edwin Drood 8 pm \$36/\$48/\$64	18 Edwin Drood 8 pm \$36/\$48/\$64
19 Carson Quartet 1 pm \$12	20	21	22 Jazz Masters 8 pm \$18/\$24/\$32	23	24 The Yearning 7 pm \$24/\$36/\$48	25 An Evening 8 pm \$24/\$36/\$48
26 Carson Quartet 1 pm \$12	27	28	29 Madison Acrobats 8 pm \$12/\$16/\$20	30 Othello 8 pm \$24/\$36/\$48	1 Othello 8 pm \$24/\$36/\$48	2 Othello 8 pm \$24/\$36/\$48

desktop version

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Complete the following:


1. Using your editor, open the **lht\_sept\_txt.html**, **lht\_tables\_txt.css**, and **lht\_columns\_txt.css** files from the html06 ► case2 folder. Enter *your name* and *the date* in the comment section of each file, and save them as **lht\_sept.html**, **lht\_tables.css**, and **lht\_columns.css** respectively.
2. Go to the **lht\_sept.html** file in your editor. Add links to the **lht\_tables.css** and **lht\_columns.css** files to the document head.
3. Directly below the **article** element, insert a web table using the ID **calendar**.
4. Add a caption with the text **September 2021 Calendar**.
5. Add a column group containing two **col** elements. Give the first **col** element the class name **weekdays** and have it span five columns. Give the second **col** element the class name **weekends** and have it span 2 columns.
6. Add the table header row group with a single row with seven heading cells containing the three-letter day abbreviations **Sun** through **Sat**.
7. Add the table body row group with five rows and seven data cells within each row. Within each table cell, add the following code to create an **h1** heading and description list:

```
<h1>day</h1>
<dl>
<dt>event</dt>
<dd>time</dd>
<dd>price</dd>
</dl>
```

where **day** is the day of the month, **event** is the name of an event occurring on that day, **time** is the time of the event, and **price** is the admission price, using the days, events, times, and prices shown in the **lht\_schedule.txt** file. If there is no event scheduled for the day, insert only the code for the **h1** heading. Start your calendar with August 29 and conclude it with October 2.

- ✚ **Explore** 8. For each data cell you create in the table body, add an attribute in the opening **td** tab named **data-date** containing the date associated with the cell. For example, in the first table cell, enter data-date value "Sun, Aug 29, 2021", the second cell will have the data-date value "Mon, Aug 30, 2021" and so forth. (Note: This code will be used to display the date information in the mobile layout.)
9. Save your changes to the file and then return to the **lht\_tables.css** file in your editor.
10. Within the Mobile Styles section, insert a media query for screen devices with a maximum width of 640 pixels.
- ✚ **Explore** 11. You want mobile devices to display the calendar information in two columns. To create this layout, add the style rules that: (a) displays **table**, **tbody**, **tr**, **td**, **th**, and **caption** elements as blocks, (b) does not display the **thead h1** element, and (c) displays the table caption in white on a medium gray background with a font size of 1.5em and a line height of 2em.
12. Create a style rule for every data cell that: (a) adds a 1-pixel dotted gray border, (b) changes the text color to **rgb(11, 12, 145)**, (c) places the cell using relative positioning, (d) sets the left padding to 40%, and e) sets the minimum height to 40 pixels.
13. Create a style rule that uses the **nth-of-type** pseudo-class to display every odd-numbered table row with a background color of **rgb(255, 235, 178)** and a 2-pixel solid gray border.
14. Create a style rule that inserts the text of the data-date attribute before every data cell. Place the attribute text using absolute positioning at the coordinates (0, 0) with a width of 40% and padding space of 5 pixels.
15. Next, you design the layout of the calendar for tablet and desktop devices. Go to the Tablet and Desktop Styles section and insert a media query for screen devices with a minimum width of 641 pixels.
16. Create a style rule for the **table** element that: (a) displays the background image **lht\_photo1.png** with no tiling in the bottom-right corner of the table with a width of 40%, (b) adds a 6-pixel double border with color value **rgb(154, 64, 3)**, (c) collapses the table borders, (d) centers the

table by setting the top/bottom margins to 20 pixels and the left/right margins to `auto`, (e) uses a fixed layout for the table content, and (f) sets the width of the table to 85%.

17. For every heading and data cell, create a style rule that: (a) adds a 1-pixel solid gray border, (b) sets the font size to 0.85em and with normal weight, (c) adds a 5-pixel padding space, (d) aligns the cell text with the top of the cell, (e) sets the width to 14.28%, and (f) allows the browser to wrap cell text within individual words. (Hint: Use the `word-wrap` property.)
18. For every data cell, create a style rule that: (a) applies a semi-transparent background color with the value `rgba(171, 171, 171, 0.6)` and (b) sets the text color to `rgb(11, 12, 145)`.
-  **Explore** 19. Lewis wants the September dates to appear in a different format from the August and October dates. Create a style rule for data cells whose `data-date` attribute contains the text **Sep** that: (a) changes the background color to the semi-transparent value `rgba(232, 214, 148, 0.6)` and (b) adds a gray inset box shadow with horizontal and vertical offsets of 0 pixels and a blur of 20 pixels. (Hint: See Figure 2-15 for a list of attribute selectors.)
20. Create a style rule for the table caption that: (a) displays the caption at the top of the table, (b) centers the caption text, (c) adds 10 pixels to the bottom padding space, and (d) sets the font size to 1.2em and the letter spacing to 3 pixels.
21. For heading cells within the table header, create a style rule to change the background color to `rgb(154, 64, 3)` and the text color to white.
22. Save your changes to the style sheet, then go to the **lht\_columns.css** file in your editor and within the Column Styles section, create a style rule for the `article` element that: (a) sets the column width to 260 pixels, (b) sets the column gap to 20 pixels, (c) adds a 1-pixel solid dividing line between columns with color value `rgb(154, 64, 31)`, and (d) sets the minimum size of widows and orphans to 2 lines.
23. Create a style rule for the `h1` heading with the `article` element that extends the heading across all columns.
24. Save your changes to the style sheet and then open the **lht\_sept.html** file in your browser. Verify that for desktop widths, the table appears as shown in right image of Figure 6–54 and the number of columns used in the introductory article changes from 2 to 3 based on the page width. Reduce the page width to below 640 pixels and verify that the calendar information is displayed in two columns as shown in the left image in Figure 6–54.

## OBJECTIVES

## Session 7.1

- Explore web forms
- Work with form servers
- Create forms and field sets
- Create labels and input boxes
- Explore form layout

## Session 7.2

- Work with date and time fields
- Create a selection list
- Create option buttons
- Create check boxes and text area boxes

## Session 7.3

- Create spinners and range sliders
- Use data lists
- Create form buttons
- Validate a form
- Apply validation styles

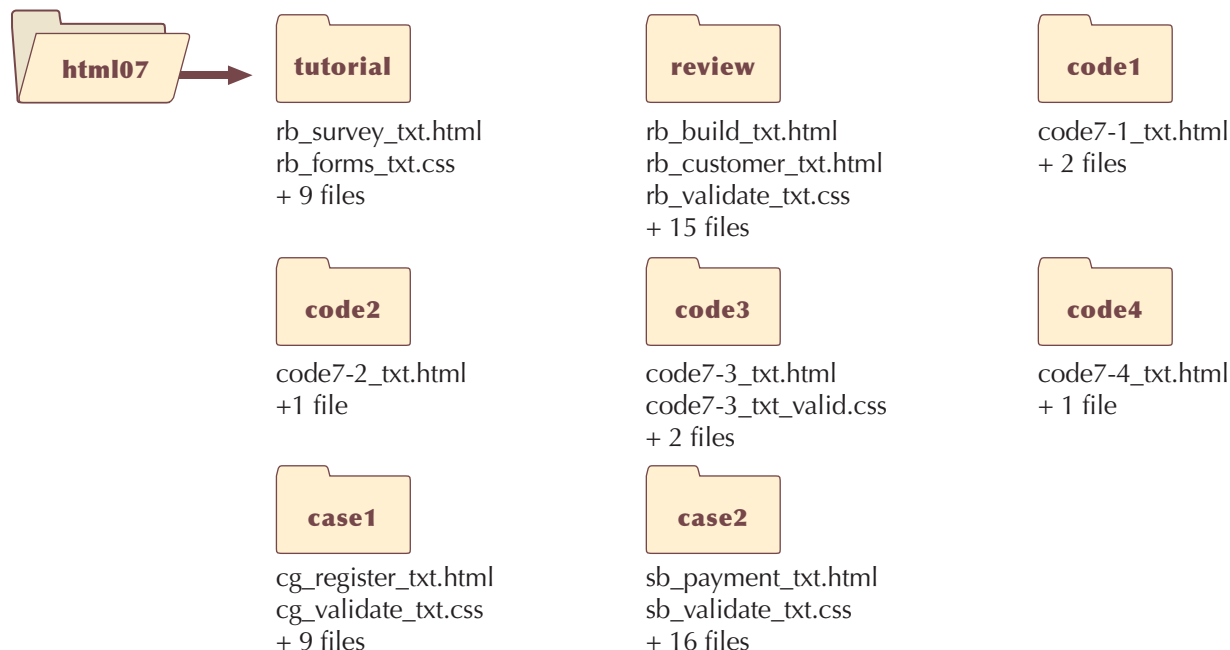
# Designing a Web Form

## Creating a Survey Form

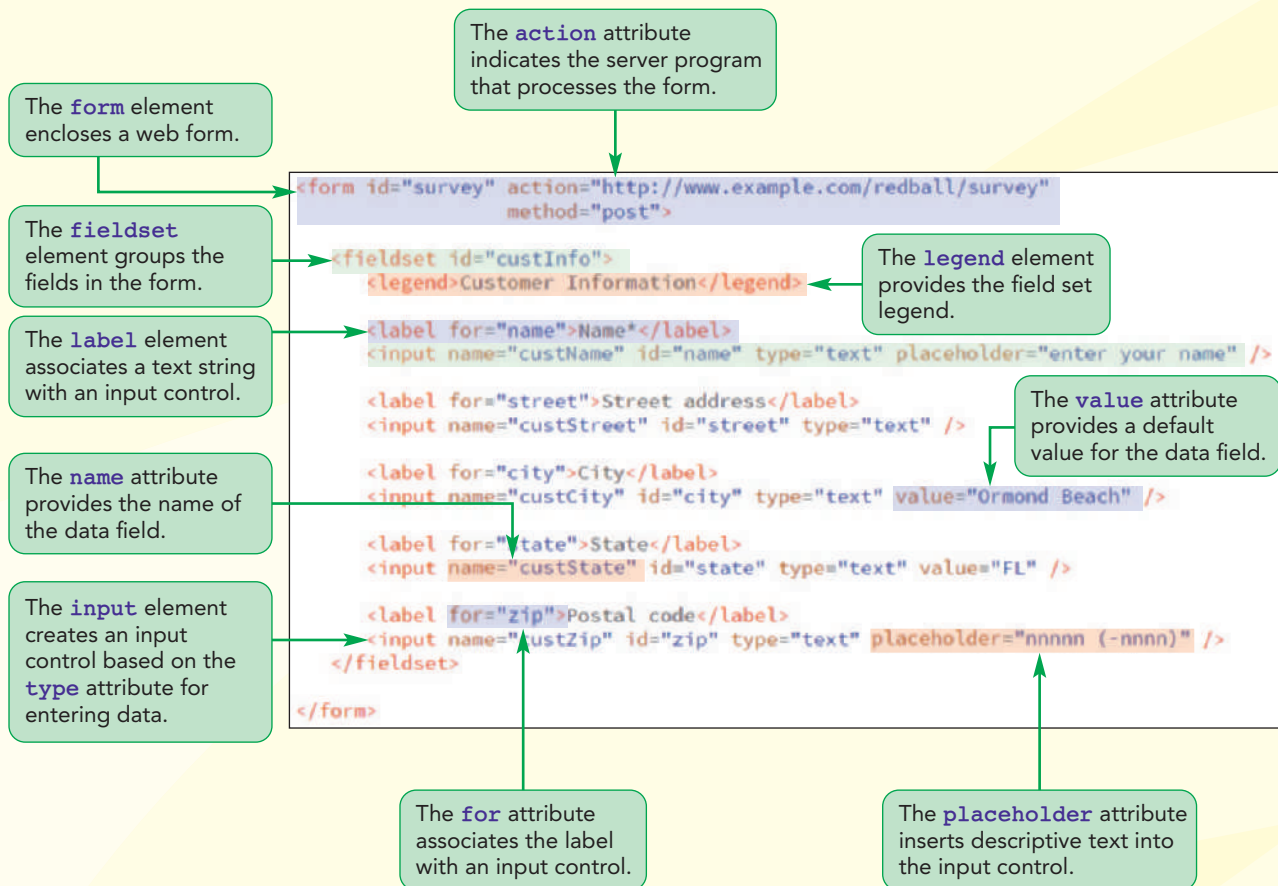
### Case | Red Ball Pizza

Alice Nichols is a manager at *Red Ball Pizza*, a popular pizzeria in Ormond Beach, Florida. She wants to conduct an online survey of Red Ball customers using a web form that will be placed on the restaurant's website. She has asked you to help design a prototype for the survey form. The form should record customer information, as well as each customer's perception of his or her last experience at the restaurant. Alice wants the form to include different tools to ensure that each user enters valid data. Once a customer completes the form, the information will be sent to the Red Ball server for processing and analysis.

#### STARTING DATA FILES



# Session 7.1 Visual Overview:



# Structure of a Web Form

**Customer Survey**

Thank you for taking our customer survey. Your response helps Red Ball Pizza maintain the tradition that has made us the top-rated pizzeria in the metro area. All participants are automatically entered into a monthly drawing to receive a *Red Ball Express PizzaFest* containing two large pizzas, a 2-liter soda, and a side order of chicken wings. Check your e-mail inbox for contest results.

Surveys are private and confidential. Red Ball Pizza will not share your contact information with third parties, ever.

Required values are marked by an asterisk (\*)

**Customer Information**

Name*	<input type="text" value="enter your name"/>
Street address	<input type="text"/>
City	<input type="text" value="Ormond Beach"/>
State	<input type="text" value="FL"/>
Postal code	<input type="text" value="nnnnn (-nnnn)"/>

A label associated with an input control

Placeholder text is dimmed within the input box

The field set legend appears at the top-left corner of the field set by default.

An input control box displaying placeholder text

A default value appears in the input box.

## Introducing Web Forms

So far, the websites you have created have been passive: allowing the user to view information but not allowing the user to directly interact with the page's content, except via hyperlinks. Starting with this tutorial, you will begin working with more interactive websites that allow for user feedback. The most common way of accepting user input is through a **web form**, which allows users to enter data that can be saved and processed.

### Parts of a Web Form

A web form contains **controls**, also known as **widgets**, which are the objects that allow the user to interact with the form. HTML supports several types of controls and widgets, including:

#### Controls

- **input boxes** for inserting text strings and numeric values
- **option buttons**, also called **radio buttons**, for selecting data values from a small predefined set of options
- **selection lists** for selecting data values from a more extensive list of options
- **check boxes** for selecting data values limited to two possibilities, such as “yes” or “no”
- **text area boxes** for entering text strings that may include several lines of content

#### Widgets

- **spin boxes** for entering integer values confined to a specified range
- **slider controls** for entering numeric values confined to a specified range
- **calendar controls** for selecting date and time values
- **color pickers** for choosing color values

Figure 7–1 shows Alice's sketch of the web form she wants you to create.

Figure 7–1 Proposed survey form

The sketch shows a web form with two main sections. The first section, 'Customer Information', contains several input fields: Name\*, Street address, City, State, Postal code, Phone number, and E-mail\*. It also includes a selection list box for 'Where did you hear about us?', a spin box for 'What's your favorite Red Ball special dish?', and a check box for 'Add me to your newsletter for great specials'. The second section, 'Share Your Experience at Red Ball Pizza', includes a calendar control for 'Date of visit', a dropdown for 'Order type', and three sets of radio buttons for 'Was your service friendly?', 'Was your order correct?', and 'Was your food hot?'. It also features a slider control for 'Rate your overall service (0 = poor; 10 = great)' and a large text area box for 'Tell us more about your experience!'. Green callout boxes with arrows identify various controls: 'input box' points to the Name field; 'option buttons' points to the radio buttons; 'calendar control' points to the Date of visit field; 'selection list box' points to the 'Where did you hear about us?' dropdown; 'spin box' points to the 'What's your favorite Red Ball special dish?' field; 'check box' points to the 'Add me to your newsletter' checkbox; 'text area box' points to the 'Tell us more about your experience!' text area; and 'slider control' points to the 'Rate your overall service' slider.

Alice's proposed form includes several of the controls discussed above, such as input boxes for entering the customer name, contact information, and email address; option buttons for storing the customer's service experience; and a selection list from which customers can choose how they heard about Red Ball Pizza from a long list of options.

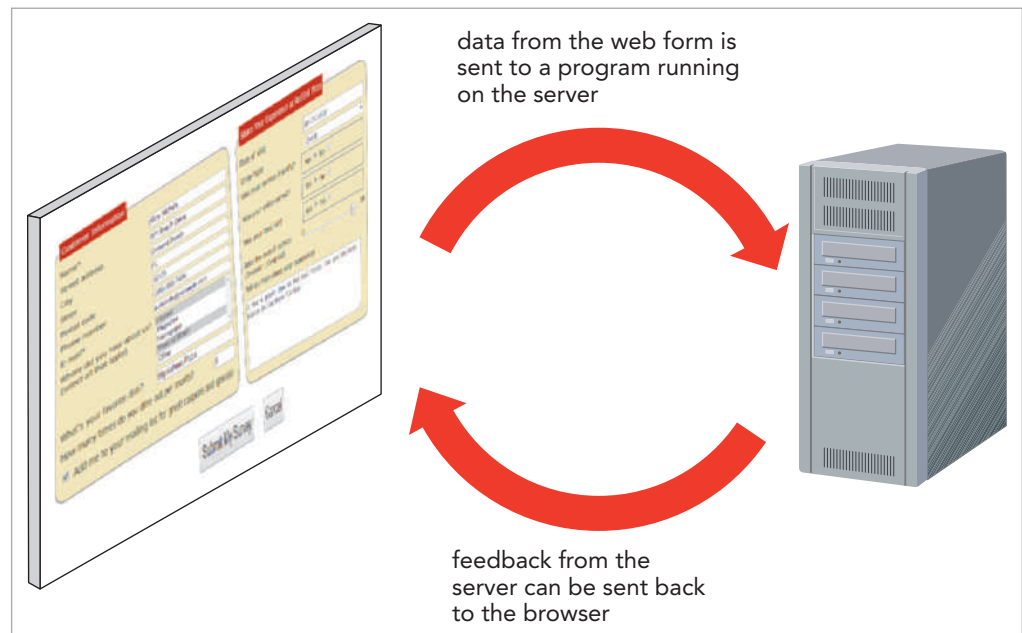
Each data entry control is associated with a **data field** or **field** in which data values supplied by the user are stored. For example, the input box in which a customer enters his or her name is associated with the `custName` field, the calendar control in which the customer enters the date he or she visited Red Ball Pizza is associated with the `visitDate` field, and so forth.

## Forms and Server-Based Programs

Once the field values have been entered by the user, they are processed by a program running on the user's computer or on a web server in a secure location. For example, a web form is used to collect sales data from the customer for an order and the server program processes that data and handles the billing and delivery of the sales items. See Figure 7–2.

Figure 7–2

Interaction between the web form and the server



Alice is already working with a programmer on a web server program that will store and interpret the survey results. You will not have access to that program, so Alice just wants you to concentrate on the design of the web form. Your colleagues will test your form to verify that the information is being collected and processed correctly by the web server.

## INSIGHT

### Restricting Access to Web Server Programs

Since the web form designer might not have permission to create or edit the programs running on the web servers, he or she will usually receive instructions about how to interact with the server programs. These instructions often include a list of fields that are required by the program and a description of the types of values expected in those fields.

There are several reasons to restrict direct access to these programs. The primary reason is that, when you run a server-based program, you are interacting directly with the server environment. Mindful of the security risks that computer hackers present and the drain on system resources caused by large numbers of programs running simultaneously, system administrators are understandably careful to maintain strict control over access to their servers and systems.

Server-based programs are written in a variety of languages. The earliest and most common of these programs is **Common Gateway Interface (CGI)**, which are scripts written in a language called **Perl**. Other popular languages widely used today for writing server-based programs include ASP, ColdFusion, C, Java, PHP, Python, and Ruby. You can check with your ISP or system administrator to find out what programs are available on your web server, and what rights and privileges you have in accessing them.

## Starting a Web Form

## TIP

HTML also supports the `name` attribute for uniquely identifying forms.

All web forms are marked using the following `form` element

```
<form id="text" attributes>
 content
</form>
```

where the `id` attribute identifies the form (which is important when more than one form is being used on the web page), `attributes` specify how the form should be processed by the browser, and `content` is the form's content. Forms typically contain many of the controls that were listed earlier, but they also can contain page elements such as tables, paragraphs, inline images, and headings. A `form` element can be placed anywhere within the body of the page.

## REFERENCE

### Inserting a Web Form

- To insert a web form, add

```
<form id="text" attributes>
 content
</form>
```

where `text` identifies the form, `attributes` control how the form is processed, and `content` is the content of the form.

Add a form to Alice's survey page now with the ID survey.

### To insert a web form:

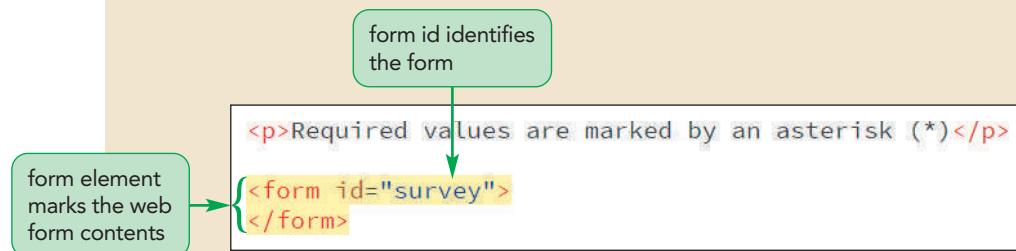
1. Use your editor to open the **rb\_survey\_txt.html** file from the html07 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **rb\_survey.html**.
2. Scroll down and, directly after the third paragraph in the `section` element, insert the following `form` element:

```
<form id="survey">
</form>
```

Figure 7–3 shows the placement of the web form.

Figure 7–3

Inserting a web form



Next, you will include attributes that tell the browser how the form should interact with the web server.

## Interacting with the Web Server

To specify where to send the form data and how to send it, include the following `action`, `method`, and `enctype` attributes

```
<form action="url" method="type" enctype="type">
 content
</form>
```

where the `action` attribute provides the location of the web server program that processes the form, the `method` attribute specifies how the browser should send form data to the server, and the `enctype` attribute specifies how the form data should be encoded as it is sent to the server.

The `method` attribute has two possible values: `get` and `post`. The default is the **get method**, which tells the browser to append the form data to the end of the URL specified in the `action` attribute. The **post method** sends the form data in its own separate data stream. Each method has its uses, but the `post` method is considered to be a more secure form of data transfer. Your website administrator can supply the necessary information about which of the two methods you should use when accessing the scripts running on the server.

The `enctype` attribute has three possible values summarized in Figure 7–4.

**Figure 7–4** Values of the enctype attribute

Value	Description
application/x-www-form-urlencoded	The default format in which the data is encoded as a long text string with spaces replaced by the + character and special characters (including tabs and line breaks) replaced with their hexadecimal code values
multipart/form-data	The format used when uploading files in which no encoding of the data values occurs
text/plain	The format in which data is transferred as plain text with spaces replaced with the + character but no other encoding of the data values occurs

Alice tells you that your survey form will be processed by the CGI script using the `action` attribute accessing a server program located at the fictional URL address `http://www.example.com/redball/survey` with the `post` method. You do not have to specify a value for the `enctype` attribute because the default value of `application/x-www-form-urlencoded` is sufficient. Add this information to your web form.

### To specify how the form interacts with the server:

1. Return to the opening `<form>` tag and add the following attributes:

```
action="http://www.example.com/redball/survey"
method="post"
```

Figure 7–5 highlights the newly added form attributes.

**Figure 7–5** Associating the web form with an action and a method

```
<p>Required values are marked by an asterisk (*)</p>
<form id="survey" action="http://www.example.com/redball/survey" method="post">
</form>
```

location of server  
processing the form

method by which  
the form data is  
sent to the server

2. Save your changes to the file.

Because `http://www.example.com/redball/survey` does not correspond to a real CGI script running on the web and thus cannot process the survey form you will create in this tutorial, you will add a JavaScript program named `rb_formsubmit.js` to handle the form. The purpose of this JavaScript program is to intercept the content of the form before the browser attempts to contact the CGI script and report whether or not the data contained in the survey form has been correctly filled out. The JavaScript program has already been created, so you will create a link to the file using the following `script` element:

```
<script src="rb_formsubmit.js"></script>
```

A `script` element is an HTML element used to access and run JavaScript programs that will run within the user's browser. You will learn more about scripts and their applications in Tutorial 9, but for now, you add this code to the document head so that it can be applied throughout this tutorial.

### To insert a script:

1. Scroll up to the document head and insert the following code directly above the closing `</head>` tag:

```
<script src="rb_formsubmit.js"></script>
```

Figure 7–6 highlights the code for the `script` element.

Figure 7–6

### Using a script to manage the form submission

the script element runs JavaScript programs within the browser

```
<title>Red Ball Survey</title>
<link href="rb_reset.css" rel="stylesheet" />
<link href="rb_styles.css" rel="stylesheet" />
<script src="rb_formsubmit.js"></script>
</head>
```

external JavaScript file

2. Save your changes to the file.

Now that you have added the `form` element to the survey page, you can start populating the survey form with controls and other form features. You will start by adding field sets.

## Creating a Field Set

Because a web form can have dozens of different fields, you can make your form easier to interpret and more accessible by grouping fields that share a common purpose into a **field set**. Field sets are created using the following `fieldset` element

```
<fieldset id="id">
 content
</fieldset>
```

where *id* identifies the field set and *content* is the form content within the field set. An *id* is not required, but it is useful in distinguishing one field set from another.

## Marking a Field Set

Alice wants you to organize the form into two field sets: the `custInfo` field set will enclose the fields containing contact information for *Red Ball Pizza* customers and the `explInfo` field set will enclose the fields that record those customers' impressions of the restaurant.

### To add field sets to a form:

1. Scroll back to the web form and, within the `form` element, insert the following `fieldset` elements:

```
<fieldset id="custInfo">
</fieldset>

<fieldset id="expInfo">
</fieldset>
```

Figure 7–7 highlights the code for the two new field sets.

Figure 7–7

### Inserting field sets

```
<form id="survey" action="http://www.example.com/redball/survey" method="post">
 <fieldset id="custInfo">
 </fieldset>
 <fieldset id="expInfo">
 </fieldset>
</form>
```

2. Save your changes to the file.

The default browser style is to place a border around the field set to set it off visually from other elements in the web form. Field sets act like block elements that expand to accommodate their content. Before viewing the two field sets in your browser, you will add a legend.

## Adding a Field Set Legend

Every field set can contain a legend describing its content using the following `legend` element

```
<legend>text</legend>
```

where *text* is the text of the legend. The `legend` element contains only text and no nested elements. By default, legends are placed in the top-left corner of the field set box, though they can be moved to a different location using the CSS positioning styles.

### REFERENCE

#### Creating a Field Set

- To create a field set, add

```
<fieldset id="id">
 content
</fieldset>
```

where *id* identifies the field set and *content* is the form content within the field set.

- To add a legend to a field set, place the following element within the `fieldset` element:

```
<legend>text</legend>
```

where *text* is the text of the legend.

Based on Alice's sketch from Figure 7-1, add the legend text "Customer Information" and "Share Your Experience at Red Ball Pizza" to the two field sets you just created.

### To add legends to the field sets:

1. Within the `custInfo` field set, add the following `legend` element:  
`<legend>Customer Information</legend>`
2. Within the `expInfo` field set, add the legend:  
`<legend>Share Your Experience at Red Ball Pizza</legend>`

Figure 7-8 highlights the code for the two legends.

Figure 7-8

### Adding legends to the field sets

legend associated with each field set

```
<form id="survey" action="http://www.example.com/redball/survey" method="post">
 <fieldset id="custInfo">
 <legend>Customer Information</legend>
 </fieldset>
 <fieldset id="expInfo">
 <legend>Share Your Experiences at Red Ball Pizza</legend>
 </fieldset>
</form>
```

3. Save your changes to the file and then open the **rb\_survey.html** file in your browser. Figure 7-9 shows the appearance of the two field sets.

Figure 7-9

### Legends displayed in the field set box

field set legend

field sets

## Customer Survey

Thank you for taking our customer survey. Your response helps Red Ball Pizza maintain the tradition that has made us the top-rated pizzeria in the metro area. All participants are automatically entered into a monthly drawing to receive a *Red Ball Express PizzaFest* containing two large pizzas, a 2-liter soda, and a side order of chicken wings. Check your e-mail inbox for contest results.

Surveys are private and confidential. Red Ball Pizza will not share your contact information with third parties, ever.

Required values are marked by an asterisk (\*)

Customer Information

Share Your Experience at Red Ball Pizza

The default browser style is to add a border around a field set

The field sets you added are currently empty, so they appear small and narrow on the survey page. Next, you will populate the field set with the controls that will be used to insert different field values.

## Creating Input Boxes

Because most form controls are designed to receive user input, they are marked using the following `input` element

```
<input name="name" id="id" type="type" />
```

where the `name` attribute provides the name of the data field associated with the control, the `id` attribute identifies the control in which the user enters the field value, and the `type` attribute indicates the data type of the field. When the form is submitted to the server, the field name is paired with the field value; thus, you always need a `name` attribute if you are submitting the form to a server. The `id` attribute is required only when you need to reference the control, as would be the case when applying a CSS style to format the control's appearance.

## Input Types

At the time of this writing, HTML supports twenty-two different values for the `type` attribute. Each input type is associated with a different form control, usually one that is tailored to make it easy for the user to enter data that matches the input type. For example, an input type of `password` is displayed as an input box that hides the input text for security purposes. Figure 7–10 describes the different `type` values for the `input` element and how their controls are typically displayed in most current browsers. If no `type` value is specified, the browser assumes a default value of `text` and adds a simple text input box to the web form.

**Figure 7–10** Controls and the input type attribute

Type Value	Control Displayed by the Browser
button	A button that can be clicked to perform an action
checkbox	A check box for yes/no or true/false responses
color	A widget from which users can select a color
date	A widget from which users can select a calendar date
datetime-local	A widget from which users can select a calendar date and time
email	An input box used for email addresses
file	A widget from which users can select a local file
hidden	A control that is hidden from the user
image	An image that can be clicked to perform an action
month	A widget from which users can select a calendar month and year
number	A spin box from which users can select a numeric value
password	An input box in which the entry value is hidden by * symbols
radio	A radio or option button that can be clicked by the user
range	A slider from which users can select a numeric value within a defined range
reset	A button that can be clicked to reset the web form
search	A widget that can be used to search for a defined term
submit	A button that can be clicked to submit the form for processing
tel	An input box used for telephone numbers
text	An input box used for text entries (the default)
time	A widget from which users can select a time value
url	An input box used for entering URLs
week	A widget from which users can select a week value

### Creating an Input Control

- To create an input control for data entry, add the element

```
<input name="name" id="id" type="type" />
```

where *name* provides the name of the field associated with the control, *id* identifies the control in which the user enters the field value, and *type* indicates the type of control displayed by the browser.

The first input elements you will add to the survey form will be input boxes in which the customer enters his or her name, street address, city, state, postal code, phone number, and e-mail address. For the program running on the web server, these input boxes will be associated with data fields named *custName*, *custStreet*, *custCity*, *custState*, *custZip*, *custPhone*, and *custEmail*, respectively. You will identify the controls for these fields with the *ids*: *name*, *street*, *city*, *state*, *zip*, *phone*, and *mail*. Before each input element, you will insert a text string that describes the content of the input box.

### To add input elements:

1. Within the *custInfo* field set, add the following text strings and input elements:

**Name\***

```
<input name="custName" id="name" type="text" />
```

**Street address**

```
<input name="custStreet" id="street" type="text" />
```

**City**

```
<input name="custCity" id="city" type="text" />
```

**State**

```
<input name="custState" id="state" type="text" />
```

**Postal code**

```
<input name="custZip" id="zip" type="text" />
```

**Phone number**

```
<input name="custPhone" id="phone" type="tel" />
```

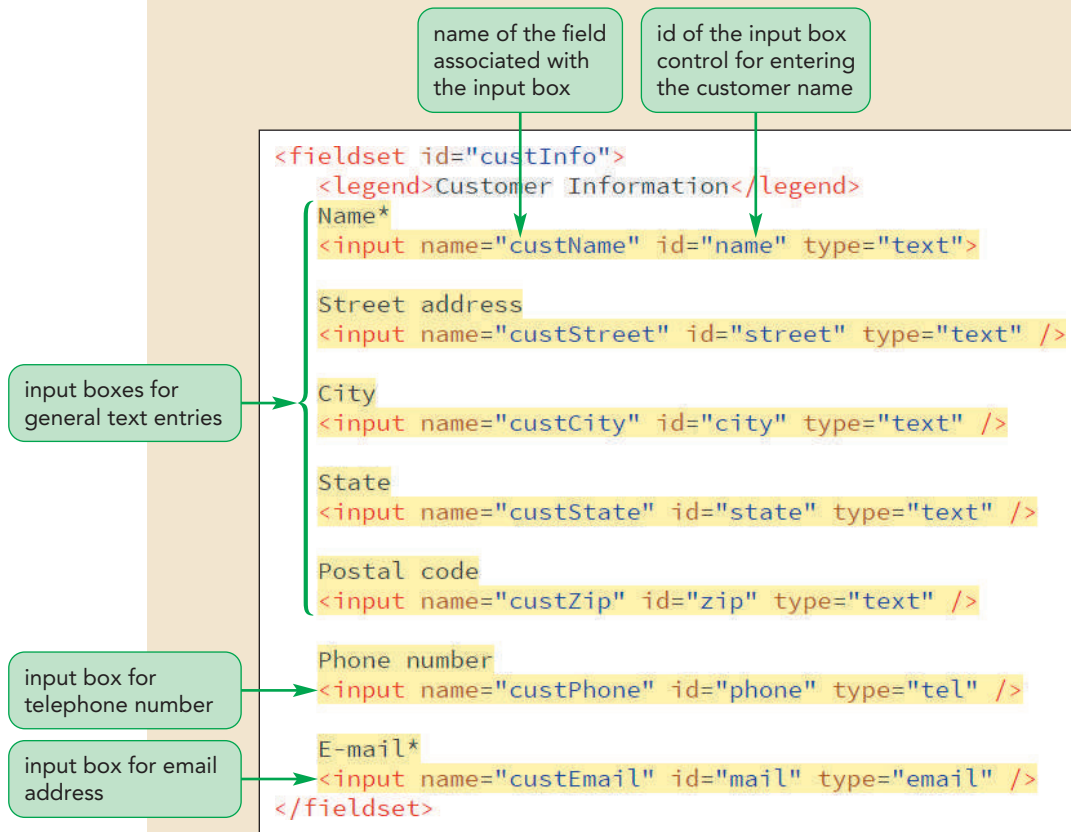
**E-mail\***

```
<input name="custEmail" id="mail" type="email" />
```

Figure 7–11 highlights the code for the newly inserted input elements.

Figure 7–11

## Adding input elements to the form



## TIP

You can prevent users from entering data into a control by adding the attribute `disabled` to the element tag.

2. Save your changes to the file and then reload the `rb_survey.html` file in your browser.
3. Click the **Name\*** input box on the form to make it active and type **your name** in the input box. Press the **Tab** key to move the insertion point to the next input box.
4. Complete the form by entering **your contact information** in the remainder of the form, pressing the **Tab** key to move from one input box to the next. Figure 7–12 shows the completed data entry for the form.

Figure 7–12

## Displaying input boxes

The screenshot shows the rendered web form. A callout points to the "Street address" input box, stating: "input box used to enter the customer street address".

Required values are marked by an asterisk (\*)

Customer Information				
Name*	Alice Nichols	Street address	811 Beach Drive	City
FL	Postal code	32175	Phone number	(386) 555-7499
anichols@example.com	E-mail*			

Share Your Experience at Red Ball Pizza

By default, browsers display input boxes as inline elements with a default length of 20 characters. Later, you will explore how to format these controls to make them easier to read and work with.

### INSIGHT

#### Navigating Forms with Access Keys

You activate controls like input boxes either by clicking them with your mouse or by tabbing from one control to another. As your forms get longer, you might want to give users the ability to jump to a particular input box. This can be done with an access key. An **access key** is a single key on the keyboard that you press in conjunction with another key, commonly the Alt key for Windows users or the control key for Mac users, to jump to a spot in the web page. You create an access key by adding the `accesskey` attribute to the HTML element that creates the control. For example, to create an access key for the `custName` input box, you would enter the following code:

```
<input name="custName" id="custName" accesskey="1" />
```

If a user types Alt+1 (or control+1 for Mac users), the insertion point automatically moves to the `custName` input box. Note that you must use letters that are not reserved by your browser. For example, Alt+f is used by many browsers to access the File menu and thus should not be used as an access key. Access keys also can be used with hypertext links and are particularly helpful to users with impaired motor skills who find it difficult to use a mouse or others who prefer not to use a mouse.

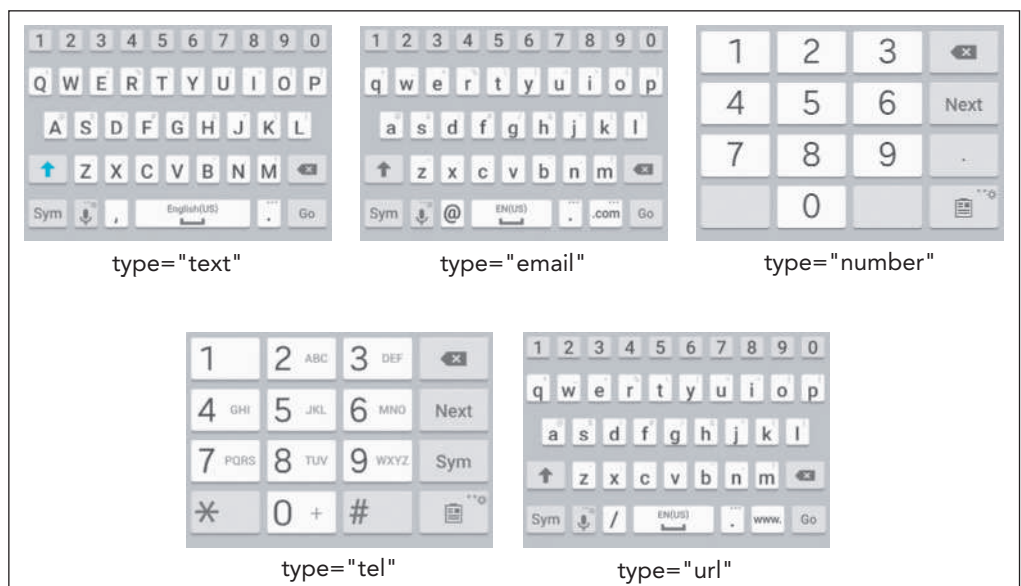
Note that you should test your access keys with different browsers since a keyboard shortcut on one browser might not work with another. Your form can be enhanced through the use of access keys but it should not rely on them.

## Input Types and Virtual Keyboards

Most mobile and tablet devices do not have physical keyboards; instead, they use **virtual keyboards** that exist as software representations of the physical device. One way that web forms can be made responsive to the needs of mobile and touch devices is by displaying different virtual keyboards for each input type. With an input box for telephone numbers, it is more convenient to have digits (instead of alphabetic characters) prominently displayed on the keyboard. Figure 7–13 shows the virtual keyboards that will be displayed based on the value of the `type` attribute.

Figure 7–13

Virtual keyboards for different input types



**TIP**

Always include a `type` attribute in your input box so that a user's device can choose a keyboard best suited for the form control.

Note that for email addresses the @ key is prominently displayed as well as a key that inserts the .com character string. Similarly, for url data, the virtual keyboard includes a key that inserts the www. character string. The choice and layout of the virtual keyboard is determined by the operating system of the device.

## Adding Field Labels

In the last set of steps, you entered a descriptive text string above each `input` element to indicate what content should be entered into the input box. However, nothing in the HTML code explicitly associates that descriptive text with the input box. To associate a text string with a control, you enclose the text string within the following `label` element

```
<label for="id">label text</label>
```

where *id* is the id of the control that you want associated with the label, and *label text* is the text of the label. For example, the following code associates the label text "Street address" with the input box for the `custStreet` control:

```
<label for="street">Street address</label>
<input name="custStreet" id="street" type="text" />
```

You also can make this association implicitly by nesting the control, such as an input element, within the `label` element as in the following code:

```
<label>
 Street address
 <input name="custStreet" id="street" />
</label>
```

Notice that you do not need to include a `for` attribute when you nest the control since the association is made implicit.

Which approach you use depends on how you want to lay out a form's content. When you use the `for` attribute, you can place the label text anywhere within the page and it will still be associated with the control. However, by nesting the control within the label, you can treat both the control and its label as a single object, which can make form layout easier because you can move both the label text and the control as a single unit around the page. Depending on the layout of your form, you might use both approaches.

### REFERENCE

#### Creating a Field Label

- To explicitly associate a text label with a control, use the following `label` element and the `for` attribute

```
<label for="id">label text</label>
```

where *id* identifies the control associated with the label.

- To implicitly associate a text label with a control, nest the control within the `label` element as follows

```
<label>
 label text
 control
</label>
```

where *control* is the HTML code for the form control.

Once you associate a label with a control, clicking the label activates the control. In the case of input boxes, clicking the label would automatically move the insertion point into the input box, making it ready for data entry. With date or color types, clicking the label will display the calendar or color picker widget.

Use the `label` element and `for` attribute now to associate the text strings you entered in the last set of steps with their corresponding input boxes.

The value of the `for` attribute should match the value of the `id` attribute for the control.

### To insert form labels:

1. Return to the **rb\_survey.html** file in your editor.
2. Go to the **custInfo** field set and enclose the text string *Name\** within the following `label` element:  

```
<label for="name">Name*</label>
```
3. Repeat Step 2 for the remaining descriptive text strings in the **custInfo** field set, using the `for` attribute to associate each text string with the `id` of the subsequent input element. Figure 7–14 highlights the newly added code in the web form.

Figure 7–14

### Adding form labels



4. Save your changes to the file and then reload the **rb\_survey.html** file in your browser.
5. Test the labels by clicking each label and verifying that the insertion point appears within the corresponding input box, making that control active on the form.

Alice stops by to see your progress on the survey form. In its current state, the form is difficult to read. She wants you to design a layout that will be easier to read and that will be responsive to both mobile and desktop devices.

## Designing a Form Layout

To be effective, the layout of your form should aid the user in interpreting the form and navigating easily from one input control to the next. There are two general layouts: one in which the labels are placed directly above the input controls in a single column and the other in which the labels and controls are placed side-by-side in two columns. See Figure 7–15.

**Figure 7–15** Form layouts

The figure illustrates two different ways to layout a form titled "Customer Information".

- one-column layout:** The labels are stacked vertically on the left, and the input boxes are stacked vertically on the right. The labels are "Name \*", "Street address", "City", and "State".
- two-column layout:** The labels are on the left, and the input boxes are on the right. The labels are "Name \*", "Street address", "City", and "State (abbr.)". The input boxes are aligned to the right of their respective labels.

### TIP

In a two-column layout, you can move the label text even closer to the input controls by right-aligning the label text.

Usability studies have shown that a single column layout is more accessible because the labels are placed more closely to their input controls. However, for long forms involving many fields, a single column layout can be difficult to work with due to the extensive vertical space required.

Alice wants you to use a single column layout for mobile devices due to the limited horizontal space on those devices, but she wants a two-column layout for devices with larger screen widths. To accomplish this, you will use a flex layout that will allow the labels and controls to assume flexible widths based on the available screen width of the device being used.

First, you will nest each label and input box within a `div` element that will act as a flexbox container.

### To create a flexbox for the label and input elements:

1. Return to the `rb_survey.html` file in your editor and scroll down to the `custInfo` field set.
2. Nest the label and input box for the `custName` field within the following `div` element, indenting the code to make it easier to read:

```
<div class="formRow">
 <label for="name">Name*</label>
 <input name="custName" id="name" type="text" />
</div>
```

3. Repeat Step 2 for the remaining label and input box pairs, nesting each pair within a `div` element belonging to the `formRow` class. Figure 7–16 highlights the new code in the file.

Figure 7–16

## Nesting labels and input controls within div elements

```

<div class="formRow">
 <label for="name">Name*</label>
 <input name="custName" id="name" type="text" />
</div>

<div class="formRow">
 <label for="street">Street address</label>
 <input name="custStreet" id="street" type="text" />
</div>

<div class="formRow">
 <label for="city">City</label>
 <input name="custCity" id="city" type="text" />
</div>

<div class="formRow">
 <label for="state">State</label>
 <input name="custState" id="state" type="text" />
</div>

<div class="formRow">
 <label for="zip">Postal code</label>
 <input name="custZip" id="zip" type="text" />
</div>

<div class="formRow">
 <label for="phone">Phone number</label>
 <input name="custPhone" id="phone" type="tel" />
</div>

<div class="formRow">
 <label for="mail">E-mail*</label>
 <input name="custEmail" id="mail" type="email" />
</div>

```

Next, you will create a style rule that displays each `div` element of the `formRow` class as a flexbox and the objects that are direct children of those `div` elements as flex items.

### To add styles for a flexible form layout:

1. Scroll to the top of the `rb_survey.html` file and then, within the document head and directly above the `script` element, add a link to the **`rb_forms.css`** style sheet.
2. Save your changes to the file and then use your editor to open the **`rb_forms_txt.css`** file from the `html07` ► tutorial folder. Enter ***your name*** and ***the date*** in the comment section of the file and save it as **`rb_forms.css`**.

3. Within the Forms Layout Styles section, add the following style rule to display the formRow `div` element as a flexbox with row orientation and a 7-pixel top and bottom margin:

```
div.formRow {
 display: flex;
 flex-flow: row wrap;
 margin: 7px 0px;
}
```

4. Add the following style rules to set the growth, shrink, and basis values of the objects that are direct children of the formRow `div` element:

```
div.formRow > * {
 flex: 1 1 150px;
}
```

Figure 7–17 shows the new style rules in the style sheet.

Figure 7–17

### Adding styles to create a flexible layout

displays the `div` element with the class `formRow` as a horizontal flexbox

sets the top/bottom margins to 7 pixels

sets the flex sizes of objects that are direct children of the `formRow` `div` element

```
/* Form Layout Styles */
```

```
div.formRow {
 display: flex;
 flex-flow: row wrap;
 margin: 7px 0px;
}
```

```
div.formRow > * {
 flex: 1 1 150px;
}
```

5. Save your changes to the style sheet and then reload `rb_survey.html` in your browser.
6. Resize your screen width to verify that the form layout changes between one and two columns as the screen changes width. See Figure 7–18.

Figure 7–18

### Flex layout of the labels and text input controls

Required values are marked by an asterisk (\*)

Customer Information

Name\*

Street address

City

State

Postal code

Phone number

E-mail\*

narrow screen layout

Required values are marked by an asterisk (\*)

Customer Information

Name\*

Street address

City

State

Postal code

Phone number

E-mail\*

wide screen layout

Another way to set the width of an input box is by adding the following `size` attribute to the `input` element in the HTML file

```
size="chars"
```

where `chars` is the width of the input box in characters. For example, the following `input` element sets the width of the input box for the `custState` field to two characters:

```
<input id="state" size="2" type="text" />
```

Note that this is not an exact measure because the width of individual characters varies depending on the typeface and font style.

Alice suggests that you also use a flexible layout for the two field sets so that they are displayed side-by-side for wider screen devices and stacked for narrow screens. Create style rules now that will change the web form to a flexbox and the field sets as items within that flexbox. You will also add styles to change the appearance of the field set boxes themselves.

### To create a flexible layout for the form:

1. Return to the `rb_forms.css` file in your editor.
2. At the top of the Form Layout Styles section, insert the following style rule to display the survey form as a flexbox:

```
form#survey {
 display: flex;
 flex-flow: row wrap;
}
```

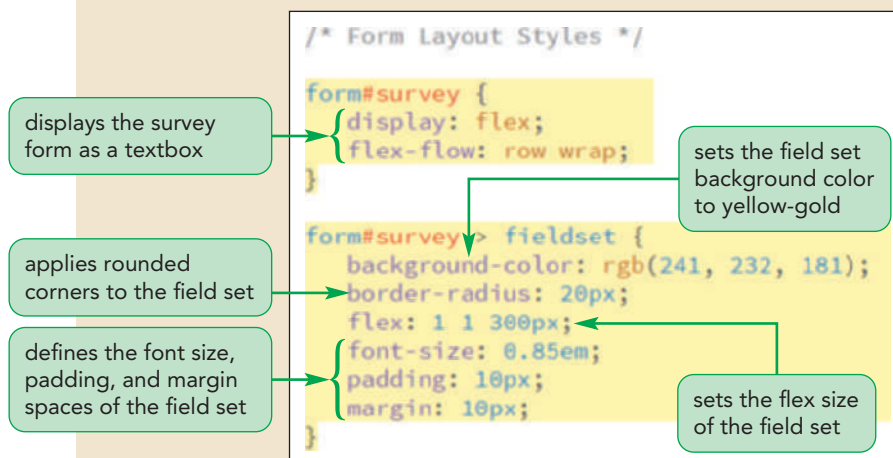
3. Add the following style rule to display the field sets within the survey form as flex items:

```
form#survey > fieldset {
 background-color: rgb(241, 232, 181);
 border-radius: 20px;
 flex: 1 1 300px;
 font-size: 0.85em;
 padding: 10px;
 margin: 10px;
}
```

Figure 7–19 shows the new style rules in the style sheet.

Figure 7–19

### Creating a flexible layout for the form field sets



4. Save your changes to the style sheet and then reload `rb_survey.html` in your browser.
5. Resize your screen width and verify that the form layout changes from one column to two columns, with both field sets side by side as shown in Figure 7–20 when the screen width is larger, to one column, with the field sets stacked vertically when the screen width is reduced.

Figure 7–20

Flex layout of the field sets for a wide screen layout

Finally, Alice wants the field set legends to stand out from the border. She suggests you change the text and background color of the legends.

### To set the style of the field set legend:

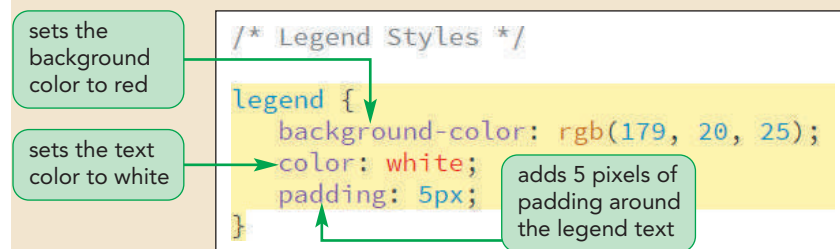
1. Return to the `rb_forms.css` file in your editor.
2. Go to the Legend Styles section and insert the following style rule:

```
legend {
 background-color: rgb(179, 20, 25);
 color: white;
 padding: 5px;
}
```

Figure 7–21 highlights the style rule for the field set legend.

Figure 7–21

Style rule for the field set legend



3. Save your changes to the style sheet and then reload `rb_survey.html` in your browser. Verify that the two field set legends appear in white font on a red background.

## INSIGHT

### Using the autocomplete Attribute

Many browsers include an autocomplete feature that automatically completes an input control based on previous user entries. For example, a user who routinely fills in his or her street address in a multitude of web forms can enable the browser to remember that information and to insert it automatically into any address field from a web form.

The autocomplete feature is a useful time-saver in most cases, but it also can be a security risk when using a computer located in a public place. After all, you may not want to have a private credit card number or password automatically filled in by a browser on a computer that other people will be using.

One way to prevent this problem is through the `autocomplete` attribute which enables or disables the browser's autocomplete function. For example, the following `input` element prevents the browser from automatically filling out the `creditCard` field.

```
<input name="creditCard" autocomplete="false" type="text" />
```

To enable the browser's autocomplete capability, set the value of the `autocomplete` attribute to `true`.

It is easier to use the form with the new layout. However, more than 90% of Red Ball Pizza customers come from Ormond Beach in Florida. Rather than forcing these customers to enter that data, it would be simpler to have those values entered for them. You can do that using default values.

## Defining Default Values and Placeholders

To specify a default field value, you add the following `value` attribute to the HTML element for the form control

```
value="value"
```

where `value` is the value that will be entered by default into the control unless the user enters a different value. For example, the following `input` element sets the default value of the `custCity` field to Ormond Beach:

```
<input name="custCity" id="city" type="text" value="Ormond Beach" />
```

## TIP

You can replace the default field value by entering a new value for the field.

Set the default values for the `custCity` and `custState` fields to *Ormond Beach* and *FL* respectively.

### To define a default field value:

1. Return to the `rb_survey.html` file in your editor and scroll down to the `custInfo` field set.
2. Add the attribute `value="Ormond Beach"` to the `input` element for the `custCity` input control.
3. Add the attribute `value="FL"` to the `input` element for the `custState` input control.

Figure 7–22 highlights the attributes that add default values to the `custCity` and `custState` fields.

Figure 7–22

## Defining the default field value



```

<div class="formRow">
 <label for="city">City</label>
 <input name="custCity" id="city" type="text" value="Ormond Beach" />
</div>

<div class="formRow">
 <label for="state">State</label>
 <input name="custState" id="state" type="text" value="FL" />
</div>

```

sets the default value  
for the custCity field

sets the default value  
for the custState field

4. Save your changes to the file and then reload `rb_survey.html` in your browser. Verify that the City and State input boxes show the text strings *Ormond Beach* and *FL*, respectively.

**Trouble?** If the form does not reload with the replacement text, close the file and reopen it in your browser, which clears all fields and opens a new copy of the form.

**Placeholders** are text strings that appear within a form control, providing a hint about the kind of data that should be entered into the field. However, unlike a default field value, a placeholder is not stored in the control as the field's value. Placeholders are defined using the following `placeholder` attribute

```
placeholder="text"
```

where `text` is the text of the placeholder. For example, the following `placeholder` attribute provides guidance about the format users should use when entering values for the `custPhone` field:

```
<input name="custPhone" id="phone" placeholder="(nnn) nnn-nnnn" />
```

When the browser displays the form, the text `(nnn) nnn-nnnn` appears grayed out in the input box indicating to the user that he or she should enter a phone number, including both the area code and the seven-digit number. The placeholder automatically disappears as soon as a user selects the control and begins to enter a value.

Alice asks you to add placeholders to the input boxes for the `custName`, `custZip`, and `custPhone` fields.

### To define a placeholder:

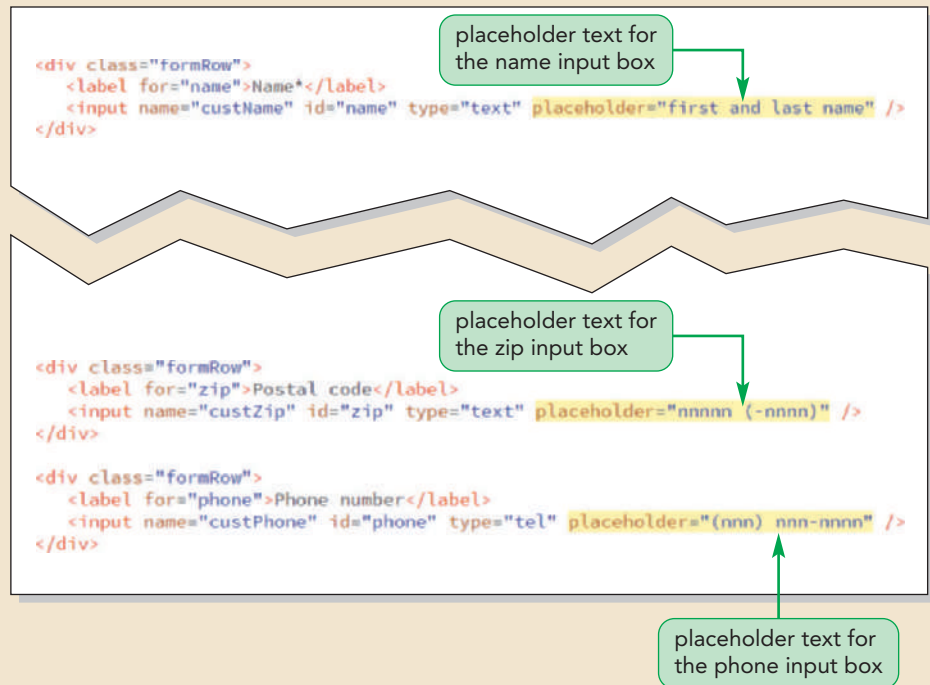
1. Return to the `rb_survey.html` file in your editor.
2. Add the attribute `placeholder="first and last name"` to the input element for the `custName` field.
3. Add the attribute `placeholder="nnnnn (-nnnn) "` to the input element for the `custZip` field.

4. Add the attribute `placeholder="(nnn) nnn-xxxx"` to the input element for the `custPhone` field.

Figure 7–23 highlights the `placeholder` attributes added to the form.

Figure 7–23

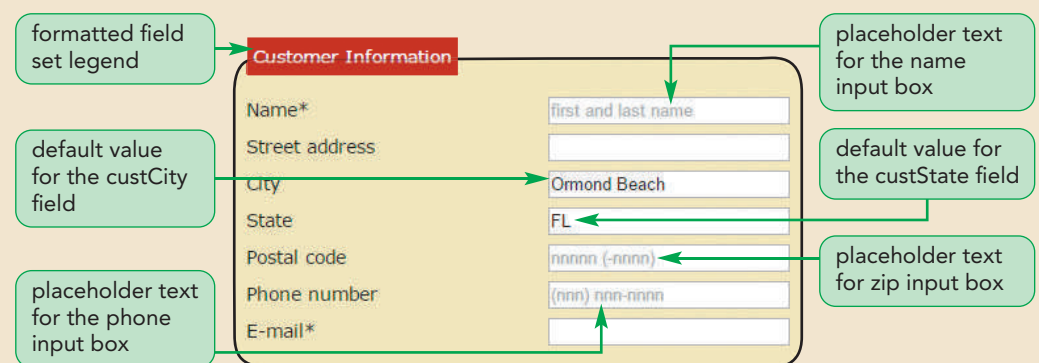
## Defining placeholder text



5. Save your changes to the file and then reload `rb_survey.html` in your browser. As shown in Figure 7–24, placeholder text has been added to the Name, Postal code, and Phone input boxes.

Figure 7–24

## Viewing default values and placeholder text



The style of the placeholder text is determined by the browser. There are no CSS styles to format the appearance of the placeholder but all major browsers include their own browser extensions for placeholders. Depending on the browser, the placeholder is treated either as a pseudo-class or a pseudo-element named either `input-placeholder` for the `webkit` and `ms` extensions or `placeholder` for the `moz` extension.

**TIP**

The `moz` extension for Firefox version 18 and earlier treats the placeholder as a pseudo-class rather than a pseudo-element.

The following code shows a cross-browser style sheet that changes the text color of the placeholder text for every input box to light red.

```
input::-webkit-input-placeholder {
 color: rgb(255, 151, 151);
}

input:-ms-input-placeholder {
 color: rgb(255, 151, 151);
}

input::-moz-placeholder {
 color: rgb(255, 151, 151);
}
```

Note that you cannot place different browser extensions within the same style rule because if style rule contains a selector that the browser doesn't recognize, the entire rule will be ignored.

**PROSKILLS**

### Decision Making: Creating Cross-Browser Compatible Forms

Several form attributes, such as the `placeholder` attribute, might not be supported by older browsers. This poses a problem for designers who must decide whether or not to use such attributes. One school of thought holds that a web form should look and function the same across all browsers and browser versions. Thus, a feature like the `placeholder` attribute should not be used. If a placeholder is needed, it should be created using a JavaScript program that can be applied uniformly across browsers and browser versions. The opposing view holds that the best design is one that uses each browser to its utmost capabilities, and that the web will only improve in the long run if the most current features are employed because their use will encourage their more rapid adoption across the browser market.

To decide between these two approaches, you must evaluate whether the form feature you're adding is critical to understanding and using your web form. If it is, you need to include workarounds so that all users are supported regardless of their browser. On the other hand, if the feature enhances the user's experience but is not essential to working with the web form, it can be safely added without leaving older browsers behind.

You have finished the initial stage of developing the survey form. Alice is pleased with the form's appearance and content. In the next session, you will extend the form by adding new fields and controls, including calendar widgets, selection lists, option buttons, and check boxes.

## REVIEW

**Session 7.1 Quick Check**

1. What attribute do you add to the `<form>` element to access the CGI script at `www.example.com/cgi-bin/registration`?
  - a. `action="www.example.com/cgi-bin/registration"`
  - b. `method="www.example.com/cgi-bin/registration"`
  - c. `src="www.example.com/cgi-bin/registration"`
  - d. `url="www.example.com/cgi-bin/registration"`
2. What attribute identifies the form control?
  - a. `name`
  - b. `id`
  - c. `control`
  - d. `method`
3. What attribute do you use to indicate a password field?
  - a. `password="true"`
  - b. `method="password"`
  - c. `id="password"`
  - d. `type="password"`
4. What attribute do you use for an input box containing a telephone number?
  - a. `type="telephone"`
  - b. `type="text"`
  - c. `type="tel"`
  - d. `type="number"`
5. What attribute do you use for an input box containing a hypertext link?
  - a. `type="url"`
  - b. `type="link"`
  - c. `rel="link"`
  - d. `type="search"`
6. What attribute do you use to associate a label with the input control `pWord`?
  - a. `type="pWord"`
  - b. `for="pWord"`
  - c. `url="pWord"`
  - d. `src="pWord"`
7. What attribute do you use to set the default value of a field to "United States"?
  - a. `default="United States"`
  - b. `text="United States"`
  - c. `placeholder="United States"`
  - d. `value="United States"`
8. What code do you enter to specify the placeholder text "nnn-nn-nnnn"?
  - a. `default="nnn-nn-nnnn"`
  - b. `text="nnn-nn-nnnn"`
  - c. `placeholder="nnn-nn-nnnn"`
  - d. `value="nnn-nn-nnnn"`

# Session 7.2 Visual Overview:

The **select** element creates a drop-down list box control.

Each option in a selection list is marked with the **option** element.

The **selected** attribute identifies the default option in a selection list.

Each radio button within an option group belongs to the same data field.

The **textarea** element marks a text area box control.

The **size** attribute sets the number of visible options.

The **multiple** attribute allows for multiple selections from the drop-down list.

The **checkbox** data type creates a checkbox control.

```
<label for="infoSrc">Where did you hear about us?</label>
<select name="infoSrc" id="info" size="5" multiple>
 <option value="internet">Internet</option>
 <option value="mag">Magazine</option>
 <option value="news">Newspaper</option>
 <option value="word">Word of Mouth</option>
 <option value="other">Other</option>
</select>

<input name="mailMe" id="mailCB" value="yes" type="checkbox" />
<label for="mailCB">Add me to your mailing list.</label>

<label for="orderType">Order type</label>
<select name="orderType" id="order">
 <option value="order1">Carry out</option>
 <option value="order2">Delivery</option>
 <option value="order3" selected>Dine in</option>
 <option value="order4">Take 'n bake</option>
</select>

<label>Was your service friendly?</label>
<fieldset class="optGroup">
 <label for="fYes">Yes</label>
 <input name="sFriend" id="fYes" value="yes" type="radio" />
 <label for="fNo">No</label>
 <input name="sFriend" id="fNo" value="no" type="radio" />
</fieldset>

<label for="commBox">Tell us more about your experience!</label>
<textarea name="custExp" id="commBox"></textarea>
```

The **radio** data type creates an option button control.

# Web Form Widgets

## Customer Survey

Thank you for taking our customer survey. Your response helps Red Ball Pizza maintain the tradition that has made us the top-rated pizzeria in the metro area. All participants are automatically entered into a monthly drawing to receive a *Red Ball Express PizzaFest* containing two large pizzas, a 2-liter soda, and a side order of chicken wings. Check your e-mail inbox for contest results.

Surveys are private and confidential. Red Ball Pizza will not share your contact information with third parties, ever.

Required values are marked by an asterisk (\*)

**Customer Information**

Name\*

Street address

City

State

Postal code

Where did you hear about us? 

Internet

Magazine

Newspaper

Word of Mouth

Other

☐ Add me to your mailing list.

**Share Your Experience at Red Ball Pizza**

Date of visit

Order type

Was your service friendly? ☐ Yes ☐ No

Tell us more about your experience!

**Annotations:**

- A check mark appears when the user clicks the checkbox control.
- Selection list box control showing five items; the user can select more than one option.
- The user can type in the text area box control.
- Selection list displayed as a drop-down list box control with the default option displayed.
- The user can select only one option button control.

## Entering Date and Time Values

To ensure that users enter data in the correct format, you can use controls specifically designed for the field's data type. Consider, for example, the following code that creates an input box for a birthdate field:

```
<label for="bdate">Date of Birth</label>
<input name="bdate" id="bdate" />
```

There is nothing to prevent users from entering the same date in a wide variety of formats such as September 14, 2021, 9/14/21, or 2021-09-14. The lack of uniformity in these date formats makes it difficult for a web server program to store and analyze the data.

### TIP

If a browser does not support date and time controls, it will display an input box, leaving the user free to enter the date or time value in whatever format he or she wishes.

Starting with HTML 5, date and time fields could be indicated using one of the following type attributes: date, time, datetime-local, month, and week. Each of these type attribute values has a different control associated with it, enabling the user to select the date, time, month, or week value. The text into the input box is based on the user's selection in the control widget, ensuring the date or time text is entered in the same format for every user. Figure 7–25 shows examples of the widgets used by the Google Chrome browser.

**Figure 7–25** Date and time controls

The figure displays five examples of HTML5 date and time controls as they appear in a Google Chrome browser:

- type="date"**: Shows a calendar for August 2021 with the date 08/17/2021 selected in the input field.
- type="datetime-local"**: Shows a calendar for August 2021 with the date 08/17/2021 selected, and a time picker set to 04:21 PM.
- type="time"**: Shows a time picker set to 04:21 PM.
- type="month"**: Shows a calendar for August 2021.
- type="week"**: Shows a calendar for August 2021 with week 33 selected.

The expInfo field set will contain fields in which the customer can describe his or her experience at the pizzeria. Alice wants the field set to include a calendar control that users can use to enter the date of their visit to Red Ball Pizza.

**To create a date field:**

1. If you took a break after the previous session, make sure **rb\_survey.html** is open in your editor.
2. Go to the `expInfo` field set and insert the following `label` and `input` elements:

```
<div class="formRow">
 <label for="visit">Date of visit</label>
 <input name="visitDate" id="visit" type="date" />
</div>
```

Figure 7–26 highlights the code for the `label` and `input` elements.

**Figure 7–26****Creating a date field**

```
<fieldset id="expInfo">
 <legend>Share Your Experiences at Red Ball Pizza</legend>

 <div class="formRow">
 <label for="visit">Date of visit</label>
 <input name="visitDate" id="visit" type="date" />
 </div>
</fieldset>
```

3. Save your changes to the file and then reload `rb_survey.html` in your browser.
4. Click the Date of visit control and select a date to verify that the text of the date is entered into the input box.

## Creating a Selection List

The next part of the survey form records how customers place their orders from Red Ball Pizza. A customer order can be placed in one of four ways: pickup, delivery, dine in, or, in the case of pizzas, uncooked pizzas that customers can take home and bake. Alice doesn't want customers to enter their order types into an input box because customers will enter this information in different ways, and the large variety of spellings and text will make it difficult to group and analyze the survey results. Instead, she wants each user to select the order type from a predetermined group of options. This can be accomplished using a selection list.

A selection list is a list box that presents users with a group of possible values for the data field and is created using the following `select` and `option` elements

```
<select name="name">
 <option value="value1">text1</option>
 <option value="value2">text2</option>
 ...
</select>
```

where `name` is the name of the data field, `value1`, `value2`, and so on are the possible field values, and `text1`, `text2`, and so on are the text of the entries in the selection list that users see on the web form. Note that the field value does not have to match the option text. In most cases, the option text will be expansive and descriptive, while the corresponding field value will be brief and succinct for use with the server program analyzing the form data.

The first option in the selection list is selected by default and thus contains the field's default value. To choose a different option as the default option, add the `selected` attribute to the `option` element as follows:

```
<option value="value" selected>text</option>
```

Note that XHTML documents require the attribute `selected="selected"` to be compliant with XHTML standards for attribute values.

## REFERENCE

### Creating a Selection List

- To create a selection list, add the elements

```
<select name="name">
 <option value="value1">text1</option>
 <option value="value2">text2</option>
 ...
</select>
```

where *name* is the name of the data field, *value1*, *value2*, and so on are the possible field values, and *text1*, *text2*, and so on are the text entries displayed in the selection list on the web form.

- To allow users to make multiple selections, add the attribute `multiple` to the `select` element.
- To set the number of options displayed at one time in the selection list, add the following attribute to the `select` element

```
size="value"
```

where *value* is the number of options displayed in the selection list at any one time.

- To specify the default value, add the `selected` attribute to the `option` element that you want to set as the default.

Add a selection list to the Red Ball Pizza survey form to record the type of order placed by the customer, storing the value in the `orderType` field. Identify the selection list control with ID `order`. Alice knows that most of the survey respondents dine in at the restaurant. Although she wants the options for the `orderType` field listed in alphabetical order, she would like the `Dine in` option selected by default.

## TIP

The default width of the selection box is equal to the width of the longest option text unless the width is set using a CSS style.

### To create a selection list:

- Return to the `rb_survey.html` file in your editor.
- Within the `explnfo` field set, add the following code to create the label and selection list:

```
<div class="formRow">
 <label for="order">Order type</label>
 <select name="orderType" id="order">
 <option value="order1">Carry out</option>
 <option value="order2">Delivery</option>
 <option value="order3" selected>Dine in</option>
 <option value="order4">Take 'n bake</option>
 </select>
</div>
```

Figure 7–27 highlights the code for the selection list.

Figure 7–27

Creating a selection list for the orderType field

```

<div class="formRow">
 <label for="visit">Date of visit</label>
 <input name="visitDate" id="visit" type="date" />
</div>

<div class="formRow">
 <label for="order">Order type</label>
 <select name="orderType" id="order">
 <option value="order1">Carry out</option>
 <option value="order2">Delivery</option>
 <option value="order3" selected>Dine in</option>
 <option value="order4">Take 'n bake</option>
 </select>
</div>

```

field name associated with the selection list

id of the selection list control

order3 (Dine in) is the default selected value of the orderType field

possible values of the orderType field

text strings displayed in the selection list for each option

3. Save your changes to the file and then reload rb\_survey.html in your browser.
4. Click the Order type selection list and verify that the list of order types appears in the drop-down list box and that Dine in is the default selected option. See Figure 7–28.

Figure 7–28

Viewing the selection list options

Share Your Experience at Red Ball Pizza

Date of visit

Order type

calendar control for selecting the date of the customer's visit

Dine in is the default selected option

a drop-down list box displays the text of the four options

## Working with select Attributes

By default, a selection list appears as a drop-down list box. To display a selection list as a scroll box with more than one option visible in the web form, add the following `size` attribute to the `select` element

```
<select size="value"> ... </select>
```

where `value` is the number of options that the selection list displays at one time. For example, a size value of 5 would display 5 items in the scroll box.

The default behavior of the selection list is to allow only one selection from the list of options. To allow more than one item to be selected, add the following `multiple` attribute to the `select` element:

```
<select multiple> ... </select>
```

**TIP**

To assist your users in completing your form, you can include instructions on your page detailing how to select multiple options from a selection list.

There are two ways for users to select multiple items from a selection list. For noncontiguous selections, users can press and hold the Ctrl key (or the command key on a Mac) while making the selections. For a contiguous selection, users can select the first item, press and hold the Shift key, and then select the last item in the range. This selects the two items, as well as all the items between them.

Alice has another selection list to add to the survey form, which will record how a customer heard about Red Ball Pizza. The survey presents the user with five options: Internet, Magazine, Newspaper, Word of Mouth, or Other. Alice wants the form to display all of the options, so you set the value of the `size` attribute to 5. She also wants customers to be able to select multiple options from the selection list.

**To apply the size and multiple attributes:**

1. Return to the **rb\_survey.html** file in your editor and go to the `custInfo` field set.
2. At the bottom of the field set, insert the following code:

```
<div class="formRow">
<label for="info">Where did you hear about us?

(select all that apply)
</label>
<select name="infoSrc" id="info" size="5" multiple>
 <option value="internet">Internet</option>
 <option value="mag">Magazine</option>
 <option value="news">Newspaper</option>
 <option value="word">Word of Mouth</option>
 <option value="other">Other</option>
</select>
</div>
```

Figure 7–29 highlights the code for the selection list.

**Figure 7–29****Inserting a selection list for the infoSrc field**

```
<div class="formRow">
 <label for="mail">E-mail</label>
 <input name="custEmail" id="mail" type="email" />
</div>

<div class="formRow">
 <label for="info">Where did you hear about us?
(select all that apply)</label>
 <select name="infoSrc" id="info" size="5" multiple>
 <option value="internet">Internet</option>
 <option value="mag">Magazine</option>
 <option value="news">Newspaper</option>
 <option value="word">Word of Mouth</option>
 <option value="other">Other</option>
 </select>
</div>

</fieldset>
```

field name

displays 5 options in the selection list

allows the user to make multiple selections

3. Save your changes and then reload `rb_survey.html` in your browser. Figure 7–30 shows the `infoSrc` selection list box.

Figure 7–30

Viewing the selection list for the `infoSrc` field

E-mail\*

Where did you hear about us?  
(select all that apply)

- Internet
- Magazine
- Newspaper
- Word of Mouth
- Other

all 5 options are displayed in the selection list

4. Verify that you can now select multiple values for the `infoSrc` field by using the **Ctrl+click**, **Command+click**, **Shift+click** keyboard and mouse combinations.

If you use a multiple selection list in a form, be aware that the form sends a name/value pair to the server for each option the user selects from the list. Verify that your server-based program can handle a single field with multiple values before using a multiple selection list.

## Grouping Selection Options

In long selection lists, it can be difficult for users to locate a particular option value. You can organize selection list options by placing them in option groups using the `optgroup` element

```
<select>
 <optgroup label="label1">
 <option>text1</option>
 <option>text2</option>
 </optgroup>
 <optgroup label="label2">
 <option>text3</option>
 <option>text4</option>
 </optgroup>
</select>
```

where `label1`, `label2`, and so forth are the labels for the different groups of options. The text of the label appears in the selection list above each group of items but it is not a selectable item from the list. Figure 7–31 shows an example of a selection list in which the options are divided into two groups.

Figure 7–31 Grouping options in a selection list

```

<label for="appetizers">Starter Menu</label>
<select name="meal">
 <optgroup label="Appetizers">
 <option value="sms">Spicy Mozzarella Sticks</option>
 <option value="pr">Pepperoni Rolls</option>
 <option value="tr">Toasted Ravioli</option>
 </optgroup>
 <optgroup label="Salads">
 <option value="sms">Pasta Salad</option>
 <option value="tbs">Tuscan Bread Salad</option>
 <option value="pr">Caesar Salad</option>
 </optgroup>
</select>

```

option group labels

The appearance of the option group label is determined by the browser. You can apply a style to an entire option group including its label, but there is no CSS style to change the appearance of the option group label alone.

## INSIGHT

### Hidden Fields

Some fields have predefined values that do not require user input and are often not displayed within the web form. You create a **hidden field** by setting the value of the `type` attribute to `hidden` as follows:

```
<input name="name" value="value" type="hidden" />
```

where `name` is the name of the data field and `value` is the value stored in the field. With a hidden field, both the field value and the input control are hidden from the user. Even though hidden fields are not displayed by browsers, the field values still can be read by examining the source code; for this reason, you should not put any sensitive information in a hidden field.

## Creating Option Buttons

Option buttons, also called radio buttons, are like selection lists in that they limit fields to a set of possible values; but, unlike selection lists, the options appear as separate controls in the web form. Option buttons are created with a group of `input` elements with a `type` attribute value of “radio”, sharing a common data field name as follows

```
<input name="name" value="value1" type="radio" />
<input name="name" value="value2" type="radio" />
<input name="name" value="value3" type="radio" />
...
```

### TIP

To show that a group of radio buttons are associated with the same field, place the radio button controls within a field set.

where *name* is the name of the data field and *value1*, *value2*, *value3*, and so on are the field values associated with each option. While a user can select multiple items in a selection list, a user can only click or check one option in a group of radio buttons. Selecting one radio button automatically deselects the others and sets the value of the field to the value of the checked radio button.

For example, the following code creates a group of option buttons for the `sFriend` field, limiting the possible field values to “yes” or “no”.

```
Was your service friendly?
<label for="fYes">Yes</label>
<input name="sFriend" value="yes" id="fYes" type="radio" />
<label for="fYes">No</label>
<input name="sFriend" value="no" id="fNo" type="radio" />
```

Note that the two radio button controls are given different `ids` and field values to distinguish them from each other, however they share the same field name, “`sFriend`”.

By default, an option button is unselected; however, you can set an option button to be selected as the default by adding the following `checked` attribute to the `input` element:

```
<input name="name" type="radio" checked />
```

### REFERENCE

#### Creating an Option List

- To create a group of option buttons associated with the same field, add the `input` elements

```
<input name="name" value="value1" type="radio" />
<input name="name" value="value2" type="radio" />
<input name="name" value="value3" type="radio" />
...
```

where *name* is the name of the data field, and *value1*, *value2*, *value3*, and so on are the field values associated with each option.

- To specify the default option, add the `checked` attribute to the `input` element.

In the next part of the form, Alice wants to ask customers general questions about their experiences at the restaurant. She wants to know whether the service was friendly, whether orders were recorded correctly, and if the food was delivered hot. She suggests that you present these questions using radio buttons, placing each group of radio buttons within a `fieldset` element belonging to the `optGroup` class.

The value of the name attribute must be the same for all option buttons within a group.

### To create a set of option buttons:

1. Return to the **rb\_survey.html** file in your editor and go to the **explnfo** field set.
2. At the bottom of the **explnfo** field set, add the following code to create radio buttons for the **sFriend** field:

```
<div class="formRow">
 <label>Was your service friendly?</label>
 <fieldset class="optGroup">
 <label for="fYes">Yes</label>
 <input name="sFriend" id="fYes" value="yes"
type="radio" />
 <label for="fNo">No</label>
 <input name="sFriend" id="fNo" value="no"
type="radio" />
 </fieldset>
</div>
```

3. Add the following group of radio buttons for the **oCorrect** field:

```
<div class="formRow">
 <label>Was your order correct?</label>
 <fieldset class="optGroup">
 <label for="cYes">Yes</label>
 <input name="oCorrect" id="cYes" value="yes"
type="radio" />
 <label for="cNo">No</label>
 <input name="oCorrect" id="cNo" value="no"
type="radio" />
 </fieldset>
</div>
```

4. Finally, add the following group of radio buttons for the **foodHot** field:

```
<div class="formRow">
 <label>Was your food hot?</label>
 <fieldset class="optGroup">
 <label for="hYes">Yes</label>
 <input name="foodHot" id="hYes" value="yes"
type="radio" />
 <label for="hNo">No</label>
 <input name="foodHot" id="hNo" value="no"
type="radio" />
 </fieldset>
</div>
```

Figure 7–32 highlights the code for the set of option buttons.

Figure 7–32

Creating option groups for the sFriend, oCorrect, and foodHot fields

```

<div class="formRow">
 <label>Was your service friendly?</label>
 <fieldset class="optGroup">
 <label for="fYes">Yes</label>
 <input name="sFriend" id="fYes" value="yes" type="radio" />
 <label for="fNo">No</label>
 <input name="sFriend" id="fNo" value="no" type="radio" />
 </fieldset>
</div>

<div class="formRow">
 <label>Was your order correct?</label>
 <fieldset class="optGroup">
 <label for="cYes">Yes</label>
 <input name="oCorrect" id="cYes" value="yes" type="radio" />
 <label for="cNo">No</label>
 <input name="oCorrect" id="cNo" value="no" type="radio" />
 </fieldset>
</div>

<div class="formRow">
 <label>Was your food hot?</label>
 <fieldset class="optGroup">
 <label for="hYes">Yes</label>
 <input name="foodHot" id="hYes" value="yes" type="radio" />
 <label for="hNo">No</label>
 <input name="foodHot" id="hNo" value="no" type="radio" />
 </fieldset>
</div>

</fieldset>
</form>

```

Annotations in the image:

- options for the sFriend field**: Points to the first fieldset.
- options for the oCorrect field**: Points to the second fieldset.
- options for the foodHot field**: Points to the third fieldset.
- label for the option group**: Points to the <label>Was your service friendly?</label> line.
- field value**: Points to the value="yes" attribute in the first radio button.
- radio button controls**: Points to the type="radio" attribute in the first radio button.

5. Save your changes to the file and then reload rb\_survey.html in your browser. Figure 7–33 shows the appearance of the three groups of radio buttons in the survey form.

Figure 7–33

Option buttons for the serve field

Visual representation of the survey form:

- Share Your Experience at Red Ball Pizza** (Header)
- Date of visit**: Input field with placeholder mm/dd/yyyy
- Order type**: Dropdown menu with "Dine in" selected
- Was your service friendly?**: Radio buttons for Yes and No
- Was your order correct?**: Radio buttons for Yes and No
- Was your food hot?**: Radio buttons for Yes and No

Annotations in the image:

- option group labels**: Points to the labels for the three question groups.
- radio buttons for the sFriend field**: Points to the Yes and No radio buttons for "Was your service friendly?"
- radio buttons for the oCorrect field**: Points to the Yes and No radio buttons for "Was your order correct?"
- radio buttons for the foodHot field**: Points to the Yes and No radio buttons for "Was your food hot?"

6. Click the radio buttons with each option group and verify that if you select one radio button, the other button in that group is automatically deselected.

## Creating Check Boxes

Check boxes are designed for fields that record the presence or absence of an object or event. The check box control is created using the following `input` element with the `type` attribute set to "checkbox"

```
<input name="name" value="value" type="checkbox" />
```

### TIP

The default field value for a check box control is "On".

where the `value` attribute contains the value of the field when the check box is checked, and the `type` attribute indicates that the input box is a check box. By default, the check box is not checked, however you can make a check box selected automatically by adding the `checked` attribute to the `input` element.

For example, the following code creates a check box for the `orderDone` field, recording whether an order has been completed:

```
<label for="orderCB">Order Completed</label>
<input name="orderDone" id="orderCB" value="yes" type="checkbox" />
```

If the check box is selected by the customer, the browser will send a name/value pair of `orderDone/yes` to the script running on the web server when the form is submitted. A name/value pair is sent to the server only when the check box is checked by the user. If the control is not checked, then no name/value pair is sent when the form is submitted.

### REFERENCE

#### Creating a Check Box

- To create a check box, add the element

```
<input name="name" value="value" type="checkbox" />
```

where `type` is the type of input control, `name` is the name of the data field, and `value` is the data field value if the check box is selected.

- To specify that a check box is selected by default, add the `checked` attribute to the `input` element.

Alice wants her survey form to include a check box that customers can select if they wish to be added to the pizzeria's email list for specials and promotions. Add a check box for the `mailMe` field to the `custInfo` field set now.

#### To add a check box control:

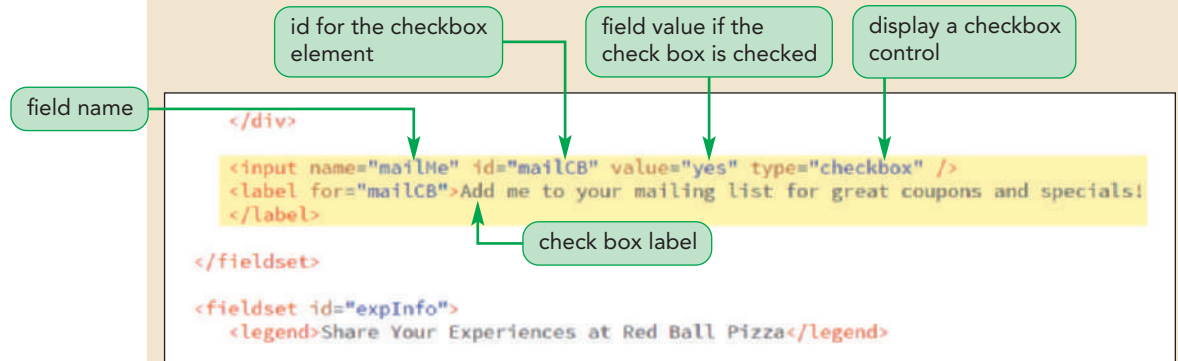
1. Return to the `rb_survey.html` file in your editor and go to the end of the `custInfo` field set.
2. Add the following code to create a check box followed by the label for the checkbox control:

```
<input name="mailMe" id="mailCB" value="yes" type="checkbox" />
<label for="mailCB">Add me to your mailing list for great
coupons and specials!</label>
```

Figure 7–34 highlights the code for the check box and label.

Figure 7–34

## Creating a checkbox control



3. Save your changes and then reload `rb_survey.html` in your browser. Figure 7–35 shows the placement of the check box within the form.

Figure 7–35

## Check box for the mailMe field

The screenshot shows a web form with the following elements:

- E-mail\***: A text input field.
- Where did you hear about us? (select all that apply)**: A multi-select dropdown menu with options: Internet, Magazine, Newspaper, Word of Mouth, and Other.
- check box**: A checkbox control.
- label associated with the check box**: The text "Add me to your mailing list for great coupons and specials!".

## Tab Indexing and Autofocus

## INSIGHT

Typically, users navigate through a form using the Tab key, which moves the insertion point from one field to another in the order that the form controls are entered into the HTML file.

You can specify an alternate order by adding the `tabindex` attribute to any control in your form. When each control is assigned a tab index number, the insertion point moves through the fields from the lowest index number to the highest. For example, to assign the tab index number 1 to the `custName` field from the survey form, you add the following `tabindex` attribute to the control:

```
<input name="custName" tabindex="1" />
```

This code places the insertion point in the `custName` field when the form is first opened. (Fields with 0 or negative tab indexes are omitted from the tab order entirely.)

Another way to place the insertion point in a field when the form is initially opened is to use the following `autofocus` attribute:

```
<input name="custName" autofocus />
```

Older browsers that do not support tab indexing or the `autofocus` attribute simply ignore them and open a file without giving the focus to any form control. When a user tabs through the form in those older browsers, the tab order will reflect the order of the elements in the HTML file.

## Creating a Text Area Box

Input boxes are limited to a single line of text and thus are not appropriate for extended text strings that might cover several lines of content. For that type of data entry, you create a text area box using the following `textarea` element

```
<textarea name="name">
 text
</textarea>
```

where `text` is the default value of the data field. You do not have to specify a default value; you can leave the text box empty or you can use the `placeholder` attribute introduced in the last session to provide a hint to users about what to enter into the text box.

The default browser style is to create a text area box that is about 20 characters wide and two or three lines high. You can increase the size of the box using CSS styles. HTML also supports the following `rows` and `cols` attributes to set the text area size

```
<textarea rows="value" cols="value"> ... </textarea>
```

where the `rows` attribute specifies the number of lines in the text area box and the `cols` attribute specifies the number of characters per line. While the `rows` and `cols` attributes represent the older standard, you may still encounter their use in older websites.

### TIP

When you enter more text than can fit into a text area box, the browser automatically adds vertical scroll bars to the box.

Content in a text area box automatically wraps to a new line as needed. You can determine whether those line returns are included as part of the field value by adding the following `wrap` attribute:

```
<textarea wrap="type"> ... </textarea>
```

where `type` is either `hard` or `soft`. In a hard wrap, line returns are included with the data field value, while in a soft wrap, line returns are not included. The default value of the `wrap` attribute is `soft`.

### REFERENCE

#### Creating a Text Area Box

- To create a text area box for multiple lines of text, use

```
<textarea name="name">
 text
</textarea>
```

where `name` is the name of the field associated with the text area box and `text` is the default text that appears in the box.

- To specify the dimensions of the box, use a CSS style or apply the following attributes

```
rows="value" cols="value"
```

where the `rows` attribute specifies the number of lines in the text area box and the `cols` attribute specifies the number of characters per line.

- To specify how the field value should handle wrapped text, use the attribute

```
wrap="type"
```

where `type` is either `hard` (to include the locations of the line wraps) or `soft` (to ignore line wrap locations).

Alice wants to include a text area box where customers can enter extended commentary about the pizzeria, storing their comments in the `custExp` field. You will set the dimensions of the text area box using CSS.

### To add a text area box:

1. Return to the **rb\_survey.html** file in your editor and go to the end of the **explnfo** field set.
2. Add the following code to create a text area box at the bottom of the field set:

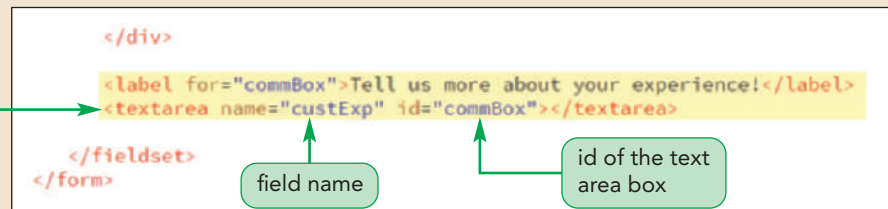
```
<label for="commBox">Tell us more about your
 experience!</label>
<textarea name="custExp" id="commBox"></textarea>
```

Figure 7–36 highlights the code for the text area box and label.

Figure 7–36

### Creating a text area box

displays a text  
area box



3. Save your changes and then return to the **rb\_forms.css** file in your editor.
4. Go to the Text Area Styles section and insert the following style rule to set the size and top margin of the text area box.

```
textarea {
 margin-top: 10px;
 height: 100px;
 width: 95%;
}
```

Figure 7–37 shows the style rule for the text area box.

Figure 7–37

### Styles for the text area box



5. Save your changes and then reload **rb\_survey.html** in your browser. Figure 7–38 shows the appearance of the text area box.

Figure 7–38

Text area box in the web form

Was your food hot? Yes ☐ No ☐

Tell us more about your experience!

label associated with the text area box

text area box

6. Test the text area box by clicking it and then typing a sample comment inside of the box.



## PROSKILLS

### Written Communication: Creating Effective Forms

Web forms are one of the main ways of getting feedback from your users, so it is important for the forms to be easily accessible. A well-designed form often can be the difference between a new customer and a disgruntled user who leaves your site to go elsewhere. Here are some tips to remember when designing a form:

- Keep your forms short and to the point.
- Mark fields that are required but also limit their number. Don't overwhelm your users with requests for information that is not really essential.
- Use the `autofocus` attribute to place users automatically into the first field of your form, rather than forcing them to click that field.
- Many users will navigate through your form using the Tab key. Make sure that your tab order is logical and easy for users to follow.
- Provide detailed instructions about what users are expected to do. Don't assume that your form is self-explanatory.
- If you ask for personal data and financial information, provide clear assurances that the data will be secure. If possible, provide a link to a web page describing your security practices.
- If you need to collect a lot of information, break the form into manageable sections spread out over several pages. Allow users to easily move backward and forward through the form without losing data. Provide information to users indicating where they are as they progress through your pages.
- Clearly indicate what users will receive once a form is submitted, and provide feedback on the website and through email that tells them when their data has been successfully submitted.

Finally, every form should undergo usability testing before it is made available to the general public. Weed out any mistakes and difficulties before your users see the form.

You have greatly extended the scope of the survey form through the use of a calendar control, selection lists, option button groups, a check box, and a text area box. In the next session, you will continue to work on the survey form by exploring how to design a form that verifies the user enters valid data before it is submitted to the web server for processing.

## REVIEW

**Session 7.2 Quick Check**

1. What code do you enter to create a date control for the expireDate field?
  - a. `<input name="expireDate" date />`
  - b. `<input name="expireDate" type="date" />`
  - c. `<input name="expireDate" src="date" />`
  - d. `<input name="expireDate" method="date" />`
2. What code do you enter to create a date/time control for the orderDelivery field?
  - a. `<input name="orderDelivery" date-time />`
  - b. `<input name="orderDelivery" type="datetime-local" />`
  - c. `<input name="orderDelivery" type="date/time" />`
  - d. `<input name="orderDelivery" type="date-time" />`
3. What HTML elements are used to create a selection list?
  - a. `<select><li /><li />...</select>`
  - b. `<select><item /><item />...</select>`
  - c. `<list><item /><item /> ... </list>`
  - d. `<select><option /><option /> ... </select>`
4. What HTML elements are used to group option buttons?
  - a. `<group><option /><option /> ... </group>`
  - b. `<optgroup><item /><item /> ... </optgroup>`
  - c. `<optgroup><option /><option /> ... </optgroup>`
  - d. `<group><item /><item /> ... </group>`
5. What HTML element do you use to create an option button control?
  - a. `<input type="option" />`
  - b. `<option />`
  - c. `<input type="radio" />`
  - d. `<radio type="option" />`
6. What HTML element do you use to create a checkbox control?
  - a. `<input type="check" />`
  - b. `<input type="checkbox" />`
  - c. `<check />`
  - d. `<option type="check" />`
7. What HTML element do you use to create a text box control?
  - a. `<text> ... </text>`
  - b. `<input type="text" />`
  - c. `<textarea> ... </textarea>`
  - d. `<input type="textarea" />`

# Session 7.3 Visual Overview:

The **required** attribute indicates that a field value is required.

The **pattern** attribute specifies the general pattern that the characters in the field value must follow.

The **min** and **max** attributes define the range of possible field values; the **step** sets the interval between values.

The **datalist** element defines a set of suggested field values.

The **submit** data type creates a button to submit the form for processing.

The **reset** data type creates a button that restores the form to its default values.

The **number** data type creates a spin box control for data entry.

The **range** data type creates a range slider for data entry.

```
<label for="name">Name *</label>
<input name="custName" id="name" type="text" required />

<label for="phone">Phone number</label>
<input name="custPhone" id="phone" type="tel"
 pattern="^\d{10}$|^\(\(\d{3}\)\s*)?\d{3}[\s-]?\d{4}$" />

<label for="dineSpin">How often do you dine out per month? </label>
<input name="dineOut" id="dineSpin" type="number"
 value="1" step="1" min="0" max="20" />

<label for="dish">What's your favorite dish?</label>
<input name="favDish" id="dish" type="text" list="dishType" />
<datalist id="dishType">
 <option value="Big Kahuna Pizza" />
 <option value="BBQ Chicken Pizza" />
 <option value="Pasta Rolls" />
 <option value="Pasto Artichoke Pizza" />
</datalist>

<label for="rangeBox">Rate the overall service at Red Ball

 (0=poor; 10=great)</label>
 0 <input name="serviceRate" id="rangeBox" type="range"
 value="5" step="1" min="1" max="10" /> 10

<input type="submit" value="Submit My Survey" />
<input type="reset" value="Cancel" />
```

# Data Validation

**Customer Survey**

Name\* Alice Nichols

Phone number 555-7499

How often do you dine out per month? 6

What's your favorite dish? Big Kahuna Pizza

Rate the service at Red Ball (0=poor; 10=great)

**Customer Survey**

Name\* Alice Nichols

Phone number 555-74997

How often do you dine out per month? 6

What's your favorite dish? Big Kahuna Pizza

Rate the service at Red Ball (0=poor; 10=great)

Submit My Survey Cancel

Please match the requested format.

A spinner control is used to select a field value by clicking spin arrows to increase or decrease the value by a set amount.

The favDish field displays a suggested value from the dishType data list.

A range slider control is used to select a field value by dragging a slider across a range of values.

Use **inline validation** to highlight invalid data as it is being entered by the user.

Forms that contain invalid data generate error messages when submitted by the browser for processing.

The Submit My Survey button is used to submit the form to the server for processing.

The Cancel button is used to reset form fields to their default values, deleting any user input.

## Entering Numeric Data

In the last session, you worked with several form controls that restricted field values to a set of possible values, ensuring that the user submits valid data to the server for processing. HTML also supports restrictions on numeric values by specifying that the values must fall within a defined range.

### Creating a Spinner Control

One way of restricting numeric values is through a **spinner control**, which displays an up or down arrow to increase or decrease the field value by a set amount. To create a spinner control, apply the following input element using the `number` data type:

```
<input name="name" id="id" type="number"
 value="value" step="value" min="value" max="value" />
```

where the `value` attribute provides the default field value, the `step` attribute indicates the amount by which the field value changes when a user clicks the spin arrow, the `min` attribute defines the minimum possible value, and the `max` attribute defines the maximum possible value of the field. For example, the following input element creates a spinner control with the ID `attSpin` for the attendance field with the spinner value ranging from 10 to 50 in steps of 5 units with a default value of 20:

```
<input name="attendance" id="attSpin" type="number"
 value="20" step="5" min="10" max="50" />
```

Add a new field to the survey form named `dineOut` that queries customers about how often they dine out, setting its default value to 1 and allowing the field value to range from 0 up to 20 in steps of 1 unit.

#### To add a spinner control:

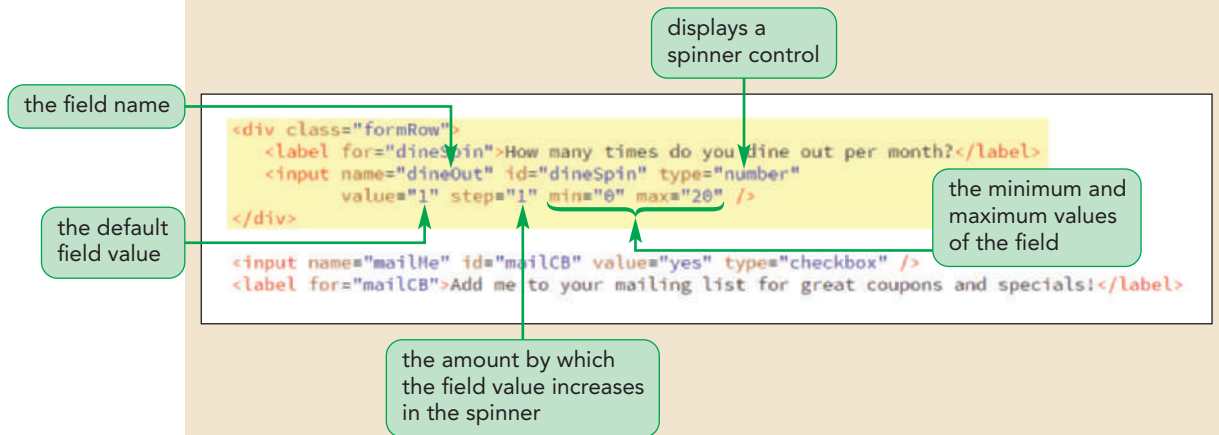
1. If you took a break after the previous session, make sure **rb\_survey.html** is open in your editor and scroll down to the `custInfo` field set.
2. Above the check box for the `mailMe` field, insert the following code to create a spinner control for the `dineOut` field:

```
<div class="formRow">
 <label for="dineSpin">How many times do you dine out per
 month?</label>
 <input name="dineOut" id="dineSpin" type="number"
 value="1" step="1" min="0" max="20" />
</div>
```

Figure 7–39 highlights the code for the spinner control and label.

Figure 7–39

## Creating a spinner control for the dineOut field



3. Save your changes to the file.

A spinner control does not need to be as wide as the input boxes used for text entries. So, next, you will create a style rule that sets the width of the spinner control.

4. Return to the **rb\_forms.css** file in your editor and scroll down to the Spinner Styles section.

5. Enter the following style rule for input elements with the number data type:

```

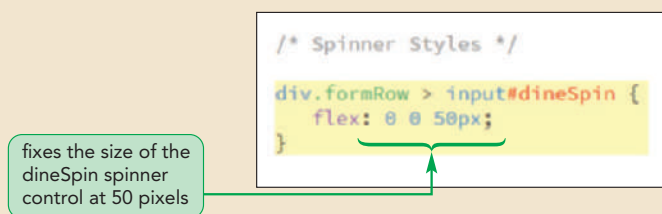
div.formRow > input#dineSpin {
 flex: 0 0 50px;
}

```

Figure 7–40 highlights the new style rule in the style sheet.

Figure 7–40

## Styles for the dineSpin spinner control



6. Save your changes to the style sheet and then reload **rb\_survey.html** in your browser. Figure 7–41 shows the layout and appearance of the spinner control.

Figure 7-41

## Spinner in the web form

Where did you hear about us?  
(select all that apply)

Internet  
Magazine  
Newspaper  
Word of Mouth  
Other

How many times do you dine out per month? 1

☐ Add me to your mailing list for great coupons and specials!

**Trouble?** At the time of this writing, some browsers (such as IE and Edge) do not support the number data type and they also ignore the `step`, `min`, and `max` attributes. In those browsers, the spinner control is displayed as a text input box.

7. Click the input box for the spinner control and verify that you use the arrow buttons to increase and decrease the field value within the range 0 to 20.

## Creating a Range Slider

Another way to limit a numeric field to a range of possible values is through a **slider control**, which the user can use to drag a marker horizontally across the possible field values. Slider controls are created by applying the range data type in the following input element

```
<input name="name" id="id" type="range"
 value="value" step="value" min="value" max="value" />
```

where the `value`, `step`, `min`, and `max` attributes have the same meanings as they did for the spinner control. Many browsers do not include a scale on the range slider widget, so it is a good idea to include the lower and upper values of the range before and after the slider control. For example, the following code creates a range slider for the attendance field with values range from 10 to 50 in steps of 5 and a default value of 20.

```
10
<input name="attendance" id="attSlider" type="range"
 value="20" step="5" min="10" max="50" />
50
```

### Creating Spinner Controls and Range Sliders

- To create a spinner control for numeric data, enter the `input` element with a type value of "number"

```
<input name="name" id="id" type="number"
 value="value" step="value" min="value" max="value" />
```

where the `value` attribute provides the default field value, the `step` attribute indicates the amount by which the field value changes when a user clicks the spin arrow, the `min` attribute defines the minimum value, and the `max` attribute defines the maximum value of the field.

- To create a range slider control for numeric data, use the following `input` element with a type value of "range":

```
<input name="name" id="id" type="range"
 value="value" step="value" min="value" max="value" />
```

Add a range slider to the survey form now, which customers can use to rate their experience at Red Ball Pizza from 0 (poor) up to 10 (great).

#### To add a range slider control:

1. Return to the `rb_survey.html` file in your editor and scroll down to the `explnfo` field set.
2. Directly above the text area control, add the following code to create a range slider control for the `serviceRate` field:

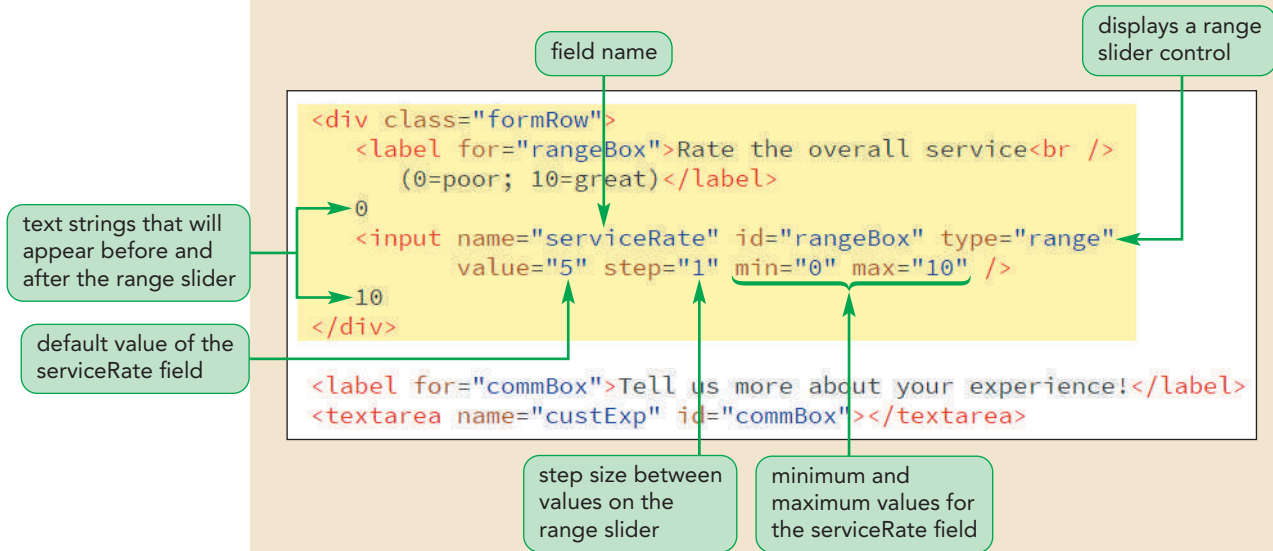
```
<div class="formRow">
 <label for="rangeBox">Rate the overall service

 (0=poor; 10=great)</label>
 0
 <input name="serviceRate" id="rangeBox" type="range"
 value="5" step="1" min="0" max="10" />
 10
</div>
```

Figure 7–42 highlights the code for the range slider control and label.

Figure 7-42

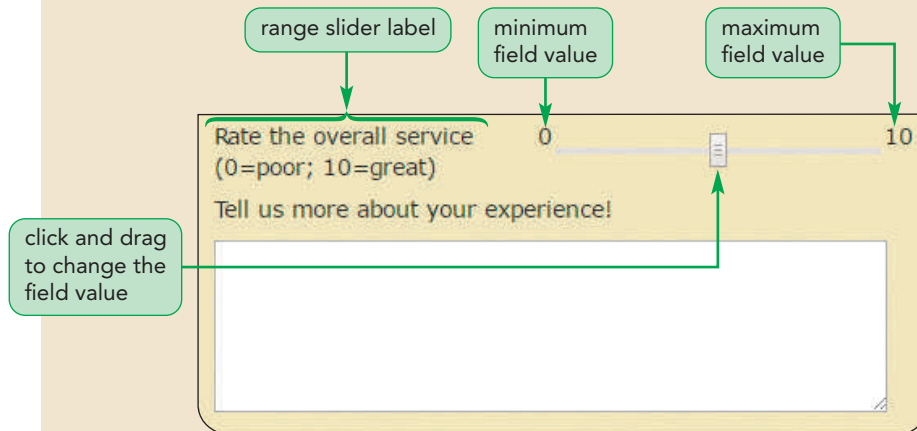
Creating a range slider control for the serviceRate field



3. Save your changes to the file and then reload `rb_survey.html` in your browser. Figure 7-43 shows the appearance of the range slider control in the Google Chrome browser.

Figure 7-43

Viewing the range slider control



**Trouble?** Other browsers will display different styles for the range slider widget. For example, Microsoft Edge and Internet Explorer will display a colored bar with a pop-up window showing the current value of the `serviceRate` field. If your browser does not support the range slider widget, it will display a text input box.

4. Verify that you can drag the marker on the range slider to the left and right.

### Styles for Widgets

The appearance of a form widget is largely determined by the browser and there are no CSS styles to alter it. However, most browsers do provide style extensions that allow you to modify their widgets. One useful browser extension is the following appearance extension that defines the widget associated with the form control

```
-moz-appearance: type;
-webkit-appearance: type;
```

where *type* is the type of widget including none (for no widget), button, checkbox, listbox, radio, range, spinner, textfield, and many other types depending on the browser. For example, to display a selection list as an input box, you would apply the following style rule:

```
select {
 -moz-appearance: textfield;
 -webkit-appearance: textfield;
}
```

The selection list options will still appear but as pop-ups for the input box. You should use these browser extensions with care because they are not part of the CSS standard, and thus respond unpredictably.

The next data field that Alice wants added to the survey form is a text box, which customers can use to indicate their favorite Red Ball Pizza dish. There are a lot of possible answers and Alice doesn't want to limit the options to a selection list, but she does want to provide suggestions to customers as they type their entries. You can add these suggestions with a data list.

## Suggesting Options with Data Lists

A **data list** is a list of possible data values that a form field can have. When applied to an input box, the data values appear as a pop-up list of suggested values. Data lists are defined using the following `datalist` element

```
<datalist id="id">
 <option value="value">
 <option value="value">
 ...
</datalist>
```

where the value assigned to the different `option` elements provides the suggested entry in the list for its associated `option` element. To apply a data list, add the following `list` attribute to the input element

```
<input list="id" />
```

where *id* references the id of the `datalist` element. For example, to create an input box for the `favDish` field that offers a few suggested items, you could enter the following code:

### TIP

When applied to the range type, a data list appears as tick marks in the range slider widget.

```
<input name="favDish" type="text" list="dishes" />
<datalist id="dishes">
 <option value="Antipasto Pizza">
 <option value="Big Kahuna Pizza">
 <option value="BBQ Chicken Pizza">
</datalist>
```

The options in the dishes data list are just suggestions. The customer is not obligated to accept any options and can type a dish of his or her own choosing.

## REFERENCE

### Creating and Applying a Data List

- To create a data list of possible values, enter

```
<datalist id="id">
 <option value="value">
 <option value="value">
 ...
</datalist>
```

where each `value` attribute provides the text of a possible value in the data list.

- To reference the data list from an input control, add the `list` attribute

```
<input name="name" list="id" />
```

where `id` references the ID of the data list structure.

Add an input box for the `favDish` field to the survey form now and augment it with a data list of suggested Red Ball Pizza dishes.

### To apply a data list to an input control:

1. Return to the `rb_survey.html` file in your editor and go to the `custInfo` field set.
2. Directly above the `div` element that encloses the spinner control for the `dineOut` field, enter the following code to create the input box for the `favDish` field along with the field's data list of suggested values.

```
<div class="formRow">
 <label for="dish">What's your favorite dish?</label>
 <input name="favDish" id="dish" type="text" list="dishType"
/>
 <datalist id="dishType">
 <option value="Anitpasto Pizza">
 <option value="Big Kahuna Pizza">
 <option value="BBQ Chicken Pizza">
 <option value="Mediterranean Herb Pizza">
 <option value="Pasta Rolls">
 <option value="Pasto Artichoke Pizza">
 </datalist>
</div>
```

Figure 7-44 highlights the code for the input box and data list.

Figure 7–44

## Applying a data list to the favDish field

data list containing  
suggested values

```
<div class="formRow">
 <label for="dish">What's your favorite dish?</label>
 <input name="favDish" id="dish" type="text" list="dishType" />
 <datalist id="dishType">
 <option value="Anitpasta Pizza">
 <option value="Big Kahuna Pizza">
 <option value="BBQ Chicken Pizza">
 <option value="Mediterranean Herb Pizza">
 <option value="Pasta Rolls">
 <option value="Pasto Artichoke Pizza">
 </datalist>
</div>

<div class="formRow">
 <label for="dineSpin">How many times do you dine out per month?</label>
 <input name="dineOut" id="dineSpin" type="number"
 value="1" step="1" min="0" max="20" />
</div>
```

links the favDish  
field to the dishType  
data list

3. Save your changes to the file and reload rb\_survey.html in your browser.
4. Click the input box for the favDish field and type the letter **p**. Note that the browser displays the list of dishes that start with the letter "p". See Figure 7–45.

Figure 7–45

## Viewing suggested data values

Where did you hear about us?  
(select all that apply)

What's your favorite dish?

How many times do you dine o

☐ Add me to your mailing list

Internet  
Magazine  
Newspaper  
Word of Mouth  
Other

p

Pasta Rolls  
Pasto Artichoke Pizza

suggested values from  
the data list starting  
with the letter "p"

**Trouble?** Currently the Firefox and Chrome browsers will display any data list entry that contains the letter "p" as opposed to only those data list values starting with the letter "p".

Now that you have entered most of the survey form fields, you will examine how to submit the form for processing. To do that, you will create a form button.

## Working with Form Buttons

So far, all of your form controls have been used to enter field values. Another type of control is one that performs an action. This is usually done with **form buttons**, which can perform the following actions:

- Run a command from a program linked to the web form.
- Submit the form to a program running on the web server.
- Reset the form fields to their default values.

The first type of button you will examine is the command button.

### Creating a Command Button

A **command button** is a button that runs a program, which affects the content of the page or the actions of the browser. Command buttons are created using the following `input` element with the `type` attribute set to `button`

```
<input value="text" onclick="script" type="button" />
```

where *text* is the text that appears on the button and *script* is the name of the program or the program code that is run when the button is clicked by the user. For example, the following `input` element creates a command button containing the text “Run Program”, which runs the `setup()` program when the button is clicked:

```
<input value="Run Program" onclick="setup()" type="button" />
```

There is no need to use command buttons in the Red Ball Pizza survey form.

### Creating Submit and Reset Buttons

The two other kinds of form buttons are submit and reset buttons. A **submit button** submits the form to the server for processing when clicked. A **reset button** resets the form, changing all fields to their original default values and deleting any field values that the user might have entered. Submit and reset buttons are created using the following `input` elements with the `type` attribute set to “submit” and “reset” respectively

```
<input value="text" type="submit" />
<input value="text" type="reset" />
```

where once again *text* is the text string that appears on the button.

#### REFERENCE

##### Creating Form Buttons

- To create a form button to run a command, use

```
<input value="text" onclick="program" type="button" />
```

where *text* is the text that appears on the button and *program* is the program that is run in response to the user clicking the button.

- To create a form button to submit the form and its fields and values to a script, use

```
<input value="text" type="submit" />
```

- To create a form button to reset the form to its default values and appearance, use

```
<input value="text" type="reset" />
```

Alice wants the survey form to include both a submit button and a reset button. The submit button, which she wants labeled “Submit My Survey”, will send the form data to the server for processing when clicked. The reset button, which she wants labeled

“Cancel”, will erase the user’s input and reset the fields to their default values. Add these two buttons at the bottom of the form within a div element with the ID buttons.

### To create submit and reset buttons:

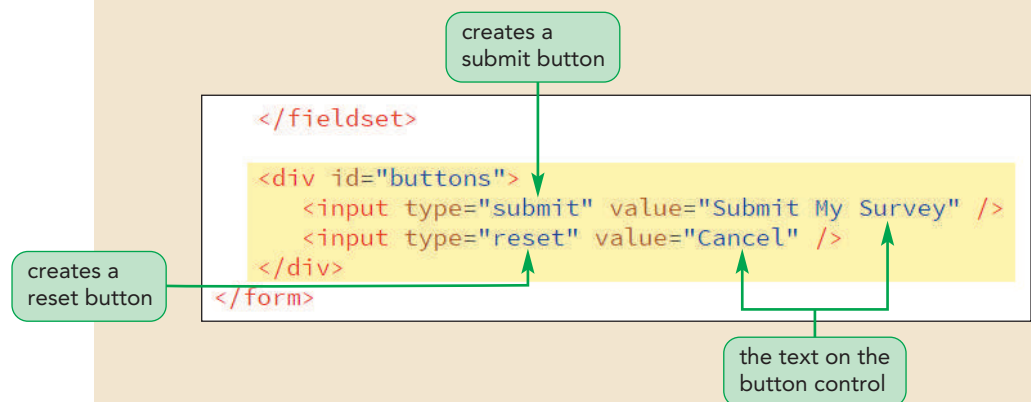
1. Return to the **rb\_survey.html** file in your editor and scroll down to the closing `</form>` tag.
2. Directly above the closing `</form>` tag, insert the following code:

```
<div id="buttons">
 <input type="submit" value="Submit My Survey" />
 <input type="reset" value="Cancel" />
</div>
```

Figure 7–46 highlights the code to create the submit and reset buttons.

Figure 7–46

### Creating submit and reset buttons



3. Save your changes to the file.  
Next, you will format the appearance of the `div` element and the two buttons it contains.
4. Return to the **rb\_forms.css** file in your editor and go to the Form Button Styles section.
5. Add the following style rule to set the width of the `div` element to 100% and to horizontally center its content.

```
div#buttons {
 text-align: center;
 width: 100%;
}
```

6. Add the following style rule to set the font size, padding, and margins for all submit and reset buttons in the page.

```
input[type='submit'], input[type='reset'] {
 font-size: 1.2em;
 padding: 5px;
 margin: 15px;
}
```

Figure 7–47 shows the style rules for the form buttons on the page.

Figure 7–47

## Styles for the form buttons

sets the width of the div element to 100% and centers its contents

sets the font size, padding, and margins of the submit and reset buttons

```
/* Form Button Styles */
```

```
div#buttons {
 text-align: center;
 width: 100%;
}
```

```
input[type='submit'], input[type='reset'] {
 font-size: 1.2em;
 padding: 5px;
 margin: 15px;
}
```

7. Save your changes to the file and then reload rb\_survey.html in your browser. Figure 7–48 shows the layout and content of the completed web form.

Figure 7–48

## Completed design and layout of the survey form

811 Beach Drive Ormond Beach, FL 32175 (386) 555-7489

## Red Ball Pizza

home menu directions coupons orders catering reviews

### Customer Survey

Thank you for taking our customer survey. Your response helps Red Ball Pizza maintain the tradition that has made us the top-rated pizzeria in the metro area. All participants are automatically entered into a monthly drawing to receive a *Red Ball Express PizzaFest* containing two large pizzas, a 2-liter soda, and a side order of chicken wings. Check your e-mail inbox for contest results.

Surveys are private and confidential. Red Ball Pizza will not share your contact information with third parties, ever.

Required values are marked by an asterisk (\*)

#### Customer Information

Name\*

Street address

City

State

Postal code

Phone number

E-mail\*

Where did you hear about us? (select all that apply)

- ☒ Internet
- ☐ Magazine
- ☐ Newspaper
- ☐ Word of Mouth
- ☐ Other

What's your favorite dish?

How many times do you dine out per month?

☐ Add me to your mailing list for great coupons and specials!

#### Share Your Experience at Red Ball Pizza

Date of visit

Order type

Was your service friendly? ☐ Yes ☐ No

Was your order correct? ☐ Yes ☐ No

Was your food hot? ☐ Yes ☐ No

Rate the overall service (0=poor; 10=great)

Tell us more about your experience!

submit button → Submit My Survey → Cancel ← reset button

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8. Enter some sample data into the form and then click the **Cancel** button to test the actions of your reset button. Verify that the form is reset to its initial state and the data fields return to their default values. You will test the actions of the submit button shortly.

## Designing a Custom Button

The appearance of a command, submit, and reset button is determined by the browser. While you can modify some basic properties such as the button border, font, or background color, you can't add clipart graphics or other features. For more control over a button's appearance use the following `button` element

```
<button type="text">
 content
</button>
```

where the `type` attribute specifies the button type (`submit`, `reset`, or `button`—for creating a command button) and `content` are HTML elements placed within the button, including formatted text, inline images, and other design elements supported by HTML. For example, the following code demonstrates how an inline image and text marked as a paragraph can be nested within a submit button.

```
<button type="submit">

 <p>Place your order now</p>
</button>
```

You do not need a custom button in the survey form.

## Validating a Web Form

The most important part of form design is ensuring that users enter reasonable values in the correct format. Part of this is accomplished through the use of form controls, such as option buttons and selection lists, which limit the user to a set of pre-approved values. However, there are other data fields that do not easily fit into those types of input controls. For example, how can you ensure that the user has entered a valid credit card number or an email address in the proper format?

### TIP

You can turn off client-validation by adding the attribute `novalidate` to the `form` element.

The process of ensuring that the user has supplied valid data is called **validation** and can take place on the web server where it is known as **server-side validation** or within the user's own browser where it is referred to as **client-side validation**. Whenever possible, you should supplement server-side validation with client-side validation to reduce the server's workload. In a payment form, you should verify that the customer correctly completed all of the fields *before* submitting the data to the server so that the server does not have to deal with an improperly completed form.

## Identifying Required Values

The first validation test you should perform is to verify that data has been supplied for all required data fields. To identify those fields that are required (as opposed to those that are optional), add the `required` attribute to the control. For example, the following code specifies that the `custName` field is required and cannot be left blank by the user:

```
<input name="custName" required />
```

In the same way, the `required` attribute can be added to the `select` element or the `textarea` box to make those data fields required. However, for a `select` element to be required, the first option in the selection list must have empty value or no text content.

If a required field is left blank in an input or textarea box, the browser will not submit the form but will return an error message instead, indicating that the required data field has not been filled out. If no option is chosen from a required selection list, the browser will once again return an error message.

For the Red Ball Pizza survey form, Alice wants every customer to enter a name and an email address, so she asks you to make the custName and custEmail fields required.

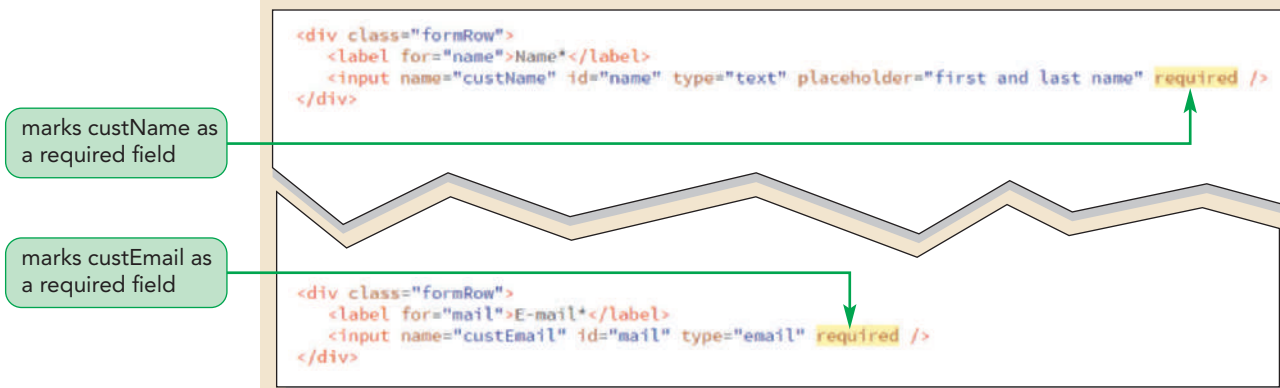
### To create submit and reset buttons:

1. Return to the **rb\_survey.html** file in your editor.
2. Add the attribute **required** to the input element for both the custName and custEmail fields.

Figure 7–49 highlights the newly added required attribute.

Figure 7–49

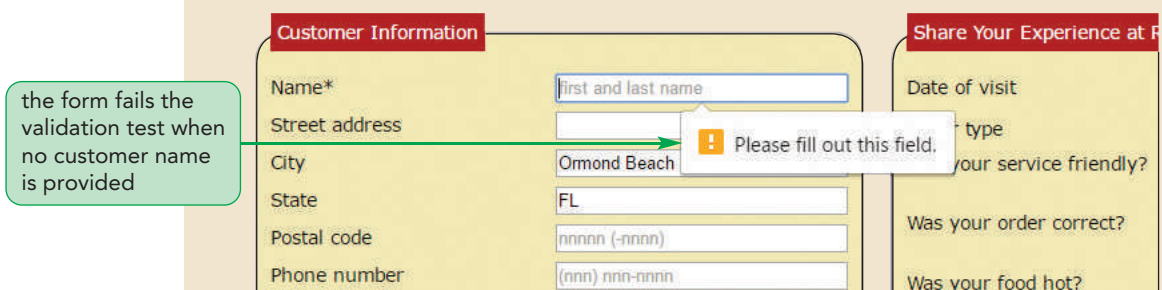
### Making custName and custEmail required fields



3. Save your changes to the file and then reload rb\_survey.html in your browser.
4. Test your form by clicking the **Submit My Survey** button without entering any values into the form itself. As shown in Figure 7–50, the browser fails to submit the form and instead displays a bubble containing the message that the custName field needs to be filled out.

Figure 7–50

### Validation error message in Google Chrome



**Trouble?** Figure 7–50 shows the error message rendered using the Google Chrome browser. The exact text and format of the validation bubble will vary from one browser to the next.

5. Enter **your name** into the `custName` field and then resubmit the form (without entering an email address). Verify that the `custName` field now passes validation but a bubble with a validation error message appears next to the blank email box.
6. Enter **your email address** into the `custEmail` field and then resubmit the form. Verify that the browser displays an alert message indicating that no invalid data have been detected.
7. Click the **OK** button to dismiss the dialog box.

The dialog box you encountered in Step 6 is not part of HTML or your browser. It was generated from the `rb_formsubmit.js` script file that you linked the web page to in Session 1. The confirmation dialog box only appears when no validation errors have been detected in the submitted form. Also, note that all of your data values have been preserved in the survey form. This is also a feature of the script file to avoid re-typing field values as you continue to test the web form. If you want to clear the form to see the default values, reopen the file in your browser.

## Validating Based on Data Type

A form will fail the validation test if the data values entered into a field do not match the field type. For example, a data field with the `number` type will be rejected if non-numeric data is entered. Similarly, fields marked using the `email` and `url` types will be rejected if a user provides an invalid email address or text that does not match the format of a URL.

You have already specified data types for the survey form fields. Verify that the form will not accept invalid data for the `custEmail` field.

### To verify the form does not accept invalid data:

1. Click the input box for the `custEmail` field in the survey form and type the text **Alice Nichols** (or any text string that does not represent an email address).
2. Click the **Submit My Survey** button to submit the form.

As shown in Figure 7–51, the browser rejects the form based on the invalid data entered for the `custEmail` field.

Figure 7–51

## Rejecting an invalid email address

the form fails the validation test when an improper text string is entered for the email address

**Customer Information**

Name\* Alice Nichols

Street address

City Ormond Beach

State FL

Postal code nnnnn (-nnnn)

Phone number (nnn) nnn-nnnn

E-mail\* Alice Nichols

Where did you hear about us? (select all that apply)

Internet  
Magazine  
Newspaper  
Word of Mouth  
Other

What's your favorite dish?

**Share Your Experience**

Date of visit

Order type

Was your service friendly?

Was your order correct?

Was your food hot?

Please include an '@' in the email address. 'Alice Nichols' is missing an '@'.

3. Change the field value to **alice.nichols@example.com** and resubmit the form. Verify that the form now passes the validation test.
4. Click the **OK** button to close the JavaScript dialog box.

Accepting the email address does not mean that the email address is real; it only means that the text field value follows the proper general pattern for email addresses, which is a string of characters with no blank spaces followed by the @ symbol and then followed by another string of nonblank characters. For validation tests that involve more complicated text patterns, you can do a pattern test.

## Testing for a Valid Pattern

To test whether a field value follows a valid pattern of characters, you can test the character string against a regular expression. A **regular expression** or **regex** is a concise description of a character pattern. It is beyond the scope of this tutorial to discuss the syntax of regular expressions, but to validate a text value against a regular expression, add the following `pattern` attribute to the `input` element

```
pattern="regex"
```

where `regex` is the regular expression pattern. For example, the following code tests the value of the `custZip` field against the regular expression pattern `^\d{5}$`

```
<input name="custZip" pattern="^\d{5}$" />
```

where the regular expression `^\d{5}$` represents any string of 5 numeric characters. Thus, the value 85017 would match this regular expression, but values like 850177 or X8514 would not. Regular expressions are based on a rich language and can be written to match credit card numbers, phone numbers, email addresses, and so forth.

## REFERENCE

**Validating Field Values**

- To indicate that a field is required, add the `required` attribute to the form control.
- To validate an email address, set the data type to `email`.
- To validate a web address, set the data type to `url`.
- To validate that a text input box follows a character pattern, add the attribute

`pattern="regex"`

where *regex* is a regular expression that defines the character pattern.

Alice has obtained regular expressions for phone numbers and 5- or 9-digit postal codes. Add the pattern attribute now to the `custZip` and `custPhone` fields to validate those field values. Note that some regular expressions are long and complicated, and you must type them exactly as written. If you make a mistake, you can copy the text of the regular expressions from the `rb_regex.txt` file in the `tutorial.07/tutorial` folder.

**To test a field value against a regular expression:**

1. Return to the `rb_survey.html` file in your editor and scroll down to the `input` element for the `custZip` field.
2. Add the following attribute to create a regular expression that matches 5- and 9-digit zip codes to the `input` element:

```
pattern="^\d{5}(-\d{4})?$"
```

3. Go to the `input` element for the `custPhone` field and add the following attribute to create a regular expression that matches phone numbers with or without an area code:

```
pattern="^\d{10}$|^(\\d{3}\\s*)?\d{3}[\s-]?\d{4}$"
```

Figure 7–52 highlights the `pattern` attribute for both the `custZip` and `custPhone` fields.

Figure 7–52

**Pattern matching with regular expressions**

regular expression pattern that matches 5- or 9-digit postal codes

```
<div class="formRow">
 <label for="zip">Postal code</label>
 <input name="custZip" id="zip" type="text" placeholder="nnnnn (-nnnn)"
 pattern="^\d{5}(-\d{4})?$" />
</div>

<div class="formRow">
 <label for="phone">Phone number</label>
 <input name="custPhone" id="phone" type="tel" placeholder="(nnn) nnn-nnnn"
 pattern="^\d{10}$|^(\\d{3}\\s*)?\d{3}[\s-]?\d{4}$" />
</div>
```

regular expression pattern that matches phone numbers with or without area codes

- 4. Save your changes to the file and then reload `rb_survey.html` in your browser.
- 5. Enter **your email address** in the input box for the `custEmail` field so that the two required fields have a value.
- 6. Type **321** in the input box for the postal code and then submit the form. As shown in Figure 7–53, the browser rejects the field value because it does not match the pattern of either a 5- or 9-digit postal code.

Figure 7–53

## Rejecting an invalid postal code

postal code does not match either the 5- or 9-digit pattern

**Customer Information**

Name\* Alice Nichols

Street address

City Ormond Beach

State FL

Postal code 321

Phone number (nnn) nnn-nnnn

E-mail\*

Where did you hear about us? (select all that apply)

Internet  
Magazine  
Newspaper  
Word of Mouth  
Other

**Share Your Experience**

Date of visit

Order type

Was your service friendly?

Was your order correct?

(0=poor; 10=great)

Tell us more about your experience

Please match the requested format.

- 7. Change the postal code value to **32175** and resubmit the form. Verify that the form now passes the validation test.
- 8. Test the `custPhone` field by entering **5-7499** in the input box for the customer phone number and then submitting the form. Verify that the browser rejects the data as invalid.
- 9. Change the phone number to **555-7499** and resubmit the form, verifying that it now passes the validation test.

## Defining the Length of the Field Value

Because older browsers might not support the `pattern` attribute, you can do a simple test based on character length using the following `maxLength` attribute

```
maxLength="value"
```

where *value* is the maximum number of characters in the field value. For example, the following `input` element limits the number of characters in the `custZip` field to 5, which means that field values with more than 5 characters will not be validated.

```
<input name="custZip" maxLength="5" />
```

Note that the `maxLength` attribute does not distinguish between characters and digits. A user could enter the text string *abcde* as easily as *32175* and have the field values pass validation.

## INSIGHT

### WebKit Styles for Validation Messages

Like widgets, the appearance of the bubble containing the validation message is determined by the browser. There is no standard CSS style to format the error message but there are browser extensions that give you more control over the error message style. For Google Chrome, the validation message is organized into the following pseudo-elements selectors:

- `::-webkit-validation-bubble`: Selecting the entire bubble containing the validation message
- `::-webkit-validation-bubble-arrow`: Selecting the pointing arrow above the validation bubble
- `::-webkit-validation-bubble-message`: Selecting the validation message within the bubble
- `::-webkit-validation-bubble-arrow-clipper`: Selecting the bubble behind the top arrow

To modify the appearance of the validation message, you can apply the following style rule, which displays the message in a gray font on an ivory background.

```
::-webkit-validation-bubble-message {
 color: gray;
 background: ivory;
}
```

Other browsers support their own collection of extensions to modify the appearance of the validation bubble. Because these are not part of the CSS standards, there is no common syntax yet for modifying the validation message. You can learn more about these extensions by viewing the documentation on the browser manufacturer's website.

## Applying Inline Validation

One disadvantage with the validation tests you have applied is that they all occur after a user has completed and submitted the form. It is extremely annoying for the user to go back to an already completed form to fix an error. Studies have shown that users are less likely to make errors and can complete a form faster if they are informed of data entry errors as they occur. The technique of immediate data validation and reporting of errors is known as inline validation.

### Using the focus Pseudo-Class

One way of integrating inline validation with a web form is to change the display style of fields that currently contain invalid data. This can be done using some of the pseudo-classes described in Figure 7–54.

Figure 7–54

## Pseudo-classes for form controls and fields

Pseudo-Class	Matches
<code>checked</code>	A check box or option button that is selected or checked
<code>default</code>	A default control, such as the default option in a selection list
<code>disabled</code>	A control that is disabled
<code>enabled</code>	A control that is enabled
<code>focus</code>	A control that has the focus (is actively selected) in the form
<code>indeterminate</code>	A check box or option button whose toggle states (checked or unchecked) cannot be determined
<code>in-range</code>	A field whose value lies within the allowed range (between the <code>min</code> and <code>max</code> attribute values)
<code>invalid</code>	A field whose value fails the validation test
<code>optional</code>	A field that is optional (not required) in the form
<code>out-of-range</code>	A field whose value lies outside the allowed range (outside the <code>min</code> and <code>max</code> attribute values)
<code>required</code>	A field that is required in the form
<code>valid</code>	A field whose value passes the validation test

For example, to create styles for all of the checked option buttons in the form, you could apply the `checked` pseudo-class, as in the following style rule

```
input[type="radio"]:checked {
 styles
}
```

where *styles* are the CSS styles applied to checked option buttons. Note that option buttons that are not checked will not receive these styles.

The first pseudo-class you will apply to the survey form will be used to change the background color of any element that has the focus. **Focus** refers to the state in which an element has been clicked by the user, making it the active control on the form. You may have noticed that some browsers highlight or add a glowing border around input boxes that have the focus.

Alice would like the input boxes, selection lists, and text area boxes that have the focus to be displayed with a light green background color.

### To create style rules for elements that have the focus:

1. Return to the **rb\_forms.css** file in your editor and scroll down to the Validation Styles section.
2. Add the following style rule to change the background color to light green for all `input`, `select`, and `textarea` elements that have the focus.

```
input:focus, select:focus, textarea:focus {
 background-color: rgb(220, 255, 220);
}
```

Figure 7–55 highlights the style rule to change the background color.

Figure 7–55

## Creating a style rule for the focus pseudo-class

change the background color to light green when the control element has the focus

```
/* Validation Styles */
input:focus, select:focus, textarea:focus {
 background-color: rgb(220, 255, 220);
}
```

3. Save your changes to the file and then reload rb\_survey.html in your browser.
4. Click the input box for the customer name and verify that the background color changes to a light green as shown in Figure 7–56.

Figure 7–56

## Text box with the focus

background color changes to light green when the text input box has the focus

Customer Information

Name\*  
Street address  
City

5. Press the **Tab** key repeatedly to change the focus to the remaining input controls. Verify the background color changes to light green when an input control has the focus and has a background.

## Pseudo-Classes for Valid and Invalid Data

The `valid` and `invalid` pseudo-classes are used to format controls based on whether their field values pass a validation test or not. For example, the following style rule displays all `input` elements containing invalid data with a light red background

```
input:invalid {
 background-color: rgb(255, 232, 233);
}
```

while the following style rule displays all `input` elements containing valid data with a light green background:

```
input:valid {
 background-color: rgb(220, 255, 220);
}
```

Both of these style rules set the background color whether the `input` element has the focus or not. Displaying a form full of input backgrounds with different background colors can be confusing and distracting to the user. As a result, it is better practice to highlight invalid field values only when those input controls have the focus, as in the following style rule that combines both the `focus` and `invalid` pseudo-classes:

```
input:focus:invalid {
 background-color: rgb(255, 232, 233);
}
```

Alice suggests that the form perform inline validation for the input boxes with IDs of “name”, “zip”, “phone”, and “mail”. For valid data, she wants those input boxes to be displayed with a light green background along with a green check mark image. For invalid data, she wants the background to be light red with a red X image. Use the `rb_valid.png` and `rb_invalid.png` image files for the green check mark and red X images.

Include the focus pseudo-class so that the validation style is only applied when the control is active in the form.

1. Return to the `rb_forms.css` file in your editor and scroll to the bottom of the file.
2. Add the following style rule to display a light green background and a green check mark image when valid data is entered in the `custName`, `custZip`, `custPhone`, and `custEmail` fields:
 

```
input#name:focus:valid,
input#zip:focus:valid,
input#phone:focus:valid,
input#mail:focus:valid {
 background: rgb(220, 255, 220) url(rb_valid.png) bottom
right/contain no-repeat;
}
```
3. Add the following style rule to display a light red background and a red X image when invalid data is entered in those same fields:
 

```
input#name:focus:invalid,
input#zip:focus:invalid,
input#phone:focus:invalid,
input#mail:focus:invalid {
 background: rgb(255, 232, 233) url(rb_invalid.png) bottom
right/contain no-repeat;
}
```

Figure 7–57 highlights the style rules to style valid and invalid data.

Figure 7–57

### Creating styles for valid and invalid field values

style for valid data values in the selected fields that have the focus

style for invalid data values in the selected fields that have the focus

```
input:focus, select:focus, textarea:focus {
 background-color: rgb(220, 255, 220);
}

input#name:focus:valid,
input#zip:focus:valid,
input#phone:focus:valid,
input#mail:focus:valid {
 background: rgb(220, 255, 220) url(rb_valid.png) bottom right/contain no-repeat;
}

input#name:focus:invalid,
input#zip:focus:invalid,
input#phone:focus:invalid,
input#mail:focus:invalid {
 background: rgb(255, 232, 233) url(rb_invalid.png) bottom right/contain no-repeat;
}
```

display a green check mark image in the input box background


display a red X image in the input box background


4. Save your changes to the style sheet and then reload `rb_survey.html` in your browser.


5. Test inline validation by typing the zip code value **32175-6136** into the input box for the customer's zip code. Note that the input box provides immediate visual feedback on whether the current field value passes the validation test. See Figure 7–58.


Figure 7–58

### Inline validation on the customer postal code

Postal code 321  the initial text string does not pass the validation test

Postal code 32175  the 5-digit postal code passes validation

Postal code 32175-61  entering more digits causes the field value to once again fail validation

Postal code 32175-6136  the final 9-digit postal code value passes validation

6. Continue to test the web form by entering data into the other input boxes, noting how the form automatically performs a validation test on your data values.



### Problem Solving: Using Form Building Tools

One of the limitations of CSS is that it does not provide an easy way to format the form controls other than basic styles for text and background colors. To gain more control over your form controls, you may want to explore third party frameworks that provide customized widgets and form design tools. Some popular frameworks include:

- Google Forms ([docs.google.com/forms](https://docs.google.com/forms)): A free service for form design that also automatically tabulates the user responses in an online spreadsheet
- Wufoo ([wufoo.com](https://wufoo.com)): A paid service that supplies a powerful form builder engine and tools for uploading documents and images
- Jotform ([www.jotform.com](https://www.jotform.com)): A paid service with form tools and the ability to automatically upload completed forms to your website
- Form Stack ([www.formstack.com](https://www.formstack.com)): A paid service with form building software and tools to manage workflow, data analysis, and tabulation

Form building tools can speed up the process of designing and testing your web forms. However, like all frameworks they are best used when you have a good understanding of the underlying HTML and CSS code that they employ.

You have finished your work on the survey form. Alice will place a copy of your files in a folder on the company's web server and from there the form can continue to be tested to verify that the server program and the web form work well together. Alice is pleased with your work on this project and will get back to you to create other web forms for the Red Ball Pizza website.

## REVIEW

## Session 7.3 Quick Check

- To create a spinner control that goes from 0 to 100 in steps of 10 with a default value of 50, which of the following attributes would you *not* include in the `<input />` tag?
  - `min = "0"`
  - `max = "100"`
  - `value = "50"`
  - `type = "spinner"`
- What attribute do you add to an `<input />` tag to create a range slider?
  - `type = "range"`
  - `type = "slider"`
  - `control = "range"`
  - `number = "slider"`
- What attribute do you add to an `<input />` tag to apply the data list "cityList" to the input box control?
  - `list = "cityList"`
  - `data = "cityList"`
  - `datalist = "cityList"`
  - `values = "cityList"`
- The code to create a submit button containing the text "Add Order" is:
  - `<input type="button">Add Order</input>`
  - `<input type="button" value="Add Order" />`
  - `<input type="submit" value="Add Order" />`
  - `<input type="submit" label="Add Order" />`
- What attribute do you add to an input element to force the user to enter a value?
  - `type = "required"`
  - `required`
  - `type = "autocomplete"`
  - `autocomplete`
- What attribute do you add to an input element to validate the element's value against the regular expression `“^\\user\\-d{4}$”`?
  - `regular="^\\user\\-d{4}$"`
  - `valid="^\\user\\-d{4}$"`
  - `value="^\\user\\-d{4}$"`
  - `pattern="^\\user\\-d{4}$"`
- What selector do you use to match all input elements that have the focus?
  - `input:focus`
  - `input#focus`
  - `input:hasFocus`
  - `input.hasFocus`
- What is inline validation?
  - Validation applied to inline elements
  - Validation with the error message displayed inline with the text
  - Validation that is applied immediately to the element prior to the form submission
  - All of the above

## Coding Challenge 1

Data Files needed for this Coding Challenge: `code7-1_txt.html`, `code7-1_forms.css`, `formsubmit.js`

Use your knowledge of HTML form elements to create the user account login form shown in Figure 7–59.

Figure 7–59 Coding Challenge 7-1 example page

Do the following:

1. Open the `code7-1_txt.html` file from the `html07 ► code1` folder. Enter *your name* and *the date* in the document and save it as `code7-1.html`.
2. Go to the `code7-1.html` file in your editor. Within the head section insert a `link` element linking the page to the `code7-1_forms.css` style sheet. Also insert a `script` element that opens the `formsubmit.js` JavaScript file for handling the form submissions.
3. Within the body of the web page insert a `form` element with the value of the `action` attribute set to `login-script.php` and the `method` value set to `post`.
4. Within the web form create a field set with the id `login`. Within the field set insert a legend with the text **Enter Account Information**.
5. Within the field set insert a label containing the text **Account Type**. After the label add a selection list with the id `acctype` and the field name `accounttype`. Set the value of the `size` attribute of the selection list to `3` and add the following three options: **administrator**, **member**, and **guest**. Set the value of the three options to `type1`, `type2`, and `type3` respectively. Link the label to the selection list using the `for` attribute with a value of `acctype`.
6. Add label to the field set containing the text **Username** followed by a text input box with the id `username` and the field name `user`. Use the `for` attribute to link the label to the input box control.
7. Add another label to the field set containing the text **Password** followed by a password input box with the id `password` and the field name `pwd`. Use the `for` attribute to link the label to the password input box.

8. Below the field set insert a submit button displaying the text **Login**.
9. Save your changes to the file and then load code7-1.html in your browser. Verify that the layout of the table resembles that shown in Figure 7–59 and that when you click each label, the control associated with that label becomes selected. Further verify that clicking the Login button submits the form for processing.
10. Submit the completed file to your instructor.

## Coding Challenge 2

**Data Files needed for this Coding Challenge: code7-2\_txt.html, code7-2\_forms.css**

You've been asked to create a survey web form for use in a seminar conference website. Some of the questions from the form are shown in Figure 7–60. Use your knowledge of HTML form elements to create the form elements and labels.

Figure 7–60

Coding Challenge 7-2 example page

### Survey Questions

1. How satisfied were you with the conference workshops?
  - a. ☐ Very Satisfied
  - b. ☐ Satisfied
  - c. ☐ Dissatisfied
  - d. ☐ Very Dissatisfied
2. How satisfied were you with the conference speakers?
  - a. ☐ Very Satisfied
  - b. ☐ Satisfied
  - c. ☐ Dissatisfied
  - d. ☐ Very Dissatisfied
3. How satisfied were you with the conference facilities?
  - a. ☐ Very Satisfied
  - b. ☐ Satisfied
  - c. ☐ Dissatisfied
  - d. ☐ Very Dissatisfied
4. How likely are you to attend next year's conference?
 

very unlikely

very likely
5. Provide any suggestions for the next conference:
 

enter your suggestions here

Do the following:

1. Open the **code7-2\_txt.html** file from the html07 ► code2 folder. Enter **your name** and **the date** in the document and save the file as **code7-2.html**.
2. Go to the **code7-2.html** file in your editor. Within the head section insert a `link` element linking the page to the **code7-2\_forms.css** style sheet.

3. The survey questions are marked as an ordered list. The first three questions include a nested list of options. For the first question do the following:
  - a. Mark the text from “Very Satisfied” to “Very Dissatisfied” as form labels.
  - b. Before each label insert a radio button belonging to the **q1** field with default values of **a** through **d**. Assign the radio button controls the ids **q1a** through **q1d**.
  - c. Use the **for** attribute to associate each label with its radio button control.
4. Repeat Step 3 for questions 2 and 3, naming the fields for those radio buttons **q2** and **q3** respectively and assigning the radio button controls the ids **q2a** through **q2d** for the second question and **q3a** through **q3d** for the third question.
5. Within the **div** element with the id **newRow** insert a range slider that ranges from 1 to 10 in steps of 1, with a default value of 5. Insert the text **very unlikely** before the range slider and the text **very likely** after the range slider. Assign the range slider the field name **q4**.
6. Mark the text “Provide any suggestions for the next conference” as a form label and use the **for** attribute to attach the label to the input control with the id **q5text**.
7. Below the label in Step 6, insert a textarea control with the id **q5text** and the field name **q5**. Add the placeholder text **enter your suggestions here**.
8. Enclose the list of questions within opening and closing **<form>** tags. Give the form the action **submit-survey.php** using the **post** method.
9. Save your changes to the file and then reload code7-2.html in your browser. Verify that the layout of form matches that shown in Figure 7–60.
10. Submit the completed file to your instructor.

### Coding Challenge 3

Data Files needed for this Coding Challenge: **code6-7\_txt.html**, **code7-3\_valid\_txt.css**, **code7-3\_forms.css**, **formsubmit.js**

You’ve been asked to complete a web form containing credit card payment information. Part of your task will be to include validation test to ensure that required data is entered correctly into the form. Figure 7–61 shows the completed form.

Figure 7–61 Coding Challenge 7-3 example page

Do the following:

1. Open the **code7-3\_txt.html** and **code7-3\_valid\_txt.css** files from the html07 ► code3 folder. Enter **your name** and **the date** in each document and save the files as **code7-3.html** and **code7-3\_valid.css** respectively.
2. Go to the **code7-3.html** file in your editor. Within the head section insert `link` elements linking the page to the `code7-3_forms.css` and `code7-3_valid.css` files. Insert a `script` element to load the `formssubmit.js` JavaScript file.
3. Within the creditcard selection list add the following options and values: Credit Card Type (leave the value as an empty text string), American Express (value="amex"), Discover (value="disc"), MasterCard (value="master"), and Visa (value="visa"). Make the selection list required.
4. Make the cardname field required.
5. Make the cardnumber field required and add the regular expression pattern indicated in the comment section of the HTML file to help ensure that a valid card number is used.
6. Within the cardmonth selection list add options for each month starting with the text **Month** and a value of a blank text string followed by the option text **January (01)** through **December (12)** with the corresponding values **01** through **12**. Make the selection list required.
7. Within the cardyear selection list add options for each year starting with the text **Year** and a value of a blank text string followed by the option text **2020** through **2024** with the corresponding values **2020** through **2024**.
8. Make the cardcsc field required with a maximum character length of **3** characters following the regular expression pattern `^\d{3}$`.
9. Save your changes and then go to the **code7-3\_valid.css** file in your editor. Add the following style rules to the file:
  - a. Display any input or select element that has the focus with a yellow background color.
  - b. Display any input element with invalid data in a red font, surrounded by a red border, and red box shadows that are offset 0 pixels horizontally and vertically with a shadow blur of 5 pixels.
10. Save your changes to the file and then view the page in your browser to verify the contents match than shown in Figure 7–61.
11. Test your payment form by trying to submit the form data with missing values or with incorrect values. Attempt to submit the form using the invalid credit card number 412345678901 and then with the valid card number 4123456789012.
12. Submit the completed file to your instructor.

## Coding Challenge 4

**Data Files needed for this Coding Challenge: code7-4\_txt.html, code7-4\_forms.css**

You have been given the HTML code for a proposed web form shown in Figure 7–62. Unfortunately, there are several syntax errors in the HTML code. You've been asked to find and correct all errors so that the page passes validation.

**Figure 7–62** Coding Challenge 7-4 example page

The image shows a web form titled "Contact Information" in a large, bold, black font. The form is enclosed in a thin black border. Inside the form, there are five text input fields, each preceded by a label in a bold, black font. The labels and their corresponding values are: "First Name" with "Calley", "Last Name" with "Jones", "Student ID" with "uw-32001", "Year" with a dropdown menu showing "Sophomore", and "Residence Hall" with "Westside 3". Below these fields is a "Submit" button with a black border and white text.

Do the following:

1. Open the **code7-4\_txt.html** file from the html07 ► code4 folder. Enter your name and the date in each document and save the file as **code7-4.html**.
2. Go to the **code7-4.html** file in your editor. Within the head section insert a `link` element linking the page to the `code7-4_forms.css`. Save your changes to the file.
3. Run the `code7-4.html` file in a validator of your choosing. Locate and fix the errors in the page so that the file passes validation with no errors or warnings. Note that some of the same errors are repeated multiple times throughout the HTML code.
4. Open the **code7-4.html** file in your browser to confirm that it resembles the page shown in Figure 7–62.
5. Submit the completed file to your instructor.

## Review Assignments

Data Files needed for the Review Assignments: **rb\_build\_txt.html**, **rb\_customer\_txt.html**, **rb\_validate\_txt.css**, 3 CSS files, 1 JavaScript file, 10 PNG files, 1 TXT file

Alice wants you to start work on an online order form for customers to place orders through the Red Ball Pizza website. The form will span several pages in which customers will specify whether the order is for pickup or delivery and will indicate the toppings they want on their pizza(s). Figure 7–63 shows a preview of the form customers will use to indicate their delivery option (including an address or pickup and at what time they want their order).

Figure 7–63 Red Ball Pizza form for Customer Data

**Customer Information**

Thank you for using our online ordering form for quick and easy orders. Please enter your name and phone number and whether you want to place an order for delivery or pickup. Note that required values are marked by an asterisk (\*). If you want to place your order over the phone, call us at (386) 555-7499.

Name\*  ✓

Phone\*

☒ Delivery ☐ Pickup

**Delivery Options**

Delivery Time (leave blank for earliest delivery)

**Pickup Options**

Pickup Time (leave blank for earliest pickup)

Alice has already written some of the HTML code for the web pages and designed many of the style sheets. Your job will be to write the code for the form elements and validation styles.

Complete the following:

1. Use your HTML editor to open the **rb\_customer\_txt.html**, **rb\_build\_txt.html**, and **rb\_validate\_txt.css** files from the html07 ► review folder. Enter *your name* and *the date* in the comment section of each file, and save them as **rb\_customer.html**, **rb\_build.html** and **rb\_validate.css** respectively.
2. Return to the **rb\_customer.html** file in your editor. Within the document head, insert links to the **rb\_forms2.css** and **rb\_validate.css** files.
3. Still within the document head, use the `script` element to link the file to the **rb\_formsubmit2.js** file.
4. Scroll down to the `section` element and, directly after the initial paragraph, insert a `form` element that employs the action at the fictional address `http://www.example.com/redball/customer` using the post method.
5. Within the `form` element, insert a `div` element that encloses a label with the text **Name\*** associated with the `nameBox` control. Also, within the `div` element, add an input text box with the ID **nameBox**, field name **custName**, and placeholder text **First and Last Name**. Make `custName` a required field.
6. Create a second `div` element in the web form that encloses a label with the text **Phone\*** associated with the `phoneBox` control. Within the `div` element, add an input box with the ID **phoneBox**, field name **custPhone**, and placeholder text **(nnn) nnn-nnnn**. Make `custPhone` a

required field and have any text entry follow the regular expression pattern

`^\d{10}$|^\(\d{3}\)\s*)?\d{3}[\s-]?\d{4}$`. (Note: You can copy the regular expression code from the **rb\_regex2.txt** file.)

7. Add another `div` element to the web form containing the following code:
  - a. Insert an `input` element to create an option button for the **orderType** field with the ID **delivery**. Make the option button checked by default. After the option button, insert a label associated with the delivery control containing the text **Delivery**.
  - b. Add an `input` element to create a second option button for the **orderType** field with the ID **pickup**, followed by a label associated with the pickup control containing the text **Pickup**.
8. Next within the form, create a field set with the ID **deliveryInfo**. Within this field set, add the following:
  - a. A legend containing the text **Delivery Options**.
  - b. A text area box with the ID **addressBox** and field name of **delAddress** containing the placeholder text **Enter delivery address**.
  - c. A label containing the text **Delivery Time (leave blank for earliest delivery)** associated with the **delBox** control.
  - d. Add an `input` element with the ID **delBox** and field name **delTime** for storing delivery time values. Use a data type of "time" for the control.
9. Next within the web form, create a field set with the ID **pickupInfo** containing the following information for pickup orders:
  - a. A legend containing the text **Pickup Options**.
  - b. A label containing the text **Pickup Time (leave blank for earliest pickup)** associated with the **pickupBox** control.
  - c. Add an `input` element with the ID **pickupBox** and field name **pickupTime** for storing time values. Add the `disabled` attribute to the tag to disable this control when the form is initially opened. Use a data type of "time" for the control.
10. Finally, within the form, add a `div` element containing a submit button displaying the text **Begin Building your Order**.
11. Save your changes to the file and then go to the **rb\_validate.css** file in your editor to add validation styles for the web form.
12. Within the Validation Styles section, add the following style rules:
  - a. A rule that displays `input`, `select`, and `textarea` elements that have the focus with a background color of `rgb(255, 255, 180)`.
  - b. A rule that displays the **nameBox** and **phoneBox** controls that have the focus and contain valid data with a background color of `rgb(220, 255, 220)` and the background image file **rb\_okay.png** at the right with no tiling contained within the background.
  - c. A rule that displays the **nameBox** and **phoneBox** controls that have the focus and invalid data with a background color of `rgb(255, 230, 230)` and the background image file **rb\_warning.png** at the right with no tiling contained within the background.
13. Save your changes to the style sheet and then open the **rb\_customer.html** file in your browser. Verify the following:
  - a. The content and the layout of the form resemble the form shown in Figure 7–63.
  - b. If you submit the form by clicking the **Begin Building your Own** button with no customer name or phone number, the browser warns you of the missing values.
  - c. As you enter text into the **custName** field, the input box background changes to show that the field value is valid.
  - d. When you enter a phone number into the **custPhone** field, the input box provides inline validation to indicate whether a valid phone number has been entered.
  - e. When you click the submit button for a successfully completed form, the browser displays the alert message that the form data passes the initial validation test.

(Note: The script file used with this web page is written to enable only either the delivery option or the pickup option but not both.)

Next, you will create a form that customers will use to build their customized pizzas. A preview of the form is shown in Figure 7–64.

**Figure 7–64** Red Ball Pizza form to Build a Pizza

14. Return to the **rb\_build.html** file in your editor. Insert a link to the **rb\_forms2.css** file and add a script element to link the file to the **rb\_formsubmit2.js** file.
15. Scroll down to the section element, insert a **form** element below the paragraph element that employs the action at the fictional address *http://www.example.com/redball/build* using the **post** method.
16. Within the **form** element, add a **div** element containing a label with the text **Quantity** associated with the **quantityBox** control. Add a spinner control with the ID **quantityBox** and the field name **pizzaQuantity**. Have the value of the field range from 1 to 10 with a default value of 1.
17. Add a **div** element that displays images of the pizza sizes, containing the following:
  - a. The inline image **rb\_sizes.png**.
  - b. The label **Pizza Size** associated with the **sizeBox** control.
  - c. A range slider with the ID **sizeBox** and the field name **pizzaSize** ranging from 10 to 16 in steps of 2 with a default value of 14.
18. Add a **div** element that provides the selection of pizza crusts containing the following:
  - a. The label **Pizza Crust** associated with the **crustBox** control.
  - b. A selection list for the **pizzaCrust** field with the ID **crustBox** and containing the following option values and text: **Thin**, **Thick**, **Stuffed**, and **Pan**.
19. Add a **div** element containing a check box with the ID **cheeseBox** for the **doubleCheese** field followed by the label **Double Cheese** associated with the **cheeseBox** control. Then, add a second check box with the ID **sauceBox** for the **doubleSauce** field followed by the label **Double Sauce** also associated with that check box.

20. Customers can choose what to place on their pizzas. Create a field set containing the legend **Meat Toppings**. Add the following content to the field set.
  - a. A `div` element containing the label **Location** but not associated with any form control. Next to the label, place the inline images `rb_full.png`, `rb_left.png`, `rb_right.png`, and `rb_none.png` with the alternate text “full”, “left”, “right”, and “none” used to graphically indicate where the meat ingredients should be placed on the pizza (on the full pie, the left side, the right side, or nowhere).
  - b. A `div` element containing the label **Pepperoni** and followed by four option buttons belonging to the **pepperoni** field and with the values “full”, “left”, “right”, and “none”. Make “none” checked by default.
  - c. Repeat Step b to insert `div` elements with the values used in Step b but associated with the ham, pork, sausage, and chicken fields.
21. Using Figure 7–60 as your guide, repeat Step 20 to create a field set with the legend **Vegetable Toppings**, followed by `div` elements with the values used in Step 20 but associated with the mushrooms, green peppers, onions, tomatoes, and jalapenos fields.
22. At the bottom of the form, add a `div` element containing a submit button with the text **Add to your Order**.
23. Save your changes to the file and then open **rb\_build.html** in your browser. Verify that the content and layout of the form resemble that shown in Figure 7–64. Verify that all of the form controls work as expected, that is, you can only select one location for each ingredient option at a time.

## APPLY

## Case Problem 1

**Data Files needed for this Case Problem:** `cg_register_txt.html`, `cg_validate_txt.css`, 3 CSS files, 1 JavaScript file, 4 PNG files, 1 TXT file

**ACGIP Conference** Professor Darshan Banerjee is the project coordinator for the annual conference of the Association of Computer Graphics and Image Processing (*ACGIP*), which takes place this year in Sante Fe, New Mexico. Darshan has asked you to work on the conference’s website, starting with the registration form for conference attendees. The initial form will collect contact information for people attending the conference. Figure 7–65 shows a preview of the form you will create for Darshan.

Figure 7–65 Registration form for the ACGIP Conference

**Computer Graphics and Image Processing**  
12th Annual Conference, March 3 - March 7, Sante Fe, New Mexico

home page  
keynote address  
speakers  
general session abstracts

programs  
workshops  
committees  
executive session  
advisory council

travel info  
accommodations  
banquet  
family attractions

registration  
ACGIP home page  
tour Sante Fe  
links

**Conference Registration Form**  
Required Item (\*)

Title: Prof.  
First Name\*: Dhanan  
Last Name\*: Banerjee  
Address\*: 882 Laredo Drive  
Austin, TX 78704  
Company or University: University of Texas - Austin  
E-mail\*: dbanerjee@example.com  
Phone Number\*: (512) 555-7810  
ACGIP Membership Number: acgip-418031 ✓  
Registration Category: ACGIP Member (\$695) ▼

continue

**ACGIP Member (\$695)**  
Eligible to attend all sessions and banquet

**Non-Member (\$795)**  
Eligible to attend all sessions and banquet

**Student (\$310)**  
Eligible to attend all sessions. **Proof** of student status required

**Poster (\$95)**  
Eligible to attend display hall and vendor stations

**Guest (\$35)**  
Eligible to attend banquet only

Association of Computer Graphics and Image Processing

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Professor Banerjee has already written the HTML code for the page and the styles for the form elements. He wants you to write the HTML code for the web form and the CSS validation styles. Complete the following:

1. Using your editor, open the **cg\_register\_txt.html** and **cg\_validate\_txt.css** files from the **html07 ► case1** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **cg\_register.html** and **cg\_validate.css** respectively.
2. Return to the **cg\_register.html** file in your editor. Add a link to the **cg\_forms.css** and **cg\_validate.css** style sheet files to the document head.
3. Add a **script** element to the document head that loads the **cg\_script.js** file.
4. Scroll down to the **section** element and insert a **web form** element that employs the action at **http://www.example.com/cg/register** via the **post** method.
5. Add the labels, input controls, and textarea boxes shown in Figure 7–65 and described in Figure 7–66. Place the input boxes directly after the labels and associate each label with its form control. You do not need to enclose these elements within **div** elements. Note that the address field should be entered within a **textarea** box.

Figure 7–66 Fields and controls from the registration form

Label	Data Field	Control ID	Type	Required	Placeholder
Title	title	titleBox	text	no	
First Name*	firstName	fnBox	text	yes	
Last Name*	lastName	lnBox	text	yes	
Address*	address	addBox		yes	
Company or University	group	groupBox	text	no	
E-mail*	email	mailBox	email	yes	
Phone Number*	phoneNumber	phoneBox	tel	yes	(nnn) nnn-nnnn
ACGIP Membership Number	acgipID	idBox	text	no	acgip-nnnnnn

- Create a data list named **titleList** containing the suggestions: Mr., Mrs., Ms., Prof., Dr., Assist. Prof., and Assoc. Prof. Apply the titleList data list to the titleBox control.
- Apply the regular expression pattern `^\d{10}$ | ^(\d{3})\s*\d{3}[\s-]?\d{4}$` to the phoneNumber field. Apply the regular expression pattern `^acgip-\d{6}$` to the acgipID field. (Note: You can copy the regular expression code for the phoneNumber field from the cg\_regex.txt file.)
- Add the **Registration Category** label associated with the regList control. Add a selection list with the ID **regList** that stores values in the **registerType** field. Populate the selection list with the option text: “ACGIP Member (\$695)”, “Non-Member (\$795)”, “Student (\$310)”, “Poster (\$95)”, and “Guest (\$35)”. Make the corresponding option values equal to “member”, “nonmember”, “student”, “poster”, and “guest”.
- Within the form, add a paragraph containing a submit button with the text **continue**.
- Save your changes to the file and return to the **cg\_validate.css** file in your editor to create styles for validating data entry.
- Within the Validation Styles section, add the following style rules:
  - Display all `input`, `select`, and `textarea` elements that have the focus with a background color of `rgb(245, 245, 140)`.
  - When the fnBox, lnBox, mailBox, phoneBox, and idBox controls have the focus and are valid, change the background color to `rgb(220, 255, 220)` and display the `cg_valid.png` image with no tiling in the right side of the background contained within the box.
  - When the fnBox, lnBox, mailBox, phoneBox, and idBox controls have the focus and are not valid, change the background color to `rgb(255, 232, 232)` and display the image `cg_invalid.png` with no tiling in the right side of the background contained within the box.
- Save your changes to the style sheet and then open **cg\_register.html** in your browser. Verify that the content and layout of the form resemble that shown in Figure 7–65. Verify that you must enter all required field values in the proper format for the form to be submitted successfully. Confirm that the browser performs inline validation on the firstName, lastName, address, email, phoneNumber, and acgipID fields.

## Case Problem 2

**Data Files needed for this Case Problem:** `sb_payment_txt.html`, `sb_validate_txt.css`, 3 CSS files, 1 JavaScript file, 10 PNG files, 2 TXT files

**The Spice Bowl** Rita Sato is the manager of the web development team for *The Spice Bowl*, an online grocery store specializing in gourmet spices. She has asked you to create web forms for the site. You will start your work by developing a payment form used to collect billing and credit data from the store's customers. The form should include validation tests for credit card numbers to ensure that the card numbers match the correct credit card number patterns. The page should also include a form in which users can log into their *Spice Bowl* account. Figure 7–67 shows a preview of the page you will create for Rita.

Figure 7–67 Payment form for The Spice Bowl

© Natalia Klenova/Shutterstock.com; Sources: American Express Company; Discover Financial Services; MasterCard Inc.; Visa, Inc.

Complete the following:

1. Using your editor, open the **sb\_payment\_txt.html** and **sb\_validate\_txt.css** files from the `html07 ► case2` folder. Enter *your name* and *the date* in the comment section of each file, and save them as **sb\_payment.html** and **sb\_validate.css** respectively.
2. Return to the **sb\_payment.html** file in your editor. Add links to the `sb_forms.css` and `sb_validate.css` style sheet files to the document head. Add a `script` element to load the `sb_script.js` file.
3. The page will contain a form in which customers can log into their account. Directly after the `sb_logo.png` image, insert a `form` element with the ID **login**. Have the form use the action at `http://www.example.com/sb/login` via the post method.
4. Within the login form, insert the following fields and controls:
  - a. A text input box with the ID **userBox** for the **username** field. Add the placeholder text **username**.
  - b. A text input box with the ID **pwdBox** for the **password** field. Add the placeholder text **password**.
5. Next, insert a payment form. Directly below the Payment Form h1 header, insert a `form` element that employs action at `http://www.example.com/sb/payment` via the post method. Assign the web form the id **payment**.
6. Insert a field set with the id **billing** to the payment form. Add the legend **Billing Information (required)** to the field set.
7. Within the billing field set, add the labels and input boxes specified in Figure 7–68. Note that none of the input boxes contain placeholder text. You do not need to enclose the `label` or `input` elements within `div` elements.

**Figure 7–68** Fields and controls from the payment form

Label	Data Field	Control ID	Data Type	Required
First Name	fName	firstBox	text	yes
Last Name	lName	lastBox	text	yes
Street Address	street	streetBox	text	yes
Street Address (2)	street2	streetBox2	text	no
City	city	cityBox	text	yes
State	state	stateBox	text	yes
ZIP/Postal Code	zip	zipBox	text	no
Country	country	countryBox	text	yes
Phone	phone	phoneBox	tel	yes

8. Create a data list with the ID **stateList** containing the two-letter abbreviations of all the states. (You can use the list of abbreviations in the `sb_state.txt` file.) Apply the data list to the `stateBox` input text box.
9. The text of the zip field should follow the `^\d{5}(-\d{4})?$` regular expression pattern. The text of the phone field should follow the `^\d{10}$ | ^(\(\d{3}\)\s*)?\d{3}[\s-]?\d{4}$` pattern. Note that both regular expression patterns can be found in the `sb_regex.txt` file.
10. Set the default value of the country field to **United States**.
11. Create a field set with the ID **creditCard**, which you use to insert credit card fields. Add the legend **Credit Card (required)**.
12. Within the `creditCard` field set, insert another field set containing four `label` elements, with each `label` element belonging to the `cardLabel` class. Within each of the four `label` elements, insert an option button from the `cCard` field with the value **amex**, **discover**, **master**, and **visa**. Make `cCard` a required field. Follow each option button with an `image` element containing the image of its corresponding credit card image using the `sb_amex.png`, `sb_discover.png`, `sb_master.png`, and `sb_visa.png` files.

- ✚ **Explore** 13. After the `creditCard` field set, insert a label containing the text **Credit Card Number** associated with the `cardBox` input control. Create an input text box with the ID **cardBox** for the `cardNumber` field. Make the field `cardNumber` required and have the field value follow the regular expression pattern for credit card numbers (using the regular expression in the `sb_regex.txt` file).
- 14. Create the **Expiration Date** label associated with the `monthList` control.
- 15. Add a selection list with the ID **monthList** for the `cardMonth` field. Make the `cardMonth` field required. Populate the selection list with the option text “--Month--”, “January (01)”, “February (02)” and so forth up to “December (12)”. For the “--Month--”, set the field value to an empty text string. For the month options, insert the month value from “01” up to “12”.
- 16. Add a selection list with the ID **yearList** for the `cardYear` field. Make the `cardYear` field required. Populate the selection list with the option text “--Year--”, “2020”, “2021”, “2022”, “2023”, and “2024”. For the “--Year--”, set the field value to an empty text string and, for the year options, insert the 4-digit year value.
- 17. Create a label with the text **CSC** associated with the `cscBox`. Add a text input box with the ID **cscBox** for the required `csc` field. Have the `csc` field value follow the regular expression pattern `^\d{3}$`. Set the maximum length of the field value to 3 characters and display the placeholder text **nnn**.
- ✚ **Explore** 18. After the `creditCard` field set, insert a `button` element of the submit type. Within the button, insert the `sb_button.png` inline image with the alternate text **next**. (Note: The text for the button is part of the button image, so the `value` attribute is not needed.)
- 19. Save your changes to the file and then go to `sb_validate.css` file in your editor to design the validation styles for the web form.
- ✚ **Explore** 20. Within the Validation Styles section, insert the following style rules to perform inline validation:
  - a. For every `input` element that is not a radio type and that has the focus, change the background color to `rgb(255, 218, 165)`. (Hint: Use the attribute selector `input:not([type='radio'])` to select `input` elements that are not radio types.)
  - b. For every `input` element that is not a radio type and that has the focus with a valid value, change the background color to `rgb(215, 255, 215)` and display the image file `sb_valid.png` with no tiling in the right edge of the input box.
  - c. For every `input` element that is not a radio type and that has the focus with an invalid value, change the background color to `rgb(255, 245, 215)` and display the image file `sb_invalid.png` with no tiling in the right edge of the input box.
- 21. Save your changes to the style sheet and then open **sb\_payment.html** in your browser.
- 22. Verify that you cannot submit the form without all required fields entered in the proper format.
- 23. Verify the validation checks for the credit card number by confirming that the form rejects the following credit card number 6012123456789019 (which does not follow a valid card number pattern). Further verify that the form accepts the following credit card number 6011123456789019 (which follows a valid card number pattern).

## OBJECTIVES

## Session 8.1

- Understand audio and video formats
- Insert an HTML audio clip
- Support multiple audio formats

## Session 8.2

- Insert an HTML video clip
- Write a video caption track
- Format video captions

## Session 8.3

- Create a CSS transition
- Explore transition attributes
- Create a CSS key frame animation
- Apply a CSS animation

# Enhancing a Website with Multimedia

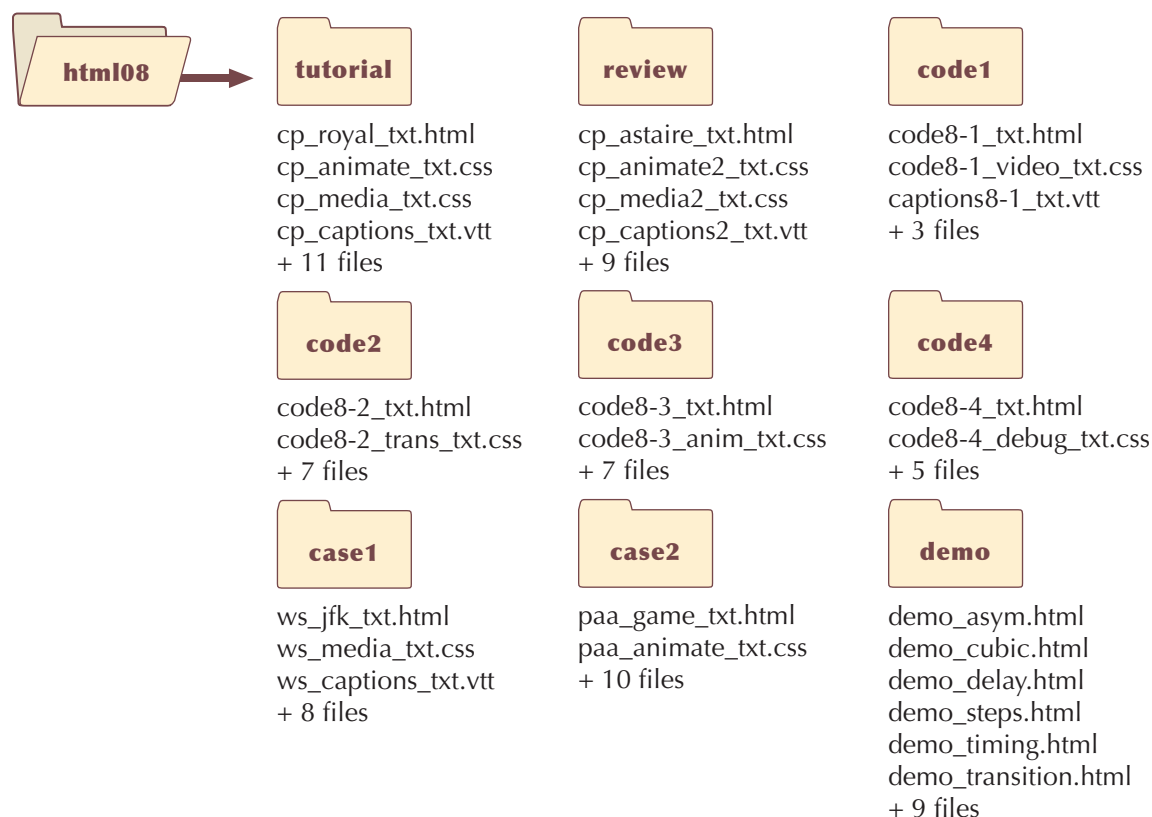
*Working with Sound, Video, and Animation*

## Case | Cinema Penguin

Maxine Michaels runs the movie blog *Cinema Penguin* containing reviews, articles, and stories about classic movies from the golden era of Hollywood. She wants to enhance the user experience of her website by adding sound and video clips of famous movie moments.

Maxine has asked for your help to develop a sample page describing the 1951 classic movie musical *Royal Wedding*, starring Fred Astaire and Jane Powell. Maxine has collected audio and video clips from the movie that she wants added to the page. The page also includes a short article describing a famous piece of cinema trickery in which Astaire appears to dance on the ceiling. Maxine wants you to use CSS animation styles to demonstrate how this effect was achieved.

### STARTING DATA FILES



# Session 8.1 Visual Overview:

The **audio** element embeds an audio file in the web page.

```
<aside>
 <h1>Listen Up</h1>
 <p>The music for <cite>Royal Wedding</cite> was composed by Burton Lane,
 who is best known for his work in <cite>Finian's Rainbow </cite> (1947)
 and his Grammy Award-winning <cite>On a Clear Day You Can See
 Forever</cite> (1965).</p>
 <p>Lane's greatest musical accomplishment may
 very well be his discovery of an 11-year-old singing sensation named
 Frances Gumm, whom the world now knows better as Judy Garland.
 </p>
 <p>Click the play button below to hear the opening of the musical overture
 for Burton Lane's <cite>Royal Wedding</cite>.</p>
 <audio controls>
 <source src="cp_overture.mp3" type="audio/mp3" />
 <source src="cp_overture.ogg" type="audio/ogg" />
 <p>To play this audio clip, your browser needs to support HTML5.</p>
 </audio>
</aside>
```

The **controls** attribute displays media player controls for the audio clip.

The **source** element provides the source of the multimedia file.

Browsers that do not support HTML5 multimedia elements will display this text as a fallback message to the user.

The **type** attribute provides the format of the multimedia file.

# Playing Web Audio

## Listen Up

The music for *Royal Wedding* was composed by Burton Lane, who is best known for his work in *Finian's Rainbow* (1947) and his Grammy Award-winning *On a Clear Day You Can See Forever* (1965).

Lane's greatest musical accomplishment may very well be his discovery of an 11-year-old singing sensation named Frances Gumm, whom the world now knows better as Judy Garland.

Click the play button below to hear the opening of the musical overture for Burton Lane's *Royal Wedding*.



Native media player provided by the browser to play audio files.

Audio player controls are part of the browser's media player.

## Introducing Multimedia on the Web

The original purpose of the web and HTML was to deliver textual information via interconnected hypertext documents. HTML was a perfect tool for academic researchers needing to share text and data. Once graphical capabilities were added to the HTML language, developers were free to create documents with images and arresting page layouts that opened up the web's potential for commerce and business. The next major phase in the language was the introduction of multimedia support in the form of streaming audio, video, and interactive games, making the web a dominant entertainment platform.

It is estimated that by 2022, online video will account for 82% of global Internet traffic, up from 75% in 2017 (*Cisco Visual Networking Index: Forecast and Methodology, 2017–2022*, February 2019). Thus, web developers need to consider how to best utilize multimedia in making their websites attractive to the public. One of the biggest challenges in delivering multimedia content is putting that content in a form that can be retrieved quickly and easily without loss of quality.

## Understanding Codecs and Containers

To achieve fast and easy transmission of multimedia content, that content is stored using a **codec**, which is a computer program that encodes and decodes streams of data. Codecs compress data so that it can be transmitted in a fast and an efficient manner and then decompress it when it is to be read or played back. The compression method can be either lossy or lossless.

Using **lossy compression**, nonessential data are removed in order to achieve a smaller file size. An audio file might be compressed by removing sounds that the human ear can barely hear. A video file might be compressed by removing frames from the video playback. The more the file is compressed, the more content is lost. The sound from a highly compressed audio file can become muddy and indistinct. A highly compressed video clip can become blurry or jerky in its movements. Thus, one consideration in lossy compression is determining at what point essential data has been removed because, once that data is lost, it cannot be recovered.

Using **lossless compression**, data is compressed by removing redundant information. For example, the following text string, consisting of 4 As followed by 5 Bs, and then 6 Cs requires 15 characters of information:

AAAABBBBBCCCCC

Yet, this content can be rewritten using the following 6 characters with no loss of information:

4A5B6C

This same general technique can be applied to digital audio and video, which can contain long stretches of redundant sound and images. The disadvantage of lossless compression is that you cannot achieve the same level of compression as with lossy compression. Most codecs involve some combination of lossy and lossless techniques. Web developers can choose from dozens of different codecs to compress their multimedia content.

Codecs are placed within a **container** that handles the packaging, transportation, and presentation of the data. The container is essentially the file format, which is identified by a file extension. The web supports a multitude of container and codec combinations but not all containers and codecs are equally supported. For example, Google Chrome uses the WebM container for video content, compressing that data with the VP8 codec; however, that combination of container and codec is not supported by any Apple device.

Thus, web developers have to account for browser support before making any multimedia content available to the user.

## Understanding Plug-Ins

Once multimedia has been stored within a container file, a **media player** is required to decode and play that content. Because multimedia was not part of the original HTML specifications, browsers, for many years, used a **plug-in**, which is a software program accessed by the browser to provide a feature or capability not native to the browser. The most commonly used plug-ins for multimedia content included Adobe Flash, Apple's QuickTime player, and the Windows Media Player. A plug-in either opens in its own external window or runs within the web page as an **embedded object**, in much the same way that a graphic image appears embedded within the page.

There are several problems with the plug-in approach for delivery of multimedia content:

- Plug-ins require users to install a separate application in addition to their web browsers.
- There is not a common plug-in that is available across all browsers, operating systems, and devices.
- HTML documents that support multiple plug-ins are difficult to create and maintain.
- Plug-ins consume valuable system resources, resulting in slow and unreliable performance.
- Plug-ins are a security risk with some of the most prominent Internet attacks working their way into browsers via a plug-in.

Starting with HTML 5, support for audio and video content was added to the HTML language, providing a common framework for delivering multimedia content without the need for plug-ins. HTML 5 is now an accepted and well-supported standard, but if you need to work with older browsers or maintain a legacy website, you might still encounter code that utilizes plug-ins. In this tutorial, you review code to access those plug-ins but your focus will be on working with the HTML 5 audio and video elements and attributes.

Before exploring these elements and attributes in depth, open the page for Cinema Penguin that Maxine has created for you.

### To open Maxine's web page:

1. Use your editor to open the **cp\_royal\_txt.html** file from the html08 ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **cp\_royal.html**.
2. Review the rest of the document to become familiar with its contents and structure.
3. Open **cp\_royal.html** in your browser. The initial page describing the movie *Royal Wedding* is shown in Figure 8-1.

Figure 8–1

Initial Royal Wedding page

**Royal Wedding (1951)**

★★★★

Tom Bowen (Fred Astaire) and Ellen Bowen (Jane Powell) are a brother and sister dance team from New York. Their agent (Keenan Wynn) books them in London for performances during the time of the royal wedding. Aboard a cruise ship to London, Ellen becomes involved with aristocrat and playboy, Lord John Brindale (Peter Lawford). In London, Tom meets and falls in love with Anne Ashmond (Sarah Churchill), a dancer in his show. Despite a few minor complications, it all ends happily as the two couples find love and marriage on the day of the royal wedding.

*Royal Wedding* is famous for several dance sequences, including a classic number in which Astaire appears to dance on the ceiling and walls of his hotel room. Jane Powell proves to be an elegant and athletic partner for Astaire; though perhaps his best duet of the movie takes place with a hat rack he discovers on the cruise to England. This is one of Astaire's best and I highly recommend it.

Cast	
Tom Bowen	Fred Astaire
Ellen Bowen	Jane Powell
Lord John Brindale	Peter Lawford
Anne Ashmond	Sarah Churchill
Irving/Edgar Klinger	Keenan Wynn
James Ashmond	Albert Sharpe

**Listen Up**

The music for *Royal Wedding* was composed by Burton Lane, who is best known for his work in *Finian's Rainbow* (1947) and his Grammy Award-winning *On a Clear Day You Can See Forever* (1965).

Lane's greatest musical accomplishment may very well be his discovery of an 11-year-old singing sensation named Frances Gumm, whom the world now knows better as Judy Garland.

**In Focus**

The high point of *Royal Wedding* is the *Ceiling Dance* in which Astaire appears to dance on the ceiling and walls of his hotel room. The effect was accomplished by putting the whole set inside of a rotating cage with fixed camera mount. As the cage turned, Astaire would seamlessly dance across the four sides of the box, creating the illusion of weightlessness.

**Overview**

Title Page  
Synopsis  
User Comments  
Reviews  
Quotes  
Trivia  
Awards  
Audio Clips  
Video Clips

**Featuring**

Fred Astaire  
Jane Powell  
Peter Lawford  
Keenan Wynn  
Sarah Churchill  
Stanley Donen  
Alan Jay Lerner

**Technical**

Trailers  
TV Schedule  
Streaming  
DVD & Blu-Ray Info  
Technical Specs  
Soundtrack  
Screenplay

**You Might Also Enjoy**

Finian's Rainbow  
Holiday Inn  
Top Hat  
Swing Time  
Three Little Words  
Roberta  
Shall We Dance?  
The Gay Divorcee  
Easter Parade  
Funny Face  
Daddy Long Legs

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Sources: openclipart.org; Archive.org

*Royal Wedding* is one of the Metro-Goldwyn-Mayer productions from the early 1950s whose original copyrights were never renewed, which places the movie in the public domain. Maxine can add production stills, sound clips, and video clips from the film to her website without worrying about copyright infringement. One of her audio clips contains the first few seconds from the film's overture. She would like to add that clip to the Listen Up box in the lower-left corner of the web page. To do that, you use the `audio` element.

## Working with the audio Element

Audio clips are embedded within a web page using the following `audio` element:

```
<audio src="url" attributes />
```

where `url` specifies the source of the audio file and `attributes` define how the audio clip should be handled by the browser. Figure 8–2 describes some of the attributes associated with HTML `audio` and `video` elements.

**Figure 8–2** Attributes of HTML audio and video elements

Attribute	Description
<code>autoplay</code>	Starts playing the media clip as soon as it is loaded by the browser
<code>controls</code>	Displays the player controls in the web page
<code>loop</code>	Automatically restarts the media clip when it is finished playing
<code>muted</code>	Specifies that the audio output should be muted
<code>preload="auto metadata none"</code>	Specifies whether the media clip should be preloaded by the browser, where <code>auto</code> preloads the entire clip, <code>metadata</code> preloads descriptive data about the clip, and <code>none</code> preloads nothing. <code>metadata</code> (to preload only descriptive data about the clip), or <code>none</code> (not to preload the media clip)
<code>src="url"</code>	Specifies the source of the media clip, where <code>url</code> is the location and name of the media file

### TIP

Because XHTML requires values for every attribute, enter the `controls` attribute as `controls="controls"` to display media player controls on a page written in XHTML.

For example, the following tag loads audio from the `cp_overture.mp3` file and displays the media player controls, which allows the user to interact with the audio clip from within the web page:

```
<audio src="cp_overture.mp3" controls />
```

If you don't include a `controls` attribute, the audio clip is embedded within the page but without the browser's native media player. This can be used to create a soundtrack that automatically starts and plays in the background. The following tag uses the `cp_overture.mp3` file as background music, automatically starting when the page is loaded and looping back to the beginning when the clip is finished:

```
<audio src="cp_overture.mp3" autoplay loop />
```

Adding background sounds to a web page is generally discouraged because they can quickly become annoying with no easy way of turning them off!

## Browsers and Audio Formats

HTML does not specify any particular audio format and thus developers are free to pick a format that meets the needs of their customers and clients. The most popular formats for web-based audio are described in Figure 8–3.

Figure 8–3

Audio formats in HTML

Format	Description	Codec	File Extension(s)	MIME Type
MP3	<b>MPEG-1 Audio Layer 3</b> or <b>MP3</b> is one of the most widely used audio types and is the standard format for digital audio players	MP3	.mp3	audio/mpeg
AAC	<b>Advanced Audio Coding</b> or <b>AAC</b> is the encoding standard for all Apple products, as well as YouTube and several gaming systems and mobile devices; AAC was introduced as the successor to MP3 with the goal of achieving better sound quality at similar compression ratios	AAC	.aac .mp4 .m4a	audio/mp4
OGG	A file compression format designed for web audio, <b>Ogg</b> is an open-source and royalty-free format; in general, Ogg provides better sound quality than MP3, especially at lower bit rates	Vorbis	.ogg	audio/ogg
WAV	The original audio format for Windows PCs, <b>WAV</b> is commonly used for storing uncompressed audio, making it impractical for all but the shortest audio clips	PCM	.wav	audio/wav
FLAC	<b>Free Lossless Audio Codec</b> or <b>FLAC</b> is a free open-source digital music format that offers bit-perfect copies of CD-quality music at half the size	FLAC	.flac	audio/flac
WebM	<b>WebM</b> is an open-source format introduced by Google to provide royalty-free audio and video to be used with the HTML audio and video elements	VP8 VP9	.webm	audio/webm

Because there is not a single audio format, browsers and devices differ on the types of audio formats they support. For example, Apple devices do not support the Ogg format. Thus, before choosing an audio format, you need to determine whether your user's browser will be able to play it. Figure 8–4 lists the browser support for different audio formats at the time of this writing, but, because browser support of audio and video is constantly evolving, you should always check the current levels of support on the browser market. Note that in some cases, a browser will support an audio format only if an extension is installed in the browser software.

Figure 8–4

Browser support for audio formats

Browser	MP3	AAC	Ogg	WAV	FLAC	WebM
Chrome	✓	✓	✓	✓	✓	✓
Firefox	✓	✓	✓	✓	✓	✓
Microsoft Edge	✓	✓	✓	✓	✓	✓
Opera	✓	✓	✓	✓	✓	✓
Safari	✓	✓		✓	✓	

You can provide the most cross-browser support by supplying multiple versions of the same audio clip and letting the browser choose which one to play. To provide several versions of the same media file, nest several `source` elements within a single `audio` element as follows

```
<audio>
 <source src="url1" type="mime-type" />
 <source src="url2" type="mime-type" />
 ...
</audio>
```

### TIP

If no `type` attribute is provided, the browser will download a section of the file to determine the audio format.

where `url1`, `url2`, and so on are the URLs for each audio file and `mime-type` specifies the audio format associated with each file. The browser goes through the `source` elements starting from the top, stopping once it encounters an audio format that it can play, so that even though multiple audio files are listed, only one audio file will be completely downloaded by the browser.

The following `audio` element provides two choices for the *Royal Wedding* overture clip:

```
<audio controls>
 <source src="cp_overture.mp3" type="audio/mp3" />
 <source src="cp_overture.ogg" type="audio/ogg" />
</audio>
```

The browser will first attempt to play the `cp_overture.mp3` file but, if that is not a supported format, it will try to play the `cp_overture.ogg` file. Notice that including the `type` attribute, while not required, informs the browser of the file type and speeds up the process of choosing a compatible audio format.

### INSIGHT

#### Exploring MIME Types

The **Multipurpose Internet Mail Extension** or **MIME type** was first introduced as a way of attaching nontextual content to email messages. With the growth of the web, the use of MIME types expanded to include the flow of information across the web. Each MIME type includes the following header:

*type/subtype*

where *type* is the general data type and *subtype* is a special classification of data within that type. The possible values for *type* are `application`, `audio`, `image`, `message`, `model`, `multipart`, `text`, and `video`. Within these types, there can be dozens or hundreds of subtypes. For example, HTML text files have the MIME type `text/html` while CSS files have the MIME type `text/css`. Audio files include MIME types such as `audio/mp3`, `audio/ogg`, and `audio/wav` among dozens of others.

When a web server sends content to the browser, it includes the MIME type so that the browser is able to interpret and render that content for the user. The file extension given to a file should correspond to its MIME type. Thus, an MP3 file should be delivered by the server with the `audio/mp3` MIME type and the `mp3` file extension.

Maxine has created two audio files of the overture music for *Royal Wedding* stored in the MP3 and Ogg format. Add these audio clips to her web page now.

**To add an audio clip:**

1. Return to the `cp_royal.html` file in your editor.
2. Scroll down to the `aside` element for the Listen Up content.
3. Directly before the closing `</aside>` tag, insert the following content:

```
<p>Click the play button below to hear the musical overture
for Burton Lane's <cite>Royal Wedding</cite>.</p>
<audio controls>
 <source src="cp_overture.mp3" type="audio/mp3" />
 <source src="cp_overture.ogg" type="audio/ogg" />
</audio>
```

Figure 8–5 highlights the newly added code.

**Figure 8–5****Inserting an audio clip**

```
<p>Lane's greatest musical accomplishment may
very well be his discovery of an 11-year-old singing sensation named
Frances Gumm, whom the world now knows better as Judy Garland.</p>
<p>Click the play button below to hear the musical overture
for Burton Lane's <cite>Royal Wedding</cite>.</p>
<audio controls>
 <source src="cp_overture.mp3" type="audio/mp3" />
 <source src="cp_overture.ogg" type="audio/ogg" />
</audio>
</aside>
```

displays the controls  
for the audio player

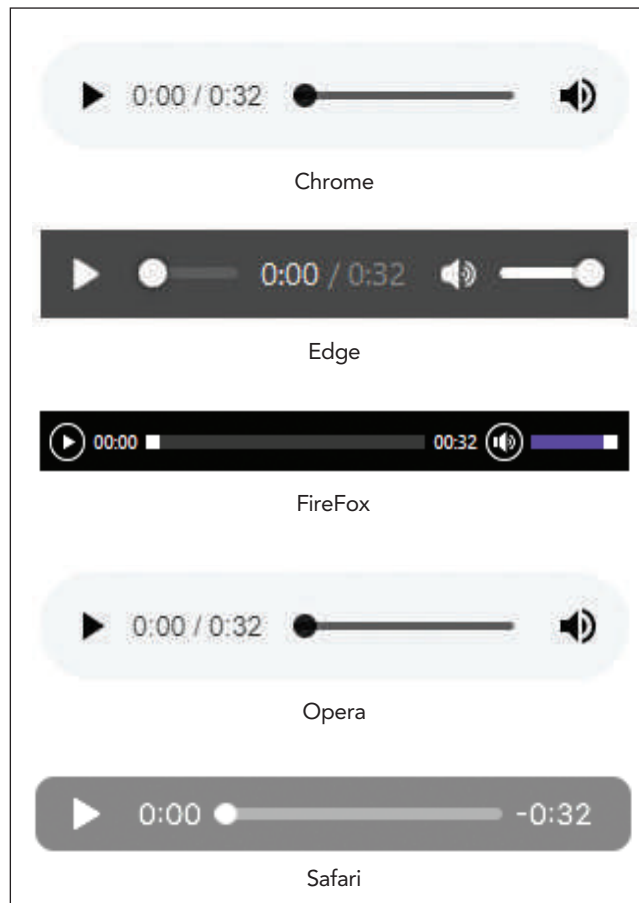
two possible  
sources for  
the audio file

4. Save your changes to the file.

Before running this audio clip, you will format the appearance of the browser's native media player that will run the audio.

## Applying Styles to the Media Player

The appearance of the media player is determined by the browser itself. Figure 8–6 shows the built-in media player for several major browsers.

**Figure 8–6** Native audio player for different browsers

You can use CSS to set the width of the media player, add borders and drop shadows, and apply filters and transformations to the player's appearance but, if you want a completely customized player, you need to build it yourself using the form controls introduced in the last tutorial along with a JavaScript program to set the behavior and operation of each control. There are also many third-party HTML 5 players available to allow you to create a customized media player adapted to the needs of your company or organization.

For the Cinema Penguin website, you will use the native media player supplied by the browser but you will use CSS to make some minor changes to the player's appearance.

### To apply styles to the media player:

1. Scroll to the document head of the **cp\_royal.html** file in your editor and add a link to the **cp\_media.css** style sheet directly before the closing `</head>` tag.
2. Save your changes to the file and then use your editor to open the **cp\_media\_txt.css** file from the **html08 ► tutorial** folder. Enter **your name** and **the date** in the comment section of the file and save it as **cp\_media.css**.

**TIP**

By default, audio and video elements are displayed in-line with the surrounding page content.

3. Go to the Audio and Video Player Styles section and insert the following style rule:

```
audio {
 filter: drop-shadow(8px 8px 15px rgb(51, 51, 51));
 display: block;
 margin: 10px auto;
 width: 90%;
}
```

Figure 8–7 highlights the newly added styles for the `audio` element.

**Figure 8–7****Styles for the native media player**

```
/* Audio and Video Player Styles */

audio {
 filter: drop-shadow(8px 8px 15px rgb(51, 51, 51));
 display: block;
 margin: 10px auto;
 width: 90%;
}
```

4. Save your changes to the style sheet.

Test the audio clip you entered into the Cinema Penguin web page.

**To play the audio clip:**

1. Reload the `cp_royal.html` file in your web browser.
2. Scroll to the bottom of the page and click the play button on the media player to play the embedded audio clip.

Figure 8–8 shows the appearance of the media player within the Google Chrome browser.

Figure 8–8

## Appearance of the native media player within Google Chrome



3. The clip will run for about 32 seconds. Press the stop button on the media player to halt the playback.

**Trouble?** Depending on your browser and device, you may see a different media player in your web page.

Maxine likes the audio clip but asks what would happen if the user opens this page in an older browser that doesn't support the `audio` element. In that situation, the browser would not display any media player, but you can provide alternate content for the user.

## Providing a Fallback to an Audio Clip

It is considered bad design to add a feature to a web page without also providing some fallback option to users who cannot take advantage of that feature. You already used one type of fallback option by specifying two audio sources so that, if the browser cannot play the MP3 version of the audio clip, it can attempt to play the OGG version.

If the browser can't play either version or doesn't support the `audio` element at all, you can follow the `source` elements with HTML code that the browser will recognize. The simplest fallback option is a text string indicating that the user needs to upgrade the browser to take advantage of the feature you added to the page.

Add a paragraph within the `audio` element to display a message for users who are unable to play either of the two source files you provided.

**To provide alternate text to the audio clip:**

1. Return to the **cp\_royal.html** file in your editor.
2. Scroll down to the `audio` element and insert the following code directly before the closing `</audio>` tag:
 

```
<p>To play this audio clip, your browser needs to support HTML 5.</p>
```

Figure 8–9 highlights the fallback text for the audio clip.

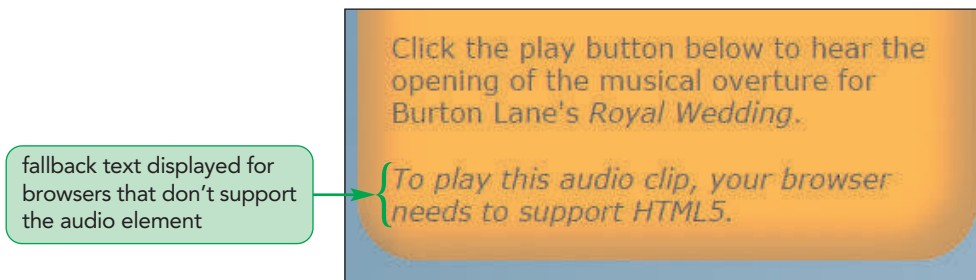
**Figure 8–9****Adding fallback text to the audio element**

```
<audio controls>
 <source src="cp_overture.mp3" type="audio/mp3" />
 <source src="cp_overture.ogg" type="audio/ogg" />
 <p>To play this audio clip, your browser needs to support HTML5.</p>
</audio>
</aside>
```

displays this paragraph  
when the audio element  
is not supported

3. Save your changes to the file.

You can test this feature by opening the page in an older browser or using the developer tools provided with your browser to emulate an earlier browser version. Figure 8–10 shows how the page might look when the `audio` element is not supported.

**Figure 8–10****Fallback text displayed within the web page**

Another way of supporting older browsers is to provide code that will work with multimedia plug-ins.

Aa

## PROSKILLS

### Verbal Communication: Tips for Effective Web Audio

Enhancing your website with audio clips can be an effective way to provide information and entertainment for your users and customers. However, it must be used judiciously to avoid annoying users. Here are some tips to keep in mind when using web audio:

- *Avoid background music.* Remember that many customers multitask when using the web and are often listening to their own music and audio files. Don't annoy them by inserting your audio clip over theirs.
- *Give users control.* Turn off the autoplay feature of your audio player. Let each user choose whether or not to play your audio clip. Your users might be accessing your site at work or in a public place where audio is inappropriate. Always give users the ability to pause, stop, and—above all—mute the audio.
- *Keep it short.* If you use sound to supplement different visual effects in your page, keep the clips short in duration. Don't force your users to listen to long clips.
- *Accommodate hearing-impaired customers.* The web is an important source of information for the hard of hearing. Always provide alternatives for those who can't hear your site's audio content.

Finally, every feature on your website, including sound, should have a reason for being there. An audio clip should provide users with important information that cannot be conveyed in any other way.

## Exploring Embedded Objects

As you learned earlier, older browsers relied on plug-ins to play audio and video files. The plug-ins were marked using the following `embed` element

```
<embed src="url" type="mime-type"
 width="value" height="value" />
```

where `url` is the location of the media file, the `type` attribute provides the mime-type, and the `width` and `height` attributes set the width and height of the media player. For example, the following code loads the `cp_overture.mp3` file into a media player 250 pixels wide by 50 pixels high:

```
<embed src="cp_overture.mp3" type="audio/mp3"
 width="250" height="50" />
```

The plug-in associated with this particular media file is defined within the user's browser. One user might associate MP3 files with Apple's QuickTime Player while another user might associate them with the Windows Media Player. One of the challenges with plug-ins is that they relied on the user installing a specific piece of software, which some users were either unable or reluctant to do. HTML 5 avoids this problem and makes inserting audio and video content as seamless as inserting inline images.

## Plug-In Attributes

The `src`, `type`, `height`, and `width` attributes are generic attributes and can be applied to the `embed` element for any plug-in. The `embed` element also allows for attributes that are tailored to specific plug-ins. For example, the following `embed` element adds attributes that are recognized by Apple's QuickTime Player to display the media player controls and prevent the playback from starting automatically:

```
<embed src="cp_overture.mp3" width="250" height="50"
 controller="yes" autoplay="no" />
```

Other plug-ins might use different attributes or attribute values to achieve the same effect. For Windows Media Player, the equivalent tag is as follows:

```
<embed src="cp_overture.mp3" width="250" height="50"
 showcontrols="yes" autostart="no" />
```

Both plug-ins can be supported by including both sets of attributes within the same tag as follows:

```
<embed src="cp_overture.mp3" width="250" height="50"
 controller="yes" autoplay="no"
 showcontrols="yes" autostart="no" />
```

Each plug-in will use the attributes designed for it and ignore the others, enabling a single tag to work across multiple plug-ins.

## Plug-Ins as Fallback Options

Plug-ins can act as a fallback option for browsers that don't support the HTML 5 multimedia elements by adding the `embed` element to the end of the `audio` element as the last option for the browser. The following code demonstrates how to employ a plug-in as a fallback to the `audio` element you inserted earlier into the `cp_royal.html` file:

```
<audio controls>
 <source src="cp_overture.mp3" type="audio/mp3" />
 <source src="cp_overture.ogg" type="audio/ogg" />
 <embed src="cp_overture.mp3" width="250" height="50"
 controller="yes" autoplay="no"
 showcontrols="yes" autostart="no" />
</audio>
```

### TIP

Browsers that don't support HTML 5 ignore the `audio` and `source` elements but apply the `embed` element to insert the media player via a plug-in.

The use of plug-ins has steadily declined since the widespread adoption of the HTML 5 standard. Maxine decides against including support for plug-in media players, instead she will rely on the fallback message directing users to upgrade older browsers.

You have completed your work to add a sound clip to the *Royal Wedding* page. In the next session, you insert a video clip of a famous dance from that movie.

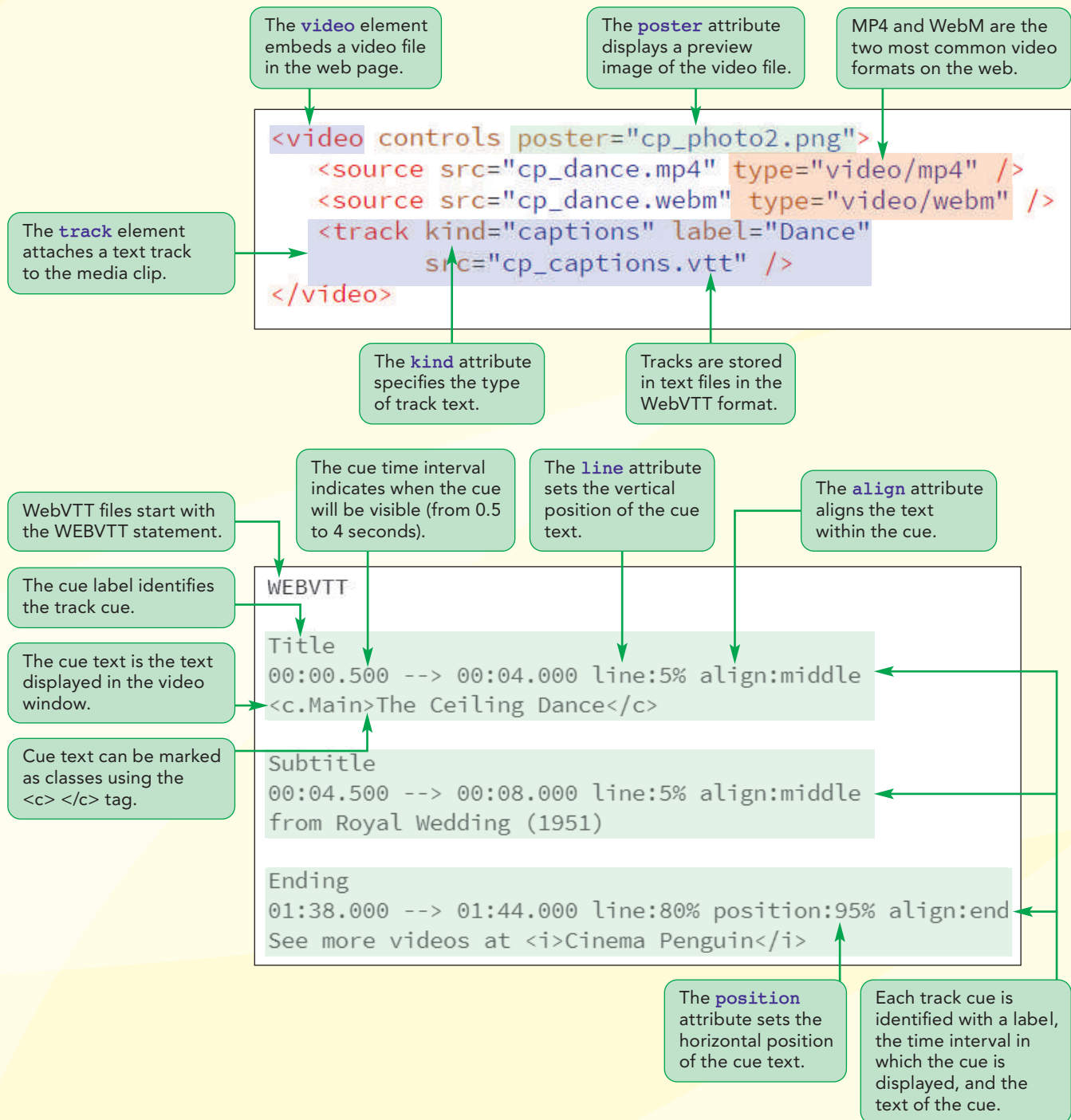
## REVIEW

### Session 8.1 Quick Check

1. What is the utility to encode and decode a multimedia file?
  - a. MIME type
  - b. codec
  - c. container
  - d. plug-in
2. To compress data by removing redundant information, apply:
  - a. lossy compression
  - b. lossless compression
  - c. codec compression
  - d. plug-in compression
3. Which of the following is *not* a sound format?
  - a. au
  - b. WebM
  - c. WAV
  - d. FLAC

4. To automatically play a sound clip continuously in the background when a page is loaded, which attribute(s) should you add to the `audio` element?
  - a. `autostart play`
  - b. `autostart = "play"`
  - c. `autoplay loop`
  - d. `autoplay = "loop"`
5. What code do you insert within an `<audio>` clip to allow the browser to choose between the `bground.mp3` and `bground.ogg` files?
  - a. `<source src="bground.mp3" type="audio/mp3" />`  
`<source src="bground.ogg" type="audio/ogg" />`
  - b. `<src audio="bground.mp3" type="audio/mp3" />`  
`<src audio="bground.ogg" type="audio/ogg" />`
  - c. `<audio src="bground.mp3" type="audio/mp3" />`  
`< audio src="bground.ogg" type="audio/ogg" />`
  - d. `<audio source="bground.mp3" type="audio/mp3" />`  
`< audio source="bground.ogg" type="audio/ogg" />`
6. When multiple audio files are suggested in the `audio` element, the one played by the browser is:
  - a. The first file in the list
  - b. The last file in the list
  - c. The first file supported by the browser in the list
  - d. The last file supported by the browser in the list
7. To mark a plug-in, use the:
  - a. `plugin` element
  - b. `plug-in` element
  - c. `audio` element
  - d. `embed` element
8. When a browser encounters the `audio` element, it:
  - a. Loads a plug-in file associated with web audio
  - b. Loads the W3C audio player
  - c. Loads an audio player built into the browser
  - d. Requests that the user update the browser

## Session 8.2 Visual Overview:



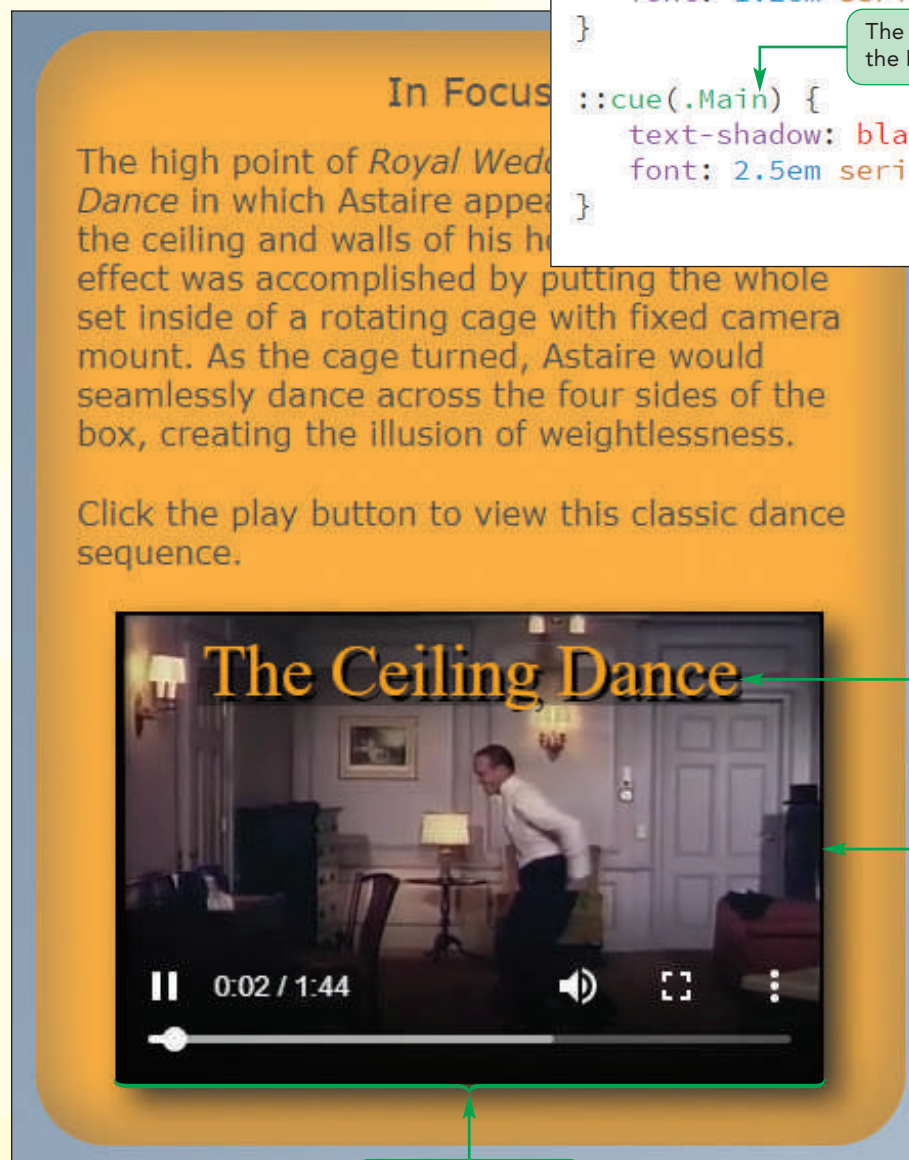
# Playing Web Video

The `cue` pseudo-element selects the cues from the media track.

```
::cue {
 background: rgba(0, 0, 0, 0.3);
 color: orange;
 font: 1.2em serif;
}

::cue(.Main) {
 text-shadow: black 3px 3px 0px;
 font: 2.5em serif;
}
```

The cue text is from the Main class.



The Title cue text as rendered in the video window.

Native media player provided by the browser to play video files.

The media player displays controls for video playback.

Source: Archive.org

## Exploring Digital Video

In this session, you explore how to embed video within your web pages. Before exploring the HTML `video` elements, you examine some of the issues involved with producing video files suitable for the web.

### Video Formats and Codecs

A video file typically contains two codecs: one codec for audio and another for the video images. The audio codecs are the same ones you examined in the last session. Figure 8–11 describes the most commonly used video codecs on the web.

**Figure 8–11** Video codecs used on the web

Codec	Description
H.264	Developed by the MPEG group, the <b>H.264</b> codec is the industry standard for high-definition video streams, movie sharing websites such as YouTube, and video plug-ins
Theora	<b>Theora</b> is a royalty-free codec developed by the Xiph.org Foundation that produces video streams that can be used with almost any container
VP8	<b>VP8</b> is an open-source royalty-free codec owned by Google for use in Google's WebM video format
VP9	<b>VP9</b> is Google's successor to the VP8 codec, offering the same video quality as VP8 at half the download size

The most popular video codec is H.264 used by YouTube and most commercial vendors; however, because H.264 is a commercial product, it is not royalty free. This is not an issue if you are creating a video that is not actually being sold. If you are creating a commercial video that uses the H.264 codec, you might have to pay licensing fees depending on the number of subscribers to your video content. The Theora, VP8, and VP9 codecs are royalty free, but they are not as widely supported at the time of this writing.

Browser support for video containers is focused on three formats: MP4, Ogg, and WebM, with multiple combinations of video and audio codecs available within each container. Figure 8–12 summarizes these formats and their use on the web.

**Figure 8–12** Video formats used on the web

Format	Description	Video Codec	File Extension(s)	MIME Type
MPEG-4	<b>MPEG-4</b> or <b>MP4</b> is a widely used proprietary format developed by Apple based on the Apple QuickTime movie format	H.264	.mp4 .m4v	video/mp4
Ogg	<b>Ogg</b> is an open-source format developed by the Xiph.org Foundation using the Theora codec as an alternative to the MPEG-4 codec	Theora	.ogg	video/ogg
WebM	<b>WebM</b> is an open-source format introduced by Google to provide royalty-free video and audio to be used with the HTML 5 video element	VP8 VP9	.webm	video/webm

Video content suffers the same limitation as audio content in that no single format has universal support among all browsers and devices. Thus, as with audio content, you may have to supply multiple versions of the same video if you want the widest cross-browser support. See Figure 8–13.

**Figure 8–13** Browser support for video formats

Browser	MPEG-4	Ogg	WebM
Chrome	✓	✓	✓
Firefox	✓	✓	✓
Microsoft Edge	✓	✓	✓
Opera	✓	✓	✓
Safari	✓		

The level of support for video formats is constantly changing as are the video formats themselves. As always, the best way to determine whether a browser supports a particular video format is to test the video file on that browser.

## Using the HTML 5 video Element

Videos are embedded into a web page using the following `video` element

```
<video attributes>
 <source src="url1" type="mime-type" />
 <source src="url2" type="mime-type" />
 ...
</video>
```

where *attributes* are the HTML attributes that control the behavior and appearance of the video playback, *url1*, *url2*, and so on are the possible sources of the video, and *mime-type* specifies the format associated with each video file. As with sources for the `audio` element, a browser uses the first source it finds in a format it supports. Fallback content can also be added after the list of video sources for browsers that don't support HTML 5 video. The `video` element supports many of the same attributes used within the `audio` element shown earlier in Figure 8–2.

The following code embeds two possible video files on the web page with a fallback message for browsers that don't support the `video` element:

```
<video controls>
 <source src="cp_dance5.mp4" type="video/mp4" />
 <source src="cp_dance5.webm" type="video/webm" />
 <p>To play this video clip, your browser needs
 to support HTML 5.</p>
</video>
```

Maxine has a video clip of a classic dance sequence from *Royal Wedding* in which Fred Astaire appears to dance on the walls and ceiling of his hotel room. She has two versions of the clip: one in MP4 format and the other in the WebM format. Use the `video` element now to embed these videos on her web page.

### To embed a video file into the web page:

1. If you took a break after the previous session, make sure the **cp\_royal.html** file is open in your editor.
2. Scroll down to the **aside** element titled In Focus and add the following code directly before the closing **</aside>** tag:

```
<p>Click the play button to view this classic dance sequence.</p>
<video controls>
 <source src="cp_dance.mp4" type="video/mp4" />
 <source src="cp_dance.webm" type="video/webm" />
 <p>To play this video clip, your browser needs to
 support HTML 5.</p>
</video>
```

Figure 8–14 highlights the code for the embedded video.

Figure 8–14

### Adding a video clip to a web page

```
<aside>
 <h1>In Focus</h1>
 <p>The high point of <cite>Royal Wedding</cite> is the <cite>Ceiling Dance</cite>
 in which Astaire appears to dance on the ceiling and walls
 of his hotel room. The effect was accomplished by putting the whole set
 inside of a rotating cage with fixed camera mount.
 As the cage turned, Astaire
 would seamlessly dance across the four sides of the box, creating the
 illusion of weightlessness.
 </p>
 <p>Click the play button to view this classic dance
 sequence.</p>
 <video controls>
 <source src="cp_dance.mp4" type="video/mp4" />
 <source src="cp_dance.webm" type="video/webm" />
 <p>To play this video clip, your browser needs to
 support HTML5.</p>
 </video>
</aside>
```

displays the browser's native media player

sources for the video clip

fallback text for browsers that don't support HTML5 video

3. Save your changes to the file.  
Next, you modify the **cp\_media.css** style sheet file to format the appearance of the video media player for your browser.
4. Go to the **mp\_media.css** file in your editor.
5. Modify the style rule for the **audio** element by adding the **video** selector separated by a comma.

Figure 8–15 highlights the modified style rule.

Figure 8–15

### Defining the video player styles

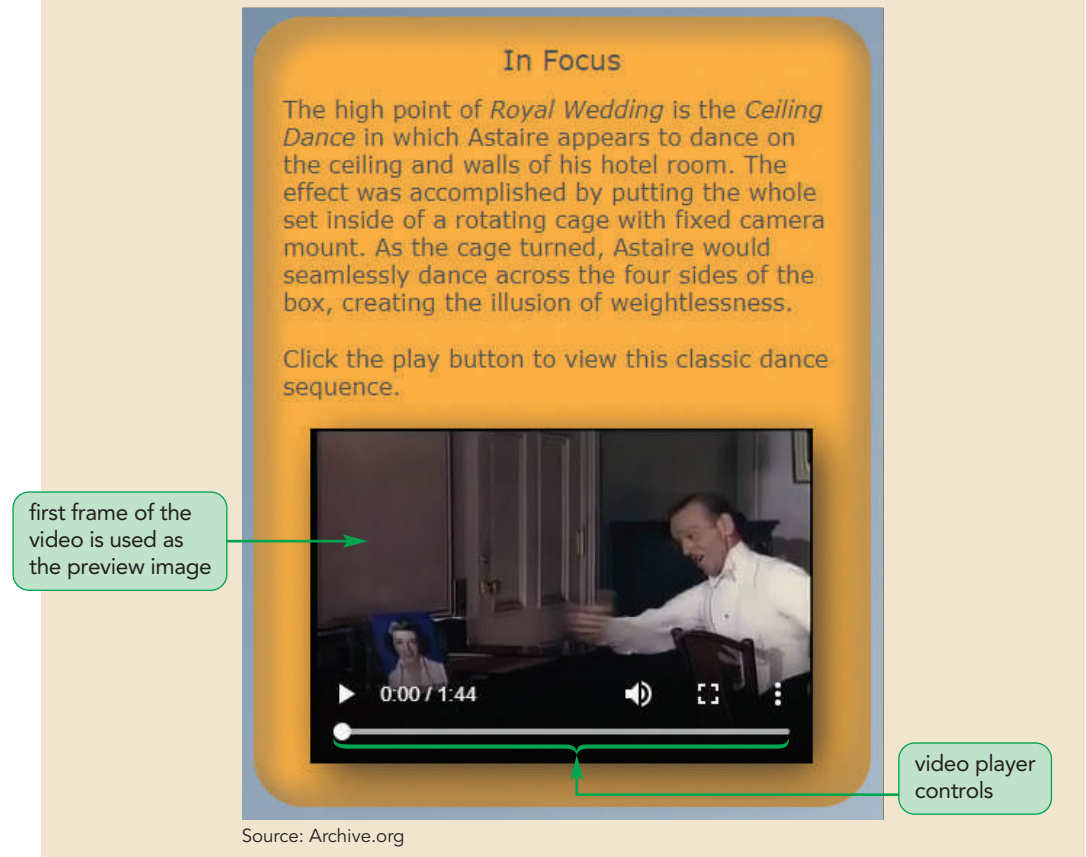
```
audio, video {
 filter: drop-shadow(8px 8px 15px rgb(51, 51, 51));
 display: block;
 margin: 10px auto;
 width: 98%;
}
```

add video to the style rule selector

- 6. Save your changes to the style sheet and then reopen the **cp\_royal.html** file in your browser.
- 7. Click the play button on your browser's media player to play the video clip.  
Figure 8–16 shows the video clip in action as it replays the ceiling dance sequence from *Royal Wedding*.

Figure 8–16

## Video clip embedded in the web page



When the media player initially loads a video file, the player shows the first video frame as a preview of the video's content. Maxine would like to replace that preview image with an image of Astaire dancing on his apartment room's wall. To define the video's preview image, you apply the following `poster` attribute to the `video` element

```
<video poster="url">
...
</video>
```

where `url` points to an image file containing the preview image. The `poster` attribute is also used as a placeholder image that is displayed when the video is still being downloaded or used in place of the video if the browser fails to download the video file at all.

Maxine suggests you use the `cp_photo2.png` file as the poster image for the video clip.

### To set the video's poster image:

1. Return to the **cp\_royal.html** file in your editor.
2. Add the following attribute to the video element: **poster="cp\_photo2.png"**.  
Figure 8–17 highlights the **poster** attribute.

Figure 8–17

### Defining a poster image for the video



3. Save your changes to the file and then reload **cp\_royal.html** in your browser.  
Figure 8–18 shows the poster image applied to the video of the ceiling dance sequence.

Figure 8–18

### Video clip poster image



Maxine suggests that the video clip would benefit from some descriptive captions. Rather than modifying the video clip itself, you can add those captions using media tracks.

## Adding a Text Track to Video

With the increased reliance on multimedia on the web comes the responsibility of making audio and video content accessible to all users. This can be done by adding a text track to the media clip that can be read or recited to visually impaired users. Text tracks are added to an audio or video clip using the following **track** element

```
<track kind="type" src="url" label="text" srclang="lang" />
```

where the `kind` attribute defines the track type, the `src` attribute references a file containing the track text, the `label` attribute gives the track name, and the `srclang` attribute indicates the language of the track. A single media clip might be associated with multiple track types as indicated by the value of the `kind` attribute. Figure 8–19 lists the different kinds of tracks that can be associated with an audio or video file.

**Figure 8–19** Values of the `kind` attribute

Kind Value	Description
<code>captions</code>	Brief text descriptions synced to specified time points within the media clip; designed for hearing impaired users
<code>chapters</code>	Chapter titles used by the media player to navigate the user to specific time points within the media clip
<code>descriptions</code>	Longer descriptions synced to specified time points within the media clip; designed for visually impaired users
<code>subtitles</code>	(the default) Translation of dialog from the media clip; the language of the subtitle must be specified in the <code>srclang</code> attribute
<code>metadata</code>	Metadata content used by external scripts accessing the media file

For example, the following code attaches six tracks to the `story.mp4` video file:

```
<video controls>
 <source src="story.mp4" type="video/mp4" />
 <track kind="captions" src="captions.vtt" label="Captions" />
 <track kind="chapters" src="chapters.vtt" label="Chapters" />
 <track kind="subtitles" src="english.vtt" srclang="en"
default />
 <track kind="subtitles" src="french.vtt" srclang="fr" />
 <track kind="subtitles" src="spanish.vtt" srclang="es" />
 <track kind="descriptions" src="summary.vtt" label="Summary" />
</video>
```

The tracks contain captions, chapter titles, subtitles in English, French, and Spanish, and finally a track that summarizes the contents of the video. The media player can only show one of these tracks at a time. The active track by is marked with the `default` attribute, which enables that track and disables all of the other tracks. In this case, the track English subtitles is enabled while all other tracks are disabled. The user can choose a different track from the media player, usually by selecting the track from one of the media player controls. Note that the `default` attribute is required, even if the track list contains only one track.

## Making Tracks with WebVTT

### TIP

A WebVTT file has the file extension `.vtt`.

Tracks are stored as simple text files written in the **Web Video Text Tracks** or **WebVTT** language. The format of a WebVTT file follows the structure

```
WEBVTT

cue1

cue2

...
```

where *cue1*, *cue2*, and so on are cues matched with specific time intervals within the media clip. Note that the list of cues is separated by a single blank line after the cue text. Unlike HTML, white space is not ignored in WebVTT files.

Each cue has the general form

```
label
start --> stop
cue text
```

where *label* is the name assigned to the cue, *start* and *stop* define the time interval associated with the cue, and *cue text* is the text of the cue. Times are entered in the format *mm:ss.ms* for the minutes, seconds, and milliseconds values. For longer clips, you can include an hours value, writing the time in the form *hh:mm:ss.ms*.

The following code adds two cues to the WebVTT file:

```
WEBVTT

Intro
00:00.500 --> 00:09.000
Once upon a time

Conclusion
14:20.000 --> 14:30.000
And they all lived happily ever after
```

### TIP

Cue text entered on multiple lines in the WebVTT file will also be displayed on multiple lines when played back.

The Intro cue, “Once upon a time”, starts at the half-second mark and runs through the 9-second mark; the Conclusion cue, “And they all lived happily ever after”, covers the time interval from 14 minutes 20 seconds through 14 minutes 30 seconds of the clip.

Create a track file now for the ceiling dance video displaying a title and subtitle at the start of the video and an advertisement for Cinema Penguin near the end.

### To create a track file:

1. Use a text editor to open the **cp\_captions\_txt.vtt** file from the **html08 ► tutorial** folder. Save this blank text file as **cp\_captions.vtt**.
2. Enter **WEBVTT** in the first line of the file.
3. Insert a blank line followed by the text for the Title cue spanning the interval from the first half-second up to the fourth second:

```
Title
00:00.500 --> 00:04.000
The Ceiling Dance
```

4. Insert a blank line followed by the Subtitle cue in the interval from 4.5 seconds through 8 seconds:

```
Subtitle
00:04.500 --> 00:08.000
from Royal Wedding (1951)
```

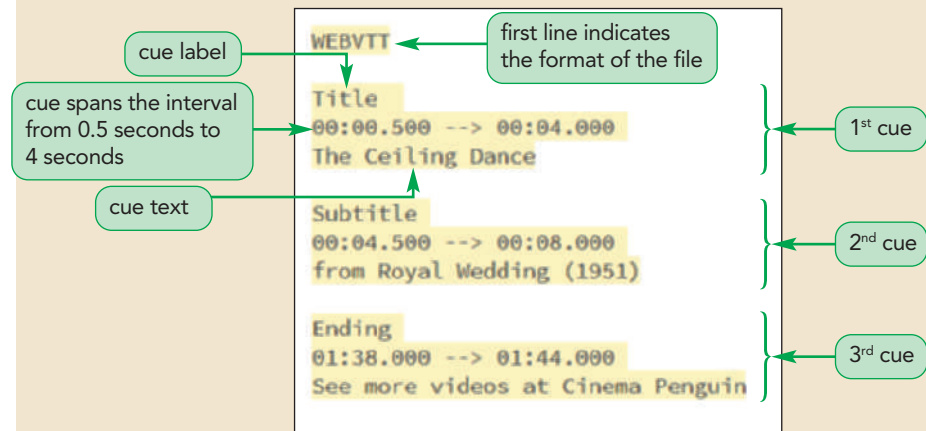
5. Insert a blank line followed by the Ending cue in the interval from 1 minute 38 seconds through 1 minute 44 seconds:

```
Ending
01:38.000 --> 01:44.000
See more videos at Cinema Penguin
```

Figure 8–20 describes the contents of the **cp\_captions.vtt** file.

Figure 8–20

## WebVTT file to define track text



6. Save your changes to the file.

Next, you apply the `cp_captions.vtt` file to the dance sequence video. If you are testing your page on Google Chrome or Opera, be aware that you will have to upload your files to a web server. Neither of these browsers will open track files stored locally.

## To add captions to a video clip:

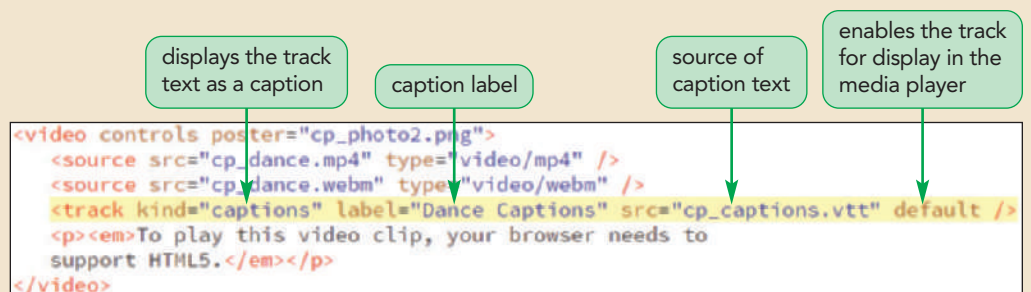
1. Return to the `cp_royal.html` file in your editor and scroll down to the video element.
2. Directly after the second `source` element, insert the following track:

```
<track kind="captions" label="Dance Captions"
 src="cp_captions.vtt" default />
```

Figure 8–21 highlights the HTML code for the track.

Figure 8–21

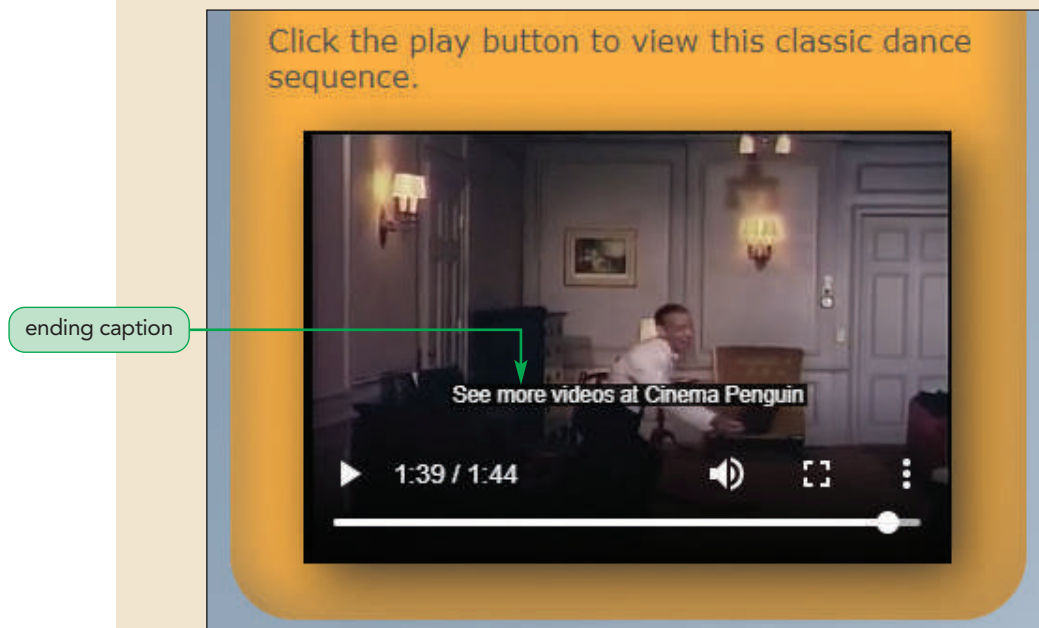
## Applying a track to a video clip



3. Save your changes to the file and then reload `cp_royal.html` in your browser. If you are using Google Chrome or Opera, upload your files to a web server for testing.
4. Click the play button on your browser's media player and, if necessary, click the Closed Captioning button to display the video captions. Verify that captions appear at the half-second, 4.5 second, and 1 minute 38 second marks in the video. Figure 8–22 shows the final caption from the video clip.

Figure 8–22

## Caption in the ceiling dance movie



Source: Archive.org

**Trouble?** If you don't see any captions, check the code in your WebVTT file against the code shown in Figure 8–20. Make sure your text matches that figure because the WebVTT syntax must be strictly followed.

By default, the caption cues are centered at the bottom of the video window. To change the position of the cues, you can edit the settings in the WebVTT file, as discussed next.

## Placing the Cue Text

The size and position of the cue text can be set by adding the following cue settings directly after the cue's time interval

```
setting1:value1 setting2:value2 ...
```

where *setting1*, *setting2*, and so on define the size and position of the cue text and *value1*, *value2*, and so on are the setting values. Note that there is no space between the setting name and value. Figure 8–23 describes the different settings supported in the WebVTT language.

**Figure 8–23** Cue attributes in WebVTT

Cue Setting	Description
<code>align: value</code>	Sets the horizontal alignment of the text within the cue, where <i>value</i> is <i>start</i> (left-aligned), <i>middle</i> (center-aligned), or <i>end</i> (right-aligned)
<code>line: value</code>	Sets the vertical position of the cue within the video window, where <i>value</i> ranges from 0% (top) to 100% (bottom)
<code>position: value</code>	Sets the horizontal position of the cue within the video window, where <i>value</i> ranges from 0% (left) to 100% (right)
<code>size: value</code>	Sets the width of the cue as a percentage of the width of the video window
<code>vertical: type</code>	Displays the cue text vertically rather than horizontally where <i>type</i> is <i>rl</i> (writing direction is right to left) or <i>lr</i> (writing direction is left to right)

**TIP**

To center the cue in the video window, set the `line` and `position` values to 50% and the `align` value to `middle`.

By applying the `line` and `align` settings, the Intro cue in the following track is placed at the top of the video window and centered horizontally. By applying the `line`, `position`, and `align` settings, the Conclusion cue is placed at the bottom-left corner of the video window with the cue text left-aligned. Note that the default placement of the cue is the bottom center of the video window.

```
Intro
00:00.500 --> 00:09.000 line:0% align:middle
Once upon a time

Conclusion
14:20.000 --> 14:30.000 line:100% position:0% align:start
And they all lived happily ever after
```

Maxine suggests that you center the Title and Subtitle cues for the ceiling dance video near the top of the video window and place the Ending cue near the bottom-right corner with the text right-aligned.

**To position the track cues:**

1. Return to the **cp\_captions.vtt** file in your editor.
2. After the time intervals for the Title and Subtitle cues, insert the attributes:

```
line:5% align:middle
```

3. After the time interval for the Ending cue, insert the attributes:

```
line:80% position:95% align:end
```

Figure 8–24 highlights the attributes for each cue within the track.

Figure 8–24

## Placing the cue text

places the Title and Subtitle cues near the top of the video window with the text centered

```
Title
00:00.500 --> 00:00:04.000 line:5% align:middle
The Ceiling Dance

Subtitle
00:04.500 --> 00:00:08.000 line:5% align:middle
from Royal Wedding (1951)

Ending
01:38.000 --> 00:01:44.000 line:80% position:95% align:end
See more videos at Cinema Penguin
```

places the Ending cue near the bottom-right corner of the video window with the text right-aligned

4. Save your changes to the file and then reload the cp\_royal.html file in your browser. If you are using Google Chrome or Opera, upload your files to a web server for testing.
5. Play the video clip and verify that the Title and Subtitle cues appear centered near the top of the video window and the Ending cue appears near the bottom-right corner of the window.

**Trouble?** If the cues have not changed position, check your code against the code in Figure 8–24. Make sure you have not entered a space between the attribute name and the attribute value or placed the values on a new line. At the time of this writing, Microsoft Edge and Internet Explorer do not support positioning the track cues.

The WebVTT settings do not include styles to format the appearance of the cue text, but you can create such styles using CSS. Note that browser support for such styles is mixed; therefore you should not make these styles crucial to users' interpretation of the video cues text.

## Applying Styles to Track Cues

CSS supports the following `cue` pseudo-element to format the appearance of the cues appearing within a media clip:

```
::cue {
 styles
}
```

Styles for the `cue` pseudo-element are limited to the `background`, `color`, `font`, `opacity`, `outline`, `text-decoration`, `text-shadow`, `visibility`, and `white-space` properties. For example, the following style rule displays all cues in a 2em yellow serif font on a red background:

```
::cue {
 background: red;
 color: yellow;
 font: 2em serif;
}
```

Use the `cue` pseudo-element to change the format of the captions in the ceiling dance video to an orange color on a semi-transparent black background. Set the size and type of the caption text to a 1.2em serif font.

### To format the cue text:

1. Return to the `cp_media.css` file in your editor and scroll down to the Track Styles section.
2. Add the following style rule:

```
::cue {
 background: rgba(0, 0, 0, 0.3);
 color: orange;
 font: 1.2em serif;
}
```

Figure 8–25 highlights the style rule for cue text.

**Figure 8–25** Applying styles to cue text

selects the cue text from the media clip

changes the background to semi-transparent black

```
/* Track Styles */

::cue {
 background: rgba(0, 0, 0, 0.3);
 color: orange;
 font: 1.2em serif;
}
```

3. Save your changes to the style sheet and then reload the `cp_royal.html` file in your browser. If you are using Google Chrome or Opera, upload your files to a web server for testing.
4. Play the video clip and verify that the captions appear in a serif orange font on a semi-transparent black background.

**Trouble?** At the time of this writing, only Google Chrome and Opera support styles that modify the color and typeface of the cue text. Safari supports styles to change the font size. Internet Explorer and Firefox do not support any cue styles.

The `cue` pseudo-element selects all of the cue text in the media clip. To format specific cues or text strings within a cue you identify sections of the cue text using the following markup tags:

- `<i></i>` for italicized text
- `<b></b>` for bold-faced text
- `<u></u>` for underlined text
- `<span></span>` to mark spans of text
- `<ruby></ruby>` to mark ruby text
- `<rt></rt>` to mark ruby text

### TIP

Ruby text refers to annotative characters placed above or to the right of other characters and is often used with Chinese or Japanese symbols.

For example, the following code italicizes the name of the website using the `<i></i>` tag

```
Ending
01:38.000 --> 01:44.000
See more videos at <i>Cinema Penguin</i>
```

WebVTT also supports tags that are not part of the HTML library, such as the following `<c></c>` tag used to mark text strings belonging to a particular class

```
<c.classname></c>
```

where *classname* defines the class.

And for captions that distinguish between one voice and another, WebVTT supports the following `<v></v>` tag

```
<v name></v>
```

where *name* is the name of the voice associated with the caption. The following track shows how to apply the `<c></c>` and `<v></v>` tags to mark scenes and the voices of Bernardo and Francisco from the opening of *Hamlet*.

```
Cue1
00:00.000 --> 00:05.000
<c.scene>Elsinore. A platform before the castle</c>

Cue2
00:05.500 --> 00:12.000
<v Bernardo>Who's there?</v>
<v Francisco>Nay, answer me: stand, and unfold yourself.</v>

Cue3
00:12.500 --> 00:18.000
<v Bernardo>Long live the king!</v>
<v Francisco>Bernardo?</v>
```

For cues based on their class name, add the class name to the cue pseudo-element as follows

```
::cue(.classname) {
 style rules
}
```

where *classname* is the class marked within in the `<c></c>` tag.

To format voice text, use the style rule

```
::cue(v[voice=name]) {
 style rules
}
```

where *name* is the name assigned in the `<v></v>` tag.

Thus, the following style rules display the scene and voices from the opening scene in *Hamlet* using red for the scene direction text, blue for Bernardo's voice, and green for Francisco's voice:

```
::cue(.scene) {color: red;}
::cue(v[voice=Bernardo]) {color: blue;}
::cue(v[voice=Francisco]) {color: green;}
```

Maxine suggests that the opening Title caption be displayed in a larger font with a drop shadow and that the website in the ending cue be italicized. Mark the caption text using the `<c></c>` tag belonging to the Main class and italicize the name of the website. Then, add the appropriate style rule to your style sheet.

### To apply styles to cue text:

1. Return to the **cp\_captions.vtt** file in your editor.
2. Enclose the cue text for the Title cue within `<c>` tags with the class name **Main**.

3. Go to the Ending cue and enclose *Cinema Penguin* within opening and closing `<i>` tags.

Figure 8–26 highlights the revised code in the file.

**Figure 8–26** Applying a class to cue text

markup tag for  
the Main class

```
WEBVTT

Title
00:00.500 --> 00:04.000 line:5% align:middle
<c.Main>The Ceiling Dance</c>

Subtitle
00:04.500 --> 00:08.000 line:5% align:middle
from Royal Wedding (1951)

Ending
01:38.000 --> 01:44.000 line:80% position:95% align:end
See more videos at <i>Cinema Penguin</i>
```

displays the website  
title in italics

4. Save your changes to the file and then return to the **cp\_media.css** in your editor.
5. Scroll to the bottom of the file and add the following style rule:

```
::cue(.Main) {
 text-shadow: black 3px 3px 0px;
 font: 2.5em serif;
}
```

Figure 8–27 highlights the style rule for cues belonging to the Main class.

**Figure 8–27** Styling cues based on class name

selector for cue text  
belonging to the  
Main class

```
::cue {
 background: rgba(0, 0, 0, 0.3);
 color: orange;
 font: 1.2em serif;
}

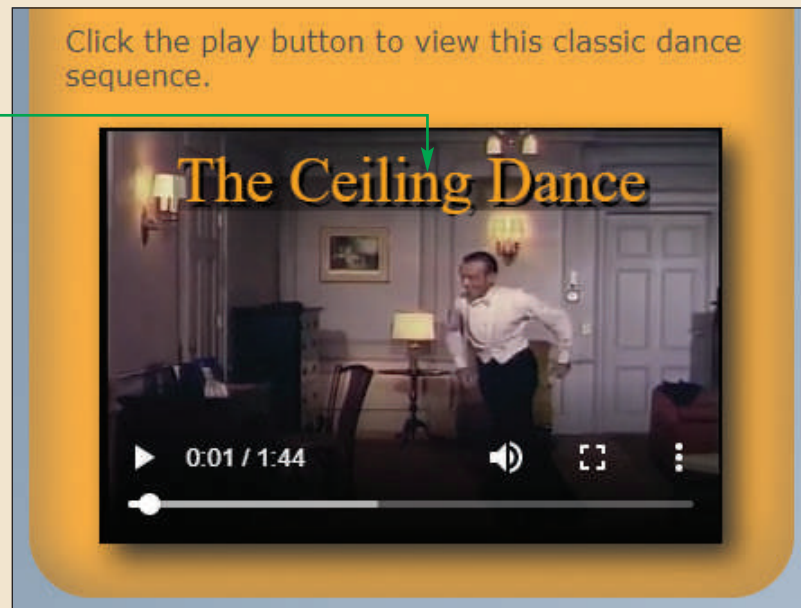
::cue(.Main) {
 text-shadow: black 3px 3px 0px;
 font: 2.5em serif;
}
```

6. Save your changes to the file and then reload the **cp\_royal.html** file in your browser. If you are using Google Chrome or Opera, upload your files to a web server for testing.
7. Play the ceiling dance video and note that the first caption is displayed in a larger font with a black drop shadow. See Figure 8–28.

Figure 8–28

Formatted text from the Title cue

Title cue is displayed in a larger font with a black text shadow



Source: Archive.org

**Trouble?** At the time of this writing, support for video captions is mixed. Only Google Chrome and Opera support all of the text styles used to format captions. Safari supports styles for font size and Firefox supports styles for font colors. Edge does not support caption styling.

Maxine likes your work in creating and formatting the ceiling dance video clip. However, she would like to review other options for embedding multimedia content on her website.

## Using Third-Party Video Players

Prior to the widespread adoption of HTML 5 for embedded video, browsers used plug-ins using the following `object` element

```
<object attributes>
 parameters
</object>
```

where *attributes* define the object and *parameters* are values passed to the object controlling the object's appearance and actions. The `object` element, which replaced the `embed` element introduced in the last session, could be used for any type of content—from sound and video clips to graphic images, PDF files, and even the content of other web pages.

The parameters of the object are defined using the following `param` element

```
<param name="name" value="value" />
```

where the *name* is the name of the parameter and the *value* is the parameter's value. There is no standard list of parameter names and values because they are based on the plug-in used to display the object. For example, the following `object` element could

be used in place of the `embed` element you studied in the first session to insert the `cp_overture.mp3` audio clip:

```
<object data="overture.mp3" type="audio/mp3"
 height="20" width="250">
 <param name="src" value="cp_overture.mp3" />
</object>
```

The presumption is that content of the `audio/mp3` mime-type would be associated with a plug-in that the browser would run to play the audio clip using the `src` and `value` attributes of the `param` element. Thus, the page's author would have to know how to work with the individual plug-ins and provide workarounds for the different plug-ins the user may have installed.

## Exploring the Flash Player

Perhaps the most-used plug-in for video playback was the Adobe Flash player, which was embedded using the following `object` element

```
<object data="url"
 type="application/x-shockwave-flash"
 width="value" height="value">
 <param name="movie" value="url" />
 parameters
</object>
```

where `url` is the location and filename of the file containing the Flash video, and *parameters* are the other `param` elements that manage the appearance and actions of the player. Notice that you must always include at least the `movie` parameter to identify the video file to be played in the Flash player. Figure 8–29 lists some of the other parameters recognized by the Adobe Flash Player.

**Figure 8–29** Parameters of the Flash player

Name	Value(s)	Description
<code>bgcolor</code>	<i>color value</i>	Sets the background color of the player
<code>flashvar</code>	<i>text</i>	Contains text values that are passed to the player as variables to control the behavior and content of the movie
<code>id</code>	<i>text</i>	Identifies the movie so that it can be referenced
<code>loop</code>	<code>true</code>   <code>false</code>	Plays the movie in a continuous loop
<code>menu</code>	<code>true</code>   <code>false</code>	Displays a popup menu when a user right-clicks the player
<code>name</code>	<i>text</i>	Names the movie so that it can be referenced
<code>play</code>	<code>true</code>   <code>false</code>	Starts the player when the page loads
<code>quality</code>	<code>low</code>   <code>autolow</code>   <code>autohigh</code>   <code>medium</code>   <code>high</code>   <code>best</code>	Sets the playback quality of the movie; low values favor playback speed over display quality; high values favor display quality over playback speed
<code>scale</code>	<code>showall</code>   <code>noborder</code>   <code>exactfit</code>	Defines how the movie clip is scaled within the defined space; a value of <code>showall</code> makes the entire clip visible in the specified area without distortion; a value of <code>noborder</code> scales the movie to fill the specified area without distortion but possibly with some cropping; a value of <code>exactfit</code> makes the entire movie visible in the specified area without trying to preserve the original aspect ratio
<code>wmode</code>	<code>window</code>   <code>opaque</code>   <code>transparent</code>	Sets the appearance of the player against the page background; a value of <code>window</code> causes the movie to play within its own window; a value of <code>opaque</code> hides everything behind the player; a value of <code>transparent</code> allows the page background to show through transparent colors in the player

The Flash player can act as a fallback for older browsers that don't support HTML 5 by nesting the `object` element within the `audio` or `video` element. The following code demonstrates how the Flash video from the `cp_dance.swf` file can be set as a fallback video for browsers that can't play either the `cp_dance.mp4` or `cp_dance.webm` files using a native media player:

**TIP**

To hide the Flash player, set the width and height values to 0.

```
<video controls>
 <source src="cp_dance.mp4" type="video/mp4" />
 <source src="cp_dance.webm" type="video/webm" />
 <object data="cp_dance.swf"
 type="application/x-shockwave-flash"
 width="320" height="240">
 <param name="movie" value="cp_dance.swf" />
 <param name="quality" value="high" />
 <p>You must have the Flash Player to play
 the video clip</p>
 </object>
</video>
```

Note that within the `object` element is a final fallback message for users with browsers that cannot play the video clip in any of the formats.

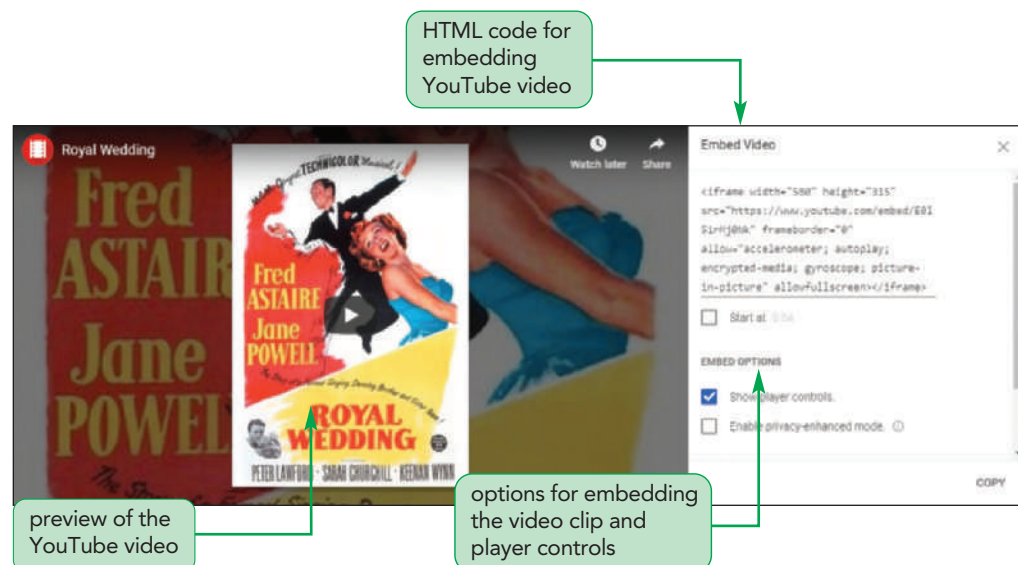
Maxine decides against providing a Flash version of the ceiling dance movie because she feels that the browser support for HTML 5 video is sufficient for users of her website.

## Embedding Videos from YouTube

The biggest supplier of online videos is YouTube with over 1 billion users and 4 billion views per day. YouTube videos are easy to embed in your web page using YouTube's HTML 5 video player, which supports a wide variety of video formats and codecs including H.264, WebM VP8, and WebM VP9.

To share a YouTube video, bring up the video on the YouTube site and click the Share button below the video player. YouTube provides options to post a hypertext link to the video to a multitude of social media sites or to share the link via email. To embed the video within your website, click Embed, which brings up a preview of the embedded player and the HTML code you need to add to your web page. Figure 8–30 shows the embed options on the YouTube website for the full movie version of *Royal Wedding*.

**Figure 8–30** Embedding a YouTube video



Source: YouTube, LLC

The general code for the embedded player is

```
<iframe width="value" height="value" src="url"
 frameborder="0" allowfullscreen>
</iframe>
```

where *url* provides the link to the YouTube video, while the *width* and *height* attributes define the dimensions of the player embedded on your web page. The *frameborder* attribute sets the width of the border around the player in pixels. The *allowfullscreen* attribute allows the user to play the video in fullscreen mode. Finally, the **iframe** element itself is used to mark **inline frames**, which are windows embedded within the web page that display the content of another page or Internet resource. Please note that any videos submitted to YouTube are still subject to copyright restrictions and might be removed if those restrictions are violated.

## HTML 5 Video Players

Rather than using your browser's native video player, you can use one of the many commercial and free HTML 5 video players on the market. Unlike plug-ins, which are applications distinct from your browser, an HTML 5 video player works within your browser with CSS and JavaScript files to present a customizable player that can be adapted to the needs of your business or organization. The YouTube player is one example of an HTML 5 player in which YouTube provides both the player and a hosting service for the video content. Some of the other popular HTML 5 video players include the following:

- **JWPlayer** ([www.jwplayer.com](http://www.jwplayer.com)) A popular commercial player that supports both HTML 5 and Flash video. A free non-commercial version is also available.
- **VideoJS** ([www.videojs.com](http://www.videojs.com)) A free player that works with the popular WordPress HTML framework. VideoJS is extremely customizable and provides support for captions and subtitles.
- **Flowplayer** ([flowplayer.org](http://flowplayer.org)) Originally marketed as a Flash player, Flowplayer is a commercially licensed audio and video player, payable as a one-time fee for perpetual use.
- **Kaltura Player** ([player.kaltura.com](http://player.kaltura.com)) A free open-source video player that can be customized with user-created player controls and skins to match the design of one's website.
- **Wistia** ([wistia.com](http://wistia.com)) An HTML 5 video player focused on business needs and applications.

Any of these video players and many others can cover your basic needs. As your company or organization grows, you may find that you will need the professional service and quality of a licensed-based player with either a one-time or annual subscription.



### Problem Solving: Tips for Effective Web Video

Web video is one of the most important mediums for conveying information and advertising products and services. With inexpensive hardware and sophisticated video editing software, almost anyone can be a movie producer with free, instant distribution available through the web. However, this also means you have a lot of competition, making it hard to get noticed; it is essential that your videos be polished and professional. Here are some things to keep in mind when creating a video for the web:

- *Keep it short.* Studies have shown that web users have an attention span of about 4 seconds. If they don't receive valuable information within that time, they will go to a different site. This means your video must get to the point quickly and keep users' attention. Also recognize that most users will not watch your entire video, so make your key points early.
- *Keep the image simple.* Your video will probably be rendered in a tiny frame, so make your content easier to view by shooting close-ups. Avoid wide-angle shots that will make your subject even smaller to the user's eye. Avoid complex backgrounds and distracting color schemes.
- *Keep the human element.* Eye-tracking studies have shown that people naturally gravitate to human faces for information and emotional content. Use tight shots in which the narrator speaks directly into the camera.
- *Use effective lighting.* Light should be projected onto the subject. Avoid relying solely on overhead lights, which can create distracting facial shadows. Video compression can result in loss of detail; thus, make sure you use bright lighting on key areas to highlight and focus users' attention on the important images in your video.
- *Follow the rule of thirds.* Avoid static layouts by imagining the frame divided into a 3 × 3 grid. Balance items of interest along the lines of the intersection in the grid rather than centered within the frame. If interviewing a subject, leave ample headroom at the top of the frame.
- *Avoid pans and zooms.* Excessive panning and zooming can make your video appear choppy and distorted, and unnecessary movement slows down the video stream.

Finally, consider investing in professional video services that can storyboard an idea for you and that have the experience and expertise to create a finished product that will capture and keep the attention of users and customers.

Maxine is pleased with the work you have done embedding the dance sequence video in the *Royal Wedding* page. In the next session, you will explore how to make your websites come alive with transitions and interactive animation.

## Session 8.2 Quick Check

1. What attribute do you add to the `video` element to display the `dickens.png` file as a preview of the video clip?
  - a. `preview = "dickens.png"`
  - b. `src = "dickens.png"`
  - c. `alt = "dickens.png"`
  - d. `poster = "dickens.png"`
2. Provide the code to insert a subtitle track named "Spanish Version" using the track text in the `spanish.vtt` file.
  - a. `<caption src="spanish.vtt" />`
  - b. `<subtitle src="spanish.vtt" />`
  - c. `<track src="spanish.vtt" />`
  - d. `<video caption="spanish.vtt" />`
3. Provide the code for a track cue in the WebVTT language with the name "Intro" and spanning the time interval from 1 second to 8.3 seconds.
  - a. Intro  
00:01.000 --> 00:08.300
  - b. Intro  
1 --> 8.3
  - c. Intro  
Start: 00:01.000 End: 00:08.300
  - d. Intro  
Start: 1s End: 8.3s
4. Provide WebVTT caption attributes to place the caption of the video window with the caption text left-aligned.
  - a. `line: 1 position: top align: left`
  - b. `top: 0% left: 0% text-align: left`
  - c. `line: 0% position: 0% align: start`
  - d. `top: 0 left: 0 align: start`
5. Provide a style rule to display cue text in a 1.3em cursive font.
  - a. `.cue {font: 1.3em cursive;}`
  - b. `.cue {font: 1.3em cursive;}`
  - c. `:cue {font: 1.3em cursive;}`
  - d. `::cue { font: 1.3em cursive;}`
6. Provide the code to mark the cue text "It was the best of times" as belonging to the voice of the narrator.
  - a. `<v narrator>It was the best of times ...</v>`
  - b. `<caption src="narrator">It was the best of times</caption>`
  - c. `<narrator>It was the best of times</narrator>`
  - d. `<track type="narrator">It was the best of times</track>`
7. Provide the code to display text in the narrator voice with a white font.
  - a. `:cue(v[voice=narrator]) {color: white; }`
  - b. `.cue(v[voice=narrator]) {color: white; }`
  - c. `::cue(v[voice=narrator]) {color: white; }`
  - d. `cue(v[voice=narrator]) {color: white; }`
8. YouTube videos are embedded within which element?
  - a. `plugin`
  - b. `ytube`
  - c. `object`
  - d. `iframe`

## Session 8.3 Visual Overview:

The initial state styles define the object's appearance before the transition.

The transition style defines the properties being changed, the duration of the change, and a timing function for the rate of change.

```
nav#topLinks a {
 color: rgb(255, 255, 255);
 font-size: 1em;
 text-shadow: rgba(0, 0, 0, 1) 1px -1px 1px;
 transition: color 1.5s ease-in 0.5s;
}
```

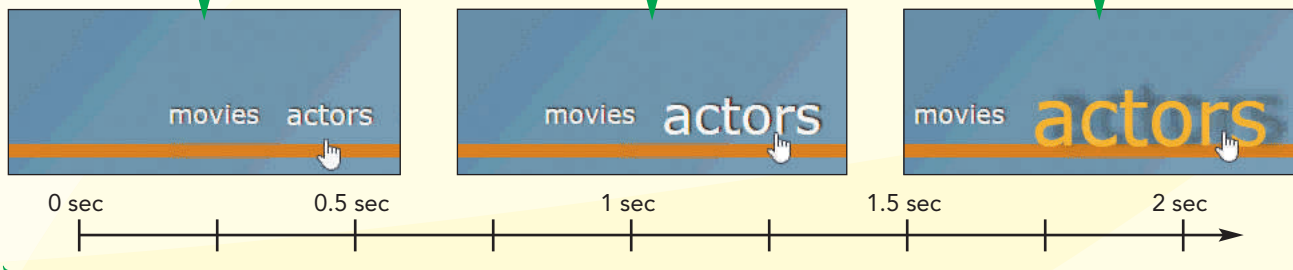
The **transition** style creates a transition between an initial state and an end state.

```
nav#topLinks a:hover {
 font-size: 3em;
 color: rgb(255, 183, 25);
 text-shadow: rgba(0, 0, 0, 0.5) 15px -3px 8px;
}
```

Prior to the hover event, the browser displays the initial state style.

During the hover event, the browser transitions between the initial state and end state style.

At the end of the transition, the browser displays the end state style.



The end state styles define the object's appearance after the transition.

The transition in styles occurs over a 2-second duration during the hover event.

# Transitions and Animations

Each key frame has a progress value and a style rule.

The `@keyframes` rule defines the key frame styles used in an animation.

A name of "spin" is assigned to the animation.

The spin animation rotates the video player.

```
@keyframes spin {
 0% {transform: rotate(0deg);}
 23% {transform: rotate(0deg);}
 28% {transform: rotate(90deg);}
 39% {transform: rotate(90deg);}
 42% {transform: rotate(180deg);}
 68% {transform: rotate(180deg);}
 72% {transform: rotate(270deg);}
 90% {transform: rotate(270deg);}
 94% {transform: rotate(360deg);}
 100% {transform: rotate(360deg);}
}

video {
 animation: spin 104.04s linear infinite;
}

input#rotateVideo:checked~video {
 animation-play-state: running;
}

input#rotateVideo:not(:checked)~video {
 animation-play-state: paused;
}
```

The spin animation is applied to the video element.

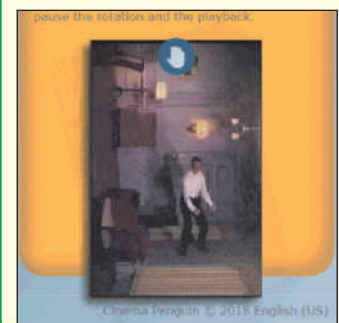
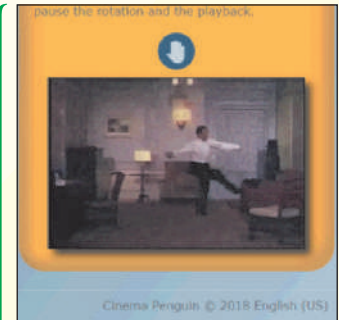
Linear timing applies the transition at a constant rate.

The animation lasts 104.04 seconds.

The `animation` style applies a key frame animation to an object.

The `animation-play-state` style defines whether the animation is running or is paused.

A value of "infinite" causes the animation to run continuously.



Source: Archive.org

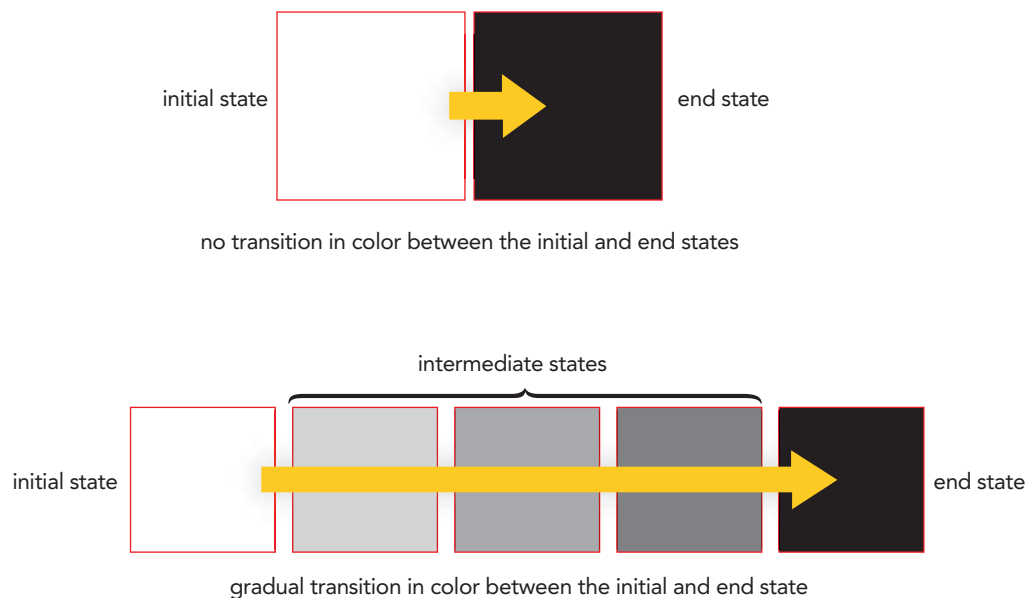
## Creating Transitions with CSS

In this session, you explore how to use CSS transitions and animations to add movement and action to your websites without relying on video files or external plug-ins. You start by examining how to create a CSS transition.

### Introducing Transitions

A **transition** is a change in an object's style from an initial state to an ending state, usually in response to an event initiated by the user or the browser. You have already worked with this type of effect starting in Tutorial 2 when you employed the `hover` pseudo-class to change the style of a hypertext link in response to the user moving the mouse pointer over a hypertext link. However, the `hover` effect is instantaneous with no intermediate steps. If the background color of the link were to change from white to black, there is no instant in which the background is gray. A transition on the other hand, slows down that change and provides intermediate styles so that a white background gradually changes into black, passing through different shades of gray (see Figure 8–31).

**Figure 8–31** Transition from an initial state to an end state



To create this type of transition, you employ the following `transition` style

```
transition: property duration;
```

where *property* is a property of the object that changes between the initial and end states and *duration* is the transition time in seconds or milliseconds. The following style rules use the `transition` style to create a transition for the background style as the hypertext link goes from an initial state to an end state (hovered) over a 4-second interval:

#### TIP

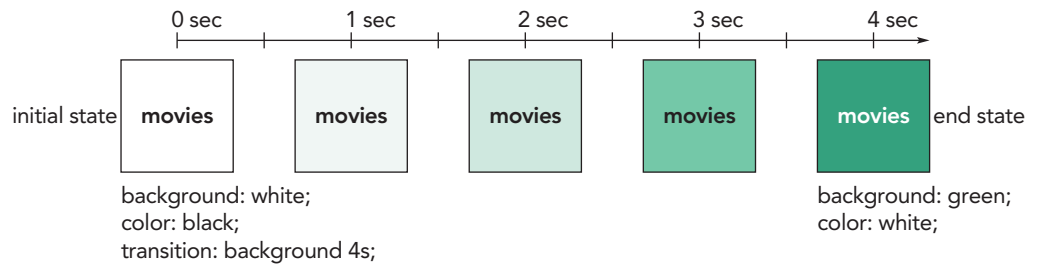
To specify a time in milliseconds, use the "ms" unit.

```
a {
 background: white;
 color: black;
 transition: background 4s;
}
```

```
a:hover {
 background: green;
 color: white;
}
```

In this example, the background color gradually changes from white to light green and then progressively to darker shades of green. This transition happens over the 4-second transition, during which the intermediate states showing the changes in color are displayed (see Figure 8–32).

**Figure 8–32** Applying a transition to the background



### TRY IT

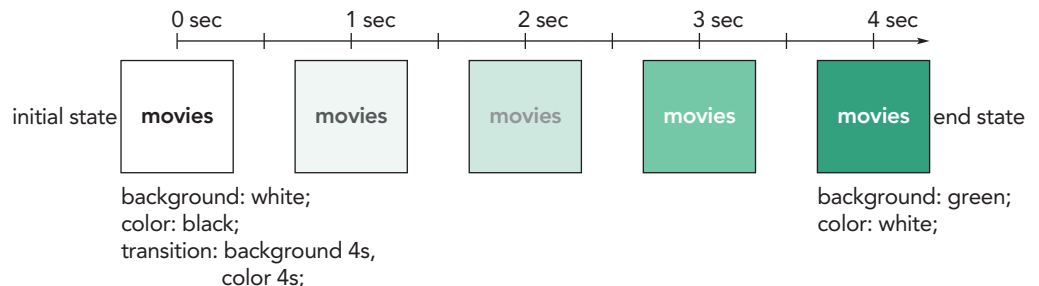
You can explore the CSS transition style using the `demo_transition.html` file in the `html08 ► demo` folder.

Note that only the background changes in the intermediate states. The text color stays black until the end state is reached because the `color` property is not included in the transition. To apply the transition to more than one property, enter the properties and their duration times in the following comma-separated list:

```
transition: background 4s, color 4s;
```

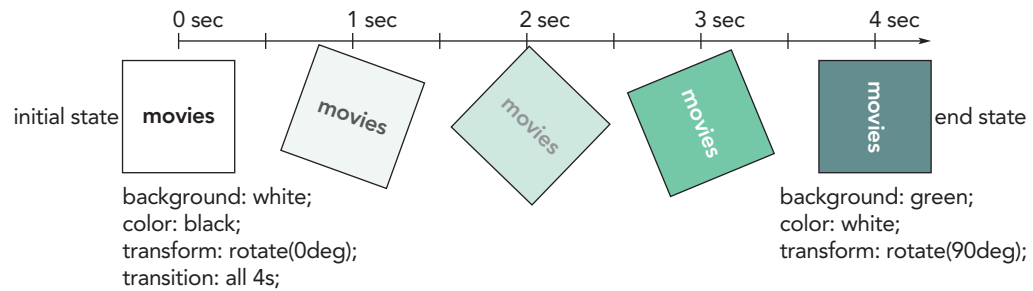
In this example, the background color changes gradually from white to dark green at the same time that the font color changes gradually from black to white (see Figure 8–33).

**Figure 8–33** Applying a transition to the background and text color



The duration values for multiple properties does not need to be the same: one property could change over a 4-second interval while another property might change over 3 seconds (in which case it would reach its end state a full second before the other property).

Rather than writing each property individually, you can apply the transition to all properties by using the keyword `all`. Figure 8–34 shows a transition applied to all of the properties that change between the initial and end states, creating an effect in which the object changes background, text color, and rotates 90° over a 4-second interval.

**Figure 8–34** Applying a transition to background, text color, and rotation

In general, it is more efficient to explicitly list the properties that are changing rather than using the `all` keyword; otherwise, the browser must keep track of all of the style properties to determine which ones are changing and which are not.

**INSIGHT****Properties Affected by Transitions**

Not every property is a candidate for the `transition` style. A general rule of thumb is that, if the property allows for an intermediate value between its initial and end states, it can be used in a transition. Your browser can calculate an intermediate value for properties such as width, height, color, or font size. However, the following style rule can't be used in a transition because there is no in-between state between no display and a block display. Either the image is displayed or it is not.

```
div img {
 display: none;
}
div:hover img {
 display: block;
}
```

To create an effect where an object gradually comes into view, you would apply the transition to the object's opacity, changing the object from completely transparent (opacity = 0) to completely opaque (opacity = 1).

**TIP**

You can also set the properties affected by the transition and their duration using the `transition-property` and `transition-duration` styles.

All current browsers support the `transition` style, but if you need to support older browsers you should include the following browser extensions:

```
-ms-transition: background 4s;
-o-transition: background 4s;
-moz-transition: background 4s;
-webkit-transition: background 4s;
transition: background 4s;
```

In this session, you use the `transition` style without the browser extensions.

**Setting the Transition Timing****TIP**

You can also define the timing-function using the `transition-timing-function` property.

The speed of the transition does not need to be constant; it can vary, with some parts of the transition occurring at a faster rate than others. To define the varying speed of the transition, add the following *timing-function* value to the transition style

```
transition: property duration timing-function;
```

where *timing-function* is one of the following keywords:

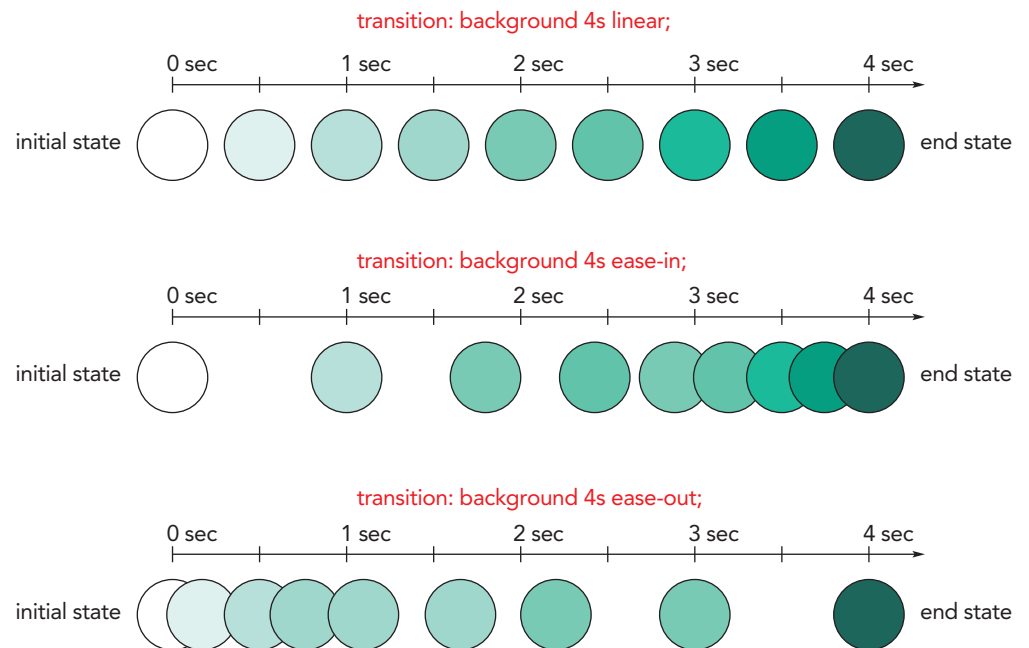
- **ease:** (the default) The transition occurs more rapidly at the beginning and slows down near the end
- **ease-in:** The transition starts slowly and maintains a constant rate until the finish
- **ease-out:** The transition starts at a constant rate and then slows down toward the finish
- **ease-in-out:** The transition starts slowly, reaches a constant rate, and then slows down toward the finish
- **linear:** The transition is applied at a constant rate throughout the duration

### TRY IT

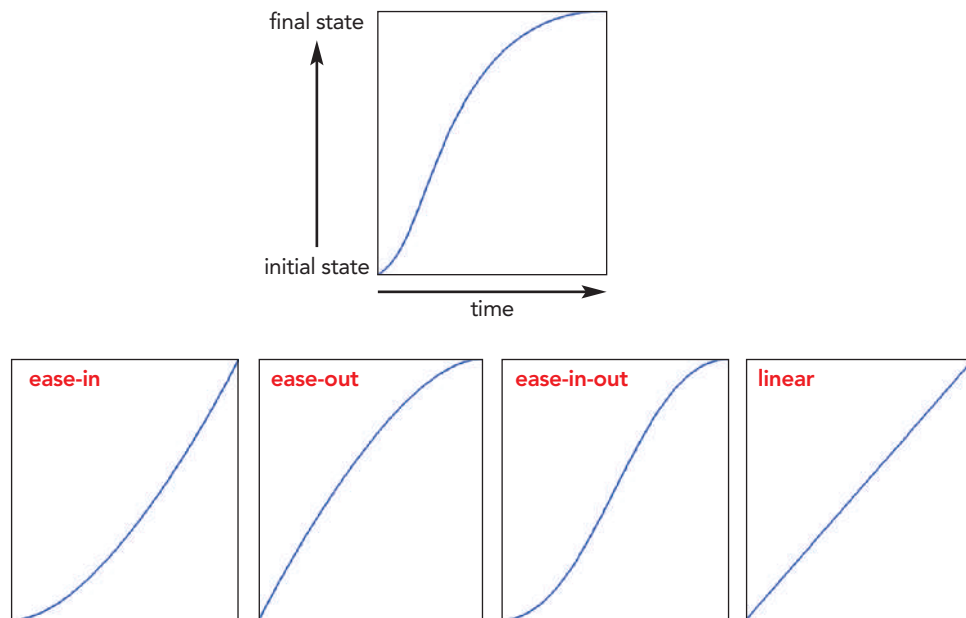
You can see the effect of different transition timings using the `demo_timing.html` file in the `html08` demo folder.

Figure 8–35 compares the linear, ease-in, and ease-out timings when applied to a 4-second transition in the background color. The linear timing changes the color at a constant rate, the ease-in timing changes the background slowly at first and rapidly at the end, and the ease-out timing does the opposite with the most rapid change occurring in the first seconds.

**Figure 8–35** Comparing transition timings



Another way to visualize a timing function is as a graph, which can show the progress of the transition vs. the duration. Figure 8–36 charts the five timing functions where the vertical axis measures the progress of the transition toward completion and the horizontal axis measures the duration. For example, the linear timing is expressed as a straight line because the transition occurs at a constant rate while the other timings contain intervals where the rate of change slows down or speeds up.

**Figure 8–36** Graphing the transition timings

The graphical representation of the timing function is the basis of another measure of transition timing using the following `cubic-bezier` function

```
cubic-bezier(n, n, n, n)
```

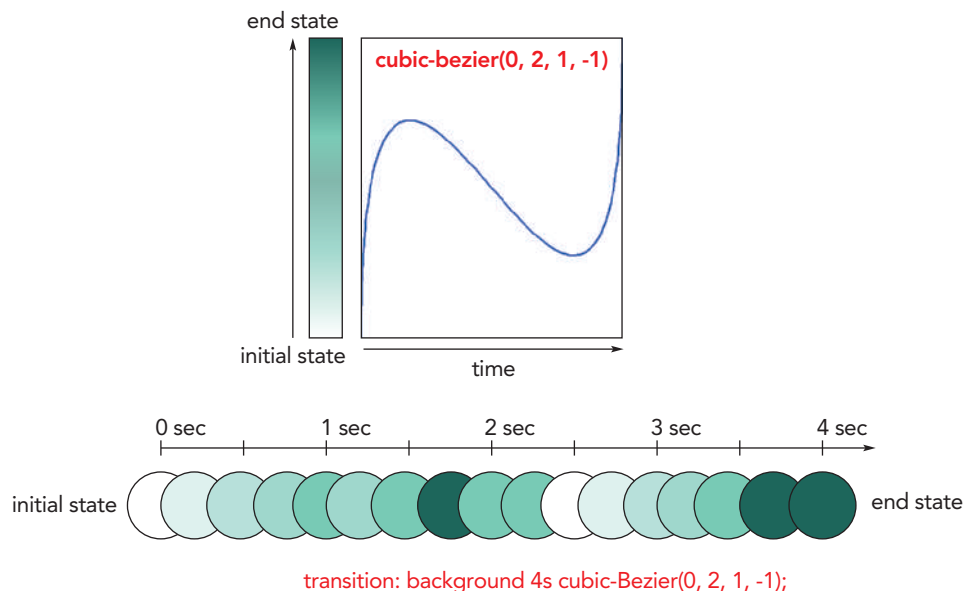
### TRY IT

You can explore timings using a `cubic-bezier` function with the `demo_cubic.html` file in the `html08 ▶ demo` folder.

where the *n* parameter values define the shape of the timing curve. Without going into the detail about the math behind Cubic Bézier curves, the advantage of this approach is that you can define a wide variety of timings, including timings in which the transition can stop, reverse itself, and then go forward again to its end state. Figure 8–37 shows one such timing using the transition

```
transition: background 4s cubic-bezier(0, 2, 1, -1)
```

in which the object's background changes from white toward green and then back toward white again before reaching its final state of dark green.

**Figure 8–37** A cubic-bezier timing

You can generate your own Cubic Bézier curves using the graphing tool at [cubic-bezier.com](http://cubic-bezier.com).

## Delaying a Transition

### TIP

You can also define the timing-function using the `transition-delay` property.

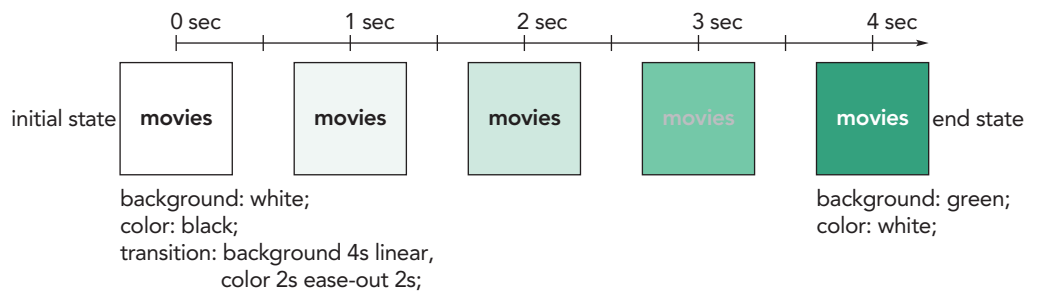
A transition does not need to start immediately after the event that triggers it. By adding the following `delay` value to the transition style you can delay the start of the transition

```
transition: property duration timing-function delay;
```

where `delay` is measured in seconds or milliseconds. The following style creates a 4-second transition for the background style and a 2-second transition for the text color that starts after a 2-second delay (see Figure 8–38):

```
transition: background 4s linear,
 color 2s ease-out 2s;
```

Figure 8–38 Delaying a transition



### TRY IT

You can explore transition delays with the `demo_delay.html` file in the `html08 ► demo` folder.

By using a transition delay you can create interesting effects in which your transitions start and end at different times.

## Creating a Hover Transition

Now that you have reviewed the CSS styles for creating transitions, Maxine wants to apply a transition effect to the navigation list at the top of the *Royal Wedding* page. When the user hovers the pointer over the items in the navigation list, she wants the links to appear to jump out of the page, increasing in size as they move “toward” the reader. Before writing the transition styles, you must first define styles for the initial and end states of these links.

### To define the initial and end state for the navigation links:

1. If you took a break after the previous session, make sure the `cp_royal.html` file is open in your editor.
2. Directly above the closing `</head>` tag, insert a link to the `cp_animate.css` style sheet file.
3. Save your changes to the workbook and then use your editor to open the `cp_animate_txt.css` file from the `html08 ► tutorial` folder. Enter **your name** and **the date** in the comment section of the file and save it as `cp_animate.css`.

4. Go to the Transition Styles section and insert the following style rule that defines the initial state of hypertext links in the navigation list:

```
nav#topLinks a {
 color: rgb(255, 255, 255);
 font-size: 1em;
 letter-spacing: 0em;
 text-shadow: rgba(0, 0, 0, 1) 1px -1px 1px;
}
```

5. Next, add the following style rule that defines the end state for those links in response to the hover event:

```
nav#topLinks a:hover {
 color: rgb(255, 183, 25);
 font-size: 3em;
 letter-spacing: 0.1em;
 text-shadow: rgba(0, 0, 0, 0.5) 15px -3px 8px;
}
```

Figure 8–39 shows the style rules for the initial and end states.

**Figure 8–39****Style rules for the initial state and end state**

initial state displays the hypertext links in white with a small text shadow

end state displays the hypertext links in light orange with a larger font and a larger text shadow

```
/* Transition Styles */

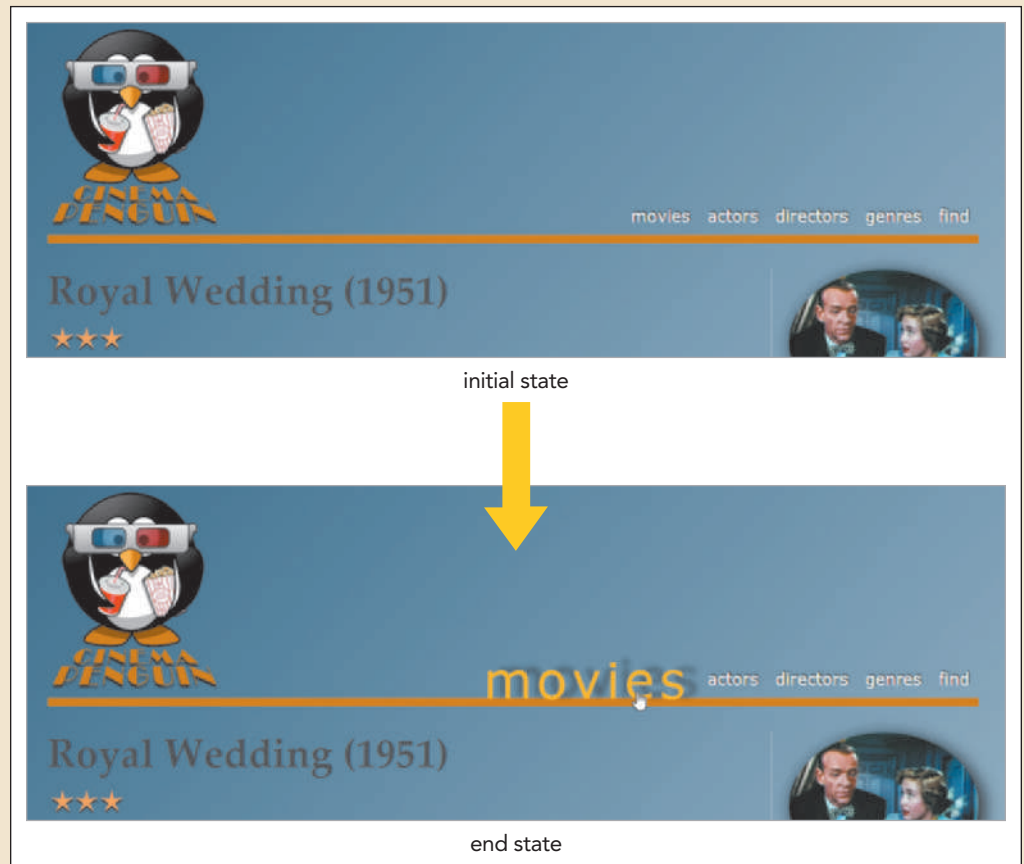
nav#topLinks a {
 color: rgb(255, 255, 255);
 font-size: 1em;
 letter-spacing: 0em;
 text-shadow: rgba(0, 0, 0, 1) 1px -1px 1px;
}

nav#topLinks a:hover {
 color: rgb(255, 183, 25);
 font-size: 3em;
 letter-spacing: 0.1em;
 text-shadow: rgba(0, 0, 0, 0.5) 15px -3px 8px;
}
```

6. Save your changes to the style sheet and then reopen the cp\_royal.html file in your browser.
7. Hover your mouse pointer over links at the top of the page and verify that the hover event causes the style of the links to change. See Figure 8–40.

Figure 8–40

Effect of the hover event on the links at the top of the page



Sources: openclipart.org; Archive.org

**TRY IT**

Transitions can be done in incremental steps using the `steps()` function. Explore how to step through transitions using the `demo_steps.html` file in the `html08 ► demo` folder.

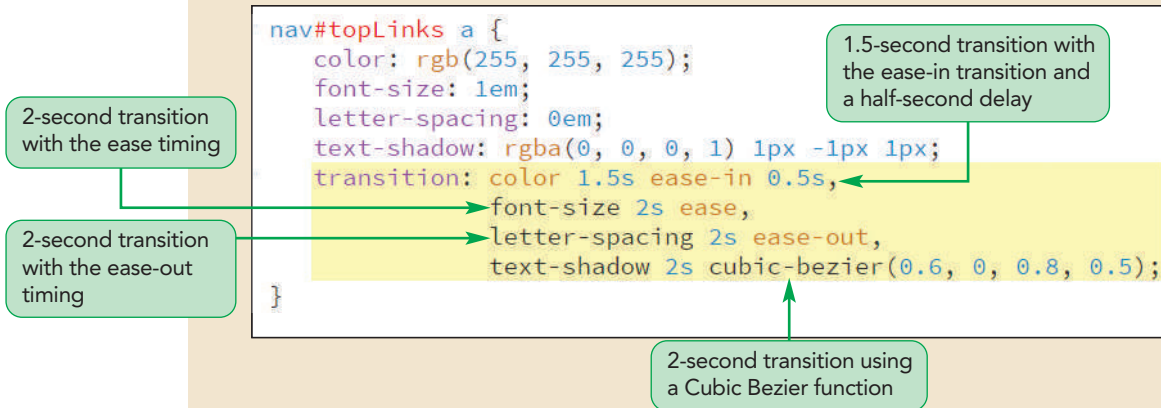
The links change instantaneously from the initial state to the end state and the effect that Maxine wants to achieve of links jumping out of the page is lost. Add the transition property to slow down the transition from initial to end state for the color, font-size, letter-spacing, and text-shadow properties.

**To define styles for the navigation links:**

1. Return to the `cp_animate.css` file and, within the style rule for the `nav#topLinks` a selector, add a new line containing the text **transition:** to insert the transition style.  
Maxine wants you to add a different transition method to each of the four properties that are changing.
2. Within the transition style, add `color 1.5s ease-in 0.5s`, which applies an ease-in transition to the change in the `color` property with a duration of 1.5 seconds after a half-second delay.
3. To the transition style, add `font-size 2s ease`, which applies a 2-second transition to the change in font size.
4. Add `letter-spacing 2s ease-out`, which applies a 2-second ease-out transition to the change in letter spacing.

5. Complete the transition style by adding `text-shadow 2s cubic-bezier(0.6, 0, 0.8, 0.5);`, which applies a 2-second transition to the `text-shadow` property using the `cubic-bezier` function.

Figure 8–41 highlights the transition style.

**Figure 8–41****Setting the transition styles values**

6. Save your changes to the style sheet and then reload `cp_royal.html` in your browser.
7. Hover the mouse pointer over the links in the top navigation list and verify that each link changes state over a 2-second duration. Note that the transition works in both directions, repeating the transition in reverse as you move the mouse pointer away from the links.

Figure 8–42 shows the change in the hypertext link over the 2-second duration of the transition.

Figure 8–42

## Running the transition



Source: Archive.org

As useful as they are for adding visual effects to a website, transitions have several limitations:

- Transitions can only be run when a CSS property is being changed, such as during the hover event. You cannot design a transition to run automatically when the page loads.
- Transitions are run once. You can't have a transition loop repeatedly.
- You can define the initial and end states of the transition but you can't define the styles of the intermediate states.

To overcome these limitations, you can create an animation.

## INSIGHT

### Creating an Asymmetric Transition

By default, a CSS transition is a **symmetric transition** because the transition going from the initial state to the end state is the reverse of the transition going from the end state back to the initial state. Thus, a text color that goes from red to blue as the mouse moves over an object during the hover event will go from blue back to red as the mouse moves away.

To create an **asymmetric transition** involving different transitions in the two directions, you must define transitions for both the initial and end states. For example, with the hover event you would create two transition styles:

```
a {transition: properties}
a:hover {transition: properties}
```

The style rule for the `a` selector is applied when the mouse moves away from the page object and the style rule for the `a:hover` selector is applied when the mouse moves toward and over the page object. Note that the two transitions can involve totally different effects and durations. One transition might involve changes to font size and color while the other transition might only modify the background color. One transition can take place over a span of 2 seconds while the other might take 4 seconds.

## TRY IT

To explore asymmetric transitions, open the `demo_asym.html` file from the `html08 ► demo` folder.

## Animating Objects with CSS

Animation is a technique of creating the illusion of movement by displaying a sequence of changing images, known as **key frames**, in rapid succession. The brain interprets the rapidly changing key frames not as distinct images but rather as a single image in motion. CSS replaces the concept of key frame images with key frame styles that are applied in rapid succession to a page object. While a transition is limited to two style rules defined at the initial and end states, an animation can contain multiple styles defined for each key frame.

### The @keyframes Rule

To define a sequence of key frames in CSS, apply the following `@keyframes` rule

```
@keyframes name {
 keyframe1 {styles;}
 keyframe2 {styles;}
 ...
}
```

where *name* provides the name or title of the animated sequence, *keyframe1*, *keyframe2*, and so on defines the progress of individual key frames, and *styles* are the styles applied within each key frame. The *keyframe1*, *keyframe2*, and so on values are expressed as percentages where 0% indicates a key frame at the start of the

sequence and 100% represents the sequence's last frame. The 0% and 100% values can also be replaced with the keywords `from` and `to`.

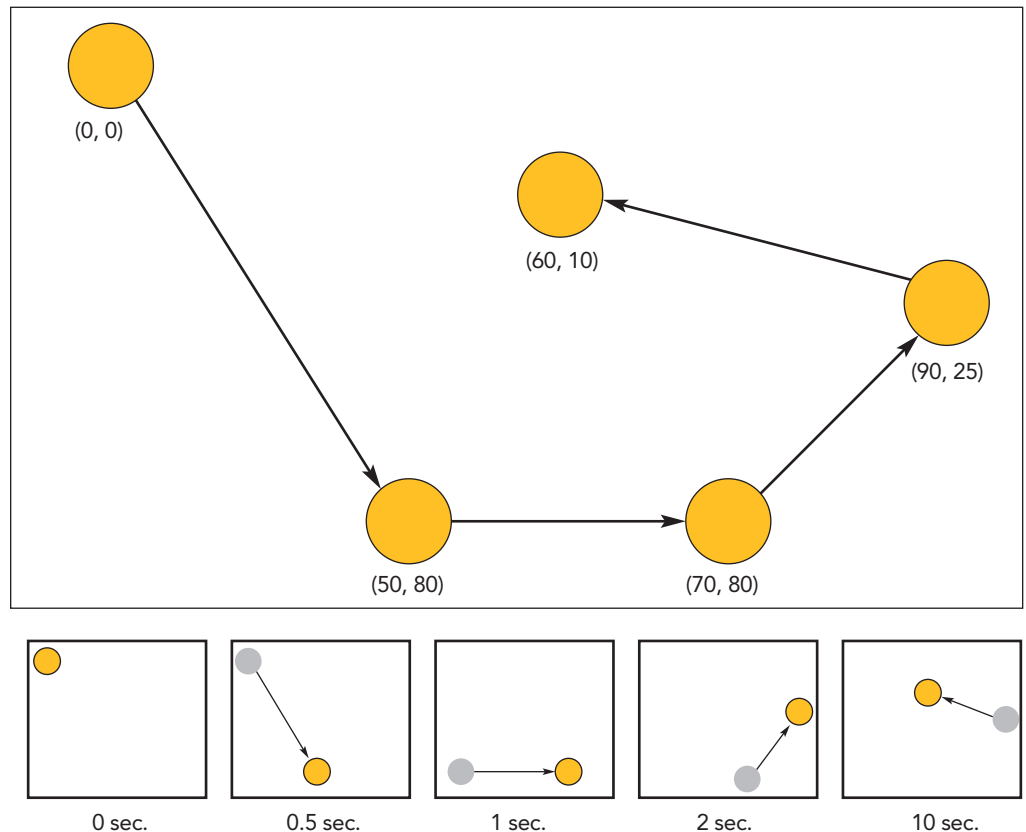
Key frames can be used to move objects across the page as in the following

`@keyframes` rule that traces out an object's flight path (see Figure 8–43).

```
@keyframes flight {
 from {left: 0px; top: 0px;}
 5% {left: 50px; top: 80px;}
 10% {left: 70px; top: 80px;}
 20% {left: 90px; top: 25px;}
 to {left: 60px; top: 10px;}
}
```

Figure 8–43

A path animation over a 10-second duration

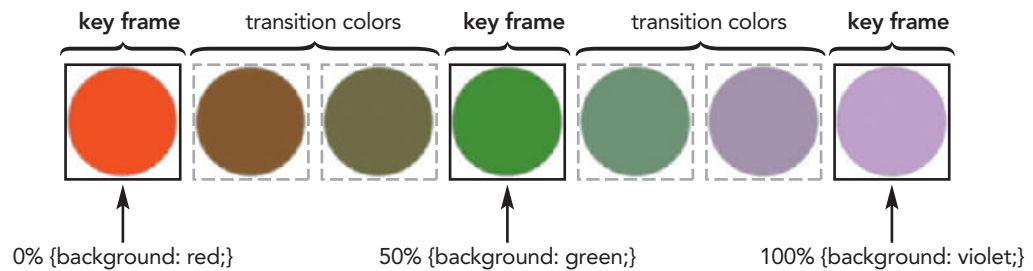


The pace at which the object moves through this path is determined by the percentages assigned to each key frame, allowing the same animation to be run at any speed by changing the total duration of the sequence. With the 10-second duration shown in Figure 8–43, the object would take 2 seconds to reach the (90, 25) coordinate and 8 more seconds to complete the circuit to the (60, 10) point. If the total duration were 20 seconds, the (90, 25) point would be reached after 4 seconds and 16 more seconds would be required to reach the last point.

Each pair of key frames can be treated as a transition with the browser providing the in-between styles, such as in the rainbow animation shown in the following code:

```
@keyframes rainbow {
 0% {background: red;}
 50% {background: green;}
 100% {background: violet;}
}
```

Figure 8–44 shows the frames of the rainbow animated sequence in which the key frames define the background color at the 0%, 50%, and 100% mark while the in-between colors are added by the browser to create a smooth transition from one key frame to the next.

**Figure 8–44** Transitions between key frames

To specify the timing between one current key frame and the next, add the following animation-timing-function to the key frame style rule

```
animation-timing-function: type;
```

where *type* is ease (the default), ease-in, ease-out, ease-in-out, linear, or the cubic-bezier function. Note that any timing value entered for the last key frame is ignored because there are no key frames to transition to.

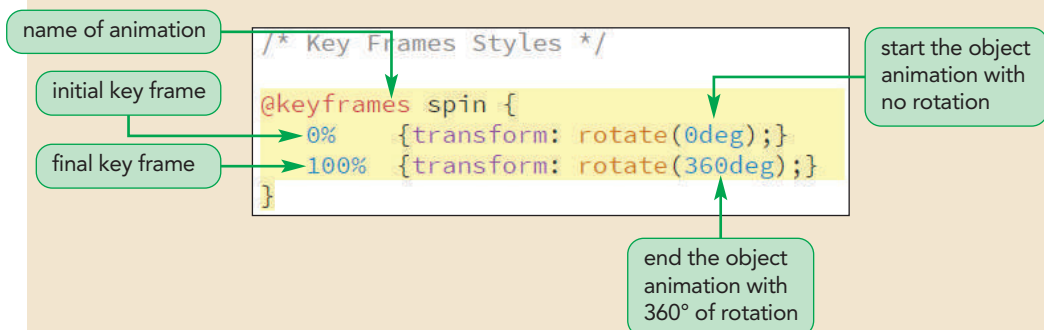
Now that you have seen how to write the code for an animation, you will create an animated sequence for the *Royal Wedding* page. The illusion of Fred Astaire dancing on the ceiling was achieved by placing Astaire within a rotating set with a fixed camera mount. Maxine wants to remove this illusion by rotating the video player so that Astaire always appears at the bottom of the video frame. First, define an animation named “spin” that rotates an object through one complete revolution.

### To create the spin animation:

1. Return to the **cp\_animate.css** file in your editor.
2. Scroll down to the Key Frame Styles section and insert the following @keyframes rule to define the spin animation:

```
@keyframes spin
{
 0% {transform: rotate(0deg);}
 100% {transform: rotate(360deg);}
}
```

Figure 8–45 highlights the initial code for the spin animation.

**Figure 8–45** Defining animation key frames

3. Save your changes to the style sheet.

Now that you have defined the animation sequence, you apply it to the video player.

## Applying an Animation

A key frames animation is applied to an object using the following `animation-name` and `animation-duration` properties

```
animation-name: keyframes;
animation-duration: times;
```

where *keyframes* is a comma-separated list of animations applied to the object using the names from the `@keyframes` rule and *times* are the lengths of each animation expressed in seconds or milliseconds. The following style rule applies the rainbow animation defined earlier to the web page body, creating an effect where the page background changes from red to green to violet over an interval of 5 seconds.

```
body {
 animation-name: rainbow;
 animation-duration: 5s;
}
```

Figure 8–46 describes other CSS properties used to control the behavior and style of the animation.

Figure 8–46

Animation properties

Property	Description
<code>animation-name = keyframes</code>	Assigns the <i>keyframes</i> animation to the object
<code>animation-duration = time</code>	Sets the length of the animation in seconds or milliseconds (default = 0s)
<code>animation-timing-function = ease ease-in ease-out ease-in-out linear cubic-bezier(n,n,n,n)</code>	Defines the default timing between key frames in the animation (default = ease)
<code>animation-delay = time</code>	Sets the delay time in seconds and milliseconds before animation is started (default = 0s)
<code>animation-iteration-count = value infinite</code>	Specifies the number of times the animation is played, where <i>value</i> is an integer and <i>infinite</i> repeats the animation without stopping (default = 1)
<code>animation-direction = normal reverse alternate alternate-reverse</code>	Defines the direction of the animation, where <i>normal</i> plays the animation as defined in the <code>@keyframes</code> rule, <i>reverse</i> reverses the order, <i>alternate</i> plays the animation in the normal direction followed by the reverse direction (for multiple iterations), and <i>alternate-reverse</i> plays the animation in reverse direction followed by normal direction (default=normal)
<code>animation-fill-mode = none backwards forwards both</code>	Defines what styles from the animation are applied to the object outside the time it is running, where <i>none</i> does not apply any styles, <i>backwards</i> applies the styles from the first key frame, <i>forwards</i> applies the styles from the last key frame, and <i>both</i> applies styles in both directions (default=none)
<code>animation-play-state = running paused</code>	Defines whether the animation is running or paused (default = running)

The following style rule applies to two animations applied to the `img` element:

```
img {
 animation-name: rainbow, spin;
 animation-duration: 6s, 2s;
 animation-timing-function: ease-in, linear;
 animation-iteration-count: 1, 3;
}
```

The rainbow animation is applied for 6 seconds using ease-in timing between the key frames and lasting 1 iteration. The spin animation is applied for 2 seconds using linear timing and repeated three times.

All of the animation properties can be combined into the following shortcut animation style

```
animation: name duration timing-function delay iteration-count
direction fill-mode play-state
```

where the *name*, *duration*, *timing-function*, and so on values match the values for the corresponding properties listed in Figure 8–46. The animation name must be listed first, then the other properties can be listed in any order; except, if both a duration and a delay time are specified, the first time value is assumed to refer to the duration and the second to the delay. Omitted values are assumed to have their default value. For example, the following style plays the rainbow animation for 4 seconds using linear timing, repeating that animation twice:

```
animation: rainbow 4s linear 2;
```

You can support older browsers by using browser extensions. Thus, the preceding style could be entered as:

```
-ms-animation: rainbow 4s linear 2;
-o-animation: rainbow 4s linear 2;
-moz-animation: rainbow 4s linear 2;
-webkit-animation: rainbow 4s linear 2;
animation: rainbow 4s linear 2;
```

In this session, you use the animation styles without browser extensions.

Once an animation has been defined and applied to an object, it will run automatically when the page is loaded. Apply the spin animation to the video player for 4 seconds using linear timing and set the iteration count to infinite so that the video player spins continuously.

### To apply the spin animation:

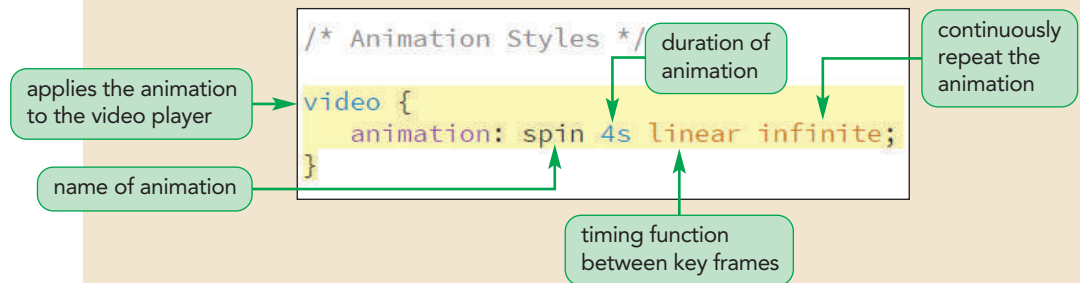
1. Scroll down to the Animation Styles section within the `cp_animate.css` file and insert the following style rule:

```
video {
 animation: spin 4s linear infinite;
}
```

Figure 8–47 highlights the code used to spin the video player.

Figure 8–47

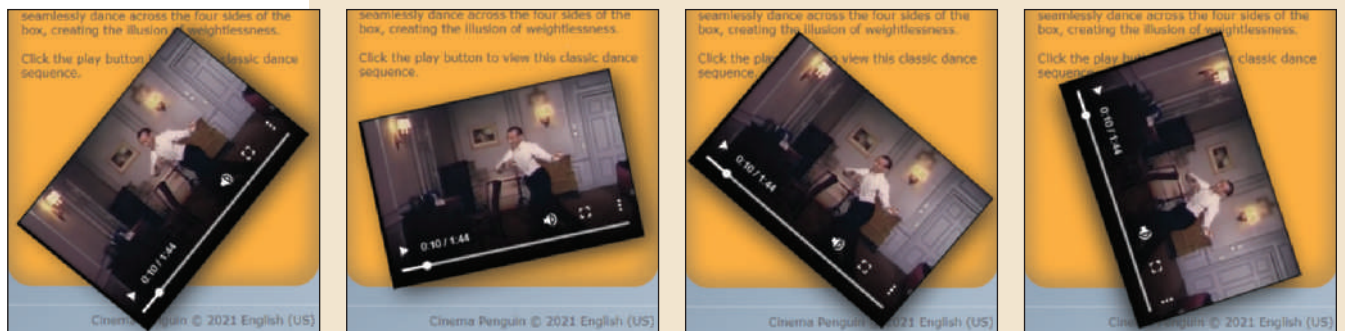
## Applying the spin animation



2. Save your changes to the style sheet.
3. Reload the `cp_royal.html` file in your browser. Verify that when the page loads, the animation rotating the video player starts automatically. See Figure 8–48.

Figure 8–48

## Rotating the video player



Source: Archive.org

**Trouble?** Videos played on some mobile devices will automatically be displayed in full screen mode so that you cannot see any animation effects on the video player.

Rather than having the video player rotate continuously when the page loads, Maxine wants the spin animation to be initiated and paused by the user. You can do this using web form controls.

## INSIGHT

### Stepping between Key Frames

To create a smooth transition between states or key frames, the browser will automatically generate a set of intermediate frames. You can specify the number of intermediate frames using the following `steps()` function

```
steps(number)
```

where *number* is the number of frames between each key frame. The `steps()` function is useful when you want to apply a specific number of discrete frames. The following style applies the clock animation for a duration of 60 seconds broken into 60 frames, each of which would occupy 1 second of time:

```
animation: clock 60s steps(60);
```

One application of the `steps()` function is to create animated images, known as **sprites**, made of several frames shown in rapid succession at timed steps. You can explore sprites in Case Problem 2 at the end of this tutorial.

## Controlling an Animation

In many applications, you will not want your animation to start automatically when the page loads but rather in response to the user clicking a form button. You can control an animation using JavaScript, but for this project, you limit yourselves to a CSS solution.

Because an animation can have two states of operation—play or pause—you can use a check box to control the animation. If the check box is selected the animation will play; if the check box is not selected the animation will be paused. First, you will create the check box alongside an empty label. Note that you will write the content of the label shortly.

### To create the animation check box:

1. Return to the `cp_royal.html` file in your editor.
2. Scroll down to the `video` element and, directly before the `<video>` tag, insert the following `checkbox` and `label` elements:

```
<input type="checkbox" id="rotateVideo" />
<label for="rotateVideo"></label>
```

Figure 8–49 highlights the HTML code.

Figure 8–49

### Creating a check box and label to run the animation

```
<input type="checkbox" id="rotateVideo" />
<label for="rotateVideo"></label>
<video controls poster="cp_photo2.png">
 <source src="cp_dance.mp4" type="video/mp4" />
 <source src="cp_dance.webm" type="video/webm" />
 <track kind="captions" label="Dance Captions" src="cp_captions.vtt" default />
 <p>To play this video clip, your browser needs to
 support HTML5.</p>
</video>
```

3. Save your changes to the file.

Next, you will define two style rules for the check box: one in which the check box is checked and other in which it is not. If the check box is checked, you want the video clip to be played; you do this by setting the value of `animation-play-state` property for the video to `running` as in the following style rule:

```
input#rotateVideo:checked~video {
 animation-play-state: running;
}
```

Remember that this style rule only affects the animation that rotates the video player, it has no effect on the playing of the video itself. The style rule uses the `~` symbol as a sibling selector to select the video that follows the `rotateVideo` check box in the document.

To pause the animation, you use the same selector but include the following `not` pseudo-class. You use the `not` pseudo-class in order to apply the `animation-play-state` property with a value of `paused` to the video player when the `rotateVideo` check box is not checked:

```
input#rotateVideo:not(:checked)~video {
 animation-play-state: paused;
}
```

Thus, depending on whether the `rotateVideo` check box is checked or not, the animation will either be running or paused. Add these two styles to the `cp_animate.css` style sheet.

### To create styles for animation playback:

1. Return to the `cp_animate.css` file in your editor.
2. Directly after the style rule for the `video` element, insert the following style rule to run the animation:

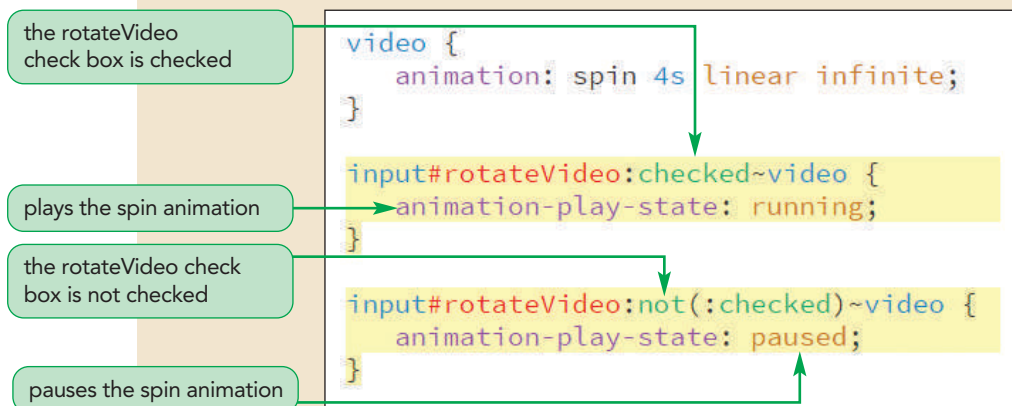
```
input#rotateVideo:checked~video {
 animation-play-state: running;
}
```

3. Add the following style rule to pause the animation:

```
input#rotateVideo:not(:checked)~video {
 animation-play-state: paused;
}
```

Figure 8–50 highlights the style rules to run and pause the animation.

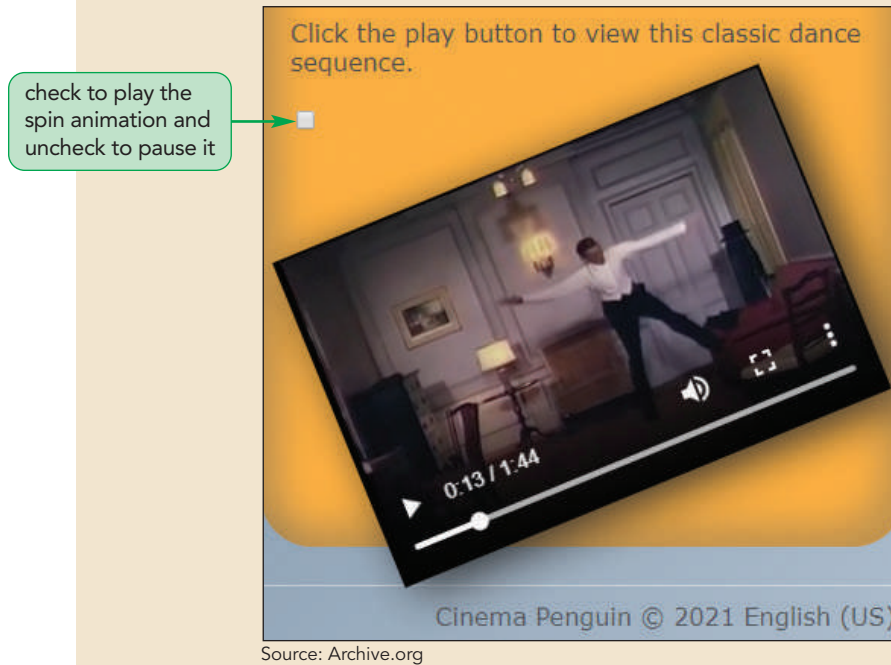
**Figure 8–50** Creating a check box and label to run the animation







- 4. Save your changes to the file and then reload the cp\_royal.html file in your browser.
- 5. Check the check box next to the video player to start the spin animation. Uncheck the check box to pause the animation. See Figure 8–51.



Figure 8–51

## Using a check box to control the animation playback



Maxine wants to replace the check box with a more attractive icon that displays the  symbol to run the animation and the  symbol to pause the animation. The two symbols have the Unicode values `\21bb` and `\270b` respectively. This is where you use the blank label by adding text to the label displaying either the  symbol when the check box is not checked or the  symbol when the check box is checked. You will add this text using the `after` pseudo-element and `content` property in the following style rules:

```
input#rotateVideo:not(:checked)+label::after {
 content: "\21bb";
}
```

to add the  symbol when the check box is not checked. Then use the style rule that follows to insert the  symbol when the check box label is checked:

```
input#rotateVideo:checked+label::after {
 content: "\270b";
}
```

Add both of these style rules to the style sheet and hide the `rotateVideo` check box so that only the icons are displayed.

**To create styles for animation playback:**

1. Return to the **cp\_animate.css** file in your editor.
2. Go to the Animation Icon Styles section and insert the following style rule to hide the rotateVideo check box:
 

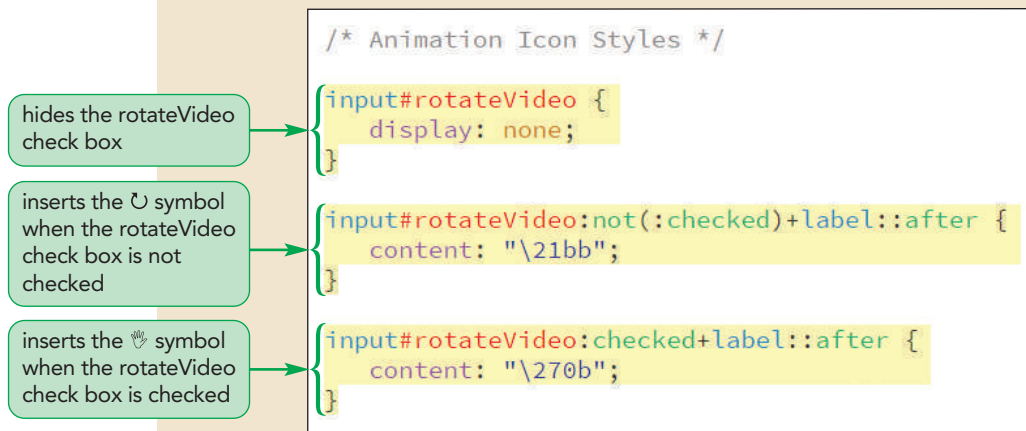
```
input#rotateVideo {
 display: none;
}
```
3. Add the following style rule to insert the ⏮ symbol after the check box label if the check box is not checked:
 

```
input#rotateVideo:not(:checked)+label::after {
 content: "\21bb";
}
```
4. Add the following style rule to insert the ⏸ symbol if the check box is checked:
 

```
input#rotateVideo:checked+label::after {
 content: "\270b";
}
```

Figure 8–52 highlights the style rules to insert the ⏮ and ⏸ icons.

**Figure 8–52**     **Displaying playback icons**



5. Save your changes to the file and then reload the **cp\_royal.html** file in your browser.
6. Verify that the ⏮ symbol appears at the top left of the video player. Click the ⏮ icon and verify that the video player starts to rotate and the icon changes to ⏸. Confirm that as you continue to click the ⏮ and ⏸ icons the animation alternately plays and pauses.

Maxine wants you to modify the format of the icons to make them larger and more attractive. She also wants the icons to always appear above the video player. She also wants to make sure the icon is never obscured by the rotating video player. You can ensure this by setting the z-index value of the label to 2.

### To format the play and pause icons:

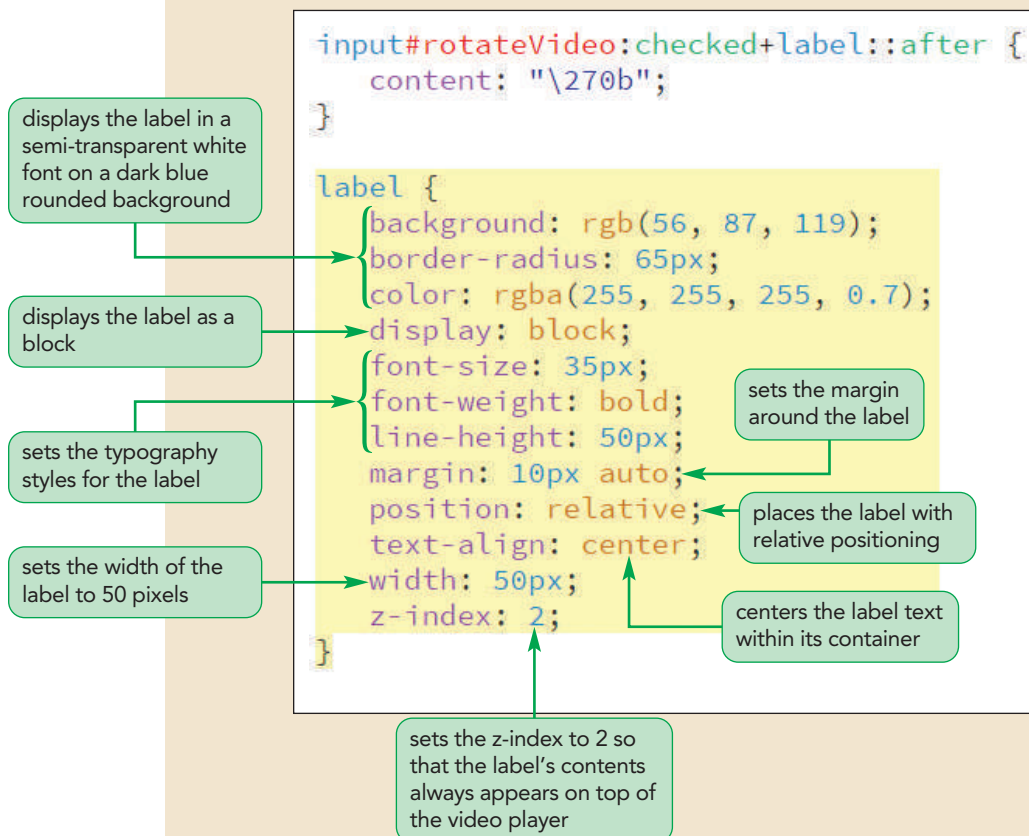
1. Return to the `cp_animate.css` file in your editor.
2. Add the following style rule at the bottom of the file:

```
label {
 background: rgb(56, 87, 119);
 border-radius: 65px;
 color: rgba(255, 255, 255, 0.7);
 display: block;
 font-size: 35px;
 font-weight: bold;
 line-height: 50px;
 margin: 10px auto;
 position: relative;
 text-align: center;
 width: 50px;
 z-index: 2;
}
```

Figure 8–53 shows the style rules for the check box label text.

Figure 8–53

CSS style rule for the play and pause icons





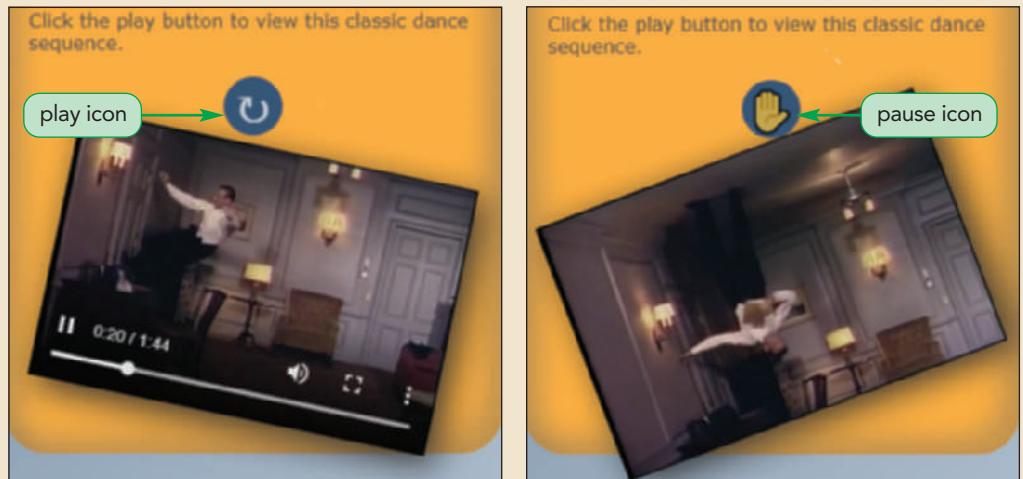
3. Save your changes to the file and then reload `cp_royal.html` in your browser.
4. Click the  and  icons to play and pause the animation. Figure 8–54 shows the revised format of the two icons.

Figure 8–54

## Revised play and pause icons



Source: Archive.org

Now that you have created controls that play and pause the spin animation, your next task is to revise the spin animation so that the rotating of the video player matches the rotation of the cage in which Fred Astaire danced. The cage was not in constant rotation during the dance but started and stopped as Astaire moved through each of its four sides. After studying the video, Maxine has determined the time intervals in which the cage rotates and the intervals in which it stays still. Use her figures now to revise the spin animation sequence.

**To revise the spin sequence:**

1. Return to the **cp\_animate.css** file in your editor and scroll to the Key Frames Styles section.
2. Directly after the 0% key frame, insert the key frames:
 

```
23% {transform: rotate(0deg);}
28% {transform: rotate(90deg);}
```

to keep the video player rotation at 0° up to 23% of the sequence and then gradually rotating the player from 0° to 90° in the 23% to 28% interval.
3. The cage stays at 90° of rotation up to 39% of the dance sequence and then from 39% to 42% it rotates to 180°. Insert the key frames:
 

```
39% {transform: rotate(90deg);}
42% {transform: rotate(180deg);}
```
4. The cage stays at 180° of rotation up to 68% of the sequence and in the interval from 68% to 72% it rotates to 270°. Insert the key frames:
 

```
68% {transform: rotate(180deg);}
72% {transform: rotate(270deg);}
```
5. Finally, the cage stays at 270° of rotation up to 90% of the sequence and then rotates to 360° at the 94% mark. Insert the key frames:
 

```
90% {transform: rotate(270deg);}
94% {transform: rotate(360deg);}
```

The length of the animation needs to match the length of the video clip to ensure that the rotation of the video player matches the rotation of the cage used in the video.

6. Change the duration of the animation from 4s to **104.04s**, which is the length of the Ceiling Dance video clip.

Figure 8–55 highlights the new and revised code in the style sheet.

**Figure 8–55** Defining the key frames to match the video

new key frames that rotate the video player at different intervals

animation duration set to 104.04 seconds to match the length of the video clip

```
@keyframes spin {
 0% {transform: rotate(0deg);}
 23% {transform: rotate(0deg);}
 28% {transform: rotate(90deg);}
 39% {transform: rotate(90deg);}
 42% {transform: rotate(180deg);}
 68% {transform: rotate(180deg);}
 72% {transform: rotate(270deg);}
 90% {transform: rotate(270deg);}
 94% {transform: rotate(360deg);}
 100% {transform: rotate(360deg);}
}

/* Animation Styles */

video {
 animation: spin 104.04s linear infinite;
}
```

7. Save your changes to the file.

Your final task is to keep the animation and the video player in sync so that when the animation starts, the video player starts and when the animation pauses, the video player pauses. Because there are no CSS styles that control video playback, this task requires an external JavaScript program. Maxine gives you the `cp_spin.js` file that contains a JavaScript program that will play and pause the video whenever the spin animation runs or pauses.

### To link to the `cp_spin.js` file:

1. Return to the `cp_royal.html` file in your editor.
2. Directly before the closing `</head>` tag, insert the following script element:

```
<script src="cp_spin.js"></script>
```

Figure 8–56 highlights the `script` element in the document head.

**Figure 8–56** Using a script to keep the animation and the video in sync

script file used to start and pause the video playback in sync with the animation

```
<link href="cp_animate.css" rel="stylesheet" />
<script src="cp_spin.js"></script>
</head>
```

You need to provide instructions to the user about how to use the animation.

3. Scroll down to the paragraph directly before the rotateVideo check box and within the paragraph, add the following text:

**To see the dance as it appeared on the movie set, go to the start of the clip and click ⌂ to rotate and play the video. Click ⏸ to pause the rotation and the playback.**

Figure 8–57 highlights the newly added text.

Figure 8–57

## Instructions to run the animation

```
<p>Click the play button to view this classic dance
sequence. To see the dance as it appeared on the movie set, go to the
start of the clip and click ⌂ to rotate and play the video.
Click ⏸ to pause the rotation and the playback.</p>
<input type="checkbox" id="rotateVideo" />
<label for="rotateVideo"></label>
<video controls poster="cp_photo2.png">
```

character code  
for the ⌂ symbol

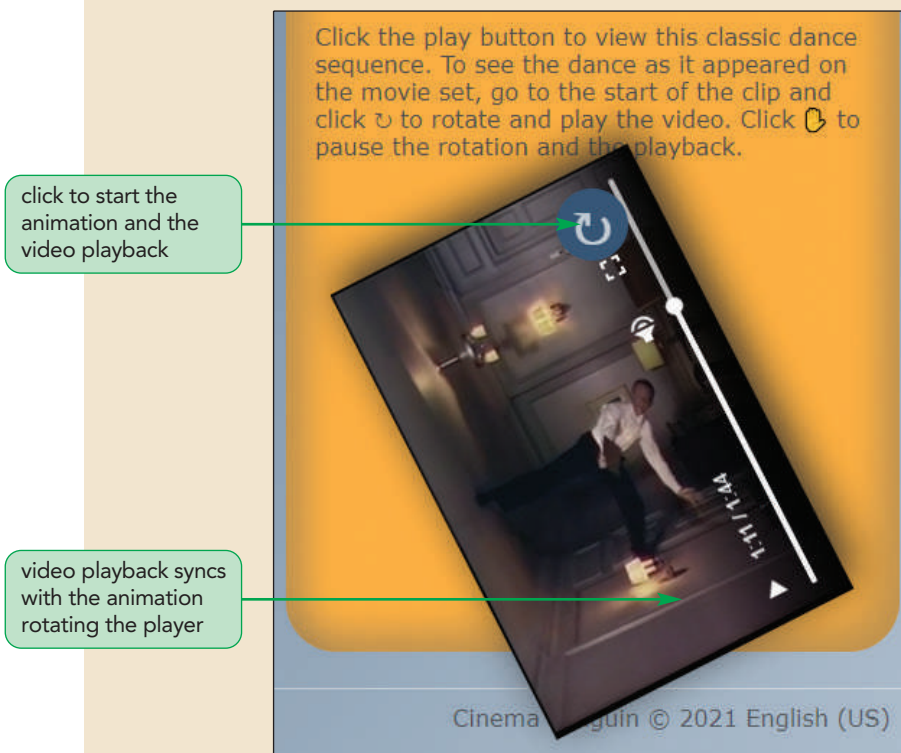
character code  
for the ⏸ symbol

4. Save your changes to the file and then reload cp\_royal.html in your browser.
5. Click the ⌂ icon to start both the animation and the video player. Verify the rotation of the player is synchronized to the dance so that Astaire always appears upright within the video window.
6. Click the ⏸ icon and verify that it pauses the animation and video playback.

Figure 8–58 shows the rotated video player in sync with the rotation of the movie set.

Figure 8–58

## Final version of the Ceiling Dance animation



Source: Archive.org

**Trouble?** Do not use the controls on the video player itself to pause or play the video; the animation will not sync up with the dance.

You have completed your work on the *Royal Wedding* page for the Cinema Penguin website. Maxine is very pleased with the enhancements you have made to the page and feels that with the audio, video, and animation you have added, the page has really come alive and provided useful insight regarding how the illusion of the Ceiling Dance was achieved. Maxine will continue to work on developing new pages of interest for her website and will contact you for help on future projects.



## PROSKILLS

### Problem Solving: Safe Animation and Motion Sensitivity

One area of web accessibility that is too often overlooked is the health impact that flashy animated effects can have on large segments of the population. For individuals afflicted with migraines, epilepsy, or vestibular disorders such as vertigo, large and rapidly changing animations can induce symptoms of nausea, headaches, and dizziness. Some of the most adverse reactions occur in response to large movement across an entire screen such as might occur with a full screen wipe of page content. Other areas of concern are animations involving apparent rapid motion, twisting in 3D space, or unexpected shifts in the direction of motion—all of which can leave viewers feeling disoriented.

In designing a safe animation for all of your users, keep in mind the following principles:

- *Keep the Animation Restrained.* Don't have your animation dominate the user experience. It should augment your design, not overwhelm it.
- *Give the User Control.* Whenever possible, give users the ability to ignore or turn off an animated sequence.
- *Test your Page Animation-Free.* Some users may need to turn off your animated sequences. Make sure your website is still useful and informative for them.

All of which is not to say that animation should be eliminated from website designs. A well-designed animation can provide useful information to the viewer and augment the user experience. Good design is inviting to everyone.

## REVIEW

### Session 8.3 Quick Check

1. Provide a style that changes the font size over a 2-second interval and the font color over a 3-second interval.
  - a. `font-size: 2sec color 3sec;`
  - b. `transition: font-size 2s color 3s;`
  - c. `transition: font-size/2s color/3s;`
  - d. `animate: font-size 2s color 3s;`
2. Which timing function should you use to start a transition at a constant rate and then slow down toward the end state?
  - a. `ease-in`
  - b. `linear`
  - c. `ease`
  - d. `ease-out`
3. Which timing function should you use for a transition that starts out rapidly and slows down near the end?
  - a. `ease-in`
  - b. `linear`
  - c. `ease`
  - d. `ease-out`

4. Provide the style that creates a transition on all properties over a 5-second interval using linear timing and a half-second delay.
  - a. `transition: all 5s linear 0.5;`
  - b. `transition: all linear 5.5s;`
  - c. `transition: all linear 4.5s;`
  - d. All of the above
5. Which of the following is a way that animations differ from transitions?
  - a. Animations can be run at any time.
  - b. Animations can be run more than once or looped repeatedly.
  - c. Animations can contain Intermediate styles in addition to the initial and end states.
  - d. All of the above
6. Provide an animation named `biggerText` that sets the font size to 1em at 0% and 2em at 100% of the animation duration.
  - a. 

```
@animate biggerText {
 0% {font-size: 1em;}
 100% {font-size: 2em;}
}
```
  - b. 

```
@keyframes biggerText {
 0% {font-size: 1em;}
 100% {font-size: 2em;}
}
```
  - c. 

```
animate biggerText {
 0% {font-size: 1em;}
 100% {font-size: 2em;}
}
```
  - d. 

```
keyframes biggerText {
 0% {font-size: 1em;}
 100% {font-size: 2em;}
}
```
7. Provide the style property to run the `biggerText` animation over an interval of 4.5 seconds.
  - a. `animate: biggerText 4.5s;`
  - b. `@animation: biggerText 4.5s;`
  - c. `keyframe: biggerText 4.5s;`
  - d. `transition: biggerText 4.5s;`
8. Provide the style to run an animation in reverse.
  - a. `animation-reverse: true;`
  - b. `animation-direction: backwards;`
  - c. `animation: backwards;`
  - d. `animation-direction: reverse;`
9. What value do you add to the animation style to have the animation loop repeatedly?
  - a. `loop = true`
  - b. `stop = no`
  - c. `infinite`
  - e. `loop = always;`

## Coding Challenge 1

Data Files needed for this Coding Challenge: `code8-1_txt.html`, `code8-1_video_txt.css`, `captions8-1_txt.vtt`, `code8-1_styles.css`, `ollie.mp4`, `ollie.webm`

You are working on a skateboard website that provides instruction in various skateboarding techniques. In this coding challenge you will complete a web page detailing how to perform a trick known as a *High Ollie* in which the skateboarder jumps over high obstacles. You will augment the page with a video of the trick being performed. See Figure 8–59.

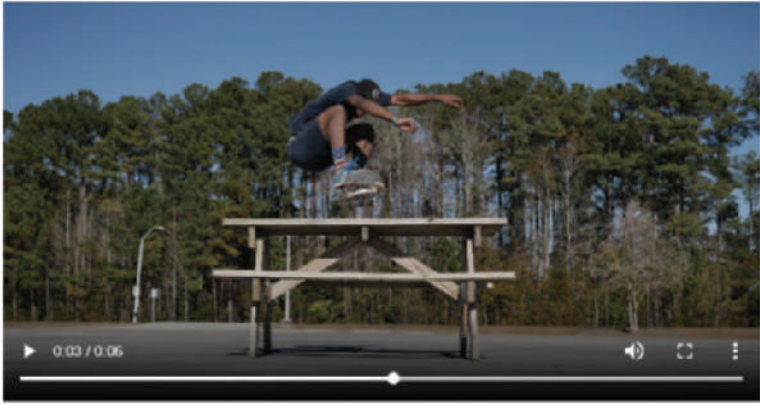
Figure 8–59

Coding Challenge 8-1 example page

## Learning the High Ollie

A High Ollie is built on the principles of a basic Ollie in which you slide your front foot forward and stomp down, popping the board to get a bit of air. To go higher, work in the following steps:

- 1. Get a good stance** Place your front foot near the middle of the board and your back foot down by tail without hanging off the tail. Your front foot should be just behind the last two bolts on the front part of your skateboard, completely parallel to them.
- 2. Extend your feet** Once you are in a stable position, move your front foot toward the center of your board by about two inches. You get lift by sliding the front foot and the more room you leave for sliding, the higher you will go.
- 3. Slide to the front** Slide your front foot all the way to the nose of the board, up to the part where the board starts to curve upward. You want your foot to get caught where the board starts to rise once you start executing the high ollie.
- 4. Jump!** Pop the board hard, sucking your feet up with the board, and jumping higher than normal. Try to get your knees almost all the way up to your chest. You can raise your arms for extra lift.
- 5. Stand tall** You have to have your shoulders centered on the board to keep stable. Do not hunch because that will throw off your balance and reduce your height. Remember: The knees are lifted up; the head is NOT pushed down!
- 6. Be smooth** Your motions should be fluid and smooth with no jagged or awkward movements that will kill your momentum. Timing is everything.



Keep practicing and as you become more comfortable with the High Ollie, you will find yourself getting more and more air!

Source: <https://www.videvo.net/video/skateboarder-picnic-table-jump/3556/>  
(public domain video)

Do the following:

1. Open the `code8-1_txt.html` and `code8-1_video_txt.css` files from the `html08 ► code1` folder. Enter *your name* and *the date* in each document and save the files as `code8-1.html` and `code8-1_video.css` respectively.
2. Go to the `code8-1.html` file in your editor. Within the head section insert a `link` element linking the page to the `code8-1_video.css` style sheet file.
3. Below the ordered list insert a `video` element with the following features:
  - a. Add the `controls` attribute to the `video` element to show player controls.
  - b. Add the source files `ollie.mp4` and `ollie.webm` to the `video` element. Include the mime-type for both video files.

- c. If the user's browser doesn't support HTML video, display a paragraph containing the text **Upgrade your browser to view embedded videos.**
  - d. Add a track using the contents of the captions8-1.vtt file. Set the value of the `kind` attribute to **captions** and add the label **Video Captions.**
4. Save your changes to the HTML file.
5. Go to the **code8-1\_video.css** file in your editor. Add a style rule for the `video` element that:
  - a. Displays the video player as a block element,
  - b. Sets the width of the player to 75%, and
  - c. Sets the top/bottom margin to 10 pixels and the left/right margins to auto.
6. Save your changes to the CSS file.
7. Open the **captions8-1\_txt.vtt** file in your editor. Create a cue with the label **Caption** going from 3 to 6 seconds of the video and displaying the text **A High Ollie** during that interval.
8. Save the file as **captions8-1.vtt**.
9. Test your page in your browser, verifying that you can play the video clip of the High Ollie and that a caption appears from 3 to 6 seconds of the video. (Note: If you are using Google Chrome or Opera, you will have to upload your files to a server if you wish to see the captions.)
10. Submit the completed file to your instructor.

## CODE

## Coding Challenge 2

Data Files needed for this Coding Challenge: **code8-2\_txt.html**, **code8-2\_trans\_txt.css**, **code8-2\_styles.css**, **image01.png** – **image06.png**

Transitions with the hover effect can be used in image galleries to display large versions of thumbnail images. Figure 8–60 shows an image gallery of Renaissance sketches that are enlarged in response to the hover event. Use your knowledge of CSS transitions to complete this web page.

Figure 8–60

Coding Challenge 8-2 example page



Source: Public Domain

Do the following:

1. Open the **code8-2\_txt.html** and **code8-2\_trans\_txt.css** files from the **html08 ► code2** folder. Enter **your name** and **the date** in each document and save the files as **code8-2.html** and **code8-2\_trans.css** respectively.
2. Go to the **code8-2.html** file in your editor. Within the head section insert a `link` element linking the page to the **code8-2\_trans.css** file. Study the contents of the file and then save your changes.
3. Go to the **code8-2\_trans.css** file. At the bottom of the file create a style rule for the `figure` element during the hover event that:
  - a. Sets the width to 400 pixels,
  - b. Sets the `z-index` value to 2, and
  - c. Applies the transition for the change in the `width` property over a 2-second interval.
4. Create a style rule for `img` elements within hovered `figure` elements that:
  - a. Sets the width to 100%
  - b. Applies the `drop-shadow()` and `grayscale()` filter functions,
  - c. Sets the drop shadow offset to 10 pixels in the horizontal and vertical directions and the blur radius to 20 pixels,
  - d. Sets the blur value to 0, and
  - e. Applies a transition to the change in the `filter` property over a 2-second interval.
5. Create a style rule for `figcaption` elements within the hovered `figure` element, that sets the font size to 1.2em, and applies the change in font size over a 2-second transition.
6. Create a style rule for the `#fig1` through `#fig6` elements which are hovered, that rotates the elements to 0 degrees using the `transform` property, and applies a 2-second transition to all properties of those figures.
7. Save your changes to the style sheet.
8. Open **code8-2.html** in your browser and verify that when you hover your mouse pointer over any of the six images, the figures are rotated to 0 degrees, increased in size, moved on top of the other figure images, and the figure captions appear below the figures.
9. Submit the completed file to your instructor.

## CODE

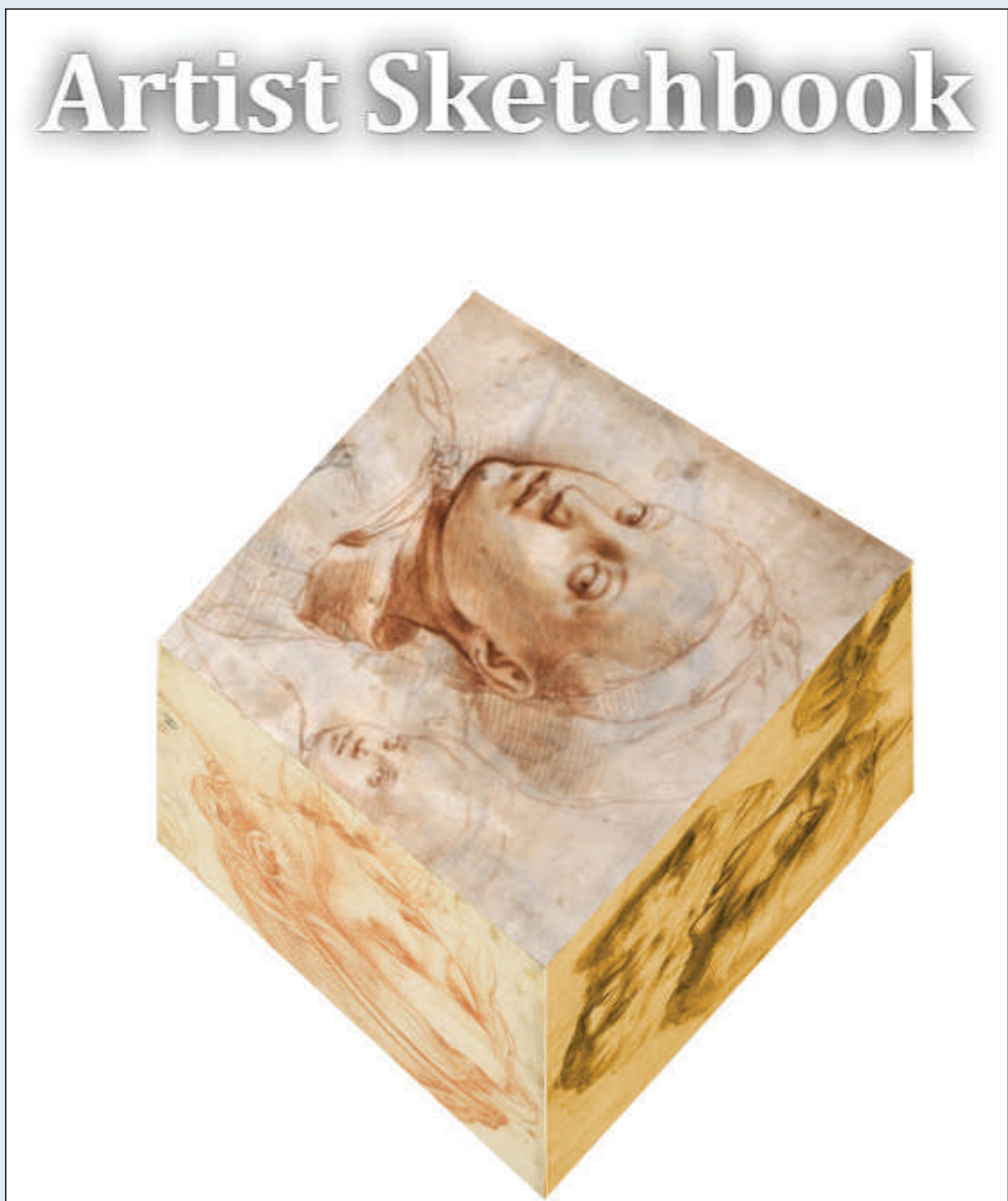
### Coding Challenge 3

**Data Files needed for this Coding Challenge: code8-3\_txt.html, code8-3\_anim\_txt.css, code8-3\_styles.css, image01.png – image06.png**

Animation can be used with 3D objects to create the illusion of objects moving and spinning in 3D space. Figure 8–61 shows the opening page of the Artist Sketchbook web page in which six drawings from Renaissance masters have been combined in a 3D cube. You will use CSS animation to spin the cube, showing all faces of the cube during the animation.

Figure 8–61

Coding Challenge 8-3 example page



Source: Public Domain

Do the following:

1. Open the **code8-3\_txt.html** and **code8-3\_anim\_txt.css** files from the **html08 ► code3** folder. Enter ***your name*** and ***the date*** in each document and save the files as **code8-3.html** and **code8-3\_anim.css** respectively.
2. Go to the **code8-3.html** file in your editor. Within the head section insert a `link` element that links the page to the **code8-3\_anim.css** style sheet file. Take some time to review the contents of the file and then save your changes.
3. Go to the **code8-3\_anim.css** file in your editor. Several keyframe animations have already been created for you. Add a keyframe animation named **spinCube** that contains the following frames:
  - a. At 0% apply the `transform` property with the `rotateX()` function set to `24deg` and the `rotateY()` function set to `40deg`
  - b. At 50% change the value of the `rotateX()` function to `204deg` and the `rotateY()` function to `220deg`
  - c. At 100%, change the value of the `rotateX()` function to `384` and the `rotateY()` function to `400deg`

- When the page is initially opened you want it to display animation of the six faces of the cube being assembled. Create a style rule that applies the `moveFront` keyframe animation to the `#faceFront` object. Set the duration of the animation to 3 seconds and set the `animation-fill-mode` property to `forwards`.
- Repeat Step 4 for the `#faceBack`, `#faceBottom`, `#faceLeft`, `#faceTop`, and `#faceRight` objects using the `moveBack`, `moveBottom`, `moveLeft`, `moveTop`, and `moveRight` animations.
- After the cube is assembled you want it to rotate. Create a style rule that applies the `spinCube` animation to the `#cube` object, running the animation over a 3-second duration after a delay of 3 seconds. Use the `linear` timing function and have the animation loop without ending.
- Save your changes to the file.
- Open the **code8-3.html** file in your browser. Verify that in the first 3 seconds the cube is assembled by moving the six faces into position and that after 3 seconds, the cube begins spinning to show all the faces of the cube.
- Submit the completed file to your instructor.

## DEBUG

## Coding Challenge 4

**Data Files needed for this Coding Challenge:** `code8-4_txt.html`, `code8-4_debug_txt.css`, `code8-4_styles.css`, `amex.png`, `discover.png`, `master.png`, `visa.png`

You can use transitions and animations in web forms to draw your eyes to particular form elements or to highlight invalid form data. You've been given a website that uses a transition effect to highlight invalid credit card values; however, the transition effects and animation are not working. You will edit the style sheet of the page shown in Figure 8–62 to fix the problem.

Figure 8–62 Coding Challenge 8-4 example page

Sources: American Express; Discover Bank; MasterCard; Visa, Inc.

Do the following:

- Open the **code8-4\_txt.html** and **code8-4\_debug\_txt.css** files from the `html08 ► code4` folder. Enter *your name* and *the date* in each document and save the files as **code8-4.html** and **code8-4\_debug.css** respectively.
- Go to the **code8-4.html** file in your editor. Within the head section insert a `link` element that links the page to the `code8-4_debug.css` style sheet file. Save your changes.
- Open the **code8-4.html** file in your browser. When the page opens, the `h1` heading should slide into the page from the left and the form should drop in from the top. Neither is happening. Open the **code8-4\_debug.css** file in your editor and study the code that applies the animation effect to the `form#payment` object and the `h1` element. Fix any mistakes in the code that you find.

4. Save your changes and reopen **code8-4.html** in your browser. Verify that the opening of the page runs the drop-in and slight-right animations.
5. When the Credit Card Number box and the CSC box receive the focus, a transition effect should appear that slowly adds a glowing brown shadow around the boxes. The glowing brown shadow appears but without a transition effect. Return to the **code8-4\_debug.css** file in your editor. Study the code that applies a transition effect to the `input#cardBox` and `input#CSC` objects, and correct any mistakes you find in the code.
6. Save your changes and reopen **code8-4.html** in your browser. Verify that when the Credit Card Number and CSC boxes receive the focus a transition effect appears that adds the glowing brown shadow to the boxes.
7. A 3-digit number should be entered in the CSC box. If something other than a 3-digit number is entered, the box should wiggle back and forth to indicate invalid data. That is not currently happening. Return to the **code8-4\_debug.css** file in your editor. Study the code that applies the transition effect to the `input#csc` object when invalid data is entered. Correct any mistakes in the code that you find.
8. Save your changes and reopen **code8-4.html** in your browser. Verify that when you enter invalid data in the CSC box, the box wiggles back and forth to indicate that the data is not valid.
9. Submit the completed file to your instructor.

## Review Assignments

**Data Files needed for the Review Assignments:** `cp_astaire_txt.html`, `cp_animate2_txt.css`, `cp_media2_txt.css`, `cp_captions2_txt.vtt`, 2 CSS files, 3 PNG files, 1 MP3 file, 1 MP4 file, 1 OGG file, 1 WebM file

Maxine has been working on new pages at the *Cinema Penguin* website. She has returned for help on a page featuring a profile of Fred Astaire. Maxine created a sound clip from one of Astaire's songs in the *Royal Wedding* and a video clip of a dance in that movie featuring Astaire's duet with a hat rack. She wants both clips embedded on the page. In addition, Maxine wants you to try a new hover transition for the links at the top of the page. Finally, she wants you to create an animation that displays a scrolling marquee of the Fred Astaire filmography. Figure 8–63 shows a preview of the final page.

Figure 8–63 Fred Astaire biography page



**Cinema Penguin**

movies actors directors genres find

## Fred Astaire (1899 – 1987)

Fred Astaire was born on May 10, 1899 in Omaha, Nebraska. His first stage experiences came in a brother/sister act with his sister Adele. Together they played the vaudeville circuit and advanced to productions on Broadway and in London. The partnership broke up with Adele's marriage in the early 30s.

Astaire's famous partnership with [Ginger Rogers](#) started with a minor role in [Dying Down to Rio](#). Astaire and Rogers would go along to make ten films together, many of which are considered classics of the genre. Astaire insisted that all dance sequences be filmed with a stationary camera in a single shot. This was a marked contrast from the style of the times in which aerial shots, quick takes, and zooms were used to enhance (and sometimes detract!) from the dance. Astaire would famously quip, "Either the camera will dance, or I will."

At the end of the 30s, the Astaire/Rogers partnership broke up and Astaire went on to make a series of classic films, including [Holiday Inn](#) with [Bing Crosby](#), [Easter Parade](#) with [Judy Garland](#), and [Royal Wedding](#) with [Jane Powell](#).

In later years, Astaire focused more on straight acting roles. He received an Academy Award nomination for his supporting actor role in [The Towering Inferno](#).

Fred Astaire died on June 22, 1987, leaving behind the wonderful memories and wonderful performances of perhaps the greatest dancer of the 20th century.

### Filmography

Hover over the Marquee to Pause

1961	<a href="#">Ghost Story</a>	Ricky Haxthorne
1979	<a href="#">The Man in the Santa Claus Suit</a>	Proprietor
1978	<a href="#">A Family Vacation Down</a>	Ted Long
1976	<a href="#">The Amazing Spiderman</a>	Daniel Hughes
1974	<a href="#">The Towering Inferno</a>	Harlow Claiborne

### Listen Up

Fred Astaire's prowess as a singer is overshadowed by his unequalled artistry in dance; however many of his contemporaries admired Astaire's lyricism and phrasing. Irving Berlin felt him to be the equal of Jolson or Crosby. The clip below comes from the song *Ev'ry Night at Seven* from *Royal Wedding*.

0:00 / 0:34

### In Focus

Fred Astaire's most famous partner was [Ginger Rogers](#), but the truth is that he could make anyone look good. The clip below is from *Royal Wedding* where his partner was ... a hat rack.

**The Hat Rack Dance**

0:00 / 1:11

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Sources: openclipart.org; Dr. Macro; Archive.org

Complete the following:

1. Use your HTML editor to open the **cp\_astaire\_txt.html**, **cp\_media2\_txt.css**, and **cp\_animate2\_txt.css** files from the html08 ► review folder. Enter *your name* and *the date* in the comment section of each file, and save them as **cp\_astaire.html**, **cp\_media2.css** and **cp\_animate2.css** respectively. In addition, use your text editor to open the **cp\_captions2\_txt.vtt** file from the same folder and save it as **cp\_captions2.vtt**.
2. Go to the **cp\_astaire.html** file in your editor. Insert links to the **cp\_media2.css** and **cp\_animate2css** files. Take some time to study the contents and structure of the document.

3. Scroll down to the `aside` element titled “Listen up”. Directly after the introductory paragraph, insert an audio clip with the audio controls displayed in the browser. Add two possible source files to the audio clip: `cp_song.mp3` and `cp_song.ogg`. Identify the mime-type of each audio source. If the browser does not support HTML 5 audio, display a paragraph with the message **Upgrade your browser to HTML 5**.
4. Scroll down to the `aside` element titled “In Focus” and after the introductory paragraph insert a video clip with the video controls enabled and display the poster image `cp_poster.png`. Add two possible sources to the video clip: `cp_hatrack.mp4` and `cp_hatrack.webm`. Include the mime-type for each video source. If the user’s browser does not support HTML 5 video, display a paragraph with the message **Upgrade your browser to HTML 5**.
5. Directly after the two video sources in the `video` element you created in the last step, insert a caption track using the captions you will specify in the `cp_captions2.vtt` file in later steps. Give the caption track the label **Movie Captions** and set it as the default track for the video clip.
6. Save your changes to the file and then open the **cp\_captions2.vtt** file in your text editor. Add an initial line to the text file indicating that this file is in WEBVTT format.
7. Add the following track cues to the `cp_caption2.vtt` file:
  - a. A Title cue appearing in the 0.5 seconds to 5-second interval containing the text **The Hat Rack Dance** enclosed in a class tag with the name **Title**. Set the `line` and `align` attributes for the caption to **10%** and **middle** respectively to place the caption centered and near the top of the video window.
  - b. A Subtitle cue in the 5.5- to 9-second interval with the text **from Royal Wedding (1951)**. Enclose “Royal Wedding (1951)” within `<i>` tags to italicize it. Place the caption at the 10% line and align the caption text in the middle.
  - c. A Finish cue displayed from the 1 minute 5 second mark to the 1 minute 11 second mark and containing the text **See more videos at Cinema Penguin**. Enclose “Cinema Penguin” within `<i>` tags and place the caption at the 80% line and 90% position with the caption text aligned at the end.
8. Save your changes to the file and then go to the **cp\_media2.css** file in your editor. Within the Media Styles section, insert a style rule for all `audio` and `video` elements that displays them as blocks with a width of 95%. Center the `audio` and `video` elements by setting the top/bottom margins to 20 pixels and left/right margins set to `auto`.
9. Go to the Track Styles section and create a style rule for track cues that: a) sets the background color to `transparent`, b) adds a black text shadow with horizontal and vertical offsets of 1 pixel and a blur of 2 pixels, c) sets the text color to `rgb(255, 177, 66)`, and d) sets the font size to 1.2 em using the sans serif font family.
10. Create a style rule for track cues belonging to the Title class that sets the font size to 2em and font family to serif.
11. Save your changes to the style sheet and then open the **cp\_astaire.html** file in your browser. Verify that you can play the audio and video clips and the layout matches that shown in Figure 8–63. Verify that captions are added to the video clip providing the title and subtitle of the clip at the start of the video and a message about *Cinema Penguin* at the end. (Note: If you are using Google Chrome or Opera, you will have to upload your files to a server if you want to see the captions and the styles you created for the video clip.)
12. Maxine wants to create a transition for the links at the top of the page that enlarges the link text and moves it out and above its default position. Return to the **cp\_animate2.css** file in your editor, go to the Transition Styles section and create a style rule for the `nav#topLinks` a selector that: a) sets the text color to `rgb(255, 255, 255)`, b) adds a text shadow with the color `rgba(0, 0, 0, 1)`, a horizontal offset of 1 pixel, a vertical offset of -1 pixel, and a blur of 1 pixel, and c) uses the `transform` style to apply the functions `scale(1,1)` and `translateY(0px)`.
13. Within the style rule you created in the last step, add a transition that applies to all of the properties of the selected element over an interval of 1.2 seconds using linear timing.

14. Create a style rule for the `nav#topLinks a:hover` selector that: a) sets the text color to `rgb(255, 183, 25)`, b) sets the text shadow to the color `rgba(0, 0, 0, 0.5)` with a horizontal offset of 0 pixels, a vertical offset of 15 pixels, and a blur of 4 pixels, and c) uses the `transform` style with `scale(2,2)` and `translateY(-15px)` to double the scale of the object and translate it -15 pixels in the vertical direction.
15. Save your changes to the style sheet and then reload `cp_astaire.html` in your browser. Hover your mouse pointer over the links at the top of the page and verify that your browser applies a transition over a 1.2 second duration as each link increases in size and appears to move upward and outward from the page in response to the hover event.

The list of Fred Astaire's films has been stored within a table nested within a `div` element with the ID `Marquee`. The table is long and Maxine wants to only display a portion of it at a time, allowing the contents of the table to automatically scroll upward as in a theater marquee. To create this animated effect, you change the `top` position style of the table over a specified time interval, moving the table upward through the marquee.

16. Return to the `cp_animate2.css` file in your editor and go to the Marquee Styles section and insert a style rule that places the marquee `div` element with relative positioning. Add a style rule for the table nested within the marquee `div` element that places the table using absolute positioning. Do not specify any coordinates for either element.
17. Go to the Keyframe Styles section and create an animation named **scroll** with the following two key frames: a) at 0%, set the value of the `top` property to **250px** and b) at 100%, set the value of the `top` property to **-1300px**.
18. Go to the Animation Styles section and apply the scroll animation to the table within the marquee `div` element over a duration of 50 seconds using linear timing within infinite looping.
19. Maxine wants the marquee to stop scrolling whenever the user hovers the mouse pointer over it. Add a style rule for the `div#marquee:hover table` selector that pauses the animation during the hover event.
20. Save your changes to the file and then reload the `cp_astaire.html` file in your browser. Verify that the marquee listing the Fred Astaire films starts scrolling automatically when the page loads, goes back to the beginning after the last film is listed, and stops whenever the user hovers the mouse pointer over the marquee. (Note: On touchscreen devices, tap the marquee to initiate the hover event and pause the scrolling text, and then tap elsewhere on the page to remove the hover and restart the marquee.)

## APPLY

### Case Problem 1

**Data Files needed for this Case Problem:** `ws_jfk_txt.html`, `ws_media_txt.css`, `ws_captions_txt.vtt`, 2 CSS files, 1 MP4 file, 4 PNG files, 1 WebM file

**Rhetoric in the United States** Professor Annie Cho teaches rhetoric and history at White Sands College. She has asked for your help in designing a companion website for her course. The page you will work on contains portions of the inaugural address delivered by President John F. Kennedy in 1961. She has obtained a video excerpt of the speech that she wants you to augment with captions. A preview of the page you will create is shown in Figure 8–64.

Figure 8–64 Rhetoric in the United States page

white sands college

Syllabus Class Notes Readings Exams Office Hours

## Rhetoric in the United States

### John F. Kennedy Inaugural Address

Vice President Johnson, Mr. Speaker, Mr. Chief Justice, President Eisenhower, Vice President Nixon, President Truman, reverend clergy, fellow citizens:

We observe today not a victory of party, but a celebration of freedom — symbolizing an end, as well as a beginning — signifying renewal, as well as change. For I have sworn before you and Almighty God the same solemn oath our forebears prescribed nearly a century and three-quarters ago.

The world is very different now. For man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life. And yet the same revolutionary beliefs for which our forebears fought are still at issue around the globe — the belief that the rights of man come not from the generosity of the state, but from the hand of God.

We dare not forget today that we are the heirs of that first revolution. Let the word go forth from this time and place, to friend and foe alike, that the torch has been passed to a new generation of Americans — born in this century, tempered by war, disciplined by a hard and bitter peace, proud of our ancient heritage, and unwilling to witness or permit the slow undoing of those human rights to which this nation has always been committed, and to which we are committed today at home and around the world.

Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, to assure the survival and the success of liberty.

This much we pledge — and more.

... continue

### Rhetorical Elements

John F. Kennedy's inaugural address drew inspiration from several sources, including Lincoln's 1865 inaugural speech and the Bible. The speech's structure evoked the rhetorical idea of *kaireis* indicating a passing instant of great opportunity and danger.

Written at a time of heightened anxiety over nuclear proliferation, Kennedy evoked *kaireis* on the pressing need to resolve the relationship between duty and power. Kennedy notes: ... *Man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life.* Yet with the power to destroy, also comes the power to build, and thus Kennedy exhorts his fellow citizens to bear the burden of a long twilight struggle ... *against the common enemies of man: tyranny, poverty, disease, and war itself.*

The speech also applies the rhetorical concepts of *prepon* and *dynaton*. *Prepon* is the principle that what is said must conform to both audience and occasion. *Dynaton* is the principle that the goals of the speech are possible and achievable. Thus for Kennedy's rhetoric to be impactful it had to be presented at the right time, to the right audience and braced with realistic goals.

Throughout the speech, Kennedy invokes *chiasmus*, a rhetorical technique in which a larger point is expressed by a reversal of the grammatical structure of two or more related clauses. The most well-known *chiasmus* in Kennedy's speech is the oft-quoted *Ask not what your country can do for you, ask what you can do for your country.* By freely applying *chiasmus* throughout his speech, Kennedy further underlines the relationship between duty and power not just between nations, but also between citizens and their government.

### Explore Other Speeches

Daniel Webster: On the Clay Compromise of 1850	Franklin Roosevelt: Pearl Harbor Address	Ronald Reagan: "A Time for Choosing"
Abraham Lincoln: Second Inaugural Address	Eleanor Roosevelt: The Struggle for Human Rights	Malcolm X: The Ballot or the Bullet
Abraham Lincoln: Gettysburg Address	Douglas MacArthur: Farewell Address to Congress	Martin Luther King, Jr: I Have A Dream
William Jennings Bryant: "Cross of Gold"	John Fitzgerald Kennedy: Inaugural Address	Martin Luther King, Jr: "I've Been to the Mountaintop"
Clarence Darrow: "Mercy for Leopold and Loeb"	John Fitzgerald Kennedy: "Ich bin ein Berliner"	Barbara Jordan: DNC Keynote Address

Rhetoric in the United States © 2021 English (US)

Source: Wikimedia Commons

Complete the following:

1. Using your editor, open the **ws\_jfk\_txt.html**, **ws\_media\_txt.css**, and **ws\_captions\_txt.vtt** files from the **html08 ► case1** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **ws\_jfk.html**, **ws\_media.css**, and **ws\_captions.vtt** files respectively.
2. Go to the **ws\_jfk.html** file in your editor. Insert a link to the **ws\_media.css** style sheet file. Take some time to study the content and structure of the document.
3. Scroll down to the **article** element and directly below the **h1** heading, insert a video clip with the controls enabled, displaying the poster image **ws\_jfk\_poster.png** file. Add two possible sources to the video clip: **ws\_jfk\_speech.mp4** and **ws\_jfk\_speech.webm**, including the mime-type for each video source.
4. After the two video sources, add a captions track with the label **Speech Captions** using the source file **ws\_captions.vtt**. If the browser does not support embedded video, display the paragraph: **To play this video clip, your browser needs to support HTML 5.**
5. Save your changes to the file and then open the **ws\_captions.vtt** file in your text editor. Add an initial line to the text file indicating that this file is in WEBVTT format.

6. Add the following track cues to the `ws_captions.vtt` file, labeling the captions 1 through 12 (times are in parenthesis):
  - (00:01.00 - 00:04.000) We observe today**
  - (00:04.000 - 00:06.000) not a victory of party,**
  - (00:06.000 - 00:10.000) but a celebration of freedom –**
  - (00:10.000 - 00:12.000) symbolizing an end,**
  - (00:12.000 - 00:15.000) as well as a beginning –**
  - (00:15.000 - 00:17.000) signifying renewal,**
  - (00:17.000 - 00:19.000) as well as change.**
  - (00:19.000 - 00:22.000) For I have sworn before you**
  - (00:22.000 - 00:24.000) and Almighty God**
  - (00:24.000 - 00:27.000) the same solemn oath**
  - (00:27.000 - 00:30.000) our forebears prescribed**
  - (00:30.000 - 00:33.000) nearly a century and three-quarters ago.**
7. Save your changes to the file and then go to the **ws\_media.css** file in your editor. Within the Video Player Styles section, insert a style rule that displays `video` elements as blocks with a width of 90% and horizontally centered by setting the top/bottom margins to 5 pixels and the left/right margins to `auto`.
8. Create a media query for screen devices with a minimum width of 521 pixels. Within the media query, create a style for `video` elements that sets the width of the player to 360 pixels, floated on the right margin with a margin width of 10 pixels.
9. Within the Track Styles section, create a style rule for caption cues that displays the text in a 1.3em sans-serif font with a text color of `rgb(221, 128, 160)`, and a background color of `rgba(255, 255, 255, 0.8)`.
10. Save your changes to the file and then load the **ws\_jfk.html** file in your browser.
11. Test the page by playing the video clip of Kennedy's speech. Verify that captions are added to the speech, matching the words uttered by the president. (Notes: If you are using Google Chrome or Opera, you will have to upload your files to a server if you wish to see the caption styles you created for the video clip. If your captions appear white on a gray background, move the mouse pointer away from the video player so that the video slider is not showing.)

## Case Problem 2

**Data Files needed for this Case Problem:** `paa_game_txt.html`, `paa_animate_txt.css`, 2 CSS files, 6 PNG files, 1 TTF file, 1 WOFF file

**Pixal Arts and Entertainment** Heather Neidell manages the website for Pixal Arts and Entertainment, a company specializing in games and entertainment apps. She has asked you to work on the initial page for the company's new game, *Frustrated Fox*. To make the page come alive, she wants you to enhance the page with animation using sprites from several characters in the game. A preview of the page you will create is shown in Figure 8–65.

Figure 8–65 Frustrated Fox page



Source: Sprites constructed from public domain images found at: <https://www.glitchthegame.com/public-domain-game-art/>; Background from public domain image at: [http://all-free-download.com/free-vector/download/cartoon\\_landscapes\\_trees\\_278582.html](http://all-free-download.com/free-vector/download/cartoon_landscapes_trees_278582.html)

Complete the following:

1. Using your editor, open the **paa\_game\_txt.html** and **paa\_animate\_txt.css** files from the **html08 ► case2** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **paa\_game.html** and **paa\_animate.css** respectively.
2. Go to the **paa\_game.html** file in your editor. Add a link to the **paa\_animate.css** style sheet file to the document head.
3. Scroll down to the **gameBox** **div** element. Within this element, insert three **div** elements with the ids **butterfly**, **bat**, and **fox** and belonging to the **sprite** class. These **div** elements will contain animated backgrounds showing three characters from the game.
4. Save your changes to the file and then return to the **paa\_animate.css** file in your editor.
5. Within the Transition Effects section, insert a style rule for the **nav#gameLinks** a selector that: (a) places the links using relative positioning, (b) sets the font color to white, and (c) transitions the font color over a 0.5-second interval.
6. Insert a style rule for the **nav#gameLinks a:hover** selector that sets the font color to **rgb(255, 194, 99)**.

- ✚ **Explore 7.** Heather wants a transition effect applied to the links in the gameLinks list in which a gradient-colored bar gradually expands under each link during the hover event. To create this effect, you will use the `after` pseudo-element and the `content` property to insert the bar. Create a style rule for the `nav#gameLinks a::after` selector that: (a) places an empty text string as the value of the `content` property, (b) places the content with absolute positioning with a top value of 100% and a left value of 0 pixels, (c) sets the width to 0% and the height to 8 pixels, (d) changes the background to a linear gradient that moves to right from the color value `rgb(237, 243, 71)` to `rgb(188, 74, 0)`, (e) sets the border radius to 4 pixels, and (f) hides the bar by setting the opacity to 0.
- When the links are hovered over, change the appearance of the bar by adding a style rule for the `nav#gameLinks a:hover::after` selector that changes the opacity to 1 and the width to 100%.
  - Return to the style rule for the `nav#gameLinks a::after` selector and add a transition style that applies the opacity and width changes over a half-second interval.
  - To create animated cartoons, Heather has stored frames of the images in the **paa\_bat.png**, **paa\_bfly.png**, and **paa\_fox.png** image files. View these files to see the different frames to be displayed in the animation.
  - Return to the **paa\_animate.css** file and, within the Sprite Styles section, create a style rule that displays all `div` elements of the `sprite` class with absolute positioning.
  - For the `div` element with the ID `bat`, create a style rule that: (a) sets the width and height to 40 pixels by 50 pixels, (b) sets the top and left coordinates to 100 pixels and -50 pixels, and (c) displays the **paa\_bat.png** as the background image placed at the left center of the background with no tiling and sized to cover the background.
  - Create a similar style rule for the `div` element with the ID `butterfly`, setting the width and height at 35 pixels, the top-left coordinates at 60 pixels and -50 pixels, and using the **paa\_bfly.png** as the background image. Create another style rule for the `div` element with the ID `fox`, setting the width and height at 280 and 260 pixels, the bottom and right coordinates at 10 pixels, and the **paa\_fox.png** file as the background image. (Note: The background image in all animations should place the image at the left center with no tiling and sized to cover the background.)
  - Sprites are animated by moving the background image file across the background of the object. Go to the Animation Styles section and create an animation named **playSprite** that sets the background image position to right center at 100% time.
  - Heather wants the bat and butterfly to flutter as they move across the animation box. Create an animation named **flyRight** with the following key frames: (a) at 25% time, set the top coordinate to 150 pixels; (b) at 50% time, set the top coordinate to 55 pixels; (c) at 65% time, set the top coordinate to 120 pixels; (d) at 90% time, set the top coordinate to 50 pixels; and (e) at 100% time, set the top and left coordinates to 80 pixels and 100%.
- ✚ **Explore 16.** Sprites achieve the animation effect by changing the background image in  $n - 1$  discrete steps, where  $n$  is the number of frames in the sprite. Apply the `playSprite` animation to the `fox` `div` element after a 4-second delay over a time interval of 3.5 seconds and a steps value of 27. Set the animation to loop infinitely.
- Apply the `playSprite` animation to the `bat` `div` element over a 2-second interval with 39 steps. Apply the `flyRight` animation over an 8-second interval with linear timing. Set both animations to loop infinitely.
  - Apply the `playSprite` animation to the `butterfly` `div` element after a 3-second delay, with a playing time of 1 second spaced out in 33 steps. Apply the `flyRight` animation over a 6-second interval. Make the butterfly appear to hover by applying a Cubic Bézier curve to the `flyRight` timing with the function `cubic-bezier(0, 1, 0.73, 0)`. Set both animations to loop infinitely.
  - Save your changes to the file and then open the **paa\_game.html** file in your browser.
  - Hover your mouse pointer over the four links below the Frustrated Fox logo and verify that a gradient-filled bar grows beneath the links in response to the hover event.
  - Verify that the animation box shows an animated bat and then a butterfly moving across the sky and that, after a short delay, an animated fox jumps up toward the bat and butterfly trying to catch them.

## OBJECTIVES

## Session 9.1

- Insert a script element
- Write JavaScript comments
- Display an alert dialog box
- Use browser debugging tools

## Session 9.2

- Reference browser and page objects
- Use JavaScript properties and methods
- Write HTML code and text content into a page
- Work with a Date object

## Session 9.3

- Use JavaScript operators
- Create a JavaScript function
- Create timed commands

# Getting Started with JavaScript

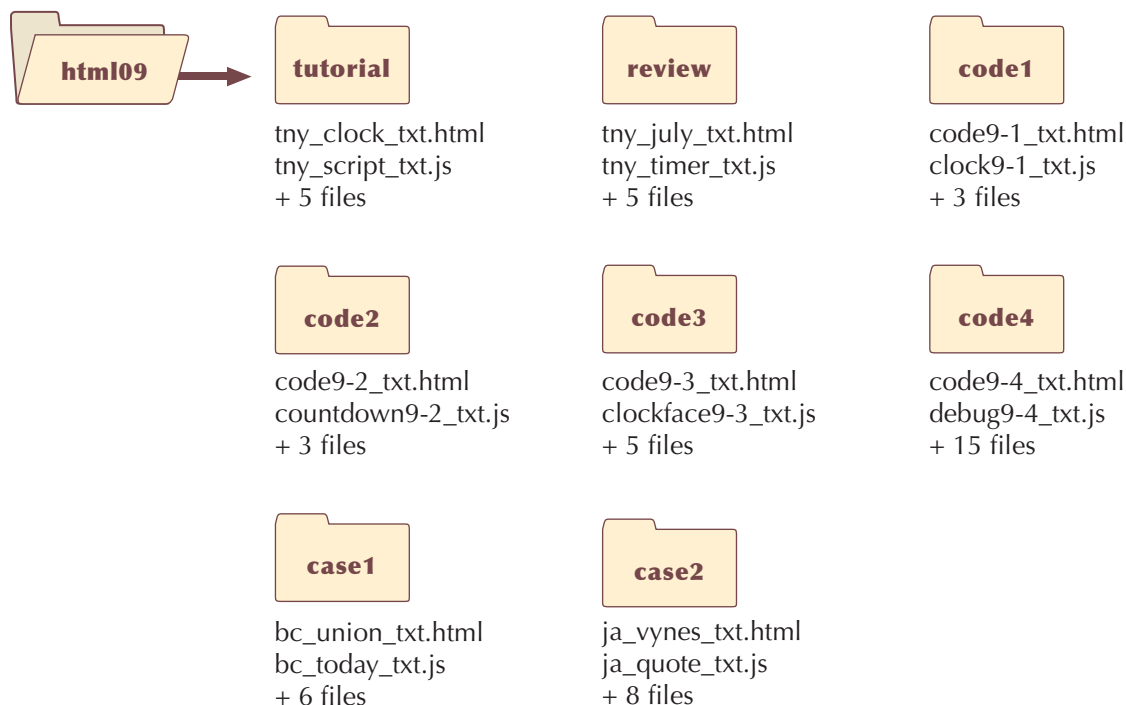
## Creating a Countdown Clock

### Case | *Tulsa's New Year's Bash*

Every year on December 31st, Tulsa, Oklahoma, rings in the New Year with a daylong celebration that includes races, circus performers, tasting booths, live bands, and dances. The celebration is capped by fireworks at midnight. The bash has become so big that partygoers come from miles away to join in the fun, and planning for the celebration starts early.

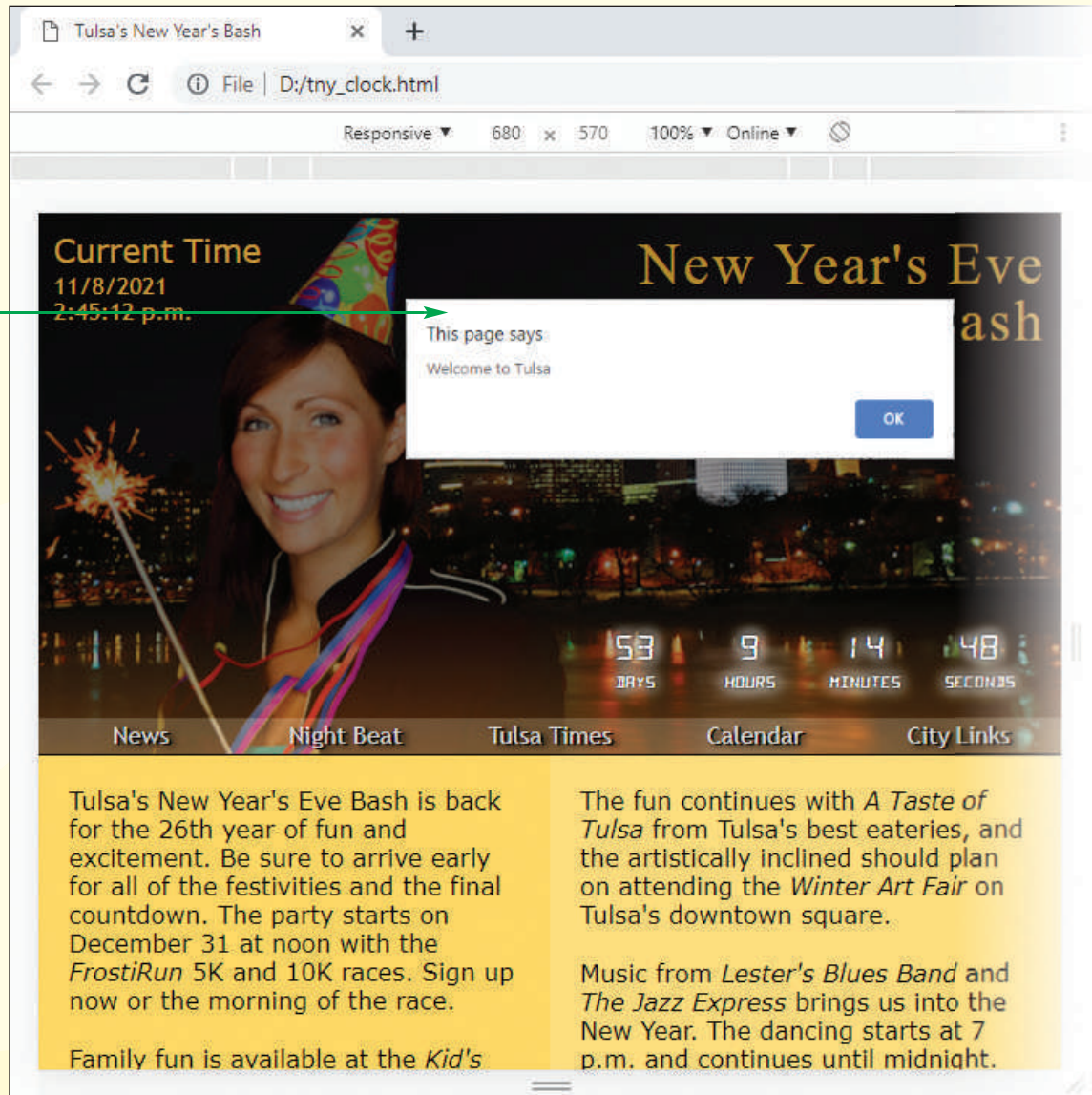
Hector Sadler manages promotion for the New Year's Bash. One of his responsibilities is to maintain a website that advertises the event and builds anticipation for it. Hector wants to include a countdown clock on the site's home page that displays the current time and the number of days, hours, minutes, and seconds remaining before the fireworks go off. You will write the JavaScript code to create this clock for Hector.

### STARTING DATA FILES



# Session 9.1 Visual Overview:

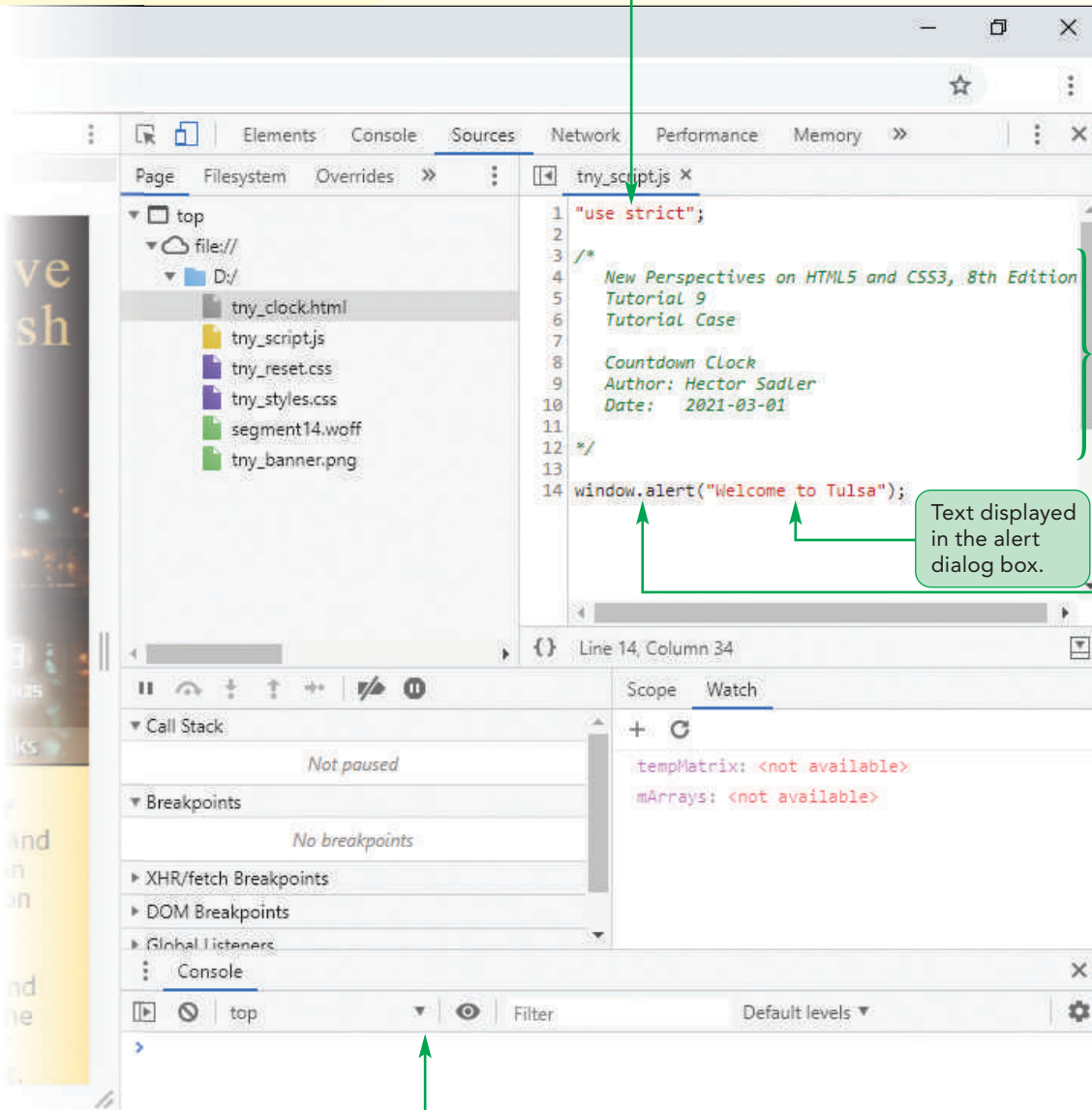
An alert dialog box created by JavaScript.



© altafulla/Shutterstock.com; © jbdphotography/Shutterstock.com; Source: www.1001fonts.com

# Creating a JavaScript File

The `use strict` statement forces JavaScript to strictly apply syntax rules.



Multi-line JavaScript comment enclosed within `/*` and `*/` characters.

Text displayed in the alert dialog box.

The `window.alert` command displays a dialog box within the browser window.

The browser Developer Pane can be used to locate and fix programming errors.

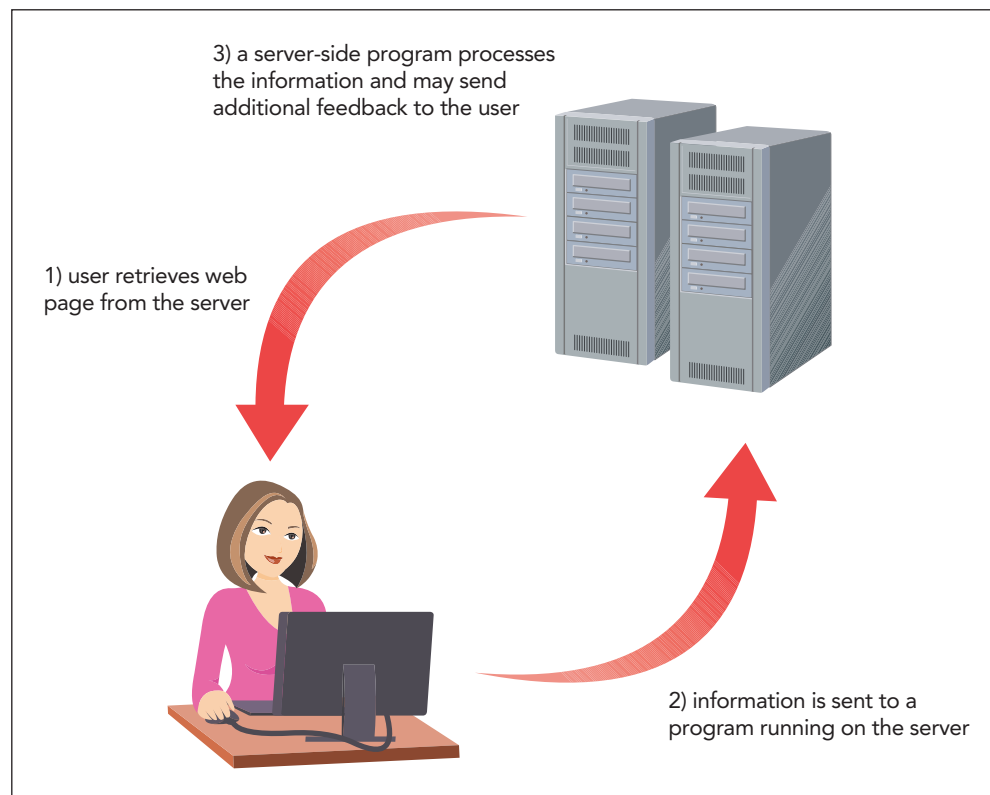
## Introducing JavaScript

In the last two tutorials, you read about JavaScript as a programming tool for creating interactive web forms and animated graphics. Starting with this tutorial, you examine the features and syntax of the JavaScript language, as well as explore how to create and apply your JavaScript programs to your websites.

### Server-Side and Client-Side Programming

Web-based programming comes in two main types: server-side programming and client-side programming. In **server-side programming**, the program code is run from the server hosting the website. In some applications, users can interact with the program, requesting specific information from the server, but the interaction is done remotely from the user to the server. See Figure 9–1.

**Figure 9–1** Server-side programming

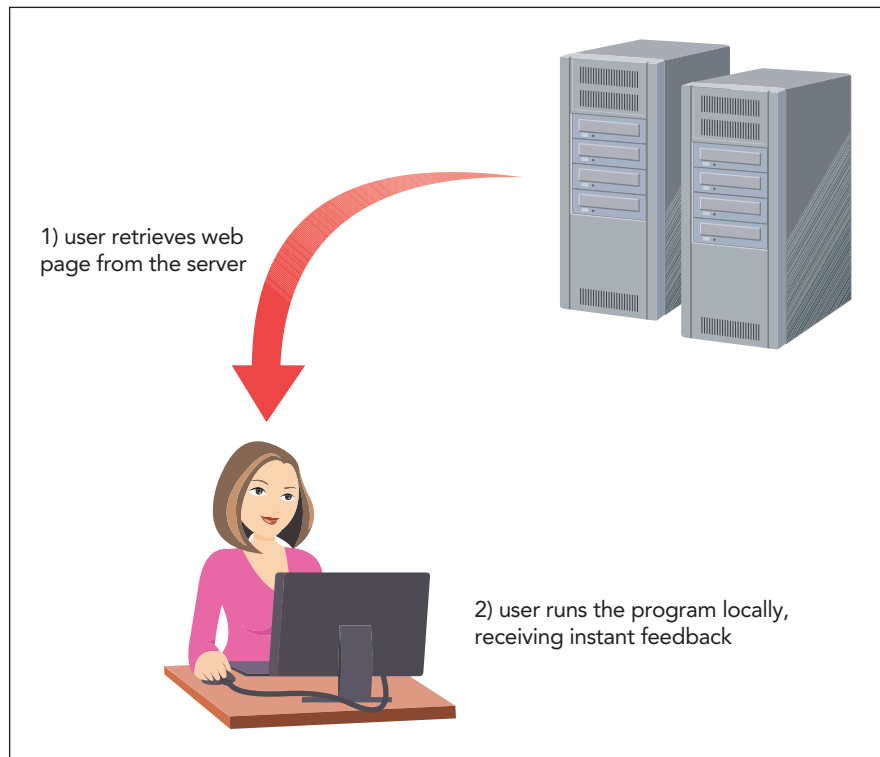


There are advantages and disadvantages to this approach. A program running on a server can be connected to an online database containing information not directly accessible to end users, enabling websites to support such features as online banking, credit card transactions, and discussion forums. However, server-side programs use server resources and require Internet access. If the system is over-loaded, the end user will have to sit through long delays, waiting for a process request to be fulfilled; or if the system is offline, the end user will have to wait for the system to come back online before the request can be processed.

In **client-side programming**, programs are run on the user's computer using scripts that are downloaded along with the HTML and CSS files. See Figure 9–2.

Figure 9–2

## Client-side programming



Client-side programming distributes the load so that one server is not overloaded with program-related requests; it tends to be more responsive because users do not have to wait for a response from a remote server. However, client-side programs can never completely replace server-side programming. For example, tasks such as running a search or processing a purchase order must be run from a central server because only the server can access the database needed to complete these types of operations.

In many cases, a combination of server-side and client-side programming is used. For example, data entry forms typically use client-side programs to validate some data entries, such as contact information, and server-side programs to submit the validated form for further processing that can only be done from a central server. In this tutorial, you will work only with client-side programming. However, it is important to be aware that in many cases, a complete web programming environment includes both client-side and server-side elements.

## The Development of JavaScript

The programming language for client-side programs is **JavaScript**. JavaScript is an **interpreted language**, meaning that the program code is executed directly without requiring an application known as a **compiler** to translate the code into machine language. You need only two things to use JavaScript: a text editor to write the JavaScript code and a browser to run the commands. This means that JavaScript code can be inserted directly into an HTML file, or it can be placed in a separate text file that is linked to the HTML file.

Through the years, JavaScript has undergone several revisions, which include new components and features that might not be supported by older browsers. Because of this, you need to test your JavaScript code on a variety of browsers and platforms in the same way you test your HTML and CSS code to ensure the widest compatibility.

## Working with the script Element

JavaScript code is attached to an HTML file using the following `script` element:

```
<script src="url"></script>
```

where `url` is the URL of the external file containing the JavaScript code. Thus, the following code loads the contents of the `tny_script.js` file:

```
<script src="tny_script.js"></script>
```

If you don't want to use an external file, you can create an **embedded script** by omitting the `src` attribute and placing all of the JavaScript code within the `script` element as follows

```
<script>
 code
</script>
```

where `code` is the code of the JavaScript program.

### REFERENCE

#### Inserting the script Element

- To link a web page to an external script file, add the following `script` element to the HTML file

```
<script src="url"></script>
```

where `url` is the URL of the external file containing the JavaScript code.

- To embed a script within the HTML file, add the following `script` element

```
<script>
 code
</script>
```

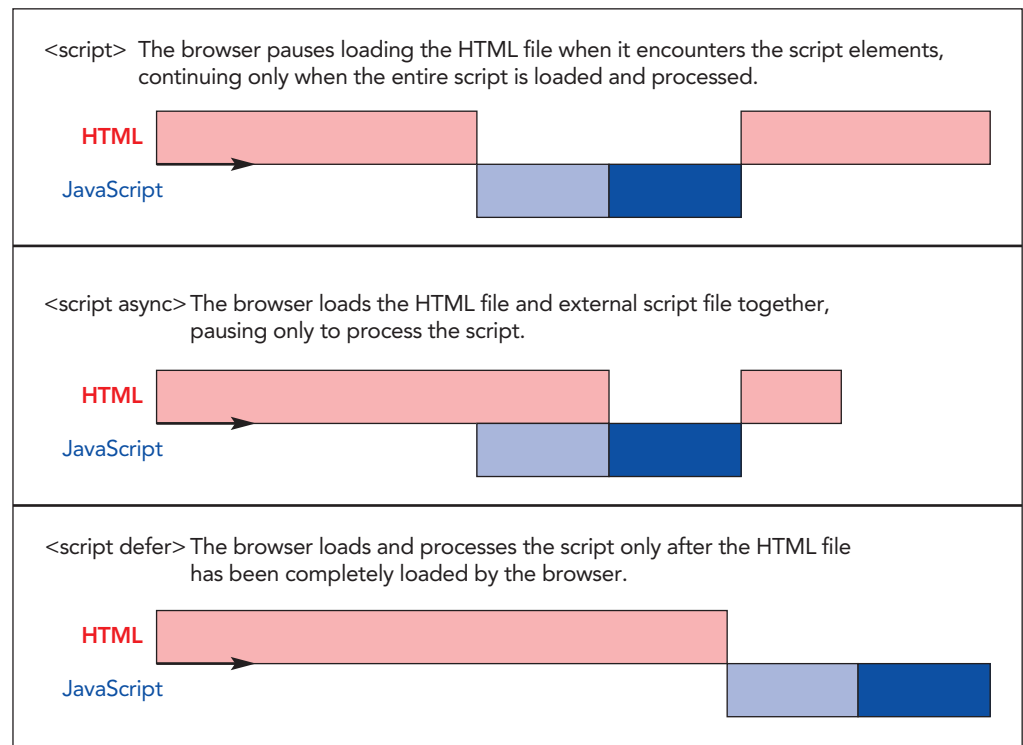
where `code` is the code of the JavaScript program.

- To load an external script file asynchronously with the HTML file, add the attribute `async` to the `script` element.
- To load an external script file after the HTML file has finished loading, add the attribute `defer` to the `script` element.

## Loading the script Element

The `script` element can be placed anywhere within the HTML document. When the browser encounters a script, it immediately stops loading the page and begins loading and then processing the script commands. Only when the script is completely processed does the browser continue to load the rest of the HTML file.

With larger and more complicated scripts, this loading sequence can degrade the user's experience because the page is literally stalled as it waits for the script to be processed. You can modify this sequence by adding the `async` or `defer` attributes to the `script` element. The `async` attribute tells the browser to parse the HTML and JavaScript code together, only pausing to process the script before returning to the HTML file. The `defer` attribute defers script processing until after the page has been completely parsed and loaded. See Figure 9-3.

**Figure 9–3** Loading HTML and JavaScript code**TIP**

You can place the script element at the end of the file so that it is processed only after all of the HTML code has been parsed by the browser.

The `async` and `defer` attributes are ignored for embedded scripts and the code nested within the `script` element is executed as soon as it is encountered within the HTML file.

## Inserting the script Element

Hector wants you to create a script that will display a running countdown clock for use with his page on Tulsa's New Year's Bash website. You will start working on his page by inserting a `script` element in the document head that will load the contents of the `tny_script.js` file. You will use the `defer` attribute to ensure that the script will not execute until all the page content is loaded by the browser.

### To insert the script element:

1. Use your editor to open the **tny\_clock\_txt.html** file from the **html09** ► tutorial folder. Enter **your name** and **the date** in the comment section of the file and save it as **tny\_clock.html**.
2. Review the rest of the document to become familiar with its contents and structure.
3. Directly before the closing `</head>` tag insert, enter:

```
<script src="tny_script.js" defer></script>
```

Figure 9–4 highlights code to insert the `script` element.

Figure 9-4

## Inserting the script element

```
<title>Tulsa's New Year's Bash</title>
<link href="tny_reset.css" rel="stylesheet" />
<link href="tny_styles.css" rel="stylesheet" />
<script src="tny_script.js" defer></script>
</head>
```

source of the  
JavaScript file

defers loading the script file  
until after the rest of the page  
is loaded by the browser

4. Open **tny\_clock.html** in your browser. The initial page is shown in Figure 9-5.

Figure 9-5

## Initial countdown clock

date and  
time values



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Source: www.1001fonts.com

days, hours, minutes, and  
seconds until January 1st

At the top of the page, Hector has inserted placeholder text showing the current date and time and the number of days, hours, minutes, and seconds until January 1st of 2022. However, this text is static and will not change to reflect the current date and time. Hector wants you to create a script that will update the date and time values every second and continually calculate the amount of time left until midnight on New Year's Eve. You will put the commands to create this countdown clock in a JavaScript file named `tny_script.js`.

## INSIGHT

### Using Other Scripting Languages

The `script` element can be used with programming languages other than JavaScript. Other client-side scripting languages are identified by including the MIME type of the language. For example, the scripting language VBScript from Microsoft has the MIME type `text/vbscript` and can be accessed using the following code:

```
<script src="url" type="text/vbscript"></script>
```

You do not have to include a `type` attribute for JavaScript files because browsers assume JavaScript's MIME type, `text/javascript`, by default.

## Creating a JavaScript Program

Because JavaScript files are simple text files, you can create and edit them using a standard text editor. You will start your study of JavaScript by first learning how to insert comments that describe the contents and goals of the script.

### Adding Comments to your JavaScript Code

Adding comments to your code is an important programming practice. It helps other people who examine your code understand what your programs are designed to do and how they work. It can even help you in the future when you return to edit the programs and need to recall the programming choices you made. JavaScript comments can be entered on single or multiple lines. The syntax of a single-line comment is

```
// comment text
```

where *comment text* is the JavaScript comment. Single-line comments can be placed on the same line containing a JavaScript command in the general format:

```
command; // comment text
```

Multiple-line comments include several comments with each comment on its own line and are inserted using the following format:

```
/*
 comment text spanning
 several lines
*/
```

## REFERENCE

### Adding a JavaScript Comment

- To add a comment on a single line or inline with other JavaScript commands, enter

```
// comment text
```

where *comment text* is the JavaScript comment.

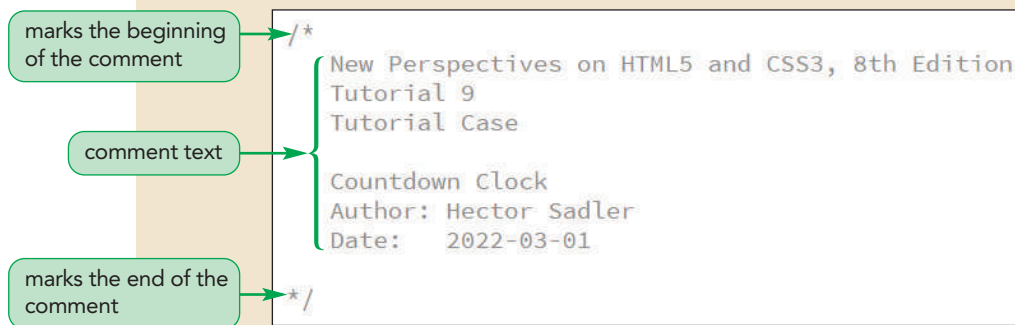
- To create a comment the spans multiple lines, enter:

```
/*
 comment text spanning
 several lines
*/
```

Hector has already started a JavaScript file with a multiple-line comment describing the file and its authorship. Open this file now and complete the initial comment lines.

**To edit JavaScript comments:**

1. Use your editor to open the **tny\_script\_txt.js** file from the html09 ► tutorial folder.
2. Enter **your name** and **the date** in the comment section of the file as shown in Figure 9–6.

**Figure 9–6****Adding a JavaScript comment**

3. Save the file as **tny\_script.js**.

Next, you insert your first JavaScript command.

## Writing a JavaScript Command

Every JavaScript program consists of a series of commands or statements. Each command is a single line that indicates an action for the browser to take. A command should end in a semicolon, employing the following syntax:

*JavaScript command;*

To test your understanding of JavaScript, you will add the following command to the `tny_script.js` file in the steps that follow:

```
window.alert("Welcome to Tulsa");
```

This command displays a dialog box to the user containing the message “Welcome to Tulsa”. Note that the text of the message is enclosed in double quotes.

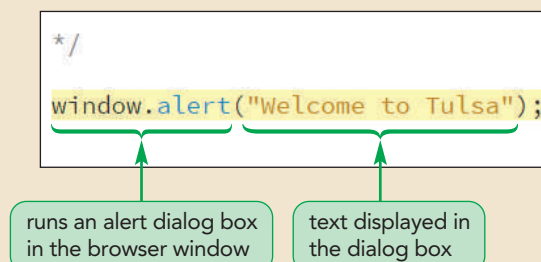
Be sure to enclose the text of the alert dialog box within both opening and closing quotes or else an error will result.

**To add a command to the script:**

1. Directly below the comments and after the `*/` line, enter:  

```
window.alert("Welcome to Tulsa");
```

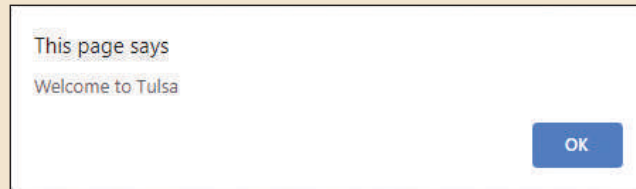
Figure 9–7 highlights the JavaScript command.

**Figure 9–7****Displaying a dialog box**

2. Save your changes to the file and then reload the `try_clock.html` file in your browser. As shown in Figure 9–8, the browser displays a dialog box with the message you specified.

Figure 9–8

## Google Chrome dialog box



Note that the dialog box style is determined by the browser. The dialog box in Figure 9–8 is the one displayed by Google Chrome.

3. Click the **OK** button to close the dialog box.

The JavaScript command you just wrote is a very simple one. Before writing more complicated commands, you should first review some of the basics of JavaScript syntax and how to locate mistakes that might appear in your programs.

## Understanding JavaScript Syntax

In addition to always including semicolons at the end of each command, there are some other syntax rules you should keep in mind when writing a JavaScript command. JavaScript is case sensitive, so you must pay attention to whether or not the letters of a JavaScript command are capitalized. For example, the command below improperly capitalizes the dialog box command as `Window.Alert` and, as a result, an error will occur when the script is run.

### Example of improper capitalization:

```
Window.Alert("Welcome to Tulsa");
```

### Example of proper capitalization:

```
window.alert("Welcome to Tulsa");
```

Like HTML, JavaScript ignores occurrences of extra white space between commands, so you can indent your code to make it easier to read. However, unlike HTML, you must be careful about line breaks within commands. A line break placed within the name of a JavaScript command or within a quoted text string will cause an error when the script is run. Thus, the following code will cause the program to fail.

### Example of improper line break:

```
window.alert("Welcome
to Tulsa");
```

If you want to break a text string into several lines, you can indicate that the text string continues on the next line by using the following backslash `\` character.

### Example of proper line break:

```
window.alert("Welcome \
to Tulsa");
```

To see how your browser will handle errors in your JavaScript code, modify the `window.alert` command you just wrote, adding an intentional error using improper capitalization.

### To insert an intentional error:

1. Return to the **tny\_script.js** file in your editor and change the command to display an alert dialog box to the following incorrect syntax:  

```
Window.Alert("Welcome to Tulsa");
```
2. Save your changes to the file and then reload the **tny\_clock.html** file in your browser. Verify that the dialog box is not displayed by the browser.

At this point, you know the dialog box did not display because of the intentional error you entered in the code. But, what if the dialog box did not display as intended and you don't know the reason? Then, you can use your browser's debugging tools to track the error to its source.

## Debugging Your Code

As you work with JavaScript, you will inevitably encounter scripts that fail to work because of an error in the code. To fix those problems, you need to debug your program. **Debugging** is the process of locating and fixing a programming error. To debug a program, you must first determine the type of error present in your code.

There are three types of errors: load-time errors, run-time errors, and logical errors. A **load-time error** occurs when a script is first loaded by a browser. As the page loads, the browser reads through the code looking for mistakes in syntax. If a syntax error is uncovered, the browser halts loading the script before trying to execute it.

A **run-time error** occurs after a script has been successfully loaded with no syntax errors and is being executed by a browser. In a run-time error, the mistake occurs when the browser cannot complete a line of code. For example, if a command includes a mathematical expression involving division by zero (something that is not allowed), the program will fail with a run-time error even though proper syntax is used.

A **logical error** is free from syntax and executable mistakes, but results in an incorrect result, such as the wrong name being returned from a database or an incorrect value being returned from a calculation. A logical error is often the hardest to fix and will require meticulous tracing of every step of the code to detect the mistake.

## Opening a Debugger

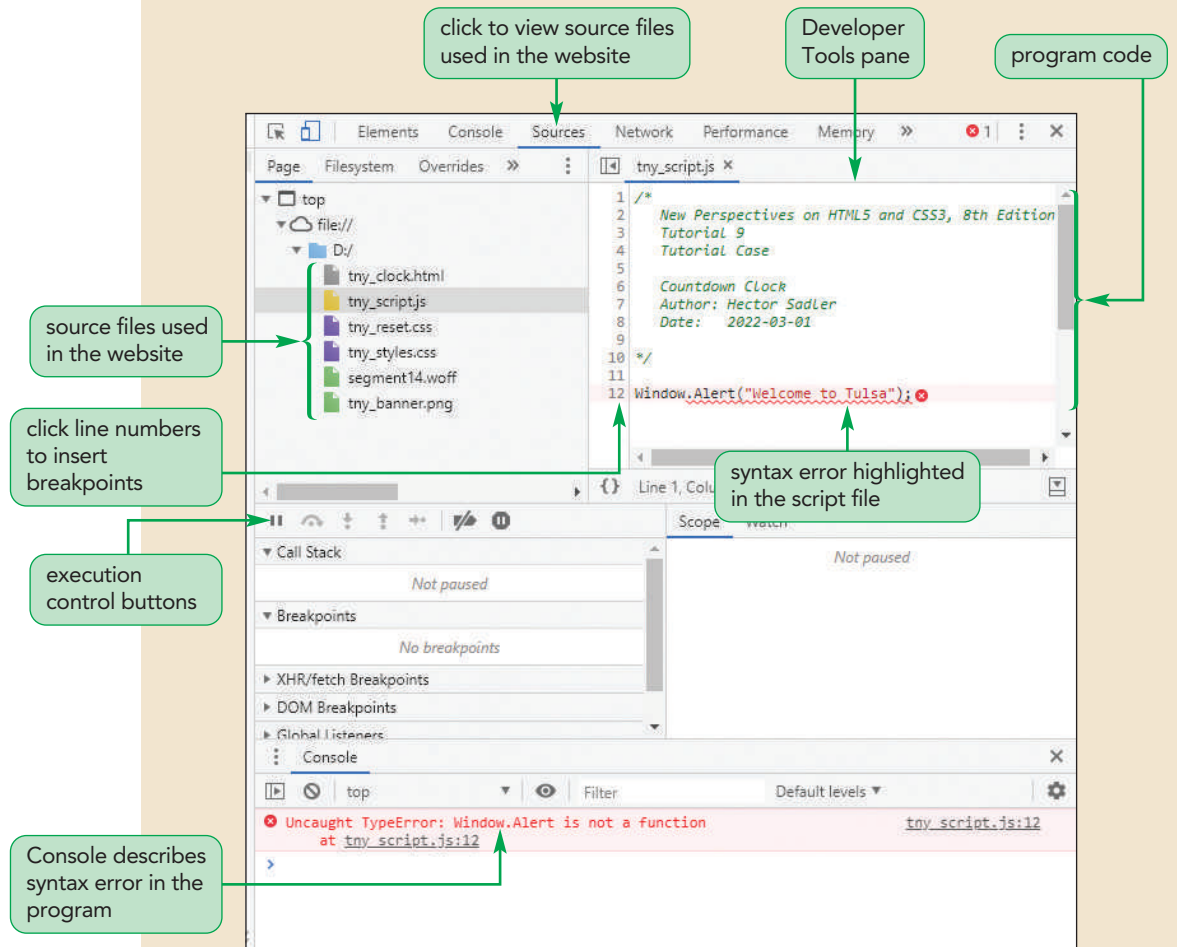
Every major browser includes debugging tools to locate and fix errors in your JavaScript code. For most browsers, you can open the debugging tool by pressing the F12 key on your keyboard or by selecting Developer Tools from the browser menu. To see a browser debugger, you will open the developer tools for Google Chrome. If you don't have access to Google Chrome, use the developer tools for your browser, reading the browser's online documentation to learn how to use your browser's tools.

### To open the Google Chrome developer tools:

1. With the browser window still open, press the **F12** key to view the Google Chrome developer tools.
2. Reload the **tny\_clock.html** file.
3. From the menu list at the top of the Developer Tools pane, click **Sources** to show the list of files used in the current page.
4. Click **tny\_script.js** from the Sources file list to show the program code in that file. See Figure 9–9.

Figure 9–9

## Google Chrome developer tools



**Trouble?** Depending on your browser setup, the location and size of your Google Chrome Developer pane might not match the one shown in Figure 9–9. If you do not see the Console shown in Figure 9–9 at the bottom of the pane, click Console to show the errors.

The syntax error you introduced in the script file is highlighted and the Console pane at the bottom of the window provides the error message, "Uncaught TypeError: Window.Alert is not a function"—a message indicating that the browser cannot process this command due to its improper syntax. At this point, you correct the syntax error by rewriting the code.

### To fix the syntax error:

1. Return to the **tny\_script.js** file in your editor and change the command to display the alert dialog box back to:  
`window.alert("Welcome to Tulsa");`
2. Save your changes and then reload the `tny_clock.html` file in your browser with the developer tools still visible. Verify that no syntax errors are reported and that the alert dialog box is once again displayed to the user.
3. Click the **OK** button to close the dialog box.

## Inserting a Breakpoint

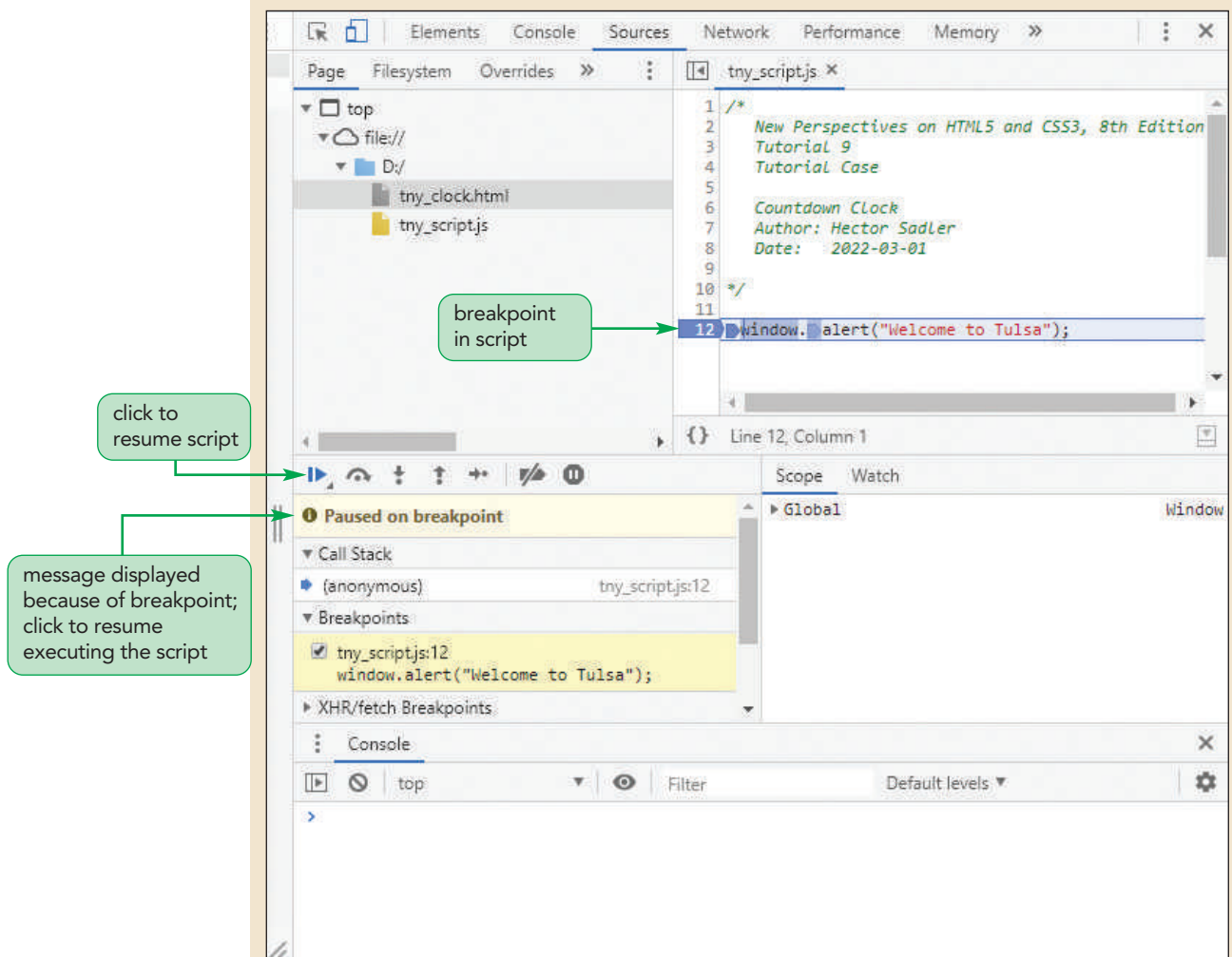
Debuggers contain a wealth of tools to aid you as you create more complex and involved programs. A script might work flawlessly except for one line that causes all subsequent commands to fail. One useful technique for locating the source of an error is to set up **breakpoints**, which are locations where the browser will pause the program, allowing the programmer to determine whether the error has already occurred at that point in the script's execution. To set a breakpoint in the Google Chrome browser, click the line number next to the line where you want the browser to pause execution of the script. Try this now by setting up a breakpoint in the line where the alert dialog box is displayed.


### To place a breakpoint:

1. In the pane showing the source code of the `tny_script.js` file, click the line number corresponding to the line containing the `window.alert` command.  
Notice that a blue arrow highlights the line, indicating that a breakpoint has been established at this location in the script.
2. Reload the `tny_clock.html` file in your browser. Verify that the browser halts execution of the script prior to displaying the alert dialog box and that a message is displayed with a control that allows the user to resume execution of the script. See Figure 9–10.

Figure 9–10

### Setting a breakpoint in Google Chrome



3. Click the **Play/Pause** button  to resume execution of the script and then click the **OK** button to close the alert dialog box.
4. Click the line number next to the line containing the `window.alert` command to remove the breakpoint.

In this tutorial, you won't be adding any more intentional errors, but you might make your own mistakes in typing the JavaScript commands for the countdown clock program. If you do, you can use the debugging tools in your browser to locate and fix the mistake. For now, you close the Developer Tools pane and remove the command you created to display an alert dialog box. You won't need it in the final version of the program.

#### To close the browser's developer tools:

1. Within the browser window, press the **F12** key to close the developer tools.
2. Return to the **tny\_script.js** file in your editor.
3. Select the line `window.alert("Welcome to Tulsa");` and delete it, removing it from the script.

## Applying Strict Usage of JavaScript

JavaScript was designed to be easy for novice programmers to use. For that reason, JavaScript differs from some other programming languages, such as Java, which demand strict application of rules for syntax and program structure. Some JavaScript lapses in syntax are resolved in a way that it is not fatal to the program's execution. While this is attractive to novice programmers, it does encourage a certain degree of laxness in coding.

Many developers advocate that JavaScript be run in **strict mode** in which all lapses in syntax result in load-time or run-time errors. Using strict mode encourages good programming technique and also makes the script run more efficiently and faster. To run a script in strict mode, add the following statement to the first line of the file:

```
"use strict";
```

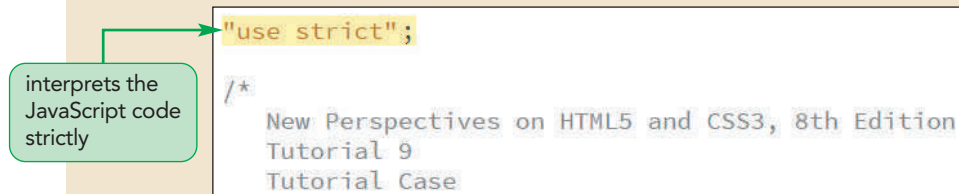
For this and future projects, you apply strict mode to the JavaScript code you create.

### To apply strict usage to JavaScript:

1. Go to the top of the `tny_script.js` file in your editor and directly before the initial comment line `/*`, insert the line  
`"use strict";`  
and press **Enter**. Figure 9–11 shows the revised code in the file.

Figure 9–11

### Applying strict usage to JavaScript



2. Save your changes to the file.

Be aware that operating JavaScript in strict mode applies not just to your code but to any third-party scripts that your program accesses. This can cause fatal errors if the authors of those scripts did not write all of their commands following strict guidelines. You can avoid this problem by applying the "use strict" statement locally only to functions that you create rather than globally as the first line of your script file. The issues of JavaScript functions and local and global scope are discussed in the next two sessions.



### Written Communication: Writing Better JavaScript Code

#### PROSKILLS

In working environments, the maintenance of a program or script is often shared among several individuals. The program you write today might be the responsibility of one of your colleagues next month. Thus, an important goal in writing program code is to make it intelligible to other users so that they can easily maintain and update it. Here are some tips to help you write better JavaScript code:

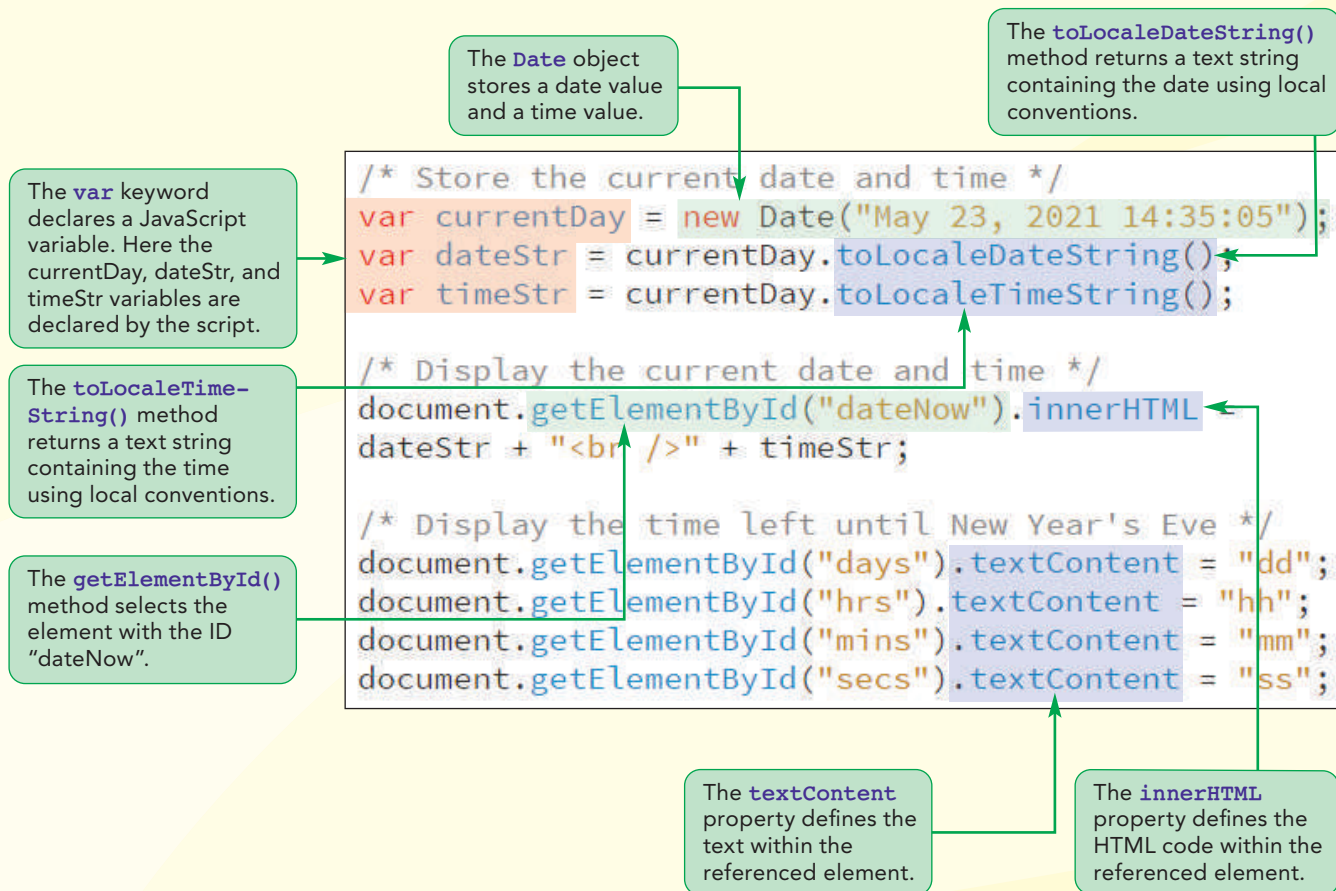
- **Use consistent names:** One common source of error is misnamed variables and functions. You can avoid this problem by being consistent in the use of uppercase and lowercase letters in your variable and function names.
- **Make the code easier to read with whitespace:** Crowded commands and statements are difficult to read and edit. Use whitespace and indented text generously to make your code more legible to others.
- **Keep your lines compact:** Long text strings can wrap to new lines in your text editor, making the text difficult to read. Strive to keep your lines to 80 characters or less. When a statement doesn't fit on a single line, break it to a new line at a point that maximizes readability.
- **Comment your work:** Always add comments to your work, documenting the purpose of each command and expression.

As your scripts become longer and more complicated you can also simplify your code by breaking it up into several JavaScript files dedicated to a specific task. Such files can be shared among several web pages, freeing you from having to rewrite the same code several times.

### Session 9.1 Quick Check

1. JavaScript code is used to create a:
  - a. server-side application
  - b. client-side application
  - c. Microsoft Windows application
  - d. cell phone application
2. To attach a JavaScript program to an HTML file, use the:
  - a. object element
  - b. javascript element
  - c. embed element
  - d. script element
3. With deferred loading, the program is not loaded until:
  - a. the page has been parsed and loaded
  - b. the page has been read by the user
  - c. the user clicks the OK button
  - d. the code has been parsed and loaded
4. To insert the comment "Countdown clock" into a JavaScript program, enter:
  - a. / Countdown clock
  - b. <-- Countdown clock -->
  - c. /\* Countdown clock \*/
  - d. 'Countdown clock
5. To display the message "Happy New Year!", enter the JavaScript command:
  - a. MsgBox "Happy New Year!"
  - b. window.message "Happy New Year!"
  - c. window.call("Happy New Year!")
  - d. window.alert("Happy New Year!")
6. What will be the result of running the following JavaScript command?  
`WINDOW.ALERT("Page Loaded");`
  - a. An alert box with the text "Page Loaded"
  - b. Nothing until the user clicks the OK box
  - c. Nothing because the code uses improper syntax
  - d. A debug warning in the console with the message "Page Loaded"
7. A location in the script where the browser will pause the program is created with an:
  - a. End statement
  - b. Pause statement
  - c. Breakpoint
  - d. Ctrl+C keyboard combination
8. What statement should be added to a JavaScript file to ensure that the code is strictly interpreted?
  - a. `debug = true;`
  - b. `"use strict";`
  - c. `use = strict;`
  - d. `use-strict;`

## Session 9.2 Visual Overview:



# JavaScript Variables and Dates

Date and time values generated with the `toLocaleDateString()` and `toLocaleTimeString()` methods.



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Countdown clock text generated using the `textContent` property.

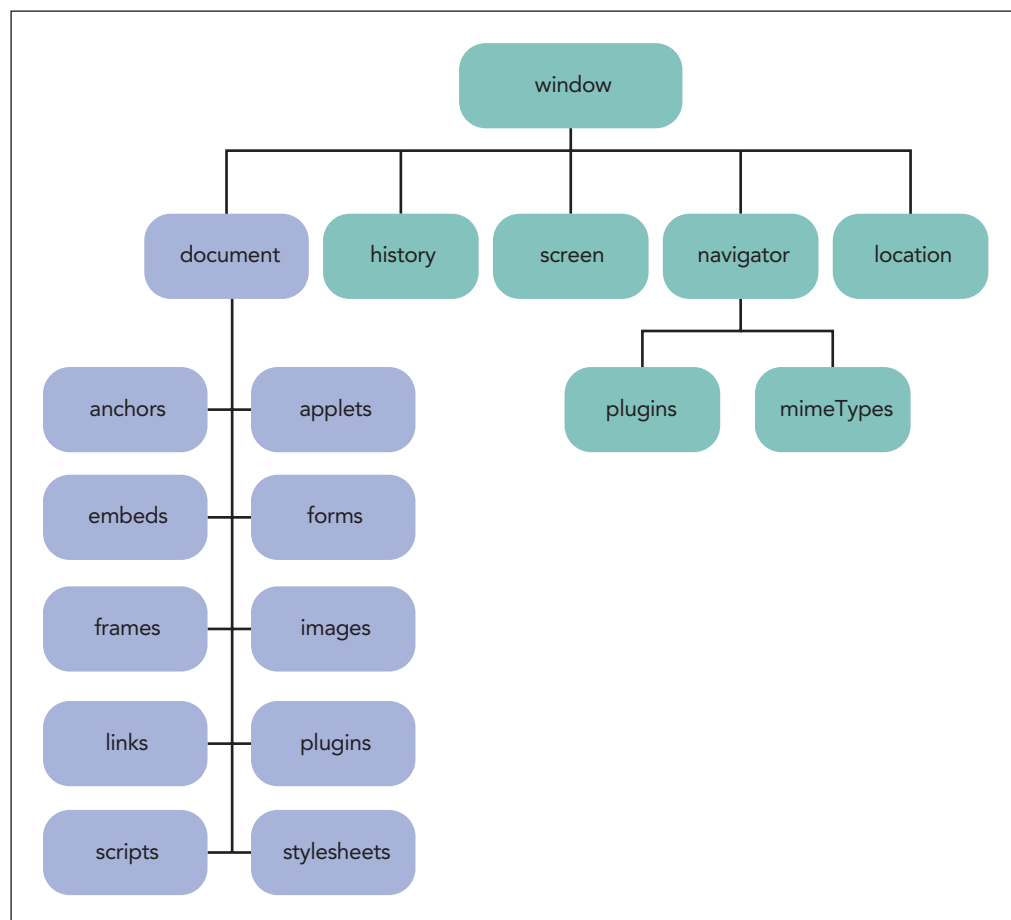
## Introducing Objects

In the last session, you limited your use of JavaScript to creating an alert dialog box, but you left the content of the web page unchanged. In this session, you will use JavaScript to write content into the web page itself. To do that, you have to work with objects. An **object** is an entity within the browser or web page that has **properties** that define it and **methods** that can be acted upon it. For example, a video embedded on a web page is an object and has properties such as source of the video file or the width and height of the video player. It also has methods such as playing or pausing the video.

JavaScript is an **object-based language** that manipulates an object by changing one or more of its properties or by applying a method that affects the object's behavior within the web page or web browser. There are four kinds of JavaScript objects: **built-in objects** that are intrinsic to the JavaScript language, **browser objects** that are part of the browser, **document objects** that are part of the web document, and **customized objects** that are created by the programmer for use in his or her application.

Browser objects and document objects are organized in hierarchical structures respectively called the **browser object model (BOM)** and the **document object model (DOM)**. Figure 9–12 shows a portion of this hierarchical structure with the `window` object, representing the browser window, as the topmost object in the hierarchy.

Figure 9–12 Object hierarchy



The following are contained within the `window` object:

- the `document` object containing objects found within the web page document
- the `history` object containing the browser's history list
- the `screen` object containing information about the computer screen
- the `navigator` object containing information about the browser application
- the `location` object containing information about the current URL

These objects themselves might contain other objects. For example, the `forms` object contained in the `document` object contains objects for each element within a web form.

It is important to note that document objects can be referenced only after the browser has finished parsing the page content. Any command that references a document object before the browser has parsed the HTML code will result in an error because those objects do not yet reside in memory. To ensure that an object can be referenced within a JavaScript program, apply the `defer` attribute to the `script` element so that JavaScript code is run only after the page is completed loaded.

## Object References

Each object within the hierarchy is referenced by its object name such as `window`, `document`, or `navigator`. Because every object aside from the `window` object is nested within other objects, you can reference an object within the hierarchy using the notation

```
object1.object2.object3 ...
```

where *object1* is at the top of the hierarchy, *object2* is a child of *object1*, and so on. Thus, to reference the `images` object nested within the `window` and `document` object, you would use the JavaScript expression:

```
window.document.images
```

You do not always have to use a complete reference detailing the entire object hierarchy. By default, JavaScript will assume that object references point to the current browser window. Thus, you can also refer to the `images` object in the current browser window using the expression:

```
document.images
```

## Referencing Object Collections

Objects are organized into groups called **object collections**. Thus, the following object reference

```
document.images
```

references all of the inline images in the document marked with the `<img />` tag. Figure 9–13 describes some other object collections found within the document object model.

**Figure 9–13** Document object collections

Object Collection	References
<code>document.anchors</code>	All elements marked with the <code>&lt;a&gt;</code> tag
<code>document.applets</code>	All <code>applet</code> elements
<code>document.embeds</code>	All <code>embed</code> elements
<code>document.forms</code>	All web forms
<code>document.frames</code>	All <code>frame</code> elements
<code>document.images</code>	All inline images
<code>document.links</code>	All hypertext links
<code>document.plugins</code>	All plug-ins supported by the browser
<code>document.scripts</code>	All <code>script</code> elements
<code>document.styleSheets</code>	All <code>stylesheet</code> elements

To reference a specific member of an object collection, you can use either

```
collection[idref]
```

or

```
collection.idref
```

where *collection* is a reference to the object collection, and *idref* is either an index number representing the position of the object in the collection or the value of the `id` attribute assigned to the element. The first object in the collection has an index number of 0 with subsequent objects given index numbers of 1, 2, 3, and so on. Thus, if the first inline image within a document has the tag

```

```

you can reference that image using any of the following expressions:

```
document.images[0]
document.images["logoImg"]
document.images.logoImg
```

Object collections can also be based on tag names using the expression

```
document.getElementsByTagName(tag)
```

where *tag* is the name of an HTML element. For instance, the expression

```
document.getElementsByTagName("h1")
```

returns an object collection of all `h1` elements within the current document, while the expression

```
document.getElementsByTagName("h1")[0]
```

references only the first `h1` element found in the document.

Object collections can also be formed from HTML elements belonging to the same class by using the expression

```
document.getElementsByClassName(class)
```

where *class* is the value of the `class` attribute from the HTML document. Thus, the expression

```
document.getElementsByClassName("newGroup")
```

returns the collection of all elements that contain the attribute `class="newGroup"`. Because there is no distinction between HTML elements in this expression, the object

collection might contain elements with different tag names as long as they all share a common value for the `class` attribute.

Finally, you also can create references to objects by the value of their `name` attribute using the expression

```
document.getElementsByName (name)
```

where `name` is the value of the `name` attribute associated with the element. Note that because more than one element can share the same name—such as radio buttons within a web form—this method returns an object collection rather than a single object.

## Referencing an Object by ID and Name

### TIP

Case is important with the `getElementById()` method. The `id` value must match both the uppercase and lowercase letters in the `id` attribute value.

One of the problems with object collections is that JavaScript will have to search through the entire collection to locate a specific item. If the object collection is large, this can be a time-consuming task and slow down the program. Another, more efficient approach, is to reference an element by its `id` attribute, using the expression

```
document.getElementById (id)
```

where `id` is the value of the `id` attribute. Thus, the expression

```
document.getElementById ("dateNow")
```

references the element with the ID `dateNow` in the document. Note that only one object is returned, not a collection, because each `id` value is unique within an HTML document.

### REFERENCE

#### Referencing Objects

- To reference an object as part of the collection in a document, use either

```
collection[idref]
or
collection.idref
```

where `idref` is either an index number representing the position of the object in the collection or the value of the `id` attribute assigned to that element.

- To reference a collection of elements based on the tag name, use

```
document.getElementsByTagName (tag)
```

where `tag` is the name of the element tag.

- To reference a collection of elements based on the value of the `class` attribute, use

```
document.getElementsByClassName (class)
```

where `class` is the `class` attribute value.

- To reference a collection of elements based on the value of the `name` attribute, use

```
document.getElementsByName (name)
```

where `name` is the value of the `name` attribute.

- To reference a document object based on the value of its `id` attribute, use

```
document.getElementById (id)
```

where `id` is the `id` attribute value.

Now that you have explored multiple ways to reference objects within a web page document, you will look at how to modify those objects.

## Changing Properties and Applying Methods

An object can be modified in two ways: either by changing the object's properties or by applying a method. First, you examine how to modify an object property.

### Object Properties

An object property is accessed using the following expression

```
object.property
```

where *object* is a reference to an object and *property* is a property associated with that object. For example, in Tutorial 8 you learned that input box controls have the `value` property, which sets the values displayed in the input box. To return the value of the input box control with the ID `firstName`, you would apply the expression:

```
document.getElementById("firstName").value
```

Thus, if the input box control displays the value "Hector", this expression will return the text string "Hector".

To change the value of an object property, run the command

```
object.property = value;
```

where *value* is the new value of the property for the referenced object. For example, to change the value in the `firstName` input box to "Diane", you would run the command:

```
document.getElementById("firstName").value = "Diane";
```

Not every property can be changed. Some properties are **read-only properties** and cannot be modified. For example, the `navigator` object representing the browser supports the `appVersion` property, which returns the version number of the browser program. So, while you can use the expression `navigator.appVersion` to view the version number of your browser, you certainly cannot use JavaScript to change your browser version.

### Applying a Method

The other way to modify an object is by applying a method to it. A method can be thought of as an action operating on an object to produce a result. Methods are applied using the expression

```
object.method(values)
```

where *object* is a reference to an object, *method* is the name of the method that can be applied to the object, and *values* is a comma-separated list of values associated with that method. You applied an object method in the previous session when you ran the command:

```
window.alert("Welcome to Tulsa")
```

In this command, the `window` object represents the browser window and the `alert()` method is a method that displays a dialog box within the browser window. The text string "Welcome to Tulsa" is the *value* associated with the `alert()` method that sets the text of the dialog box.

Similarly, the `getElementById()` expression is a method applied to the `document` object in order to reference a particular object within the document based on its ID value.

Now that you have learned the basic syntax of objects, properties, and methods, you can use JavaScript to write content into a web page.

## Writing HTML Code

The HTML code that is stored within a page element can be referenced using the following `innerHTML` property

```
element.innerHTML
```

where `element` is an object reference to an element within the web document. For example, if the document contains the following `div` element

```
<div id="daysLeft">58
Days</div>
```

then the expression

```
document.getElementById("daysLeft").innerHTML
```

returns the text string `"58<br /><span>Days</span>"`. Notice that both HTML tags and text content are returned by the `innerHTML` property. To change the content of this `div` element so that it contains the HTML code `"45<br /><span>Days</span>"`, you could change the value of the `innerHTML` property in the following command:

```
document.getElementById("daysLeft").innerHTML =
"45
Days"
```

### TIP

The `innerHTML` property can only be applied to an object representing an element within the web document.

Changing the value of the `innerHTML` property overwrites whatever content is currently contained within the selected object, so you should be careful when using it to rewrite the content of elements that already exist in your document.

Hector has set up his web page with the following `div` element containing date and time values:

```
<div id="dateNow">11/3/2021
2:45:12 p.m.</div>
```

Use the `innerHTML` property to change the content of this `div` element to the text string `"m/d/y<br />h:m:s"`. Note that you will replace this text string later with calculated values representing the current date and time.

### To write HTML code with JavaScript:

1. If you took a break after the previous session, make sure the `tny_script.js` file is open in your editor.
2. Directly below the `*/` line in the comments area, insert the following code:

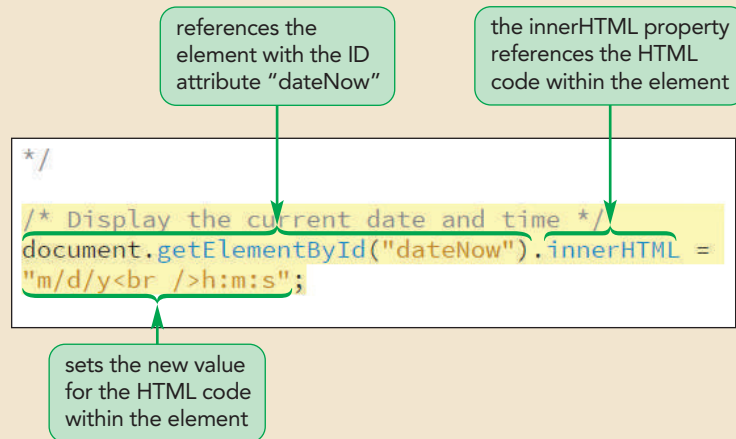
```
/* Display the current date and time */
document.getElementById("dateNow").innerHTML =
"m/d/y
h:m:s";
```

Figure 9–14 highlights the newly added code.

Be sure to match the text of the `id` value to the `id` value in the HTML file, including uppercase and lowercase letters.

Figure 9–14

## Changing the value of the HTML code within an element



3. Save your changes to the file and then reload the `try_clock.html` file in your browser.

Figure 9–15 shows the content written by revising the value of the `innerHTML` property.

Figure 9–15

## Revised date and time content



Figure 9–16 lists other JavaScript properties and methods that can be used to modify the content of page elements.

Figure 9–16

## Properties and methods to insert content

Property or Method	Description
<code>element.innerHTML</code>	Returns the HTML code within <code>element</code>
<code>element.outerHTML</code>	Returns the HTML code within <code>element</code> as well as the HTML code of <code>element</code> itself
<code>element.textContent</code>	Returns the text within <code>element</code> disregarding any HTML tags
<code>element.insertAdjacentHTML( position, text)</code>	Inserts HTML code defined by <code>text</code> into <code>element</code> at <code>position</code> , where <code>position</code> is one of the following: 'beforeBegin' (before the element's opening tag), 'afterBegin' (right after the element's opening tag), 'beforeEnd' (just before the element's closing tag), or 'afterEnd' (after the element's closing tag)

For example, if a page element contains only text and no HTML markup, you can modify its content more efficiently using the `textContent` property. In the `tny_clock.html` file, Hector has placed the countdown values in the following span elements:

```
<div>53
Days</div>
<div>9
Hours</div>
<div>14
Minutes</div>
<div>48
Seconds</div>
```

Use the `textContent` property now to change the days, hours, minutes, and seconds values to the text strings "dd", "hh", "mm", and "ss".

## To write text content with JavaScript:

1. Return to the `tny_script.js` file in your editor.
2. At the bottom of the file, insert the following code:

```
/* Display the time left until New Year's Eve */
document.getElementById("days").textContent = "dd";
document.getElementById("hrs").textContent = "hh";
document.getElementById("mins").textContent = "mm";
document.getElementById("secs").textContent = "ss";
```

Figure 9–17 highlights the newly added code.

Figure 9–17

## Revised text content

```
/* Display the current date and time */
document.getElementById("dateNow").innerHTML =
 "m/d/y
h:m:s";

/* Display the time left until New Year's Eve */
document.getElementById("days").textContent = "dd";
document.getElementById("hrs").textContent = "hh";
document.getElementById("mins").textContent = "mm";
document.getElementById("secs").textContent = "ss";
```

references the element  
with the IDs "days", "hrs",  
"mins", and "secs"

property for the  
text content within  
each element

new text content  
within each  
element

3. Save your changes to the file and reload the `tny_clock.html` file in your browser.

Figure 9–18 shows the placeholder text used for countdown clock values.

Figure 9–18

## Revised text content

countdown clock text generated by JavaScript using the `textContent` property



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Note that if you want to insert HTML code along with the text content, you must use the `innerHTML` property. The `textContent` property should only be used when no markup tags are involved.

## INSIGHT

Writing Content with `document.write()`

Another way to write HTML content to the web page document is with the following method

```
document.write(text)
```

where `text` is the text of the content. The `document.write()` method is most often used with embedded scripts, writing content directly into the document as it is being loaded by the browser. For example, the following code uses an embedded script to write an `h1` heading directly into the page header:

```
<header>
 <script>
 document.write("<h1>Welcome to Tulsa</h1>");
 </script>
</header>
```

Note that if this method is applied after the HTML file is completely loaded by the browser, it will *overwrite all of the HTML content in the document*, replacing the HTML code with the text specified in the `document.write()` method. If you want to modify the page after it has been loaded by the browser, you should only use the `innerHTML` or `textContent` properties.

Next, you will begin replacing the current date, time, and countdown placeholder values with calculated values. To do that, you must learn how to work with JavaScript variables.

## Working with Variables

Because you used a specific text string with the `innerHTML` and `textContent` properties, your script did little more than what you could have accomplished by entering the HTML code directly into the web page document. JavaScript is much more powerful and versatile when used in conjunction with variables. A **variable** is a named item in a program that stores a data value, such as a number or text string, or an object, such as a part of the web browser or browser window. Variables are useful because they can store information created in one part of the script and use that information elsewhere.

### Declaring a Variable

Variables are introduced into a script by **declaring** the variable using the following `var` keyword

```
var variable = value;
```

where *variable* is the name assigned to the variable and *value* is the variable's initial value. For example, the following statement declares a variable named `currentDay` and assigns it an initial value of "May 3, 2021".

```
var currentDay = "May 3, 2021";
```

You do not have to provide an initial value to a variable. You can leave the variable's value undefined as in the following command which declares the `currentDay` variable but does not provide a value.

```
var currentDay;
```

You can declare multiple variables by entering the variable names in a comma-separated list. The following statement declares two variables named `currentMonth`, and `currentYear`, assigning them the values of "May" and 2021 respectively.

```
var currentMonth = "May", currentYear = 2021;
```

JavaScript imposes the following limits on variable names:

- The first character must be either a letter or an underscore character ( `_` ).
- The remaining characters can be letters, numbers, or underscore characters.
- Variable names cannot contain spaces.
- You cannot use names that are part of the JavaScript language itself; for example, you cannot name a variable "document" or "window" or "textContent".

#### TIP

To avoid programming errors, use a consistent pattern of case for variable names and give your variables descriptive names that are easy to interpret.

Like other aspects of the JavaScript language, variable names are case sensitive. The variable names `currentDay` and `currentday` represent two different variables. One common programming mistake is to forget this important fact and to use uppercase and lowercase letters interchangeably in variable names.

After a variable is declared, its value can be changed by assigning a new value using the following command

```
variable = value;
```

where *variable* is the variable name and *value* is a new value assigned to the variable. Thus, the following command changes the value of the `currentDay` variable to "May 4, 2021":

```
currentDay = "May 4, 2021";
```

One of the advantages of using variables is that you can change their values several times throughout the program, often in response to user actions within the web page.

## Variables and Data Types

JavaScript variables can store different types of information known as the variable's **data type**. JavaScript supports the following data types:

- numeric value
- text string
- Boolean value
- object
- null value

A **numeric value** is any number, such as 13, 22.5, or 3.14159. Numbers can also be expressed in scientific notation, such as 5.1E2 for the value  $5.1 \times 10^2$  (or 510). Thus, if you wish to store the value 2021 in the `currentYear` variable, you would run the command

```
currentYear = 2021;
```

### TIP

If you enclose a number within double or single quotation marks, JavaScript will treat the number as a text string.

A **text string** is any group of characters enclosed within either double or single quotation marks. The following statement stores the text "May" in the `currentMonth` variable:

```
currentMonth = "May";
```

A **Boolean value** indicates the truth or falsity of a statement. There are only two possible Boolean values: `true` or `false`. For example, the following statement sets the value of the `isMay` variable to `true` and the value of the `isApril` variable to `false`:

```
var isMay = true, isApril = false;
```

Boolean values are most often used in programs that must respond differently to different conditions. The `isMay` variable cited above might be used in a program that tests whether the current month is May. If the value is set to `true`, the program runs differently than if the value is set to `false`. Note that if no value is assigned to a Boolean variable, it is interpreted as having a value of `false`.

Variables that represent objects can be used to simplify code by removing the need to rewrite long and sometimes complicated object references. Thus, the following `dateDiv` variable will store the reference to the document element with the ID `dateNow`:

```
var dateDiv = document.getElementById("dateNow");
```

Finally, a `null` value indicates that no value has yet been assigned to a variable. This can be done explicitly assigning the keyword `null` to a variable, as in the statement

```
var currentDate = null;
```

or implicitly by simply declaring the variable without assigning it a value.

## INSIGHT

### JavaScript and Weakly Typed Languages

In JavaScript, a variable's data type can be changed by the context in which it is used. In the following two statements, the `currentMonth` variable starts out as a numeric variable with an initial value of 4, but then becomes a text string variable containing the text "May":

```
var currentMonth = 4;
currentMonth = "May";
```

A programming language like JavaScript, in which variables are not strictly tied to specific data types, is referred to as a **weakly typed language**. Some other programming languages, known as **strongly typed languages**, force the programmer to explicitly identify a variable's data type. In strongly typed languages, the above code would result in an error because variables are not allowed to switch from one data type to another.

While a strongly typed language might seem restricting, it has the advantage of flagging programming errors, such as might occur when your program inadvertently switches the data type of a variable from a number to a text string.

## Using a Variable

After you have created a variable, you can use it in JavaScript statements in place of the value it contains by inserting the variable name into a command or expression. For example, the following code uses the `dateDiv` variable to reference the page element with ID `dateNow` and then applies the `innerHTML` property to that object:

```
var dateDiv = document.getElementById("dateNow");
dateDiv.innerHTML = "May 3, 2021";
```

The effect is the same as if you had inserted the following command into your program:

```
document.getElementById("dateNow").innerHTML = "May 3, 2021";
```

The advantage of using a variable is that having defined the `dateDiv` variable, you can use it throughout the program without having to reenter a long and complicated object reference every time, which speeds up the execution of the code and makes your program easier to read and manage.

## Working with Date Objects

One type of object you can store in a variable is a **Date object**, which is a built-in JavaScript object used to store information about dates and times. Date objects are defined using the following expression

```
new Date("month day, year hrs:mins:secs");
```

where *month*, *day*, *year*, *hrs*, *mins*, and *secs* provide the Date object's date and time. For example, the following command stores a Date object containing a date of May 23, 2021 and a time of 2:35:05 p.m. in the `thisDate` variable:

```
var thisDate = new Date("May 23, 2021 14:35:05");
```

Note that time values are based on 24-hour time so that a time of 2:35 p.m. would be entered as 14:35. If you omit the hours, minutes, and seconds values, JavaScript assumes that the time is 0 hours, 0 minutes, and 0 seconds—in other words, midnight of the specified day. If you omit both a date and time value, the Date object returns the current date and time based on the computer's system clock. Thus, the

following command stores a `Date` object containing the current date and time in the `thisDate` variable:

```
var thisDate = new Date();
```

You can also define a date using the expression

```
new Date(year, month, day, hrs, mins, secs);
```

where *year*, *month*, *day*, *hrs*, *mins*, and *secs* are numeric values for the date and time. The *month* value is entered as an integer from 0 to 11, where 0 = January, 1 = February, and so forth. Time values are again expressed in 24-hour time. Thus, the following command also creates a variable storing the date and time May 23, 2021, at 2:35:05 p.m.:

```
var thisDate = new Date(2021, 4, 23, 14, 35, 5);
```

## REFERENCE

### Creating and Storing a Date

- To create a `Date` object, use  

```
new Date("month day, year hrs:mins:secs")
```

 where *month*, *day*, *year*, *hrs*, *mins*, and *secs* indicate the date and time to be stored in the `Date` object. Time values are entered in 24-hour time.
- To create a `Date` object using numeric values, use  

```
new Date(year, month, day, hrs, mins, secs)
```

 where *year*, *month*, *day*, *hrs*, *mins*, and *secs* are numeric values of the date and time with *month* an integer from 0 to 11, where 0 = January, 1 = February, and so forth. Time values are entered in 24-hour time.
- To create a `Date` object containing the current date and time, use:  

```
new Date()
```

## Creating a Date Object

Now that you have seen how to store date and time information in a variable, you will create a variable named `currentDay` that stores a `Date` object. You use May 23, 2021 as the initial date and 2:35:05 p.m. as the initial time. Later in this tutorial, you will set the value of the `currentDay` variable to the current date and time. For now, using a preset date and time lets you check that any calculations based on the date and time are correct.

### To create the `currentDay` variable:

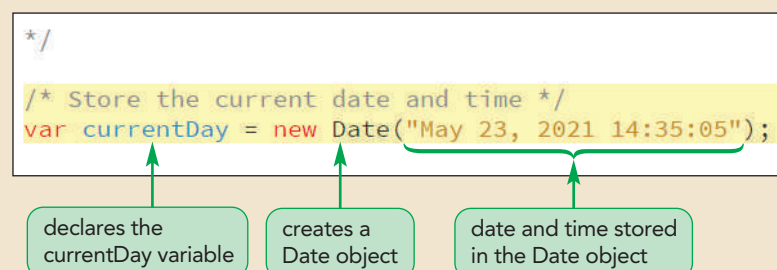
1. Return to the `tny_script.js` file in your editor.
2. Directly below the closing `*/` line near the top of the file, insert:

```
/* Store the current date and time */
var currentDay = new Date("May 23, 2021 14:35:05");
```

Figure 9–19 highlights the newly added code.

Figure 9–19

Creating a Date object



Next, you apply JavaScript's `Date` methods to extract information about this `Date` object.

## Applying Date Methods

JavaScript dates are stored as numeric values equal to the number of milliseconds between the specified date and January 1, 1970 at midnight. For example, a `Date` object for May 23, 2021 at 2:35:05 p.m. has a hidden value equal to 1,621,798,505,000 milliseconds. Fortunately, you don't have to work directly with this value! Instead, Figure 9–20 describes some of the JavaScript methods used to extract information from a `Date` object.

**Figure 9–20**

**Methods of the Date object**

Date	Method	Description	Results
var thisDay = new Date("May 23, 2021 14:35:05");	thisDay.getSeconds()	seconds	5
	thisDay.getMinutes()	minutes	35
	thisDay.getHours()	hours	14
	thisDay.getDate()	day of the month	23
	thisDay.getMonth()	month number, where January = 0, February = 1, etc.	4
	thisDay.getFullYear()	year	2021
	thisDay.getDay()	day of the week, where Sunday = 0, Monday = 1, etc.	0
	thisDay.toLocaleDateString()	text of the date using local conventions	"5/23/2021"
	thisDay.toLocaleTimeString()	text of the time using local conventions	"2:35:05 PM"

Hector wants to display the date and time on separate lines in the page header. To accomplish this, you create two new variables. The following `dateStr` variable will store the text string of the date portion of the `Date` object and the `timeStr` variable will store the text string of the time portion:

```
var dateStr = currentDay.toLocaleDateString();
var timeStr = currentDay.toLocaleTimeString();
```

Both the `toLocaleDateString()` and `toLocaleTimeString()` methods return text strings based on local conventions for rendering dates and times. Thus, in the United States the `dateStr` and `timeStr` variables will store the text "5/23/2021" and "2:35:05 PM" respectively. Other countries, with different local conventions, will use different text representations of these dates and times.

The `dateStr` and `timeStr` variables can be used with the `innerHTML` property for the `dateNow` div element to change the code inserted into the page element:

```
document.getElementById("dateNow").innerHTML =
dateStr + "
" + timeStr;
```

The `+` symbol is used in this command to combine two or more text strings in a single text string. Thus, in this command if the `dateStr` variable stores the text "5/23/2021" and the `timeStr` variable stores the text string "2:35:05 PM", the text string "5/23/2021<br />2:35:05 PM" will be added to the inner HTML of the `dateNow` element.

## REFERENCE

### Using Date Methods

- To retrieve the year, month, day, hours, minutes, and seconds value from a Date object, use the following methods

```
date.getFullYear()
date.getMonth()
date.getDate()
date.getHours()
date.getMinutes()
date.getSeconds()
```

where *date* is a Date object.

- To retrieve the date as a text string using local conventions, apply the method:

```
date.toLocaleDateString()
```

- To retrieve the time as a text string using local conventions, apply the method:

```
date.toLocaleTimeString()
```

Rewrite the code in the `try_script.js` file now to use Date objects and methods to display dates and times.

### To apply date variables and methods:

1. Directly after the line declaring the `currentDay` variable, insert:

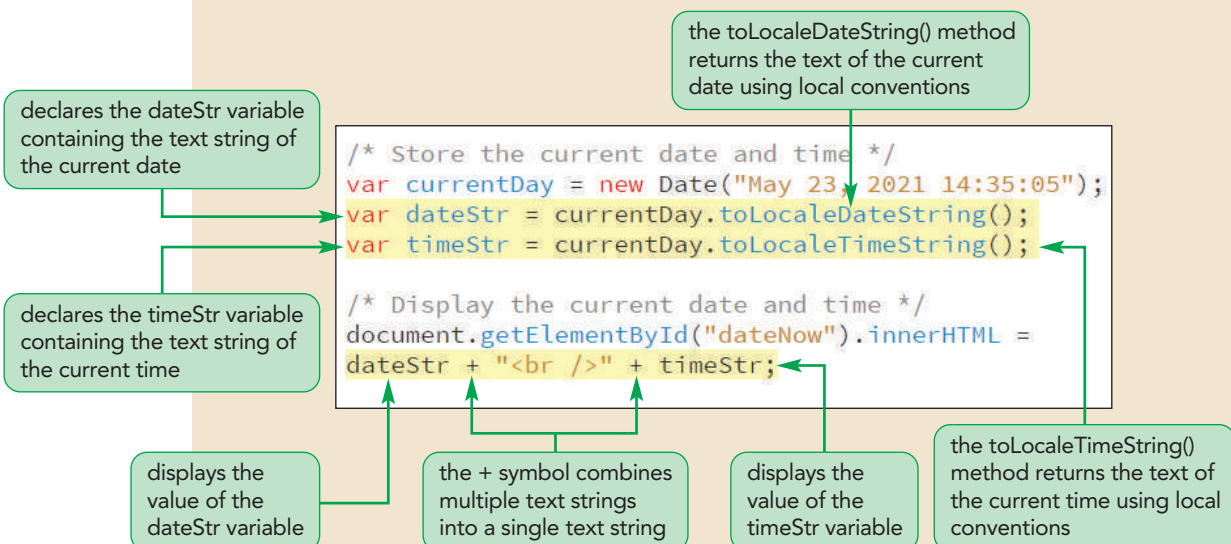
```
var dateStr = currentDay.toLocaleDateString();
var timeStr = currentDay.toLocaleTimeString();
```

2. Change the line that displays the current date and time to:

```
document.getElementById("dateNow").innerHTML =
dateStr + "
" + timeStr;
```

Figure 9–21 highlights the new code in the file.

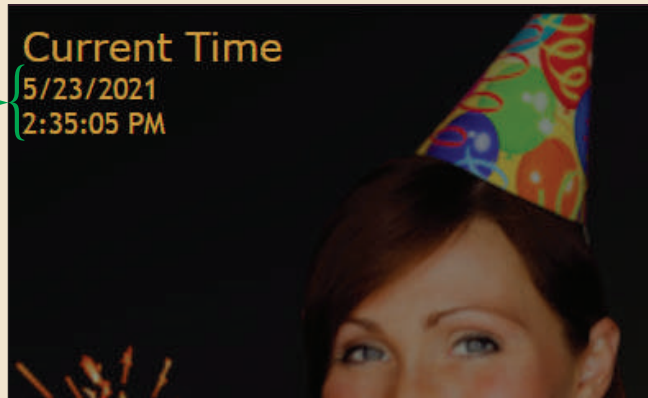
**Figure 9–21** Displaying dates and times



3. Save your changes to the file and then reload `tny_clock.html` in your browser. Figure 9–22 shows the date values generated by JavaScript.

**Figure 9–22** Date and time in the page header

text string of the date and time as returned from the `toLocaleDateString()` and `toLocaleTimeString()` methods



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## PROSKILLS

### Written Communication: Writing Dates and Times for a Global Marketplace

The Tulsa New Year's Bash is a strictly local event; thus, you can write the dates and times using local formats. However, America's date and time conventions are not shared across the globe. If you are not careful with your dates and times, you run the risk of confusing your international readers. For example, the text string 10/3/2021 is interpreted as October 3rd, 2021 in some countries, and as March 10th, 2021 in others. Some countries express times in a 12-hour (AM/PM) format while others use the 24-hour clock.

If you expect your dates and times to be read by an international audience, you need to ensure that your text corresponds to local standards. One way to do this is to spell out the month portion of the date, expressing a date as "October 3, 2021". Other designers suggest that a date format with the year expressed first (for example, 2021-10-3) is less likely to be misinterpreted.

With JavaScript, you can write dates and times in the user's own local format using method

```
date.toLocaleString()
```

which converts `date` to a text string displaying the date and time formatted based on the conventions employed by the user's computer. Thus, a date and time such as October 3rd, 2021 at 2:45 p.m. would be displayed using the `toLocaleString()` method as

Tue, October 3, 2021 2:45:00 PM

from a computer located in the United States and as

mardi 3 octobre 2021 1714:45:00

from a computer located in France. Note that the exact appearance of the string generated by the `toLocaleString()` method depends on the date/time settings on the computer and the settings of the browser.

As businesses continue to expand to meet the needs of a global market, you should use JavaScript's Date object in a way that makes it easier to communicate with your international customers and clients in a "timely" fashion.

## Setting Date and Time Values

JavaScript also supports methods to change the date stored within a `Date` object. Changing dates is most often used in programs that involve setting the value of a future date or time, such as an expiration date for an online membership or an online calendar used for event scheduling. Figure 9–23 summarizes the methods supported by the JavaScript `Date` object used for setting date and time values.

**Figure 9–23****JavaScript methods to set values of the `Date` object**

Date Method	Description
<code>date.setDate(value)</code>	Sets the day of the month of <i>date</i> , where <i>value</i> is an integer, ranging from 1 up to 31 (for some months)
<code>date.setFullYear(value)</code>	Sets the four-digit year value of <i>date</i> , where <i>value</i> is an integer
<code>date.setHours(value)</code>	Sets the 24-hour value of <i>date</i> , where <i>value</i> is an integer ranging from 0 to 23
<code>date.setMilliseconds(value)</code>	Sets the millisecond value of <i>date</i> , where <i>value</i> is an integer between 0 and 999
<code>date.setMinutes(value)</code>	Sets the minutes value of <i>date</i> , where <i>value</i> is an integer ranging from 0 to 59
<code>date.setMonth(value)</code>	Sets the month value of <i>date</i> , where <i>value</i> is an integer ranging from 0 (January) to 11 (December)
<code>date.setSeconds(value)</code>	Sets the seconds value of <i>date</i> , where <i>value</i> is an integer ranging from 0 to 59
<code>date.setTime(value)</code>	Sets the time value of <i>date</i> , where <i>value</i> is an integer representing the number of milliseconds since midnight on January 1, 1970

For example, the following code uses the `setFullYear()` method to change the date stored in the `thisDate` variable from May 23, 2021 to May 23, 2022:

```
var thisDate = new Date("May 23, 2021");
thisDate.setFullYear(2022);
```

In the next session, you will use the `setFullYear()` method in the countdown clock to calculate the number of days, hours, minutes, and seconds remaining until the New Year's Bash. If you want to take a break, you can close your editor and your browser now.

### Session 9.2 Quick Check

1. Which of the following is a type of JavaScript object?
  - a. built-in JavaScript objects
  - b. browser objects contained within the browser itself
  - c. document objects contained with the web page
  - d. all of the above
2. Which expression references all paragraph elements in the document?
  - a. `document.paragraphs`
  - b. `document.all.paragraphs`
  - c. `document.getElementsByTagName("p")`
  - d. `document.getParagraphs()`
3. Which expression references an element with the ID sidebar?
  - a. `document#sidebar`
  - b. `document.id.sidebar`
  - c. `document.getElementById("sidebar")`
  - d. `document.getIds("sidebar")`
4. The HTML code stored within a page element is referenced with the property:
  - a. `innerHTML`
  - b. `html`
  - c. `htmlCode`
  - d. `innerCode`
5. The HTML code stored within a page element is referenced with the property:
  - a. `innerText`
  - b. `textContent`
  - c. `text`
  - d. `textString`
6. Which command declares the variable `totalMonths` with an initial value of 12?
  - a. `variable totalMonths = 12;`
  - b. `var totalMonths(12);`
  - c. `var 12 = totalMonths;`
  - d. `var totalMonths = 12;`
7. Which command creates a `Date` object for the date April 4, 2021 at 8:38:14 a.m.?
  - a. `Date("April 4, 2021 8:38:14");`
  - b. `new Date("April 4, 2021 8:38:14");`
  - c. `new date("April 4, 2021 8:38:14");`
  - d. `dateValue("April 4, 2021 8:38:14");`
8. Which expression extracts the hours value from the `expDate` variable?
  - a. `expDate.getHours()`
  - b. `expDate.hours()`
  - c. `expDate.hours`
  - d. `expDate.calcHours()`

# Session 9.3 Visual Overview:

The `setInterval()` method is used to repeatedly run a command after an interval expressed in milliseconds.

Every function begins with the keyword `function` followed by the function name and parameters (if any) enclosed in parenthesis.

The `getFullYear()` method sets the year value in the `Date` object.

This code converts the difference in dates (stored as milliseconds) into a difference in days.

This code converts the fractional part of the `daysLeft` value to hours.

This code converts the fractional part of `minsLeft` value to seconds.

The `runClock()` statement runs the commands in the `runClock()` function.

```

/*Execute the function to run and display the countdown clock */
runClock();
setInterval("runClock()", 1000);

/* Function to create and run the countdown clock */
function runClock() {
 /* Store the current date and time */
 var currentDay = new Date("November 17, 2021 16:28:49");
 var dateStr = currentDay.toLocaleDateString();
 var timeStr = currentDay.toLocaleTimeString();

 /* Display the current date and time */
 document.getElementById("dateNow").innerHTML =
 dateStr + "
" + timeStr;

 /* Calculate the days until January 1st */
 var newYear = new Date("January 1, 2022");
 var nextYear = currentDay.getFullYear() + 1;
 newYear.setFullYear(nextYear);
 var daysLeft = (newYear - currentDay)/(1000*60*60*24);

 /* Calculate the hours left in the current day */
 var hrsLeft = (daysLeft - Math.floor(daysLeft))*24;

 /* Calculate the minutes and seconds left in the current hour */
 var minsLeft = (hrsLeft - Math.floor(hrsLeft))*60;
 var secsLeft = (minsLeft - Math.floor(minsLeft))*60;

 /* Display the time left until New Year's Eve */
 document.getElementById("days").textContent = Math.floor(daysLeft);
 document.getElementById("hrs").textContent = Math.floor(hrsLeft);
 document.getElementById("mins").textContent = Math.floor(minsLeft);
 document.getElementById("secs").textContent = Math.floor(secsLeft);
}

```

The `getFullYear()` method returns the 4-digit year value.

This code converts the fractional part of `hrsLeft` value to minutes.

The `Math.floor()` method rounds the enclosed value down to the nearest integer.

# JavaScript Functions and Expressions



The days, hours, minutes, and seconds values are displayed as whole numbers due to the `Math.floor()` method.

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The days, hours, minutes, and seconds left values are updated every second due to the `setInterval()` method.

## Working with Operators and Operands

In the previous session, you worked with `Date` objects to display specified dates and times on a web page. In this session, you will learn how to perform calculations with dates and JavaScript variables. To perform a calculation, you need to insert a JavaScript statement that contains an operator. An **operator** is a symbol used to act upon an item or a variable within an expression. The variables or expressions that operators act upon are called **operands**. Figure 9–24 describes the operators supported by JavaScript.

**Figure 9–24** JavaScript operators

Operator	Description	Expression	Returns
+	Combines or adds two items	12 + 3	15
–	Subtracts one item from another	12 – 3	9
*	Multiplies two items	12*3	36
/	Divides one item by another	12/3	4
%	Returns the remainder after dividing one item by another	18%5	3
++	Increases a value by 1	12++	13
--	Decreases a value by 1	12--	11
–	Changes the sign of a value	–12	–12

Note that the `+` operator is used to add two or more numbers to calculate a sum, but as you saw in the last session it can also be used to combine two or more text strings into a single text string. The following command shows an expression that uses the `+` operator to combine several text strings:

```
""
```

### TIP

To insert single quotation marks into a text string, you must enclose the text string with double quotation marks.

If the `imgFile` variable stores the text string `"logo.png"`, this expression would return the text string `"<img src='logo.png' alt=''" />"`.

Operators are organized into **binary operators**, like `+` and `–`, which work with two operands in an expression and **unary operators**, which work on only one operand. One such unary operator is `++` (also known as the **increment operator**), which increases the value of the operand by 1. For example, the following two commands both increase the value of the `x` variable by 1; the first uses the `+` operator and the second uses the increment `++` operator:

```
x = x + 1;
x++;
```

A similar operator is the **decrement operator**, indicated by the `--` symbol, which decreases the operand's value by 1.

## Using Assignment Operators

Another type of operator is the **assignment operator**, which is used to assign a value to an item. Figure 9–25 lists the different JavaScript assignment operators.

Figure 9–25

JavaScript assignment operators

Operator	Example	Equivalent To
=	x = y	x = y
+=	x += y	x = x + y
-=	x -= y	x = x - y
*=	x *= y	x = x * y
/=	x /= y	x = x / y
%=	x %= y	x = x % y

The most common assignment operator is the equal sign (=), which assigns the value of one expression to another. JavaScript also allows you to combine the act of assigning a value and changing a value within a single operator. For example, both of the following expressions increase the value of the *x* variable by 2 but the += operator does so more efficiently.

```
x = x + 2;
x += 2;
```

**TIP**

Do not insert a space between the symbols in the += operator or JavaScript will report a syntax error.

After you master the syntax, you can use assignment operators to create efficient and compact expressions.

## Calculating the Days Left in the Year

You will use operators and Date objects to calculate the number of days remaining until the New Year's Bash. To calculate this value, you need to do the following:

1. Create a Date object for January 1st of the next year
2. Calculate the difference between the current date and the upcoming January 1st

To create the January 1st Date object, you first declare the following newYear variable:

```
var newYear = new Date("January 1, 2022");
```

Using 2022 for the year is only a temporary step. The end goal is to create a Date object for January 1st of the upcoming year (whenever that may be). You can determine this value by extracting the year value from the currentDay variable you created in the last session and adding 1 to it using the following command:

```
var nextYear = currentDay.getFullYear() + 1;
```

Then, by applying the setFullYear() method, change the year of the newYear Date object to the coming year as follows:

```
newYear.setFullYear(nextYear);
```

With the newYear variable now containing a date matching the upcoming January 1st, the following command calculates the time difference between that date and the current day:

```
var daysLeft = newYear - currentDay;
```

However, because JavaScript measures time difference in milliseconds, not days, the daysLeft variable stores the number of milliseconds between January 1st and the current date. To express this value in days, you need to divide the difference by the number of milliseconds in one day. Because there are 1000 milliseconds in one second, 60 seconds in one minute, 60 minutes in one hour, and 24 hours are in one day, the revised command becomes:

```
var daysLeft = (newYear - currentDay) / (1000*60*60*24);
```

Add all of these commands to the `tny_script.js` file to calculate the days between the current date and upcoming January 1st.

### To calculate the days left until the new year:

1. If you took a break after the previous session, make sure the `tny_script.js` file is open in your editor.
2. Directly above the comment `/* Display the time left until New Year's Eve */`, insert the following code:

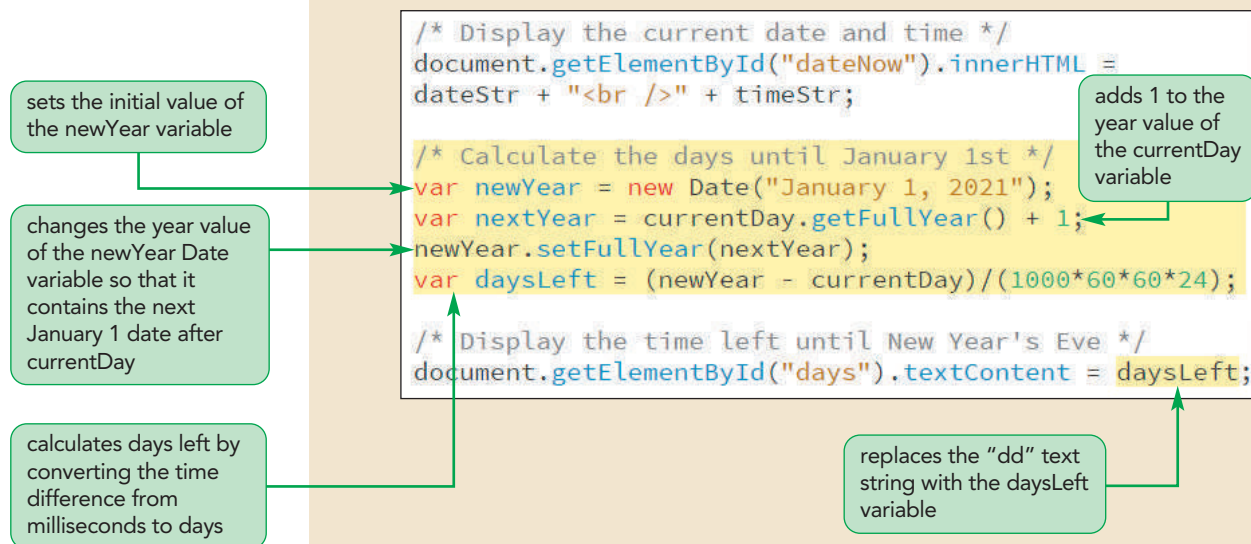
```
/* Calculate the days until January 1st */
var newYear = new Date("January 1, 2021");
var nextYear = currentDay.getFullYear() + 1;
newYear.setFullYear(nextYear);
var daysLeft = (newYear - currentDay)/(1000*60*60*24);
```

3. Replace the text string `"dd"` in the first line below the `"Display the time left until New Year's Eve"` comment with the `daysLeft` variable.

Figure 9–26 describes the newly added code.

Figure 9–26

Calculating the days left before the next January 1st

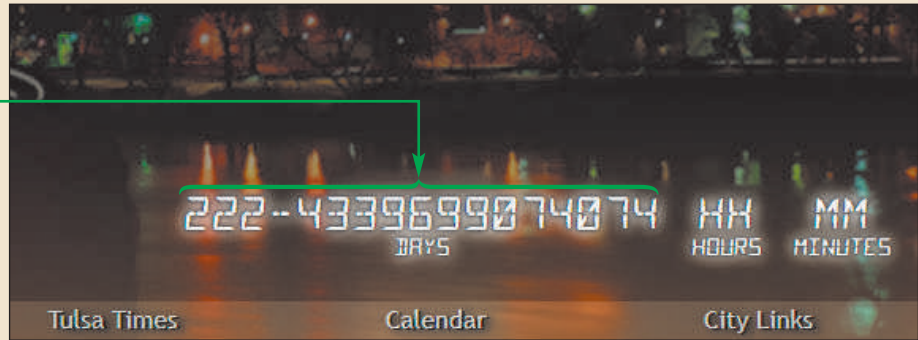


4. Save your changes to the file and then reload `tny_clock.html` in your browser.

Figure 9–27 shows the calculated days until January 1st for the sample date of May 23, 2021.

Figure 9–27

Days left until January 1st

calculated value of the  
daysLeft variable

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**Trouble?** If no value appears for the daysLeft variable, you might have made an error when entering the code. Use your browser debugger to check your code against the code shown in Figure 9–26, making corrections as needed. Save the file and then reload the web page.

The value displayed in the daysLeft field is 222.43396... (the clock font displays a decimal point as --), indicating that almost 222 and a half days are left until the start of the New Year's Bash. The fractional part of the value represents how much of the current day is remaining, which in this case is about 0.434 days. Since Hector wants the countdown clock to display the days, hours, minutes, and seconds until the party begins as integers, you have to modify the results by converting the fractional values to integer values expressed in hours, minutes, and seconds. You can do this by using some of the built-in JavaScript functions for mathematical calculations.

## Working with the Math Object

One way of performing these types of calculations is to use JavaScript's `Math` object. The **Math object** is a built-in object used for performing mathematical tasks and storing mathematical values.

### Using Math Methods

#### TIP

Case is important when applying the `Math` object; you must use `Math` instead of `math` as the object name.

The `Math` object supports several different methods for calculating logarithms, extracting square roots, returning trigonometric values, and so forth. The syntax for applying a `Math` method is

```
Math.method(expression)
```

where *method* is the method you apply to a mathematical expression. Figure 9–28 lists the JavaScript `Math` methods and their descriptions.

**Figure 9–28** Methods of the Math object

Method	Description	Example	Returns
Math.abs(x)	Returns the absolute value of x	Math.abs(–5)	5
Math.ceil(x)	Rounds x up to the next highest integer	Math.ceil(3.58)	4
Math.exp(x)	Raises e to the power of x	Math.exp(2)	e <sup>2</sup> (approximately 7.389)
Math.floor(x)	Rounds x down to the next lowest integer	Math.floor(3.58)	3
Math.log(x)	Returns the natural logarithm of x	Math.log(2)	0.693
Math.max(x, y)	Returns the larger of x and y	Math.max(3, 5)	5
Math.min(x, y)	Returns the smaller of x and y	Math.min(3, 5)	3
Math.pow(x, y)	Returns x raised to the power of y	Math.pow(2,3)	2 <sup>3</sup> (or 8)
Math.rand()	Returns a random number between 0 and 1	Math.rand()	Random number between 0 and 1
Math.round(x)	Rounds x to the nearest integer	Math.round(3.58)	4
Math.sqrt(x)	Returns the square root of x	Math.sqrt(2)	approximately 1.414

Because the countdown clock will display only the integer portion of the days left, you will apply the `Math.floor()` method, which rounds a value down to the next lowest integer, to the `daysLeft` variable. For the 222.4339... value currently in the countdown clock, this method returns the integer value 222.

#### To apply the `Math.floor()` method:

1. Return to the `tny_script.js` file in your editor.
2. Apply the `Math.floor()` method to the command that displays the value of the `daysLeft` variable, changing it to:

```
document.getElementById("days").textContent =
Math.floor(daysLeft);
```

Figure 9–29 highlights the revised code in the command.

**Figure 9–29** Applying the `Math.floor()` method

```
/* Display the time left until New Year's Eve */
document.getElementById("days").textContent = Math.floor(daysLeft);
```

rounds the daysLeft  
value down to the next  
lowest integer

3. Save your changes to the file and then reload the `tny_clock.html` file in your browser. Verify that 222 days with no decimal places are now shown in the countdown clock.

The difference between the exact days left in the year 222.43396... and the rounded value 222 is 0.43396..., which represents the fractional part of the current day left until the New Year's Eve Bash. Hector wants this value expressed in hours, which you can calculate by multiplying the fraction part by 24 (the number of hours in a single day) using the following command:

```
var hrsLeft = (daysLeft - Math.floor(daysLeft)) * 24;
```

As with the `daysLeft` variable in the previous set of steps, you need to round this value down to the next lowest integer using the `Math.floor()` method so that the integer portion only is displayed in the countdown clock.

Be sure that the number of opening parentheses symbols matches the number of closing parentheses symbols.

### To calculate the hours left:

1. Return to the `tny_script.js` file in your editor.
2. Directly below the line declaring the `daysLeft` variable, insert:  

```
/* Calculate the hours left in the current day */
var hrsLeft = (daysLeft - Math.floor(daysLeft))*24;
```
3. Change the command that displays the text string "hh" as the hours left to:  

```
document.getElementById("hrs").textContent =
Math.floor(hrsLeft);
```

Figure 9–30 highlights the code to calculate and displays the `hrsLeft` variable.

Figure 9–30

### Calculating the hours left in the current day

```
var daysLeft = (newYear - currentDay)/(1000*60*60*24);

/* Calculate the hours left in the current day */
var hrsLeft = (daysLeft - Math.floor(daysLeft))*24;

/* Display the time left until New Year's Eve */
document.getElementById("days").textContent = Math.floor(daysLeft);
document.getElementById("hrs").textContent = Math.floor(hrsLeft);
document.getElementById("mins").textContent = "mm";
document.getElementById("secs").textContent = "ss";
```

calculates the fractional part of the current day in terms of hours

displays the integer part of hours left

4. Save your changes to the file and then reload `tny_clock.html` in your browser. Figure 9–31 shows the hours left in the current day.

Figure 9–31

### Days and hours left until January 1st

number of hours left in the current day

number of days left in the current year



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You may have noticed that JavaScript appears to have reported an extra hour in the day. The total is accurate since the current time is given as 2:35:05 p.m. but JavaScript reports that 10 hours are left. The extra hour comes from daylight savings time, which moves the clock backward one hour in the autumn, adding an extra hour to the overall calculation. Because the time interval between May 23 and January 1st includes the switch to daylight savings time, the extra hour appears in the hours part of the countdown clock.

Complete the countdown clock by calculating the minutes left in the current hour and the seconds left in the current minute. The technique to calculate the minutes left in the current hour is similar to the one you used to calculate the hours left in the current day. You multiply the difference between the `hrsLeft` value and the whole hours value by 60 (the number of minutes in an hour) to express the fractional part in terms of minutes, as shown in the following command:

```
var minsLeft = (hrsLeft - Math.floor(hrsLeft)) * 60;
```

Finally, to calculate the seconds left in the current minute, you multiply the fractional part of the `minsLeft` variable by 60 (the number of seconds in a minute), as follows:

```
var secsLeft = (minsLeft - Math.floor(minsLeft)) * 60;
```

As with the `daysLeft` and `hrsLeft` variables, you want to display only the integer part of the `minsLeft` and `secsLeft` variables by using the `Math.floor()` method. Add these commands to the script.

### To calculate the minutes and seconds left:

1. Return to the **tny\_script.js** file in your editor.
2. Directly below the command to declare the `hrsLeft` variable, add the following code:
 

```
/* Calculate the minutes and seconds left in the current hour */
var minsLeft = (hrsLeft - Math.floor(hrsLeft)) * 60;
var secsLeft = (minsLeft - Math.floor(minsLeft)) * 60;
```
3. Replace the "mm" and "ss" text strings in the countdown clock commands with values for the `minsLeft` and `secsLeft` variables rounded down to the next lowest integer using the `Math.floor()` method. The revised commands should appear as:

```
document.getElementById("mins").textContent =
Math.floor(minsLeft);
document.getElementById("secs").textContent =
Math.floor(secsLeft);
```

Figure 9–32 highlights the code to calculate the minutes and seconds left in the year.

Figure 9–32

## Calculating the minutes and seconds left

calculates the fractional part of the hours left in terms of minutes

calculates the fractional part of the minutes left in terms of seconds

```
/* Calculate the hours left in the current day */
var hrsLeft = (daysLeft - Math.floor(daysLeft))*24;

/* Calculate the minutes and seconds left in the current hour */
var minsLeft = (hrsLeft - Math.floor(hrsLeft))*60;
var secsLeft = (minsLeft - Math.floor(minsLeft))*60;

/* Display the time left until New Year's Eve */
document.getElementById("days").textContent = Math.floor(daysLeft);
document.getElementById("hrs").textContent = Math.floor(hrsLeft);
document.getElementById("mins").textContent = Math.floor(minsLeft);
document.getElementById("secs").textContent = Math.floor(secsLeft);
```

displays minutes left and seconds left as whole numbers

4. Save your changes to the file and then reload `try_clock.html` in your browser. The countdown clock values for the specified date are shown in Figure 9–33.

Figure 9–33

## Days, hours, minutes, and seconds left until January 1st



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time left broken down by days, hours, minutes, and seconds

Another factor in time calculations is that the day is not evenly divided into seconds. A fraction of a second is always left over each day. As the days accumulate, these fractions of a second add up. Most time devices, such as atomic clocks, account for this accumulation by adding a leap second on certain days of the year. JavaScript includes leap seconds in its time calculations as well and thus, it may sometimes appear that the seconds value in the countdown clock is off by a second.

## Using Math Constants

Many functions require the use of mathematical constants, such as  $\pi$  and  $e$ . Rather than entering the numeric values of these constants directly into the code, you can reference the built-in constants stored in the JavaScript `Math` object. The syntax to access one of these mathematical constants is

```
Math.CONSTANT
```

where `CONSTANT` is the name of one of the mathematical constants supported by the `Math` object, shown in Figure 9–34.

Figure 9–34

Math constants

Constant	Description
Math.E	The base of the natural logarithms (2.71828...)
Math.LN10	The natural logarithm of 10 (2.3026...)
Math.LN2	The natural logarithm of 2 (0.6931...)
Math.LOG10E	The base 10 logarithm of $e$ (0.4343...)
Math.LOG2E	The base 2 logarithm of $e$ (1.4427...)
Math.PI	The value of $\pi$ (3.14159...)
Math.SQRT1_2	The value of 1 divided by the square root of 2 (0.7071...)
Math.SQRT2	The square root of 2 (1.4142 ...)

For example, the formula to calculate the volume of a sphere is  $4\pi r^3/3$ , where  $r$  is the radius of the sphere. To reference the value of  $\pi$  in the calculation of a sphere's volume, you would apply the `Math.PI` constant. To cube the value of  $r$ , you would use the method `Math.pow(r, 3)`. Putting these together, the code to calculate the volume of a sphere of 10 units would be as follows:

```
var radius = 10;
var volume = 4*Math.PI*Math.pow(radius, 3)/3;
```

You don't need to use any `Math` object constants for the New Year's Bash website.

## INSIGHT

### Generating Random Numbers

One of the most useful applications of JavaScript is to create dynamic pages that can change in a random fashion. A commercial website might need to display banner ads in a random order so that customers see a different ad each time they access the page. To create these kinds of effects, you need a script that generates a random value. JavaScript accomplishes this using the `Math.random()` method, which returns a random value between 0 and 1. You can change the range of possible random values using the expression

```
lowest + size*Math.random()
```

where *lowest* is the lower boundary of the range and *size* is the size of the range. For example, to generate a random number from 20 to 30, you could apply the following expression:

```
10*Math.random() + 20;
```

In many cases, you want to limit a random number to integer values. To do so, enclose the random value within the `Math.floor()` method as follows

```
Math.floor(lowest + size*Math.random())
```

where *lowest* is the smallest integer in the range and *size* is the number of integer values in the range. Thus, to generate a random integer from 21 to 30, you would apply the following expression:

```
Math.floor(21 + 10*Math.random());
```

Note that using the `Math.floor()` method guarantees that the random number is rounded down to the next lowest integer, which in this example limits it to a range of integers from 21 to 30.

You will complete the calculations on the countdown clock so that instead of the sample date and time you used in this session, you will display the actual date and time based on your computer's clock. Recall that you can create a `Date` object showing the current date and time by using the expression

```
new Date()
```

with no parameter value for the object constructor.

#### To use the current date and time:

1. Return to the **tny\_script.js** file in your editor.
2. Change the command declaring the `currentDay` variable to:

```
var currentDay = new Date();
```

Figure 9–35 highlights the revised command.

Figure 9–35

#### Storing the current date and time

stores the current date and time in the `currentDay` variable

```
/* Store the current date and time */
var currentDay = new Date();
var dateStr = currentDay.toLocaleDateString();
var timeStr = currentDay.toLocaleTimeString();
```

3. Save your changes and then reload `try_clock.html` in your browser. Verify that the browser displays the current date and time.
4. Continue to reload the web page and verify that each time you reload the page, the time and countdown clock are updated with the current values.

Reloading the page updates the time and countdown values, but Hector would like your script to automatically update those values every second without requiring the user to reload the page. To create this effect, you first need to place all of the code you have written within a function.

## Working with JavaScript Functions

When you want to reuse the same JavaScript commands throughout your web page, you store the commands in a function. A **function** is a collection of commands that performs an action or returns a value. Every function includes a function name that identifies it and a set of commands that are run when the function is called. Some functions also require **parameters**, which are variables associated with the function. The general syntax of a JavaScript function is

```
function function_name(parameters) {
 commands
}
```

where *function\_name* is the name of the function, *parameters* is a comma-separated list of variables used in the function, and *commands* is the set of statements run by the function. As with variable names, a function name must begin with a letter or underscore ( `_` ) and cannot contain any spaces. Also, like variable names, function names are case sensitive and thus, JavaScript treats names such as `runClock` and `runclock` as different functions.

For example, the following `showDay` function sets the `innerHTML` property of the `dateNow` element to the text string `"11/8/2021<br />2:45:12 p.m."`

```
function showDay() {
 document.getElementById("dateNow").innerHTML =
 "11/8/2021
2:45:12 p.m.";
}
```

Note that there are no parameters for this function, which means it always writes the same HTML code into the `dateNow` element. However, you could store the date and time text strings as parameters named `dateStr` and `timeStr` as the following function demonstrates:

```
function showDay(dateStr, timeStr) {
 document.getElementById("dateNow").innerHTML =
 dateStr + "
" + timeStr;
}
```

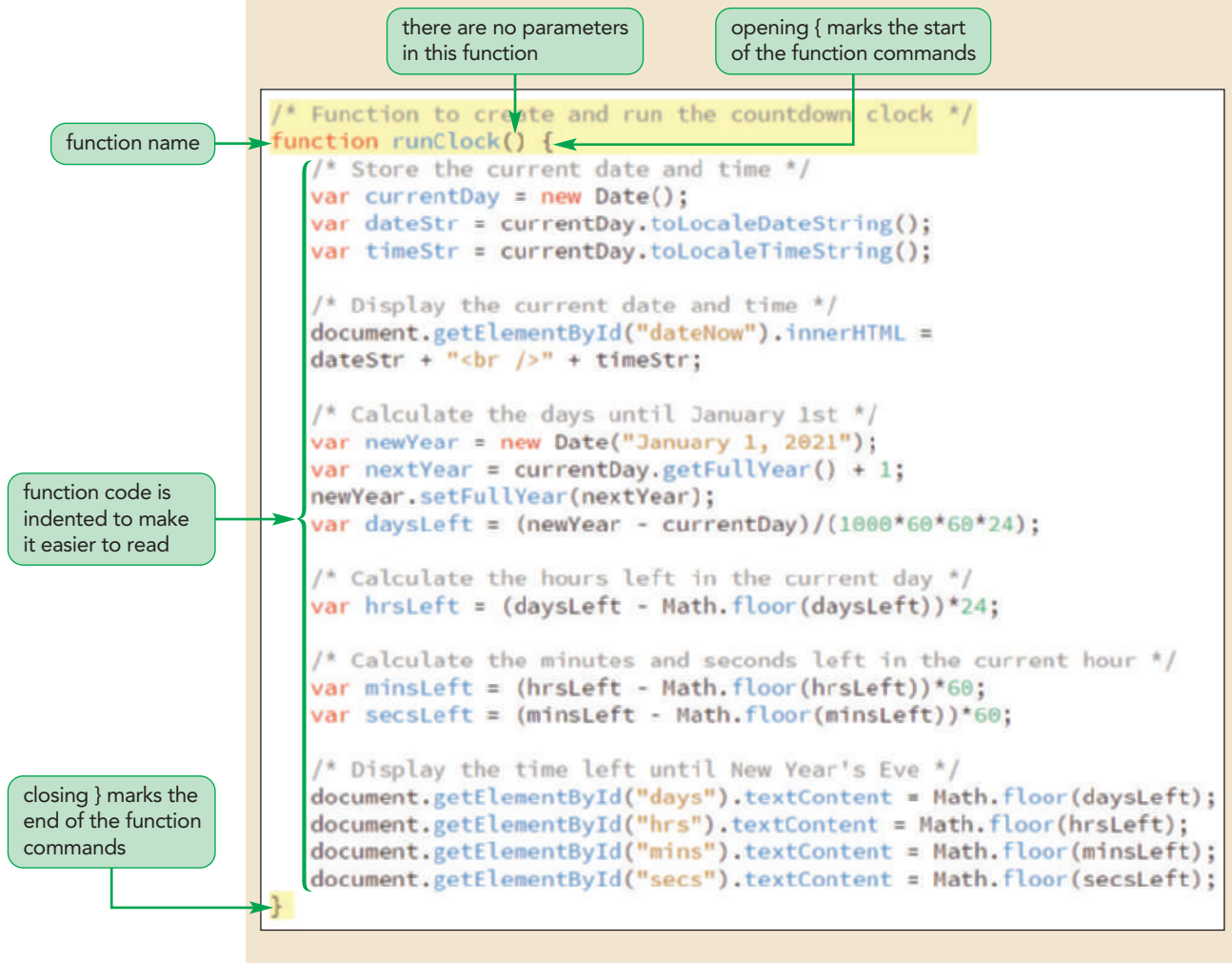
Parameters are treated as variables within the function. By defining the parameter values elsewhere in the JavaScript file, you can run this function to write different HTML code into the `dateNow` element.

Create a new function now named `runClock()` containing the code you have written to create and display the countdown clock.

**To insert the runClock() function:**

1. Return to the **tny\_script.js** file in your editor.
2. Directly below the initial comment section, insert the following comment:  
`/* Function to create and run the countdown clock */`
3. Next, add the following code as the initial line of the runClock() function:  
`function runClock() {`
4. Scroll to the bottom of the file and insert a closing `}` to close the runClock() function.
5. Indent the code within the function to make it easier to read.

Figure 9–36 shows the code and structure of the runClock() function.

**Figure 9–36****Complete runClock() function**

Next, you explore how to run a function within your program.

## Calling a Function

To run a function, you have to call it. If the function has any parameters, the initial values of the parameters are set when the function is called. The expression to call a function and run the commands it contains has the general form

```
function_name(parameter values)
```

where *function\_name* is the name of the function and *parameter values* is a comma-separated list of values that match the parameters of the function. If no parameters are used with the function, leave the parameter values blank as follows:

```
function_name()
```

For example, to call the `showDay()` function described earlier with the text string "11/8/2021" for the `dateStr` parameter and "2:45:12 p.m." as the value of the `timeStr` parameter, you would run the following command:

```
showDay("11/8/2021", "2:45:12 p.m.");
```

resulting in the following HTML code being written into the `dateNow` element:

```
11/8/2021
2:45:12 p.m.
```

Parameter values can also be variables. The following code calls the `showDay()` function using the values stored in the `text1` and `text2` variables:

```
var text1="11/8/2021";
var text2="2:45:12 p.m.";
showDay(text1, text2);
```

resulting in the same code written to the `innerHTML` property of the `dateNow` element. One of the great advantages of functions is that they can be repeatedly called with different parameter values to achieve different results. Another advantage is that functions break long and complicated scripts into manageable chunks. It's also good programming practice to include oft-used functions in a separate JavaScript file so that they can be accessed and used by multiple scripts throughout the website.

Execute the `runClock()` function now by adding a line to call it.

### To call the `runClock()` function:

1. Directly above the `runClock()` function, insert the following command:
 

```
/* Execute the function to run and display the countdown clock */
runClock();
```
2. Compare your code to Figure 9–37, which highlights the code to run the `runClock()` function.

Figure 9–37

### Calling the `runClock()` function

command to execute  
the `runClock()` function

```
/* Execute the function to run and display the countdown clock */
runClock();

/* Function to create and run the countdown clock */
function runClock() {
 /* Store the current date and time */
```

3. Save your changes to the file and then reload `tny_clock.html` in your browser. Verify that the page once again displays the current date and time and calculates the time interval until the New Year's Bash.

## Creating a Function to Return a Value

You created the `runClock()` function to perform the action of writing HTML code to elements on the countdown clock web page. The other use of a function is to return a calculated value. For a function to return a value, it must conclude with a `return` statement as follows

```
function function_name(parameters) {
 commands
 return value;
}
```

where *value* is the calculated value that is returned by the function. For example, the following `calcArea()` function returns the area of a rectangle for a given length and width:

```
function calcArea(length, width) {
 var rectArea = length*width;
 return rectArea;
}
```

In this function, the value of the `rectArea` variable is returned by the function. The following code demonstrates how to call the `calcArea()` function for an 8×6 rectangle, storing the calculated area in the `totalArea` variable:

```
var x = 8;
var y = 6;
var totalArea = calcArea(x,y);
```

The first two commands assign the values 8 and 6 to the `x` and `y` variables, respectively. The values of both of these variables are then sent to the `calcArea()` function as the values of the `length` and `width` parameters. The `calcArea()` function uses these values to calculate the area, which is stored in the `totalArea` variable.

Functions that return a value can be placed within larger expressions. For example, the following code calls the `calcArea()` function within an expression that multiplies the area value by 2 and store it as the variable `z2`:

```
var z2 = calcArea(x,y)*2;
```

You do not need to create a function that returns a value for Hector's countdown clock page.

### INSIGHT

#### Functions and Variable Scope

As you have seen, the commands within a function are run only when the function is called. This has an impact on how variables within the function are treated. Every variable you create has a property known as **scope**, which indicates where you can reference the variable within the JavaScript file. A variable's scope can be either local or global. A variable declared within a function has **local scope** and can be referenced only within that function. Variables with local scope are sometimes referred to as **local variables**. All of the variables you created in this session have local scope and can only be referenced from within the `runClock()` function. Function parameters also have local scope and are not recognized outside of the function in which they are used.

Variables not declared within functions have **global scope** and can be referenced from anywhere within the script file or from within other script files. Variables with global scope are often referred to as **global variables**.

## Running Timed Commands

You have completed the functions required for the countdown clock, but the clock is largely static, changing only when the page is reloaded by the browser. Hector wants the clock to be updated constantly so that it always shows the current time and the time remaining until the New Year's Bash. To do this, you need to rerun the `runClock()` function at specified times. JavaScript provides two methods for doing this: time-delayed commands and timed-interval commands.

### Working with Time-Delayed Commands

A **time-delayed command** is a JavaScript command that is run after a specified amount of time has passed. The time delay is defined using the following `setTimeout()` method

```
setTimeout("command", delay);
```

where *command* is a JavaScript command and *delay* is the delay time in milliseconds before a browser runs the command. The command must be placed within either double or single quotation marks. For example, the following command sets a 5-millisecond delay before a browser runs the `runClock()` function:

```
setTimeout("runClock()", 5);
```

In some JavaScript programs, you may want to cancel a time-delayed command. This can be necessary when other user actions remove the need to run the command. Time-delayed commands are canceled using the following statement:

```
clearTimeout();
```

There is no limit to the number of time-delayed commands a browser can process. To distinguish one time-delayed command from another, you assign a unique identification to each command using the statement

```
var timeID = setTimeout("command", delay);
```

where *timeID* is a variable that stores the ID of the time-delayed command. After you have assigned an ID to the command, you can cancel it using the following `clearTimeout()` method

```
clearTimeout(timeID);
```

where once again *timeID* is the variable that stores the ID of the command.

### Running Commands at Specified Intervals

The other way to time JavaScript commands is by using a timed-interval command, which instructs browsers to run the same command repeatedly at a specified interval. Timed-interval commands are applied using the following `setInterval()` method

```
setInterval("command", interval);
```

#### TIP

With timed-interval commands, the first execution of the command occurs after a delay equal to the size of the time interval.

where *interval* is the interval in milliseconds before the command is run again. Timed-interval commands are halted using the following statement:

```
clearInterval();
```

As with time-delayed commands, you may have several timed-interval commands running simultaneously. To distinguish one timed-interval command from another, you store the time ID in a variable as follows

```
var timeID = setInterval("command", interval);
```

and halt the timed-interval command by applying the `clearInterval()` method with *timeID* as the parameter value:

```
clearInterval(timeID);
```

An important point to remember about the `setTimeout()` and `setInterval()` methods is that after a browser processes a request to run a command at a later time, the browser doesn't stop. Instead, the browser processes the next commands in the script without delay. For example, you might try to run three functions at 50-millisecond intervals using the following structure:

```
setTimeout("function1()", 50);
setTimeout("function2()", 50);
setTimeout("function3()", 50);
```

However, a browser would execute this code by running all three functions almost simultaneously. To run the functions with a separation of about 50 milliseconds between one function and the next, you would need to use three different delay times, as follows:

```
setTimeout("function1()", 50);
setTimeout("function2()", 100);
setTimeout("function3()", 150);
```

In this case, a user's browser would run the first function after 50 milliseconds, the second function 50 milliseconds after that, and the third function after another 50 milliseconds have passed.

## REFERENCE

### Running Timed Commands

- To run a command after a delay, use the method

```
var timeID = setTimeout("command", delay)
```

where *command* is the command to be run, *delay* is the delay time in milliseconds, and *timeID* is a variable that stores the ID associated with the time-delayed command.

- To repeat a command at set intervals, use the method

```
var timeID = setInterval("command", interval)
```

where *interval* is the time, in milliseconds, between repetitions of the command.

- To cancel a specific time-delayed command, use the method

```
clearTimeout(timeID)
```

where *timeID* is the ID of the time-delayed command.

- To clear all time-delayed commands, use the following method:

```
clearTimeout()
```

- To cancel a repeated command, use the method

```
clearInterval(timeID)
```

where *timeID* is the ID of the repeated command.

- To clear all repeated commands, use the following method:

```
clearInterval()
```

Use the `setInterval()` method to repeatedly run the `runClock()` function. Because the function should run once every second, set the interval length to 1000 milliseconds using the command:

```
setInterval("runClock()", 1000);
```

Add this command to the `tny_script.js` file now.

**To run the runClock() function every second:**

1. Return to the **tny\_script.js** file in your editor and, directly below the `runClock()` command, insert the following:

```
setInterval("runClock()", 1000);
```

Figure 9–38 highlights the code to run the timed-interval command.

**Figure 9–38****Repeating the runClock() function**

```
/* Execute the function to run and display the countdown clock */
runClock();
setInterval("runClock()", 1000);
```

repeats the runClock()  
function every second

2. Save your changes to the file and then reload `tny_clock.html` in your browser.
3. Verify that every second the time value and the countdown value change as the date of the New Year's Eve Bash comes ever closer.

You have completed the countdown clock for the New Year's Bash. Hector will continue to work on the event's website and get back to you with any new projects or concerns.

## Controlling How JavaScript Works with Numeric Values

As you perform mathematical calculations using JavaScript, you will encounter situations in which you need to work with the properties of numeric values themselves. JavaScript provides several methods that allow you to examine the properties of numbers and specify how they are displayed on a web page.

### Handling Illegal Operations

Some mathematical operations can return results that are not numeric values. For example, you cannot divide a number by a text string. An expression such as `5/"A"` will return the value `NaN`, which stands for "Not A Number" and is JavaScript's way of indicating an illegal operation that should involve only numeric values, but doesn't. You can check for the presence of this particular error using the following `isNaN()` function

```
isNaN(value)
```

where *value* is the value or variable you want to test for being numeric. The `isNaN()` function returns a Boolean value of `true` if the value is not numeric and `false` otherwise. The use of the `isNaN()` function is one way to locate illegal operations in code in which non-numeric values are treated as numeric.

Another illegal operation is dividing a number by 0, which returns a value of `Infinity`, indicating a numeric calculation whose result is greater than the largest numeric value supported by JavaScript. An `Infinity` value is also generated for an operation whose result is less than the smallest numeric value. JavaScript is limited to numeric values that fall between approximately  $1.8 \times 10^{-308}$  and  $1.8 \times 10^{308}$ . Any operation that exceeds those bounds, such as attempting to divide a number by 0, causes JavaScript to assign a value of `Infinity` to the result. You can check for this outcome using the function

```
isFinite(value)
```

**TIP**

A program that reports a run-time or logical error may have a mismatched data value; you can use the `isFinite()` and `isNaN()` functions to determine the state of your data values.

where *value* is the value you want to test for being finite. Like the `isNaN()` function, the `isFinite()` function returns a Boolean value of `true` if the value is a finite number falling within JavaScript's acceptable range and `false` if the numeric value falls outside that range or if the value is not a number at all.

## Defining a Number Format

When JavaScript displays a numeric value, it stores that value to 16 decimal places of accuracy. This can result in long numeric strings of digits being displayed by browsers. For example, a value such as  $1/3$  is stored as 0.3333333333333333.

It is rare that you will need to display a calculated value to 16 decimal places. To control the number of digits displayed by browsers, you can apply the following `toFixed()` method

```
value.toFixed(n)
```

where *value* is the value or variable and *n* is the number of decimal places that should be displayed in the output. The following examples show the `toFixed()` method applied to different numeric values:

```
var testValue = 2.835;
testValue.toFixed(0) // returns "3"
testValue.toFixed(1) // returns "2.8"
testValue.toFixed(2) // returns "2.84"
```

Note that the `toFixed()` method limits the number of decimals displayed by a value and converts the value into a text string. Also, the `toFixed()` method rounds the last digit in an expression rather than truncating it.

## Converting Between Numbers and Text

Sometimes, you might need to convert a number to a text string and vice versa. One way to convert a number to a text string is by using the `+` operator to add a text string to a number. For example, the following code uses the `+` operator to concatenate a numeric value with an empty text string. The result is a text string containing the characters 123.

```
testNumber = 123; // numeric value
testString = testNumber + ""; // text string
```

To convert a text string to a number, you can apply an arithmetic operator (other than the `+` operator) to the text string. The following code takes the text string 123 and multiplies it by 1. JavaScript converts the text string "123" to the numeric value 123.

```
testString = "123"; // text string
testNumber = testString*1; // numeric value
```

Another way of converting a text string to a numeric value is to use the following `parseInt()` function, which extracts the leading integer value from a text string

```
parseInt(text)
```

where *text* is the text string or variable from which you want to extract the leading integer value. The `parseInt()` function returns the integer value from the text string, discarding any non-integer characters. If a text string does not begin with an integer, the function returns the value `NaN`, indicating that the text string contains no accessible number. The following are some sample values returned by the `parseInt()` function:

```
parseInt("120 lbs"); // returns 120
parseInt("120.88 lbs"); // returns 120
parseInt("weight equals 120 lbs"); // returns NaN
```

**TIP**

You can use the `parseFloat()` function to extract decimal values from text strings.

Figure 9–39 summarizes the different JavaScript functions and methods used to work with numeric values.

Figure 9–39

## Numerical functions and methods

Numerical Function	Description
<code>isFinite(value)</code>	Indicates whether <i>value</i> is finite and a real number
<code>isNaN(value)</code>	Indicates whether <i>value</i> is a number
<code>parseFloat(string)</code>	Extracts the first numeric value from the text <i>string</i>
<code>parseInt(string)</code>	Extracts the first integer value from the text <i>string</i>
Numerical Method	Description
<code>value.toExponential(n)</code>	Returns a text string displaying <i>value</i> in exponential notation with <i>n</i> digits to the right of the decimal point
<code>value.toFixed(n)</code>	Returns a text string displaying <i>value</i> to <i>n</i> decimal places
<code>value.toPrecision(n)</code>	Returns a text string displaying <i>value</i> to <i>n</i> significant digits either to the left or to the right of the decimal point

You don't need to use the `parseInt()` or other numeric functions in your code. At this point, you can close any open files or applications.



## PROSKILLS

## Problem Solving: Fixing Common Programming Mistakes

When you begin writing JavaScript programs, you will invariably encounter mistakes in your code. Some common sources of programming errors include:

- **Misspelling a variable name:** For example, if you named a variable `ListPrice`, then misspellings or incorrect capitalization—such as `listprice`, `ListPrice`, or `list_price`—will result in the program failing to run correctly.
- **Mismatched parentheses or braces:** The following code results in an error because the function lacks the closing brace:

```
function Area(width, height) {
 var size = width*height;
```

- **Mismatched quotes:** If you neglect the closing quotes around a text string, JavaScript treats the text string as an object or variable, resulting in an error. The following code results in an error because the closing double quote is missing from the `firstName` variable:

```
var firstName = "Sean";
var lastName = "Lee";
```

- **Missing quotes:** When you combine several text strings using the `+` symbol, you might neglect to quote all text strings. For example, the following code generates an error because of the missing quotes around the `<br />` tag:

```
document.write("MidWest Student Union" +
);
```

As you become more experienced, you will be able to quickly spot these types of errors, making it easier for you to debug your programs.

### Session 9.3 Quick Check

1. The command to increase the value of the `thisDay` variable by 1, using the increment operator is:
  - a. `thisDay+`
  - b. `thisDay++`
  - c. `incr(thisDay)`
  - d. `increment(thisDay)`
2. Rewrite the following command using an assignment operator: `income = income - taxes;`
  - a. `income = - taxes`
  - b. `income -- taxes`
  - c. `income -= taxes`
  - d. `income/taxes -`
3. Which expression returns the value of `dailyIncome`, rounded up to the next highest integer?
  - a. `Math.round(dailyIncome)`
  - b. `Math.int(dailyIncome)`
  - c. `Math.roundup(dailyIncome)`
  - d. `Math.ceil(dailyIncome)`
4. The area of a circle is  $\pi r^2$  where  $r$  is the circle's radius. Which JavaScript expression returns a circle's area where the radius has been stored in a variable named `radius`?
  - a. `PI()*radius**2`
  - b. `PI*radius^^2`
  - c. `Math.PI*Math.pow(radius, 2)`
  - d. `Math.PI*radius*2`
5. Which command calls the `calcCirArea()` function using a value of 15 for the circle's radius and storing the result in a variable named `finalArea`?
  - a. `finalArea = calCirArea 15;`
  - b. `finalArea = calCirArea(radius = 15);`
  - c. `finalArea = radius.calCirArea();`
  - d. `finalArea = calcCirArea(15);`
6. Variables that can be referenced only within the function in which they are created have:
  - a. function scope
  - b. global scope
  - c. local scope
  - d. nested scope
7. Which command runs the `init()` function after a 5-second delay?
  - a. `setDelay("init()", 5000);`
  - b. `setDelay("init()", 5);`
  - c. `setTimeout("init()", 5000);`
  - d. `setTime("init()", 5);`
8. Which command runs the `init()` function once every 5 seconds?
  - a. `setInterval("init()", 5);`
  - b. `setInterval("init()", 5000);`
  - c. `repeat("init()", 5);`
  - d. `repeatFunction("init()", 5000);`

## Coding Challenge 1

Data files needed for this Coding Challenge: `code9-1_txt.html`, `clock9-1_txt.js`, `code9-1_styles.css`, `segment14.ttf`, `segment14.woff`

You are working on a JavaScript clock that will show the date, day of the week, and time. The clock will update every second. Figure 9–40 shows a preview of the completed page.

Figure 9–40 Coding Challenge 9-1 example page



Do the following:

1. Open the `code9-1_txt.html` and `clock9-1_txt.js` files from the `html09 ► code1` folder. Enter *your name* and *the date* in each document and save the files as `code9-1.html` and `clock9-1.js` respectively.
2. Go to the `code9-1.html` file in your editor. Within the head section insert a `script` element connecting the page to the `clock9-1.js` file. Add the `defer` attribute to the `script` element to defer the loading of the script until after the page contents load.
3. Study the contents of the file and then save your changes.
4. Go to the `clock9-1.js` file in your editor. Directly below the initial comment section, insert the `runClock()` function. Within the function do the following:
  - a. Declare the `thisDay` variable containing the current date using the `new Date()` command.
  - b. Create the `thisDate` variable containing the text string of the current date by applying the `toLocaleDateString()` method to the `thisDay` variable.
  - c. Create the `thisDayNum` variable to store the number of the current weekday by applying the `getDay()` method to the `thisDay` variable.
  - d. Create the `thisWeekday` variable by storing the value returned by the `getWeekday()` function using `thisDayNum` as the function value.
  - e. Create the `thisTime` variable containing the text string of the current date by applying the `toLocaleTimeString()` method to the `thisDay` variable.
  - f. Using the `textContent` property, change the text stored in the document element with the ID "date" to the value of the `thisDate` variable, the text stored in the document with element with "wday" ID to the value of the `thisWeekday` variable, and the text stored in the document element with the ID "time" to the value of the `thisTime` variable.

5. Directly before the `runClock()` function insert a statement to run the `runClock()` function and then another statement that uses the `setInterval()` method to run the `runClock()` function every second.
6. Save your changes to the file and then open the **code9-1.html** file in your browser. Verify that the page shows the current date, weekday, and time, and that the clock automatically updates every second.
7. Submit the completed file to your instructor.

## CODE

## Coding Challenge 2

Data Files needed for this Coding Challenge: **code9-2\_txt.html**, **countdown9-2\_txt.js**, **code9-2\_styles.css**, **segment14.ttf**, **segment14.woff**

Figure 9–41 shows a preview of a page containing a countdown clock that counts down from 10 seconds to zero. When zero is reached, the page will show the message "Time's Up".

Figure 9–41 Coding Challenge 9-2 example page



Do the following:

1. Open the **code9-2\_txt.html** and **countdown9-2\_txt.js** files from the `html09 ► code2` folder. Enter **your name** and **the date** in each document and save the files as **code9-2.html** and **countdown9-2.js** respectively.
2. Go to the **code9-2.html** file in your editor. Within the head section insert a `script` element connecting the page to the `countdown9-2.js` file. Add the `defer` attribute to the `script` element. Save your changes to the file.
3. Go to the **countdown9-2.js** file in your editor. Directly below the initial comment section, declare the **secsLeft** variable, setting its initial value to 10.
4. Create the `countdown()` function. Within the function add the following:
  - a. Declare the **secsString** variable by calling the `addLeadingZero()` function using the `secsLeft` variable as the function value. The `addLeadingZero()` function is used to add leading zeroes to numeric values from 0 to 9.
  - b. Change the text content of the document element with the ID "seconds" to the value of the `secsString` variable.
  - c. Run the `checkCountdown()` function to determine whether the end of the countdown has been reached.
  - d. Use the decrement operator to reduce the value of the `secsLeft` variable by 1.

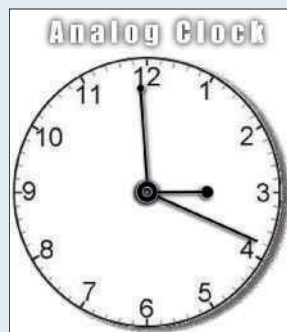
5. Create the `stopCountdown()` function to stop the countdown when 0 is reached. Add the following commands to the function:
  - a. Change the text content of the document with the ID "Alert" to the text string "Time's Up".
  - b. Use the `clearInterval()` method to clear the repeating command with the `timeID` variable `clockID`.
6. Go back to the top of the file and directly after the command to declare the `secsLeft` variable, insert a command using the `setInterval()` method to run the `countdown()` function every second. Store the time ID associated with the repeating command in the `clockID` variable.
7. Save your changes to the file and then open the **code9-2.html** file in your browser. Verify that the page shows a countdown from 10 down to 0 seconds and when 0 seconds is reached, the page shows the message "Time's Up".
8. Submit the completed file to your instructor.

### Coding Challenge 3

Data Files needed for this Coding Challenge: **code9-3\_txt.html**, **clockface9-3\_txt.js**, **code9-3\_styles.css**, **clockface.png**, **hours.png**, **minutes.png**, **seconds.png**

Figure 9–42 shows a preview of a page containing an analog clock with moving second, minute, and hour hands.

Figure 9–42 Coding Challenge 9-3 example page



Do the following:

1. Open the **code9-3\_txt.html** and **clockface9-3\_txt.js** files from the `html09 ► code3` folder. Enter **your name** and **the date** in each document and save the files as **code9-3.html** and **clockface9-3.js** respectively.
2. Go to the **code9-3.html** file in your editor. Within the head section insert a `script` element connecting the page to the `clockface9-3.js` file. Add the `defer` attribute to the `script` element. Save your changes to the file.
3. Go to the **clockface9-3.js** file in your editor. Below the initial comment section insert the `moveHands()` function that moves the three hands of the analog clock. Add the following to the function:
  - a. Create a variable named **nowTime** that contains the current date and time.
  - b. Create the **nowSeconds**, **nowMinutes**, and **nowHours** variables containing the seconds, minutes, and hours values from the `nowTime` variable.
  - c. Calculate the angle that the second hand makes on the clock face by multiplying the `nowSeconds` value by 6. Store the result in the **secondsAngle** variable.

- d. Determine the angle that the minute hand makes on the clock face by calculating the following expression:  

$$(\text{nowMinutes} + \text{nowSeconds}/60) * 6$$
 Store the calculated value in the **minutesAngle** variable.
- e. Determine the angle that the hour hand makes on the clock face by calculating the following expression:  

$$(\text{nowHours} + \text{nowSeconds}/3600 + \text{nowMinutes}/60) * 30$$
 Store the calculated value in the **hoursAngle** variable.
- f. Call the `rotateHand()` function using `secondsAngle` and `"seconds"` as the argument value to rotate the image of the second hand. Call the `rotateHand()` function again using the `minutesAngle` and `"minutes"` as the argument values. Call the `rotateHand()` function one last time using the `hoursAngle` and `"hours"` as the argument values.
4. Directly below the `moveHands()` function insert a command to run the `moveHands()` function and then use the `setInterval()` method to run the `moveHands()` method every second.
5. Save your changes to the file and then open the **code9-3.html** file in your browser. Verify that the page shows an analog clock face with the current time and that the hands of the clock move as the time changes.
6. Submit the completed file to your instructor.

## DEBUG

### Coding Challenge 4

**Data Files needed for this Coding Challenge:** `code9-4_txt.html`, `debug9-4_txt.js`, `code9-4_styles.css`, `slide1.jpg` - `slide14.jpg`

You can use JavaScript to display a random gallery of images. A page of a random gallery of images of the International Space Station has been created for you, but there are errors in the code. Locate and fix the errors to display the gallery. One of the images with its caption is shown in Figure 9–43.

Figure 9–43 Coding Challenge 9-4 example page



Do the following:

1. Open the **code9-4\_txt.html** and **debug9-4\_txt.js** files from the html09 ► code4 folder. Enter ***your name*** and ***the date*** in each document and save the files as **code9-4.html** and **code9-4\_debug.js** respectively.
2. Go to the **code9-4.html** file in your editor. There is a mistake in the `script` element in that the external JavaScript will be opened and run before the page is completely loaded. Fix the `script` element so that it loads the script file only once the page is loaded.
3. Save your changes and go to the **debug9-4.js** file in your editor.
4. The slide images should update every 5 seconds. Fix the parameter values for the `setInterval()` method so that the `showImage()` function is run every 5 seconds.
5. There are several mistakes in the code in which items that should be quoted are not. Locate and fix those errors.
6. Use of uppercase and lowercase letters is another source of error. Find and fix all situations in which variable names or JavaScript commands are written with improper case.
7. Save your changes to the file.
8. Open the **code9-4.html** file in your browser. When the page is free of errors, you should see a random image every 5 seconds. If the page is not working, you can use the Developer tools in your browser to locate any errors remaining in the code.
9. Submit the completed file to your instructor.

## PRACTICE

### Review Assignments

**Data Files needed for the Review Assignments: tny\_july\_txt.html, tny\_timer\_txt.js, 2 CSS files, 1 PNG file, 1 TTF file, 1 WOFF file**

Hector wants you to create a countdown clock page for the Tulsa Summer Party held on July 4th of every year. He wants the page to show the current date and time and to include a timer that counts down to the start of the fireworks at 9 p.m. on the 4th. Hector has already completed the page content and needs you to write the JavaScript code. A preview of the completed page for a sample date and time is shown in Figure 9–44.

Figure 9–44 Tulsa Summer Party



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Complete the following:

1. Use your editor to open the **tny\_july\_txt.html** and **tny\_timer\_txt.js** files from the html09 ► review folder. Enter **your name** and **the date** in the comment section of each file, and save them as **tny\_july.html** and **tny\_timer.js** respectively.
2. Go to the **tny\_july.html** file in your editor. Directly above the closing `</head>` tag, insert a `script` element that links to the **tny\_timer.js** file. Defer the loading of the script file until the web page loads.
3. Take some time to study the content and structure of the file, paying close attention to the `id` attributes applied to different page elements. Save your changes to the document.
4. Go to the **tny\_timer.js** file in your editor. At the top of the file, insert a statement to tell the browser to apply strict usage of the JavaScript code in the file.
5. Directly above the `nextJuly4()` function, insert a function named **showClock()** that has no parameters. Within the `showClock()` function, complete Steps a through g.
  - a. Declare a variable named **thisDay** that stores a `Date` object containing the date May 19, 2021 at 9:31:27 a.m.
  - b. Declare a variable named **localDate** that contains the text of the date from the `thisDay` variable using local conventions. Declare another variable named **localTime** that contains the text of the time stored in the `thisDay` variable using local conventions.

- c. Within the inner HTML of the page element with the ID `currentTime`, write the following code  

```
datetime
```

 where `date` and `time` are the values of the `localDate` and `localTime` variables.
- d. Hector has supplied you with a function named `nextJuly4()` that returns the date of the next 4th of July. Call the `nextJuly4()` function using `thisDay` as the parameter value and store the date returned by the function in the **j4Date** variable.
- e. The countdown clock should count down to 9 p.m. on the 4th of July. Apply the `setHours()` method to the `j4Date` variable to change the hours value to 9 p.m. (*Hint: Express the value for 9 p.m. in 24-hour time.*)
- f. Create variables named **days**, **hrs**, **mins**, and **secs** containing the days, hours, minutes, and seconds until 9 p.m. on the next 4th of July. (*Hint: Use the code from the `tny_script.js` file in the tutorial case as a guide for calculating these variable values.*)
- g. Change the text content of the elements with the IDs `"dLeft"`, `"hLeft"`, `"mLeft"`, and `"sLeft"` to the values of the `days`, `hrs`, `mins`, and `secs` variables rounded down to the next lowest integer.
6. Directly after the opening comment section in the file, insert a command to call the `showClock()` function.
7. After the command that calls the `showClock()` function, insert a command that runs the `showClock()` function every second.
8. Document your work in this script file with comments.
9. Save your changes to the file and then open the **tny\_july.html** file in your browser. Verify that the page shows the date and time of May 19, 2021 at 9:31:27 a.m., and that the countdown clock shows that Summer Party fireworks will begin in 46 days, 11 hours, 28 minutes, and 33 seconds. The countdown clock will not change because the script uses a fixed date and time for the `thisDay` variable.
10. Return to the **tny\_timer.js** file in your editor. Change the statement that declares the `thisDay` variable so that it contains the current date and time rather than a specific date and time.
11. Save your changes to the file and then reload the `tny_july.html` file in your browser. Verify that the countdown clock changes every second as it counts down the time until the start of the fireworks at 9 p.m. on the 4th of July.

## Case Problem 1

**Data Files needed for this Case Problem:** `bc_union_txt.html`, `bc_today_txt.css`, 2 CSS files, 4 PNG files

**Bridger College Student Union** Sean Baris manages the website for the student union at Bridger College in Bozeman, Montana. The student union provides daily activities for the students on campus. As website manager, part of Sean's job is to keep the site up to date on the latest activities sponsored by the union. At the beginning of each week, he revises a set of seven web pages detailing the events for each day in the upcoming week.

Sean would like the website to display the current day's schedule within an `aside` element. To do this, the page must determine the day of the week and then load the appropriate HTML code into the element. He would also like the Today at the Union page to display the current day and date. Figure 9–45 shows a preview of the page he wants you to create.

Figure 9–45 Daily events at the Bridger College Student Union



© Rawpixel.com/Shutterstock; Sources: openclipart.org; Source: Facebook; Source: Twitter, Inc.

Complete the following:

1. Use your editor to open the **bc\_union\_txt.html** and **bc\_today\_txt.js** files from the html09 ► case1 folder. Enter **your name** and **the date** in the comment section of each file, and save them as **bc\_union.html** and **bc\_today.js** respectively.
2. Go to the **bc\_union.html** file in your editor. Directly above the closing `</head>` tag, insert a `script` element that links the page to the **bc\_today.js** file. Defer the loading of the script until after the rest of the page is loaded by the browser.
3. Study the contents of the file and then save your changes.
4. Go to the **bc\_today.js** file in your editor. At the top of the file, insert a statement indicating that the code will be handled by the browser assuming strict usage.  
Note that within the file is the `getEvent()` function, which returns the HTML code for the daily events at the union given a day number ranging from 0 (Sunday) to 6 (Saturday).
5. Declare the **thisDate** variable containing the `Date` object for the date October 12, 2021.
6. Declare the **dateString** variable containing the text of the **thisDate** variable using local conventions.
7. Declare the **dateHTML** variable containing the following text string  
`<h2>date</h2>`  
where *date* is the value of the *dateString* variable.

8. Create the **thisDay** variable containing the day of the week number from the `thisDate` variable. (*Hint: Use the `getDay()` method.*)
9. Using the `thisDay` variable as the parameter value, call the `getEvent()` function to get the HTML code of that day's events and store that value in a variable named **eventHTML**.
10. Applying the `insertAdjacentHTML()` method to the page element with the ID `unionToday`, insert the value of the `dateHTML` plus the `eventHTML` variables before the end of the element contents.
11. Document your code with descriptive comments.
12. Save your changes to the file and then load **bc\_union.html** in your browser. Verify that the sidebar shows both the date "10/12/2021" formatted as an h2 heading and the daily events for that date formatted as a description list. Your content should resemble that shown in Figure 9–45.
13. Return to the **bc\_today.js** file and test your code by changing the date in the `thisDate` variable from 10/13/2021 up to 10/19/2021. Verify that a different set of events is listed for each date when you refresh the page in your browser.
14. Return to the **bc\_today.js** file and change the value of the `thisDate` variable so that it uses the current date and time.
15. Reload the **bc\_union.html** file in your browser to show the date and the events for the current day of the week.

## Case Problem 2

**Data Files needed for this Case Problem:** `ja_vynes_txt.html`, `ja_quote_txt.js`, 2 CSS files, 4 PNG files, 1 TTF file, 1 WOFF file

### CHALLENGE

**Austen Vynes** Emelia Dawes shares her passion for the works of Jane Austen by managing a website named Austen Vynes dedicated to the writer and her works. Emelia is revising the layout and design of her website and would like your assistance in redesigning the front page. She wants the front page to display a random Jane Austen quote every time the page is loaded by the browser. Emelia asks you to write a JavaScript program to supply a randomly selected quote. A preview of the page is shown in Figure 9–46.


Figure 9–46 Random quote on the Austen Vynes page



Sources: opendclipart.org; Patrick Carey; British National Archives; A Memoir of Jane Austen by her nephew J. E. Austen-Leigh, Vicar of Bray, Berks. London: Richard Bentley, New Burlington Street, Publisher in Ordinary to her Majesty, 1870

Complete the following:

1. Use your editor to open the **ja\_vynes\_txt.html** and **ja\_quote\_txt.js** files from the html09 ► case2 folder. Enter **your name** and **the date** in the comment section of each file, and save them as **ja\_vynes.html** and **ja\_quote.js** respectively.
2. Go to the **ja\_vynes.html** file in your editor. Directly above the closing `</head>` tag, insert a `script` element that links the page to the `ja_quote.js` file. Defer the loading of the script file until the rest of the page is loaded by the browser.
3. Study the contents of the file and then save your changes.
4. Go to the **ja\_quote.js** file in your editor. At the top of the file, insert a statement indicating that the code will be handled by the browser assuming strict usage.
- ➦ **Explore** 5. Directly below the comment section, insert a function named **randomInt** that will be used to generate a random integer. Specify two parameters for the function named **lowest** and **size**. The lowest parameter will specify the lowest possible value for the random integer and the size parameter will set the number of integers to be generated. Use those two parameter values and the `Math.floor()` and `Math.random()` methods to return a random integer within the specified range.

6. Above the `randomInt()` function insert a command to call the function, generating a random integer from 0 to 9. (*Hint:* Remember that the size of this interval is 10 because it includes 0 in its range.) Store the result from the function in the **randomQ** variable.
-  **Explore** 7. Create a variable named **quoteElem** that references the first element in the document that has the `quote` tag name.
8. Call the `getQuote()` function using the `randomQ` variable as the parameter value to generate a random Jane Austen quote. Display the text of the quote as the inner HTML code of the `quoteElem` variable.
9. Add appropriate comments to your code to document your work.
10. Save your changes to the file and then open the **ja\_vynes.html** file in your browser. Verify that a random Jane Austen quote appears at the top of the page.
11. Reload the page several times and verify that with each reloading, a different Austen quote appears on the page.

## OBJECTIVES

**Session 10.1**

- Create an array
- Work with array properties and methods

**Session 10.2**

- Create a program loop
- Work with the `for` loop
- Write comparison and logical operators

**Session 10.3**

- Create a conditional statement
- Use the `if` statement

# Exploring Arrays, Loops, and Conditional Statements

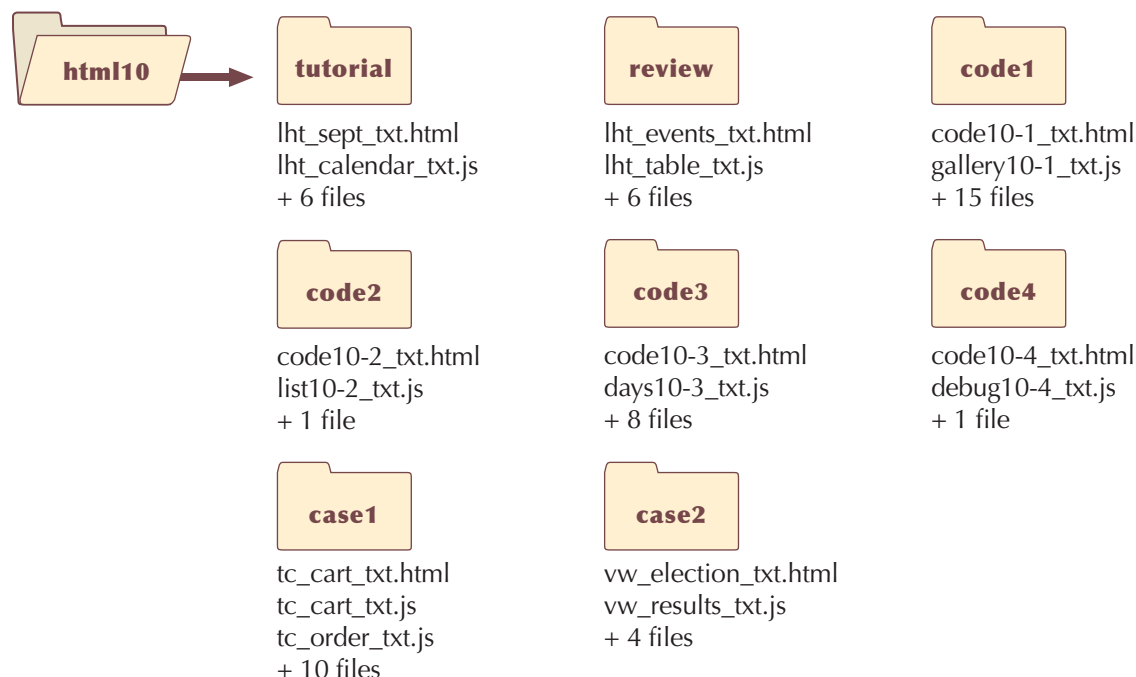
## *Creating a Monthly Calendar*

### Case | *The Lyman Hall Theater*

With first-class concerts, performances from Broadway touring companies, and shows from famous comics, singers, and other entertainers, the Lyman Hall Theater is a popular attraction in Brookhaven, Georgia. Lewis Kern is the center's events manager tasked with the job of updating the theater's website.

Lewis wants your help with developing an event calendar application. Rather than constructing the calendar manually, he wants you to write a JavaScript program to automatically generate a web table for a given calendar month, listing the events occurring at the theater during that month. The application should be flexible enough to work with any month so that Lewis only has to enter the event list each month. He wants you to develop a prototype for the September calendar.

### STARTING DATA FILES



# Session 10.1 Visual Overview:

The createCalendar() function writes the HTML code of the calendar table.

The calCaption() function writes the calendar caption.

An **array** is a collection of values organized under a single name.

```
/* Set the date displayed in the calendar */
var thisDay = new Date("September 24, 2021");

/* Write the calendar to the element with the id 'calendar' */
document.getElementById("calendar").innerHTML = createCalendar(thisDay);

/* Function to generate the calendar table */
function createCalendar(calDate) {
 var calendarHTML = "<table id='calendar_table'>";
 calendarHTML += calCaption(calDate);
 calendarHTML += "</table>";
 return calendarHTML;
}

/* Function to write the calendar caption */
function calCaption(calDate) {
 // monthName array contains the list of month names
 var monthName = ["January", "February", "March", "April",
 "May", "June", "July", "August", "September",
 "October", "November", "December"];

 // Determine the current month
 var thisMonth = calDate.getMonth();

 // Determine the current year
 var thisYear = calDate.getFullYear();

 // Write the caption
 return "<caption>" + monthName[thisMonth] + " " + thisYear + "</caption>";
}
```

Values within an array are referenced using the format

`array[i]`

where *array* is the array name and *i* is the index number of the value within the array.

Arrays can be created using the object constructor

`var arrayName = new Array(values);`

or using an array literal

`var arrayName = [values];`

# Creating and Using Arrays



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The code written to the web page is:

```
<table id='calendar_table'>
 <caption>September 2021</caption>
</table>
```

## Introducing the Monthly Calendar

You and Lewis meet to discuss his idea for a monthly events calendar. He wants the calendar to appear in the form of a web table with links to specific events placed within the table cells. The appearance and placement of the calendar will be set using a CSS style sheet. Figure 10–1 shows a preview of the monthly calendar you will create for the Lyman Hall Theater website.

Figure 10–1 Monthly events calendar

The Lyman Hall Theater website header includes a navigation bar with links: home, events, box office, facilities, directions, and contact. The main heading is "September at the Lyman Hall Theater". Below this, there are three columns of text describing upcoming events: "Broadway starts out a great autumn at the LHT with seven performances of [Hamilton](#)", "The young will enjoy [Have Spacesuit, Will Travel](#)", and "School's in session with our continuing lecture series. Mary Dees presents the latest developments in cognitive research with [Hacking your Dreams](#) and David Wu discusses quantum entanglement in [What Einstein Got Wrong](#)".

The calendar for September 2021 is displayed below. The current date, September 24th, is highlighted in orange. A green callout points to the calendar table, and another green callout points to the highlighted cell for September 24th.

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2 <a href="#">Classic Cinema: Wines</a> 7 pm \$5	3 <a href="#">The Future is Prologue</a> 8 pm \$18/\$24/\$36	4 <a href="#">American Favorites</a> 7:30 pm \$24/\$36/\$48
5 <a href="#">Classics Brunch</a> 11 am \$12	6 <a href="#">LHT Jazz Band</a> 7 pm \$24	7	8 <a href="#">Civic Forum</a> 7 pm free	9 <a href="#">Hamilton</a> 7:30 pm \$48/\$64/\$88	10 <a href="#">Hamilton</a> 7:30 pm \$48/\$64/\$88	11 <a href="#">Hamilton</a> 7:30 pm \$48/\$64/\$88
12 <a href="#">Classics Brunch</a> 11 am \$12	13	14 <a href="#">Hacking your Dreams</a> 7 pm free	15 <a href="#">Hamilton</a> 7:30 pm \$48/\$64/\$88	16 <a href="#">Hamilton</a> 7:30 pm \$48/\$64/\$88	17 <a href="#">Hamilton</a> 7:30 pm \$48/\$64/\$88	18 <a href="#">Hamilton</a> 2 pm \$48/\$64/\$88
19 <a href="#">Classics Brunch</a> 11 am \$12	20 <a href="#">What Einstein Got Wrong</a> 7 pm free	21	22 <a href="#">Governor's Banquet</a> 6 pm by invitation	23 <a href="#">Classic Cinema: City Lights</a> 7 pm \$5	24 <a href="#">Stardust Memories</a> 8 pm \$24/\$36/\$48	25 <a href="#">Summer Concert</a> 8 pm \$16/\$24
26 <a href="#">Classics Brunch</a> 11 am \$12	27	28 <a href="#">Children's Shakespeare</a> 6 pm free	29 <a href="#">Kids Fair</a> 6 pm free	30 <a href="#">Have Spacesuit, Will Travel</a> 7:30 pm \$22/\$36/\$48		

The Lyman Hall Theater  
414 Loward Drive  
Brookhaven, GA 30319  
Offices (404) 555 - 4140

Box Office  
Group Rates  
Events

Staff  
Employment Info  
Directions & Parking

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The program you create should be easily adaptable so that it can be used to create other monthly calendars. Lewis wants the code that generates the calendar placed in the `lht_calendar.js` file. The events listed in the calendar will be placed in the `lht_events.js` file. Finally, the styles for the calendar will be placed in the `lht_calendar.css` style sheet file. Lewis already has created the styles required for the calendar table, but he has left the JavaScript coding to you. You will start by adding links to the `lht_calendar.js`

and `lht_calendar.css` files to a web page describing the September events at the Lyman Hall Theater. You will work with the `lht_events.js` file later in this tutorial.

### To access the September Events web page:

1. Use your editor to open the `lht_sept_txt.html` and `lht_calendar_txt.js` files from the `html10` ► tutorial folder. Enter **your name** and **the date** in the comment section of each file and save them as `lht_sept.html` and `lht_calendar.js` respectively.
2. Return to the `lht_sept.html` file in your editor, and then add the following code above the closing `</head>` tag to create links to both the calendar style sheet and the JavaScript file that will generate the HTML code for the calendar:

```
<link href="lht_calendar.css" rel="stylesheet"/>
<script src="lht_calendar.js" defer></script>
```

Figure 10–2 highlights the revised code in the document head.

Figure 10–2

### Linking to the style sheet and JavaScript file

style sheet for the calendar table

JavaScript file that will generate the HTML code for the calendar table

```
<title>Lyman Hall Theater in September</title>
<link href="lht_base.css" rel="stylesheet" />
<link href="lht_layout.css" rel="stylesheet" />
<link href="lht_calendar.css" rel="stylesheet" />
<script src="lht_calendar.js" defer></script>
</head>
```

The calendar will be placed within a `div` element with the ID `calendar`.

3. Scroll down the file and, and, directly below the closing `</article>` tag, insert the following `div` element:

```
<div id="calendar"></div>
```

Figure 10–3 highlights the location where the calendar will be placed.

Figure 10–3

### Location of the calendar table

```
</section>
</article>
<div id="calendar"></div>
```

HTML code for the calendar table will be placed within this `div` element

4. Save your changes to the file.

## Reviewing the Calendar Structure

The calendar you create will be constructed as a web table. Before you start writing the code to create this table, you should understand the table's structure. Lewis wants the following class names and IDs assigned to the different parts of the table:

- The entire calendar is set in a web table with the ID `calendar_table`.
- The cell containing the calendar title has the ID `calendar_head`.

- The seven cells containing the days of the week abbreviations all belong to the class *calendar\_weekdays*.
- The cells containing the dates of the month all belong to the class *calendar\_dates*.
- The cell containing the current date has the ID *calendar\_today*.

These class and ID designations make it easier for page developers to assign different styles to the different parts of the calendar. If developers want to change the table's appearance, they will not have to edit the JavaScript code to do so; instead, they only will have to modify the style sheet.

## Adding the calendar() Function

You will place the commands that generate the calendar within a single function named `createCalendar()`. The initial code to generate the calendar follows:

```
var thisDay = new Date("September 24, 2021");
document.getElementById("calendar").innerHTML =
createCalendar(thisDay);

function createCalendar(calDate) {
 var calendarHTML = "<table id='calendar_table'>";
 calendarHTML += "</table>";
 return calendarHTML;
}
```

The `thisDay` variable stores the current date. For the purposes of this example, you will set the date to September 24, 2021. The next line of the function stores the HTML code for the calendar in the `div` element with the ID `calendar` that you have just created. Initially this HTML code, taken from the `createCalendar()` function, consists only of the opening and closing tags of the `table` element. Note that you place the value of the `id` attribute within single quotes because the entire text string of HTML code is already enclosed within double quotes.

### To insert the initial code of the calendar app:

1. Return to the `lht_calendar.js` file in your editor. Insert following code at the bottom of the file to set the calendar date:
2. Next, add the following code to insert the HTML code of the calendar into the web page:
3. Finally, enter the initial code for the `createCalendar()` function that generates the HTML code:

```
/* Set the date displayed in the calendar */
var thisDay = new Date("September 24, 2021");
```

```
/* Write the calendar to the element with the id "calendar" */
document.getElementById("calendar").innerHTML =
createCalendar(thisDay);
```

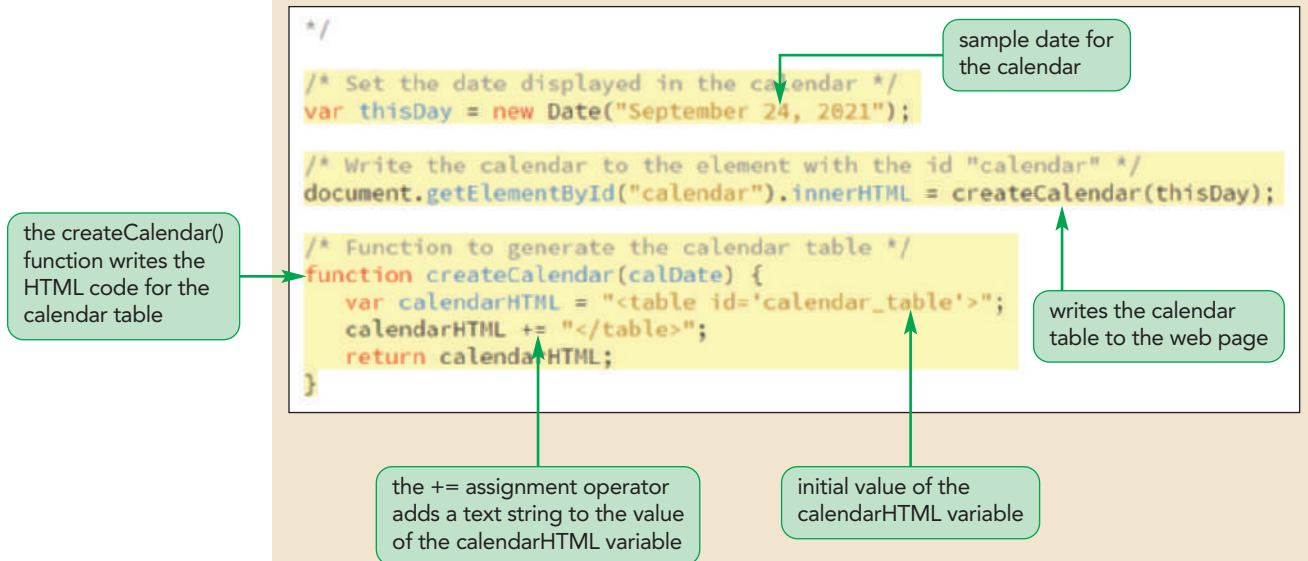
```
/* Function to generate the calendar table */
function createCalendar(calDate) {
 var calendarHTML = "<table id='calendar_table'>";
 calendarHTML += "</table>";
 return calendarHTML;
}
```

When writing attribute values, you need to enclose the values within single quotes while the text of the HTML code is enclosed within double quotes.

Figure 10–4 describes the code in the file.

Figure 10–4

## Initial code for the calendar app



## 4. Save your changes to the file.

Next, you will start to write the code to create the contents of the calendar table. The three main tasks to complete the calendar table are as follows:

- Create a caption displaying the month and the year
- Create the table row containing the names of the days of the week
- Create rows for each week in the month with cells for each day in the week

In this session, you will learn how to create a calendar table caption. In the next session, you will complete the rest of the table.

## Introducing Arrays

Lewis wants the calendar table caption to display the text *Month Year*, where *Month* is the name of the month and *Year* is the four-digit year value. In the last tutorial, you learned that you can use the `getMonth()` method of the JavaScript `Date` object to extract a month number and the `getFullYear()` method to extract the four-digit year value. For example, a `Date` object storing the date March 18, 2021 has a month value of 2 (because month values start with 0 for the month of January) and a four-digit year value of 2021. However, Lewis wants the month name rather than the month number to appear in the table but, because no `Date` method returns the name of the month, you will have to write code to associate each month number with a month name. One way of doing this is by using an array.

An array is a collection of values organized under a single name. Each individual value is associated with a number known as an **index** that distinguishes it from other values in the array. Array values are referenced using the expression

```
array[i]
```

**TIP**

A common programming mistake is to use parenthesis symbols `()` rather than square brackets `[]` to create and reference array values.

where *array* is the name of the array and *i* is the index of a specific value in the array. Index values start with 0 so that the initial item in an array has an index value of 0, the second item has an index value of 1, and so on. For example, the expression

```
monthName[4]
```

references the fifth (not the fourth) item in the monthName array.

## Creating and Populating an Array

To create an array, you can apply the object constructor

```
var array = new Array(length);
```

where *array* is the name of the array and *length* is the number of items in the array. The *length* value is optional; if you omit this parameter, the array expands automatically as more items are added to it. However, by defining the length of an array, JavaScript will allot only the amount of memory needed to generate the array so that the code runs more efficiently. Thus, to create an array named monthName for the 12 month names, you would enter the following statement:

```
var monthName = new Array(12);
```

Alternatively, you could omit the array length and enter the statement as follows:

```
var monthName = new Array();
```

Once you have created an array, you can populate it with values using the same commands you use for any variable. The only difference is that you must specify both the array name and the index number of the array item. The command to set the value of a specific item in an array is

```
array[i] = value;
```

where *value* is the value assigned to the array item with the index value *i*. For example, to insert month names in the monthName array, starting with January, you could enter the following statements:

```
monthName[0] = "January";
monthName[1] = "February";
...
monthName[11] = "December";
```

Rather than writing each array value in a separate statement, you can populate the entire array in a single statement using the following command

```
var array = new Array(values);
```

where *values* is a comma-separated list of the values in the array. The following command places twelve month names into the monthName array in a single statement:

```
var monthName = new Array("January", "February", "March", "April",
 "May", "June", "July", "August", "September", "October", "November",
 "December");
```

The index numbers are based on the position of the values in the list. The first item in the list ("January") would have an index number 0, the second ("February") would have an index of 1, and so forth.

A final way to create an array is with an **array literal**, in which the array values are a comma-separated list within a set of square brackets. The expression to create an array literal is

```
var array = [values];
```

where *values* are the values of the array. The following command uses the array literal form to store an array of month names:

```
var monthName = ["January", "February", "March", "April", "May",
 "June", "July", "August", "September", "October", "November",
 "December"];
```

### TIP

To create an empty array literal that you populate later in the program, leave the brackets blank as in the command `var x = []`;

If you know the contents of your array, it is usually quicker and easier to set up your array using the array literal notation.

Array values do not need to be the same data type. You can mix numeric values, text strings, and other data types within a single array, as demonstrated by the following statement:

```
var x = ["April", 3.14, true, null];
```

### REFERENCE

#### Creating and Populating Arrays

- To create an array, use the object constructor

```
var array = new Array(length);
```

where *array* is the name of the array and *length* is the number of items in the array. The optional *length* value sets the array to a specified size; if omitted, the array expands as new items are added to it.

- To set the value of an item within an array, use the command

```
array[i] = value;
```

where *i* is the index of the array item and *value* is the value assigned to the item.

- To create and populate an array within a single command, use

```
var array = new Array(values);
```

where *values* is a comma-separated list of values.

- To create an array using the array literal format, use the following statement:

```
var array = [values];
```

Now that you have seen how to create and populate an array, you will create an array of month names to use in your calendar application. You will insert the array in a function named `calCaption()` whose purpose is to write the HTML code of the calendar caption. The function has a single parameter named `calDate` that stores a `Date` object containing the current date.

#### To create the `calCaption()` function:

1. Return to the `lht_calendar.js` file in your editor.
2. At the bottom of the file, insert the following function to write the caption of the calendar table and create the `monthName` array:

```
/* Function to write the calendar caption */
function calCaption(calDate) {
 // monthName array contains the list of month names
 var monthName = ["January", "February", "March", "April",
 "May", "June", "July", "August", "September",
 "October", "November", "December"];
```

3. Next, within the function, use the `getMonth()` and `getFullYear()` methods to extract the month number and 4-digit year number from the `calDate` parameter by entering the following commands:

```
// Determine the current month
var thisMonth = calDate.getMonth();

// Determine the current year
var thisYear = calDate.getFullYear();
```

4. Finally, complete the function by returning the caption tag for the calendar containing the month name and 4-digit year number. To display the month name, use the `monthName` array with the value of the `thisMonth` variable as the index number. Enter the code:

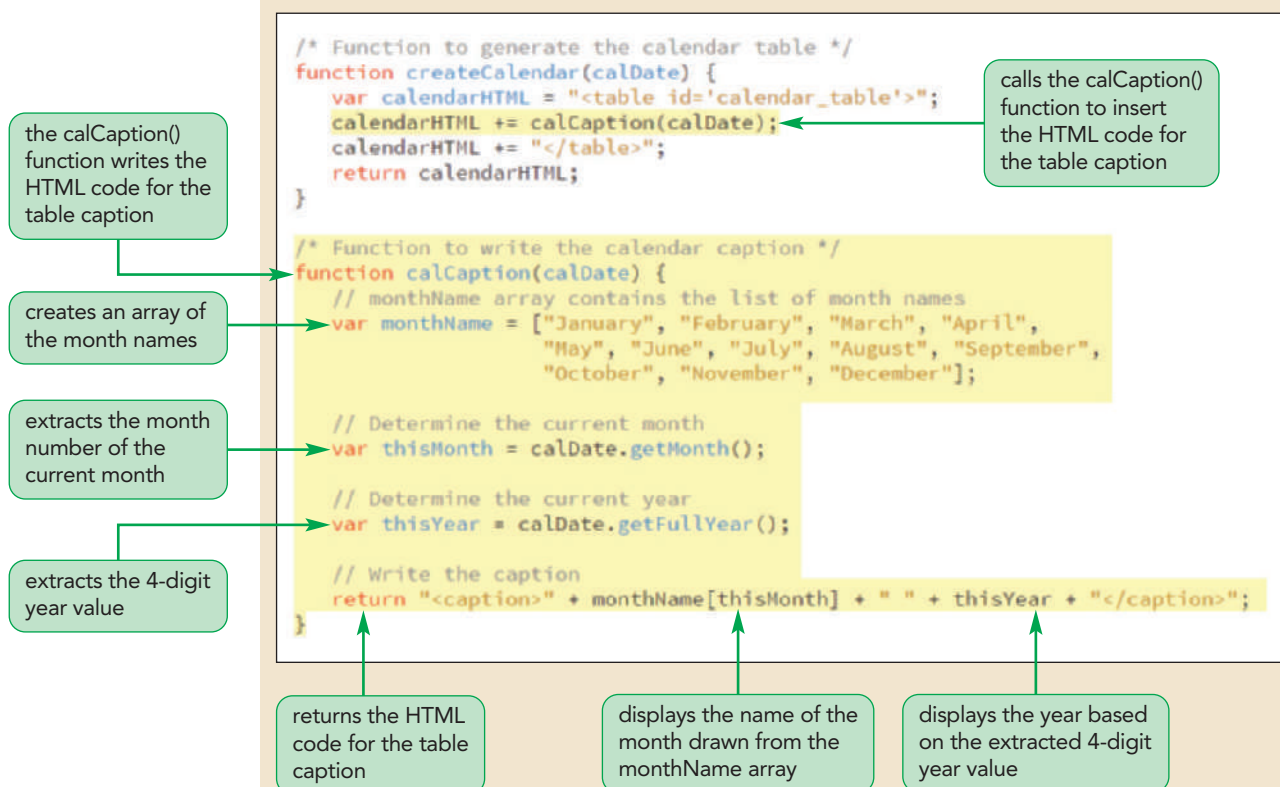
```
// Write the caption
return "<caption>" + monthName[thisMonth] + " " + thisYear +
"</caption>";
}
```

5. Scroll up to the `createCalendar()` function and insert the following statement directly before the command `calendarHTML += "</table>";`:

```
calendarHTML += calCaption(calDate);
```

This code calls the `calCaption()` function, which returns the HTML code of the table caption. Figure 10–5 describes the newly added code.

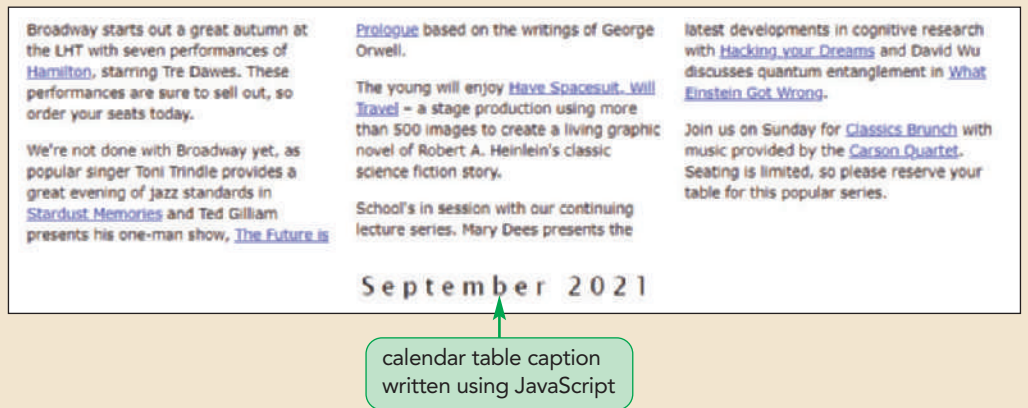
Figure 10–5

The `calCaption()` function

6. Save your changes to the file, and then open **lht\_sept.html** in your browser. Verify that the web page now shows the caption of the calendar table with the September 2021 date as shown in Figure 10–6.

Figure 10–6

## Calendar caption displayed in the web page



**Trouble?** If the caption does not appear in the page, your code might contain a mistake. Check your code against the code shown in the previous figures. Common sources of error include forgetting to close all quoted text strings, failing to match the use of uppercase and lowercase letters in function names and variable names, misspelling function names and variable names, and failing to close parentheses and brackets when required.

Next, you will explore the properties and methods associated with arrays.

## Working with Array Length

A JavaScript array automatically expands in length as more items are added. To determine the array's current size, apply the following `length` property

```
array.length
```

where `array` is the name of the array. The value returned by the `length` property is equal to one more than the highest index number in the array (because array indices start at 0 rather than 1), so, if the highest number in the index is 11, then the value returned would be 12.

JavaScript allows for the creation of **sparse arrays**, in which some array values are undefined. As a result, the `length` value is not always the same as the number of array values. For example, the following commands create a sparse array in which only the first and last items have defined values:

```
var x = new Array();
x[0] = "Lewis";
x[99] = "80517";
```

**TIP**

You can add new items to the end of any array using the command `array[array.length] = value;`

The value of the `length` property for this array is 100 even though it only contains two values. Sparse arrays occur frequently in database applications involving customer records where items such as mobile phone numbers or postal codes have not been entered for every person.

**REFERENCE**

### Specifying Array Length

- To determine the size of an array, use the property

`array.length`

where `array` is the name of the array and `length` is one more than the highest index number in the array.

- To add an item to the end of an array, run the command

`array[i] = value;`

where `i` is an index value higher than the highest index currently in the array. If you don't know the highest index number, use the property `array.length` in place of `i`.

- To remove items from an array, run the command

`array.length = value;`

where `value` is an integer that is smaller than the highest index currently in the array.

Note that you cannot reduce the value of the `length` property without removing items from the end of your array. For example, the following command would reduce the `monthName` array to the first three months—January, February, and March:

```
monthName.length = 3;
```

Increasing the value of the `length` property adds more items to an array, but the items have null values until they are defined.



### Problem Solving: Using Multidimensional Arrays

Many database applications need to store data in a rectangular format known as a **matrix**, in which the values are arranged in a rectangular grid. The following is an example of a matrix laid out in a grid of three rows and four columns:

$$\begin{bmatrix} 4 & 15 & 8 & 2 \\ 1 & 3 & 18 & 6 \\ 3 & 7 & 10 & 4 \end{bmatrix}$$

The rows and columns in a matrix form the basis for indices. For example, the value 18 from this matrix is referenced using the index pair (2, 3) because the value 18 appears at the intersection of the second row and third column.

Although matrices are commonly used in databases (where each row might represent an individual and each column a characteristic of that individual), JavaScript does not support matrices. However, you can mimic the behavior of matrices in JavaScript by nesting one array within another in a structure called a **multidimensional array**. For example, the following code creates the array *mArray*, which contains a collection of nested arrays:

```
var mArray =
[
 [4, 15, 8, 2],
 [1, 3, 18, 6],
 [3, 7, 10, 4]
];
```

Note that the values of this array match the values of the matrix shown above. In this case, the first nested array matches the first row of the matrix, the second array matches the second row, and the third array matches the third row. The values of the nested arrays are matched with each of the four columns.

Values within a multidimensional array are referenced by the expression

`array[x][y]`

where *x* contains the index of the outer array (the row) and *y* contains the index of the nested array (the column). Thus, the expression

`mArray[1][2]`

returns the value 18 from the matrix's second row and third column (remember that indices start with 0, not 1). The number of rows in a multidimensional array is given by the `length` property. The number of columns can be determined by retrieving the `length` property for the first row of the table. For example, the expression

`mArray[1].length`

would return a value of 4 for the four columns in *mArray*. Note that this approach presumes that every row has the same number of columns. You can continue to nest arrays in this fashion to create matrices of even higher dimensions.

## Reversing an Array

Arrays are associated with a collection of methods that allow you to change their content, order, and size. You can also use these methods to combine different arrays into a single array and to convert arrays into text strings. Although you will not need to use these methods in the calendar app, you will examine them for future projects.

By default, items are placed in an array either in the order in which they are defined or explicitly by index number. JavaScript supports two methods for changing the order of these items: `reverse()` and `sort()`. The `reverse()` method, as the name suggests, reverses the order of items in an array, making the last items first and the first items last. In the following set of commands, the `reverse()` method is used to change the order of the values in the `weekDay` array:

```
var weekDay = ["Sun", "Mon", "Tue", "Wed", "Thu", "Fri", "Sat"];
weekDay.reverse();
```

After running the `reverse()` method, the `weekDay` array would contain the items in the following order: "Sat", "Fri", "Thu", "Wed", "Tue", "Mon", and finally, "Sun".

## Sorting an Array

The `sort()` method rearranges array items in alphabetical order. This can cause unexpected results if you apply the `sort()` method to data values that are not usually sorted alphabetically. Applying the `sort()` method to numeric values, will sort the values in order by their leading digits, rather than by their numerical values. Thus, applying the `sort()` method in the following set of commands

```
var x = [3, 45, 1234, 24];
x.sort();
```

would result in the order 1234, 24, 3, 45 because this is the order of those numbers when sorted by their leading digits. To correctly sort numeric data, you must create a **compare function** that compares the values of two adjacent array items. The general form of a compare function is

```
function fname(a, b) {
 return a negative, positive, or 0 value
}
```

where `fname` is the name of the compare function, and `a` and `b` are parameters that represent a pair of array values. The function then returns a negative, positive, or zero value based on the comparison of those values. If a negative value is returned, then `a` is placed before `b` in the array. If a positive value is returned, then `b` is placed before `a`, and finally, if a zero value is returned, `a` and `b` retain their original positions. The compare function is applied to every pair of values in the array to ensure they are sorted in the proper order.

The following compare function could be used to sort numeric values in ascending order

```
function ascending(a, b) {
 return a - b;
}
```

whereas to sort numbers in a descending order, you could apply the following function, which subtracts `a` from `b`, rather than `b` from `a`:

```
function descending(a, b) {
 return b - a;
}
```

Other compare functions are possible to deal with a wide variety of sorting rules, but these two are the simplest for sorting arrays of numeric values.

The compare function is applied to the `sort()` method as follows

```
array.sort(fname)
```

**TIP**

You can also sort an array in descending order by sorting it first in ascending order and then by applying the `reverse()` method to reverse the sorted order of the array.

where *fname* is the name of the compare function. For example, to use the `ascending()` compare function to sort the `x` array described earlier in ascending numeric order, you would run the following command:

```
x.sort(ascending)
```

After applying the `sort()` method with the ascending function, the values in the `x` array would be sorted in ascending numeric order as: 3, 24, 45, and finally, 1234.

**INSIGHT**

### Performing a Random Shuffle

For some applications, you will want to randomly rearrange the contents of an array. For example, you might be writing a program to simulate a randomly shuffled deck of cards. You can shuffle an array using the same `sort()` method you use to place the array in a defined order; however, to place the items in a random order, you use a compare function that randomly returns a positive, negative, or 0 value. The following compare function employs a simple approach to this problem:

```
function randOrder(){
 return 0.5 - Math.random();
}
```

The following code demonstrates how this compare function could be used to randomly shuffle an array of poker cards:

```
var pokerDeck = new Array(52);
pokerDeck[0] = "2 of Clubs";
pokerDeck[1] = "3 of Clubs";
...
pokerDeck[51] = "Ace of Spades";
pokerDeck.sort(randOrder)
```

After running this command, the contents of the `pokerDeck` array will be placed in random order. To reshuffle the array, you would simply rerun the `sort()` method with the `randOrder()` function.

## Extracting and Inserting Array Items

In some scripts, you might want to extract a section of an array, known as a **subarray**. One way to create a subarray is with the following `slice()` method

```
array.slice(start, stop)
```

where *start* is the index value of the array item at which the slicing starts and *stop* is the index value at which the slicing ends. Note that the *stop* index value is not included in the subarray. The *stop* value is optional; if it is omitted, the array is sliced to its end. The original contents of the array are unaffected after slicing, but the extracted items can be stored in another array. For example, the following command slices the `monthName` array, extracting only three summer months—June, July, August—and storing them in the `summerMonths` array:

```
summerMonths = monthName.slice(5, 8);
```

Remember that arrays start with the index value 0, so the sixth month of the year (June) has an index value of 5 and the ninth month of the year (September) has an index value of 8.

Related to the `slice()` method is the following `splice()` method

```
array.splice(start, size, values)
```

which is a general-purpose method for removing and inserting array items, where *start* is the starting index in the array, *size* is the number of array items to remove after the *start* index, and *values* is an optional comma-separated list of values to insert into the array. If no *values* are specified, the `splice` method simply removes items from the array.

The following statement employs the `splice()` method to remove the summer months from the `monthName` array:

```
summerMonths = monthName.splice(5, 3);
```

However, to insert new abbreviations of month names into the `monthName` array, you could apply the following `splice()` method which places the values “Jun”, “Jul”, and “Aug” into the array starting with the 5<sup>th</sup> index number:

```
monthName.splice(5, 3, "Jun", "Jul", "Aug");
```

The important difference between the `slice()` and `splice()` methods is that the `splice()` method always alters the original array, so you should not use the `splice()` method if you want the original array left unaffected.

## Using Arrays as Data Stacks

Arrays can be used to store information in a data structure known as a **stack** in which new items are added to the top of the stack—or to the end of the array—much like a person clearing a dinner table adds dishes to the top of a stack of dirty plates. A stack data structure employs the **last-in first-out (LIFO)** principle in which the last items added to the stack are the first ones removed. You encounter stack data structures when using the Undo feature of some software applications, in which the last command you performed is the first command that is undone.

JavaScript supports several methods to allow you to work with a stack of array items. For example, the `push()` method appends new items to the end of an array. It has the syntax

```
array.push(values)
```

where *values* is a comma-separated list of values to be appended to the end of the array. To remove—or **unstack**—the last item, you apply the `pop()` method, as follows:

```
array.pop()
```

The following set of commands demonstrates how to use the `push()` and `pop()` methods to employ the LIFO principle by adding and then removing items from a data stack:

```
var x = ["a", "b", "c"];
x.push("d", "e"); // x = ["a", "b", "c", "d", "e"]
x.pop(); // x = ["a", "b", "c", "d"]
x.pop(); // x = ["a", "b", "c"]
```

In this code, the `push()` method adds two items to the end of the array, and then the `pop()` method removes those last items one at a time.

A **queue**, which employs the **first-in-first-out (FIFO)** principle in which the first item added to the data list is the first removed, is similar to a stack. You see the FIFO principle in action in a line of people waiting to be served. For array data that should be treated as a queue, you use the `shift()` method, which is similar to the `pop()` method except that it removes the first array item, not the last item. JavaScript also supports the `unshift()` method, which inserts new items at the front of the array.

### Using Array Methods

- To reverse the order of items in an array, use the method

```
array.reverse()
```

where *array* is the name of the array.

- To sort an array in alphabetical order, use the following method:

```
array.sort();
```

- To sort an array in any order, use

```
array.sort(fname)
```

where *fname* is the name of a compare function that returns a positive, negative, or 0 value.

- To extract items from an array without affecting the array contents, use

```
array.slice(start, stop)
```

where *start* is the index of the array item at which the slicing starts and *stop* is the index at which the slicing ends. If no *stop* value is provided, the array is sliced to the end of the array.

- To remove items from an array, use

```
array.splice(start, size)
```

where *start* is the index of the array item at which the splicing starts and *size* is the number of items to remove from the array. If no *size* value is specified, the array is spliced to its end.

- To replace items in an array, use

```
array.splice(start, size, values)
```

where *values* is a comma-separated list of new values to replace the old values in the array.

- To add new items to the end of an array, use

```
array.push(values)
```

where *values* is a comma-separated list of values.

- To remove the last item from an array, use the following method:

```
array.pop()
```

Figure 10–7 summarizes several other methods that can be applied to arrays. Arrays are a powerful and useful feature of the JavaScript language. The methods associated with arrays can be used to simplify and expand the capabilities of web page scripts.

Figure 10–7

## Array methods

Method	Description
<code>copyWithin(target, start[, end])</code>	Copies items within the array to the <i>target</i> index, starting with the <i>start</i> index and ending with the optional <i>end</i> index
<code>concat(array1, array2, ...)</code>	Joins the array to two or more arrays, creating a single array containing the items from all the arrays
<code>fill(value[, start][, end])</code>	Fills the array with items having the value <i>value</i> , starting from the <i>start</i> index and ending at the <i>end</i> index
<code>indexOf(value[, start])</code>	Searches the array, returning the index number of the first element equal to <i>value</i> , starting from the optional <i>start</i> index
<code>join(separator)</code>	Joins all items in the array into a single text string; the array items are separated using the text in the <i>separator</i> parameter; if no <i>separator</i> is specified, a comma is used
<code>lastIndexOf(value[, start])</code>	Searches backward through the array, returning the index number of the first element equal to <i>value</i> , starting from the optional <i>start</i> index
<code>pop()</code>	Removes the last item from the array
<code>push(values)</code>	Appends the array with new items, where <i>values</i> is a comma-separated list of item values
<code>reverse()</code>	Reverses the order of items in the array
<code>shift()</code>	Removes the first item from the array
<code>slice(start, stop)</code>	Extracts the array items starting with the <i>start</i> index up to the <i>stop</i> index, returning a new subarray
<code>array.splice(start, size, values)</code>	Extracts <i>size</i> items from the array starting with the item with the index <i>start</i> ; to insert new items into the array, specify the array items in a comma-separated <i>values</i> list
<code>array.sort(fname)</code>	Sorts the array where <i>fname</i> is the name of a function that returns a positive, negative, or 0 value; if no function is specified, <i>array</i> is sorted in alphabetical order
<code>array.toString()</code>	Converts the contents of the array to a text string with the array values in a comma-separated list
<code>array.unshift(values)</code>	Inserts new items at the start of the array, where <i>values</i> is a comma-separated list of new values

You set up the first parts of the online calendar in this session. In the next sessions, you will complete the monthly calendar by working with loops and conditional statements.

### Session 10.1 Quick Check

1. Which command creates an array named `dayNames` using the object constructor form?
  - a. `var dayNames = Array;`
  - b. `var dayNames is Array;`
  - c. `var dayNames = new Array();`
  - d. `var dayNames = Array();`
2. Which command uses the array literal form to create and populate the `dayNames` array with the abbreviations of weekdays (starting with Mon and going through Fri)?
  - a. `var dayNames = ("Mon", "Tue", "Wed", "Thu", "Fri");`
  - b. `var dayNames = ["Mon", "Tue", "Wed", "Thu", "Fri"];`
  - c. `var dayNames = {"Mon", "Tue", "Wed", "Thu", "Fri"};`
  - d. All of the above
3. Which command returns the third value from the `dayNames` array?
  - a. `dayNames[2]`
  - b. `dayNames[3]`
  - c. `dayNames.3`
  - d. `dayNames:3`
4. Which command sorts the `dayNames` array in alphabetical order?
  - a. `sort(dayNames);`
  - b. `daysNames.sort`
  - c. `Sort(dayNames);`
  - d. `dayNames.sort();`
5. Which command extracts the middle five values from the `dayNames` array?
  - a. `dayNames.cut(1,6);`
  - b. `dayNames.cut(0,5);`
  - c. `dayNames.extract(0,5);`
  - d. `dayNames.slice(1, 6);`
6. An array in which some array values are undefined is a(n):
  - a. empty array
  - b. minor array
  - c. sparse array
  - d. multidimensional array
7. To append a new item to an existing array, use the:
  - a. `pop()` method
  - b. `push()` method
  - c. `add()` method
  - d. All of the above

# Session 10.2 Visual Overview:

The **start expression** provides the starting value of the counter variable, `i`.

A **for loop** is a programming structure in which a set of commands is repeated based on the changing values of a **counter variable**.

The **continue expression** is a Boolean expression that must be true for the loop to continue.

The **update expression** updates the counter variable each time through the loop.

```
/* Function to write a table row of weekday abbreviations */
function calWeekdayRow() {

 // Array of weekday abbreviations:
 var dayName = ["SUN", "MON", "TUE", "WED", "THU", "FRI", "SAT"];
 var rowHTML = "<tr>";

 // Loop through the dayName array
 for (var i = 0; i < dayName.length; i++) {
 rowHTML += "<th class='calendar_weekdays'>" + dayName[i] + "</th>";
 }

 rowHTML += "</tr>";
 return rowHTML;
}
```

The same command block is executed with different values of the counter variable during each iteration of the `for` loop.

# Applying a Program Loop

**September at the Lyman Hall Theater**

Broadway starts out a great autumn at the LHT with seven performances of [Hamilton](#), starring Tre Dawes. These performances are sure to sell out, so order your seats today.

We're not done with Broadway yet, as popular singer Toni Trindle provides a great evening of jazz standards in [Stardust Memories](#) and Ted Gilliam presents his one-man show, [The Future Is](#)

[Prologue](#) based on the writings of George Orwell.

The young will enjoy [Have Spacesuit, Will Travel](#) – a stage production using more than 500 images to create a living graphic novel of Robert A. Heinlein's classic science fiction story.

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Join us on Sunday for [Classics Brunch](#) with music provided by the [Carson Quartet](#). Seating is limited, so please reserve your table for this popular series.

**September 2021**

SUN	MON	TUE	WED	THU	FRI	SAT
-----	-----	-----	-----	-----	-----	-----

The days of the week are written using a **program loop** that repeats a set of similar commands until a stopping condition is met.

The code created for the table row is as follows:

```
<tr>
 <th class='calendar _ weekdays'>SUN</th>
 <th class='calendar _ weekdays'>MON</th>
 <th class='calendar _ weekdays'>TUE</th>
 <th class='calendar _ weekdays'>WED</th>
 <th class='calendar _ weekdays'>THU</th>
 <th class='calendar _ weekdays'>FRI</th>
 <th class='calendar _ weekdays'>SAT</th>
</tr>
```

## Working with Program Loops

Now that you are familiar with the properties and methods of arrays, you will return to working on the calendar app. So far, you have created only the table caption displaying the calendar's month and year. The first row of the table will contain the three-letter abbreviations of the seven days of the week, starting with SUN and continuing through SAT. Each abbreviation needs to be placed within an element with the class name `calendar_weekdays` using the following code:

```
<tr>
 <th class='calendar_weekdays'>SUN</th>
 <th class='calendar_weekdays'>MON</th>
 <th class='calendar_weekdays'>TUE</th>
 <th class='calendar_weekdays'>WED</th>
 <th class='calendar_weekdays'>THU</th>
 <th class='calendar_weekdays'>FRI</th>
 <th class='calendar_weekdays'>SAT</th>
</tr>
```

This code contains a lot of repetitive text with the same `th` element and class name repeated seven times. Imagine if you had to repeat essentially the same string of code dozens, hundreds, or even thousands of times—the code would become unmanageably long. Programmers deal with this kind of situation by creating program loops. A **program loop** is a set of commands executed repeatedly until a stopping condition is met. Two commonly used program loops in JavaScript are `for` loops and `while` loops.

## Exploring the `for` Loop

In a `for` loop, a variable known as a counter variable is used to track the number of times a block of commands is run. Each time through the loop, the value of the counter variable is increased or decreased by a set amount. When the counter variable reaches or exceeds a specified value, the `for` loop stops. The general structure of a `for` loop is

```
for (start; continue; update) {
 commands
}
```

where *start* is an expression that sets the initial value of a counter variable, *continue* is a Boolean expression that must be true for the loop to continue, *update* is an expression that indicates how the value of the counter variable should change each time through the loop, and *commands* are the JavaScript statements that are run for each loop.

Suppose you want to set a counter variable to range in value from 1 to 4 in increments of 1. You could use the following expression to set the initial value of the counter variable:

```
var i = 1;
```

The name of the counter variable in this example is `i`, which is a common variable name often applied in program loops.

The next expression in the `for` loop structure defines the condition under which the program loop continues. The following expression sets the loop to continue as long as the value of the counter variable is less than or equal to 4:

```
i <= 4;
```

Finally, the following update expression uses the increment operator to indicate that the value of the counter variable increases by 1 each time through the program loop:

```
i++;
```

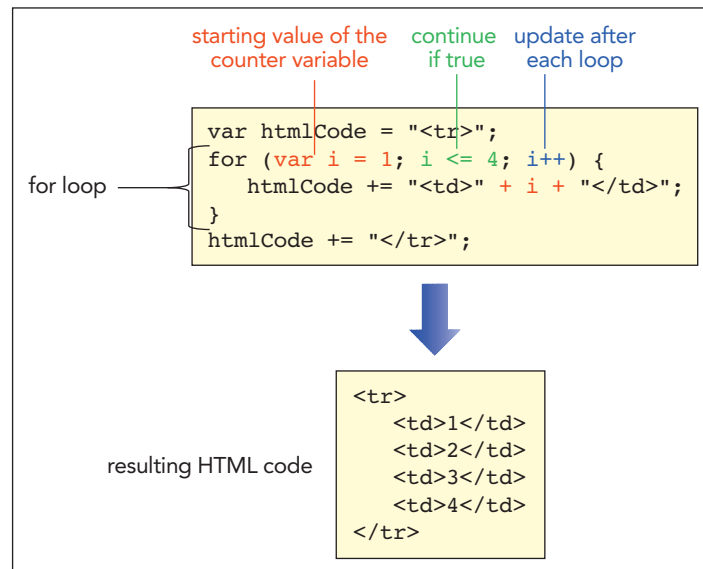
Putting all of these expressions together, you get the following `for` loop:

```
for (var i = 1; i <= 4; i++) {
 commands
}
```

The collection of commands that is run each time through a loop is known collectively as a **command block**, a feature you have already worked with in functions. A command block is indicated by its opening and closing curly braces `{ }`. The following is an example of a `for` loop that adds the HTML code for four `td` elements to a table row:

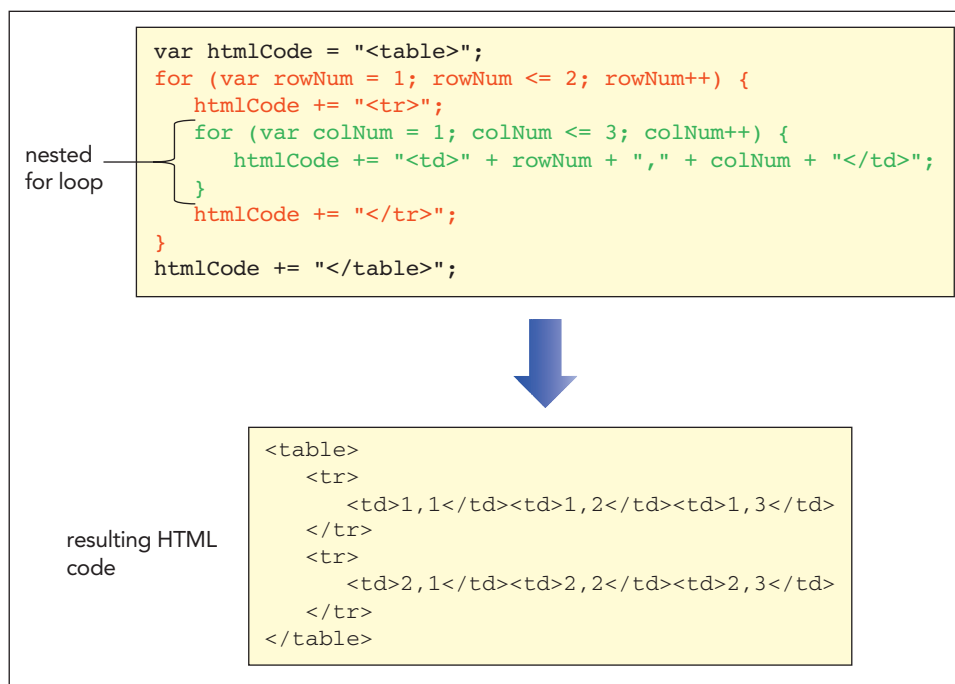
```
var htmlCode = "<tr>";
for (var i = 1; i <= 4; i++) {
 htmlCode += "<td>" + i + "</td>";
}
htmlCode += "</tr>";
```

As shown in Figure 10–8, each time through the loop, the value displayed in the table cell is changed by 1.

**Figure 10–8****Writing HTML code with a `for` loop**

One `for` loop can be nested within another. Figure 10–9 shows the code used to create a table with two rows and three columns.

Figure 10–9 Nested for loop



This example uses two counter variables named `rowNum` and `colNum`. The `rowNum` variable loops through the values 1 and 2 and for each of those values, the `colNum` variable loops through the values 1, 2, and 3. Each time the value of the `colNum` variable changes, a new cell is added to the table. Each time the value of the `rowNum` variable changes, a new row is added to the table.

The update expression is not limited to increasing the counter by 1. You can use the other operators introduced in the previous tutorial to create a wide variety of increment patterns. Figure 10–10 shows a few of the many different ways of updating the value of the counter variable in a `for` loop.

Figure 10–10 for loop counter values

for Loop	Counter Values
<code>for (var i = 1; i &lt;= 5; i++)</code>	<code>i = 1, 2, 3, 4, 5</code>
<code>for (var i = 5; i &gt; 0; i--)</code>	<code>i = 5, 4, 3, 2, 1</code>
<code>for (var i = 0; i &lt;= 360; i+=60)</code>	<code>i = 0, 60, 120, 180, 240, 360</code>
<code>for (var i = 1; i &lt;= 64; i*=2)</code>	<code>i = 1, 2, 4, 8, 16, 32, 64</code>

## Exploring the while Loop

The `for` loop is only one way of creating a program loop in JavaScript. The **while loop**, in which a command block is run as long as a specific condition is met, is similar to the `for` loop. However, unlike the `for` loop, the condition in a `while` loop does not depend on the value of a counter variable. The `while` loop has the general syntax

```
while (continue) {
 commands
}
```

where *continue* is a Boolean expression that must be true for the command block to be run; otherwise, the command block is skipped and the program loop ends.

The following code shows how to create the table shown earlier in Figure 10–8 as a `while` loop:

```
var htmlCode = "<tr>";
var i = 1;
while (i <= 4) {
 htmlCode += "<td>" + i + "</td>";
 i++;
}
```

The `while` loop continues as long as the value of the `i` variable remains less than or equal to 4. Each time through the command block, the loop writes the value of `i` into a table cell and then increases the counter by 1.

Like `for` loops, `while` loops can be nested within one another. The following code demonstrates how to create the 2 × 3 table shown earlier in Figure 10–9 using nested `while` loops:

```
var htmlCode = "<table>";
var rowNum = 1;
while (rowNum <= 2) {
 htmlCode += "<tr>";
 var colNum = 1;
 while (colNum <= 3) {
 htmlCode += "<td>" + rowNum + "," + colNum + "</td>";
 colNum++;
 }
 htmlCode += "</tr>";
 rowNum++;
}
```

Again, the initial values of the counter variables are set before the `while` loops are run and are updated within the command blocks.

### TIP

Use a `for` loop when your loop contains a counter variable. Use a `while` loop for a more general stopping condition.

Because `for` loops and `while` loops share many of the same characteristics, which one you choose for a given application is often a matter of personal preference. In general, `for` loops are used whenever you have a counter variable and `while` loops are used for conditions that don't easily lend themselves to using counters. For example, you could construct a `while` loop that runs as long as the current time falls within a specified time interval.

## Exploring the `do/while` Loop

In the `for` and `while` loops, the test to determine whether to continue the loop is made before the command block is run. JavaScript also supports a program loop called **`do/while`** that tests the condition to continue the loop right after the latest command block is run. The structure of the `do/while` loop is as follows:

```
do {
 commands
}
while (continue);
```

For example, the following code is used to create the table shown earlier in Figure 10–8 as a `do/while` loop:

```
var htmlCode = "<tr>";
var i = 1;
do {
 htmlCode += "<td>" + i + "</td>";
 i++;
}
while (i <= 4);
htmlCode += "</tr>";
```

The `do/while` loop is usually used when the program loop should run at least once before testing for the stopping condition.

The `<=` symbol used in these program loops is an example of a comparison operator. Before continuing your work on the calendar app, you examine the different types of comparison operators supported by JavaScript.

## Comparison and Logical Operators

A **comparison operator** is an operator that compares the value of one expression to another returning a Boolean value indicating whether the comparison is true or not. Thus, the following expression uses the `<` comparison operator to test whether the value of the `x` variable is less than 100:

```
x < 100
```

If this comparison is true, the expression returns the Boolean value `true` and, if otherwise, `false`. Figure 10–11 lists the comparison operators supported by JavaScript.

**Figure 10–11** Comparison operators

Operator	Example	Description
<code>==</code>	<code>x == y</code>	Tests whether <code>x</code> is equal in value to <code>y</code>
<code>===</code>	<code>x === y</code>	Tests whether <code>x</code> is equal in value to <code>y</code> and has the same data type
<code>!=</code>	<code>x != y</code>	Tests whether <code>x</code> is not equal to <code>y</code> or has a different data type
<code>!==</code>	<code>x !== y</code>	Tests whether <code>x</code> is not equal to <code>y</code> and/or doesn't have the same data type
<code>&gt;</code>	<code>x &gt; y</code>	Tests whether <code>x</code> is greater than <code>y</code>
<code>&gt;=</code>	<code>x &gt;= y</code>	Tests whether <code>x</code> is greater than or equal to <code>y</code>
<code>&lt;</code>	<code>x &lt; y</code>	Tests whether <code>x</code> is less than <code>y</code>
<code>&lt;=</code>	<code>x &lt;= y</code>	Tests whether <code>x</code> is less than or equal to <code>y</code>

When you want to test whether two values are equal, you use either a double equal sign (`==`) or a triple equal sign (`===`). The double equal sign tests whether two items are equal in value while the triple equal sign tests whether the two items are equal in value and also in data type. Thus, the following expression tests whether `x` is equal in value to 100 and is a number:

```
x === 100
```

Using the single equal sign (`=`) for the comparison operator is a common programming mistake; remember that the equal sign is an assignment operator and is reserved for setting one value equal to another, not for testing whether two values are equal.

JavaScript also supports **logical operators** that allow you to connect several expressions. For example, the logical operator `&&` returns a value of `true` only if both of the expressions are true. Figure 10–12 lists the JavaScript logical operators.

Figure 10–12

Logical operators

Operator	Definition	Example	Description
&&	and	(x === 5) && (y === 8)	Tests whether x is equal to 5 and y is equal to 8
	or	(x === 5)    (y === 8)	Tests whether x is equal to 5 or y is equal to 8
!	not	!(x < 5)	Tests whether x is not less than 5

## Program Loops and Arrays

Program loops can be used to cycle through the different values contained within an array. The general structure for accessing each value from an array using a `for` loop is

```
for (var i = 0; i < array.length; i++) {
 commands involving array[i]
}
```

where *array* is the array containing the values to be looped through and *i* is the counter variable used in the loop. The counter variable in this case represents the index number of an item from the array. The `length` property is used to determine the size of the array. The last item in the array has an index value of one less than the array's length—because array indices start with zero—so you continue the loop only when the array index is less than the length value.

### REFERENCE

#### Creating Program Loops

- To create a `for` loop, use looping structure

```
for (start; continue; update) {
 commands
}
```

where *start* is an expression that sets the initial value of a counter variable, *continue* is a Boolean expression that must be true for the loop to continue, *update* is an expression that indicates how the value of the counter variable should change each time through the loop, and *commands* is the JavaScript commands that are run each time through the loop.

- To create a `while` loop, use the following structure:

```
while (continue) {
 commands
}
```

- To create a `do/while` loop, use the following:

```
do {
 commands
}
while (continue);
```

- To loop through the contents of an array, enter the `for` loop

```
for (var i = 0; i < array.length; i++) {
 commands involving array[i]
}
```

where *i* is a counter variable representing the indices of the array items and *array* is the array to be looped through.

With this information, you can create a function that employs arrays and a `for` loop to create a row displaying the names of the seven days of the week. First, you will place the three-letter abbreviation of each weekday in an array and then loop through that array, writing a table heading cell for each day. You will place these commands in a function named `calWeekdayRow()`.

### To create the `calWeekdayRow()` function:

1. If you took a break after the previous session, make sure the `lht_calendar.js` file is open in your text editor.
2. At the bottom of the file, insert the following commands to begin creating the function by inserting an array named `dayName` containing the three-letter abbreviations of the seven days of the week:

```
/* Function to write a table row of weekday abbreviations */
function calWeekdayRow() {
 // Array of weekday abbreviations
 var dayName = ["SUN", "MON", "TUE", "WED", "THU", "FRI",
 "SAT"];
```

3. Next, create the `rowHTML` variable containing the opening tag for the table row by inserting the following command:

```
var rowHTML = "<tr>";
```

4. Add the following `for` loop to loop through the contents of the `dayName` array, adding HTML code for each `th` element:

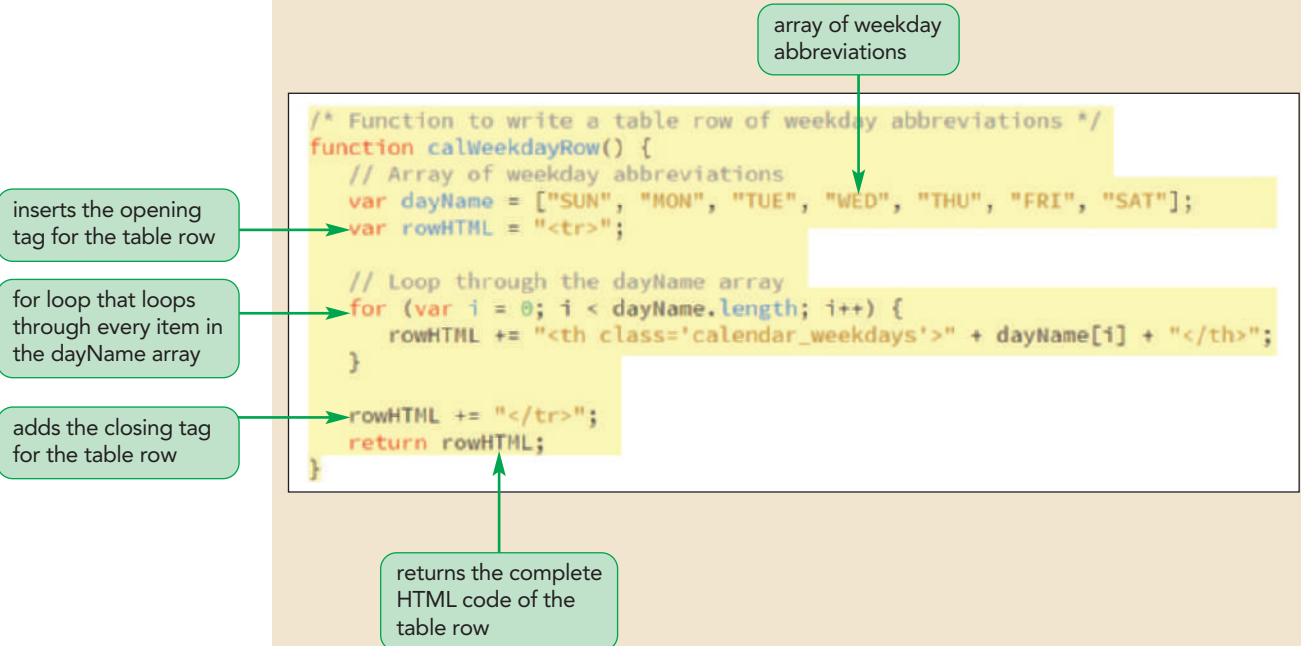
```
// Loop through the dayName array
for (var i = 0; i < dayName.length; i++) {
 rowHTML += "<th class='calendar_weekdays'>" + dayName[i] +
 "</th>";
}
```

5. Finally, complete the `calWeekdayRow()` function by adding a closing `</tr>` tag to the value of the `rowHTML` variable and return that variable's value. Add the code that follows:

```
 rowHTML += "</tr>";
 return rowHTML;
}
```

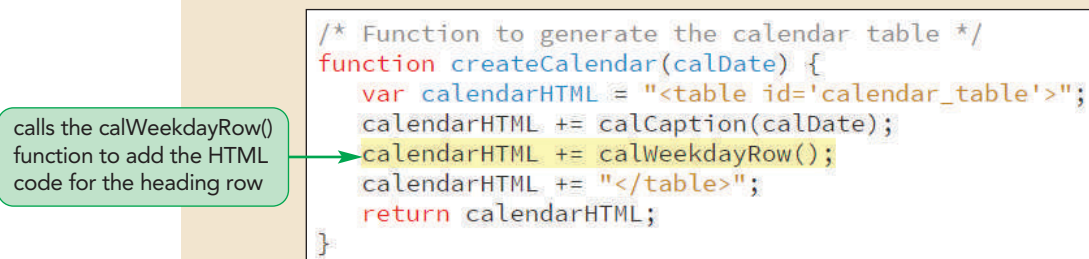
Figure 10–13 shows the complete contents of the `calWeekdayRow()` function.

You must enclose all commands in a `for` loop within a set of opening and closing curly braces so that each command is run every time through the loop.

**Figure 10–13** The calWeekdayRow() function

6. Scroll back up to the `createCalendar()` function and insert the following command as shown in Figure 10–14:

```
calendarHTML += calWeekdayRow();
```

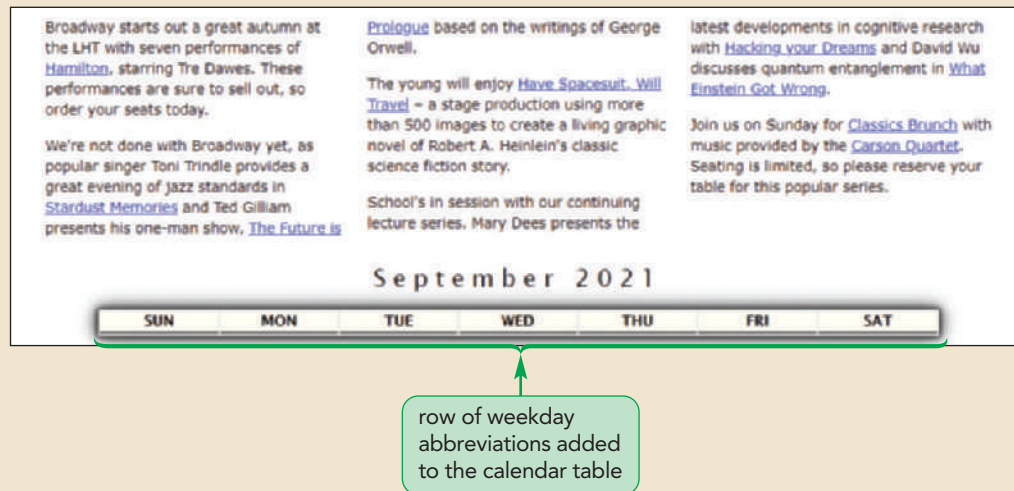
**Figure 10–14** Calling the calWeekdayRow() function

7. Save your changes to the file, and then reload the `lht_sept.html` file in your browser.

Figure 10–15 shows the revised appearance of the page with the calendar table now showing a row of weekday abbreviations.

Figure 10–15

Row of weekday abbreviations



## INSIGHT

### Returning a Random Array Item

In some programs, such as gaming apps, you might want to return a random value from an array. You can use the array index numbers along with the `Math.random` and `Math.floor` methods to achieve this. Assuming that an array is not sparse, the total number of array items is provided by the `length` property. To return a random index from the array, you use the expression

```
Math.floor(Math.random() * array.length);
```

where `array` is the name of the array. The value returned by this expression would be a random integer from 0 up to the value `length-1`, which corresponds to all of the array indices. You could place this expression in a function such as

```
function randItem(arr) {
 return arr[Math.floor(Math.random() * arr.length)];
}
```

using the `arr` parameter as the array to be evaluated.

To pick a random item from any array, you could apply the `randItem()` function to any array as follows

```
var color = ["red", "blue", "green", "yellow"];
var randColor = randItem(color);
```

and the `randColor` variable would contain one of the four colors chosen at random from the `color` array.

## Array Methods to Loop Through Arrays

JavaScript supports several methods to loop through the contents of an array without having to create a program loop structure. Because these methods are built into the JavaScript language, they are faster than program loops; however, older browsers might not support them, so you should apply them with caution.

Each of these methods is based on calling a function that will be applied to each item in the array. The general syntax is

```
array.method(callback [, thisArg])
```

### TIP

Callback function parameters can be given any descriptive name you choose, but the parameters must be listed in the order: value, index, and array name.

where *array* is the array, *method* is the array method, and *callback* is the name of the function that will be applied to each array item. An optional argument, *thisArg*, can be included to pass a value to the callback function. The general syntax of the callback function is

```
function callback(value [, index, array]) {
 commands
}
```

where *value* is the value of the array item during each pass through the array, *index* is the numeric index of the current array item, and *array* is the name of the array. Only the *value* parameter is required; the others are optional.

## Running a Function for Each Array Item

The first method you will explore is `forEach()`, which is used to run a function for each item in the array. The general syntax is

```
array.forEach(callback [, thisArg])
```

where *callback* is the function that is applied to each item in the array. For example, the following `forEach()` method applies the `sumArray()` function with each item in the `x` array:

```
var sum = 0;
var x = [2, 5, 7, 12];

x.forEach(sumArray);

function sumArray(value) {
 sum += value;
}
```

Note that the `sumArray()` function has a single parameter named *value*, representing the current array item. The result of running the `forEach()` method with the `sumArray()` function is that the value of each item in the `x` array is added to the `sum` variable, resulting in a final value of 26 in this example. The `forEach()` method can also be used to modify the values of individual array items.

The following code calls the `stepUp()` function to increase the value of each item in the `x` array by 1:

```
var x = [4, 7, 11];

x.forEach(stepUp);

function stepUp(value, i, arr) {
 arr[i] = value + 1;
}
```

Notice that in this case, the `stepUp()` function has three parameters, with the second parameter (*i*) representing the array index and the third parameter (*arr*) representing the array itself. After running this code, the `x` array would contain the values [5, 8, 12].

## Mapping an Array

The `map()` method performs an action similar to the `forEach()` method except that the function it calls returns a value that can be used to map the contents of an existing array into a new array. The following code demonstrates how to use the `map()`

method to create a new array in which each item is equal to twice the value of the corresponding item in the original array:

```
var x = [3, 8, 12];

var y = x.map(DoubleIt);

function DoubleIt(value) {
 return 2*value;
}
```

After running this code, the `y` array contains the values `[6, 16, 24]`. Note that the `map()` method does not affect the contents or structure of the original array, and the new array will have the same number of array items as the original. If the original array is sparse with several missing indices, the mapped array will have the same sparseness.

## Filtering an Array

Often when working with arrays, you will want to extract array items that match some specified condition. For example, in an array of test scores, you might want to extract only those test scores with a value of 90 or above. The following `filter()` method can be used to create such arrays

```
array.filter(callback [, thisArg])
```

where `callback` is a function that returns a Boolean value of `true` or `false` for each item in the array. The array items that return a value of `true` get copied into the new array. The following code demonstrates how to use the `filter()` method to create a subarray of items whose value is greater than 90:

```
var scores = [92, 68, 83, 95, 91, 65, 77];

var highScores = scores.filter(gradeA);

function gradeA(value) {
 return value > 90;
}
```

After running this code, the `highScores` array would contain the values `[92, 95, 91]`.

### Passing a Value to a Callback Function

If you need to pass a value to a callback function used by any of the array methods, you can include the optional `thisArg` parameter. In the following code, a value of 92 is entered as argument in the `filter()` method in order to return array items whose value is greater than or equal to 92

```
var scores = [92, 68, 83, 95, 91, 65, 77];

var highScores = scores.filter(gradeA, 92);

function gradeA(value) {
 return value >= this;
}
```

resulting in an array with the values `[92, 95]`. Note that the `gradeA` function uses the JavaScript keyword `this` to represent the value of the `thisArg` parameter. The `this` keyword is an important part of the JavaScript language and is used to represent a current value being operated upon by the browser.

Another common use of arrays is to examine an array's contents to determine whether every array item satisfies a specified condition. The following `every()` method returns the value `true` if every item in the array matches the condition specified by the callback function and, if otherwise, returns `false`:

```
array.every(callback [, thisArg])
```

As with the `filter()` method, the function used by the `every()` method must return a Boolean value of `true` or `false`. For example, the following code uses the `every()` method to test whether every test score exceeds a value of 70:

```
var scores = [92, 68, 83, 95, 91, 65, 77];

var allPassing = scores.every(passTest);

function passTest(value) {
 return value > 70;
}
```

In this example, the value of the `allPassing` variable would be `false` because not every value in the `scores` array is greater than 70. Similarly, the following `some()` method

```
array.some(callback [, thisArg])
```

returns a value of `true` if some—but not necessarily all—array items match a condition specified in the function and a value of `false` if none of the array items match the condition specified in the function. Applying the `some()` method to the above array would return a value of `true` because some (but not all) of the scores are greater than 70.

Figure 10–16 summarizes the different JavaScript array methods that can be used to work with the collection of items within an array.

Figure 10–16

Array methods to loop through arrays

Array Method	Description
<code>every(callback [, thisArg])</code>	Tests whether the condition returned by the <code>callback</code> function holds for all items in <code>array</code> ; in all array methods, the optional <code>thisArg</code> parameter is used to pass values to the <code>callback</code> function
<code>filter(callback [, thisArg])</code>	Creates a new array populated with the elements of <code>array</code> that return a value of <code>true</code> from the <code>callback</code> function
<code>forEach(callback [, thisArg])</code>	Applies the <code>callback</code> function to each item in <code>array</code>
<code>map(callback [, thisArg])</code>	Creates a new array by passing the original array items to the <code>callback</code> function, which returns the mapped value of the array items
<code>reduce(callback [, thisArg])</code>	Reduces <code>array</code> by keeping only those items that return a value of <code>true</code> from the <code>callback</code> function
<code>reduceRight(callback [, thisArg])</code>	Reduces <code>array</code> from the last element by keeping only those items that return a value of <code>true</code> from the <code>callback</code> function
<code>some(callback [, thisArg])</code>	Tests whether the condition returned by the <code>callback</code> function holds for at least one item in <code>array</code>
<code>find(callback [, thisArg])</code>	Returns the value of the first element in the array that passes a test in the <code>callback</code> function
<code>findIndex(callback [, thisArg])</code>	Returns the index of the first element in the array that passes a test in the <code>callback</code> function

### Decision Making: Efficient Loops

As your programs increase in size and complexity, the ability to write efficient code becomes essential. Bloated, inefficient code is particularly noticeable with program loops that might repeat the same set of commands hundreds or thousands of times. A millisecond wasted due to one poorly written command can mean an overall loss of dozens of seconds when it is part of a loop. Because studies show that users will rarely wait more than a few seconds for program results, it is important to shave off as many milliseconds as you can. Here are some ways to speed up your loops:

- **Calculate outside the loop.** There is no reason to repeat the exact same calculation hundreds of times within a loop. For example, the following code unnecessarily recalculates the same `Math.log(cost)` value a thousand times in the `for` loop:

```
for (i = 0; i < 1000; i++) {
 x[i] = i*Math.log(cost);
}
```

Instead, place that calculation outside the loop, where it will be calculated only once:

```
var costLog = Math.log(cost);
for (i = 0; i < 1000; i++) {
 x[i] = i*costLog;
}
```

- **Determine array lengths once.** Rather than forcing JavaScript to count up the length of a large array each time through the loop, calculate the length before the loop starts:

```
var x = myArray.length;
for (var i = 0; i < x; i++) {
 commands
}
```

- **Decrement rather than increment.** Instead of counting up to an array length, count down from the array length to 0, as in the following `for` loop:

```
var x = myArray.length;
for (var i = x; i-- > 0) {
 commands
}
```

When the counter variable equals 0, the loop will stop.

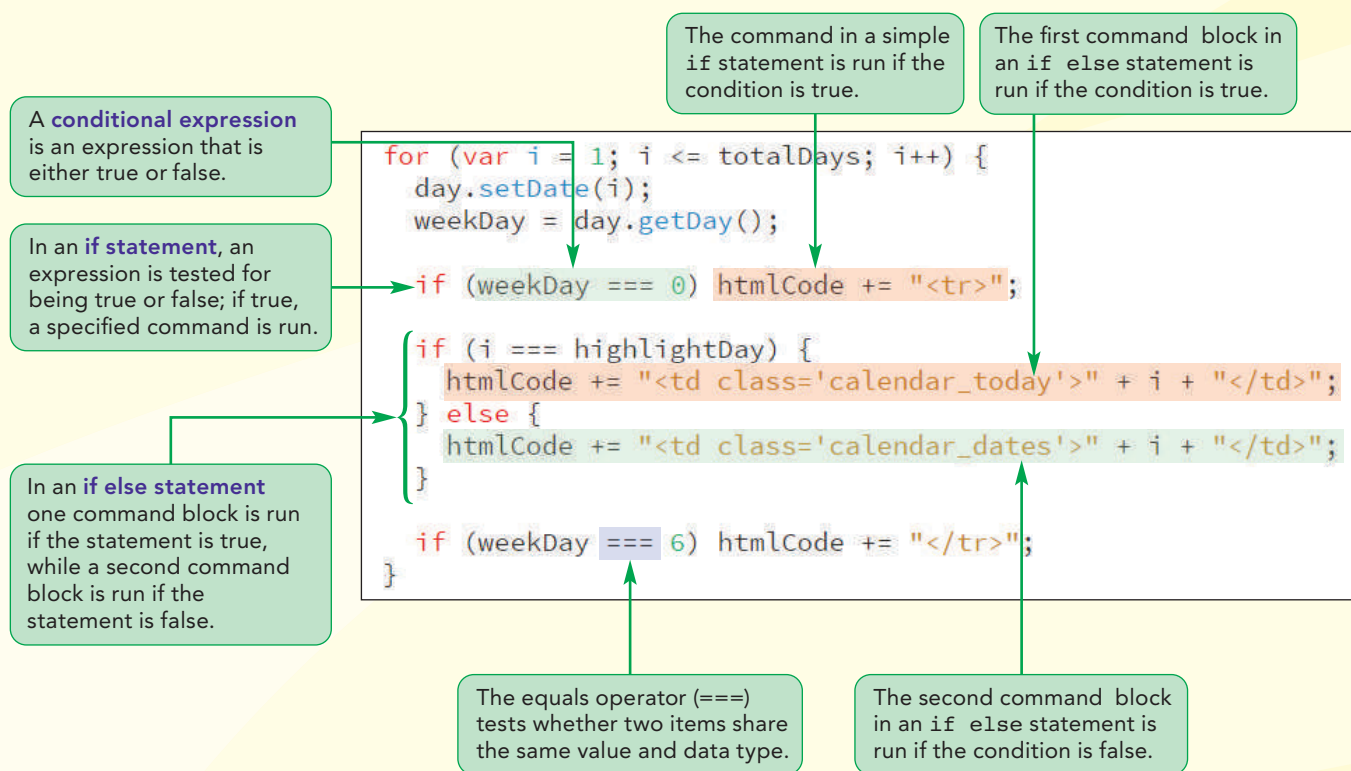
- **Unroll the loop.** When only a few items are being iterated in a loop, it is actually faster not to use a program loop. Instead, enter each counter value explicitly in separate statements.
- **Manage loop size.** A long command block is a red flag warning you that you might be trying to do too much each time through a loop. Look for ways to reduce the number of tasks and calculations in the command block to a bare minimum.

In the next session, you will explore how to work with JavaScript's conditional statements and put together everything you have learned to complete the calendar app.

**Session 10.2 Quick Check**

1. Which of the following is a type of program loop?
  - a. for
  - b. while
  - c. do/while
  - d. All of the above
2. Provide a for statement using a counter variable named i starting with the value 0 and continuing to 100 in increments of 10.
  - a. for (var i = 0; 100; 10)
  - b. for (var i = 0; i<=100; i+=10)
  - c. for (var i = 0; i = 100; 10)
  - d. for (var i = 0 to 100 by 10)
3. Provide a for statement using a counter variable named j starting with the value 100 and decreasing to 0 in increments of 10.
  - a. for (var i = 100; 0; -10)
  - b. for (var i = 100; i >= 0; i-=10)
  - c. for (var i = 100; i = 0; -10)
  - d. for (var i = 100 to 0 by -10)
4. Provide an expression that tests whether the x variable is not equal to 100.
  - a. x <> 100
  - b. x .ne. 100
  - c. x != 100
  - d. x ~= 100
5. Provide an expression that tests whether the x variable is equal to 10 or the y variable is equal to 20.
  - a. (x = 10) || (y = 20)
  - b. (x = 10) or (y = 20)
  - c. (x = 10) | (y = 20)
  - d. (x === 10) || (y === 20)
6. Which method do you apply to run a function for each item in an array?
  - a. forEach()
  - b. for-each()
  - c. forEvery()
  - d. every()
7. Which method do you apply to create a new array based on calculations done to every item from an existing array?
  - a. forEach()
  - b. map()
  - c. transfer()
  - d. copy()
8. Which method do you use to return the value of the first element in the array that passes a logical test?
  - a. find()
  - b. if()
  - c. while()
  - d. findIndex()

## Session 10.3 Visual Overview:



# Conditional Statements

```
function daysInMonth(calDate) {
 var dayCount = [31,28,31,30,31,30,31,31,30,31,30,31];

 var thisYear = calDate.getFullYear();
 var thisMonth = calDate.getMonth();

 if (thisYear % 4 === 0) {
 if ((thisYear % 100 !== 0) || (thisYear % 400 === 0)) {
 dayCount[1] = 29;
 }
 }

 return dayCount[thisMonth];
}
```

The or operator (||) is used when either of two conditions may be true for the entire conditional expression to be true.

In a nested if structure, one if statement is placed within another; the nested if statement is run only if the conditional expressions of both the outer and inner if statements are true.

## Introducing Conditional Statements

Your next task in your calendar app is to create a program loop that writes the days of the month, entered within different table cells arranged in separate table rows. The process should end when the last day of the month is reached. Because months have different numbers of days, you first need to create a function named `daysInMonth()` that determines the number of days in a given month.

Like the `calCaption()` function you created earlier, the `daysInMonth()` function will have a single parameter, `calDate`, containing a `Date` object on which your calendar will be based. The function will also store the year value and month value in the variables `thisYear` and `thisMonth`, respectively, and will contain the following array that stores the number of days in each month:

```
var dayCount = [31,28,31,30,31,30,31,31,30,31,30,31];
```

This array is an example of a **parallel array** because each entry in the array matches—or is parallel to—an entry in the `monthName` array you created in the first session. To return the days of the month from the calendar date, the function will use the value of the `thisMonth` variable to reference the corresponding day value in the `dayCount` array with the following expression:

```
dayCount[thisMonth]
```

So, for instance, given the date July 6, 2018, the function would return the value 31.

You add the `daysInMonth()` function now.

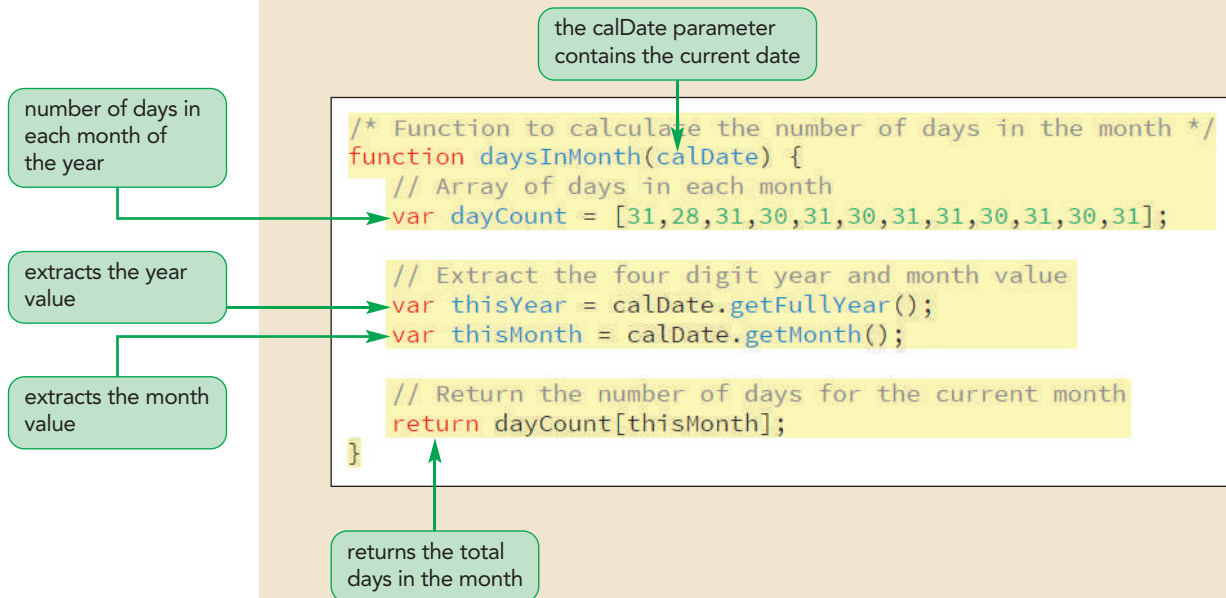
### To start creating the `daysInMonth()` function:

1. If you took a break after the previous session, make sure the `lht_calendar.js` file is open in your text editor.
2. At the bottom of the file, insert the following code, as shown in Figure 10–17:

```
* Function to calculate the number of days in the month */
function daysInMonth(calDate) {
 // Array of days in each month
 var dayCount = [31,28,31,30,31,30,31,31,30,31,30,31];

 // Extract the four digit year and month value
 var thisYear = calDate.getFullYear();
 var thisMonth = calDate.getMonth();

 // Return the number of days for the current month
 return dayCount[thisMonth];
}
```

**Figure 10–17** Inserting the `daysInMonth()` function**3.** Save your changes to the file.

Perhaps you have already noticed a problem with the `dayCount` array: February has 29 days during a leap year, not 28 days as shown in the array. For the `daysInMonth()` function to return the correct value for the month of February, it must examine the year value and then set the value for the number of days in February to either 28 or 29 based on whether the current year is a leap year. You can do this through a conditional statement. A **conditional statement** is a statement that runs a command or command block only when certain circumstances are met.

## Exploring the if Statement

The most common conditional statement is the `if` statement, which has the structure

```

if (condition) {
 commands
}

```

where *condition* is a Boolean expression that is either true or false, and *commands* is the command block that is run if *condition* is true. If only one command is run, you can eliminate the command block and enter the `if` statement as follows:

```

if (condition) command;

```

A conditional statement uses the same comparison and logical operators you used with the program loops in the last session. For example, the following `if` statement would set the value of the `dayCount` array for February to 29 if the year value were 2020 (a leap year):

```

if (thisYear === 2020) {
 dayCount[1] = 29;
}

```

For the calendar app, you will need to create a conditional expression that tests whether the current year is a leap year and then sets the value of `dayCount[1]`

appropriately. The general rule is that leap years are divisible by 4, so you will start by looking at operators that can determine whether the year is divisible by 4. One way is to use the `%` operator, which is also known as the modulus operator. The **modulus operator** returns the integer remainder after dividing one integer by another. For example, the expression `15 % 4` returns the value 3 because 3 is the remainder after dividing 15 by 4. To test whether a year value is divisible by 4, you use the conditional expression

```
thisYear % 4 === 0
```

where the `thisYear` variable contains the four-digit year value. The following is the complete `if` statement to change the value of the `dayCount` array for the month of February:

```
if (thisYear % 4 === 0) {
 dayCount[1] = 29;
}
```

Add this `if` statement to the `daysInMonth()` function now.

Be sure to use the triple equal sign symbol (`===`) and not the single equal sign symbol (`=`) when making a comparison in an `if` statement.

### To revise the `daysInMonth()` function:

1. After the statement that declares the `thisMonth` variable, insert the following `if` statement:

```
// Revise the days in February for leap years
if (thisYear % 4 === 0) {
 dayCount[1] = 29;
}
```

Figure 10–18 highlights the newly added code in the function.

**Figure 10–18** Inserting an `if` statement

tests whether `thisYear` is evenly divisible by 4

if it is, sets the value of `dayCount[1]` (February) to 29

```
/* Function to calculate the number of days in the month */
function daysInMonth(calDate) {
 // Array of days in each month
 var dayCount = [31,28,31,30,31,30,31,31,30,31,30,31];

 // Extract the four digit year and month value
 var thisYear = calDate.getFullYear();
 var thisMonth = calDate.getMonth();

 // Revise the days in February for leap years
 if (thisYear % 4 === 0) {
 dayCount[1] = 29;
 }

 // Return the number of days for the current month
 return dayCount[thisMonth];
}
```

2. Save your changes to the file.

### Assigning Values with Conditional Operators

When you want to simply assign a value to a variable rather than run a command block, you can write a more compact conditional expression using a **conditional operator** or a **ternary operator**, which has the syntax

```
condition ? value1 : value2;
```

where *condition* is a Boolean expression, *value1* is the value if the expression is true and *value2* is the value if the expression is false. For example, the following statement assigns a value of "Morning" to the session variable if the hour variable is less than 12 and "Afternoon" if otherwise:

```
var session = hour < 12 ? "Morning" : "Afternoon";
```

Conditional operators can test more than one possible condition by adding a second conditional operator to the last term in the expression as follows

```
condition1 ? value1 : condition2 ? value2 : value3;
```

where *value1* is assigned if *condition1* is true, *value2* is assigned if *condition2* is true (but not *condition1*), and *value3* is assigned if neither *condition1* nor *condition2* are true. Thus, the following statement assigns one of three possible values to the session variable based on the value of the hour variable:

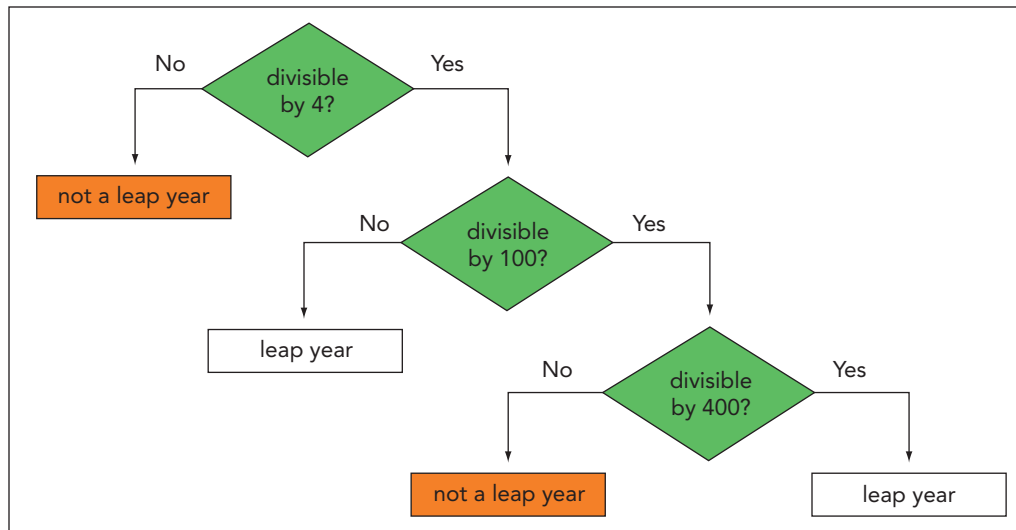
```
var session = hour < 12 ? "Morning" : hour < 16 ? "Afternoon" :
"Evening";
```

If hour is less than 12, the session variable has the value "Morning"; if hour is less than 16 (but greater than 12), the value is "Afternoon"; and otherwise, the value of the session variable is "Evening".

Note that conditional operators can only be used to assign a value. If you need to do more than one action in response to a conditional expression, use an `if` statement.

## Nesting if Statements

The `if` statement you wrote for the `daysInMonth()` function works as a simple approximation, but it is not completely accurate. In most cases, a year that is evenly divisible by 4 is a leap year. The only exceptions are years that occur at the turn of the century, which are evenly divisible by 100. These years are not leap years unless they are also evenly divisible by 400. Thus, years such as 1800, 1900, and 2100 are not leap years even though they are evenly divisible by 4. Years such as 2000 and 2400 are leap years because they are evenly divisible by 400. Figure 10–19 shows the complete process used to determine whether a particular year is a leap year.

**Figure 10–19** Process to calculate leap years

To translate these rules into our calendar app, you need to nest one `if` statement inside another one. The general structure of this nested `if` statement is as follows:

```

if (thisYear % 4 === 0) {
 further test for century years
}

```

The nested `if` statement needs to add two more conditions: (1) the year is not divisible by 100, and (2) the year is divisible by 400. The expressions for these two conditions are as follows:

```

thisYear % 100 !== 0
thisYear % 400 === 0

```

If either of those two conditions is true for a year evenly divisible by 4, then the year is a leap year. Note that you will use the not equal to operator (`!==`) to test for an inequality in the first expression. You will then combine these two expressions into a single expression using the `or` operator (`||`), as follows:

```

(thisYear % 100 !== 0) || (thisYear % 400 === 0)

```

Finally, you will nest this conditional expression as follows:

```

if (thisYear % 4 === 0) {
 if ((thisYear % 100 !== 0) || (thisYear % 400 === 0)) {
 dayCount[1] = 29;
 }
}

```

Under this set of nested `if` statements, the number of days in February is 29 only if the `thisYear` variable is divisible by 4, and then only if it is also divisible by 400 or not divisible by 100. Take some time to compare this set of nested `if` statements with the chart shown earlier in Figure 10–19 to confirm that it satisfies all possible conditions for leap years. After incorporating this set of nested `if` statements, the `daysInMonth()` function returns the correct number of days for any month in any given year.

**To complete the `daysInMonth()` function:**

1. Within the `if` statement you entered in the last set of steps, delete the following statement:

```
dayCount[1] = 29
```

2. Replace the statement you just deleted with the following nested `if` statement:

```
if ((thisYear % 100 != 0) || (thisYear % 400 === 0)) {
 dayCount[1] = 29;
}
```

Figure 10–20 highlights the newly inserted nested `if` statement.

**Figure 10–20****Inserting a nested `if` statement**

if the year is divisible by 4 and either not divisible by 100 or divisible by 400, it's a leap year

```
// Revise the days in February for leap years
if (thisYear % 4 === 0) {
 if ((thisYear % 100 != 0) || (thisYear % 400 === 0)) {
 dayCount[1] = 29;
 }
}
```

3. Save your changes to the file.

## Exploring the `if else` Statement

The `if` statement runs a command or a command block only if the conditional expression returns the value `true`; it does nothing if the condition is false. On some occasions, you might want to choose between alternate command blocks so that one command block is run if the conditional expression is true, and a different command block is run if the expression is false. The general structure of an `if else` statement follows:

```
if (condition) {
 commands if condition is true
} else {
 commands if condition is false
}
```

If only a single command is run in response to the `if` statement, you can use the following abbreviated form:

```
if (condition) command if condition is true
else command if condition is false;
```

The following example shows an `if else` statement that displays two possible alert boxes depending on whether the value of the `day` variable is Friday or not:

```
if (day === "Friday") alert("Thank goodness it's Friday")
else alert("Today is " + day);
```

Like `if` statements, `if else` statements can be nested as in the following code, which chooses between three possible alert boxes:

```
if (day === "Friday") alert("Thank goodness it's Friday")
else {
 if (day === "Monday") alert("Blue Monday")
 else alert("Today is " + day);
}
```

### TIP

To make it easier to interpret nested `if` statements, always indent your code, lining up all of the commands for one set of nested statements.

Some programmers advocate always using curly braces even if the command block contains only a single command. This practice visually separates one `else` clause from another. Also, when reading through nested statements, it can be helpful to remember that an `else` clause usually pairs with the nearest preceding `if` statement.

## Using Multiple `else if` Statements

For more complex scripts, you might need to choose from several alternatives. In these cases, you can specify multiple `else` clauses, each with its own `if` statement. This is not a new type of conditional structure, but rather a way of taking advantage of the syntax rules inherent in the `if else` statement. The general structure for choosing from several alternatives is

```
if (condition1) {
 commands1
} else if (condition2) {
 commands2
} else if (condition3) {
 commands3
...
} else {
 default commands
}
```

### TIP

To simplify code, keep your nesting of multiple `if` statements to three or less, if possible. For more conditions, use the `case/switch` structure.

where *condition 1*, *condition 2*, *condition 3*, and so on are the different conditions to be tested. This construction should always include a final `else` clause that is run by default if none of the preceding conditional expressions is true. When a browser runs a series of statements like this one, it stops examining the remaining `else` clauses at the first true condition. The structure in the following example employs multiple `else if` conditions:

```
if (day === "Friday") {
 alert("Thank goodness it's Friday");
} else if (day === "Monday") {
 alert("Blue Monday");
} else if (day === "Saturday") {
 alert("Sleep in today");
} else {
 alert("Today is " + day);
}
```

### Working with Conditional Statements

- To test a single condition, use the construction

```
if (condition) {
 commands
}
```

where *condition* is a Boolean expression and *commands* is a command block run if the conditional expression is true.

- To test between two conditions, use the following construction:

```
if (condition) {
 commands if condition is true
} else {
 commands if not true
}
```

- To test multiple conditions, use the construction

```
if (condition1) {
 commands1
} else if (condition2) {
 commands2
} else if (condition3) {
 commands3
...
} else {
 default commands
}
```

where *condition 1*, *condition 2*, *condition 3*, and so on are the different conditions to be tested. If no conditional expressions return the value true, the *default command block* is run.

You now have all of the tools you need to complete the calendar app. The only remaining task involves writing out the table cells containing the calendar days so that they are organized into separate rows. You will complete the calendar app in the next section.

### Exploring the switch Statement

Another way to handle multiple conditions is with the **switch statement**—also known as the **case statement**—in which different commands are run based upon different possible values of a specified variable. The syntax of the `switch` statement is

```
switch (expression) {
 case label1: commands1; break;
 case label2: commands2; break;
 case label3: commands3; break;
 ...
 default: default commands
}
```

where *expression* is an expression that returns a value; *label1*, *label2*, and so on are possible values of that expression; *commands1*, *commands2*, and so on are the commands associated with each label; and *default commands* is the set of commands to be run if no label matches the value returned by expression. The following `switch` statement demonstrates how to display a different alert box based on the value of the `day` variable:

```
switch (day) {
 case "Friday": alert("Thank goodness it's Friday"); break;
 case "Monday": alert("Blue Monday"); break;
 case "Saturday": alert("Sleep in today"); break;
 default: alert("Today is " + day);
}
```

The `break` statement is optional and is used to halt the execution of the `switch` statement once a match has been found. For programs with multiple matching cases, you can omit the `break` statements and JavaScript will continue moving through the `switch` statements, running all matching commands.

Because of its simplicity, the `switch` statement is often preferred over a long list of `else if` statements that can be confusing to read and to debug.

## Completing the Calendar App

The last part of creating the calendar involves writing table cells for each day of the month. The completed calendar app must do the following:

- Calculate the day of the week in which the month starts.
- Write blank table cells for the days before the first day of the month.
- Loop through the days of the current month, writing each date in a different table cell and starting a new table row on each Sunday.

You will place all of these commands in a function named `calDays()`. The function will have a single parameter named `calDate` storing a `Date` object for the current date. You add this function to the `lht_calendar.js` file.

**To start the calDays() function:**

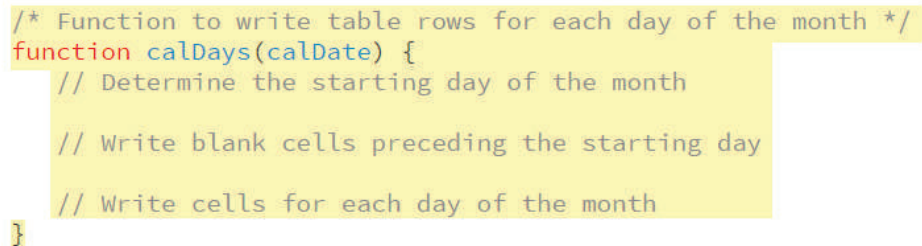
1. At the bottom of the lht\_calendar.js file, insert the following function:

```
/* Function to write table rows for each day of the month */
function calDays(calDate) {
 // Determine the starting day of the month

 // Write blank cells preceding the starting day

 // Write cells for each day of the month
}
```

Figure 10–21 highlights the initial code of the function, as well as comments to help explain the code that will be added.

**Figure 10–21****Inserting the calDays() function and comments**


```
/* Function to write table rows for each day of the month */
function calDays(calDate) {
 // Determine the starting day of the month

 // Write blank cells preceding the starting day

 // Write cells for each day of the month
}
```

2. Save your changes to the file.

## Setting the First Day of the Month

To loop through all of the days of the month, you need to keep track of each day as its table cell is written into the calendar table. You will store this information in a `Date` object named `day`. The initial value of the `day` variable will be set to match the first day of the calendar month using the following expression:

```
var day = new Date(calDate.getFullYear(), calDate.getMonth(), 1);
```

Note that the new `Date()` object constructor uses the four-digit year value and month value from the `calDate` parameter to set the year and month, and then sets the day value to 1 to match the first day of the month. For example, if the current date is August 12, 2021, the date stored in the `day` variable will be August 1, 2021; that is, no matter what current day is, the date stored in the `day` variable will be the first day for that month and year.

Next, to determine the day of the week on which the month starts, you use the following `getDay()` method:

```
var weekDay = day.getDay();
```

Recall that the `getDay()` method returns an integer ranging from 0 (Sunday) to 6 (Saturday). You add these two commands to the `calDays()` function now.

### To create the day and weekDay variables:

1. Below the first comment in the `calDays()` function, insert the following commands:

```
var day = new Date(calDate.getFullYear(), calDate.getMonth(), 1);
var weekDay = day.getDay();
```

Figure 10–22 highlights the newly added code.

Figure 10–22

### Calculating the start day of the month

sets the first day  
of the month

determines the  
weekday on which  
the month begins

```
/* Function to write table rows for each day of the month */
function calDays(calDate) {
 // Determine the starting day of the month
 var day = new Date(calDate.getFullYear(), calDate.getMonth(), 1);
 var weekDay = day.getDay();

 // Write blank cells preceding the starting day

 // Write cells for each day of the month
}
```

2. Save your changes to the file.

## Placing the First Day of the Month

Before the first day of the month, the calendar table should show only empty table cells that represent the days from the previous month. The value of the `weekDay` variable indicates how many empty table cells you need to create. For example, if the value of the `weekDay` variable is 4, indicating that the month starts on a Thursday, you know that there are four blank table cells—corresponding to Sunday, Monday, Tuesday, and Wednesday—that need to be written at the start of the first table row. The following loop writes the HTML code for the empty table cells to start the table row:

```
var htmlCode = "<tr>";
for (var i = 0; i < weekDay; i++) {
 htmlCode += "<td></td>";
}
```

Note that if `weekDay` equals 0—indicating that the month starts on a Sunday—then no blank table cells will be written because the value of the counter variable is never less than the value of the `weekDay` variable and thus, the command block in the `for` loop is completely skipped.

### To write the initial blank cells of the first table row:

1. Below the second comment line, insert the following `for` loop:

```
var htmlCode = "<tr>";
for (var i = 0; i < weekDay; i++) {
 htmlCode += "<td></td>";
}
```

Figure 10–23 highlights the code for the `for` loop.

Figure 10–23

## Inserting blank cells for the days that precede the start of the month

inserts opening <tr>  
tag for the initial  
table row

inserts a blank table  
cell for each weekday  
prior to the first of the  
month

```
/* Function to write table rows for each day of the month */
function calDays(calDate) {
 // Determine the starting day of the month
 var day = new Date(calDate.getFullYear(), calDate.getMonth(), 1);
 var weekDay = day.getDay();

 // Write blank cells preceding the starting day
 var htmlCode = "<tr>";
 for (var i = 0; i < weekDay; i++) {
 htmlCode += "<td></td>";
 }

 // Write cells for each day of the month
}
```

2. Save your changes to the file.

## Writing the Calendar Days

Finally, you will write the table cells for each day of the month using the following for loop:

```
var totalDays = daysInMonth(calDate);

for (var i = 1; i <= totalDays; i++) {
 day.setDate(i);
 weekDay = day.getDay();

 if (weekDay === 0) htmlCode += "<tr>";
 htmlCode += "<td class='calendar_dates'>" + i + "</td>";
 if (weekDay === 6) htmlCode += "</tr>";
}
```

The code starts by determining the total days in the month using the `daysInMonth()` function you created earlier. It then loops through those days, and each time through the loop it changes the `day` and `weekDay` variables to match the current day being written. If the day is a Sunday, a new table row is started; if the day is a Saturday, the current table row is ended. Each table cell displays the day number and belongs to the `calendar_dates` class, which allows it to be styled using the style rule from the `lht_calendar.css` style sheet.

### To write the calendar days:

1. Below the last comment in the `calDays()` function, add the following commands:

```
var totalDays = daysInMonth(calDate);

for (var i = 1; i <= totalDays; i++) {
 day.setDate(i);
 weekDay = day.getDay();
```

```

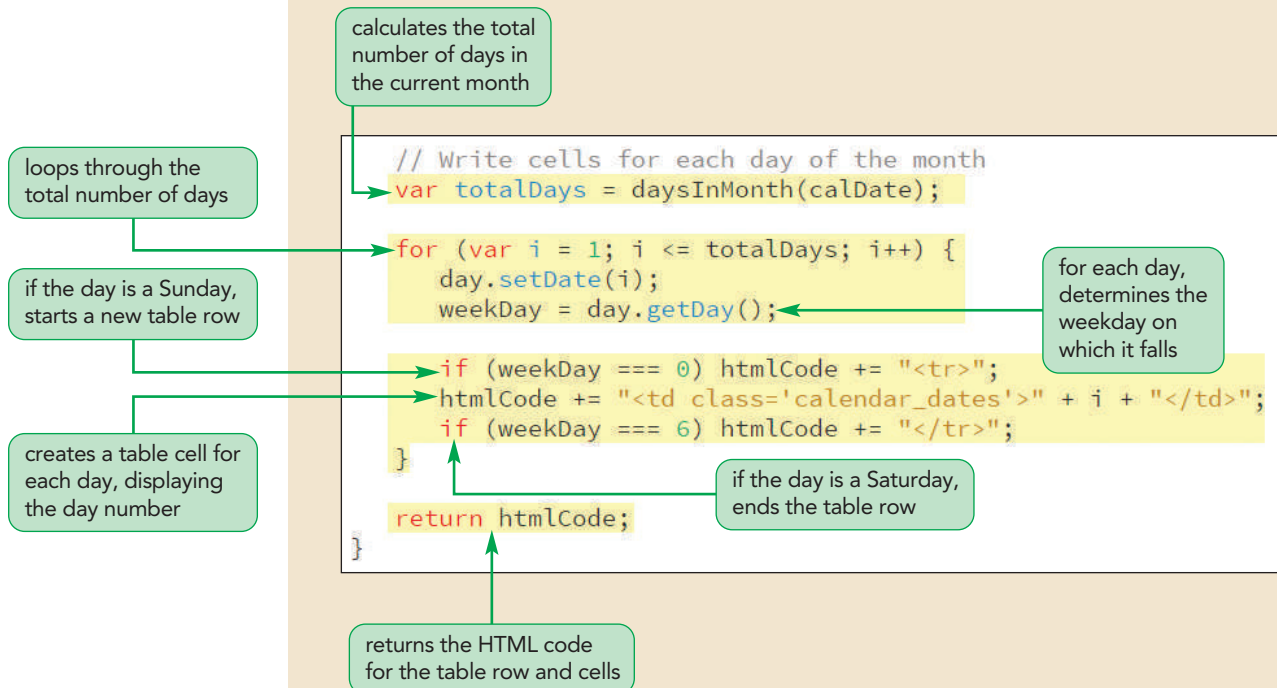
 if (weekDay === 0) htmlCode += "<tr>";
 htmlCode += "<td class='calendar_dates'>" + i + "</td>";
 if (weekDay === 6) htmlCode += "</tr>";
 }

 return htmlCode;

```

Figure 10–24 highlights the code to write the table cells for each day of the month.

**Figure 10–24** Writing the HTML code for the table row and cells



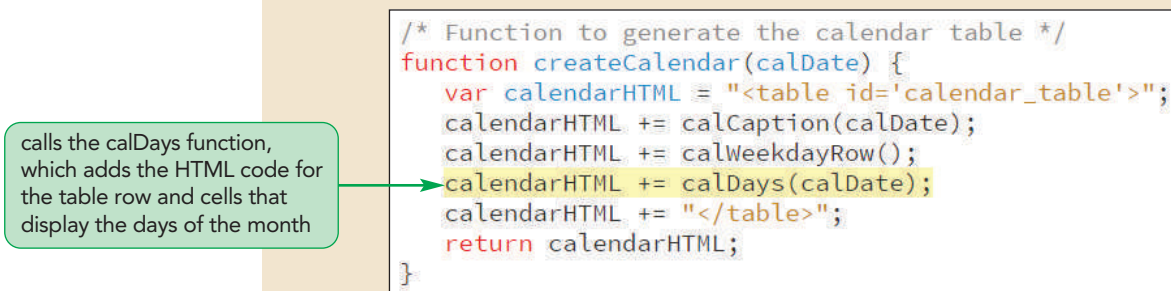
Next, you call the `calDays()` function from within the `createCalendar()` function and view the results.

2. Scroll up to the `createCalendar()` function, and then insert the following statement directly above the command that writes the closing `</table>` tag.

```
calendarHTML += calDays(calDate);
```

Figure 10–25 highlights the code in the function.

**Figure 10–25** Calling the `calDays()` function



3. Save your changes to the file, and then reload the lht\_sept.html file in your browser. As shown in Figure 10–26, the page should now display the monthly calendar for September 2021.

Figure 10–26

## Monthly calendar for September 2021

days from the preceding month are displayed as blank cells

We're not done with Broadway yet, as popular singer Toni Trindle provides a great evening of jazz standards in [Stardust Memories](#) and Ted Gilling presents his one-man show, [The Future Is](#)

novel of Robert A. Heinlein's classic science fiction story.

School's in session with our continuing lecture series. Mary Dees presents the

music provided by the [Carson Quartet](#). Seating is limited, so please reserve your table for this popular series.

### September 2021

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

days from the next month are displayed as blank cells

**Trouble?** If you do not see a calendar, you might have made a mistake in the code. Common mistakes include misspelling variable names, forgetting to close quoted text strings, inconsistently using uppercase and lowercase letters in variable names, and omitting closing braces in command blocks. Compare your code to the complete code of the `calDays()` function shown in Figures 10–23 and 10–24.

## Highlighting the Current Date

Lewis likes the calendar's appearance but mentions that the calendar should also highlight the current day: September 24, 2021. Recall that Lewis has created a special style rule for the current day, identified using the HTML `id` value "calendar\_today". Thus, to highlight that table cell, the `calDays()` function should test each day as it is being written; and if the date matches the calendar day, the function should write the table cell as

```
<td class='calendar_dates' id='calendar_today'>day</td>
```

where `day` is the day number. Otherwise, the function should write the table cell without the `id` attribute as follows:

```
<td class='calendar_dates'>day</td>
```

To determine the day number of the calendar day, you create the `highlightDay` variable, using the `getDate()` method to extract the day value from the `calDate` parameter. When the counter in the `for` loop matches the value of this variable, the loop will write the table cell including the `calendar_today` `id` attribute.

**TIP**

Calculations such as the `getDate()` method that need to be performed once should always be placed outside the program loop to avoid unnecessarily repeating the same calculation each time through the loop.

**To highlight the current date in the calendar:**

1. Return to the `lht_calendar.js` file in your editor, and then scroll down to the `calDays()` function.
2. In the Write cells for each day of the month section and directly above the `for` loop in that section, insert the following statement to calculate the day value of the current day:

```
var highlightDay = calDate.getDate();
```

3. Replace the statement that writes the value of the `htmlCode` variable in the `for` loop with the following code:

```
if (i === highlightDay) {
 htmlCode += "<td class='calendar_dates' id='calendar_today'>"
 + i + "</td>";
} else {
 htmlCode += "<td class='calendar_dates'>" + i + "</td>";
}
```

Figure 10–27 highlights the newly added `if` statement in the function.

**Figure 10–27****Highlighting the current date in the calendar**

stores the current day  
in the `highlightDay`  
variable

if the day is the  
highlight day, write a  
table cell with the id  
'calendar\_today'

otherwise write a  
table cell with no id  
value

```
// Write cells for each day of the month
var totalDays = daysInMonth(calDate);

var highlightDay = calDate.getDate();
for (var i = 1; i <= totalDays; i++) {
 day.setDate(i);
 weekDay = day.getDay();

 if (weekDay === 0) htmlCode += "<tr>";
 if (i === highlightDay) {
 htmlCode += "<td class='calendar_dates' id='calendar_today'>" + i + "</td>";
 } else {
 htmlCode += "<td class='calendar_dates'>" + i + "</td>";
 }
 if (weekDay === 6) htmlCode += "</tr>";
}

return htmlCode;
}
```

4. Save your changes to the file, and then reload `lht_august.html` in your browser. The table cell corresponding to September 24, 2021 should now be highlighted as shown in Figure 10–28.

Figure 10–28

Calendar with the current date highlighted

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

## Displaying Daily Events

The final piece of your calendar app is to display the daily events in September. Lewis already has created an array of daily event text, part of which is shown in Figure 10–29.

Figure 10–29

The dayEvent array

```
var dayEvent = new Array();

dayEvent[1] = "";
dayEvent[2] = "
Classic Cinema: Wings
7 pm
$5";
dayEvent[3] = "
The Future is Prologue
8 pm
$18/$24/$36";
dayEvent[4] = "
American Favorites
7:30 pm
$24/$36/$48";
dayEvent[5] = "
Classics Brunch
11 am
$12";
dayEvent[6] = "
LHT Jazz Band
7 pm
$24";
dayEvent[7] = "";
```

The dayEvent array has 30 items to match the 30 days in September. Array items that match days on which no event is scheduled contain a blank text string, while daily events are written in the HTML code that will be inserted into the calendar table. To display this content, you create a link to the lht\_events.js file and then, within the calDays() function, you add an expression to write the contents of the dayEvent array into the individual table cells.

### To display the daily events:

1. Return to the **lht\_sept.html** file in your text editor. Directly above the script element for the lht\_calendar.js file, insert the following script element for the lht\_events.js file:

```
<script src="lht_events.js" defer></script>
```

Figure 10–30 highlights the newly added code.

**Figure 10–30** Linking to the `lht_events.js` file

links to the script file containing the `dayEvents` array

```
<link href="lht_base.css" rel="stylesheet" />
<link href="lht_layout.css" rel="stylesheet" />
<link href="lht_calendar.css" rel="stylesheet" />
<script src="lht_events.js" defer></script>
<script src="lht_calendar.js" defer></script>
</head>
```

2. Close the `lht_sept.html` file, saving your changes.
3. Return to the **`lht_calendar.js`** file in your text editor, and then scroll down to the `calDays()` function.
4. Within the `if` else statement conditions, change the expression `+ i +` in two places to:
   
`+ i + dayEvent[i] +`

Figure 10–31 highlights the newly added code that displays the events on each day.

**Figure 10–31** Displaying events for each day of the month

```
if (weekDay === 0) htmlCode += "<tr>";
if (i === highlightDay) {
 htmlCode += "<td class='calendar_dates' id='calendar_today'>" + i + dayEvent[i] + "</td>";
} else {
 htmlCode += "<td class='calendar_dates'>" + i + dayEvent[i] + "</td>";
}
if (weekDay === 6) htmlCode += "</tr>";
```

displays the event for the day

5. Save your changes to the file.
6. Reload the **`lht_sept.html`** file in your browser. Verify that the calendar now shows the daily events as displayed in Figure 10–32.

Figure 10–32

Final version of the September 2021 calendar

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2 Classic Cinema: Wings 7 pm \$5	3 The Future is Prologue 8 pm \$18/\$24/\$36	4 American Favorites 7:30 pm \$24/\$36/\$48
5 Classics Brunch 11 am \$12	6 LHT Jazz Band 7 pm \$24	7	8 Civic Forum 7 pm free	9 Hamilton 7:30 pm \$48/\$64/\$88	10 Hamilton 7:30 pm \$48/\$64/\$88	11 Hamilton 7:30 pm \$48/\$64/\$88
12 Classics Brunch 11 am \$12	13	14 Hacking your Dreams 7 pm free	15 Hamilton 7:30 pm \$48/\$64/\$88	16 Hamilton 7:30 pm \$48/\$64/\$88	17 Hamilton 7:30 pm \$48/\$64/\$88	18 Hamilton 2 pm \$48/\$64/\$88
19 Classics Brunch 11 am \$12	20 What Einstein Got Wrong 7 pm free	21	22 Governor's Banquet 6 pm by invitation	23 Classic Cinema: City Lights 7 pm \$5	24 Starburst Memories 8 pm \$24/\$36/\$48	25 Summer Concert 8 pm \$16/\$24
26 Classics Brunch 11 am \$12	27	28 Children's Shakespeare 6 pm free	29 Kids Fair 6 pm free	30 Have Soapsuit Will Travel 7:30 pm \$22/\$36/\$48		

You complete your work on the app by modifying the code so that it shows the calendar for the current month.

### To display the calendar for the current month:

1. Return to the `lht_calendar.js` file in your editor.
2. Change the statement setting the value of the `thisDay` variable to:

```
var thisDay = new Date();
```

Figure 10–33 highlights the changed code in the file.

Figure 10–33

Displaying a calendar for the current month and date

```
/* Set the date displayed in the calendar */
var thisDay = new Date();
```

sets the `thisDay` variable to the current date and time

3. Close the file, saving your changes.
4. Reload the `lht_sept.html` file in your browser. Verify that the page shows the calendar for the current month and that the current date is highlighted within the calendar (the events listed in the calendar will still be based on the entries in the `dayEvent` array).

## Managing Program Loops and Conditional Statements

Although you are finished with the calendar app, you still should become familiar with some features of program loops and conditional statements for future work with these JavaScript structures. You examine three features in more detail—the `break`, `continue`, and `label` statements.

### Exploring the `break` Command

Although you briefly saw how to use the `break` statement when creating a `switch` statement, the `break` statement can be used anywhere within program code. Its purpose is to terminate any program loop or conditional statement. When a `break` statement is encountered, control is passed to the statement immediately following it. It is most often used to exit a program loop before the stopping condition is met. For example, consider a loop that examines an array for the presence or absence of a particular value, such as a customer ID number. The code for the loop might look as follows:

```
for (var i = 0; i < ids.length; i++) {
 if (ids[i] === "C-14281") {
 alert("C-14281 is in the list");
 }
}
```

What would happen if the `ids` array had tens of thousands of entries? It would be time consuming to keep examining the array once the C-14281 ID has been encountered. To address this, the following `for` loop breaks off when it encounters the ID value, keeping the browser from needlessly examining the rest of the array:

```
for (var i = 0; i < ids.length; i++) {
 if (ids[i] === "C-14281") {
 alert("C-14281 is in the list");
 break; // stop processing the for loop
 }
}
```

### Exploring the `continue` Command

The **`continue` statement** is similar to the `break` statement except that instead of stopping the program loop altogether, the `continue` statement stops processing the commands in the current iteration of the loop and continues on to the next iteration. For example, your program might employ the following `for` loop to add the values from an array:

```
var total = 0;
for (var i = 0; i < data.length; i++) {
 total += data[i];
}
```

Each time through the loop, the value of the current entry in the data array is added to the total variable. When the `for` loop is finished, the total variable is equal to the sum of the values in the data array. However, what would happen if this were a sparse array containing several empty entries? In that case, when a browser encountered a missing or null value, that value would be added to the total variable, resulting in a null total. One way to fix this problem would be to use the `continue` statement, jumping out of the current iteration if a missing or null value were encountered. The revised code would look like the following:

```
var total = 0;
for (var i = 0; i < data.length; i++) {
 if (data[i] === null) continue; // continue to next iteration
 total += data[i];
}
```

## Exploring Statement Labels

**Statement labels** are used to identify statements in JavaScript code so that you can reference those lines elsewhere in a program. The syntax of the statement label is

```
label: statements
```

where *label* is the text of the label and *statements* are the statements identified by the label. You have already seen labels with the `switch` statement, but labels can also be used with other program loops and conditional statements to provide more control over how statements are processed. Labels often are used with `break` and `continue` statements in order to break off or continue a program loop. The syntax to reference a label in such cases is simply

```
break label;
```

or

```
continue label;
```

For example, the following `for` loop uses a statement label not only to jump out of the programming loop when the text string C-14281 is found but also to jump to the location in the script identified by the `next_report` label and to continue to process the statements found there:

```
for (var i = 0; i < ids.length; i++) {
 if (ids[i] === "C-14281") {
 document.write("C-14281 is in the list.");
 break next_report;
 }
}

next_report:
JavaScript statements
```



### Teamwork: The Danger of Spaghetti Code

**Spaghetti code** is a pejorative programming term that refers to convoluted or poorly written code. One hallmark of spaghetti code is the frequent branching from one section of code to another, making it difficult to track the program line-by-line as it is executed. A change in one part of the program could lead to unpredictable changes in a completely different section of the code.

Most developers discourage the use of `break`, `continue`, and `label` statements unless absolutely necessary. They can confuse a programmer trying to debug code in which a program loop can end before its stopping condition, or code in which statements are not processed in the order that they are written in a document. Almost all of the tasks you perform with these statements can also be performed by carefully setting up the conditions for program loops.

Even with the best of intentions, spaghetti code can easily occur in environments in which the same code is maintained by several people or passed from one employee to another. Each programmer adds a particular feature that is needed today without adequately documenting the changes made to the code and without considering the impact of those changes on the larger program.

To avoid or at least reduce the occurrence of spaghetti code, you should always document your code and develop a structure that is easy to follow. Break up tasks into smaller functions that are easier to manage and can be reused in other parts of your programs. Also, avoid global variables whenever possible because a change in the value of a global variable can have repercussions throughout the entire code. Instead, use local variables with their scope limited to small, compact functions. If a variable must be used elsewhere in your code, it should be passed as a parameter value with the meaning and purpose of the parameter well documented within the program.

By practicing good coding techniques, you can make your programs more accessible to your colleagues and make it easier to pass your code on to your successors.

Lewis is pleased with the final version of the calendar app. Because of the way the function and the style sheets were designed, he can use this utility in many other pages on the website with only a minimal amount of recoding in the documents.

### Session 10.3 Quick Check

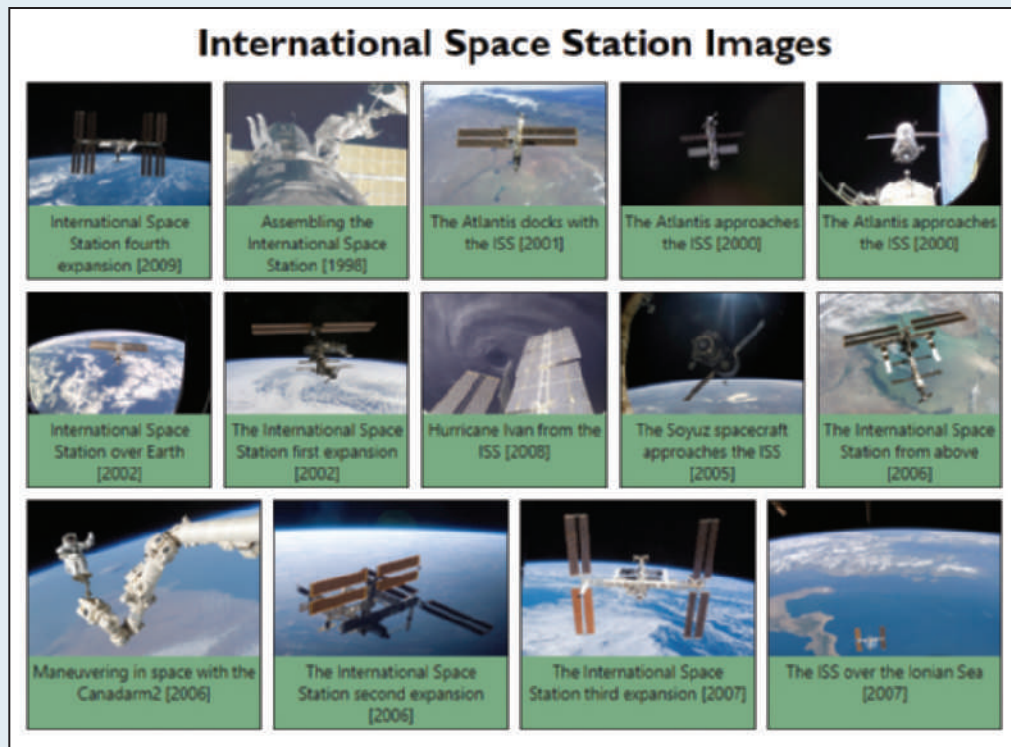
1. Which of the following displays an alert box with the message "Good Morning" if the value of the `thisHour` variable is less than 9?
  - a. `if (thisHour .le. 9) alert("Good Morning");`
  - b. `if (thisHour le 9) alert("Good Morning");`
  - c. `if (thisHour < 9) alert("Good Morning");`
  - d. `if (thisHour LE 9) alert("Good Morning");`
2. Which expression extracts the day of the week value from a `Date` object variable named `thisDate`?
  - a. `thisDate.day()`
  - b. `thisDate.getday()`
  - c. `thisDate.getWeekday()`
  - d. `thisDate.getDay()`
3. In place of a command block, you can write a conditional expression using `a(n)`:
  - a. `if` statement
  - b. conditional operator
  - c. `while` statement
  - d. `continue` statement
4. In place of multiple `if` statements, you can handle multiple conditions with `a`:
  - a. `switch` statement
  - b. `while` statement
  - c. `function` statement
  - d. `setInterval()` function
5. Which command can be used to break out of the current iteration in a `for` loop?
  - a. `stop`
  - b. `break`
  - c. `exit`
  - d. `quit`
6. Which command forces a script to go to the next iteration of the current program loop?
  - a. `continue`
  - b. `go`
  - c. `exit`
  - d. `quit`

## Coding Challenge 1

Data Files needed for this Coding Challenge: `code10-1_txt.html`, `gallery10-1_txt.js`, `code10-1_styles.css`, `slide0.jpg` - `slide13.jpg`

You are working on a JavaScript app to create a gallery of slide images. To create the gallery, you will apply a `for` loop that loops through an array of images and captions to create the HTML code for the figure elements. Figure 10–34 shows a preview of the gallery.

Figure 10–34 Coding Challenge 10-1 gallery preview



Source: NASA

Do the following:

1. Open the `code10-1_txt.html` and `gallery10-1_txt.js` files from the `html10 ► code1` folder. Enter **your name** and **the date** in each document and save the files as `code10-1.html` and `gallery10-1.js` respectively.
2. Go to the `code10-1.html` file in your editor. Within the head section insert a `script` element connecting the page to the `gallery10-1.js` file. Add the `defer` attribute to the `script` element to defer the loading of the script until after the contents of the page loads.
3. Save your changes to the file and then go to the `gallery10-1.js` file in your editor.
4. Below the code that creates and populates the captions array, declare the `htmlCode` variable, setting its initial value to an empty text string.
5. Create a `for` loop with a counter variable `i` that goes from 0 to 13 in increments of 1. Each time through the `for` loop, add the following code to the value of the `htmlCode` variable:

```
<figure>

 <figcaption>caption_i</figcaption>
</figure>
```

where `i` is the value of the counter variable and `caption_i` is the value from the captions array with index number `i`.

- After the `for` loop, change the inner HTML of the document element by the ID "gallery" to the value of the `htmlCode` variable.
- Save your changes to the file and then load **code10-1.html** in your browser. Verify that the page displays the 14 images in the slide gallery.
- Submit the completed file to your instructor.

## Coding Challenge 2

Data Files needed for this Coding Challenge: **code10-2\_txt.html**, **list10-2\_txt.js**, **code10-2\_styles.css**

In this Coding Challenge you will use JavaScript to write the contents of a table listing the top ranked movies on the IMDb website. The names of the movies, descriptions, scores, and links to pages describing the movies have been stored in arrays. You will use a `for` loop to write the individual rows of the table. Figure 10–35 shows a preview of the completed page.

Figure 10–35 Coding Challenge 10-2 example page

IMDb Top Movie List		
MOVIE	DESCRIPTION	SCORE
<a href="#">The Shawshank Redemption (1994)</a>	Two imprisoned men bond over a number of years, finding solace and eventual redemption through acts of common decency.	9.3
<a href="#">The Godfather (1994)</a>	The aging patriarch of an organized crime dynasty transfers control of his clandestine empire to his reluctant son.	9.2
<a href="#">The Dark Knight (2008)</a>	When the menace known as the Joker emerges from his mysterious past, he wreaks havoc and chaos on the people of Gotham. The Dark Knight must accept one of the greatest psychological and physical tests of his ability to fight injustice.	9
<a href="#">The Godfather: Part II (1974)</a>	The early life and career of Vito Corleone in 1920s New York City is portrayed, while his son, Michael, expands and tightens his grip on the family crime syndicate.	9
<a href="#">The Lord of the Rings: The Return of the King (2003)</a>	Gandalf and Aragorn lead the World of Men against Sauron's army to draw his gaze from Frodo and Sam as they approach Mount Doom with the One Ring.	8.9
<a href="#">Pulp Fiction (1994)</a>	The lives of two mob hitmen, a boxer, a gangster's wife, and a pair of diner bandits intertwine in four tales of violence and redemption.	8.9
<a href="#">Schindler's List (1993)</a>	In German-occupied Poland during World War II, industrialist Oskar Schindler gradually becomes concerned for his Jewish workforce after witnessing their persecution by the Nazis.	8.9
<a href="#">The Good, the Bad and the Ugly (1966)</a>	A bounty hunting scam joins two men in an uneasy alliance against a third in a race to find a fortune in gold buried in a remote cemetery.	8.9
<a href="#">12 Angry Men (1957)</a>	A jury holdout attempts to prevent a miscarriage of justice by forcing his colleagues to reconsider the evidence.	8.9
<a href="#">Inception (2010)</a>	A thief who steals corporate secrets through the use of dream-sharing technology is given the inverse task of planting an idea into the mind of a CEO.	8.8

Do the following:

- Open the **code10-2\_txt.html** and **list10-2\_txt.js** files from the **html10 ► code2** folder. Enter **your name** and **the date** in each document and save the files as **code10-2.html** and **list10-2.js** respectively.
- Go to the **code10-2.html** file in your editor. Within the head section insert a script element connecting the page to the **list10-2.js** file. Add the **defer** attribute to the script element. Save your changes to the file.

- Go to the **list10-2.js** file in your editor. Directly below the code populating the links array, declare the **htmlCode** variable. Store within the variable the following text:

```
<table>
<thead>
<tr>
 <th>Movie</th><th>Description</th><th>Score</th>
</tr>
</thead>
<tbody>
```

- Create a **for** loop with a counter variable **i** that goes from 0 to 9. Each time through the **for** loop add the following text to the **htmlCode** variable:

```
<tr>
 <td>titles_i<td>
 <td>summaries_i</td>
 <td>ratings_i</td>
</tr>
```

where **i** is the value of the counter variable, and **links\_i**, **titles\_i**, **summaries\_i**, and **ratings\_i** are the values from the links, titles, summaries, and ratings array with index number **i**.

- After the **for** loop add the following text to the **htmlCode** variable:

```
</tbody>
</table>
```

- Store the value of the **htmlCode** variable in the inner HTML of the element with the ID "list".
- Save your changes to the file and then load **code10-2.html** in your browser. Verify that the page displays the table describing the ten movies from the IMDb movie list. Also verify that when you click the links in the Movie column you are redirected to a page providing information about the selected movie.
- Submit the completed file to your instructor.

### Coding Challenge 3

Data Files needed for this Coding Challenge: **code10-3\_txt.html**, **days10-3\_txt.js**, **code10-3\_styles.css**, **sunday.png** - **saturday.png**

You can use the **switch/case** statement to apply different possible values to the same variable. Figure 10–36 shows a web page that displays different banner image on each day of the week. You will write the code to generate this page.

Figure 10–36 Coding Challenge 10-3 example page



Source: [openclipart.org](http://openclipart.org)

Do the following:

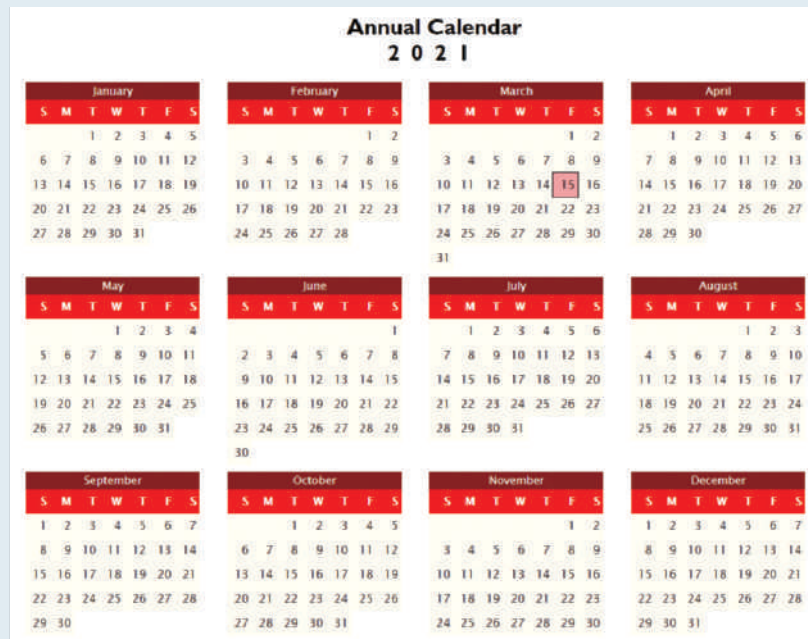
1. Open the **code10-3\_txt.html** and **days10-3\_txt.js** files from the **html10 ► code3** folder. Enter **your name** and **the date** in each document and save the files as **code10-3.html** and **days10-3.js** respectively.
2. Go to the **code10-3.html** file in your editor. Within the head section insert a `script` element connecting the page to the `days10-3.js` file. Add the `defer` attribute to the `script` element. Save your changes to the file.
3. Go to the **days10-3.js** file in your editor. Below the initial comment section, create a variable named **thisDay** containing the date object for the current date.
4. Use the `getDay()` method to extract the day of the week from the `thisDay` variable, storing the value in the **wDay** variable.
5. Declare a variable named **imgSrc** setting its initial value to an empty text string.
6. Create a `switch/case` statement that tests values of the `wDay` variable from 0 to 6. If `wDay` equals 0, set `imgSrc` to the text string "sunday.png"; if `wDay` equals 1, set `imgSrc` to "monday.png"; and so forth.
7. Store the text string `<img src='imgsrc' alt='' />` in the **htmlCode** variable where **imgsrc** is the value of the `imgSrc` variable.
8. Store the value of the `imgSrc` variable in the inner HTML of the element with the ID "banner".
9. Save your changes to the file and then load **code10-3.html** in your browser. Verify that the page shows the banner image for the current day.
10. Submit the completed file to your instructor.

## Coding Challenge 4

Data Files needed for this Coding Challenge: `code10-4_txt.html`, `debug10-4_txt.js`, `code10-4_styles.css`

Figure 10–37 shows a page that contains monthly calendars for every month of the year. You've been given the files for this page but there are several errors that prevent the code from running correctly. You will analyze the code and correct the mistakes.

Figure 10–37 Coding Challenge 10-4 example page



Do the following:

1. Open the `code10-4_txt.html` and `debug10-4_txt.js` files from the `html10 ► code4` folder. Enter *your name* and *the date* in each document and save the files as `code10-4.html` and `debug10-4.js` respectively.
2. Go to the `code10-4.html` file in your editor. Within the head section insert a `script` element connecting the page to the `days10-4.js` file. Add the `defer` attribute to the `script` element. Save your changes to the file.
3. Go to the `debug10-4.js` file in your editor.
4. Fix the syntax errors in the following locations to allow the code to run correctly (there are no logic errors in the code):
  - a. The statement that declares the `thisDay` variable
  - b. The statement that declares the `monthName` variable
  - c. The `for` loop that calls the `writeMonthTable()` function
  - d. The code that writes the value of the `htmlCode` variable into the element with ID "calendar"
  - e. The three `if` statements found within the `writeMonthTable()` function
5. Save your changes to the file.
6. Open the `code10-4.html` file in your browser. When the page is free of errors, you should see a calendar for the current year with the current day highlighted on the page.
7. Submit the completed file to your instructor.

## Review Assignments

Data Files needed for the Review Assignments: `lht_events_txt.html`, `lht_table_txt.js`, 3 CSS files, 1 JS file, 2 PNG files

Lewis wants you to write another script that shows a table of events at the Lyman Hall Theater over the next two weeks from the current date. He has already created three arrays for use with the script:

- The `eventDates` array containing a list of dates and time at which theater events are scheduled
- The `eventDescriptions` array containing the description of those events
- The `eventPrices` array containing the admission prices of those events

Lewis has already written the page content and provided style sheets for use with the page. Your job will be to write a script that selects the events that occur in the two-week window from the current date and display them in the web page. A preview of the page you will create is shown in Figure 10–38.

Figure 10–38 Upcoming events at the Lyman Hall Theater

**The Lyman Hall Theater**

home events box office facilities directions contact

### At the Theater

Great shows are coming to the Lyman Hall Theater in the upcoming weeks. The Broadway Touring Company of [Cabaret](#) arrives for four performances, featuring Tony-award winning actress Kayla James. Tickets are limited, so be sure to [order online](#) or by calling the LHT boxoffice.

Enjoy a stunning multimedia event with Edward Lee's [Visions of Light and Dreams](#) featuring sound, video, and interactive demonstrations of the latest innovations in film and theater.

If music is more your passion, LHT welcomes the popular group [San Diego Blues](#). Want an evening of laughs? Get your tickets now for [Gerry Jones](#) and his one-person show, [Exit Stage Left](#).

For an inexpensive night out, be sure to check out LHT's [Classic Cinema](#). For a delicious Sunday brunch, join us for [Classics Brunch](#).

### Upcoming Events

Date	Event	Price
Fri Oct 01 2021 @ 7:30:00 PM	Have Spacesuit, Will Travel	\$22/\$36/\$48
Sat Oct 02 2021 @ 7:00:00 PM	Cabaret	\$48/\$64/\$88
Sun Oct 03 2021 @ 11:00:00 AM	Classics Brunch	\$12
Tue Oct 05 2021 @ 7:00:00 PM	Visions of Light and Dreams	\$18/\$32
Wed Oct 06 2021 @ 7:00:00 PM	San Diego Blues	\$24/\$36
Thu Oct 07 2021 @ 7:00:00 PM	Cabaret	\$48/\$64/\$88
Fri Oct 08 2021 @ 7:00:00 PM	Cabaret	\$48/\$64/\$88
Sat Oct 09 2021 @ 7:00:00 PM	Cabaret	\$48/\$64/\$88
Sun Oct 10 2021 @ 11:00:00 AM	Classics Brunch	\$12
Mon Oct 11 2021 @ 7:00:00 PM	Classic Cinema: Safety First	\$12
Wed Oct 13 2021 @ 8:00:00 PM	Exit Stage Left	\$18/\$28/\$36
Thu Oct 14 2021 @ 8:00:00 PM	Antonio Perez	\$32/\$48/\$64

The Lyman Hall Theater  
414 Lenox Drive  
Brookhaven, GA 30319  
Office: (404) 555 - 4140

Box Office  
Group Rates  
Events

Staff  
Employment Info  
Directions & Parking

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Complete the following:

1. Use your editor to open the `lht_events_txt.html` and `lht_table_txt.js` files from the `html10 ► review` folder. Enter **your name** and **the date** in the comment section of each file, and save them as `lht_events.html` and `lht_table.js` respectively.
2. Go to the `lht_events.html` file in your editor. Directly above the closing `</head>` tag, insert script elements that link the page to the `lht_list.js` and `lht_table.js` files in that order. Defer the loading and running of both script files until after the page has loaded.

3. Scroll down the document and, directly after the closing `</article>` tag, insert a `div` element with the ID `eventList`. It is within this element that you will write the HTML code for the table of upcoming theater events. Close the file saving your changes. (*Hint: Be sure to review this file and all the support files, noting especially the names of variables that you will be using in the code you create.*)
4. Go to the `lht_table.js` file in your editor. Below the comment section, declare a variable named `thisDay` containing the date October 1, 2021. You will use this date to test your script.
5. Create a variable named `tableHTML` that will contain the HTML code of the events table. Add the text of the following HTML code to the initial value of the variable:

```
<table id='eventTable'>
 <caption>Upcoming Events</caption>
 <tr><th>Date</th><th>Event</th><th>Price</th></tr>
```

6. Lewis only wants the page to list events occurring within 14 days after the current date. Declare a variable named `endDate` that contains a `Date` object that is 14 days after the date stored in the `thisDay` variable. (*Hint: Use the new `Date()` object constructor and insert a time value that is equal to `thisDay.getTime() + 14*24*60*60*1000`.*)
7. Create a `for` loop that loops through the length of the `eventDates` array. Use `i` as the counter variable.
8. Within the `for` loop insert the following commands in a command block:
  - a. Declare a variable named `eventDate` containing a `Date` object with the date stored in the `ith` entry in the `eventDates` array.
  - b. Declare a variable named `eventDay` that stores the text of the `eventDate` date using the `toString()` method.
  - c. Declare a variable named `eventTime` that stores the text of the `eventDate` time using the `toLocaleTimeString()` method.
  - d. Insert an `if` statement that has a conditional expression that tests whether `thisDay` is  $\leq$  `eventDate` and `eventDate`  $\leq$  `endDate`. If so, the event falls within the two-week window that Lewis has requested and the script should add the following HTML code text to the value of the `tableHTML` variable.

```
<tr>
 <td>eventDay @ eventTime</td>
 <td>description</td>
 <td>price</td>
</tr>
```

where `eventDay` is the value of the `eventDay` variable, `eventTime` is the value of the `eventTime` variable, `description` is the `ith` entry in the `eventDescriptions` array, and `price` is the `ith` entry in the `eventPrices` array.

9. After the `for` loop, add the text of the HTML code `</table>` to the value of the `tableHTML` variable.
10. Insert the value of the `tableHTML` variable into the inner HTML of the page element with the ID `eventList`.
11. Document your code in the script file using appropriate comments.
12. Save your changes to the file, and then load the `lht_events.html` file in your browser. Verify that the page shows theater events over a two-week period starting with Friday, October 1, 2021 and concluding with Thursday, October 14, 2021.

## Case Problem 1

**Data Files needed for this Case Problem:** `tc_cart_txt.html`, `tc_cart_txt.js`, `tc_order_txt.js`, 2 CSS files, 8 PNG files

**Trophy Case Sports** Sarah Nordheim manages the website for Trophy Case Sports, a sports memorabilia store located in Beavercreek, Ohio. She has asked you to work on creating a script for the shopping cart page. The script should take information on the items that the customer has purchased and present it in table form, calculating the total cost of the order. A preview of the page you will create is shown in Figure 10–39.

Figure 10–39 Trophy Case Sports shopping cart



voyeg3r/openclipart; © Marie C Fields/Shutterstock; Sources: Courtesy of the Gerald R. Ford Presidential Museum; Vintagecardprices.com; Library of Congress Prints and Photographs Division; facebook.com

Sarah has already designed the page layout. Your job will be to use JavaScript to enter the order information (this task will later be handled by a script running on the website) and to write a script that generates the HTML code for the shopping cart table.

Complete the following:

1. Use your editor to open the **tc\_cart\_txt.html**, **tc\_cart\_txt.js** and **tc\_order\_txt.js** files from the html10 ► case1 folder. Enter *your name* and *the date* in the comment section of each file, and save them as **tc\_cart.html**, **tc\_cart.js** and **tc\_order.js** respectively.
2. Go to the **tc\_cart.html** file in your editor. Directly above the closing `</head>` tag, insert `script` elements to link the page to the **tc\_order.js** and **tc\_cart.js** files in that order. Defer the loading and running of both script files until after the page has loaded.
3. Scroll down the file and directly below the h1 heading titled “Shopping Cart” insert a `div` element with the ID `cart`.
4. Save your changes to the file and go to the **tc\_order.js** file in your editor.
5. Within the **tc\_order.js** file, you will create arrays containing information on a sample customer order. Create an array named **item** that will contain the ID numbers of the items purchased by the customer. Add the following four item numbers to the array: 10582, 23015, 41807, and 10041.
6. Create an array named **itemDescription** containing the following item descriptions:
  - 1975 Green Bay Packers Football (signed), Item 10582
  - Tom Landry 1955 Football Card (unsigned), Item 23015
  - 1916 Army-Navy Game, Framed Photo (signed), Item 41807
  - Protective Card Sheets, Item 10041
7. Create an array named **itemPrice** containing the following item prices: 149.93, 89.98, 334.93, and 22.67.
8. Create an array named **itemQty** containing the following quantities that the customer ordered of each item: 1, 1, 1, and 4.
9. Save your changes to the file, and then open the **tc\_cart.js** file in your editor.
10. In your script, you will calculate a running total of the cost of the order. Declare a variable named **orderTotal** and set its initial value to 0.
11. Declare a variable named **cartHTML** that will contain the HTML code for the contents of the shopping cart, which will be displayed as a table. Set its initial value to the text string:

```
<table>
<tr>
<th>Item</th><th>Description</th><th>Price</th><th>Qty</th><th>Total</th>
</tr>
```

12. Create a `for` loop that loops through the entries in the **item** array. Each time through the loop, execute the commands described in Steps a through e.

- a. Add the following HTML code to the value of the **cartHTML** variable

```
<tr>
<td></td>
```

where *item* is the current value from the **item** array.

- b. Add the following HTML code to the **cartHTML** variable to display the description, price, and quantity ordered of the item

```
<td>description</td>
<td>$price</td>
<td>quantity</td>
```

where *description* is the current value from the **itemDescription** array, *price* is the current value from the **itemPrice** array preceded by a \$ symbol, and *quantity* is the current value from the **itemQty** array.

- c. Declare a variable named **itemCost** equal to the *price* value multiplied by the *quantity* value for the current item.
- d. Add the following HTML code to the `cartHTML` variable to display the cost for the item(s) ordered, completing the table row

```
<td>$cost</td></tr>
```

where *cost* is the value of the `itemCost` variable, preceded by a \$ symbol.

- e. Add the value of the `itemCost` variable to the `orderTotal` variable to keep a running total of the total cost of the customer order.
13. After the `for` loop has completed, add the following HTML code to the value of the `cartHTML` variable, completing the shopping cart table

```
<tr>
<td colspan='4'>Subtotal</td>
<td>$total</td>
</tr>
</table>
```

where *total* is the value of the `orderTotal` variable, preceded by a \$ symbol.

14. Apply the `cartHTML` value to the inner HTML of the `div` element with the ID "cart".
15. Document your script file with appropriate comments, and then save your work.
16. Open the **tc\_cart.html** file in your browser and verify that the page now shows the shopping cart data for the sample customer order.

## Case Problem 2

**Data Files needed for this Case Problem:** `vw_election_txt.html`, `vw_results_txt.js`, 2 CSS files, 1 JS file, 1 PNG file

**VoterWeb** Pam Carls is a manager for the website Voter Web, which compiles voting totals and statistics from local and national elections. Pam has the results of recent congressional elections from eight districts in Minnesota stored as multidimensional arrays in a JavaScript file. Pam wants you to create a script displaying these results and calculating the vote percentage for each candidate within each race. A preview of the page is shown in Figure 10–40.

Figure 10–40 Election results at VoterWeb



© Courtesy Patrick Carey

Complete the following:

1. Use your editor to open the **vw\_election\_txt.html** and **vw\_results\_txt.js** files from the **html10 ► case2** folder. Enter **your name** and **the date** in the comment section of each file, and save them as **vw\_election.html** and **vw\_results.js** respectively.
2. Go to the **vw\_election.html** file in your editor. Directly above the closing **</head>** tag, insert **script** elements to link the page to the **vw\_congminn.js** and **vw\_results.js** files in that order. Defer the loading and running of both script files until after the page has loaded.
3. Scroll down the file and, directly above the footer, insert an empty **section** element. You will write the HTML code of the election report in this element. Save your changes to the file.
4. Open the **vw\_congminn.js** file in your editor and study the contents. Note that the file contains the results of 8 congressional elections in Minnesota. The candidate information is stored in multidimensional arrays named **candidate**, **party**, and **votes**. Do not make any changes to this file.
5. Go to the **vw\_results.js** file in your editor. Declare a variable named **reportHTML** containing the following HTML text


```
<h1>title</h1>
```

where *title* is the value of the *raceTitle* variable stored in the **vw\_congminn.js** file.

6. Create a `for` loop that loops through the contents of the `race` array using `i` as the counter variable. Place the commands specified in Steps a through e within this program for loop:
  - a. Create a variable named **totalVotes** that will store the total votes cast in each race. Set its initial value to 0.
  - b. Calculate the total votes cast in the current race by applying the `forEach()` method to  $i^{\text{th}}$  index of the `votes` array using the `calcSum()` function as the callback function.
  - c. Add the following HTML text to the value of the `reportHTML` variable to write the name of the current race in the program loop

```
<table>
 <caption>race</caption>
 <tr><th>Candidate</th><th>Votes</th></tr>
```


where `race` is the  $i^{\text{th}}$  index of the `race` array.

- d. Call the `candidateRows()` function (you will create this function shortly) using the counter variable `i` and the `totalVotes` variable as parameter values. Add the value returned by this function to the value of the `reportHTML` variable.
  - e. Add the text `</table>` to the value of the `reportHTML` variable.
7. After the `for` loop has completed, write the value of the `reportHTML` variable into the `innerHTML` of the first (and only) `section` element in the document.
8. Next, create the **candidateRows()** function. The purpose of this function is to write individual table rows for each candidate, showing the candidate's name, party affiliation, vote total, and vote percentage. The `candidateRows()` function has two parameters named **raceNum** and **totalVotes**. Place the commands in Steps a through c within this function.
  - a. Declare a local variable named **rowHTML** that will contain the HTML code for the table row. Set the initial value of this variable to an empty text string.
  -  **Explore** b. Create a `for` loop in which the counter variable `j` goes from 0 to 2 in steps of 1 unit. Within the `for` loop do the following:
    - i. Declare a variable named **candidateName** that retrieves the name of the current candidate and the current race. (*Hint: Retrieve the candidate name from the multidimensional candidate array using the reference, `candidate[raceNum][j]`.*)
    - ii. Declare a variable named **candidateParty** that retrieves the party affiliation of the current candidate in the current race from the multidimensional party array.
    - iii. Declare a variable named **candidateVotes** that retrieves the votes cast for the current candidate in the current race from the multidimensional votes array.
    - iv. Declare a variable named **candidatePercent** equal to the value returned by the `calcPercent()` function, calculating the percentage of votes received by the current candidate in the loop. Use `candidateVotes` as the first parameter value and `totalVotes` as the second parameter value.
    - v. Add the following HTML code to the value of the `rowHTML` variable

```
<tr>
 <td>name (party)</td>
 <td>votes (percent)</td>
</tr>
```

where `name` is the value of `candidateName`, `party` is the value of `candidateParty`, `votes` is the value of `candidateVotes`, and `percent` is the value of `candidatePercent`. Apply the `toLocaleString()` method to `votes` in order to display the vote total with a thousands separator. Apply the `toFixed(1)` method to `percent` in order to display percentage values to 1 decimal place.

- c. Return the value of the `rowHTML` variable.

9. Save your changes to the file, and then load **vw\_election.html** in your browser. Verify that the three candidate names, party affiliations, votes, and vote percentages are shown for each of the eight congressional races.
10. Pam also wants the report to display the vote percentages as bar charts with the length of the bar corresponding to the percentage value. Return to the **vw\_results.js** file in your editor. At the bottom of the file, create a function named **createBar()** with one parameter named **partyType**. Add the commands described in Steps a through b to the function:
  - a. Declare a variable named **barHTML** and set its initial value to an empty text string.
  -  **Explore** b. Create a **switch/case** statement that tests the value of the **partyType** parameter. If **partyType** equal "D" set **barHTML** equal to:
 

```
<td class='dem'></td>
```

 If **partyType** equals "R" set **barHTML** equal to:
 

```
<td class='rep'></td>
```

 Finally, if **partyType** equals "I" set **barHTML** to:
 

```
<td class='ind'></td>
```
11. Return the value of **barHTML**.  
Next, add these empty data cells to the race results table, with one cell for every percentage point cast for the candidate.
12. Scroll up to the **candidateRows()** function. Directly before the line that adds the HTML code `</tr>` to the value of the **rowHTML** variable, insert a **for** loop with a counter variable **k** that goes from 0 up to a value less than **candidatePercent** in increments of 1 unit. Each time through the loop call the **createBar()** function using **candidateParty** and **candidatePercent** as the parameter values.
13. Add comments throughout the file with descriptive information about the variables and functions.
14. Save your changes to the file, and then reload **vw\_election.html** in your browser. Verify that each election table shows a bar chart with different the length of bars representing each candidate's vote percentage.

# Color Names with Color Values, and HTML Character Entities

Both HTML and XHTML allow you to define colors using either color names or color values. HTML and XHTML support a list of 16 basic color names. Most browsers also support an extended list of color names, which are listed in Table A–1 in this appendix, along with their RGB and hexadecimal values.

Table A–2 in this appendix lists the extended character set for HTML, also known as the ISO Latin-1 Character Set. You can specify characters by name or by numeric value. For example, you can use either &reg; or &#174; to specify the registered trademark symbol, ®.

## STARTING DATA FILES

There are no starting Data Files needed for this appendix.

**Table A-1:**  
Color names and  
corresponding values

Color Name	RGB Value	Hexadecimal Value
aliceblue	(240,248,255)	#F0F8FF
antiquewhite	(250,235,215)	#FAEBD7
aqua	(0,255,255)	#00FFFF
aquamarine	(127,255,212)	#7FFFD4
azure	(240,255,255)	#F0FFFF
beige	(245,245,220)	#F5F5DC
bisque	(255,228,196)	#FFE4C4
black	(0,0,0)	#000000
blanchedalmond	(255,235,205)	#FFEBCD
blue	(0,0,255)	#0000FF
blueviolet	(138,43,226)	#8A2BE2
brown	(165,42,42)	#A52A2A
burlywood	(222,184,135)	#DEB887
cadetblue	(95,158,160)	#5F9EA0
chartreuse	(127,255,0)	#7FFF00
chocolate	(210,105,30)	#D2691E
coral	(255,127,80)	#FF7F50
cornflowerblue	(100,149,237)	#6495ED
cornsilk	(255,248,220)	#FFF8DC
crimson	(220,20,54)	#DC1436
cyan	(0,255,255)	#00FFFF
darkblue	(0,0,139)	#00008B
darkcyan	(0,139,139)	#008B8B
darkgoldenrod	(184,134,11)	#B8860B
darkgray	(169,169,169)	#A9A9A9
darkgreen	(0,100,0)	#006400
darkkhaki	(189,183,107)	#BDB76B
darkmagenta	(139,0,139)	#8B008B
darkolivegreen	(85,107,47)	#556B2F
darkorange	(255,140,0)	#FF8C00
darkorchid	(153,50,204)	#9932CC
darkred	(139,0,0)	#8B0000
darksalmon	(233,150,122)	#E9967A
darkseagreen	(143,188,143)	#8FBC8F
darkslateblue	(72,61,139)	#483D8B
darkslategray	(47,79,79)	#2F4F4F
darkturquoise	(0,206,209)	#00CED1
darkviolet	(148,0,211)	#9400D3
deeppink	(255,20,147)	#FF1493
deepskyblue	(0,191,255)	#00BFFF
dimgray	(105,105,105)	#696969
dodgerblue	(30,144,255)	#1E90FF
firebrick	(178,34,34)	#B22222
floralwhite	(255,250,240)	#FFFAF0
forestgreen	(34,139,34)	#228B22
fuchsia	(255,0,255)	#FF00FF

**Table A–1**  
**(Continued):**  
 Color names and  
 corresponding values

Color Name	RGB Value	Hexadecimal Value
gainsboro	(220,220,220)	#DCDCDC
ghostwhite	(248,248,255)	#F8F8FF
gold	(255,215,0)	#FFD700
goldenrod	(218,165,32)	#DAA520
gray	(128,128,128)	#808080
green	(0,128,0)	#008000
greenyellow	(173,255,47)	#ADFF2F
honeydew	(240,255,240)	#F0FFF0
hotpink	(255,105,180)	#FF69B4
indianred	(205,92,92)	#CD5C5C
indigo	(75,0,130)	#4B0082
ivory	(255,255,240)	#FFFFF0
khaki	(240,230,140)	#F0E68C
lavender	(230,230,250)	#E6E6FA
lavenderblush	(255,240,245)	#FFF0F5
lawngreen	(124,252,0)	#7CFC00
lemonchiffon	(255,250,205)	#FFFACD
lightblue	(173,216,230)	#ADD8E6
lightcoral	(240,128,128)	#F08080
lightcyan	(224,255,255)	#E0FFFF
lightgoldenrodyellow	(250,250,210)	#FAFAD2
lightgreen	(144,238,144)	#90EE90
lightgrey	(211,211,211)	#D3D3D3
lightpink	(255,182,193)	#FFB6C1
lightsalmon	(255,160,122)	#FFA07A
lightseagreen	(32,178,170)	#20B2AA
lightskyblue	(135,206,250)	#87CEFA
lightslategray	(119,136,153)	#778899
lightsteelblue	(176,196,222)	#B0C4DE
lightyellow	(255,255,224)	#FFFFE0
lime	(0,255,0)	#00FF00
limegreen	(50,205,50)	#32CD32
linen	(250,240,230)	#FAF0E6
magenta	(255,0,255)	#FF00FF
maroon	(128,0,0)	#800000
mediumaquamarine	(102,205,170)	#66CDAA
mediumblue	(0,0,205)	#0000CD
mediumorchid	(186,85,211)	#BA55D3
mediumpurple	(147,112,219)	#9370DB
mediumseagreen	(60,179,113)	#3CB371
mediumslateblue	(123,104,238)	#7B68EE
mediumspringgreen	(0,250,154)	#00FA9A
mediumturquoise	(72,209,204)	#48D1CC
mediumvioletred	(199,21,133)	#C71585
midnightblue	(25,25,112)	#191970
mintcream	(245,255,250)	#F5FFFA
mistyrose	(255,228,225)	#FFE4E1

**Table A–1**  
**(Continued):**  
 Color names and  
 corresponding values

Color Name	RGB Value	Hexadecimal Value
moccasin	(255,228,181)	#FFE4B5
navajowhite	(255,222,173)	#FFDEAD
navy	(0,0,128)	#000080
oldlace	(253,245,230)	#FDF5E6
olive	(128,128,0)	#808000
olivedrab	(107,142,35)	#6B8E23
orange	(255,165,0)	#FFA500
orangered	(255,69,0)	#FF4500
orchid	(218,112,214)	#DA70D6
palegoldenrod	(238,232,170)	#EEE8AA
palegreen	(152,251,152)	#98FB98
paleturquoise	(175,238,238)	#AFEEEE
palevioletred	(219,112,147)	#DB7093
papayawhip	(255,239,213)	#FFEFD5
peachpuff	(255,218,185)	#FFDAB9
peru	(205,133,63)	#CD853F
pink	(255,192,203)	#FFC0CB
plum	(221,160,221)	#DDA0DD
powderblue	(176,224,230)	#B0E0E6
purple	(128,0,128)	#800080
red	(255,0,0)	#FF0000
rosybrown	(188,143,143)	#BC8F8F
royalblue	(65,105,0)	#4169E1
saddlebrown	(139,69,19)	#8B4513
salmon	(250,128,114)	#FA8072
sandybrown	(244,164,96)	#F4A460
seagreen	(46,139,87)	#2E8B57
seashell	(255,245,238)	#FFF5EE
sienna	(160,82,45)	#A0522D
silver	(192,192,192)	#C0C0C0
skyblue	(135,206,235)	#87CEEB
slateblue	(106,90,205)	#6A5ACD
slategray	(112,128,144)	#708090
snow	(255,250,250)	#FFFAFA
springgreen	(0,255,127)	#00FF7F
steelblue	(70,130,180)	#4682B4
tan	(210,180,140)	#D2B48C
teal	(0,128,128)	#008080
thistle	(216,191,216)	#D8BFD8
tomato	(255,99,71)	#FF6347
turquoise	(64,224,208)	#40E0D0
violet	(238,130,238)	#EE82EE
wheat	(245,222,179)	#F5DEB3
white	(255,255,255)	#FFFFFF
whitesmoke	(245,245,245)	#F5F5F5
yellow	(255,255,0)	#FFFF00
yellowgreen	(154,205,50)	#9ACD32

**Table A-2:**  
HTML character entities

Character	Code	Code Name	Description
	&#09;		Tab
	&#10;		Line feed
	&#32;		Space
!	&#33;		Exclamation mark
"	&#34;	&quot;	Double quotation mark
#	&#35;		Pound sign
\$	&#36;		Dollar sign
%	&#37;		Percent sign
&	&#38;	&amp;	Ampersand
'	&#39;		Apostrophe
(	&#40;		Left parenthesis
)	&#41;		Right parenthesis
*	&#42;		Asterisk
+	&#43;		Plus sign
,	&#44;		Comma
-	&#45;		Hyphen
.	&#46;		Period
/	&#47;		Forward slash
0 - 9	&#48;-&#57;		Numbers 0–9
:	&#58;		Colon
;	&#59;		Semicolon
<	&#60;	&lt;	Less than sign
=	&#61;		Equal sign
>	&#62;	&gt;	Greater than sign
?	&#63;		Question mark
@	&#64;		Commercial at sign
A - Z	&#65;-&#90;		Letters A–Z
[	&#91;		Left square bracket
\	&#92;		Back slash
]	&#93;		Right square bracket
^	&#94;		Caret
_	&#95;		Horizontal bar (underscore)
`	&#96;		Grave accent
a - z	&#97;-&#122;		Letters a–z
{	&#123;		Left curly brace
	&#124;		Vertical bar
}	&#125;		Right curly brace
~	&#126;		Tilde
,	&#130;		Comma
f	&#131;		Function sign (florin)
"	&#132;		Double quotation mark
...	&#133;		Ellipsis
†	&#134;		Dagger

**Table A-2**  
(Continued):  
HTML character entities

Character	Code	Code Name	Description
‡	&#135;		Double dagger
ˆ	&#136;		Circumflex
‰	&#137;		Permil
Š	&#138;		Capital S with hacek
‹	&#139;		Left single angle
Œ	&#140;		Capital OE ligature
	&#141;–&#144;		Unused
‘	&#145;		Single beginning quotation mark
’	&#146;		Single ending quotation mark
“	&#147;		Double beginning quotation mark
”	&#148;		Double ending quotation mark
•	&#149;		Bullet
–	&#150;		En dash
—	&#151;		Em dash
~	&#152;		Tilde
™	&#153;	&trade;	Trademark symbol
š	&#154;		Small s with hacek
›	&#155;		Right single angle
œ	&#156;		Lowercase oe ligature
ÿ	&#159;		Capital Y with umlaut
	&#160;	&nbsp;	Non-breaking space
¡	&#161;	&iexcl;	Inverted exclamation mark
¢	&#162;	&cent;	Cent sign
£	&#163;	&pound;	Pound sterling
¤	&#164;	&curren;	General currency symbol
¥	&#165;	&yen;	Yen sign
¦	&#166;	&brvbar;	Broken vertical bar
§	&#167;	&sect;	Section sign
¨	&#168;	&uml;	Umlaut
©	&#169;	&copy;	Copyright symbol
ª	&#170;	&ordf;	Feminine ordinal
«	&#171;	&laquo;	Left angle quotation mark
¬	&#172;	&not;	Not sign
–	&#173;	&shy;	Soft hyphen
®	&#174;	&reg;	Registered trademark
ˆ	&#175;	&macr;	Macron
°	&#176;	&deg;	Degree sign
±	&#177;	&plusmn;	Plus/minus symbol
²	&#178;	&sup2;	Superscript <sup>2</sup>
³	&#179;	&sup3;	Superscript <sup>3</sup>
´	&#180;	&acute;	Acute accent
µ	&#181;	&micro;	Micro sign
¶	&#182;	&para;	Paragraph sign

**Table A–2**  
(Continued):  
HTML character entities

Character	Code	Code Name	Description
.	&#183;	&middot;	Middle dot
ç	&#184;	&cedil;	Cedilla
<sup>1</sup>	&#185;	&sup1;	Superscript <sup>1</sup>
º	&#186;	&ordm;	Masculine ordinal
»	&#187;	&raquo;	Right angle quotation mark
¼	&#188;	&frac14;	Fraction one-quarter
½	&#189;	&frac12;	Fraction one-half
¾	&#190;	&frac34;	Fraction three-quarters
¿	&#191;	&iquest;	Inverted question mark
À	&#192;	&Agrave;	Capital A, grave accent
Á	&#193;	&Aacute;	Capital A, acute accent
Â	&#194;	&Acirc;	Capital A, circumflex accent
Ã	&#195;	&Atilde;	Capital A, tilde
Ä	&#196;	&Auml;	Capital A, umlaut
Å	&#197;	&Aring;	Capital A, ring
Æ	&#198;	&Aelig;	Capital AE ligature
Ç	&#199;	&Ccedil;	Capital C, cedilla
È	&#200;	&Egrave;	Capital E, grave accent
É	&#201;	&Eacute;	Capital E, acute accent
Ê	&#202;	&Ecirc;	Capital E, circumflex accent
Ë	&#203;	&Euml;	Capital E, umlaut
Ì	&#204;	&Igrave;	Capital I, grave accent
Í	&#205;	&Iacute;	Capital I, acute accent
Î	&#206;	&Icirc;	Capital I, circumflex accent
Ï	&#207;	&Iuml;	Capital I, umlaut
ƒ	&#208;	&ETH;	Capital ETH, Icelandic
Ñ	&#209;	&Ntilde;	Capital N, tilde
Ò	&#210;	&Ograve;	Capital O, grave accent
Ó	&#211;	&Oacute;	Capital O, acute accent
Ô	&#212;	&Ocirc;	Capital O, circumflex accent
Õ	&#213;	&Otilde;	Capital O, tilde
Ö	&#214;	&Ouml;	Capital O, umlaut
×	&#215;	&times;	Multiplication sign
Ø	&#216;	&Oslash;	Capital O, slash
Ù	&#217;	&Ugrave;	Capital U, grave accent
Ú	&#218;	&Uacute;	Capital U, acute accent
Û	&#219;	&Ucirc;	Capital U, circumflex accent
Ü	&#220;	&Uuml;	Capital U, umlaut
Ý	&#221;	&Yacute;	Capital Y, acute accent
Þ	&#222;	&THORN;	Capital THORN, Icelandic
ß	&#223;	&szlig;	Small sz, ligature
à	&#224;	&agrave;	Small a, grave accent
á	&#225;	&aacute;	Small a, acute accent

**Table A–2**  
(Continued):  
HTML character entities

Character	Code	Code Name	Description
â	&#226;	&acirc;	Small a, circumflex accent
ã	&#227;	&atilde;	Small a, tilde
ä	&#228;	&auml;	Small a, umlaut
å	&#229;	&aring;	Small a, ring
æ	&#230;	&aelig;	Small ae, ligature
ç	&#231;	&ccedil;	Small c, cedilla
è	&#232;	&egrave;	Small e, grave accent
é	&#233;	&eacute;	Small e, acute accent
ê	&#234;	&ecirc;	Small e, circumflex accent
ë	&#235;	&euml;	Small e, umlaut
ì	&#236;	&igrave;	Small i, grave accent
í	&#237;	&iacute;	Small i, acute accent
î	&#238;	&icirc;	Small i, circumflex accent
ï	&#239;	&iuml;	Small i, umlaut
ð	&#240;	&eth;	Small eth, Icelandic
ñ	&#241;	&ntilde;	Small n, tilde
ò	&#242;	&ograve;	Small o, grave accent
ó	&#243;	&oacute;	Small o, acute accent
ô	&#244;	&ocirc;	Small o, circumflex accent
õ	&#245;	&otilde;	Small o, tilde
ö	&#246;	&ouml;	Small o, umlaut
÷	&#247;	&divide;	Division sign
ø	&#248;	&oslash;	Small o, slash
ù	&#249;	&ugrave;	Small u, grave accent
ú	&#250;	&uacute;	Small u, acute accent
û	&#251;	&ucirc;	Small u, circumflex accent
ü	&#252;	&uuml;	Small u, umlaut
ý	&#253;	&yacute;	Small y, acute accent
þ	&#254;	&thorn;	Small thorn, Icelandic
ÿ	&#255;	&yuml;	Small y, umlaut

# HTML Elements and Attributes

This appendix provides descriptions of the major elements and attributes of HTML. The elements and attributes represent the specifications of the W3C; therefore, they might not all be supported by the major browsers. Also, in some cases, an element or attribute is not part of the W3C specifications, but instead is an extension offered by a particular browser. Where this is the case, the element or attribute is listed with the supporting browser indicated in parentheses.

Many elements and attributes have been deprecated by the W3C. Deprecated elements and attributes are supported by most browsers, but their use is discouraged. In addition, some elements and attributes have been marked as *obsolete*. The use of both deprecated and obsolete items is not recommended. However, while deprecated items are in danger of no longer being supported by the browser market, obsolete items will probably still be supported by the browser market for the foreseeable future.

Finally, elements and attributes that are new with HTML 5 are indicated by (HTML 5) in the text. Note that some of these elements and attributes are not supported by all browsers and browser versions.

The following data types are used throughout this appendix:

- *char* A single text character
- *char code* A character encoding
- *color* An HTML color name or value
- *date* A date and time in the format:  
*yyyy-mm-ddThh:mm:ssTIMEZONE*
- *id* An id value
- *lang* A language type
- *media* A media type equal to all, aural, braille, handheld, print, projection, screen, tty, or tv
- *integer* An integer value
- *mime-type* A MIME data type, such as "text/html"
- *mime-type list* A comma-separated list of mime-types
- *option1|option2| ...* The value is limited to the specified list of *options*, with the default in **bold**
- *script* A script or a reference to a script
- *styles* A list of style declarations
- *text* A text string
- *text list* A comma-separated list of text strings
- *url* The URL for a web page or file
- *value* A numeric value
- *value list* A comma-separated list of numeric values

## STARTING DATA FILES

There are no starting Data Files needed for this appendix.

## General Attributes

Several attributes are common to many page elements. Rather than repeating this information each time it occurs, the following tables summarize these attributes.

### Core Attributes

The following attributes apply to all page elements and are supported by most browser versions.

Attribute	Description
<code>class="text"</code>	Specifies the class or group to which an element belongs
<code>contenteditable="text list"</code>	Specifies whether the contents of the element are editable
<code>contextmenu="id"</code>	Specifies the value of the id attribute on the menu with which to associate the element as a context menu
<code>draggable="true false"</code>	Specifies whether the element is draggable
<code>dropzone="copy move link"</code>	Specifies what types of content can be dropped on the element and which actions to take with content when it is dropped
<code>hidden="hidden"</code>	Specifies that the element is not yet, or is no longer, relevant and that the element should not be rendered
<code>id="text"</code>	Specifies a unique identifier to be associated with the element
<code>spellcheck="true false"</code>	Specifies whether the element represents an element whose contents are subject to spell checking and grammar checking
<code>style="styles"</code>	Defines an inline style for the element
<code>title="text"</code>	Provides an advisory title for the element

### Language Attributes

The web is designed to be universal and has to be adaptable to languages other than English. Thus, another set of attributes provides language support. This set of attributes is not as widely supported by browsers as the core attributes are. As with the core attributes, they can be applied to most page elements.

Attribute	Description
<code>dir="ltr rtl"</code>	Indicates the text direction as related to the lang attribute; a value of ltr displays text from left to right; a value of rtl displays text from right to left
<code>lang="lang"</code>	Identifies the language used in the page where lang is the language code name

### Form Attributes

The following attributes can be applied to most form elements or to a web form itself, but not to other page elements.

Attribute	Description
<code>accesskey="char"</code>	Indicates the keyboard character that can be pressed along with the accelerator key to access a form element
<code>disabled="disabled"</code>	Disables a form field for input
<code>tabindex="integer"</code>	Specifies a form element's position in a document's tabbing order

## Event Attributes

To make web pages more dynamic, HTML supports event attributes that identify scripts to be run in response to an event occurring within an element. For example, clicking a main heading with a mouse can cause a browser to run a program that hides or expands a table of contents. Each event attribute has the form

```
onevent = "script"
```

where *event* is the name of the event attribute and *script* is the name of the script or command to be run by the browser in response to the occurrence of the event within the element.

## Core Events

The core event attributes are part of the specifications for HTML. They apply to almost all page elements.

Attribute	Description
onabort	Loading of the element is aborted by the user.
onclick	The mouse button is clicked.
oncontextmenu	The user requested the context menu for the element.
ondblclick	The mouse button is double-clicked.
onerror	The element failed to load properly.
onkeydown	A key is pressed down.
onkeypress	A key is initially pressed.
onkeyup	A key is released.
onload	The element finishes loading.
onmousedown	The mouse button is pressed down.
onmousemove	The mouse pointer is moved within the element's boundaries.
onmouseout	The mouse pointer is moved out of the element's boundaries.
onmouseover	The mouse pointer hovers over the element.
onmouseup	The mouse button is released.
onmousewheel	The user rotates the mouse wheel.
onreadystatechange	The element and its resources finish loading.
onscroll	The element or document window is being scrolled.
onshow	The user requests that the element be shown as a context menu.
onsuspend	The browser suspends retrieving data.

## Document Events

The following list of event attributes applies not to individual elements within the page, but to the entire document as it is displayed within the browser window or frame.

Attribute	Description
onafterprint	The document has finished printing (IE only).
onbeforeprint	The document is about to be printed (IE only).
onload	The page is finished being loaded.
onunload	The page is finished unloading.

## Form Events

The following list of event attributes applies to either an entire web form or fields within a form.

Attribute	Description
onblur	The form field has lost the focus.
onchange	The value of the form field has been changed.
onfocus	The form field has received the focus.
onformchange	The user made a change in the value of a form field in the form.
onforminput	The value of a control in the form changes.
oninput	The value of an element changes.
oninvalid	The form field fails to meet validity constraints.
onreset	The form has been reset.
onselect	Text content has been selected in the form field.
onsubmit	The form has been submitted for processing.

## Drag and Drop Events

The following list of event attributes applies to all page elements and can be used to respond to the user action of dragging and dropping objects in the web page.

Attribute	Description
ondrag	The user continues to drag the element.
ondragenter	The user ends dragging the element, entering the element into a valid drop target.
ondragleave	The user's drag operation leaves the element.
ondragover	The user continues a drag operation over the element.
ondragstart	The user starts dragging the element.
ondrop	The user completes a drop operation over the element.

## Multimedia Events

The following list of event attributes applies to embedded multimedia elements such as audio and video clips and is used to respond to events initiated during the loading or playback of those elements.

Attribute	Description
oncanplay	The browser can resume playback of the video or audio, but determines when the playback will have to stop for further buffering.
oncanplaythrough	The browser can resume playback of the video or audio, and determines the playback can play through without further buffering.
ondurationchange	The DOM duration of the video or audio element changes.
onemptied	The video or audio element returns to the uninitialized state.
onended	The end of the video or audio is reached.
onloadeddata	The video or audio is at the current playback position for the first time.

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Attribute	Description
onloadedmetadata	The duration and dimensions of the video or audio element are determined.
onloadstart	The browser begins looking for media data in the video or audio element.
onpause	The video or audio is paused.
onplay	The video or audio playback is initiated.
onplaying	The video or audio playback starts.
onprogress	The browser fetches data for the video or audio.
onratechange	The video or audio data changes.
onseeked	A seek operation on the audio or video element ends.
onseeking	Seeking is initiated on the audio or video.
onstalled	An attempt to retrieve data for the video or audio is not forthcoming.
ontimeupdate	The current playback position of the video or audio element changes.
onvolumechange	The volume of the video or audio element changes.
onwaiting	Playback of the video or audio stops because the next frame is unavailable.

## HTML Elements and Attributes

The following table contains an alphabetic listing of the elements and attributes supported by HTML. Some attributes are not listed in this table but instead, they are described in the general attributes tables presented in the previous section of this appendix.

Element/Attribute	Description
<code>&lt;!-- text --&gt;</code>	Inserts a comment into the document (comments are not displayed in the rendered page)
<code>&lt;!doctype&gt;</code>	Specifies the Document Type Definition for a document
<code>&lt;a&gt; &lt;/a&gt;</code>	Marks the beginning and end of a link
<code>charset="text"</code>	Specifies the character encoding of the linked document (obsolete)
<code>coords="value list"</code>	Specifies the coordinates of a hotspot in a client-side image map; the value list depends on the shape of the hotspot: <code>shape="rect" "left, right, top, bottom"</code> <code>shape="circle" "x_center, y_center, radius"</code> <code>shape="poly" "x1, y1, x2, y2, x3, y3, ..."</code> (obsolete)
<code>href="url"</code>	Specifies the URL of the link
<code>hreflang="text"</code>	Specifies the language of the linked document
<code>name="text"</code>	Specifies a name for the enclosed text, allowing it to be a link target (obsolete)
<code>rel="text"</code>	Specifies the relationship between the current page and the link specified by the href attribute
<code>rev="text"</code>	Specifies the reverse relationship between the current page and the link specified by the href attribute (obsolete)
<code>shape="rect   circle   polygon"</code>	Specifies the shape of the hotspot (obsolete)
<code>title="text"</code>	Specifies the pop-up text for the link
<code>target="text"</code>	Specifies the target window or frame for the link
<code>type="mime-type"</code>	Specifies the data type of the linked document
<code>&lt;abbr&gt; &lt;/abbr&gt;</code>	Marks abbreviated text

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Element/Attribute	Description
<code>&lt;acronym&gt; &lt;/acronym&gt;</code>	Marks acronym text (deprecated)
<code>&lt;address&gt; &lt;/address&gt;</code>	Marks address text
<code>&lt;applet&gt; &lt;/applet&gt;</code>	Embeds an applet into the browser (deprecated)
<code>align="align"</code>	Specifies the alignment of the applet with the surrounding text where <i>align</i> is <i>absmiddle</i> , <i>absbottom</i> , <i>baseline</i> , <i>bottom</i> , <i>center</i> , <i>left</i> , <i>middle</i> , <i>right</i> , <i>texttop</i> , or <i>top</i>
<code>alt="text"</code>	Specifies alternate text for the applet (deprecated)
<code>archive="url"</code>	Specifies the URL of an archive containing classes and other resources to be used with the applet (deprecated)
<code>code="url"</code>	Specifies the URL of the applet's code/class (deprecated)
<code>codebase="url"</code>	Specifies the URL of all class files for the applet (deprecated)
<code>datafld="text"</code>	Specifies the data source that supplies bound data for use with the data source
<code>datasrc="text"</code>	Specifies the ID or URL of the applet's data source
<code>height="integer"</code>	Specifies the height of the applet in pixels
<code>hspace="integer"</code>	Specifies the horizontal space around the applet in pixels (deprecated)
<code>mayscript="mayscript"</code>	Permits access to the applet by programs embedded in the document
<code>name="text"</code>	Specifies the name assigned to the applet (deprecated)
<code>object="text"</code>	Specifies the name of the resource that contains a serialized representation of the applet (deprecated)
<code>src="url"</code>	Specifies an external URL reference to the applet
<code>vspace="integer"</code>	Specifies the vertical space around the applet in pixels (deprecated)
<code>width="integer"</code>	Specifies the width of the applet in pixels (deprecated)
<code>&lt;area /&gt;</code>	Marks an image map hotspot
<code>alt="text"</code>	Specifies alternate text for the hotspot
<code>coords="value list"</code>	Specifies the coordinates of the hotspot; the value list depends on the shape of the hotspot: <i>shape="rect"</i> " <i>left, right, top, bottom</i> " <i>shape="circle"</i> " <i>x_center, y_center, radius</i> " <i>shape="poly"</i> " <i>x1, y1, x2, y2, x3, y3, ...</i> "
<code>href="url"</code>	Specifies the URL of the document to which the hotspot points
<code>hreflang="lang"</code>	Language of the hyperlink destination
<code>media="media"</code>	The media for which the destination of the hyperlink was designed
<code>rel="text"</code>	Specifies the relationship between the current page and the destination of the link
<code>nohref="nohref"</code>	Specifies that the hotspot does not point to a link
<code>shape="rect   circle   polygon"</code>	Specifies the shape of the hotspot
<code>target="text"</code>	Specifies the target window or frame for the link
<code>&lt;article&gt; &lt;/article&gt;</code>	Structural element marking a page article
<code>&lt;aside&gt; &lt;/aside&gt;</code>	Structural element marking a sidebar that is tangentially related to the main page content
<code>&lt;audio&gt; &lt;/audio&gt;</code>	Marks embedded audio content
<code>autoplay="autoplay"</code>	Automatically begins playback of the audio stream
<code>preload="none   metadata   auto"</code>	Specifies whether to preload data to the browser
<code>controls="controls"</code>	Specifies whether to display audio controls

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Element/Attribute	Description
<code>loop="loop"</code>	Specifies whether to automatically loop back to the beginning of the audio clip
<code>src="url"</code>	Provides the source of the audio clip
<code>&lt;b&gt; &lt;/b&gt;</code>	Marks text offset from its surrounding content without conveying any extra emphasis or importance
<code>&lt;base /&gt;</code>	Specifies global reference information for the document
<code>href="url"</code>	Specifies the URL from which all relative links in the document are based
<code>target="text"</code>	Specifies the target window or frame for links in the document
<code>&lt;basefont /&gt;</code>	Specifies the font setting for the document text (deprecated)
<code>color="color"</code>	Specifies the text color (deprecated)
<code>face="text list"</code>	Specifies a list of fonts to be applied to the text (deprecated)
<code>size="integer"</code>	Specifies the size of the font range from 1 (smallest) to 7 (largest) (deprecated)
<code>&lt;bdi&gt; &lt;/bdi&gt;</code>	Marks text that is isolated from its surroundings for the purposes of bidirectional text formatting
<code>&lt;bdo&gt; &lt;/bdo&gt;</code>	Indicates that the enclosed text should be rendered with the direction specified by the <code>dir</code> attribute
<code>&lt;big&gt; &lt;/big&gt;</code>	Increases the size of the enclosed text relative to the default font size (deprecated)
<code>&lt;blockquote&gt; &lt;/blockquote&gt;</code>	Marks content as quoted from another source
<code>cite="url"</code>	Provides the source URL of the quoted content
<code>&lt;body&gt; &lt;/body&gt;</code>	Marks the page content to be rendered by the browser
<code>alink="color"</code>	Specifies the color of activated links in the document (obsolete)
<code>background="url"</code>	Specifies the background image file used for the page (obsolete)
<code>bgcolor="color"</code>	Specifies the background color of the page (obsolete)
<code>link="color"</code>	Specifies the color of unvisited links (obsolete)
<code>marginheight="integer"</code>	Specifies the size of the margin above and below the page (obsolete)
<code>marginwidth="integer"</code>	Specifies the size of the margin to the left and right of the page (obsolete)
<code>text="color"</code>	Specifies the color of page text (obsolete)
<code>vlink="color"</code>	Specifies the color of previously visited links (obsolete)
<code>&lt;br /&gt;</code>	Inserts a line break into the page
<code>clear="none   left   right   all"</code>	Displays the line break only when the specified margin is clear (obsolete)
<code>&lt;button&gt; &lt;/button&gt;</code>	Creates a form button
<code>autofocus="autofocus"</code>	Gives the button the focus when the page is loaded
<code>disabled="disabled"</code>	Disables the button
<code>form="text"</code>	Specifies the form to which the button belongs
<code>formaction="url"</code>	Specifies the URL to which the form data is sent
<code>formenctype="mime-type"</code>	Specifies the encoding of the form data before it is sent
<code>formmethod="get   post"</code>	Specifies the HTTP method with which the form data is submitted
<code>formnovalidate="formnovalidate"</code>	Specifies that the form should not be validated during submission
<code>formtarget="text"</code>	Provides a name for the target of the button
<code>name="text"</code>	Provides the name assigned to the form button
<code>type="submit   reset   button"</code>	Specifies the type of form button
<code>value="text"</code>	Provides the value associated with the form button

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Element/Attribute	Description
<code>&lt;canvas&gt; &lt;/canvas&gt;</code>	Marks a resolution-dependent bitmapped region that can be used for dynamic rendering of images, graphs, and games
<code>height="integer"</code>	Height of canvas in pixels
<code>width="integer"</code>	Width of canvas in pixels
<code>&lt;caption&gt; &lt;/caption&gt;</code>	Creates a table caption
<code>align="align"</code>	Specifies the alignment of the caption where <i>align</i> is bottom, center, left, right, or top (deprecated)
<code>valign="top bottom"</code>	Specifies the vertical alignment of the caption
<code>&lt;center&gt; &lt;/center&gt;</code>	Centers content horizontally on the page (obsolete)
<code>&lt;cite&gt; &lt;/cite&gt;</code>	Marks citation text
<code>&lt;code&gt; &lt;/code&gt;</code>	Marks text used for code samples
<code>&lt;col&gt; &lt;/col&gt;</code>	Defines the settings for a column or group of columns (obsolete)
<code>align="align"</code>	Specifies the alignment of the content of the column(s) where <i>align</i> is left, right, or center
<code>char="char"</code>	Specifies a character in the column used to align column values (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the <i>char</i> attribute (obsolete)
<code>span="integer"</code>	Specifies the number of columns in the group
<code>valign="align"</code>	Specifies the vertical alignment of the content in the column(s) where <i>align</i> is top, middle, bottom, or baseline
<code>width="integer"</code>	Specifies the width of the column(s) in pixels (obsolete)
<code>&lt;colgroup&gt; &lt;/colgroup&gt;</code>	Creates a container for a group of columns
<code>align="align"</code>	Specifies the alignment of the content of the column group where <i>align</i> is left, right, or center (obsolete)
<code>char="char"</code>	Specifies a character in the column used to align column group values (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the <i>char</i> attribute (obsolete)
<code>span="integer"</code>	Specifies the number of columns in the group
<code>valign="align"</code>	Specifies the vertical alignment of the content in the column group where <i>align</i> is top, middle, bottom, or baseline (obsolete)
<code>width="integer"</code>	Specifies the width of the columns in the group in pixels (obsolete)
<code>&lt;command&gt; &lt;/command&gt;</code>	Defines a command button
<code>checked="checked"</code>	Selects the command
<code>disabled="disabled"</code>	Disables the command
<code>icon="url"</code>	Provides the URL for the image that represents the command
<code>label="text"</code>	Specifies the text of the command button
<code>radiogroup="text"</code>	Specifies the name of the group of commands toggled when the command itself is toggled
<code>type="command radio checkbox"</code>	Specifies the type of command button
<code>&lt;datalist&gt; &lt;/datalist&gt;</code>	Encloses a set of option elements that can act as a dropdown list
<code>&lt;dd&gt; &lt;/dd&gt;</code>	Marks text as a definition within a definition list

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Element/Attribute	Description
<b>&lt;del&gt; &lt;/del&gt;</b>	Marks text as deleted from the document
cite="url"	Provides the URL for the document that has additional information about the deleted text
datetime="date"	Specifies the date and time of the text deletion
<b>&lt;details&gt; &lt;/details&gt;</b>	Represents a form control from which the user can obtain additional information or controls
open="open"	Specifies that the contents of the details element should be shown to the user
<b>&lt;dfn&gt; &lt;/dfn&gt;</b>	Marks the defining instance of a term
<b>&lt;dir&gt; &lt;/dir&gt;</b>	Contains a directory listing (deprecated)
compact="compact"	Permits use of compact rendering, if available (deprecated)
<b>&lt;div&gt; &lt;/div&gt;</b>	Creates a generic block-level element
align="left center right justify"	Specifies the horizontal alignment of the content (obsolete)
datafld="text"	Indicates the column from a data source that supplies bound data for the block (IE only)
dataformatas="html  plaintext text"	Specifies the format of the data in the data source bound with the the button (IE only)
datasrc="url"	Provides the URL or ID of the data source bound with the block (IE only)
<b>&lt;dl&gt; &lt;/dl&gt;</b>	Encloses a definition list using the dd and dt elements
compact="compact"	Permits use of compact rendering, if available (obsolete)
<b>&lt;dt&gt; &lt;/dt&gt;</b>	Marks a definition term in a definition list
nowrap="nowrap"	Specifies whether the content wraps using normal HTML line-wrapping conventions
<b>&lt;em&gt; &lt;/em&gt;</b>	Marks emphasized text
<b>&lt;embed&gt; &lt;/embed&gt;</b>	Defines external multimedia content or a plugin
align="align"	Specifies the alignment of the object with the surrounding content where align is bottom, left, right, or top (obsolete)
height="integer"	Specifies the height of the object in pixels
hspace="integer"	Specifies the horizontal space around the object in pixels (obsolete)
name="text"	Provides the name of the embedded object (obsolete)
src="url"	Provides the location of the file containing the object
type="mime-type"	Specifies the mime-type of the embedded object
vspace="integer"	Specifies the vertical space around the object in pixels (obsolete)
width="integer"	Specifies the width of the object in pixels
<b>&lt;fieldset&gt; &lt;/fieldset&gt;</b>	Places form fields in a common group
disabled="disabled"	Disables the fieldset
form="id"	The id of the form associated with the fieldset
name="text"	The name part of the name/value pair associated with this element
<b>&lt;figure&gt; &lt;/figure&gt;</b>	A structural element that represents a group of media content that is self-contained along with a caption
<b>&lt;figcaption&gt; &lt;/figcaption&gt;</b>	Represents the caption of a figure
<b>&lt;font&gt; &lt;/font&gt;</b>	Formats the enclosed text (deprecated)
color="color"	Specifies the color of the enclosed text (deprecated)
face="text list"	Specifies the font face(s) of the enclosed text (deprecated)
size="integer"	Specifies the size of the enclosed text, with values ranging from 1 (smallest) to 7 (largest); a value of +integer increases the font size relative to the font size specified in the basefont element (deprecated)

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Element/Attribute	Description
<code>&lt;footer&gt; &lt;/footer&gt;</code>	A structural element that represents the footer of a section or page
<code>&lt;form&gt; &lt;/form&gt;</code>	Encloses the contents of a web form
<code>accept="mime-type list"</code>	Lists mime-types that the server processing the form will handle (deprecated)
<code>accept-charset="char code"</code>	Specifies the character encoding that the server processing the form will handle
<code>action="url"</code>	Provides the URL to which the form values are to be sent
<code>autocomplete="on off"</code>	Enables automatic insertion of information in fields in which the user has previously entered data
<code>enctype="mime-type"</code>	Specifies the mime-type of the data to be sent to the server for processing; the default is "application/x-www-form-urlencoded"
<code>method="get post"</code>	Specifies the method of accessing the URL specified in the action attribute
<code>name="text"</code>	Specifies the name of the form
<code>novalidate="novalidate"</code>	Specifies that the form is not meant to be validated during submission
<code>target="text"</code>	Specifies the frame or window in which output from the form should appear
<code>&lt;frame&gt; &lt;/frame&gt;</code>	Marks a single frame within a set of frames (deprecated)
<code>bordercolor="color"</code>	Specifies the color of the frame border
<code>frameborder="1 0"</code>	Determines whether the frame border is visible (1) or invisible (0); Netscape also supports values of yes or no
<code>longdesc="url"</code>	Provides the URL of a document containing a long description of the frame's contents
<code>marginheight="integer"</code>	Specifies the space above and below the frame object and the frame's borders, in pixels
<code>marginwidth="integer"</code>	Specifies the space to the left and right of the frame object and the frame's borders, in pixels
<code>name="text"</code>	Specifies the name of the frame
<code>noresize="noresize"</code>	Prevents users from resizing the frame
<code>scrolling="auto yes no"</code>	Specifies whether the browser will display a scroll bar with the frame
<code>src="url"</code>	Provides the URL of the document to be displayed in the frame
<code>&lt;frameset&gt; &lt;/frameset&gt;</code>	Creates a collection of frames (deprecated)
<code>border="integer"</code>	Specifies the thickness of the frame borders in the frameset in pixels (not part of the W3C specifications, but supported by most browsers)
<code>bordercolor="color"</code>	Specifies the color of the frame borders
<code>cols="value list"</code>	Arranges the frames in columns with the width of each column expressed either in pixels, as a percentage, or using an asterisk (to allow the browser to choose the width)
<code>frameborder="1 0"</code>	Determines whether frame borders are visible (1) or invisible (0); (not part of the W3C specifications, but supported by most browsers)
<code>framespacing="integer"</code>	Specifies the amount of space between frames in pixels (IE only)
<code>rows="value list"</code>	Arranges the frames in rows with the height of each column expressed either in pixels, as a percentage, or using an asterisk (to allow the browser to choose the height)

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Element/Attribute	Description
<code>&lt;h<i>i</i>&gt; &lt;/h<i>i</i>&gt;</code>	Marks the enclosed text as a heading, where <i>i</i> is an integer from 1 (the largest heading) to 6 (the smallest heading)
<code>align="align"</code>	Specifies the alignment of the heading text where <i>align</i> is left, center, right, or justify (obsolete)
<code>&lt;head&gt; &lt;/head&gt;</code>	Encloses the document head, containing information about the document
<code>profile="url"</code>	Provides the location of metadata about the document
<code>&lt;header&gt; &lt;/header&gt;</code>	Structural element that represents the header of a section or the page
<code>&lt;hgroup&gt; &lt;/hgroup&gt;</code>	Structural element that groups content headings
<code>&lt;hr /&gt;</code>	Draws a horizontal line (rule) in the rendered page
<code>align="align"</code>	Specifies the horizontal alignment of the line where <i>align</i> is left, center, or right (obsolete)
<code>color="color"</code>	Specifies the color of the line (obsolete)
<code>noshade="noshade"</code>	Removes 3D shading from the line (obsolete)
<code>size="integer"</code>	Specifies the height of the line in pixels or as a percentage of the enclosing element's height (obsolete)
<code>width="integer"</code>	Specifies the width of the line in pixels or as a percentage of the enclosing element's width (obsolete)
<code>&lt;html&gt; &lt;/html&gt;</code>	Encloses the entire content of the HTML document
<code>manifest="url"</code>	Provides the address of the document's application cache manifest
<code>xmlns="text"</code>	Specifies the namespace prefix for the document
<code>&lt;i&gt; &lt;/i&gt;</code>	Represents a span of text offset from its surrounding content without conveying any extra importance or emphasis
<code>&lt;iframe&gt; &lt;/iframe&gt;</code>	Creates an inline frame in the document
<code>align="align"</code>	Specifies the horizontal alignment of the frame with the surrounding content where <i>align</i> is bottom, left, middle, top, or right (obsolete)
<code>datafld="text"</code>	Indicates the column from a data source that supplies bound data for the inline frame (IE only)
<code>dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the inline frame (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the inline frame (IE only)
<code>frameborder="1   0"</code>	Specifies whether to display a frame border (1) or not (0) (obsolete)
<code>height="integer"</code>	Specifies the height of the frame in pixels
<code>longdesc="url"</code>	Indicates the document contains a long description of the frame's content (obsolete)
<code>marginheight="integer"</code>	Specifies the space above and below the frame object and the frame's borders, in pixels (obsolete)
<code>marginwidth="integer"</code>	Specifies the space to the left and right of the frame object and the frame's borders, in pixels (obsolete)
<code>name="text"</code>	Specifies the name of the frame
<code>sandbox="allow-forms   allow-scripts   allow-top-navigation   allow-same-origin"</code>	Defines restrictions to the frame content
<code>seamless="seamless"</code>	Displays the inline frame as part of the document
<code>scrolling="auto   yes   no"</code>	Determines whether the browser displays a scroll bar with the frame (obsolete)

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Element/Attribute	Description
<code>src="url"</code>	Indicates the document displayed within the frame
<code>srcdoc="text"</code>	Provides the HTML code shown in the inline frame
<code>width="integer"</code>	Specifies the width of the frame in pixels
<b>&lt;img&gt; &lt;/img&gt;</b>	Inserts an inline image into the document
<code>align="align"</code>	Specifies the alignment of the image with the surrounding content where <i>align</i> is left, right, top, text, toptext, middle, absmiddle, baseline, bottom, absbottom (obsolete)
<code>alt="text"</code>	Specifies alternate text to be displayed in place of the image
<code>border="integer"</code>	Specifies the width of the image border (obsolete)
<code>datafld="text"</code>	Names the column from a data source that supplies bound data for the image (IE only)
<code>dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the image (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the image (IE only)
<code>dynsrc="url"</code>	Provides the URL of a video or VRML file (IE and Opera only)
<code>height="integer"</code>	Specifies the height of the image in pixels
<code>hspace="integer"</code>	Specifies the horizontal space around the image in pixels (deprecated)
<code>ismap="ismap"</code>	Indicates that the image can be used as a server-side image map
<code>longdesc="url"</code>	Provides the URL of a document containing a long description of the image (obsolete)
<code>name="text"</code>	Specifies the image name (obsolete)
<code>src="url"</code>	Specifies the image source file
<code>usemap="url"</code>	Provides the location of a client-side image associated with the image (not well-supported when the URL points to an external file)
<code>vspace="integer"</code>	Specifies the vertical space around the image in pixels (obsolete)
<code>width="integer"</code>	Specifies the width of the image in pixels
<b>&lt;input&gt; &lt;/input&gt;</b>	Marks an input field in a web form
<code>align="align"</code>	Specifies the alignment of the input field with the surrounding content where <i>align</i> is left, right, top, toptext, middle, absmiddle, baseline, bottom, or absbottom (obsolete)
<code>alt="text"</code>	Specifies alternate text for image buttons and image input fields
<code>checked="checked"</code>	Specifies that the input check box or input radio button is selected
<code>datafld="text"</code>	Indicates the column from a data source that supplies bound data for the input field (IE only)
<code>dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the input field (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the input field (IE only)
<code>disabled="disabled"</code>	Disables the input control
<code>form="text"</code>	Specifies the form to which the button belongs
<code>formaction="url"</code>	Specifies the URL to which the form data is sent
<code>formenctype="mime-type"</code>	Specifies the encoding of the form data before it is sent
<code>formmethod="get   post"</code>	Specifies the HTTP method with which the form data is submitted
<code>formnovalidate="formnovalidate"</code>	Specifies that the form should not be validated during submission
<code>formtarget="text"</code>	Provides a name for the target of the button
<code>height="integer"</code>	Specifies the height of the image input field in pixels

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Element/Attribute	Description
<code>list="id"</code>	Specifies the id of a data list associated with the input field
<code>max="value"</code>	Specifies the maximum value of the field
<code>maxlength="integer"</code>	Specifies the maximum number of characters that can be inserted into a text input field
<code>min="value"</code>	Specifies the minimum value of the field
<code>multiple="multiple"</code>	Specifies that the user is allowed to specify more than one input value
<code>name="text"</code>	Specifies the name of the input field
<code>pattern="text"</code>	Specifies the required regular expression pattern of the input field value
<code>placeholder="text"</code>	Specifies placeholder text for the input field
<code>readonly="readonly"</code>	Prevents the value of the input field from being modified
<code>size="integer"</code>	Specifies the number of characters that can be displayed at one time in an input text field
<code>src="url"</code>	Indicates the source file of an input image field
<code>step="any   value"</code>	Specifies the value granularity of the field value
<code>type="text"</code>	Specifies the input type where text is button, checkbox, color, date, datetime, datetime-local, email, file, hidden, image, month, number, password, radio, range, reset, search, submit, tel, text, time, url, or week
<code>value="text"</code>	Specifies the default value of the input field
<code>width="integer"</code>	Specifies the width of an image input field in pixels
<code>&lt;ins&gt; &lt;/ins&gt;</code>	Marks inserted text
<code>  cite="url"</code>	Provides the URL for the document that has additional information about the inserted text
<code>  datetime="date"</code>	Specifies the date and time of the text insertion
<code>&lt;kbd&gt; &lt;/kbd&gt;</code>	Marks keyboard-style text
<code>&lt;keygen&gt; &lt;/keygen&gt;</code>	Defines a generate key within a form
<code>  autofocus="autofocus"</code>	Specifies that the element is to be given the focus when the form is loaded
<code>  challenge="text"</code>	Provides the challenge string that is submitted along with the key
<code>  disabled="disabled"</code>	Disables the element
<code>  form="id"</code>	Specifies the id of the form associated with the element
<code>  keytype="rsa"</code>	Specifies the type of key generated
<code>  name="text"</code>	Specifies the name part of the name/value pair associated with the element
<code>&lt;label&gt; &lt;/label&gt;</code>	Associates the enclosed content with a form field
<code>  datafld="text"</code>	Indicates the column from a data source that supplies bound data for the label (IE only)
<code>  dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the label (IE only)
<code>  datasrc="url"</code>	Provides the URL or ID of the data source bound with the label (IE only)
<code>  for="text"</code>	Provides the ID of the field associated with the label
<code>  form="id"</code>	Specifies the id of the form associated with the label
<code>&lt;legend&gt; &lt;/legend&gt;</code>	Marks the enclosed text as a caption for a field set
<code>  align="bottom   left   top   right"</code>	Specifies the alignment of the legend with the field set; Internet Explorer also supports the center option (deprecated)
<code>&lt;li&gt; &lt;/li&gt;</code>	Marks an item in an ordered (ol), unordered (ul), menu (menu), or directory (dir) list
<code>  value="integer"</code>	Sets the value for the current list item in an ordered list; subsequent list items are numbered from that value

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Element/Attribute	Description
<b>&lt;link /&gt;</b>	Creates an element in the document head that establishes the relationship between the current document and external documents or objects
charset="char code"	Specifies the character encoding of the external document (obsolete)
href="url"	Provides the URL of the external document
hreflang="text"	Indicates the language of the external document
media="media"	Indicates the media in which the external document is presented
rel="text"	Specifies the relationship between the current page and the link specified by the href attribute
rev="text"	Specifies the reverse relationship between the current page and the link specified by the href attribute (obsolete)
sizes="any   value"	Specifies the sizes of icons used for visual media
target="text"	Specifies the target window or frame for the link (obsolete)
type="mime-type"	Specifies the mime-type of the external document
<b>&lt;map&gt; &lt;/map&gt;</b>	Creates an element that contains client-side image map hotspots
name="text"	Specifies the name of the image map
<b>&lt;mark&gt; &lt;/mark&gt;</b>	Defines marked text
<b>&lt;menu&gt; &lt;/menu&gt;</b>	Represents a list of commands
compact="compact"	Reduces the space between menu items (obsolete)
label="text"	Defines a visible label for the menu
type="context   list   toolbar"	Defines which type of list to display
<b>&lt;meta /&gt;</b>	Creates an element in the document's head section that contains information and special instructions for processing the document
charset="char code"	Defines the character encoding for the document
content="text"	Provides information associated with the name or http-equiv attributes
http-equiv="text"	Provides instructions to the browser to request the server to perform different http operations
name="text"	Specifies the type of information specified in the content attribute
scheme="text"	Supplies additional information about the scheme used to interpret the content attribute (obsolete)
<b>&lt;meter&gt; &lt;/meter&gt;</b>	Defines a measurement within a predefined range
high="value"	Defines the high value of the range
low="value"	Defines the low value of the range
max="value"	Defines the maximum value
min="value"	Defines the minimum value
optimum="value"	Defines the optimum value from the range
value="value"	Defines the meter's value
<b>&lt;nav&gt; &lt;/nav&gt;</b>	Structural element defining a navigation list
<b>&lt;noabr&gt; &lt;/noabr&gt;</b>	Disables line wrapping for the enclosed content (not part of the W3C specifications, but supported by most browsers)
<b>&lt;noembed&gt; &lt;/noembed&gt;</b>	Encloses alternate content for browsers that do not support the embed element (not part of the W3C specifications, but supported by most browsers)
<b>&lt;noframe&gt; &lt;/noframe&gt;</b>	Encloses alternate content for browsers that do not support frames (obsolete)
<b>&lt;noscript&gt; &lt;/noscript&gt;</b>	Encloses alternate content for browsers that do not support client-side scripts

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Element/Attribute	Description
<b>&lt;object&gt; &lt;/object&gt;</b>	Places an embedded object (image, applet, sound clip, video clip, etc.) into the page
<code>archive="url"</code>	Specifies the URL of an archive containing classes and other resources preloaded for use with the object (obsolete)
<code>align="align"</code>	Aligns the object with the surrounding content where <i>align</i> is absbottom, absmiddle, baseline, bottom, left, middle, right, texttop, or top (obsolete)
<code>border="integer"</code>	Specifies the width of the border around the object (obsolete)
<code>classid="url"</code>	Provides the URL of the object (obsolete)
<code>codebase="url"</code>	Specifies the base path used to resolve relative references within the embedded object (obsolete)
<code>codetype="mime-type"</code>	Indicates the mime-type of the embedded object's code (obsolete)
<code>data="url"</code>	Provides the URL of the object's data file
<code>datafld="text"</code>	Identifies the column from a data source that supplies bound data for the embedded object (IE only)
<code>dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the embedded object (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the embedded object (IE only)
<code>declare="declare"</code>	Declares the object without embedding it on the page (obsolete)
<code>form="id"</code>	Specifies the id of the form associated with the object
<code>height="integer"</code>	Specifies the height of the object in pixels
<code>hspace="integer"</code>	Specifies the horizontal space around the image in pixels (obsolete)
<code>name="text"</code>	Specifies the name of the embedded object
<code>standby="text"</code>	Specifies the message displayed by the browser while loading the embedded object (obsolete)
<code>type="mime-type"</code>	Indicates the mime-type of the embedded object
<code>vspace="integer"</code>	Specifies the vertical space around the embedded object (obsolete)
<code>width="integer"</code>	Specifies the width of the object in pixels
<b>&lt;ol&gt; &lt;/ol&gt;</b>	Contains an ordered list of items
<code>reversed="reversed"</code>	Specifies that the list markers are to be displayed in descending order
<code>start="integer"</code>	Specifies the starting value in the list
<code>type="A   a   I   i   1"</code>	Specifies the bullet type associated with the list items (deprecated)
<b>&lt;optgroup&gt; &lt;/optgroup&gt;</b>	Contains a group of option elements in a selection field
<code>disabled="disabled"</code>	Disables the option group control
<code>label="text"</code>	Specifies the label for the option group
<b>&lt;option&gt; &lt;/option&gt;</b>	Formats an option within a selection field
<code>disabled="disabled"</code>	Disables the option control
<code>label="text"</code>	Supplies the text label associated with the option
<code>selected="selected"</code>	Selects the option by default
<code>value="text"</code>	Specifies the value associated with the option
<b>&lt;output&gt; &lt;/output&gt;</b>	Form control representing the result of a calculation
<code>name="text"</code>	Specifies the name part of the name/value pair associated with the field
<code>form="id"</code>	Specifies the id of the form associated with the field
<code>for="text list"</code>	Lists the id references associated with the calculation

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Element/Attribute	Description
<code>&lt;p&gt; &lt;/p&gt;</code> <code>align="align"</code>	Marks the enclosed content as a paragraph Horizontally aligns the contents of the paragraph where <i>align</i> is left, center, right, or justify (obsolete)
<code>&lt;param&gt; &lt;/param&gt;</code> <code>name="text"</code> <code>type="mime-type"</code> <code>value="text"</code> <code>valuetype="data   ref   object"</code>	Marks parameter values sent to an object element or an applet element Specifies the parameter name Specifies the mime-type of the resource indicated by the value attribute (obsolete) Specifies the parameter value Specifies the data type of the value attribute (obsolete)
<code>&lt;pre&gt; &lt;/pre&gt;</code>	Marks the enclosed text as preformatted text, retaining white space from the document
<code>&lt;progress&gt; &lt;/progress&gt;</code> <code>value="value"</code> <code>max="value"</code>	Represents the progress of completion of a task Specifies how much of the task has been completed Specifies how much work the task requires in total
<code>&lt;q&gt; &lt;/q&gt;</code> <code>cite="url"</code>	Marks the enclosed text as a quotation Provides the source URL of the quoted content
<code>&lt;rp&gt; &lt;/rp&gt;</code>	Used in ruby annotations to define what to show browsers that do not support the ruby element
<code>&lt;rt&gt; &lt;/rt&gt;</code>	Defines explanation to ruby annotations
<code>&lt;ruby&gt; &lt;/ruby&gt;</code>	Defines ruby annotations
<code>&lt;s&gt; &lt;/s&gt;</code>	Marks the enclosed text as strikethrough text
<code>&lt;samp&gt; &lt;/samp&gt;</code>	Marks the enclosed text as a sequence of literal characters
<code>&lt;script&gt; &lt;/script&gt;</code>  <code>async="async"</code>  <code>charset="char code"</code> <code>defer="defer"</code> <code>language="text"</code> <code>src="url"</code> <code>type="mime-type"</code>	Encloses client-side scripts within the document; this element can be placed within the head or the body element or it can refer to an external script file Specifies that the script should be executed asynchronously as soon as it becomes available Specifies the character encoding of the script Defers execution of the script Specifies the language of the script (obsolete) Provides the URL of an external script file Specifies the mime-type of the script
<code>&lt;section&gt; &lt;/section&gt;</code>	Structural element representing a section of the document
<code>&lt;select&gt; &lt;/select&gt;</code>  <code>autofocus="autofocus"</code>  <code>datafld="text"</code>  <code>dataformatas="html   plaintext   text"</code> <code>datasrc="url"</code>  <code>disabled="disabled"</code> <code>form="id"</code> <code>multiple="multiple"</code> <code>name="text"</code> <code>size="integer"</code>	Creates a selection field (drop-down list box) in a web form Specifies that the browser should give focus to the selection field as soon as the page loads Identifies the column from a data source that supplies bound data for the selection field (IE only) Specifies the format of the data in the data source bound with the selection field (IE only) Provides the URL or ID of the data source bound with the selection field (IE only) Disables the selection field Provides the id of the form associated with the selection field Allows multiple sections from the field Specifies the selection field name Specifies the number of visible items in the selection list

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Element/Attribute	Description
<code>&lt;small&gt; &lt;/small&gt;</code>	Represents "final print" or "small print" in legal disclaimers and caveats
<code>&lt;source /&gt;</code>	Enables multiple media sources to be specified for audio and video elements
<code>media="media"</code>	Specifies the intended media type of the media source
<code>src="url"</code>	Specifies the location of the media source
<code>type="mime-type"</code>	Specifies the MIME type of the media source
<code>&lt;span&gt; &lt;/span&gt;</code>	Creates a generic inline element
<code>datafld="text"</code>	Identifies the column from a data source that supplies bound data for the inline element (IE only)
<code>dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the inline element (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the inline element (IE only)
<code>&lt;strong&gt; &lt;/strong&gt;</code>	Marks the enclosed text as strongly emphasized text
<code>&lt;style&gt; &lt;/style&gt;</code>	Encloses global style declarations for the document
<code>media="media"</code>	Indicates the media of the enclosed style definitions
<code>scoped="scoped"</code>	Indicates that the specified style information is meant to apply only to the style element's parent element
<code>type="mime-type"</code>	Specifies the mime-type of the style definitions
<code>&lt;sub&gt; &lt;/sub&gt;</code>	Marks the enclosed text as subscript text
<code>&lt;summary&gt; &lt;/summary&gt;</code>	Defines the header of a detail element
<code>&lt;sup&gt; &lt;/sup&gt;</code>	Marks the enclosed text as superscript text
<code>&lt;table&gt; &lt;/table&gt;</code>	Encloses the contents of a web table
<code>align="align"</code>	Aligns the table with the surrounding content where <i>align</i> is left, center, or right (obsolete)
<code>bgcolor="color"</code>	Specifies the background color of the table (obsolete)
<code>border="integer"</code>	Specifies the width of the table border in pixels (obsolete)
<code>cellpadding="integer"</code>	Specifies the space between the table data and the cell borders in pixels (obsolete)
<code>cellspacing="integer"</code>	Specifies the space between table cells in pixels (obsolete)
<code>datafld="text"</code>	Indicates the column from a data source that supplies bound data for the table (IE only)
<code>dataformatas="html   plaintext   text"</code>	Specifies the format of the data in the data source bound with the table (IE only)
<code>datapagesize="integer"</code>	Sets the number of records displayed within the table (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the table (IE only)
<code>frame="frame"</code>	Specifies the format of the borders around the table where <i>frame</i> is above, below, border, box, hside, lhs, rhs, void, or vside (obsolete)
<code>rules="rules"</code>	Specifies the format of the table's internal borders or gridlines where <i>rules</i> is all, cols, groups, none, or rows (obsolete)
<code>summary="text"</code>	Supplies a text summary of the table's content
<code>width="integer"</code>	Specifies the width of the table in pixels (obsolete)

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Element/Attribute	Description
<b>&lt;tbody&gt; &lt;/tbody&gt;</b>	Encloses the content of the web table body
<code>align="align"</code>	Specifies the alignment of the contents in the cells of the table body where <i>align</i> is left, center, right, justify, or char (obsolete)
<code>char="char"</code>	Specifies the character used for aligning the table body contents when the align attribute is set to "char" (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the char attribute (obsolete)
<code>valign="align"</code>	Specifies the vertical alignment of the contents in the cells of the table body where <i>align</i> is baseline, bottom, middle, or top (obsolete)
<b>&lt;td&gt; &lt;/td&gt;</b>	Encloses the data of a table cell
<code>abbr="text"</code>	Supplies an abbreviated version of the contents of the table cell (obsolete)
<code>align="align"</code>	Specifies the horizontal alignment of the table cell data where <i>align</i> is left, center, or right (obsolete)
<code>bgcolor="color"</code>	Specifies the background color of the table cell (obsolete)
<code>char="char"</code>	Specifies the character used for aligning the table cell contents when the align attribute is set to "char" (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the char attribute (obsolete)
<code>colspan="integer"</code>	Specifies the number of columns the table cell spans
<code>headers="text"</code>	Supplies a space-separated list of table headers associated with the table cell
<code>height="integer"</code>	Specifies the height of the table cell in pixels (obsolete)
<code>nowrap="nowrap"</code>	Disables line-wrapping within the table cell (obsolete)
<code>rowspan="integer"</code>	Specifies the number of rows the table cell spans
<code>scope="col colgroup row rowgroup"</code>	Specifies the scope of the table for which the cell provides data (obsolete)
<code>valign="align"</code>	Specifies the vertical alignment of the contents of the table cell where <i>align</i> is top, middle, or bottom (obsolete)
<code>width="integer"</code>	Specifies the width of the cell in pixels (obsolete)
<b>&lt;textarea&gt; &lt;/textarea&gt;</b>	Marks the enclosed text as a text area input box in a web form
<code>autofocus="autofocus"</code>	Specifies that the text area is to receive the focus when the page is loaded
<code>datafld="text"</code>	Specifies the column from a data source that supplies bound data for the text area box (IE only)
<code>dataformatas="html plaintext text"</code>	Specifies the format of the data in the data source bound with the text area box (IE only)
<code>datasrc="url"</code>	Provides the URL or ID of the data source bound with the text area box (IE only)
<code>cols="integer"</code>	Specifies the width of the text area box in characters
<code>disable="disable"</code>	Disables the text area field
<code>form="id"</code>	Associates the text area with the form identified by <i>id</i>
<code>maxlength="integer"</code>	Specifies the maximum allowed value length for the text area
<code>name="text"</code>	Specifies the name of the text area box
<code>placeholder="text"</code>	Provides a short hint intended to aid the user when entering data
<code>readonly="readonly"</code>	Specifies the value of the text area box, cannot be modified
<code>required="required"</code>	Indicates whether the text area is required for validation
<code>rows="integer"</code>	Specifies the number of visible rows in the text area box
<code>wrap="soft hard"</code>	Specifies how text is wrapped within the text area box and how that text-wrapping information is sent to the server-side program

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Element/Attribute	Description
<b>&lt;tfoot&gt; &lt;/tfoot&gt;</b>	Encloses the content of the web table footer
<code>align="align"</code>	Specifies the alignment of the contents in the cells of the table footer where <i>align</i> is left, center, right, justify, or char (obsolete)
<code>char="char"</code>	Specifies the character used for aligning the table footer contents when the <i>align</i> attribute is set to "char" (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the <i>char</i> attribute (obsolete)
<code>valign="align"</code>	Specifies the vertical alignment of the contents in the cells of the table footer where <i>align</i> is baseline, bottom, middle, or top (obsolete)
<b>&lt;th&gt; &lt;/th&gt;</b>	Encloses the data of a table header cell
<code>abbr="text"</code>	Supplies an abbreviated version of the contents of the table cell (obsolete)
<code>align="align"</code>	Specifies the horizontal alignment of the table cell data where <i>align</i> is left, center, or right (obsolete)
<code>axis="text list"</code>	Provides a list of table categories that can be mapped to a table hierarchy (obsolete)
<code>bgcolor="color"</code>	Specifies the background color of the table cell (obsolete)
<code>char="char"</code>	Specifies the character used for aligning the table cell contents when the <i>align</i> attribute is set to "char" (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the <i>char</i> attribute (obsolete)
<code>colspan="integer"</code>	Specifies the number of columns the table cell spans
<code>headers="text"</code>	A space-separated list of table headers associated with the table cell
<code>height="integer"</code>	Specifies the height of the table cell in pixels (obsolete)
<code>nowrap="nowrap"</code>	Disables line-wrapping within the table cell (obsolete)
<code>rowspan="integer"</code>	Specifies the number of rows the table cell spans
<code>scope="col colgroup row rowgroup"</code>	Specifies the scope of the table for which the cell provides data
<code>valign="align"</code>	Specifies the vertical alignment of the contents of the table cell where <i>align</i> is top, middle, or bottom (obsolete)
<code>width="integer"</code>	Specifies the width of the cell in pixels (obsolete)
<b>&lt;thead&gt; &lt;/thead&gt;</b>	Encloses the content of the web table header
<code>align="align"</code>	Specifies the alignment of the contents in the cells of the table header where <i>align</i> is left, center, right, justify, or char (obsolete)
<code>char="char"</code>	Specifies the character used for aligning the table header contents when the <i>align</i> attribute is set to "char" (obsolete)
<code>charoff="integer"</code>	Specifies the offset in pixels from the alignment character specified in the <i>char</i> attribute (obsolete)
<code>valign="align"</code>	Specifies the vertical alignment of the contents in the cells of the table header where <i>align</i> is baseline, bottom, middle, or top (obsolete)
<b>&lt;time&gt; &lt;/time&gt;</b>	Represents a date and/or time
<b>&lt;title&gt; &lt;/title&gt;</b>	Specifies the title of the document, placed in the head section of the document

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Element/Attribute	Description
<b>&lt;tr&gt; &lt;/tr&gt;</b>	Encloses the content of a row within a web table
align="align"	Specifies the horizontal alignment of the data in the row's cells where <i>align</i> is left, center, or right (obsolete)
char="char"	Specifies the character used for aligning the table row contents when the align attribute is set to "char" (obsolete)
charoff="integer"	Specifies the offset in pixels from the alignment character specified in the char attribute (obsolete)
valign="align"	Specifies the vertical alignment of the contents of the table row where <i>align</i> is baseline, bottom, middle, or top (obsolete)
<b>&lt;track&gt; &lt;/track&gt;</b>	Enables supplementary media tracks such as subtitles and captions
default="default"	Enables the track if the user's preferences do not indicate that another track would be more appropriate
kind="kind"	Specifies the kind of track, where <i>kind</i> is subtitles, captions, descriptions, chapters, or metadata
label="text"	Provides a user-readable title for the track
src="url"	Provides the address of the track
srclang="lang"	Provides the language of the track
<b>&lt;tt&gt; &lt;/tt&gt;</b>	Marks the enclosed text as teletype or monospaced text (deprecated)
<b>&lt;u&gt; &lt;/u&gt;</b>	Marks the enclosed text as underlined text (deprecated)
<b>&lt;ul&gt; &lt;/ul&gt;</b>	Contains an unordered list of items
compact="compact"	Reduces the space between unordered list items (obsolete)
type="disc square circle"	Specifies the bullet type associated with the list items (obsolete)
<b>&lt;var&gt; &lt;/var&gt;</b>	Marks the enclosed text as containing a variable name
<b>&lt;video&gt; &lt;/video&gt;</b>	Defines an embedded video clip
audio="text"	Defines the default audio state; currently only "muted" is supported
autoplay="autoplay"	Specifies that the video should begin playing automatically when the page is loaded
controls="controls"	Instructs the browser to display the video controls
height="value"	Provides the height of the video clip in pixels
loop="loop"	Instructs the browser to loop the clip back to the beginning
preload="auto metadata none"	Indicates whether to preload the video clip data
poster="url"	Specifies the location of an image file to act as a poster for the video clip
width="value"	Provides the width of the video clip in pixels
<b>&lt;wbr /&gt;</b>	Indicates a line-break opportunity
<b>&lt;xml&gt; &lt;/xml&gt;</b>	Encloses XML content (also referred to as a <i>data island</i> ) or references an external XML document (IE only)
ns="url"	Provides the URL of the XML data island (IE only)
prefix="text"	Specifies the namespace prefix of the XML content (IE only)
src="url"	Provides the URL of an external XML document (IE only)
<b>&lt;xmp&gt; &lt;/xmp&gt;</b>	Marks the enclosed text as preformatted text, preserving the white space of the source document; replaced by the pre element (deprecated)

# Cascading Styles and Selectors

This appendix describes the selectors, units, and attributes supported by Cascading Style Sheets (CSS). Note that not all CSS features are supported by all browsers and all browser versions, so you should always check your code against different browsers and browser versions to ensure that your page is being rendered correctly. Also, many CSS styles are still in the draft stage and will undergo continuing revisions and additions. Additional information about CSS can be found at the World Wide Web Consortium website at [www.w3.org](http://www.w3.org).

## STARTING DATA FILES

There are no starting Data Files needed for this appendix.

## Selectors

The general form of a style declaration is:

```
selector {attribute1:value1; attribute2:value2; ...}
```

where *selector* is the selection of elements within the document to which the style will be applied; *attribute1*, *attribute2*, and so on are the different style attributes; and *value1*, *value2*, and so on are values associated with those styles. Table C–1 shows some of the different forms that a selector can take.

**Table C–1:**  
CSS selectors

Selector	Matches
*	All elements in the document
<i>e</i>	An element, <i>e</i> , in the document
<i>e1</i> , <i>e2</i> , <i>e3</i> , ...	A group of elements, <i>e1</i> , <i>e2</i> , <i>e3</i> , in the document
<i>e1 e2</i>	An element, <i>e2</i> , nested within the parent element, <i>e1</i>
<i>e1 &gt; e2</i>	An element, <i>e2</i> , that is a child of the parent element, <i>e1</i>
<i>e1+e2</i>	An element, <i>e2</i> , that is adjacent to element, <i>e1</i>
<i>e1.class</i>	An element, <i>e1</i> , belonging to the <i>class</i> class
<i>.class</i>	Any element belonging to the <i>class</i> class
<i>#id</i>	An element with the id value <i>id</i>
[ <i>att</i> ]	The element contains the <i>att</i> attribute
[ <i>att</i> ="val"]	The element's <i>att</i> attribute equals "val"
[ <i>att</i> ~="val"]	The element's <i>att</i> attribute value is a space-separated list of "words," one of which is exactly "val"
[ <i>att</i>  ="val"]	The element's <i>att</i> attribute value is a hyphen-separated list of "words" beginning with "val"
[ <i>att</i> ^="val"]	The element's <i>att</i> attribute begins with "val"
[ <i>att</i> \$="val"]	The element's <i>att</i> attribute ends with "val"
[ <i>att</i> *="val"]	The element's <i>att</i> attribute contains the value "val"
[ <i>ns att</i> ]	References all <i>att</i> attributes in the <i>ns</i> namespace

## Pseudo-Elements and Pseudo-Classes

Pseudo-elements are elements that do not exist in HTML code but whose attributes can be set with CSS. Table C–2 lists CSS pseudo-elements.

**Table C–2:**  
Pseudo-elements

Pseudo-Element	Matches
<i>e::after</i> {content: "text"}	Text content, text, that is inserted at the end of an element, <i>e</i>
<i>e::before</i> {content: "text"}	Text content, text, that is inserted at the beginning of an element, <i>e</i>
<i>e::first-letter</i>	The first letter in the element <i>e</i>
<i>e::first-line</i>	The first line in the element <i>e</i>
::selection	A part of the document that has been highlighted by the user

Pseudo-classes are classes of HTML elements that define the condition or state of the element in the web page. Table C–3 lists CSS pseudo-classes.

**Table C–3:**  
*Pseudo-classes*

Pseudo-Class	Matches
:canvas	The rendering canvas of the document
:first	The first printed page of the document (used only with print styles created with the @print rule)
:last	The last printed page of the document (used only with print styles created with the @print rule)
:left	The left side of a two-sided printout (used only with print styles created with the @print rule)
:right	The right side of a two-sided printout (used only with print styles created with the @print rule)
:root	The root element of the document
e:active	The element, e, that is being activated by the user (usually applies only to hyperlinks)
e:checked	The checkbox or radio button, e, that has been checked
e:disabled	The element, e, that has been disabled in the document
e:empty	The element, e, that has no children
e:enabled	The element, e, that has been enabled in the document
e:first-child	The element, e, which is the first child of its parent element
e:first-node	The first occurrence of the element, e, in the document tree
e:first-of-type	The first element of type e
e:focus	The element, e, that has received the focus of the cursor
e:hover	The mouse pointer is hovering over the element, e
e:lang(text)	Sets the language, text, associated with the element, e
e:last-child	The element, e, that is the last child of its parent element
e:last-of-type	The last element of type e
e:link	The element, e, has not been visited yet by the user (applies only to hyperlinks)
e:not	Negates the selector rule for the element, e, applying the style to all e elements that do not match the selector rules
e:nth-child(n)	Matches $n^{\text{th}}$ child of the element, e; n can also be the keywords odd or even
e:nth-last-child(n)	Matches $n^{\text{th}}$ child of the element, e, counting up from the last child; n can also be the keywords odd or even
e:nth-of-type(n)	Matches $n^{\text{th}}$ element of type e; n can also be the keywords odd or even
e:nth-last-of-type(n)	Matches $n^{\text{th}}$ element of type e, counting up from the last child; n can also be the keywords odd or even
e:only-child	Matches element e only if it is the only child of its parent
e:only-of-type	Matches element e only if it is the only element of its type nested within its parent
e:target	Matches an element, e, that's the target of the identifier in the document's URL
e:visited	The element, e, has been already visited by the user (to only the hyperlinks)

## @ Rules

CSS supports different @ rules designed to run commands within a style sheet. These commands can be used to import other styles, download font definitions, or define the format of printed output, as shown in Table C–4.

**Table C–4:**  
@ rule commands

@ Rule	Description
@charset "encoding"	Defines the character set encoding used in the style sheet (this must be the very first line in the style sheet document)
@font-face {font descriptors}	Defines custom fonts that are available for automatic download when needed
@import url(url) media	Imports an external style sheet document into the current style sheet, where <i>url</i> is the location of the external stylesheet and <i>media</i> is a comma-separated list of media types (optional)
@media media {style declaration}	Defines the media for the styles in the <i>style declaration</i> block, where <i>media</i> is a comma-separated list of media types
@namespace prefix url(url)	Defines the namespace used by selectors in the style sheet, where <i>prefix</i> is the local namespace prefix (optional) and <i>url</i> is the unique namespace identifier; the @namespace rule must come before all CSS selectors
@page label pseudo-class {styles}	Defines the properties of a printed page, where <i>label</i> is a label given to the page (optional), <i>pseudo-class</i> is one of the CSS pseudo-classes designed for printed pages, and <i>styles</i> are the styles associated with the page

## Miscellaneous Syntax

The syntax elements in Table C–5 do not fit into the previous categories but are useful in constructing CSS style sheets.

**Table C–5:**  
Miscellaneous syntax  
elements

Item	Description
<i>style</i> !important	Places high importance on the preceding <i>style</i> , overriding the usual rules for inheritance and cascading
/* comment */	Attaches a <i>comment</i> to the style sheet

## Units

Many style attribute values use units of measurement to indicate color, length, angles, time, and frequencies. Table C–6 describes the measuring units used in CSS.

**Table C–6:**  
CSS units of  
measurement

Unit	Description
<b>Color</b>	
<code>currentColor</code>	The computed value of the color property
<code>flavor</code>	An accent color chosen by the user to customize the user interface of the browser
<code>name</code>	A color name; all browsers recognize 16 base color names: aqua, black, blue, fuchsia, gray, green, lime, maroon, navy, olive, purple, red, silver, teal, white, and yellow
<code>#rrggbb</code>	A hexadecimal color value, where <i>rr</i> is the red value, <i>gg</i> is the green value, and <i>bb</i> is the blue value
<code>#rgb</code>	A compressed hexadecimal value, where the <i>r</i> , <i>g</i> , and <i>b</i> values are doubled so that, for example, #A2F = #AA22FF
<code>hsl(hue, sat, light)</code>	Color value based on hue, saturation, and lightness, where <i>hue</i> is the degree measure on the color wheel ranging from 0° (red) up to 360°, <i>sat</i> is the saturation range from 0% to 100%, and <i>light</i> is the lightness range from 0% to 100%
<code>hsla(hue, sat, light, alpha)</code>	Semi-transparent color based on the HSL model with <i>alpha</i> representing the opacity of the color ranging from 0 (transparent) up to 1 (completely opaque)
<code>rgb(red, green, blue)</code>	The decimal color value, where <i>red</i> is the red value, <i>green</i> is the green value, and <i>blue</i> is the blue value
<code>rgb(red%, green%, blue%)</code>	The color value percentage, where <i>red%</i> is the percent of maximum red, <i>green%</i> is the percent of maximum green, and <i>blue%</i> is the percent of maximum blue
<code>rgba(red, green, blue, alpha)</code>	Semi-transparent color based on the RGB model with <i>alpha</i> representing the opacity of the color ranging from 0 (transparent) up to 1 (completely opaque)
<b>Length</b>	
<code>auto</code>	Keyword that allows the browser to automatically determine the size of the length
<code>ch</code>	Width of the “0” glyph found in the font
<code>em</code>	A relative unit indicating the width and the height of the capital “M” character for the browser’s default font
<code>ex</code>	A relative unit indicating the height of the small “x” character for the browser’s default font
<code>px</code>	A pixel, representing the smallest unit of length on the output device
<code>in</code>	An inch
<code>cm</code>	A centimeter
<code>mm</code>	A millimeter
<code>pt</code>	A point, approximately 1/72 inch
<code>pc</code>	A pica, approximately 1/12 inch
<code>%</code>	A percent of the width or height of the parent element
<code>rem</code>	A relative unit basing its size relative to the size in the root (html) element
<code>fr</code>	A fractional unit that expands or contracts the size of grid tracks based on the available space within the grid

(Continues)

**Table C–6**  
(Continued):  
CSS units of  
measurement

Unit	Description
xx-small	Keyword representing an extremely small font size
x-small	Keyword representing a very small font size
small	Keyword representing a small font size
vw	A percentage of the viewport width
vh	A percentage of the viewport height
vmin	The smaller value between vw and vh
medium	Keyword representing a medium-sized font
large	Keyword representing a large font
x-large	Keyword representing a very large font
xx-large	Keyword representing an extremely large font
<b>Angle</b>	<b>Units of Angles</b>
deg	The angle in degrees
grad	The angle in gradients
rad	The angle in radians
turns	Number of complete turns
<b>Time</b>	<b>Units of Time</b>
ms	Time in milliseconds
s	Time in seconds
<b>Frequency</b>	<b>Units of Frequency</b>
hz	The frequency in hertz
khz	The frequency in kilohertz

## Attributes and Values

Table C–7 describes the attributes and values for different types of elements. The attributes are grouped into categories to help you locate the features relevant to your particular design task.

**Table C–7:**  
Attributes and values

Attribute	Description
<b>Aural</b>	<b>Styles for Aural Browsers</b>
<code>cue: url(url1) url(url2)</code>	Adds a sound to an element: if a single value is present, the sound is played before and after the element; if two values are present, the first is played before and the second is played after
<code>cue-after: url(url)</code>	Specifies a sound to be played immediately after an element
<code>cue-before: url(url)</code>	Specifies a sound to be played immediately before an element
<code>elevation: location</code>	Defines the vertical location of the sound, where <i>location</i> is below, level, above, lower, higher, or an angle value
<code>mark: before after</code>	Adds a marker to an audio stream
<code>mark-before: text</code>	Marks an audio stream with the text <i>string</i>
<code>mark-after: text</code>	Marks an audio stream afterwards with the text <i>string</i>
<code>pause: time1 time2</code>	Adds a pause to an element: if a single value is present, the pause occurs before and after the element; if two values are present, the first pause occurs before and the second occurs after
<code>pause-after: time</code>	Adds a pause after an element
<code>pause-before: time</code>	Adds a pause before an element

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>phonemes: text</code>	Specifies the phonetic pronunciation for the audio stream
<code>pitch: value</code>	Defines the pitch of a speaking voice, where <i>value</i> is x-low, low, medium, high, x-high, or a frequency value
<code>pitch-range: value</code>	Defines the pitch range for a speaking voice, where <i>value</i> ranges from 0 to 100; a low pitch range results in a monotone voice, whereas a high pitch range sounds very animated
<code>play-during: url(url) mix repeat type</code>	Defines a sound to be played behind an element, where <i>url</i> is the URL of the sound file; <i>mix</i> overlays the sound file with the sound of the parent element; <i>repeat</i> causes the sound to be repeated, filling up the available time; and <i>type</i> is <i>auto</i> to play the sound only once, <i>none</i> to play nothing but the sound file, or <i>inherit</i>
<code>rest: before after</code>	Specifies the rest-before and rest-after values for the audio
<code>rest-before: type</code>	Specifies a rest to be observed before speaking the content, where <i>type</i> is <i>none</i> , <i>x-weak</i> , <i>weak</i> , <i>medium</i> , <i>strong</i> , <i>x-strong</i> , or <i>inherit</i>
<code>rest-after: type</code>	Specifies a rest to be observed after speaking the content, where <i>type</i> is <i>none</i> , <i>x-weak</i> , <i>weak</i> , <i>medium</i> , <i>strong</i> , <i>x-strong</i> , or <i>inherit</i>
<code>richness: value</code>	Specifies the richness of the speaking voice, where <i>value</i> ranges from 0 to 100; a low value indicates a softer voice, whereas a high value indicates a brighter voice
<code>speak: type</code>	Defines how element content is to be spoken, where <i>type</i> is <i>normal</i> (for normal punctuation rules), <i>spell-out</i> (to pronounce one character at a time), <i>none</i> (to suppress the aural rendering), or <i>inherit</i>
<code>voice-balance: type</code>	Specifies the voice balance, where <i>type</i> is <i>left</i> , <i>center</i> , <i>right</i> , <i>leftwards</i> , <i>rightwards</i> , <i>inherit</i> , or a <i>number</i>
<code>voice-duration: time</code>	Specifies the duration of the voice
<code>voice-family: text</code>	Defines the name of the speaking voice, where <i>text</i> is <i>male</i> , <i>female</i> , <i>child</i> , or a text string indicating a specific speaking voice
<code>voice-rate: type</code>	Specifies the voice rate, where <i>type</i> is <i>x-slow</i> , <i>slow</i> , <i>medium</i> , <i>fast</i> , <i>x-fast</i> , <i>inherit</i> , or a <i>percentage</i>
<code>voice-pitch: type</code>	Specifies the voice pitch, where <i>type</i> is <i>x-low</i> , <i>low</i> , <i>medium</i> , <i>high</i> , <i>x-high</i> , <i>inherit</i> , a <i>number</i> , or a <i>percentage</i>
<code>voice-pitch-range: type</code>	Specifies the voice pitch range, where <i>type</i> is <i>x-low</i> , <i>low</i> , <i>medium</i> , <i>high</i> , <i>x-high</i> , <i>inherit</i> , or a <i>number</i>
<code>voice-stress: type</code>	Specifies the voice stress, where <i>type</i> is <i>strong</i> , <i>moderate</i> , <i>none</i> , <i>reduced</i> , or <i>inherit</i>
<code>voice-volume: type</code>	Specifies the voice volume, where <i>type</i> is <i>silent</i> , <i>x-soft</i> , <i>soft</i> , <i>medium</i> , <i>loud</i> , <i>x-loud</i> , <i>inherit</i> , a <i>number</i> , or a <i>percentage</i>
<b>Backgrounds</b>	<b>Styles Applied to an Element's Background</b>
<code>background: color url(url) repeat attachment position</code>	Defines the background of the element, where <i>color</i> is a CSS color name or value, <i>url</i> is the location of an image file, <i>repeat</i> defines how the background image should be repeated, <i>attachment</i> defines how the background image should be attached, and <i>position</i> defines the position of the background image

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>background: url(url) position size repeat attachment origin clip color</code>	Defines the background of the element, where <i>url</i> is the location of the image file, <i>position</i> is the position of the image, <i>size</i> is the size of the image, <i>repeat</i> defines how the image should be repeated, <i>attachment</i> defines how the image should be attached, <i>origin</i> defines the origin of the image, <i>clip</i> defines the location of the clipping box, and <i>color</i> defines the background color
<code>background-attachment: type</code>	Specifies how the background image is attached, where <i>type</i> is <code>inherit</code> , <code>scroll</code> (move the image with the page content), or <code>fixed</code> (fix the image and not scroll)
<code>background-clip: location</code>	Specifies the location of the background box, where <i>location</i> is <code>border-box</code> , <code>padding-box</code> , <code>content-box</code> , <code>no-clip</code> , a unit of <i>length</i> , or a <i>percentage</i>
<code>background-color: color</code>	Defines the color of the background, where <i>color</i> is a CSS color name or value; the keyword <code>inherit</code> can be used to inherit the background color of the parent element, or <code>transparent</code> can be used to allow the parent element background image to show through
<code>background-image: url(url)</code>	Specifies the image file used for the element's background, where <i>url</i> is the URL of the image file
<code>background-origin: box</code>	Specifies the origin of the background image, where <i>box</i> is <code>border-box</code> , <code>padding-box</code> , or <code>content-box</code>
<code>background-position: x y</code>	Sets the position of a background image, where <i>x</i> is the horizontal location in pixels, as a percentage of the width of the parent element, or the keyword <code>left</code> , <code>center</code> , or <code>right</code> , <i>y</i> is the vertical location in pixels, as a percentage of the height and of the parent element, or the keyword <code>top</code> , <code>center</code> , or <code>bottom</code>
<code>background-repeat: type</code>	Defines the method for repeating the background image, where <i>type</i> is <code>no-repeat</code> , <code>repeat</code> (to tile the image in both directions), <code>repeat-x</code> (to tile the image in the horizontal direction only), or <code>repeat-y</code> (to tile the image in the vertical direction only)
<code>background-size: size</code>	Sets the size of the background image, where <i>size</i> is <code>auto</code> , <code>cover</code> , <code>contain</code> , a <i>length</i> , or a <i>percentage</i>
Block-Level Styles	Styles Applied to Block-Level Elements
<code>border: length style color</code>	Defines the border style of the element, where <i>length</i> is the border width, <i>style</i> is the border design, and <i>color</i> is the border color
<code>border-bottom: length style color</code>	Defines the border style of the bottom edge of the element
<code>border-left: length style color</code>	Defines the border style of the left edge of the element
<code>border-right: length style color</code>	Defines the border style of the right edge of the element
<code>border-top: length style color</code>	Defines the border style of the top edge of the element
<code>border-color: color</code>	Defines the color applied to the element's border using a CSS color unit
<code>border-bottom-color: color</code>	Defines the color applied to the bottom edge of the element
<code>border-left-color: color</code>	Defines the color applied to the left edge of the element
<code>border-right-color: color</code>	Defines the color applied to the right edge of the element
<code>border-top-color: color</code>	Defines the color applied to the top edge of the element

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>border-image: url(url) size</code>	Sets an image file for the border, where <i>url</i> is the location of the image file and <i>size</i> is <i>stretch</i> , <i>repeat</i> , <i>round</i> , <i>none</i> , a <i>length</i> , or a <i>percentage</i>
<code>border-style: style</code>	Specifies the design of the element's border where <i>style</i> is <i>dashed</i> , <i>dotted</i> , <i>double</i> , <i>groove</i> , <i>inset</i> , <i>none</i> , <i>outset</i> , <i>ridge</i> , or <i>solid</i>
<code>border-style-bottom: style</code>	Specifies the design of the element's bottom edge
<code>border-style-left: style</code>	Specifies the design of the element's left edge
<code>border-style-right: style</code>	Specifies the design of the element's right edge
<code>border-style-top: style</code>	Specifies the design of the element's top edge
<code>border-radius: tr br bl tl</code>	Specifies the radius of the border corners in pixels, where <i>tr</i> is the top-right corner, <i>br</i> is the bottom-right corner, <i>bl</i> is the bottom-left corner, and <i>tl</i> is the top-left corner
<code>border-top-right-radius: horiz vert</code>	Specifies the horizontal and vertical radius for the top-right corner
<code>border-bottom-right-radius: horiz vert</code>	Specifies the horizontal and vertical radius for the bottom-right corner
<code>border-bottom-left-radius: horiz vert</code>	Specifies the horizontal and vertical radius for the bottom-left corner
<code>border-top-left-radius: horiz vert</code>	Specifies the horizontal and vertical radius for the top-left corner
<code>border-width: length</code>	Defines the width of the element's border, in a unit of measure or using the keyword <i>"thick"</i> , <i>"medium"</i> , or <i>"thin"</i>
<code>border-width-bottom: length</code>	Defines the width of the element's bottom edge
<code>border-width-left: length</code>	Defines the width of the element's left edge
<code>border-width-right: length</code>	Defines the width of the element's right edge
<code>border-width-top: length</code>	Defines the width of the element's top edge
<code>box-shadow: top right bottom left color</code>	Adds a box shadow, where <i>top</i> , <i>right</i> , <i>bottom</i> , and <i>left</i> set the width of the shadow and <i>color</i> sets the shadow color
<code>margin: top right bottom left</code>	Defines the size of the margins around the top, right, bottom, and left edges of the element, in one of the CSS units of length
<code>margin-bottom: length</code>	Defines the size of the element's bottom margin
<code>margin-left: length</code>	Defines the size of the element's left margin
<code>margin-right: length</code>	Defines the size of the element's right margin
<code>margin-top: length</code>	Defines the size of the element's top margin
<code>padding: top right bottom left</code>	Defines the size of the padding space within the top, right, bottom, and left edges of the element, in one of the CSS units of length
<code>padding-bottom: length</code>	Defines the size of the element's bottom padding
<code>padding-left: length</code>	Defines the size of the element's left padding
<code>padding-right: length</code>	Defines the size of the element's right padding
<code>padding-top: length</code>	Defines the size of the element's top padding
<b>Browser</b>	<b>Styles to Affect the Appearance of the Browser</b>
<code>appearance: type</code>	Specifies that an element should be displayed like a standard browser object, where <i>type</i> is <i>normal</i> , <i>button</i> , <i>push-button</i> , <i>hyperlink</i> , <i>radio-button</i> , <i>checkbox</i> , <i>pop-up-menu</i> , <i>list-menu</i> , <i>radio-group</i> , <i>checkbox-group</i> , <i>field</i> , or <i>password</i>

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>cursor: type</code>	Defines the cursor image used, where <i>type</i> is n-resize, ne-resize, e-resize, se-resize, s-resize, sw-resize, w-resize, nw-resize, crosshair, pointer, move, text, wait, help, auto, default, inherit, or a URL pointing to an image file
<code>icon: value</code>	Specifies that an element should be styled with an iconic equivalent, where <i>value</i> is auto, a <i>url</i> , or inherit
<code>nav-down: position</code>	Specifies where to navigate using the arrow-down and arrow-up navigation keys, where <i>position</i> is auto, a <i>target-name</i> , or an element <i>id</i>
<code>nav-index: value</code>	Specifies the tabbing order, where <i>value</i> is auto, inherit, or a <i>number</i>
<code>nav-left: position</code>	Specifies where to navigate using the arrow-left and arrow-right navigation keys, where <i>position</i> is auto, a <i>target-name</i> , or an element <i>id</i>
<code>nav-right: position</code>	Specifies where to navigate using the arrow-left and arrow-right navigation keys, where <i>position</i> is auto, a <i>target-name</i> , or an element <i>id</i>
<code>nav-up: position</code>	Specifies where to navigate using the arrow-down and arrow-up navigation keys, where <i>position</i> is auto, a <i>target-name</i> , or an element <i>id</i>
<code>resize: type</code>	Specifies whether an element is resizable and in what direction, where <i>type</i> is none, both, horizontal, vertical, or inherit
Column	Styles for Multi-Column Layouts
<code>column-count: value</code>	Specifies the number of columns, where <i>value</i> is the column number or auto
<code>column-fill: type</code>	Specifies whether to balance the content of the columns, where <i>type</i> is auto or balance
<code>column-gap: value</code>	Sets the size of the gap between the columns, where <i>value</i> is the width of the gap or auto
<code>column-rule: width style color</code>	Adds a dividing line between the columns, where <i>width</i> , <i>style</i> , and <i>color</i> define the style of the line
<code>column-rule-color: color</code>	Defines the color of the dividing line
<code>column-rule-style: style</code>	Defines the border style of the dividing line
<code>column-rule-width: width</code>	Sets the width of the dividing line
<code>columns: width count</code>	Sets the width and number of columns in the multi-column layout
<code>column-span: value</code>	Sets the element to span across the columns, where <i>span</i> is 1 or all
<code>column-width: value</code>	Sets the width of the columns
Content	Styles to Generate Content
<code>bookmark-label: value</code>	Specifies the label of a bookmark, where <i>value</i> is content, an <i>attribute</i> , or a text <i>string</i>
<code>bookmark-level: value</code>	Specifies the bookmark level, where <i>value</i> is an <i>integer</i> or none
<code>bookmark-target: value</code>	Specifies the target of a bookmark link, where <i>value</i> is self, a <i>url</i> , or an <i>attribute</i>
<code>border-length: value</code>	Describes a way of separating footnotes from other content, where <i>value</i> is a <i>length</i> or auto
<code>content: text</code>	Generates a text string to attach to the content of the element
<code>content: attr(attr)</code>	Returns the value of the <i>attr</i> attribute from the element

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>content: close-quote</code>	Attaches a close quote using the characters specified in the quotes style
<code>content: counter(text)</code>	Generates a counter using the text string <i>text</i> attached to the content (most often used with list items)
<code>content: counters(text)</code>	Generates a string of counters using the comma-separated text string <i>text</i> attached to the content (most often used with list items)
<code>content: no-close-quote</code>	Prevents the attachment of a close quote to an element
<code>content: no-open-quote</code>	Prevents the attachment of an open quote to an element
<code>content: open-quote</code>	Attaches an open quote using the characters specified in the quotes style
<code>content: url(url)</code>	Attaches the content of an external file indicated in the <i>url</i> to the element
<code>counter-increment: id integer</code>	Defines the element to be automatically incremented and the amount by which it is to be incremented, where <i>id</i> is an identifier of the element and <i>integer</i> defines by how much
<code>counter-reset: id integer</code>	Defines the element whose counter is to be reset and the amount by which it is to be reset, where <i>id</i> is an identifier of the element and <i>integer</i> defines by how much
<code>crop: value</code>	Allows a replaced element to be a rectangular area of an object instead of the whole object, where <i>value</i> is a shape or auto
<code>hyphenate-after: value</code>	Specifies the minimum number of characters after the hyphenation character, where <i>value</i> is an <i>integer</i> or auto
<code>hyphenate-before: value</code>	Specifies the minimum number of characters before the hyphenation character, where <i>value</i> is an <i>integer</i> or auto
<code>hyphenate-character: string</code>	Specifies the hyphenation character, <i>string</i>
<code>hyphenate-line: value</code>	Specifies the maximum number of hyphenated lines, where <i>value</i> is an <i>integer</i> or no-limit
<code>hyphenate-resource: url(url)</code>	Provides an external resource at <i>url</i> that defines hyphenation points
<code>hyphens: type</code>	Defines the hyphenation property, where <i>type</i> is none, manual, or auto
<code>image-resolution: value</code>	Defines the image resolution, where <i>value</i> is normal, auto, or the dpi of the image
<code>marks: type</code>	Defines an editor's mark, where <i>type</i> is crop, cross, or none
<code>quotes: text1 text2</code>	Defines the text strings for the open quotes ( <i>text1</i> ) and the close quotes ( <i>text2</i> )
<code>string-set: values</code>	Accepts a comma-separated list of named strings, where <i>values</i> is the list of text strings
<code>text-replace: string1 string2</code>	Replaces <i>string1</i> with <i>string2</i> in the element content
Display Styles	Styles that Control the Display of the Element's Content
<code>box-sizing: type</code>	Specifies how the width and height properties should be interpreted for a block element where <i>type</i> is content-box, border-box, initial, or inherit
<code>clip: rect(top, right, bottom, left)</code>	Defines what portion of the content is displayed, where <i>top</i> , <i>right</i> , <i>bottom</i> , and <i>left</i> are distances of the top, right, bottom, and left edges from the element's top-left corner; use a value of auto to allow the browser to determine the clipping region

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>display: type</code>	Specifies the display type of the element, where <i>type</i> is one of the following: block, inline, inline-block, inherit, flex, list-item, none, run-in, table, inline-table, table-caption, table-column, table-cell, table-column-group, table-header-group, table-footer-group, table-row, or table-row-group
<code>flex: grow shrink basis</code>	Sets the growth rate, shrink rate, and basis size for items within a flexbox
<code>flex-basis: length</code>	Sets the basis size for items within a flex box
<code>flex-direction: direction</code>	Sets the direction of items within a flexbox where <i>direction</i> is row, row-reverse, column, column-reverse, initial, or inherit
<code>flex-flow: direction wrap</code>	Sets the flow of items within a flexbox where <i>direction</i> is the flex direction and <i>wrap</i> indicates whether items are wrapped to a new line
<code>flex-grow: value</code>	Sets the growth rate of a flex item where <i>value</i> is a numeric value
<code>flex-shrink: value</code>	Sets the shrink rate of a flex item where <i>value</i> is a numeric value
<code>flex-wrap: type</code>	Sets whether flex items wrap to a new line where <i>type</i> is nowrap, wrap, wrap-reverse, initial, or inherit
<code>height: length</code>	Specifies the height of the element in one of the CSS units of length
<code>min-height: length</code>	Specifies the minimum height of the element
<code>min-width: length</code>	Specifies the minimum width of the element
<code>max-height: length</code>	Specifies the maximum height of the element
<code>max-width: length</code>	Specifies the maximum width of the element
<code>overflow: type</code>	Instructs the browser how to handle content that overflows the dimensions of the element, where <i>type</i> is auto, inherit, visible, hidden, or scroll
<code>overflow-style: type</code>	Specifies the preferred scrolling method for overflow content, where <i>type</i> is auto, marquee-line, or marquee-block
<code>visibility: type</code>	Defines the element's visibility, where <i>type</i> is hidden, visible, or inherit
<code>width: length</code>	Specifies the width of the element in one of the CSS units of length
<b>Fonts and Text</b>	<b>Styles that Format the Appearance of Fonts and Text</b>
<code>color: color</code>	Specifies the color of the element's foreground (usually the font color)
<code>direction: type</code>	Specifies the direction of the text flow, where <i>type</i> equals ltr, rtl, or inherit
<code>font: style variant weight size/line-height family</code>	Defines the appearance of the font, where <i>style</i> is the font's style, <i>variant</i> is the font variant, <i>weight</i> is the weight of the font, <i>size</i> is the size of the font, <i>line-height</i> is the height of the lines, and <i>family</i> is the font face; the only required attributes are <i>size</i> and <i>family</i>
<code>font-effect: type</code>	Controls the special effect applied to glyphs where <i>type</i> is none, emboss, engrave, or outline
<code>font-emphasize: emphasize position</code>	Sets the style of the font emphasis and decoration
<code>font-emphasize-position: position</code>	Sets the font emphasis position, where <i>position</i> is before or after
<code>font-emphasize-style: style</code>	Sets the emphasis style, where <i>style</i> is none, accent, dot, circle, or disc

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
font-family: <i>family</i>	Specifies the font face used to display text, where <i>family</i> is sans-serif, serif, fantasy, monospace, cursive, or the name of an installed font
font-size: <i>value</i>	Specifies the size of the font in one of the CSS units of length
font-size-adjust: <i>value</i>	Specifies the aspect <i>value</i> (which is the ratio of the font size to the font's ex unit height)
font-smooth: <i>type</i>	Specifies the type of font smoothing, where <i>type</i> is auto, never, always, or a specified size
font-stretch: <i>type</i>	Expands or contracts the font, where <i>type</i> is narrower, wider, ultra-condensed, extra-condensed, condensed, semi-condensed, normal, semi-expanded, extra-expanded, or ultra-expanded
font-style: <i>type</i>	Specifies a style applied to the font, where <i>type</i> is normal, italic, or oblique
font-variant: <i>type</i>	Specifies a variant of the font, where <i>type</i> is inherit, normal, or small-caps
font-weight: <i>value</i>	Defines the weight of the font, where <i>value</i> is 100, 200, 300, 400, 500, 600, 700, 800, 900, normal, lighter, bolder, or bold
hanging-punctuation: <i>type</i>	Determines whether a punctuation mark may be placed outside the text box, where <i>type</i> is none, start, end, or end-edge
letter-spacing: <i>value</i>	Specifies the space between letters, where <i>value</i> is a unit of length or the keyword "normal"
line-height: <i>value</i>	Specifies the height of the lines, where <i>value</i> is a unit of length or the keyword "normal"
punctuation-trim: <i>type</i>	Determines whether or not a full-width punctuation character should be trimmed if it appears at the start or end of a line, where <i>type</i> is none, start, end, or adjacent
text-align: <i>type</i>	Specifies the horizontal alignment of text within the element, where <i>type</i> is inherit, left, right, center, or justify
text-align-last: <i>type</i>	Specifies how the last line of a block is aligned for fully justified text, where <i>type</i> is start, end, left, right, center, or justify
text-decoration: <i>type</i>	Specifies the decoration applied to the text, where <i>type</i> is blink, line-through, none, overline, or underline
text-emphasis: <i>type</i> <i>location</i>	Specifies the emphasis applied to the text, where <i>type</i> is none, accent, dot, circle, or disk and <i>location</i> is before or after
text-indent: <i>length</i>	Specifies the amount of indentation in the first line of the text, where <i>length</i> is a CSS unit of length
text-justify: <i>type</i>	Specifies the justification method applied to the text, where <i>type</i> is auto, inter-word, inter-ideograph, inter-cluster, distribute, kashida, or tibetan
text-outline: <i>value1</i> <i>value2</i>	Specifies a text outline, where <i>value1</i> represents the outline thickness and <i>value2</i> represents the optional blur radius
text-shadow: <i>color</i> <i>x</i> <i>y</i> <i>blur</i>	Applies a shadow effect to the text, where <i>color</i> is the color of the shadow, <i>x</i> is the horizontal offset in pixels, <i>y</i> is the vertical offset in pixels, and <i>blur</i> is the size of the blur radius (optional); multiple shadows can be added with shadow effects separated by commas
text-transform: <i>type</i>	Defines a transformation applied to the text, where <i>type</i> is capitalize, lowercase, none, or uppercase
text-wrap: <i>type</i>	Specifies the type of text wrapping, where <i>type</i> is normal, unrestricted, none, or suppress

(Continues)

**Table C-7**  
**(Continued):**  
*Attributes and values*

Attribute	Description
unicode-bidi: <i>type</i>	Allows text that flows left-to-right to be mixed with text that flows right-to-left, where <i>type</i> is normal, embed, bidi-override, or inherit
vertical-align: <i>type</i>	Specifies how to vertically align the text with the surrounding content, where <i>type</i> is baseline, middle, top, bottom, text-top, text-bottom, super, sub, or one of the CSS units of length
white-space: <i>type</i>	Specifies the handling of white space (blank spaces, tabs, and new lines), where <i>type</i> is inherit, normal, pre (to treat the text as preformatted text), or nowrap (to prevent line-wrapping)
white-space-collapse: <i>type</i>	Defines how white space inside the element is collapsed, where <i>type</i> is preserve, collapse, preserve-breaks, or discard
word-break: <i>type</i>	Controls line-breaks within words, where <i>type</i> is normal, keep-all, loose, break-strict, or break-all
word-spacing: <i>length</i>	Specifies the amount of space between words in the text, where <i>length</i> is either a CSS unit of length or the keyword "normal" to use normal word spacing
<b>Layout</b>	<b>Styles that Define the Layout of Elements</b>
bottom: <i>y</i>	Defines the vertical offset of the element's bottom edge, where <i>y</i> is either a CSS unit of length or the keyword "auto" or "inherit"
clear: <i>type</i>	Places the element only after the specified margin is clear of floating elements, where <i>type</i> is inherit, none, left, right, or both
float: <i>type</i>	Floats the element on the specified margin with subsequent content wrapping around the element, where <i>type</i> is inherit, none, left, right, or both
float-offset: <i>horiz vert</i>	Pushes floated elements in the opposite direction of where they would have been, where <i>horiz</i> is the horizontal displacement and <i>vert</i> is the vertical displacement
left: <i>x</i>	Defines the horizontal offset of the element's left edge, where <i>x</i> is either a CSS unit of length or the keyword "auto" or "inherit"
move-to: <i>type</i>	Causes the element to be removed from the page flow and reinserted at later point in the document, where <i>type</i> is normal, here, or an <i>id</i> value
position: <i>type</i>	Defines how the element is positioned on the page, where <i>type</i> is absolute, relative, fixed, static, and inherit
right: <i>x</i>	Defines the horizontal offset of the element's right edge, where <i>x</i> is either a CSS unit of length or the keyword "auto" or "inherit"
top: <i>y</i>	Defines the vertical offset of the element's top edge, where <i>y</i> is a CSS unit of length or the keyword "auto" or "inherit"
z-index: <i>value</i>	Defines how overlapping elements are stacked, where <i>value</i> is either the stacking number (elements with higher stacking numbers are placed on top) or the keyword "auto" to allow the browser to determine the stacking order
<b>Grids</b>	<b>Styles for CSS Grids</b>
align-content: <i>placement</i> ;	Sets the vertical alignment of the grid within its container, where <i>placement</i> is start, end, center, space-around, space-between, or space-evenly
align-items: <i>placement</i> ;	Sets the vertical placement of content within a grid area or cell, where <i>placement</i> is stretch, start, end, or center
display: grid	Sets the display property of a page element to a block-level grid
display: inline-grid	Sets the display property of a page element to an inline grid

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>grid-area: area;</code>	Assigns items to areas within the grid where <i>area</i> is the name of an area defined in the <code>grid-template-areas</code> property
<code>grid-area: row-start/col-start/row-end/col-end;</code>	Places items within a grid area where <i>row-start</i> , <i>col-start</i> , <i>row-end</i> , and <i>col-end</i> are the starting and ending gridline numbers from the grid's rows and columns
<code>grid-auto-columns: width1 width2 ...;</code>	Implicitly sets the size of the grid columns where <i>width1</i> , <i>width2</i> , etc. are the widths of the columns with the sequence repeating with each new set of columns added by the browser
<code>grid-auto-rows: height1 height2 ...;</code>	Implicitly sets the size of the grid rows where <i>height1</i> , <i>height2</i> , etc. are the heights of the rows with the sequence repeating with each new set of rows added by the browser
<code>grid-column: span value;</code>	Spans a grid item the number of columns specified by <i>value</i>
<code>grid-column: start/end;</code>	Places or sizes a grid item between the <i>start</i> and <i>end</i> column line numbers
<code>grid-column-end: integer;</code>	Places an item within a grid where <i>integer</i> is the column line number for ending the item
<code>grid-column-gap: value;</code>	Sets the gap between grid columns where <i>value</i> is the size of the column gap
<code>grid-column-start: integer;</code>	Places an item within a grid where <i>integer</i> is the column line number for starting the item
<code>grid-gap: row column;</code>	Sets the space between grid rows and columns where <i>row</i> is the internal space between grid rows and <i>column</i> is the internal space between grid columns
<code>grid-row: span value;</code>	Spans a grid item the number of rows specified by <i>value</i>
<code>grid-row: start/end;</code>	Places or sizes a grid item between the <i>start</i> and <i>end</i> row line numbers
<code>grid-row-end: integer;</code>	Places an item within a grid where <i>integer</i> is the row line number for ending the item
<code>grid-row-gap: value;</code>	Sets the gap between grid rows where <i>value</i> is the size of the row gap
<code>grid-row-start: integer;</code>	Places an item within a grid where <i>integer</i> is the row line number for starting the item
<code>grid-template-areas: "row1"                           "row2"                           ...;</code>	Defines the areas within the grid where <i>row1</i> , <i>row2</i> , etc. are text strings containing the names of the areas for each row
<code>grid-template-columns: width1 width2 ...;</code>	Sets the number and size of the grid columns where <i>width1</i> , <i>width2</i> , etc. defines the width of the columns or tracks within the grid
<code>grid-template-rows: height1 height2 ...;</code>	Sets the number and size of the grid rows where <i>height1</i> , <i>height2</i> , etc. defines the height of the rows or tracks within the grid
<code>justify-content: placement;</code>	Sets the horizontal alignment of the grid within its container, where <i>placement</i> is <i>start</i> , <i>end</i> , <i>center</i> , <i>space-around</i> , <i>space-between</i> , or <i>space-evenly</i>
<code>justify-items: placement;</code>	Sets the horizontal placement of content within a grid area or cell, where <i>placement</i> is <i>stretch</i> , <i>start</i> , <i>end</i> , or <i>center</i>
<code>minmax(min, max)</code>	A function that defines a grid track size where <i>min</i> is the minimum track size for a row and column and <i>max</i> is the maximum
<code>repeat(repeat, tracks)</code>	A function that repeats the size of grid tracks, where <i>repeat</i> is the number of repetitions of the tracks specified in <i>tracks</i>

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<b>Lists</b>	<b>Styles that Format Lists</b>
<code>list-style: type image position</code>	Defines the appearance of a list item, where <i>type</i> is the marker type, <i>image</i> is the URL of the location of an image file used for the marker, and <i>position</i> is the position of the marker
<code>list-style-image: url(url)</code>	Defines image used for the list marker, where <i>url</i> is the location of the image file
<code>list-style-type: type</code>	Defines the marker type used in the list, where <i>type</i> is disc, circle, square, decimal, decimal-leading-zero, lower-roman, upper-roman, lower-alpha, upper-alpha, or none
<code>list-style-position: type</code>	Defines the location of the list marker, where <i>type</i> is inside or outside
<code>marker-offset: length</code>	Defines the distance between the marker and the enclosing list box, where <i>length</i> is either a CSS unit of length or the keyword "auto" or "inherit"
<b>Outlines</b>	<b>Styles to Create and Format Outlines</b>
<code>outline: color style width</code>	Creates an outline around the element content, where <i>color</i> is the color of the outline, <i>style</i> is the outline style, and <i>width</i> is the width of the outline
<code>outline-color: color</code>	Defines the color of the outline
<code>outline-offset: value</code>	Offsets the outline from the element border, where <i>value</i> is the length of the offset
<code>outline-style: type</code>	Defines the style of the outline, where <i>type</i> is dashed, dotted, double, groove, inset, none, outset, ridge, solid, or inherit
<code>outline-width: length</code>	Defines the width of the outline, where <i>length</i> is expressed in a CSS unit of length
<b>Printing</b>	<b>Styles for Printed Output</b>
<code>fit: type</code>	Indicates how to scale an element to fit on the page, where <i>type</i> is fill, hidden, meet, or slice
<code>fit-position: vertical horizontal</code>	Sets the position of the element in the page, where <i>vertical</i> is top, center, or bottom; <i>horizontal</i> is left or right; or either or both positions are auto, a <i>value</i> , or a <i>percentage</i>
<code>page: label</code>	Specifies the page design to apply, where <i>label</i> is a page design created with the @page rule
<code>page-break-after: type</code>	Defines how to control page breaks after the element, where <i>type</i> is avoid (to avoid page breaks), left (to insert a page break until a left page is displayed), right (to insert a page break until a right page is displayed), always (to always insert a page break), auto, or inherit
<code>page-break-before: type</code>	Defines how to control page breaks before the element, where <i>type</i> is avoid left, always, auto, or inherit
<code>page-break-inside: type</code>	Defines how to control page breaks within the element, where <i>type</i> is avoid, auto, or inherit
<code>marks: type</code>	Defines how to display crop marks, where <i>type</i> is crop, cross, none, or inherit
<code>size: width height orientation</code>	Defines the size of the page, where <i>width</i> and <i>height</i> are the width and the height of the page and <i>orientation</i> is the orientation of the page (portrait or landscape)

(Continues)

**Table C-7**  
**(Continued):**  
Attributes and values

Attribute	Description
<code>orphans: value</code>	Defines how to handle orphaned text, where <i>value</i> is the number of lines that must appear within the element before a page break is inserted
<code>widows: value</code>	Defines how to handle widowed text, where <i>value</i> is the number of lines that must appear within the element after a page break is inserted
Special Effects	Styles to Create Special Visual Effects
<code>animation: name duration timing delay iteration direction</code>	Applies an animation with the specified <i>duration</i> , <i>timing</i> , <i>delay</i> , <i>iteration</i> , and <i>direction</i>
<code>animation-delay: time</code>	Specifies the animation delay <i>time</i> in milliseconds
<code>animation-direction: direction</code>	Specifies the animation direction, where <i>direction</i> is normal or alternate
<code>animation-duration: time</code>	Specifies the duration of the animation <i>time</i> in milliseconds
<code>animation-iteration-count: value</code>	Specifies the number of iterations in the animation
<code>animation-name: text</code>	Provides a name for the animation
<code>animation-play-state: type</code>	Specifies the playing state of the animation, where <i>type</i> is running or paused
<code>animation-timing-function: function</code>	Provides the timing function of the animation, where <i>function</i> is ease, linear, ease-in, ease-out, ease-in-out, cubic-Bezier, or a <i>number</i>
<code>backface-visibility: visible</code>	Specifies whether the back side of an element is visible during a transformation, where <i>visible</i> is hidden or visible
<code>image-orientation: angle</code>	Rotates the image by the specified <i>angle</i>
<code>marquee-direction: direction</code>	Specifies the direction of a marquee, where <i>direction</i> is forward or reverse
<code>marquee-play-count: value</code>	Specifies how often to loop through the marquee
<code>marquee-speed: speed</code>	Specifies the speed of the marquee, where <i>speed</i> is slow, normal, or fast
<code>marquee-style: type</code>	Specifies the marquee style, where <i>type</i> is scroll, slide, or alternate
<code>opacity: alpha</code>	Sets opacity of the element, ranging from 0 (transparent) to 1 (opaque)
<code>perspective: value</code>	Applies a perspective transformation to the element, where <i>value</i> is the perspective length
<code>perspective-origin: origin</code>	Establishes the origin of the perspective property, where <i>origin</i> is left, center, right, top, bottom, or a <i>position</i> value
<code>rotation: angle</code>	Rotates the element by <i>angle</i>
<code>rotation-point: position</code>	Sets the location of the rotation point for the element
<code>transform: function</code>	Applies a 2D or a 3D transformation, where <i>function</i> provides the transformation parameters
<code>transform-origin: position</code>	Establishes the origin of the transformation of an element, where <i>position</i> is the position within the element
<code>transform-style: type</code>	Defines how nested elements are rendered in 3D space, where <i>type</i> is flat or preserve-3d

(Continues)

Attribute	Description
<code>transition: <i>property duration timing delay</i></code>	Defines a timed transition of an element, where <i>property</i> , <i>duration</i> , <i>timing</i> , and <i>delay</i> define the appearance and timing of the transition
<code>transition-delay: <i>time</i></code>	Sets the delay time of the transition in milliseconds
<code>transition-duration: <i>time</i></code>	Sets the duration time of the transition in milliseconds
<code>transition-property: <i>type</i></code>	Defines the name of the CSS property modified by the transition, where <i>type</i> is all or none
<code>transition-timing-function: <i>type</i></code>	Sets the timing function of the transition, where <i>type</i> is ease, linear, ease-in, ease-out, ease-in-out, cubic-Bezier, or a <i>number</i>
Tables	Styles to Format the Appearance of Tables
<code>border-collapse: <i>type</i></code>	Determines whether table cell borders are separate or collapsed into a single border, where <i>type</i> is separate, collapse, or inherit
<code>border-spacing: <i>length</i></code>	If separate borders are used for table cells, defines the distance between borders, where <i>length</i> is a CSS unit of length or inherit
<code>caption-side: <i>type</i></code>	Defines the position of the caption element, where <i>type</i> is bottom, left, right, top, or inherit
<code>empty-cells: <i>type</i></code>	If separate borders are used for table cells, defines whether to display borders for empty cells, where <i>type</i> is hide, show, or inherit
<code>table-layout: <i>type</i></code>	Defines the algorithm used for the table layout, where <i>type</i> is auto (to define the layout once all table cells have been read), fixed (to define the layout after the first table row has been read), or inherit

# Making the Web More Accessible

Studies indicate that about 20% of the population has some type of disability. Many of these disabilities do not affect an individual's ability to interact with the web. However, other disabilities can severely affect an individual's ability to participate in the web community. For example, on a news website, a blind user could not see the latest headlines. A deaf user would not be able to hear a news clip embedded in the site's main page. A user with motor disabilities might not be able to move a mouse pointer to activate important links featured on the site's home page.

Disabilities that inhibit an individual's ability to use the web fall into four main categories:

- **Visual disability:** A visual disability can include complete blindness, color-blindness, or an untreatable visual impairment.
- **Hearing disability:** A hearing disability can include complete deafness or the inability to distinguish sounds of certain frequencies.
- **Motor disability:** A motor disability can include the inability to use a mouse, to exhibit fine motor control, or to respond in a timely manner to computer prompts and queries.
- **Cognitive disability:** A cognitive disability can include a learning disability, attention deficit disorder, or the inability to focus on large amounts of information.

While the web includes some significant obstacles to full use by disabled people, it also offers the potential for contact with a great amount of information that is not otherwise cheaply or easily accessible. For example, before the web, in order to read a newspaper, a blind person was constrained by the expense of Braille printouts and audio tapes, as well as the limited availability of sighted people willing to read the news out loud. As a result, blind people would often only be able to read newspapers after the news was no longer new. The web, however, makes news available in an electronic format and in real-time. A blind user can use a browser that converts electronic text into speech, known as a **screen reader**, to read a newspaper website. Combined with the web, screen readers provide access to a broader array of information than was possible through Braille publications alone.

"The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."

— Tim Berners-Lee, W3C Director and inventor of the World Wide Web

## STARTING DATA FILES

There are no starting Data Files needed for this appendix.

In addition to screen readers, many other programs and devices—known collectively as **assistive technology** or **adaptive technology**—are available to enable people with different disabilities to use the web. The challenge for the web designer, then, is to create web pages that are accessible to everyone, including (and perhaps especially) to people with disabilities. In addition to being a design challenge, for some designers, web accessibility is the law.

## Working with Section 508 Guidelines

In 1973, Congress passed the Rehabilitation Act, which aimed to foster economic independence for people with disabilities. Congress amended the act in 1998 to reflect the latest changes in information technology. Part of the amendment, **Section 508**, requires that any electronic information developed, procured, maintained, or used by the federal government be accessible to people with disabilities. Because the web is one of the main sources of electronic information, Section 508 has had a profound impact on how web pages are designed and how web code is written. Note that the standards apply to federal websites, but not to private sector websites; however, if a site is provided under contract to a federal agency, the website or portion covered by the contract has to comply. Required or not, though, you should follow the Section 508 guidelines not only to make your website more accessible, but also to make your HTML code more consistent and reliable. The Section 508 guidelines are of interest not just to web designers who work for the federal government, but to all web designers.

The Section 508 guidelines encompass a wide range of topics, covering several types of disabilities. The part of Section 508 that impacts web design is sub-section 1194.22, titled

### § 1194.22 Web-based intranet and internet information and applications.

Within this section are 15 paragraphs, numbered (a) through (p), which describe how each facet of a website should be designed so as to maximize accessibility. Let's examine each of these paragraphs in detail.

## Graphics and Images

The first paragraph in sub-section 1194.22 deals with graphic images. The standard for the use of graphic images is that

### §1194.22 (a) A text equivalent for every nontext element shall be provided (e.g., via "alt", "longdesc", or in element content).

In other words, any graphic image that contains page content needs to include a text alternative to make the page accessible to visually impaired people. One of the simplest ways to do this is to use the `alt` attribute with every inline image that displays page content. For example, in Figure D–1, the `alt` attribute provides the text of a graphical logo for users who can't see the graphic.

Figure D–1

Using the alt attribute



Not every graphic image requires a text alternative. For example, a decorative image such as a bullet does not need a text equivalent. In those cases, you should include the `alt` attribute, but set its value to an empty text string. You should never neglect to include the `alt` attribute. If you are writing XHTML-compliant code, the `alt` attribute is required. In other cases, screen readers and other nonvisual browsers will recite the filename of a graphic image file if no value is specified for the `alt` attribute. Since the filename is usually of no interest to the end-user, this results in needless irritation.

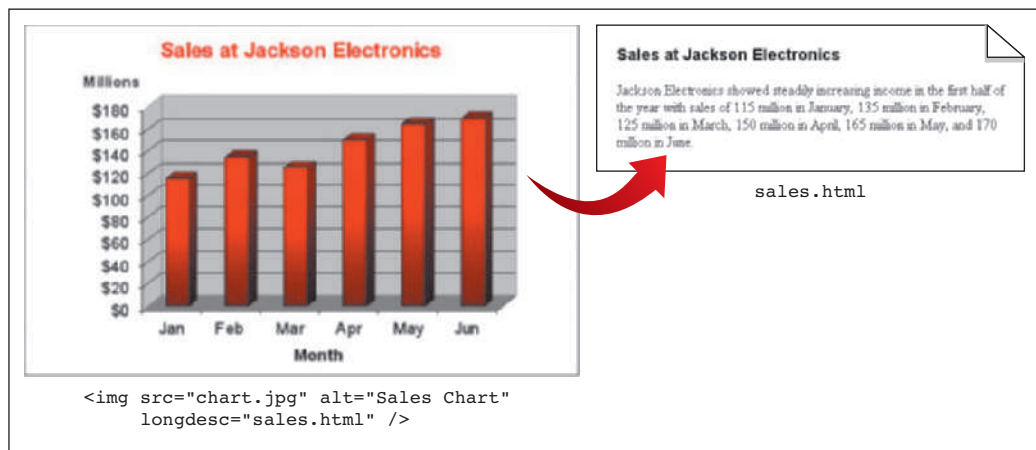
The `alt` attribute is best used for short descriptions that involve five words or fewer. It is less effective for images that require long descriptive text. You can instead link these images to a document containing a more detailed description. One way to do this is with the `longdesc` attribute, which uses the syntax

```

```

where `url` for the `longdesc` attribute points to a document containing a detailed description of the image. Figure D–2 shows an example that uses the `longdesc` attribute to point to a web page containing a detailed description of a sales chart.

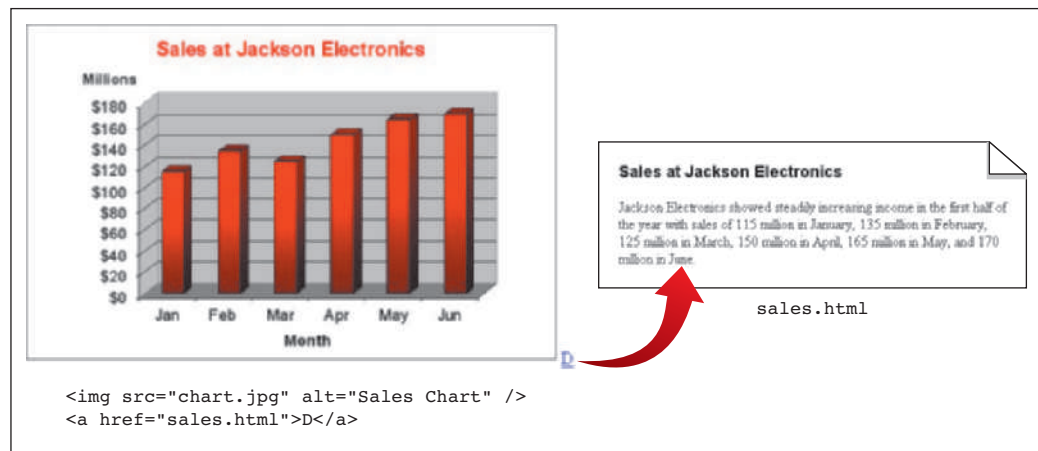
**Figure D–2** Using the `alt` attribute



In browsers that support the `longdesc` attribute, the attribute's value is presented as a link to the specified document. However, since many browsers do not yet support this attribute, many web designers currently use a D-link. A **D-link** is an unobtrusive "D" placed next to the image on the page, which is linked to an external document containing a fuller description of the image. Figure D–3 shows how the sales chart data can be presented using a D-link.

Figure D–3

## Using a D-link



To make your pages accessible to visually-impaired users, you will probably use a combination of alternative text and linked documents.

## Multimedia

Audio and video have become important ways of conveying information on the web. However, creators of multimedia presentations should also consider the needs of deaf users and users who are hard of hearing. The standard for multimedia accessibility is

**§1194.22 (b) Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.**

This means that any audio clip needs to be accompanied by a transcript of the audio's content, and any video clip needs to include closed captioning. Refer to your multimedia software's documentation on creating closed captioning and transcripts for your video and audio clips.

## Color

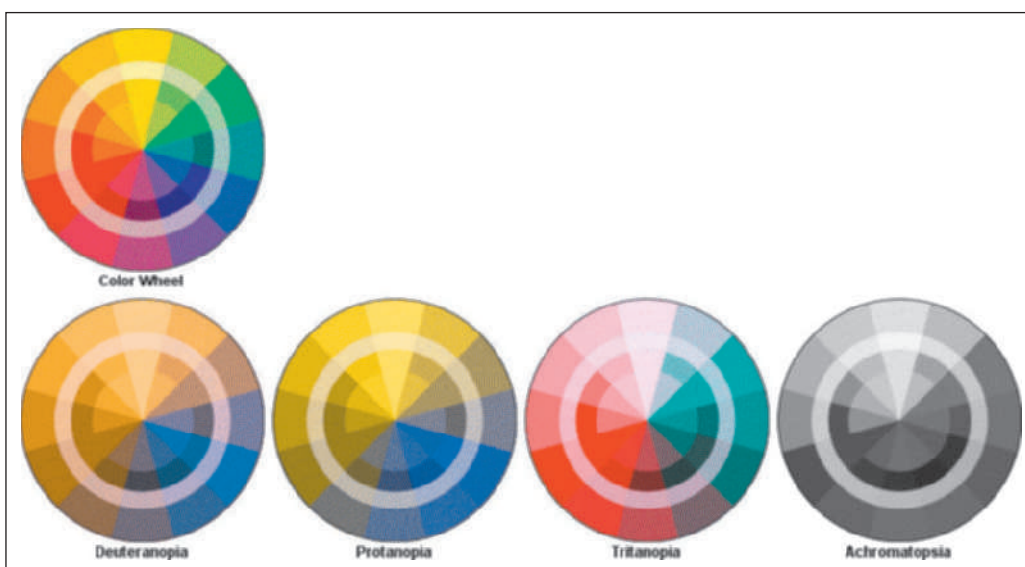
Color is useful for emphasis and conveying information, but when color becomes an essential part of the site's content, you run the risk of shutting out people who are color blind. For this reason the third Section 508 standard states that

**§1194.22 (c) Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup.**

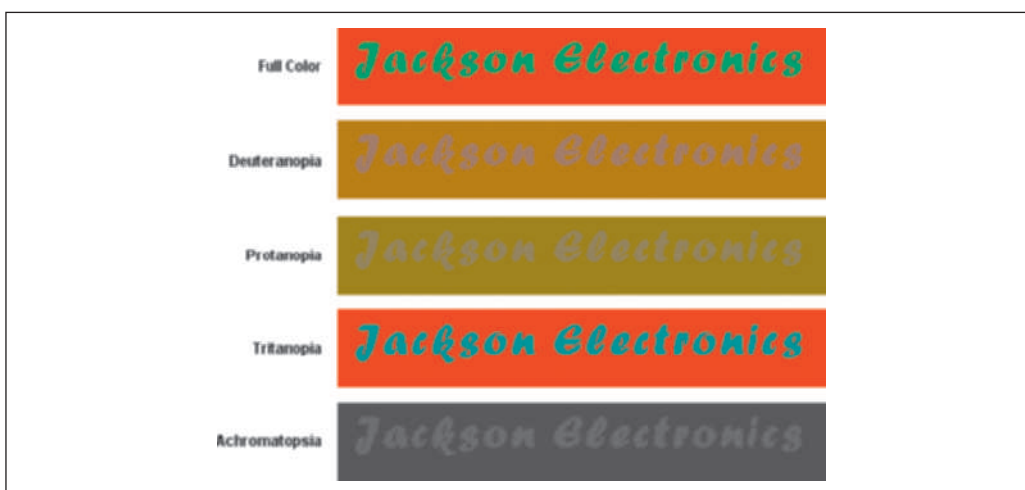
About 8% of men and 0.5% of women are afflicted with some type of color blindness. The most serious forms of color blindness are

- **deuteranopia:** an absence of green sensitivity; deuteranopia is one example of red-green color blindness, in which the colors red and green cannot be easily distinguished.
- **protanopia:** an absence of red sensitivity; protanopia is another example of red-green color blindness.
- **tritanopia:** an absence of blue sensitivity; people with tritanopia have much less loss of color sensitivity than other types of color blindness.
- **achromatopsia:** absence of any color sensitivity.

The most common form of serious color blindness is red-green color blindness. Figure D–4 shows how each type of serious color blindness would affect a person's view of a basic color wheel.

**Figure D–4** Types of color blindness

Color combinations that are easily readable for most people may be totally unreadable for users with certain types of color blindness. Figure D–5 demonstrates the accessibility problems that can occur with a graphical logo that contains green text on a red background. For people who have deuteranopia, protanopia, or achromatopsia, the logo is much more difficult to read.

**Figure D–5** The effect of color blindness on graphical content

To make your page more accessible to people with color blindness, you can do the following:

- Provide noncolor clues to access your page's content. For example, some web forms indicate required entry fields by displaying the field names in a red font. You can supplement this for color blind users by marking required fields with a red font *and* with an asterisk or other special symbol.
- Avoid explicit references to color. Don't instruct your users to click a red button in a web form when some users are unable to distinguish red from other colors.
- Avoid known areas of color difficulty. Since most color blindness involves red-green color blindness, you should avoid red and green text combinations.

- Use bright colors, which are the easiest for color blind users to distinguish.
- Provide a grayscale or black and white alternative for your color blind users, and be sure that your link to that page is easily viewable.

Several sites on the web include tools you can use to test your website for color blind accessibility. You can also load color palettes into your graphics software to see how your images will appear to users with different types of color blindness.

## Style Sheets

By controlling how a page is rendered in a browser, style sheets play an important role in making the web accessible to users with disabilities. Many browsers, such as Internet Explorer, allow a user to apply their own customized style sheet in place of the style sheet specified by a web page's designer. This is particularly useful for visually impaired users who need to display text in extra large fonts with a high contrast between the text and the background color (yellow text on a black background is a common color scheme for such users). In order to make your pages accessible to those users, Section 508 guidelines state that

**§1194.22 (d) Documents shall be organized so they are readable without requiring an associated style sheet.**

To test whether your site fulfills this guideline, you should view the site without the style sheet. Some browsers allow you to turn off style sheets; alternately, you can redirect a page to an empty style sheet. You should modify any page that is unreadable without its style sheet to conform with this guideline.

## Image Maps

Section 508 provides two standards that pertain to image maps:

**§1194.22 (e) Redundant text links shall be provided for each active region of a server-side image map.**

and

**§1194.22 (f) Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape.**

In other words, the *preferred* image map is a client-side image map, unless the map uses a shape that cannot be defined on the client side. Since client-side image maps allow for polygonal shapes, this should not be an issue; however if you must use a server-side image map, you need to provide a text alternative for each of the map's links. Because server-side image maps provide only map coordinates to the server, this text is necessary in order to provide link information that is accessible to blind or visually impaired users. Figure D–6 shows a server-side image map that satisfies the Section 508 guidelines by repeating the graphical links in the image map with text links placed below the image.

**Figure D–6** Making a server-side image map accessible



Client-side image maps do not have the same limitations as server-side maps because they allow you to specify alternate text for each hotspot within the map. For example, if the image map shown in Figure D–6 were a client-side map, you could make it accessible using the following HTML code:

```

<map name="links">
 <area shape="rect" href="home.html" alt="home"
 coords="21,69,123,117" />
 <area shape="rect" href="products.html" alt="products"
 coords="156,69,258,117" />
 <area shape="rect" href="stores.html" alt="stores"
 coords="302,69,404,117" />
 <area shape="rect" href="support.html" alt="support"
 coords="445,69,547,117" />
</map>
```

Screen readers or other nonvisual browsers use the value of the `alt` attribute within each `<area />` tag to give users access to each area. However, because some older browsers cannot work with the `alt` attribute in this way, you should also include the text alternative used for server-side image maps.

## Tables

Tables can present a challenge for disabled users, particularly for those who employ screen readers or other nonvisual browsers. To render a web page, these browsers employ a technique called **linearizing**, which processes web page content using a few general rules:

1. Convert all images to their alternative text.
2. Present the contents of each table one cell at a time, working from left to right across each row before moving down to the next row.
3. If a cell contains a nested table, that table is linearized before proceeding to the next cell.

Figure D–7 shows how a nonvisual browser might linearize a sample table.

Figure D–7

Linearizing a table

table							linearized content						
Desktop PCs	Model	Processor	Memory	DVD Burner	Modem	Network Adapter	Desktop PCs						
	Paragon 2.4	Intel 2.4GHz	256MB	No	Yes	No	Model						
	Paragon 3.7	Intel 3.7GHz	512MB	Yes	Yes	No	Processor						
	Paragon 5.9	Intel 5.9GHz	1024MB	Yes	Yes	Yes	Memory						
							DVD Burner						
							Modem						
							Network Adapter						
							Paragon 2.4						
							Intel 2.4GHz						
							256MB						
							No						
							Yes						
							No						
							Paragon 3.7						
							Intel 3.7GHz						
							512MB						
							Yes						
							Yes						
							No						
							Paragon 5.9						
							Intel 5.9GHz						
							1024MB						
							Yes						
							Yes						
							Yes						

One way of dealing with the challenge of linearizing is to structure your tables so that they are easily interpreted even when linearized. However, this is not always possible, especially for tables that have several rows and columns or may contain several levels of nested tables. The Section 508 guidelines for table creation state that

**§1194.22 (g) Row and column headers shall be identified for data tables.**

and

**§1194.22 (h) Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers.**

To fulfill the 1194.22 (g) guideline, you should use the `<th>` tag for any table cell that contains a row or column header. By default, header text appears in a bold centered font; however, you can override this format using a style sheet. Many nonvisual browsers can search for header cells. Also, as a user moves from cell to cell in a table, these browsers can announce the row and column headers associated with each cell. In this way, using the `<th>` tag can significantly reduce some of the problems associated with linearizing.

You can also use the `scope` attribute to explicitly associate a header with a row, column, row group, or column group. The syntax of the `scope` attribute is

```
<th scope="type"> ... </th>
```

where `type` is either `row`, `column`, `rowgroup`, or `colgroup`. Figure D–8 shows how to use the `scope` attribute to associate the headers with the rows and columns of a table.



## Frame Sites

When a nonvisual browser opens a frame site, it can render the contents of only one frame at a time. Users are given a choice of which frame to open. So, it's important that the name given to a frame indicates the frame's content. For this reason, the Section 508 guideline for frames states that

**§1194.22 (i) Frames shall be titled with text that facilitates frame identification and navigation.**

Frames can be identified using either the title attribute or the name attribute, and different nonvisual browsers use different attributes. For example, the Lynx browser uses the name attribute, while the IBM Home Page Reader uses the title attribute. For this reason, you should use both attributes in your framed sites. If you don't include a title or name attribute in the frame element, some nonvisual browsers retrieve the document specified as the frame's source and then use that page's title as the name for the frame.

The following code demonstrates how to make a frame site accessible to users with disabilities.

```
<frameset cols="25%, *">
 <frame src="title.htm" title="banner" name="banner" />
 <frameset rows="100, *">
 <frame src="links.htm" title="links" name="links" />
 <frame src="home.htm" title="documents" name="documents" />
 </frameset>
</frameset>
```

Naturally, you should make sure that any document displayed in a frame follows the Section 508 guidelines.

## Animation and Scrolling Text

Animated GIFs, scrolling marquees, and other special features can be sources of irritation for any web user; however, they can cause serious problems for certain users. For example, people with photosensitive epilepsy can experience seizures when exposed to a screen or portion of a screen that flickers or flashes within the range of 2 to 55 flashes per second (2 to 55 Hertz). For this reason, the Section 508 guidelines state that

**§1194.22 (j) Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz.**

In addition to problems associated with photosensitive epilepsy, users with cognitive or visual disabilities may find it difficult to read moving text, and most screen readers are unable to read moving text. Therefore, if you decide to use animated elements, you must ensure that each element's flickering and flashing is outside of the prohibited range, and you should not place essential page content within these elements.

## Scripts, Applets, and Plug-Ins

Scripts, applets, and plug-ins are widely used to make web pages more dynamic and interesting. The Section 508 guidelines for scripts state that

**§1194.22 (l) When pages utilize scripting languages to display content, or to create interface elements, the information provided by the script shall be identified with functional text that can be read by adaptive technology.**

Scripts are used for a wide variety of purposes. The following list describes some of the more popular uses of scripts and how to modify them for accessibility:

- **Pull-down menus:** Many web designers use scripts to save screen space by inserting pull-down menus containing links to other pages in the site. Pull-down menus are usually accessed with a mouse. To assist users who cannot manipulate a mouse, include keyboard shortcuts to all pull-down menus. In addition, the links in a pull-down menu should be repeated elsewhere on the page or on the site in a text format.
- **Image rollovers:** Image rollovers are used to highlight linked elements. However, since image rollovers rely on the ability to use a mouse, pages should be designed so that rollover effects are not essential for navigating a site or for understanding a page's content.
- **Dynamic content:** Scripts can be used to insert new text and page content. Because some browsers designed for users with disabilities have scripting turned off by default, you should either not include any crucial content in dynamic text, or you should provide an alternate method for users with disabilities to access that information.

Applets and plug-ins are programs external to a web page or browser that add special features to a website. The Section 508 guideline for applets and plug-ins is

**§1194.22 (m) When a Web page requires that an applet, plug-in or other application be present on the client system to interpret page content, the page must provide a link to a plug-in or applet that complies with §1994.21(a) through (i).**

This guideline means that any applet or plug-in used with your website must be compliant with sections §1994.21(a) through (i) of the Section 508 accessibility law, which deal with accessibility issues for software applications and operating systems. If the default applet or plug-in does not comply with Section 508, you need to provide a link to a version of that applet or plug-in that does. For example, a web page containing a Real Audio clip should have a link to a source for the necessary player. This places the responsibility on the web page designer to know that a compliant application is available before requiring the clip to work with the page.

## Web Forms

The Section 508 standard for web page forms states that

**§1194.22 (n) When electronic forms are designed to be completed on-line, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form, including all directions and cues.**

This is a general statement that instructs designers to make forms accessible, but it doesn't supply any specific instructions. The following techniques can help you make web forms that comply with Section 508:

- **Push buttons** should always include value attributes. The value attribute contains the text displayed on a button, and is rendered by different types of assistive technology.
- **Image buttons** should always include alternate text that can be rendered by nonvisual browsers.
- **Labels** should be associated with any input box, text area box, option button, checkbox, or selection list. The labels should be placed in close proximity to the input field and should be linked to the field using the label element.
- **Input boxes** and **text area boxes** should, when appropriate, include either default text or a prompt that indicates to the user what text to enter into the input box.
- **Interactive form elements** should be triggered by either the mouse or the keyboard.

The other parts of a web form should comply with other Section 508 standards. For example, if you use a table to lay out the elements of a form, make sure that the form still makes sense when the table is linearized.

## Links

It is common for web designers to place links at the top, bottom, and sides of every page in their websites. This is generally a good idea, because those links enable users to move quickly and easily through a site. However, this technique can make it difficult to navigate a page using a screen reader, because screen readers move through a page from the top to bottom, reading each line of text. Users of screen readers may have to wait several minutes before they even get to the main body of a page, and the use of repetitive links forces such users to reread the same links on each page as they move through a site. To address this problem, the Section 508 guidelines state that

**§1194.22 (o) A method shall be provided that permits users to skip repetitive navigation links.**

One way of complying with this rule is to place a link at the very top of each page that allows users to jump to the page's main content. In order to make the link unobtrusive, it can be attached to a transparent image that is one pixel wide by one pixel high. For example, the following code lets users of screen readers jump to the main content of the page without needing to go through the content navigation links on the page; however, the image itself is invisible to other users and so does not affect the page's layout or appearance.

```


...

page content goes here ...
```

One advantage to this approach is that a template can be easily written to add this code to each page of the website.

## Timed Responses

For security reasons, the login pages of some websites automatically log users out after a period of inactivity, or if users are unable to log in quickly. Because disabilities may prevent some users from being able to complete a login procedure within the prescribed time limit, the Section 508 guidelines state that

**§1194.22 (p) When a timed response is required, the user shall be alerted and given sufficient time to indicate that more time is required.**

The guideline does not suggest a time interval. To satisfy Section 508, your page should notify users when a process is about to time out and prompt users whether additional time is needed before proceeding.

## Providing a Text-Only Equivalent

If you cannot modify a page to match the previous accessibility guidelines, as a last resort you can create a text-only page:

**§1194.22 (k) A text-only page, with equivalent information or functionality, shall be provided to make a Web site comply with the provisions of this part, when compliance cannot be accomplished in any other way. The content of the text-only pages shall be updated whenever the primary page changes.**

To satisfy this requirement, you should

- provide an easily accessible link to the text-only page.
- make sure that the text-only page satisfies the Section 508 guidelines.
- duplicate the essential content of the original page.
- update the alternate page when you update the original page.

By using the Section 508 guidelines, you can work toward making your website accessible to everyone, regardless of disabilities.

## Understanding the Web Accessibility Initiative

In 1999, the World Wide Web Consortium (W3C) developed its own set of guidelines for web accessibility called the **Web Accessibility Initiative (WAI)**. The WAI covers many of the same points as the Section 508 rules, and expands on them to cover basic website design issues. The overall goal of the WAI is to facilitate the creation of websites that are accessible to all, and to encourage designers to implement HTML in a consistent way.

The WAI sets forth 14 guidelines for web designers. Within each guideline is a collection of checkpoints indicating how to apply the guideline to specific features of a website. Each checkpoint is also given a priority score that indicates how important the guideline is for proper web design:

- **Priority 1:** A web content developer **must** satisfy this checkpoint. Otherwise, one or more groups will find it impossible to access information in the document. Satisfying this checkpoint is a basic requirement for some groups to be able to use web documents.
- **Priority 2:** A web content developer **should** satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing web documents.
- **Priority 3:** A web content developer **may** address this checkpoint. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to web documents.

The following table lists WAI guidelines with each checkpoint and its corresponding priority value. You can learn more about the WAI guidelines and how to implement them by going to the World Wide Web Consortium website at [www.w3.org](http://www.w3.org).

WAI Guidelines	Priority
<b>1. Provide equivalent alternatives to auditory and visual content</b>	
<b>1.1</b> Provide a text equivalent for every nontext element (e.g., via alt, longdesc, or in element content). <i>This includes:</i> images, graphical representations of text (including symbols), image map regions, animations (e.g., animated GIFs), applets and programmatic objects, ascii art, frames, scripts, images used as list bullets, spacers, graphical buttons, sounds (played with or without user interaction), stand-alone audio files, audio tracks of video, and video.	1
<b>1.2</b> Provide redundant text links for each active region of a server-side image map.	1
<b>1.3</b> Until user agents can automatically read aloud the text equivalent of a visual track, provide an auditory description of the important information of the visual track of a multimedia presentation.	1
<b>1.4</b> For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation.	1
<b>1.5</b> Until user agents render text equivalents for client-side image map links, provide redundant text links for each active region of a client-side image map.	3
<b>2. Don't rely on color alone</b>	
<b>2.1</b> Ensure that all information conveyed with color is also available without color, for example from context or markup.	1
<b>2.2</b> Ensure that foreground and background color combinations provide sufficient contrast when viewed by someone having color deficits or when viewed on a black and white screen. [Priority 2 for images, Priority 3 for text].	2
<b>3. Use markup and style sheets and do so properly</b>	
<b>3.1</b> When an appropriate markup language exists, use markup rather than images to convey information.	2
<b>3.2</b> Create documents that validate to published formal grammars.	2
<b>3.3</b> Use style sheets to control layout and presentation.	2
<b>3.4</b> Use relative rather than absolute units in markup language attribute values and style sheet property values.	2
<b>3.5</b> Use header elements to convey document structure and use them according to specification.	2
<b>3.6</b> Mark up lists and list items properly.	2
<b>3.7</b> Mark up quotations. Do not use quotation markup for formatting effects such as indentation.	2
<b>4. Clarify natural language usage</b>	
<b>4.1</b> Clearly identify changes in the natural language of a document's text and any text equivalents (e.g., captions).	1
<b>4.2</b> Specify the expansion of each abbreviation or acronym in a document where it first occurs.	3
<b>4.3</b> Identify the primary natural language of a document.	3
<b>5. Create tables that transform gracefully</b>	
<b>5.1</b> For data tables, identify row and column headers.	1
<b>5.2</b> For data tables that have two or more logical levels of row or column headers, use markup to associate data cells and header cells.	1
<b>5.3</b> Do not use a table for layout unless the table makes sense when linearized. If a table does not make sense, provide an alternative equivalent (which may be a linearized version).	2
<b>5.4</b> If a table is used for layout, do not use any structural markup for the purpose of visual formatting.	2

WAI Guidelines	Priority
5.5 Provide summaries for tables.	3
5.6 Provide abbreviations for header labels.	3
<b>6. Ensure that pages featuring new technologies transform gracefully</b>	
6.1 Organize documents so they may be read without style sheets. For example, when an HTML document is rendered without associated style sheets, it must still be possible to read the document.	1
6.2 Ensure that equivalents for dynamic content are updated when the dynamic content changes.	1
6.3 Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported. If this is not possible, then provide equivalent information on an alternative accessible page.	1
6.4 For scripts and applets, ensure that event handlers are input device-independent.	2
6.5 Ensure that dynamic content is accessible or provide an alternative presentation or page.	2
<b>7. Ensure user control of time-sensitive content changes</b>	
7.1 Until user agents allow users to control flickering, avoid causing the screen to flicker.	1
7.2 Until user agents allow users to control blinking, avoid causing content to blink (i.e., change presentation at a regular rate, such as turning on and off).	2
7.3 Until user agents allow users to freeze moving content, avoid movement in pages.	2
7.4 Until user agents provide the ability to stop the refresh, do not create periodically auto-refreshing pages.	2
7.5 Until user agents provide the ability to stop auto-redirect, do not use markup to redirect pages automatically. Instead, configure the server to perform redirects.	2
<b>8. Ensure direct accessibility of embedded user interfaces</b>	
8.1 Make programmatic elements such as scripts and applets directly accessible or compatible with assistive technologies [Priority 1 if functionality is important and not presented elsewhere, otherwise Priority 2.]	2
<b>9. Design for device-independence</b>	
9.1 Provide client-side image maps instead of server-side image maps except where the regions cannot be defined with an available geometric shape.	1
9.2 Ensure that any element with its own interface can be operated in a device-independent manner.	2
9.3 For scripts, specify logical event handlers rather than device-dependent event handlers.	2
9.4 Create a logical tab order through links, form controls, and objects.	3
9.5 Provide keyboard shortcuts to important links (including those in client-side image maps), form controls, and groups of form controls.	3
<b>10. Use interim solutions</b>	
10.1 Until user agents allow users to turn off spawned windows, do not cause pop-ups or other windows to appear and do not change the current window without informing the user.	2
10.2 Until user agents support explicit associations between labels and form controls, ensure that labels are properly positioned for all form controls with implicitly associated labels.	2
10.3 Until user agents (including assistive technologies) render side-by-side text correctly, provide a linear text alternative (on the current page or some other) for <i>all</i> tables that lay out text in parallel, word-wrapped columns.	3
10.4 Until user agents handle empty controls correctly, include default, place-holding characters in edit boxes and text areas.	3
10.5 Until user agents (including assistive technologies) render adjacent links distinctly, include nonlink, printable characters (surrounded by spaces) between adjacent links.	3

WAI Guidelines	Priority
<b>11. Use W3C technologies and guidelines</b>	
11.1 Use W3C technologies when they are available and appropriate for a task and use the latest versions when supported.	2
11.2 Avoid deprecated features of W3C technologies.	2
11.3 Provide information so that users may receive documents according to their preferences (e.g., language, content type, etc.)	3
11.4 If, after best efforts, you cannot create an accessible page, provide a link to an alternative page that uses W3C technologies, is accessible, has equivalent information (or functionality), and is updated as often as the inaccessible (original) page.	1
<b>12. Provide context and orientation information</b>	
12.1 Title each frame to facilitate frame identification and navigation.	1
12.2 Describe the purpose of frames and how frames relate to each other if this is not obvious from frame titles alone.	2
12.3 Divide large blocks of information into more manageable groups where natural and appropriate.	2
12.4 Associate labels explicitly with their controls.	2
<b>13. Provide clear navigation mechanisms</b>	
13.1 Clearly identify the target of each link.	2
13.2 Provide metadata to add semantic information to pages and sites.	2
13.3 Provide information about the general layout of a site (e.g., a site map or table of contents).	2
13.4 Use navigation mechanisms in a consistent manner.	2
13.5 Provide navigation bars to highlight and give access to the navigation mechanism.	3
13.6 Group related links, identify the group (for user agents), and, until user agents do so, provide a way to bypass the group.	3
13.7 If search functions are provided, enable different types of searches for different skill levels and preferences.	3
13.8 Place distinguishing information at the beginning of headings, paragraphs, lists, etc.	3
13.9 Provide information about document collections (i.e., documents comprising multiple pages).	3
13.10 Provide a means to skip over multiline ASCII art.	3
<b>14. Ensure that documents are clear and simple</b>	
14.1 Use the clearest and simplest language appropriate for a site's content.	1
14.2 Supplement text with graphic or auditory presentations where they will facilitate comprehension of the page.	3
14.3 Create a style of presentation that is consistent across pages.	3

## Checking Your Website for Accessibility

As you develop your website, you should periodically check it for accessibility. In addition to reviewing the Section 508 and WAI guidelines, you can do several things to verify that your site is accessible to everyone:

- Set up your browser to suppress the display of images. Does each page still convey all of the necessary information?
- Set your browser to display pages in extra large fonts and with a different color scheme. Are your pages still readable under these conditions?
- Try to navigate your pages using only your keyboard. Can you access all of the links and form elements?
- Open your page in a screen reader or other nonvisual browser. (The W3C website contains links to several alternative browsers that you can download as freeware or on a short-term trial basis in order to evaluate your site.)
- Use tools that test your site for accessibility. (The WAI pages at the W3C website contain links to a wide variety of tools that report on how well your site complies with the WAI and Section 508 guidelines.)

Following the accessibility guidelines laid out by Section 508 and the WAI will result in a website that is not only more accessible to a wider audience, but whose design is also cleaner, easier to work with, and easier to maintain.



# Designing for the Web

Before you begin creating links between your website pages, it's worthwhile to use a technique known as storyboarding to map out exactly how you want the pages to relate to each other. A **storyboard** is a diagram of a website's structure, showing all the pages in the site and indicating how they are linked together. Because websites use a variety of structures, it's important to storyboard your website before you start creating your pages. This helps you determine which structure works best for the type of information your site contains. A well-designed structure ensures that users will be able to navigate the site without getting lost or missing important information.

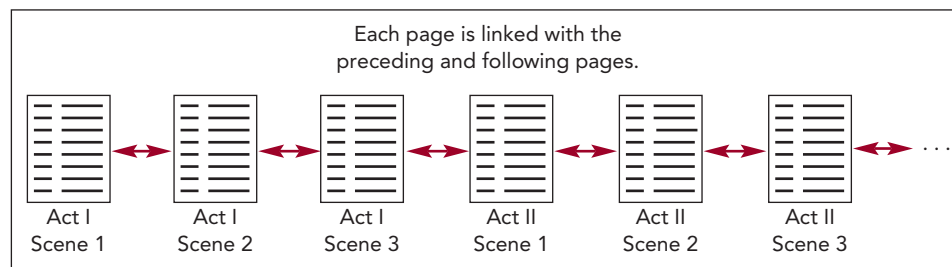
Every website should begin with a single home page that acts as a focal point for the website. It is usually the first page that users see. From that home page, you add links to other pages in the site, defining the site's overall structure. The websites you commonly encounter as you navigate the web employ several different web structures. You'll examine some of these structures to help you decide how to design your own sites.

## Linear Structures

If you wanted to create an online version of a famous play, like Shakespeare's *Hamlet*, one method would be to link the individual scenes of the play in a long chain. Figure E-1 shows the storyboard for this **linear structure**, in which each page is linked with the pages that follow and precede it. Readers navigate this structure by moving forward and backward through the pages, much as they might move forward and backward through the pages of a book.

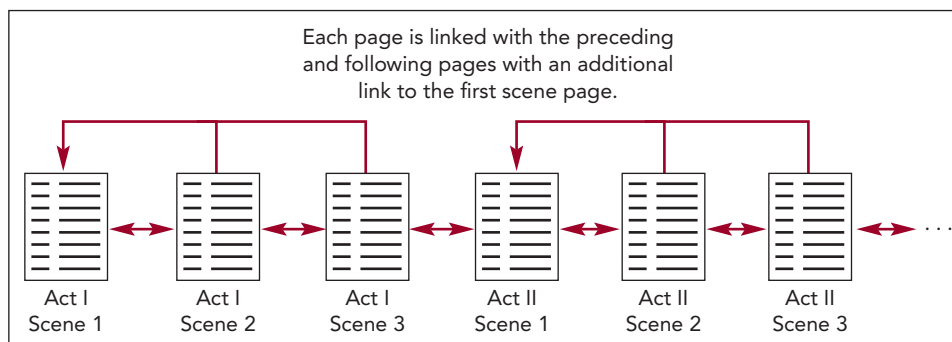
## STARTING DATA FILES

There are no starting Data Files needed for this appendix.

**Figure E-1** A linear structure

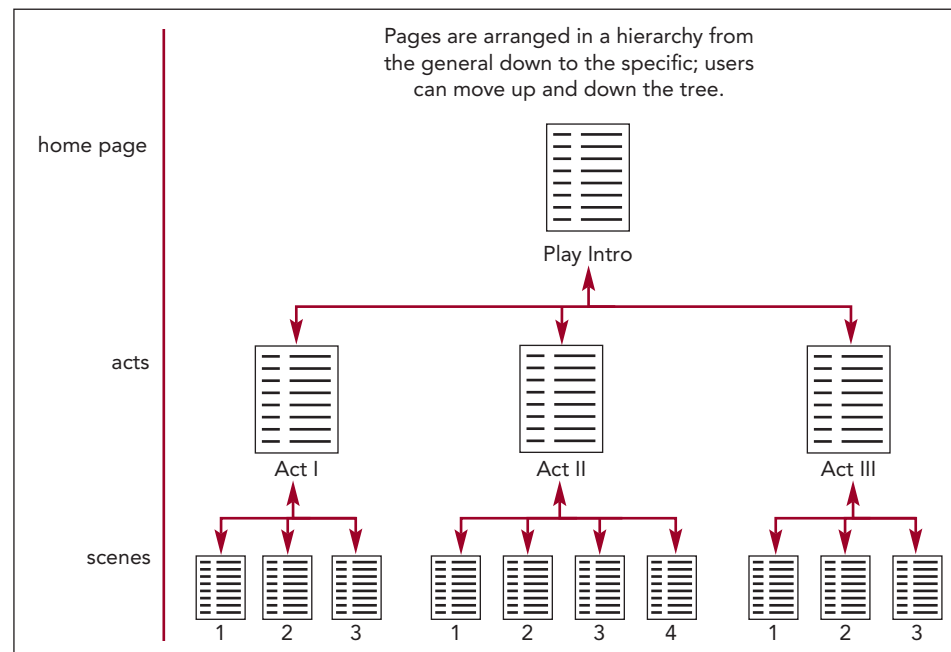
Linear structures work for websites that are small in size and have a clearly defined order of pages. However, they can be difficult to work with as the chain of pages increases in length. An additional problem is that in a linear structure, you move farther and farther away from the home page as you progress through the site. Because home pages often contain important general information about a site and its author, this is usually not the best design technique.

You can modify this structure to make it easier for users to return immediately to the home page or other main pages. Figure E-2 shows this online play with an **augmented linear structure**, in which each page contains an additional link back to the opening page of each act.

**Figure E-2** An augmented linear structure

## Hierarchical Structures

Another popular structure is the **hierarchical structure**, in which the home page links to pages dedicated to specific topics. Those pages, in turn, can be linked to even more specific topics. A hierarchical structure allows users to easily move from general to specific and back again. In the case of the online play, you could link an introductory page containing general information about the play to pages that describe each of the play's acts, and within each act you could include links to individual scenes. See Figure E-3.

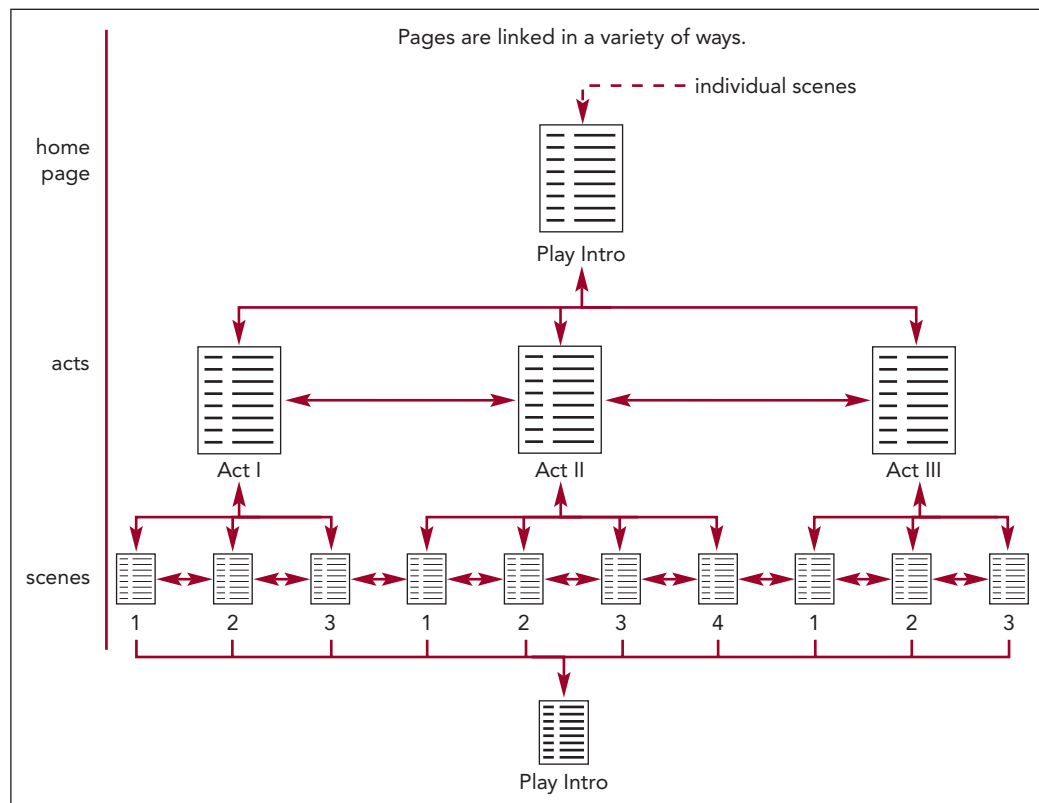
**Figure E-3** A hierarchical structure

### Mixed Structures

Within this structure, a user could move quickly to a specific scene within the play, bypassing the need to move through each scene that precedes it.

With larger and more complex websites, you often need to use a combination of structures. Figure E-4 shows the online play using a mixture of hierarchical and linear structures. The overall form is hierarchical, as users can move from a general introduction down to individual scenes; however, users can also move through the site in a linear fashion, going from act to act and scene to scene. Finally, each individual scene contains a link to the home page, allowing users to jump to the top of the hierarchy without moving through the different levels.

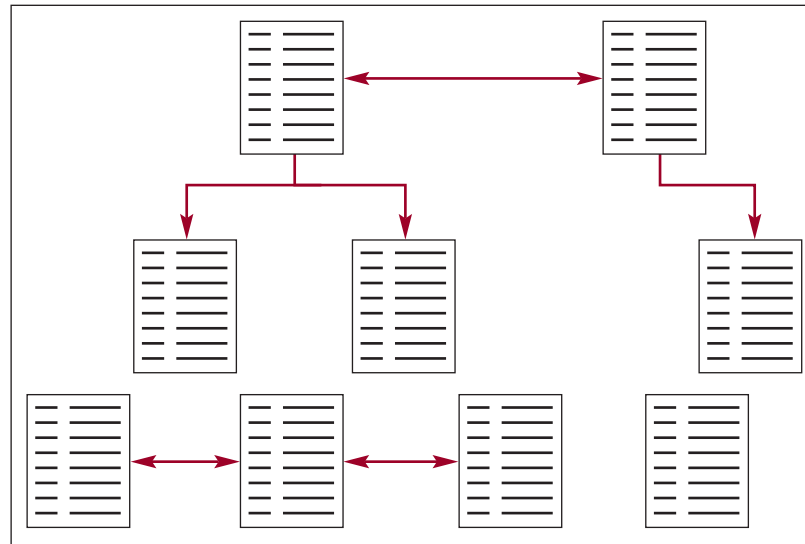
Figure E-4 A mixed structure



As these examples show, a little foresight can go a long way toward making your website easier to use. Also keep in mind that search results from a web search engine such as Google or Yahoo! can point users to any page in your website—not just your home page—so users will need to be able to quickly understand what your site contains and how to navigate it. At a minimum, each page should contain a link to the site's home page or to the relevant main topic page. In some cases, you might want to supply your users with a [site index](#), which is a page containing an outline of the entire site and its contents. Unstructured websites can be difficult and frustrating to use. Consider the storyboard of the site displayed in Figure E-5.

Figure E-5

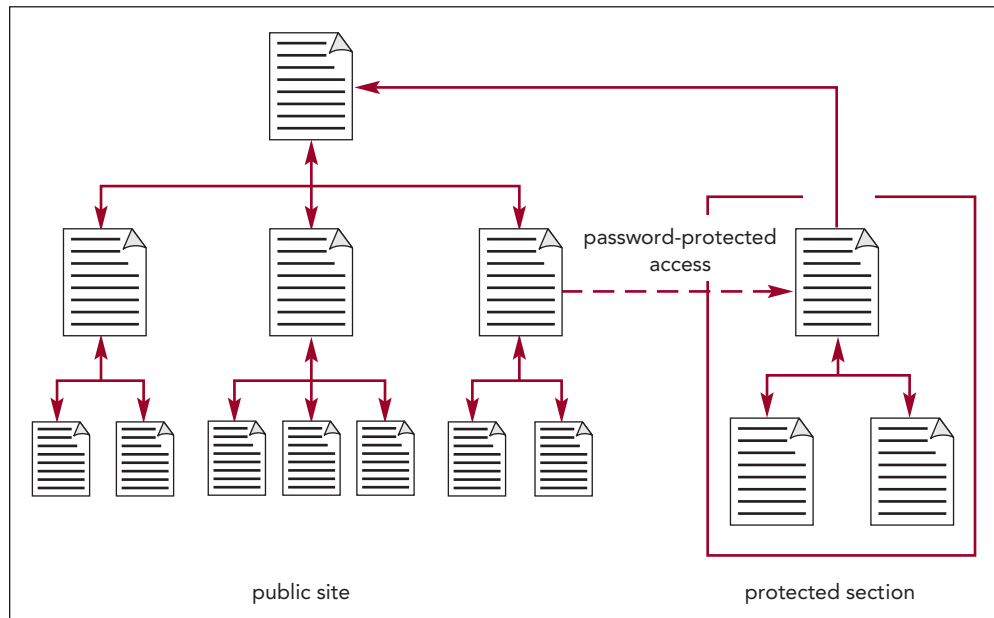
## Website with no coherent structure



This confusing structure makes it difficult for users to grasp the site's contents and scope. The user might not even be aware of the presence of some pages because there are no connecting links, and some of the links point in only one direction. The web is a competitive place; studies have shown that users who don't see how to get what they want within the first few seconds often leave a website. How long would a user spend on a site like the one shown in Figure E-5?

## Protected Structures

Sections of most commercial websites are often off-limits except to subscribers and registered customers. Storyboarding a protected structure is particularly important to ensure that no unauthorized access to the protected area is allowed in the site design. As shown in Figure E-6, these sites have a password-protected web page that users must go through to get to the off-limits areas.

**Figure E-6** A protected structure

The same website design principles apply to the protected section as the regular, open section of the site. As always, you want to create and maintain detailed storyboards to improve your site's performance and accessibility to all users.

# Page Validation with XHTML

## Introducing XHTML

In these tutorials, you have worked with documents written to correspond with the specifications of HTML 5. However, other versions of HTML have applications both on the web and in the business world. One of these versions is XHTML. To understand what XHTML is, you will look at the XML language first.

### XML

**Extensible Markup Language** or **XML** is a language for designing specialized markup languages called **XML vocabularies**, which can be used for a variety of document needs. Some popular XML vocabularies include MathML for mathematical content, CML for documenting chemical structures, and MusicML for describing musical scores. Individual users and businesses can also create markup languages tailored for their specific needs. The content of XML documents resembles what you have seen for HTML documents in which content is marked with element tags that can contain element attributes. For example, the following code is an excerpt from a MusicML document describing Mozart's *Piano Sonata in A Major*:

```
<work>
 <work-number>K. 331</work-number>
 <work-title>Piano Sonata in A Major</work-title>
</work>
<identification>
 <creator type="composer">Wolfgang Amadeus
 Mozart</creator>
 <rights>Copyright 2018 Recordare LLC</rights>
</identification>
```

XHTML is another XML vocabulary in which the content and structure is written in XML but uses the tags and attributes associated with HTML. However, the structure of an XHTML document differs from an HTML document in ways you will explore next.

### STARTING DATA FILES

There are no starting Data Files needed for this appendix.

## Starting an XHTML Document

All XML documents, and thus all XHTML documents, must begin with a **prolog** that indicates the document adheres to the syntax rules of XML. The form of the XML prolog is

```
<?xml version="value" encoding="type" ?>
```

where the `version` attribute indicates the XML version of the document and the `encoding` attribute specifies its character encoding. For XHTML documents, set the version to "1.0". The encoding depends on the character set being used. For example, if a document is saved using the UTF-8 character set, you would start the XHTML document with the following prolog:

```
<?xml version="1.0" encoding="UTF-8" ?>
```

With XHTML documents, you can define the character encoding within the XML prolog or with the following meta element, added to the document head

```
<meta http-equiv="Content-type" content="text/html; charset=type" />
```

where `type` is once again the character encoding. Thus, the meta element

```
<meta http-equiv="Content-type" content="text/html; charset=UTF-8" />
```

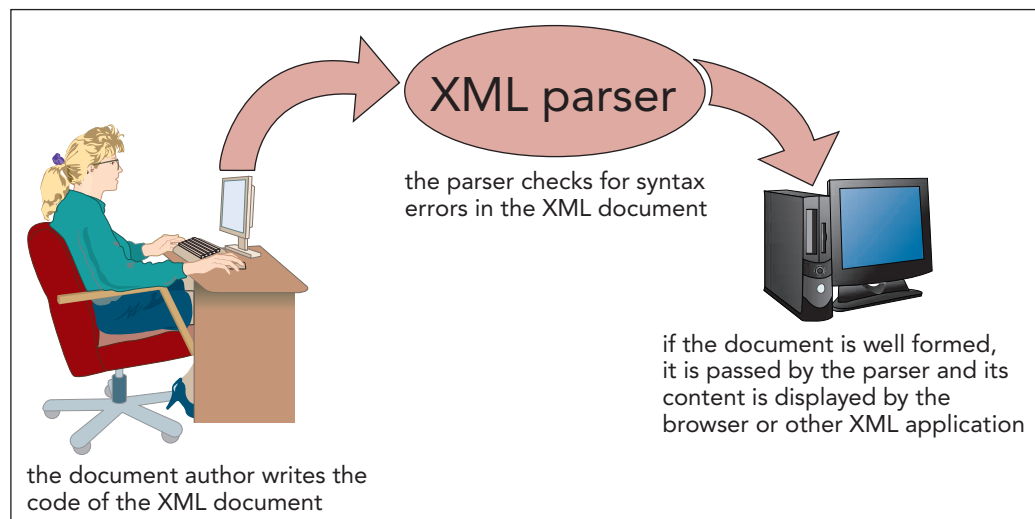
defines the content type as using the UTF-8 character set.

## Creating Well-Formed Documents

Once an XML document has been created, a program called an **XML parser** checks the file for errors in syntax and content. An XML document that employs the correct syntax is known as a **well-formed document**. Browsers usually accept HTML documents that violate HTML syntax as long as the violation is not too severe; however, an XML parser rejects any XML document that is not well formed. See Figure F–1.

Figure F–1

Testing for well formedness



For example, the following code is an example of code that is not well formed because it violates the basic rule that every two-sided tag must have both an opening and closing tag:

**Not well-formed code:**

```
<body>
 <h1>Web Page Title
</body>
```

An XML parser rejects documents that are not well formed and thus the document content will not be displayed by the browser. To correct this error and make the code well formed, you need to add the closing tag as shown next.

**Well-formed code:**

```
<body>
 <h1>Web Page Title </h1>
</body>
```

When you write XHTML code, it is important to be familiar with all of the rules of proper syntax. Figure F–2 lists seven syntax requirements that all XML documents (and therefore all XHTML documents) must follow.

Figure F–2

Rules for well-formed XML code

Rule	Incorrect	Correct
Element names must be lowercase.	<P>This is a paragraph.</P>	<p>This is a paragraph.</p>
Elements must be properly nested.	<p>This text is <b>bold</p>.</b>	<p>This text is <b>bold</b>.</p>
All elements must be closed.	<p>This is a paragraph.	<p>This is a paragraph.</p>
Empty elements must be terminated.	This is a line break.  	This is a line break.  
Attribute names must be lowercase.	<td COLSPAN="3">	<td colspan="3">
Attribute values must be quoted.	<td colspan=3>	<td colspan="3">
Attributes must have values.	<option selected>	<option selected="selected">

In addition to the rules specified in Figure F–2, all XML documents must also include a single **root element** that contains all other elements. For XHTML, that root element is the `html` element. You should already be familiar with many of these rules because you have been working with well-formed HTML since Tutorial 1. However, on older websites, you may find document code that violates this basic syntax but which most browsers still support.

In some older HTML documents, you might find cases of attribute minimization, a situation in which an element attribute lacks a value. XHTML does not allow attribute minimization so XHTML uses the name of the attribute as the attribute value. Figure F–3 lists the minimized attributes found in some HTML documents, along with the XHTML-compliant versions of these attributes.

Figure F-3

Attribute minimization in HTML and XHTML

HTML	XHTML
compact	compact="compact"
checked	checked="checked"
declare	declare="declare"
readonly	readonly="readonly"
disabled	disabled="disabled"
selected	selected="selected"
defer	defer="defer"
ismap	ismap="ismap"
nohref	nohref="nohref"
noshade	noshade="noshade"
nowrap	nowrap="nowrap"
multiple	multiple="multiple"
noresize	noresize="noresize"

For example, in HTML, the following code can be used to indicate that a radio button should be selected by default:

```
<input type="radio" checked>
```

In XHTML, this code would be rewritten as follows:

```
<input type="radio" checked="checked" />
```

Failure to make this change would cause the XHTML document to be rejected as not well formed. Note that in HTML, either form is accepted: You can write a minimized attribute either with the attribute value or without it.

## Creating Valid XHTML Documents

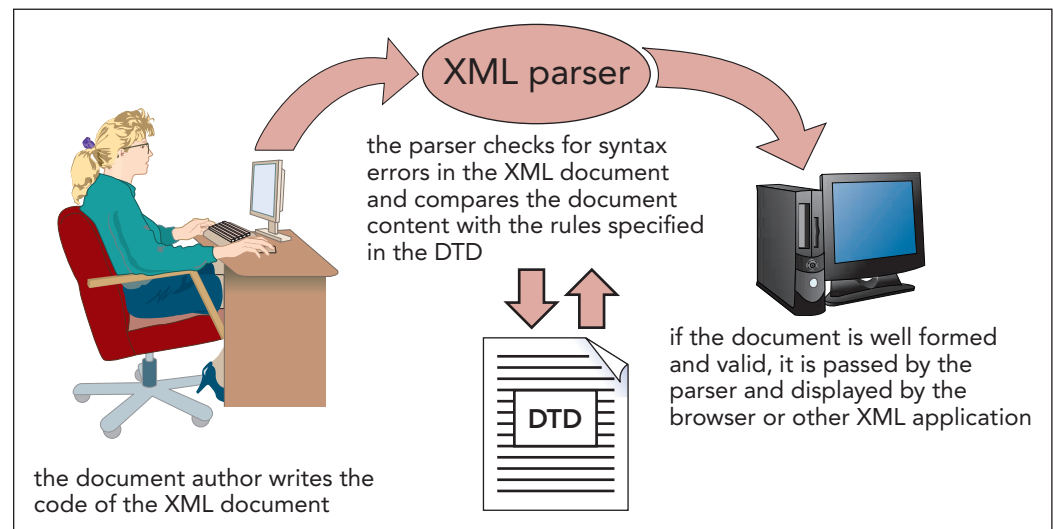
In addition to being tested for well formedness, XML documents can also be checked to see if they are valid. A **valid document** is a well-formed document that also contains only those elements, attributes, and other features that have been defined for its XML vocabulary. For example, if the code

```
<body>
 <mainhead>Web Page Title</mainhead>
</body>
```

was entered into an XHTML file, the code would be considered well formed because it complies with the syntax rules of XML—but it would not be valid because XHTML does not support a mainhead element. To specify the correct content and structure for a document, the developers of an XML-based language can create a collection of rules called the **document type definition** or **DTD**, which are stored either within the XML file or externally in a text file known as a **DTD file**. As shown in Figure F-4, an XML parser tests the content of a document against the rules in the DTD file. If the document does not conform to those rules, the parser rejects the document as not valid.

Figure F-4

## Testing for validity



For example, an XML vocabulary designed for a business might contain elements naming each product in its inventory. The DTD for that document could require that each product name element be accompanied by an `id` attribute value and that no products share the same name or `id`. An XML parser would reject any XML document that didn't satisfy those rules, even if the document was well formed. In this way, XML differs from HTML, which does not include a mechanism to force web page authors to adhere to rules for syntax and content.

## Transitional, Frameset, and Strict DTDs

There are several different DTDs associated with HTML and XHTML documents. Some DTDs represent older versions of HTML. For example, if you want to create a document that is validated only against the standards of HTML 5, a DTD is available for this purpose.

For XHTML 1.0, there are three DTDs available for testing the validity of XHTML documents:

- **transitional DTD:** The transitional DTD supports many presentational features of HTML, including elements and attributes that have been deprecated in HTML 5. It is best used with websites that need to support older standards.
- **frameset DTD:** The frameset DTD is used for documents containing frames, as well as deprecated elements and attributes. It is best used with older websites that rely on frames.
- **strict DTD:** The strict DTD does not allow for any deprecated HTML elements and attributes, and it does not support frames or inline frames. It is best used for documents that must conform strictly to the latest standards.

All three DTDs require that every valid XHTML document include the following elements: `html`, `head`, `title`, and `body`. If these elements are omitted, the document will be rejected by the XML parser.

There are elements that are allowed in one DTD but not in another. For example, the following elements are allowed under the transitional DTD but they are not allowed under the strict DTD for XHTML 1.0:

- applet
- basefont
- center
- dir
- font
- isindex
- menu
- noframes
- s
- strike
- u

In addition to using these elements in the transitional DTD, you often will encounter them in older websites.

The frameset DTD supports these elements as well as the `frame`, `frameset`, and `noframes` elements. Therefore, the following code, which uses the deprecated `font` element and `color` attribute,

```
Wizard Works
```

would be considered valid code under the transitional and frameset DTDs but not under the strict DTD.

In addition to prohibiting the use of certain elements, the strict DTD also requires a particular document structure. For example, you cannot nest a block-level element within an inline element. Figure F–5 lists the prohibited child elements under the strict DTD.

Figure F–5

Child elements prohibited under the XHTML strict DTD

Element	Prohibited Children
<i>inline elements</i>	<i>any block-level element</i>
body	a, abbr, acronym, b, bdo, big, br, button, cite, code, dfn, em, i, img, input, kbd, label, map, object, q, samp, select, small, span, strong, sub, sup, textarea, tt, var
button	button, form, fieldset, iframe, input, isindex, label, select, textarea
blockquote	a, abbr, acronym, b, bdo, big, br, button, cite, code, dfn, em, i, img, input, kbd, label, map, object, q, samp, select, small, span, strong, sub, sup, textarea, tt, var
form	a, abbr, acronym, b, bdo, big, br, cite, code, dfn, em, form, i, img, kbd, map, object, q, samp, small, span, strong, sub, sup, tt, var
label	label
pre	big, img, object, small, sub, sup

Thus, the following code would be disallowed under the strict DTD because it places an inline image as a child of the `body` element:

```
<body>

</body>
```

However, you could make this code compliant with the strict DTD by placing the inline image within a paragraph, as follows:

```
<body>
 <p>

 </p>
</body>
```

The goal of this rule is to enforce the inline nature of the `img` element. Because an inline image is displayed inline within a block element such as a paragraph, it should not be found outside of that context. For the same reason, form elements (such as the `input` or `select` elements) should be found only within a form, not outside of a form, under the strict DTD.

## The Valid Use of Attributes

DTDs also include different rules for attributes and their use. Under the strict DTD, deprecated attributes are not allowed. A list of these prohibited attributes with their corresponding elements is displayed in Figure F–6.

Figure F–6

Attributes prohibited under the XHTML strict DTD

Element	Prohibited Attribute(s)
a	target
area	target
base	target
body	alink, bgcolor, link, text, vlink
br	clear
caption	align
div	align
dl	compact
form	name, target
hn	align
hr	align, noshade, size, width
img	align, border, hspace, name, vspace
input	align
li	type, value
link	target
map	name
object	align, border, hspace, vspace
ol	compact, start
p	align
pre	width
script	language
table	align, bgcolor
td	bgcolor, height, nowrap, width
th	bgcolor, height, nowrap, width
tr	bgcolor
ul	type, compact

Many of the attributes listed in Figure F–6 are called presentational attributes because they define how browsers should render the element. Note that all of the attributes listed in Figure F–6 are supported in the transitional and frameset DTDs. Therefore, the following code, which uses the `align` attribute to float an inline image on the left margin of the page, would not be valid under the strict DTD because the `align` attribute is prohibited; however, it would be allowed under the frameset and transitional DTDs.

```

```

The strict DTD also requires the use of the `id` attribute in place of the `name` attribute for several elements. For example, the following tag that you might see in older HTML code

```

```

would be written in XHTML under the strict DTD using the `id` attribute as follows:

```

```

Whereas some attributes are prohibited, others are required. A list of the required attributes and the elements they are associated with is shown in Figure F–7.

Figure F–7

Required attributes for XHTML elements

Element	Required Attribute(s)
applet	height, width
area	alt
base	href
basefont	size
bdo	dir
form	action
img	src, alt
map	id
meta	content
optgroup	label
param	name
script	type
style	type
textarea	cols, rows

For example, an inline image is valid only if it contains both the `src` and `alt` attributes, and a `form` element is valid only if it contains an `action` attribute.

Although the list of rules for well-formed and valid documents may seem long and onerous, these rules simply reflect good coding practice. You would not, for example, want to create an image map without an ID or an inline image without alternate text.

## Inserting the DOCTYPE Declaration

To specify which DTD is used by an XML document, you add the following `DOCTYPE` declaration directly after the XML prolog

```
<!DOCTYPE root type "id" "url">
```

where `root` is the name of the root element of the document, `type` identifies the type of DTD (either `PUBLIC` or `SYSTEM`), `id` is an id associated with the DTD, and `url` is the location of an external file containing the DTD rules. For XHTML documents, you set the `root` value to `html` and the `type` value to `PUBLIC`.

Figure F–8 lists the complete DOCTYPE declarations for different versions of HTML and XHTML. Note that you can validate a document not only against different versions of XHTML 1.0, but even against different W3C specifications for HTML; this can be beneficial if you need to develop code for older browsers that do not support current standards. You can access the most recent versions of these DTDs on the W3C website.

Figure F–8

DTDs for different versions of HTML and XHTML

DTD	DOCTYPE
HTML 4.01 strict	<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01//EN" "http://www.w3.org/TR/html4/strict.dtd">
HTML 4.01 transitional	<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN" "http://www.w3.org/TR/html4/loose.dtd">
HTML 4.01 frameset	<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Frameset//EN" "http://www.w3.org/TR/html4/frameset.dtd">
HTML 5	<!DOCTYPE html>
XHTML 1.0 strict	<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
XHTML 1.0 transitional	<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
XHTML 1.0 frameset	<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Frameset//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-frameset.dtd">
XHTML 1.1	<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN" "http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
XHTML 5	<!DOCTYPE html>

## Setting the XHTML Namespace

As noted earlier, XHTML is only one of hundreds of XML vocabularies. In some situations, a document author may want to combine elements and attributes from different vocabularies in the same document. For example, a mathematician might want to create a single document that combines elements from both the XHTML and MathML vocabularies. Each element or attribute that belongs to a particular language is part of that language's **namespace**. There are two types of namespaces: default and local. For now, you will focus only on the default namespace. A **default namespace** is the namespace that is assumed to be applied, by default, to any element or attribute in the document. To declare a default namespace, you add the following `xmlns` (XML namespace) attribute to the `root` element of the document

```
<root xmlns="namespace">
```

where *namespace* is the namespace id. Every XML vocabulary has a unique namespace id. For example, if you wish to declare that the elements in your document belong to the XHTML namespace by default, you add the following attribute to the `html` element:

```
<html xmlns="http://www.w3.org/1999/xhtml">
```

The namespace id for XHTML looks like a URL but it is not treated as one by XML parsers. The id can actually be any string of characters as long as it uniquely identifies the document namespace. For XHTML 1.0, it was decided by the W3C to use `http://www.w3.org/1999/xhtml` as the unique identifier.

Even if you don't intend to combine different XML-based languages within the same document, it is still a good idea to add a namespace to an XHTML file to explicitly identify the XML vocabulary in use. In practical terms, though, an XHTML document is still interpretable by most browsers without a namespace.

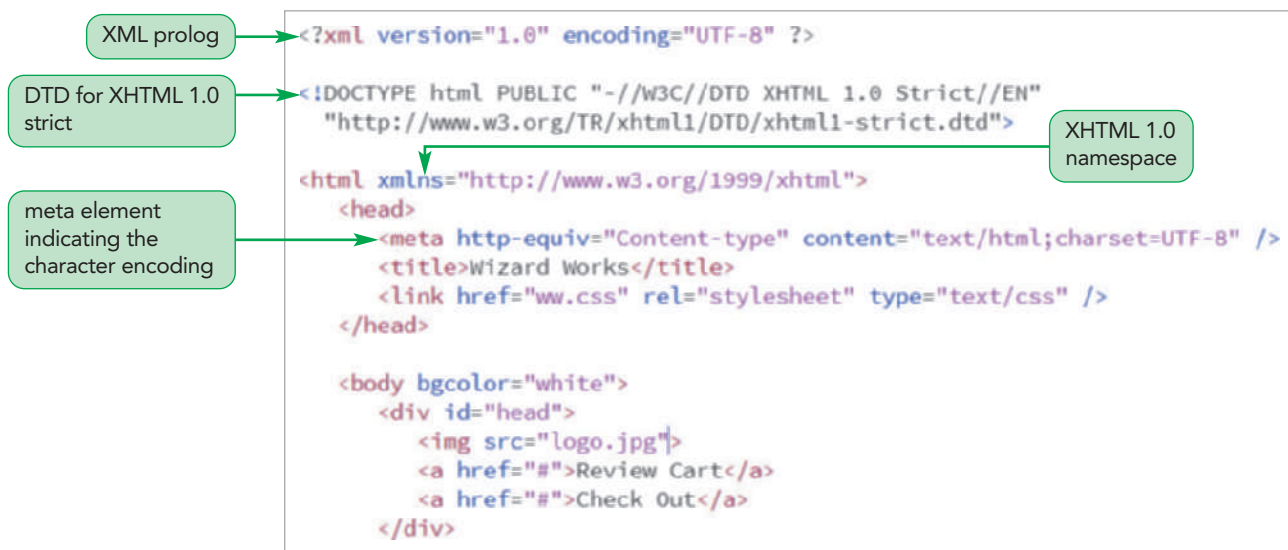
## Validating a File on the Web

Once you have created an XHTML or HTML document, you can check it for well formedness and validity using any one of the validators available on the web. One such validator is located at the W3C website: <https://validator.w3.org>. To use the validator:

1. Go to <https://validator.w3.org> in your browser.
2. Choose the location of your file:
  - a. For a page on the web, click the Validate by URI tab and enter the address of the page.
  - b. For a file on your computer, click the Validate by File Upload tab, click the Choose File button, then locate and select the file on your computer.
  - c. For code you wish to enter directly, click the Validate by Direct Input tab and enter the markup code in text box.
3. Click the Check button to run the validator.

Figure F–9 shows part of an XHTML document that can be tested against the W3C validator.

**Figure F–9** Contents of an XHTML file



When tested by the validator using the XHTML Strict DTD, the W3C validator returns the results shown in Figure F–10.

Figure F-10 Results for an invalid document

3 errors are found in the document

Errors found while checking this document as XHTML 1.0 Strict!

3 Errors

File: Choose File No file chosen

Encoding: utf-8 (detect automatically)

Doctype: XHTML 1.0 Strict (detect automatically)

Root Element: html

Root Namespace: http://www.w3.org/1999/xhtml

I ♥ VALIDATOR

The W3C validators rely on community support for hosting and development. Donate and help us build better tools for a better web.

Options

Show Source Show Outline List Messages Sequentially Group Error Messages by Type

Validate error pages Verbose Output Clean up Markup with HTML-Tidy

Revalidate

Validation Output: 3 Errors

Line 13, Column 18: there is no attribute "bgcolor"

`<body bgcolor="white">`

You have used the attribute named above in your document, but the document type you are using does not support that attribute for this element. This error is often caused by incorrect use of the "Strict" document type with a document that uses frames (e.g. you must use the "Transitional" document type to get the "target" attribute), or by using vendor proprietary extensions such as "marginheight" (this is usually fixed by using CSS to achieve the desired effect instead).

This error may also result if the element itself is not supported in the document type you are using, as an undefined element will have no supported attributes. In this case, see the element-undefined error message for further information.

How to fix: check the spelling and case of the element and attribute. (Remember XHTML is all lower-case) and/or check that they are both allowed in the chosen document type, and/or use CSS instead of this attribute. If you received this error when using the <embed> element to incorporate flash media in a Web page, see the FAQ item on valid flash.

Line 15, Column 29: required attribute "alt" not specified

``

The attribute given above is required for an element that you've used, but you have omitted it. For instance, in most HTML and XHTML document types the "type" attribute is required on the "script" element and the "alt" attribute is required for the "img" element.

Typical values for type are type="text/css" for <style> and type="text/javascript" for <script>.

Line 15, Column 30: end tag for "img" omitted, but OMITTAG NO was specified

``

You may have neglected to close an element, or perhaps you meant to "self-close" an element, that is, ending it with "</>" instead of "<".

Line 15, Column 10: start tag was here

``

list and description of errors in the XHTML document

A total of three errors are reported by the validator. The first error is on Line 13:  
Error Line 13, Column 18: there is no attribute "bgcolor"

```
<body bgcolor="white">
```

This is an error because there is no `bgcolor` attribute for the `body` element. Instead, the `bgcolor` attribute, used to define the background color, is a presentational attribute that has been deprecated in more recent versions of HTML and XHTML. To correct this error, you would have to remove the `bgcolor` attribute and use a CSS style to define the background color.

The next error is on Line 15:

Error Line 15, Column 29: required attribute "alt" not specified

```

```

This error occurs because the `alt` attribute is missing from the inline image. To correct this error, you would have to specify an alternate text for the inline image.

The third and final error also occurs on Line 15:

Error Line 15, Column 30: end tag for "img" omitted, but OMITTAG NO was specified

```

```

This error occurs because the improper syntax was used for the one-sided tag. The correct syntax for the inline image should appear as

```

```

with “Wizard Works” used as the alternate text for the logo image and / added to the closing tag.

Once all of these corrections have been made, you should rerun the validator on the revised markup code to ensure no other errors exist. As shown in Figure F–11, the validator reports a successful test of the markup code.

**Figure F–11** Page that successfully passes validation

document passes validation under the XHTML 1.0 Strict DTD

The screenshot shows the W3C Validator interface. At the top, a green banner states "This document was successfully checked as XHTML 1.0 Strict!". Below this, the "Results" section shows "Passed". The "File" section shows "Choose File" and "No file chosen". The "Encoding" is set to "utf-8", and the "Doctype" is set to "XHTML 1.0 Strict". The "Root Element" is "html" and the "Root Namespace" is "http://www.w3.org/1999/xhtml". The "Options" section includes checkboxes for "Show Source", "Show Outline", "List Messages Sequentially", "Group Error Messages by Type", "Validate error pages", "Verbose Output", and "Clean up Markup with HTML-Tidy". The "Congratulations" section states: "The uploaded document 'works.html' was successfully checked as XHTML 1.0 Strict. This means that the resource in question identified itself as 'XHTML 1.0 Strict' and that we successfully performed a formal validation of it. The parser implementations we used for this check are based on [OpenSP](#) (SGML/XML) and [libxml2](#) (XML)." It also provides a "valid" icon and the HTML code to use it: ``. A "Revalidate" button is located at the bottom right.

When your document passes the validation test, you might want to make a note of this fact in the body of your web page. The W3C provides code that you can paste into your document to let others know that your document matches all of the validation tests.

## Conclusion

Browsers are very forgiving of lapses in syntax. In fact, this is one of the reasons that non-programmers were able to quickly create their own web pages in the early days of the web.

You may wonder if it is really important to validate a document and follow syntax rules when browsers are so accommodating. In fact, there are several good reasons to enforce syntax rules and follow good coding practices:

- Although many browsers accommodate variations in syntax, not all browsers do so and not always in the same way, which can result in varying display results when using different browsers. However, when you follow the syntax rules of the W3C, all browsers enforce those rules and in the same way.
- Web pages tend to be rendered more quickly when they use good syntax because browsers don't have to interpret poorly written code.

- If a browser renders one of your pages incorrectly, it is easier to debug the page if it is written in compliance with standard syntax. Many web developers do a validation check as part of the debugging process to locate errors in the code.
- In a working group where several people are tasked with maintaining the same website code, you need to have a common set of rules to avoid confusion and mistakes. So, for collaboration purposes, it is best to use the rules set down by the W3C.
- Even if you are writing your document in HTML, your business might also need to create XML-based documents. Given the similarity between the two markup languages, it is easier for everyone to use the same set of syntax rules.

Thus, even if you are writing your code in HTML rather than XHTML, it may be best to follow the syntax rules of XHTML. This does not mean you have to run a validation check every time or add a namespace or an XML prolog to your document, but you should use XHTML standards such as lowercasing element and attribute names, and you should always provide attribute values enclosed within quotes.



# GLOSSARY

**!important** CSS keyword that forces a particular style to override the default style sheet cascade. HTML 96

**@charset** CSS rule defining the character encoding used in a style sheet. HTML 86

**@font-face** CSS rule that defines a web font. HTML 108

**@import** CSS rule used to import a style sheet file into the current style sheet. HTML 98

**@keyframe** CSS rule that defines key frame styles used in an animation. HTML 641

**@page** CSS rule that defines the size and margins of the printed page. HTML 418

**<a>** HTML tag that marks a hypertext link to an external resource. HTML 46

**<body>** HTML tag that marks the document body. HTML 2

**<cite>** HTML tag that marks a citation. HTML 22

**<em>** HTML tag that marks emphasized text. HTML 22

**<h1>** HTML tag that marks a major heading. HTML 22

**<head>** HTML tag that marks the document head within an HTML file. HTML 2

**<html>** HTML tag that marks the beginning of the HTML document. HTML 2

**<img>** HTML tag that marks an image using the file specified in the `src` attribute. HTML 22

**<li>** HTML tag that marks a list item. HTML 46

**<meta>** HTML tag that marks metadata containing information about the document. HTML 2

**<nav>** HTML tag that marks a list of hypertext links used for navigation. HTML 46

**<p>** HTML tag that marks a document paragraph. HTML 22

**<strong>** HTML tag that marks text of major importance or seriousness. HTML 22

**<title>** HTML tag that marks the page title, which appears in the browser title bar or browser tab. HTML 2

**<ul>** HTML tag that marks an unordered list. HTML 46

**3D transformation** A transformation that involves three spatial axes. HTML 332

## A

**AAC.** See Advanced Audio Coding

**absolute path** A folder path that starts from the root folder and processes down the entire folder structure. HTML 61

**absolute positioning** A layout technique that places an element at specified coordinates within its container element. HTML 238

**absolute unit** Units that are fixed in size regardless of the output devices. HTML 123

**access key** A single key on the keyboard that can be pressed in conjunction with another key to jump to a location on the web page. HTML 531

**Accessible Rich Internet Application (ARIA)** An HTML standard that assists screen readers in interpreting web page content. HTML 44

**action** HTML attribute that indicates the server program that processes a web form. HTML 518

**active** CSS pseudo-class that selects actively-clicked links. HTML 136

**adaptive technology** Technology that enables people with disabilities to use the web. HTML D2

**Advanced Audio Coding (AAC)** A standard audio coding for all Apple products, as well as YouTube and several gaming systems. HTML 608

**after** CSS pseudo-element that selects page space directly after the element. HTML 136

**align** WEBVTT attribute that aligns the text within a track cue. HTML 618

**American Standard Code for Information Interchange.** See ASCII (American Standard Code for Information Interchange)

**animation** CSS style that applies a key frame animation to an object. HTML 641

**animation-play-state** CSS style that defines whether an animation is running or is paused. HTML 641

**ARIA.** See Accessible Rich Internet Application (ARIA)

**array** A collection of JavaScript values organized under a single name. HTML 752

**array literal** JavaScript syntax that defines an array using a comma-separated list of values within a set of square brackets. HTML 758

**ASCII (American Standard Code for Information Interchange)** The character set used for the English alphabet. HTML 33

**assignment operator** An operator that assigns a value to an item. HTML 720

**assistive technology** Technology that enables people with disabilities to use the web. HTML D2

**asymmetric transition** A transition in which the initial state to end state transition is not the reverse of the end state to initial state transition. HTML 652

**attribute minimization** Element attributes that do not require an attribute value. HTML 11

**audio** HTML element that embeds an audio file in the web page. HTML 602

**augmented linear structure** A linear structure in which each page contains an additional link to the opening page of the structure. HTML E2

## B

**background** CSS property that defines all background options, including the use of multiple backgrounds. HTML 274

**background-color** CSS property that sets the background color. HTML 86

**background-image** CSS property that applies an image file to the element background. HTML 274

**before** CSS pseudo-element that selects page space directly before the element. HTML 136

**binary operator** An operator that works with two operands. HTML 720

**bitmap image** An image format in which the image is comprised of pixels that can be marked with different colors. HTML 280

**BOM.** See browser object model

**Boolean value** A data type whose values are limited to true or false. HTML 710

**border** The part of the box model that surrounds the padding space. HTML 143

**border** CSS property that adds a border around all sides of an element. HTML 274

**border box model** A layout model in which the width property refers to the width of the element's content, padding, and border spaces. HTML 197

**border-collapse** CSS attribute that specifies which table borders are separated or collapsed into each other. HTML 453

**border-image** CSS property that defines an image file to create a graphic border. HTML 274

**border-left** CSS property that adds a border to the left edge of an element. HTML 274

**border-radius** CSS property that creates rounded corners with a specified radius. HTML 274

**border-right** CSS property that adds a border to the right edge of an element. HTML 274

**box model** A layout model in which element content is surrounded by padding, border, and margin spaces. HTML 143

**box-shadow** CSS property that adds a drop shadow to a block element. HTML 302

**breakpoint** A location in the program code where the browser will pause the program, allowing the programmer to determine whether an error has already occurred in the script's execution. HTML 694

**browser extension** An extension to CSS supported by a specific browser. HTML 92

**browser object** An object that is part of the web browser. HTML 700

**browser object model (BOM)** A hierarchical structure that defines the relationship of the object within the web browser. HTML 700

**browser style** A style built into the web browser itself. HTML 89

**built-in object** An object that is intrinsic to the JavaScript language. HTML 700

## C

**calendar control** A web form control for selecting date and time values. HTML 520

**caption** HTML element that marks a web table caption. HTML 452

**caption-side** CSS property that specifies the location (top or bottom) of the web table caption. HTML 453

**Cascading Style Sheets (CSS)** A style sheet language supported by the W3C and used in web page design. HTML 32

**case statement.** See switch statement

**CGI.** See Common Gateway Interface

**character encoding** The process by which the computer converts text into a sequence of bytes and then converts those bytes back into characters. HTML 17

**character entity reference** An HTML string that inserts a character based on a defined name. HTML 22

**character set** A collection of characters and symbols. HTML 33

**check box** A web form control used for selecting data limited to two possible values. HTML 520

**checkbox** HTML element that marks a check box control. HTML 544

**child element** An element contained within a parent element. HTML 110

**clear** CSS property that displays an element only when the left, right, or both floated objects have been cleared. HTML 176

**client** A device that receives network information or services. HTML 4

**client-server network** A network in which clients access information provided by one or more servers. HTML 4

**client-side image map** An image map that is defined within the web page and handled entirely by the web browser. HTML 341

**client-side programming** The programming environment in which program code is run locally on the user's computer with scripts that are downloaded from the server. HTML 684

**client-side validation** Validation that takes place in the user's browser. HTML 575

**closing tag** The tag that marks the end of the element content. HTML 2

**codec** A computer program that encodes and decodes streams of data. HTML 604

**col** HTML element that marks individual columns in a web table. HTML 476

**colgroup** HTML element that marks groups of columns in a web table. HTML 476

**color** CSS property that sets the text color. HTML 56

**color gradient** A background in which one color gradually blends into another color. HTML 312

**color picker** A web form control for choosing color values. HTML 520

**color value** A numeric expression that defines a color. HTML 99

**color-stop** A parameter of a color gradient that defines the extent of the color. HTML 302

**colspan** HTML attribute that indicates a table cell should cover several columns. HTML 452

**command block** A set of JavaScript commands enclosed within a set of curly braces. HTML 773

**command button** A web form button that runs a program. HTML 572

**Common Gateway Interface (CGI)** A server-based program, written in Perl, used for processing web form data. HTML 522

**compare function** A function used with the JavaScript `sort()` method to define a sorting order. HTML 764

**comparison operator** An operator that compares the value of one expression to another, returning a Boolean value indicating whether the comparison is true or not. HTML 776

**compiler** A software program that translates program code into machine language. HTML 685

**conditional comment** An Internet Explorer extension that encloses content that should only be run by particular versions of Internet Explorer. HTML 20

**conditional expression** An expression that is either true or false. HTML 786

**conditional operator** An operator used in an expression that returns one value if the condition is true and another if it is false. Also called ternary operator. HTML 791

**conditional statement** A statement that runs a command or command block only when certain circumstances are met. HTML 789

**container** An object that handles the packaging, transportation, and presentation of multimedia data. HTML 604

**container collapse** A layout challenge that occurs when an element contains only floated content and thus collapses in height. HTML 201

**content** CSS property that inserts content into a page element. HTML 136

**content box model** A layout model in which the width property only refers to the width of the element content. HTML 197

**content-box** CSS keyword that specifies the background extends only over the element content. HTML 274

**contextual selector** A selector that specifies the context under which a particular page element is matched. HTML 110

**continue expression** The Boolean expression in a `for` loop that must be true for the loop to continue. HTML 770

**continue statement** JavaScript statement that stops the processing of the commands in the current iteration of the loop and continues to the next iteration. HTML 806

**control** An object within a web form that allows users to interact with the form. HTML 520

**controls** HTML attribute that displays player controls for a multimedia clip. HTML 602

**counter variable** A variable within a `for` loop that changes value each time the loop is run. HTML 770

**cover** CSS keyword that specifies that the background image should completely cover the background. HTML 274

**cross axis** The flexbox axis that is perpendicular to the main axis. HTML 394

**CSS.** See Cascading Style Sheets (CSS)

**CSS at-rule** CSS rule that directs how the browser should interpret and parse the CSS code. HTML 98

**CSS grid model** A set of CSS design styles to create grid-based layouts. HTML 210

**CSS pixel** A pixel that is the fundamental unit in CSS measurements. HTML 375

**CSS** The third, and most current version, of CSS. HTML 88

**cue** HTML pseudo-element that selects the cues from a media track. HTML 619

**curative** A typeface that mimics handwriting with highly stylized elements and flourishes. HTML 118

**customized object** An object that is created by the programmer for use in an application. HTML 700

## D

**data attribute** HTML attribute that stores customized data. HTML 494

**data field** The part of a web form in which data values are stored. HTML 521

**data list** A list of possible values that a form field can have. HTML 569

**data type** The type of information stored within a variable including numeric values, text strings, Boolean values, objects, and null values. HTML 710

**datalist** HTML element that defines a set of suggested field values. HTML 562

**Date object** JavaScript object used for storing date and time values. HTML 711

**debugging** The process of locating and fixing a programming error. HTML 692

**declaring** The process by which a variable is introduced and defined. HTML 709

**decrement operator** A unary operator that decreases the value of the operand by 1. HTML 720

**default namespace** The namespace that is assumed to be applied to any element or attribute in the document. HTML F9

**deprecated** The features and code from earlier HTML versions that have been phased out and are either no longer supported or developed. HTML 6

**descendant element** An element that descends from a parent element within the document hierarchy. HTML 110

**description list** A list of terms and matching descriptions. HTML 51

**device pixel** A pixel that refers to the actual physical pixel on a screen. HTML 375

**device-pixel ratio** A measure of the number of device pixels matched to a single CSS pixel. HTML 375

**display** CSS property that defines how an element should be laid out. HTML 176

**do/while loop** A program loop in which a stopping condition is tested right after the last command block is run. HTML 775

**document body** The part of an HTML file containing all of the content that will display in the web page. HTML 2

**document head** The part of an HTML file containing information about the document. HTML 2

**document object** An object that is part of the web page document. HTML 700

**document object model (DOM)** A hierarchical structure that defines the relationship of the object within the web document. HTML 700

**document type declaration** A processing instruction indicating the markup language used in the document. HTML 2

**document type definition** A collection of rules for an XML vocabulary that defines the content and structure of a valid document in that vocabulary. HTML F4

**DOM.** See document object model

**domain name** The server name portion of a URL. HTML 65

**drop cap** A design element in which the initial letter in a body of text drops down into the text body. HTML 193

**DTD.** See document type definition

**DTD file** A text file in which a DTD is stored. HTML F4

**dynamic pseudo-class** A pseudo-class based on the actions of the user within the element. HTML 152

## E

**elastic layout** A layout in which all measurements are expressed in em units and based on the default font size. HTML 183

**element attribute** The part of an element that provides information to the browser about the purpose of the element or how the element should be handled by the browser. HTML 11

**element tag** The fundamental building block of an HTML file, used to mark every document element. HTML 9

**em** CSS relative unit of length that expresses a size relative to the font size of the containing element. HTML 106

**email harvester** An automated program that scans web pages for e-mail addresses. HTML 67

**embedded content** Content that is imported from another resource, often nontextual. HTML 36

**embedded element** An element containing embedded content such as graphic images, audio soundtracks, video clips, or interactive games. HTML 36

**embedded object** An object, such as a graphic image or media clip, that appears within a web page. HTML 605

**embedded script** A program script that is loaded within the HTML file. HTML 686

**embedded style** A style added to the head of an HTML file. HTML 89

**empty element** An element that is either nontextual or contains directives to the browser about how the page should be treated. HTML 9

**ending tag** The tag that marks the end of the element content. HTML 9

**explicit grid** A grid in which the number and size of the rows and columns are defined within the CSS style sheet. HTML 216

**Extensible Markup Language** A language for designing specialized markup languages. HTML F1

**extension** The top level of a URL, indicating the general audience supported by the web server. HTML 65

**external style** A style created by the page author and placed into a CSS file and linked to the page. HTML 89

## F

**fantasy** A highly ornamental typeface used for page decoration. HTML 118

**field** The part of a web form in which data values are stored. HTML 521

**field set** A web form feature that groups fields that share a common characteristic or purpose. HTML 525

**fieldset** HTML element that groups fields within a web form. HTML 518

**FIFO.** See first-in first-out

**Free Lossless Audio Codec (FLAC)** A free open-source digital music format that offers bit-perfect copies of CD-quality music at half the size HTML 608

**filter** CSS property used to modify an object's color, brightness, contrast, or general purpose. HTML 326

**first-in first-out (FIFO)** A data structure principle in which the first item added to an array is the first one removed. HTML 766

**first-of-type** CSS pseudo-class that selects the first element type of the parent element. HTML 136

**fixed grid** A grid layout in which the widths of the columns and margins are specified in pixels with fixed positions. HTML 209

**fixed layout** A layout in which the size of the page and the page elements are fixed, usually using pixels as the unit of measure. HTML 182

**FLAC.** See Free Lossless Audio Codec

**flex** CSS property that defines the size of the flex items and how they will grow or shrink in response to the changing size of the flexbox. HTML 392

**flex-basis** CSS property that provides the basis or initial size of the item prior to flexing. HTML 392

**flexbox** A box that contains items whose sizes automatically expand or contract to match the dimensions of the box. HTML 392

**flex-flow** CSS property that defines the orientation of the flexbox and whether items can wrap to a new line. HTML 392

**flex-grow** CSS property that specifies how fast the item grows above its basis size relative to other items in the flex box. HTML 392

**flex-shrink** CSS property that specifies how fast the item shrinks below its basis size relative to other items in the flex box. HTML 392

**float** CSS property that takes an object out of normal document flow and floats it on the left or right margin of its container element. HTML 176

**floating** A design technique in which an element is taken out of its default document position and placed along the left or right edge of its parent element. HTML 189

**fluid grid** A grid layout in which the widths of the columns and margins are specified in percentages. HTML 209

**fluid layout** A layout in which the size of the page elements are set using percentages. HTML 183

**focus** The state in which an element has been clicked by the user, making it the active control on the web form. HTML 582

**font** Definition of the style and appearance of each character in an alphabet. HTML 117

**font stack** A list of fonts defined in the font-family property. HTML 117

**font-family** CSS property that defines a font stack. HTML 108

**font-size** CSS property that sets the text size. HTML 108

**for** HTML attribute that associates a label with an input control. HTML 518

**for loop** A programming structure in which a set of commands is repeated based on the changing values of a counter variable. HTML 770

**form** HTML element that encloses a web form. HTML 518

**form button** A button on a web form that can be clicked to either run, submit, or reset the form. HTML 572

**fr (fractional) unit** CSS grid unit that represents a fraction of the available space left on the grid after all other rows and columns have attained their maximum allowable size. HTML 217

**frameset DTD** The DTD used by XHTML that supports frames and those HTML features that were deprecated in HTML 5. HTML F5

**framework** A software package that provides a library of tools to design a website. HTML 210

**Free Lossless Audio Codec (FLAC)** A free, open-source digital music format that offers bit-perfect copies of CD-quality music at half the size of other formats. HTML 608

**function** A collection of JavaScript commands that performs an action or returns a value. HTML 730

## G

**generic font** A general description of a font face. HTML 117

**get method** HTML method applied to web forms that tells the browser to append the form data to the end of the URL specified by the action attribute. HTML 523

**getElementById()** JavaScript method that selects a web page element based on its ID value. HTML 698

**getFullYear()** JavaScript method that gets the 4-digit year value from a Date object. HTML 718

**GIF (Graphic Interchange Format)** The oldest bitmap image format, limited to 256 colors, but that also supports transparent colors and animated images. HTML 280

**global scope** The scope of a variable that can be referenced anywhere within the JavaScript file. HTML 733

**global variable** A variable with global scope. HTML 733

**grid area** A region that covers several rows and/or columns with a grid layout HTML 206.

**grid cell** A cell at the intersection of a grid row and grid column. HTML 224

**grid column** A column floated within the rows of a grid row. HTML 206

**grid layout** A layout that arranges the page within grid rows with grid columns floated inside those rows. HTML 208

**grid row** A row found within a grid layout. HTML 206

**grid tracks** Rows or columns within a grid layout HTML 211.

**gridline names** Descriptive names for row and column gridlines in the CSS grid model. HTML 226.

**grouping element** An element that organizes similar content into a distinct group, much like a paragraph groups sentences that share a common theme. HTML 26

## H

**H.264** A video codec that is the industry standard for high-definition video streams. HTML 620

**hanging indent** A layout in which the first line extends to the left of the block. HTML 128

**hexadecimal number** A number expressed in the base 16 numbering system. HTML 100

**hidden field** A web form field that is not displayed within the web form. HTML 552

**hierarchical structure** A website structure in which the home page links to pages dedicated to specific topics, which are linked to even more specific topics. HTML E2

**host** Any network device that is capable of sending and/or receiving data electronically. HTML 4

**hotspot** A region within an image that can be linked to a specific URL. HTML 341

**hover** CSS pseudo-class that selects links that are being hovered over. HTML 136

**HSL color value** Color defined by its hue, saturation, and lightness values. HTML 86

**HTML 5** The latest version of HTML, compatible with earlier HTML releases. HTML 5

**HTML 5 Shiv** A script that provides support for HTML 5 in older browsers. HTML 39

**HTML (Hypertext Markup Language)** A markup language that supports the tagging of distinct document elements and connecting documents through hypertext links. HTML 5

**HTML 4.01** The fourth version of HTML, released in 1999, that provided support for multimedia, online commerce, and interactive scripts. HTML 5

**HTML comment** A descriptive note added to an HTML file that does not get rendered by a user agent. HTML 2

**HTTP.** See Hypertext Transfer Protocol (HTTP)

**hue** The tint of a color, represented by a direction on the color wheel. HTML 101

**hyperlink** A link within a hypertext document that can be activated to access a data source. HTML 4

**hypertext** A method of organizing information in which data sources are interconnected through a series of hyperlinks that users activate to jump from one data source to another. HTML 5

**Hypertext Markup Language.** See HTML (Hypertext Markup Language)

**Hypertext Transfer Protocol (HTTP)** The protocol used by devices on the web. HTML 64

## I

**IANA.** See Internet Assigned Numbers Authority (IANA)

**IDE (Integrated Development Environment)** A software package providing comprehensive coverage of all phases of the HTML development process. HTML 6

**if else statement** JavaScript conditional expression that runs a specified command if the condition is true and a different command if the condition is false. HTML 786

**if statement** JavaScript conditional expression that runs a specified command if the condition is true. HTML 786

**iframe** HTML element used to insert windows showing external content within a web page. HTML 637

**image map** Information that specifies the location and URLs associated within each hotspot within an image. HTML 341

**implicit grid** A grid in which the number and size of the rows and columns are determined by the browser as it populates the grid with content from the grid container.

**increment operator** A unary operator that increases the value of the operand by 1. HTML 720

**index** A number used with an array to distinguish one array value from another. HTML 757

**inline element** An element in which the content is placed in line with surrounding page content rather than starting on a new line. HTML 29

**inline frames** Windows within a web page that show external content. HTML 637

**inline image** An image that is placed, like text-level elements, in line with the surrounding content. HTML 37

**inline style** A style added as attributes of an HTML element. HTML 89

**inline validation** A technique in which invalid data from a web form is highlighted as it is entered by the user. HTML 563

**innerHTML** JavaScript method that returns or defines the HTML code contained within a web page element. HTML 698

**input** HTML element that creates an input control for a web form. HTML 518

**input box** A web form control for inserting text strings and numeric values. HTML 520

**inset** CSS keyword that places a box shadow inside the element. HTML 302

**interactive element** An element that allows for interaction between the user and the embedded object. *Also called* embedded element. HTML 36

**Internet** A wide area network incorporating an almost uncountable number of networks and hosts across the world. HTML 4

**Internet Assigned Numbers Authority (IANA)** The registration authority used to register the top levels of every domain name. HTML 65

**interpreted language** A computer language in which the program code is executed directly without requiring a compiler. HTML 685

**ISO 8859-1** An extended version of the ASCII character set. HTML 33

## J

**JavaScript** A programming language used for client-side programs. HTML 685

**JPEG (Joint Photographic Experts Group)** A bitmap image format that supports a palette of over 16 million colors, as well as file compression. HTML 280

## K

**Kerning** A measure of the space between characters. HTML 108

**key frames** A series of images that are displayed in rapid succession to create the illusion of motion. HTML 652

**kind** HTML attribute that specifies the type of text track attached to a media clip. HTML 618

## L

**label** HTML element that associates a text string with an input control. HTML 518

**LAN.** See Local area network (LAN)

**last-in first-out (LIFO)** A data structure principle in which the last item added to an array is the first one removed. HTML 766

**last-of-type** CSS pseudo-class that selects the last element type of the parent element. HTML 136

**Latin-1** An extended version of the ASCII character set. HTML 33

**layout viewport** The part of the mobile layout containing the entire page content. HTML 372

**leading** A measure of the amount of space between lines of text, set using the line-height property. HTML 127

**left** CSS property that defines the left coordinates of an element placed using relative, absolute, or fixed positioning. HTML 238

**legend** HTML element that provides the text of a field set legend. HTML 518

**letter-spacing** CSS property that sets the space between letters. HTML 108

**LIFO.** See last-in first-out

**lightness** The brightness of a chosen color, ranging from 0% to 100%. HTML 101

**line** WEBVTT attribute that sets the vertical position of cue text. HTML 618

**linear structure** A website structure in which each page is linked with the pages that follow it and precede it. HTML E1

**linear-gradient** CSS property that creates a color gradient proceeding along a straight line. HTML 302

**line-height** CSS property that sets the height of a line. HTML 108

**link** CSS pseudo-class that selects unvisited links. HTML 136

**list marker** A symbol displayed alongside a list item. HTML 138

**list-style-image** CSS property that inserts an image for the list marker. HTML 136

**list-style-type** CSS property that defines the appearance of the list marker. HTML 136

**load-time error** A program error that occurs when the browser initial loads and reads the program code. HTML 692

**local area network (LAN)** A network confined to a small geographic area, such as within a building or department. HTML 4

**local scope** The scope of a variable that can only be referenced within the function in which the variable is defined. HTML 733

**local variable** A variable with local scope. HTML 733

**logical error** A program error that is free from syntax and executable mistakes but that results in an incorrect result. HTML 692

**logical operator** An operator that allows you to connect several Boolean expressions. HTML 776

**lorem ipsum** Nonsensical improper Latin commonly used in page design as filler text. HTML 232

**lossless compression** File compression in which redundant data are removed to achieve a smaller file size. HTML 604

**lossy compression** File compression in which nonessential data are removed to achieve a smaller file size. HTML 604

## M

**mailto** HTML communication scheme used to provide the URL for an e-mail link. HTML 46

**main axis** The central axis along which items within a flexbox are laid out. HTML 394

**margin area** The page section that contains the space between the printed content and the edges of the page. HTML 422

**margin space** The part of the box model that surrounds the element border, extending to the next element. HTML 143

**margin-top** CSS property that sets the margin space above the element. HTML 136

**markup language** A language that describes the content and structure of a document by tagging different document elements. HTML 5

**Math object** JavaScript object used for performing mathematical tasks and storing mathematical values. HTML 723

**Math.floor()** JavaScript method that rounds a numeric value down to the next nearest integer. HTML 718

**matrix** A data structure in which data values are arranged in a rectangular grid. HTML 763

**max** HTML attribute that specifies the maximum value from a range of possible field values. HTML 562

**max-width** CSS property that defines the maximum width of an element. HTML 176

**media player** A software program that decodes and plays multimedia content. HTML 605

**media query** Code used to apply specified style rules to a device based on the device type and the device features. HTML 362

**metadata** Content that describes the document or provides information about how the document should be processed by the browser. HTML 15

**method** An action that can be performed on an object. HTML 700

**MIME type.** See Multipurpose Internet Mail Extension

**min** HTML attribute that specifies the minimum value from a range of possible field values. HTML 562

**min-width** CSS property that defines the minimum width of an element. HTML 176

**minifying** The process of removing unnecessary characters from HTML and CSS files in order to increase processing speed. HTML 416

**mobile device emulator** A software program that duplicates the look and feel of a mobile device. HTML 379

**mobile first** A design principle by which the overall page design starts with base styles that apply to all devices followed by style rules specific to mobile devices. HTML 370

**modernizr** A script that provides support for HTML 5 in older browsers. HTML 39

**module** A component of CSS that focuses on a particular design topic. HTML 88

**modulus operator** An operator that returns the integer remainder after dividing one integer by another. HTML 790

**monospace** A typeface in which each character has the same width, often used to display programming code. HTML 117

**MP3.** See MPEG-1 Audio Layer 3

**MP4.** See MPEG-4

**MPEG-1 Audio Layer 3 (MP3)** A widely used format for digital audio players. HTML 608

**MPEG-4 (MP4)** Proprietary video form developed by Apple based on the Apple QuickTime movie format. HTML 620

**multidimensional array** A JavaScript structure in which one array is nested within another. HTML 763

**multiple** HTML attribute that allows for multiple selections from a drop-down list. HTML 544

**Multipurpose Internet Mail Extension (MIME)** An extension that provides a way of attaching nontextual content to e-mail messages. HTML 609

## N

**name** HTML attribute that provides the name of a data field associated with an input control. HTML 518

**namespace** The part of a document that combines several vocabularies that define which part of the document belongs to which vocabulary. HTML F9

**navicon** A symbol, usually represented as three horizontal lines, used to hide menu items in mobile devices. HTML 412

**navigation list** An unordered list of hypertext links placed within the `nav` element. HTML 55

**nested element** An element contained within another element. HTML 9

**nested list** A list that is placed inside another list. HTML 50

**network** A structure in which information and services are shared among devices known as nodes or hosts. HTML 4

**node** A network location that can access and share information and services. HTML 4

**no-repeat** CSS keyword that specifies that no tiling should be done with the background image. HTML 274

**nth-of-type** CSS pseudo-class that selects the *nth* element type of the parent element. HTML 136

**number** HTML data type for an input control that creates a spin box control. HTML 562

**numeric character reference** An HTML string that inserts a character based on its code value. HTML 22

**numeric value** A data type for storing numbers. HTML 710

## O

**object** An entity within the web browser or web page. HTML 700

**object collections** A group of objects. HTML 701

**object-based language** A programming language that manipulates an object by changing a property or applying a method. HTML 700

**Ogg (audio)** An open source and royalty-free audio format that provides better sound quality than MP3. HTML 608

**Ogg (video)** An open source video format developed by the Xiph.org Foundation as an alternative to the MPEG-4 codec. HTML 620

**one-sided element tag** A tag used for empty elements, containing no closing tag. HTML 9

**opacity** A measure of the solidness of a color, ranging from 0 to 1. HTML 102

**opacity** CSS property that makes an object semi-transparent. HTML 302

**opening tag** The tag that marks the start of the element content. HTML 2

**operand** The variable or expression that operators act upon. HTML 720

**operator** A symbol used in JavaScript to act upon an item or variable within an expression. HTML 720

**option** HTML element that marks options from a selection list. HTML 544

**option button** A web form control for selecting data from a small predefined list of options. Also called radio button. HTML 520

**ordered list** A list that is used for items that follow some defined sequential order. HTML 48

**orphans** A property that limits the number of lines stranded at the bottom of a page. HTML 418

**outline** CSS property that draws a line around the selected elements. HTML 221

**overflow** CSS property that determines how the browser should handle content that exceeds the space allotted to the element. HTML 238

## P

**padding space** The part of the box model that extends from the element content to the element border. HTML 143

**padding-box** CSS keyword that specifies the background extends through the padding space. HTML 274

**page area** The page section that contains the content of the document. HTML 422

**page box** The layout definition of the printed page. HTML 422

**page-break-before** CSS property that inserts page breaks before elements. HTML 418

**page-break-inside** CSS property that prohibits page breaks within an element. HTML 418

**parallel array** An array in which an item matches, or is parallel to, another entry in a different array. HTML 788

**parameter** A variable that is associated with a JavaScript function. HTML 730

**parent element** An element that contains one or more child elements. HTML 110

**pattern** HTML attribute that specifies the general pattern that characters in a field value must follow. HTML 562

**Perl** A programming language used with server-based programs. HTML 522

**perspective** CSS property and a function used in 3D transformations to measure how rapidly objects appear to recede or approach the viewer. HTML 326

**pixel** A single dot on the output device. HTML 124

**placeholder** HTML attribute that inserts descriptive text into an input control. HTML 518

**placeholder** A text string that appears within a form control, providing a hint about the kind of data that should be entered into the field. HTML 540

**plug-in** A software program accessed by the browser to provide a feature not native to the browser. HTML 605

**PNG (Portable Network Graphic)** A bitmap image format designed to replace the GIF format with a palette of a million colors. HTML 280

**position** WEBVTT attribute that sets the horizontal position of cue text. HTML 618

**post method** HTML method applied to web forms that tells the browser to send the form data in its own separate data stream. HTML 523

**poster** HTML attribute that displays a preview image of a video file. HTML 618

**presentational attribute** An attribute that describes how page content should be rendered by the browser. HTML 36

**presentational element** An element that describes how page content should be rendered by the browser. HTML 36

**print style sheet** A style sheet that formats the printed version of the web document. HTML 420

**program loop** A programming structure in which a set of commands is repeated until a stopping condition is met. HTML 771

**progressive enhancement** A CSS technique in which styles that conform to older standards are entered first with newer standards placed last. HTML 106

**prolog** The first line of an XML document that indicates that the document adheres to the syntax rules of XML. HTML F2

**property** A defining characteristic of an object. HTML 700

**protocol** A set of rules defining how information is passed between two network devices. HTML 64

**pseudo-class** A classification of an element based on its current status, position, or use in the document. HTML 149

**pseudo-element** An object that exists only in the rendered page. HTML 154

## Q

**queue** A data structure principle in which items are arranged in an array following the first-in first-out principle. HTML 766

**quirks mode** An operating mode in which the browser renders the web page based on styles and practices from the 1990s and early 2000s. HTML 9

**quotes** CSS property that defines characters for quotation marks. HTML 136

## R

**radial gradient** A color gradient proceeding outward from a central point in a series of concentric circles or ellipses. HTML 302

**radial-gradient** CSS property that creates a color gradient proceeding outward from a central point. HTML 302

**radio** HTML element that marks an option button control. HTML 544

**radio button** A web form control for selecting data from a small predefined list of options. Also called option button. HTML 520

**range** HTML data type for an input control that creates a range slider control. HTML 562

**read-only property** An object property whose value cannot be changed. HTML 704

**regex.** See regular expression

**regular expression** A concise description of a character pattern that is used in data validation. HTML 578

**relative path** A folder path expressed relative to the location of the current document. HTML 61

**relative positioning** A layout technique that shifts an element from its default position in the document flow. HTML 238

**relative unit** A unit that is expressed relative to the size of other objects within the web page or relative to the display properties of the device itself. HTML 123

**rem.** See Root em unit

**required** HTML attribute that indicates a field value is required. HTML 562

**reset** HTML data type for an input control that creates a button that restores the form to its default values. HTML 562

**reset button** A web form button that resets the form, changing all fields to their original default values. HTML 572

**reset style sheet** A base style sheet that supersedes the browser's default styles, providing a consisting starting point for page design. HTML 178

**responsive design** A design principle in which the layout and design of the page changes in response to the device that is rendering the page. HTML 183

**RGB color value** Color defined by its red, green, and blue components. HTML 86

**RGB triplet** A color value indicating the red, green, and blue values of a color. HTML 100

**rollover effect** An effect in which the page appearance changes as the user hovers the mouse pointer over a hypertext link. HTML 59

**root element** The topmost element in an XML document that contains all other elements. HTML F3

**Root em unit** A relative unit of length that expresses a size relative to the font size of the root element. HTML 124

**Root folder** The folder at the top of the folder hierarchy, containing all other folders. HTML 60

**rowspan** HTML attribute that indicates a table cell should cover several rows. HTML 452

**run-time error** A program error that occurs after the script has been loaded, during the time when the code is being executed. HTML 692

## S

**sans-serif** A typeface without any serif ornamentation. HTML 117

**saturation** The intensity of a chosen color, ranging from 0% to 100%. HTML 101

**scalable** The principle by which text is resized using relative units. HTML 124

**Scalable Vector Image.** See SVG (Scalable Vector Image)

**scope** The characteristic of a variable that indicates where it can be referenced within a JavaScript program. HTML 733

**script** An external program that is run within the browser. HTML 39

**Section 508** A section from the 1973 Rehabilitation Act that requires any electronic information to be accessible to people with disabilities. HTML D2

**sectioning element** An element used to define major topical areas in the document. HTML 24

**select** HTML element that creates a drop-down list box control. HTML 544

**selected** HTML attribute that indicates the default option in a selection list. HTML 544

**selection list** A web form control for selecting data from an extensive list of options. HTML 520

**selector** CSS code that defines what element or elements are affected by the style rule. HTML 86

**selector pattern** A selector that matches only those elements that correspond to the specified pattern. HTML 110

**semantic element** An element in which the element name describes the purpose of the element and the type of content it contains. HTML 24

**serif** A typeface in which a small ornamentation appears at the tail end of each character. HTML 117

**server** A host that provides information or a service to other devices on the network. HTML 4

**server-side image map** An image map that relies on a program running on the web server to create and manage the map. HTML 341

**server-side programming** The programming environment in which program code is run from the server hosting the website. HTML 684

**server-side validation** Validation that takes place on the web server. HTML 575

**setFullYear()** JavaScript method that sets the year value in a Date object. HTML 718

**setInterval()** JavaScript method used to repeatedly run a command after an interval expressed in milliseconds. HTML 718

**sibling selector** A selector that matches elements based on the elements that are adjacent to them in the document hierarchy. HTML 111

**site index** A page containing an outline of the entire website structure and its contents. HTML E4

**size** HTML attribute that sets the number of visible options in a drop-down list. HTML 544

**slider control** A web form control for entering numeric values confined to a specified range that includes a marker the user can drag horizontally across a range of possible field values. HTML 520

**source** HTML element that provides the source of a multimedia file. HTML 602

**spaghetti code** A pejorative programming term that refers to convoluted or poorly written code. HTML 808

**spam** Unsolicited e-mail sent to large numbers of people. HTML 67

**sparse array** An array in which some array values are left undefined. HTML 761

**specific font** A font that is identified by name. HTML 117

**spin box** A web form control for entering integer values confined to a specified range. HTML 520

**spinner control** A web form control that displays an up or a down arrow to increase a field value by a set amount. HTML 564

**sprite** An animated image that is made from several frames shown in rapid succession at timed steps. HTML 658

**stack** A data structure in which new data items are added to the end of an array. HTML 766

**standards mode** An operating mode in which the browser renders the web page in line with the most current HTML specifications. HTML 9

**start expression** The expression in a `for` loop that provides the starting value of the counter variable. HTML 770

**starting tag** The tag that marks the start of the element content. HTML 9

**statement label** A label used to identify a statement in the JavaScript code so that you can reference those lines elsewhere in the program. HTML 807

**static positioning** A layout technique that places an element where it would have fallen naturally within the flow of the document. HTML 240

**step** HTML attribute that sets the interval between values in a data field. HTML 562

**storyboard** A diagram of a website's structure, showing all of the pages in the site and how they are linked together. HTML E1

**strict DTD** The DTD used by XHTML that does not allow for deprecated elements, attributes, or frames. HTML F5

**strict mode** A programming mode in which all lapses in syntax result in load-time or run-time errors. HTML 695

**strongly typed language** A programming language in which a variable's data type must be explicitly defined. HTML 711

**structural pseudo-class** A pseudo-class based on the element's location within the structure of the HTML document. HTML 149

**style comment** Text that provides information about the style sheet. HTML 86

**style inheritance** The principle by which style properties are passed from a parent element to its children. HTML 94

**style property** CSS code that specifies what aspect of the selector to modify. HTML 86

**style rule** CSS code that sets the display properties of a page element. HTML 84

**style sheet** A set of rules defining how page elements are displayed. HTML 32

**subarray** A section of an array. HTML 765

**submit** HTML data type for an input control that creates a button used for submitting the form for processing. HTML 562

**submit button** A web form button that submits the form to the server for processing. HTML 572

**SVG (Scalable Vector Image)** An XML markup language that can be used to create vector images. HTML 280

**switch statement** A JavaScript statement used to run different commands based on different values of a specified variable. Also called *case* statement. HTML 796

**symmetric transition** A transition in which the initial state to end state transition is the reverse of the end state to initial state transition. HTML 652

**syntax** The rules governing how a language should be used and interpreted. HTML 5

## T

**table** HTML element that marks a web table. HTML 452

**tbody** HTML element that marks the row(s) in a web table body. HTML 476

**td** HTML element that marks a cell containing table data. HTML 452

**tel** HTML communication scheme used to provide the URL for a telephone link. HTML 46

**ternary operator.** See conditional operator

**text area box** A web form control for entering text strings that may include several lines of content. HTML 520

**text string** A data type for storing any group of characters enclosed within either double or single quotation marks. HTML 710

**text-align** CSS property that defines the horizontal alignment of the content of an element. HTML 108

**textarea** HTML element that marks a text area control. HTML 544

**textContent** JavaScript method that returns or defines the text contained within a web page element. HTML 698

**text-level element** An element within a grouping element that contains strings of the characters or page content. HTML 29

**text-shadow** CSS property that adds a drop shadow to a text string. HTML 302

**tfoot** HTML element that marks the row(s) in a web table footer. HTML 476

**th** HTML element that marks a cell containing a table header. HTML 452

**thead** HTML element that marks the row(s) in a web table header. HTML 476

**Theora** A royalty-free video codec that produces video streams that can be used with almost any container. HTML 620

**tiling** A process by which a background image is repeated, filling up the background space. HTML 281

**time-delayed command** A JavaScript command that is run after a specific amount of time has passed. HTML 734

**toLocaleDateString()** JavaScript method that returns a text string containing the date using local conventions. HTML 698

**toLocaleTimeString()** JavaScript method that returns a text string containing the time using local conventions. HTML 682

**top** CSS property that defines the top coordinates of an element placed using relative, absolute, or fixed positioning. HTML 238

**tr** HTML element that encloses a table row. HTML 452

**track** HTML element that attaches a text track to a media clip. HTML 618

**tracking** A measure of the amount of space between words, set using the word-spacing property. HTML 127

**tracks** Rows or columns within a grid layout.

**transform** CSS property used to rotate, rescale, skew, or shift a page object. HTML 326

**transition** A change in an object's style from an initial state to an ending state. HTML 640

**transition** CSS property that defines a transition between an initial state and an end state. HTML 642

**transitional DTD** The DTD used by XHTML that supports those HTML features that were deprecated in HTML 5. HTML F5

**typography** The art of designing the appearance of characters and letters on a page. HTML 117

## U

**unary operator** An operator that works with only one operand. HTML 720

**Unicode** The largest character set supporting up to 65,536 symbols that can be used with any of the world's languages. HTML 33

**Uniform Resource Locator (URL)** A standard address format used to link to a variety of resource documents. HTML 57

**unordered list** A list that is used for items that do not follow a defined sequential order. HTML 49

**unstack** The process of removing the last item from an array. HTML 766

**update expression** The expression in a *for* loop that updates the value of the counter variable each time through the loop. HTML 770

**URL.** See Uniform Resource Locator (URL)

**use strict** JavaScript statement that specifies syntax rules should be strictly applied. HTML 683

**user agent style** A style built into the web browser itself. HTML 89

**user-defined style** A style defined by the user based on settings made in configuring the browser. HTML 87

**UTF-8** The most common character encoding in present use. HTML 17

## V

**valid document** A well-formed XML document that contains only those elements, attributes, and other features that have been defined for its XML vocabulary. HTML F4

**validation** The process of ensuring the user has supplied valid data. HTML 575

**validator** A program that tests code to ensure that it contains no syntax errors. HTML 7

**value** HTML attribute that provides the default value for a data field. HTML 518

**vanishing point** An effect of perspective in which parallel lines appear to converge to a point. HTML 333

**var** JavaScript keyword used to declare a variable. HTML 698

**variable** A named item in a program that stores a data value or an object. HTML 709

**vector image** An image format in which the lines and curves that comprise the image are based on mathematical functions. HTML 280

**vendor prefix** The prefix added to a browser extension. HTML 92

**video** HTML element that embeds a video file in a web page. HTML 618

**viewport meta** A meta tag used to set the properties of the layout viewport. HTML 362

**viewport unit** A relative unit of length that expresses a size relative to the width or height of the browser window. HTML 125

**virtual keyboard** A keyboard that exists as a software representation of a physical keyboard. HTML 531

**visited** CSS pseudo-class that selects previously-visited links. HTML 136

**visual viewport** The part of the mobile layout that displays the web page content that fits within a mobile screen. HTML 372

**VP8** An open source video codec used in Google's WebM video format. HTML 620

**VP9** A video codec developed by Google as a successor to VP8, offering the same video quality at half the download size. HTML 620

## W

**W3C.** See World Wide Web Consortium (W3C)

**WAN.** See wide area network (WAN)

**watermark** A translucent graphic that is part of the page content and that displays a message that the content is copyrighted or in draft form

or some other message directed toward the reader. HTML 283

**WAV** The original audio format for Windows PCs, commonly used for storing uncompressed audio, making it impractical for all but the shortest audio clips. HTML 608

**weakly typed language** A programming language in which variables are not strictly tied to specific data types. HTML 711

**web browser** A software program that retrieves and displays web pages. HTML 4

**web content management system (wcms)** Provides authoring tools for website content and administration. HTML 7

**web font** A font in which the font definition is supplied to the browser in an external file. HTML 119

**web form** A web page design element in which users can enter data that can be saved and processed. HTML 520

**web framework** Software that provides the foundation for the design and deployment of web technologies including HTML, databases, and web server programs for managing electronic commerce and communication. HTML 7

**Web Hypertext Application Technology Working Group (WHATWG)** A group formed in 2004 to develop HTML 5 as a rival version to XHTML 2.0. HTML 5

**web page** A document stored by a web server and accessed by a web browser. HTML 4

**web safe font** A font that is displayed mostly the same way in all operating systems and on all devices. HTML 118

**web server** A server that makes web pages accessible to the network. HTML 4

**web table** An HTML structure consisting of multiple rows with each row containing one or more table cells. HTML 454

**Web Video Text Tracks (WebVTT)** A text file format used for storing video text tracks. HTML 625

**WebM** An open source format introduced by Google to provide royalty-free video and audio to be used with the HTML audio and video elements HTML 608

**well-formed document** An XML document that employs the correct syntax. HTML F2

**WHATWG.** See Web Hypertext Application Technology Working Group (WHATWG)

**while loop** A program loop in which the command block is run as long as a specified condition is met. HTML 774

**white-space character** An empty or blank character such as a space, tab, or line break. HTML 12

**wide area network (WAN)** A network that covers a wide area, such as several buildings or cities. HTML 4

**widget** An object within a web form that allows users to interact with the form. HTML 520

**widows** CSS property that limits the number of lines stranded at the top of a page. HTML 418

**width** CSS property that defines the width of an element. HTML 176

**wildcard selector** A selector that matches all elements. HTML 111

**window.alert** JavaScript command to display an alert dialog box in the browser window. HTML 683

**World Wide Web Consortium (W3C)** A group of web designers and programmers that set the standards or specifications for browser manufacturers to follow. HTML 5

**World Wide Web (WWW)** The totality of interconnected hypertext documents on the Internet. HTML 4

**WWW.** See World Wide Web (WWW)

## X

**XHTML (Extensible Hypertext Markup Language)** A version of HTML in which syntax standards are strictly enforced. HTML 5

**XML.** See Extensible Markup Language

**XML parser** A software program that checks an XML file for errors in syntax and content. HTML F2

**XML vocabularies** Markup languages developed using XML. HTML F1

# INDEX

**Note:** Boldface indicates key terms.

## Special Characters

- (minus sign), HTML 720
- / (forward slash), HTML 720
- & (ampersand), HTML 35, HTML 777
- # (pound symbol), HTML 35
- \* (asterisk), HTML 111, HTML 720
- + (plus sign), HTML 720
- % (percent sign), HTML 720
- = (equal sign), HTML 721, HTML 776, HTML 786
- [] (square brackets), HTML 758
- < (left angle bracket), HTML 776
- { } (curly braces), HTML 773
- ! (exclamation point), HTML 776, HTML 777
- | (pipe), HTML 777, HTML 787
- > (right angle bracket), HTML 776
- &#8226; (numeric entity reference), HTML 23, HTML 34

## A

- `<a>` tag, HTML 29, HTML 46, HTML B5
  - attributes, HTML 68–69
- AAC format. *See* Advanced Audio Coding (AAC) format
- `<abbr>` tag, HTML 29, HTML B5
- absolute paths**, HTML 61
- absolute positioning**, HTML 238, HTML 241–244
- absolute units, font size**, HTML 123, HTML 133
- access keys**, HTML 531
- accessibility, HTML D1–D17
  - animation and motion sensitivity, HTML 666
  - ARIA, HTML 44
  - checking for, HTML D17
  - Section 508 guidelines. *See* Section 508
  - tables, HTML 474
  - WAI, HTML D13–D16
- Accessible Rich Internet Applications (ARIA)**, HTML 44
- achromatopsia, HTML D4, HTML D5
- `<acronym>` tag, HTML B6
- action attribute**, HTML 518, HTML 523
- active pseudo-class**, HTML 136, HTML 152, HTML C3
- adaptive technology**, HTML D2
- `<address>` tag, HTML 24, HTML B6
- Advanced Audio Coding (AAC) format**, HTML 608
- after pseudo-class, HTML 136
- after pseudo-element**, HTML 154, HTML 418, HTML C2
- align attribute**, HTML 618
- align-content property**, HTML 410, HTML 411
- aligning
  - along flexbox main axis, HTML 409
  - flex lines, HTML 410
  - items along flexbox cross axis, HTML 410–411
  - text, horizontally and vertically, HTML 130–131
- align-items property**, HTML 411
- alt attribute**, HTML 36, HTML D2, HTML D3
- American Standard Code for Information Interchange (ASCII)**, HTML 33
- ampersand (&)
  - character encoding references, HTML 35
  - logical operators, HTML 777
- analogic color scheme, HTML 106
- animation(s), HTML 652–666
  - applying, HTML 655–657

- controlling, HTML 658–666
- key frames, HTML 652
- properties, HTML 655
- safe, HTML 666
- Section 508 guidelines, HTML D10
- animation style**, HTML 641
- animation-play-state style**, HTML 641
- applet(s), Section 508 guidelines, HTML D10–D11
- `<applet>` tag, HTML B6
- `<area>` tag, HTML B6
- ARIA. *See* Accessible Rich Internet Applications (ARIA)
- array(s)**, HTML 752–769
  - creating and populating, HTML 758–761
    - as data stacks, HTML 766–768
  - extracting and inserting items, HTML 765–766
  - filtering, HTML 782–783
  - indexes, HTML 757
  - length, HTML 761–763
  - mapping, HTML 781–782
  - methods, HTML 767–768
  - methods to loop through arrays, HTML 780–781
  - multidimensional, HTML 763
  - parallel, HTML 788
  - passing a value to a callback function, HTML 782
  - program loops, HTML 777–784
  - random shuffle, HTML 765
  - returning random values, HTML 780
  - reversing, HTML 763–764
  - running a function for each array item, HTML 781
  - sorting, HTML 764–765
  - sparse, HTML 761
- array literals**, HTML 758–759
- `<article>` tag, HTML 24, HTML B6
- ASCII. *See* American Standard Code for Information Interchange (ASCII)
- aside blockquote selector**, HTML 108
- `<aside>` tag, HTML 24, HTML B6
- assignment operators**, HTML 720–721
- assistive technology**, HTML D2
- asterisk (\*)
  - JavaScript operators, HTML 720
  - wildcard selector, HTML 111
- asymmetric transitions**, HTML 652
- at-rules**, CSS, HTML 98, HTML C4
- attribute(s), HTML B2–B5. *See also* specific attribute names
  - adding to elements, HTML 12
  - aural browsers, HTML C6–C7
  - autocomplete, HTML 539
  - backgrounds, HTML C7–C8
  - block-level styles, HTML C8–C9
  - browsers, HTML C9–C10
  - column, HTML C10
  - content, HTML C10–C11
  - core, HTML B2
  - core events, HTML B3
  - display styles, HTML C11–C12
  - document events, HTML B3
  - drag and drop event, HTML B4
  - elements, HTML 11–12
  - event, HTML B3
  - fonts and text, HTML C12–C14

- form, HTML B2
- form events, HTML B4
- formatting tables using, HTML 492
- grids, HTML C14–C15
- hypertext, HTML 68–69
- language, HTML B2
- layout, HTML C14
- lists, HTML C16
- meta element, HTML 17
- multimedia event, HTML B4–B5
- outlines, HTML C16
- presentational, HTML 36
- printing, HTML C16–C17
- required for XHTML elements, HTML F8
- special effects, HTML C17–C18
- tables, HTML C18
- valid use of, HTML F7–F8

- attribute minimization**, HTML 11
- attribute selectors, HTML 113–116
- audio element**, HTML 602, HTML 607
- audio formats, browser support, HTML 607–610
- `<audio>` tag, HTML 36, HTML B6–B7
- augmented linear structures**, HTML E2
- aural browsers, attributes, HTML C6–C7
- autocomplete attribute**, HTML 539
- autofocus, HTML 557

## B

- `<b>` tag, HTML 29, HTML B7
- background**
  - attributes, HTML C7–C8
  - setting color, HTML 102–105
- background images**, HTML 280–290
  - attaching, HTML 282–283
  - background property, HTML 286–287
  - defining extent, HTML 284
  - multiple backgrounds, HTML 288–290
  - setting image options, HTML 286
  - setting image position, HTML 283–284
  - sizing and clipping, HTML 285
  - tiling, HTML 281–283
- background property**, HTML 274, HTML 286–287
- background styles**, HTML 280–290
- background-color property**, HTML 86
- background-image property**, HTML 274
- balance, HTML 259
- `<base>` tag, HTML 15, HTML 62, HTML B7
- `<basefont>` tag, HTML B7
- `<bdi>` tag, HTML B7
- `<bdo>` tag, HTML B7
- before pseudo-class**, HTML 136
- before pseudo-element**, HTML 154, HTML C2
- Berners-Lee, Timothy, HTML 4, HTML D1
- `<big>` tag, HTML B7
- binary operators**, HTML 720
- bitmap images**, HTML 280
- block elements, centering, HTML 187
- block quotes, HTML 39–41, HTML 157
- block-level styles, attributes, HTML C8–C9
- `<blockquote>` tag, HTML 27, HTML B7
- blur function, HTML 338
- body, HTML 24–31

- grouping elements, HTML 26–28
  - sectioning elements, HTML 24–26
  - text-level elements, HTML 29–31
  - `<body>` tag, HTML 2, HTML 10, HTML 24, HTML B7
  - BOM. See browser object model (BOM)
  - Boolean values**, HTML 710
  - border(s)**, HTML 143, HTML 290–300
    - adding to tables using CSS, HTML 459–464
    - applying border images, HTML 297–300
    - collapse style, HTML 464
    - collapsing, HTML 463–464
    - color, HTML 290–291
    - design, HTML 291–293
    - hidden, reconciling, HTML 462
    - reconciling different styles, HTML 463
    - rounded corners, HTML 293–296
    - style, HTML 463
    - width, HTML 290–291
  - border box model**, HTML 197
  - border property**, HTML 274
  - border-collapse property**, HTML 453, HTML 461
  - border-color property**, HTML 290–291
  - border-image property**, HTML 274, HTML 297–300
  - border-left property**, HTML 274
  - border-radius property**, HTML 274, HTML 293–296
  - border-right property**, HTML 274
  - border-side property**, HTML 292
  - border-style property**, HTML 291–293
  - border-width property**, HTML 290–291, HTML 292
  - box model**, HTML 143–144
  - box shadow(s), HTML 306–311, HTML 341
  - box-shadow property**, HTML 302, HTML 306–311, HTML 341
  - `<br>` tag, HTML 29, HTML B7
  - break statement, HTML 806
  - break-after property, HTML 502
  - break-before property, HTML 502
  - breakpoints**, HTML 694
    - inserting, HTML 694–695
  - brightness function, HTML 338
  - browser developer tools, HTML 95–96
  - browser extensions**
    - gradients, HTML 320
    - style rules, HTML 92–93
  - browser object(s)**, HTML 700
  - browser object model (BOM)**, HTML 700
  - browser styles**, HTML 89
  - browser(s). See web browsers
  - built-in objects**, HTML 700
  - `<button>` tag, HTML B7
  - buttons. See also *specific buttons*
    - command, HTML 572
    - form. See form buttons
    - image, HTML D11
    - option (radio), HTML 520, HTML 553–555
    - push, HTML D11
- C**
- calCaption() function, HTML 752, HTML 759–760
  - calendar app, HTML 754–757, HTML 796–805
    - createCalendar() function, HTML 756–757
    - highlighting the current date, HTML 801–803
    - placing first day of the month, HTML 798–799
    - setting first day of the month, HTML 797–798
    - structure, HTML 755–756
    - writing calendar days, HTML 799–801
  - calendar controls**, HTML 520
  - callback functions, passing values to, HTML 782
  - callto: scheme, HTML 67
  - canvas pseudo-class, HTML C3
  - `<canvas>` tag, HTML 36, HTML B8
  - caption(s)
    - adding to tables, HTML 471–473
    - formatting, HTML 473
  - caption attribute, HTML D9
  - caption element**, HTML 452, HTML 471–473
  - `<caption>` tag, HTML B8
  - caption-side property**, HTML 453, HTML 472
  - Cascading Style Sheets (CSSs)**, HTML 32, HTML 85–174. See also *entries beginning with CSS*
    - @ rules, HTML 98, HTML C4
    - adding table borders, HTML 459–464
    - attributes and values, HTML C6–C17
    - color. See color in CSS
    - creating pulldown menus, HTML 376–379
    - drop caps, HTML 193
    - filters, HTML 337–341
    - frameworks, HTML 210
    - generating content, HTML 155–156
    - grids. See CSS grids
    - introducing grids, HTML 210–213
    - lists. See formatting lists
    - modules, HTML 88
    - positioning objects, HTML 244
    - pseudo-classes, HTML C3
    - pseudo-elements, HTML C2
    - quotation marks, HTML 157–158
    - selectors, HTML C2–C17
    - style rules. See style rules
    - style sheets. See style sheets
    - styles. See style(s); table styles
    - syntax, HTML C4
    - transformations. See transformations
    - typography. See CSS typography; font(s); selector patterns
    - units, HTML C5–C6
    - white space, HTML 257
  - case statement**, HTML 796
  - cells
    - spanning rows and columns, HTML 464–471
    - types, HTML 456
  - `<center>` tag, HTML B8
  - centering block elements, HTML 187
  - centering vertically, HTML 188–189
    - using flexboxes, HTML 412
  - CGI. See Common Gateway Interface (CGI)
  - `&char`; character encoding reference, HTML 33, HTML 34
  - character encoding**, HTML 17, HTML 33–34
    - defining, HTML 97–98
  - character entity references**, HTML 22, HTML 34–35
  - character sets**, HTML 33
  - charset meta element, HTML 17
  - @charset rule**, HTML 86, HTML 97, HTML C4
  - check boxes**, HTML 520
  - checkbox data type**, HTML 544
  - checked pseudo-class, HTML 582, HTML C3
  - child elements**, HTML 110
  - `<cite>` tag, HTML 22, HTML 23, HTML 29, HTML 30, HTML B8
  - class attribute, HTML 11
    - attribute selectors, HTML 115–117
  - clear property**, HTML 176
  - clearing floats, HTML 193–197
  - client(s)**, HTML 4
  - client-server networks**, HTML 4
  - client-side image maps**, HTML 341
  - client-side programming**, HTML 684–685
  - client-side validation**, HTML 575
  - clip property, HTML 257–258
  - clipping
    - background images, HTML 285
    - elements, HTML 257–258
  - closing tags**, HTML 2
  - `&#code`; character encoding reference, HTML 33, HTML 34
  - `<code>` tag, HTML 29, HTML B8
  - codecs**
    - audio, HTML 604
    - video, HTML 620–621
  - cognitive disability**, HTML D1
  - col element, HTML 476
  - `<col>` tag, HTML B8
  - colgroup element**, HTML 476, HTML 482
  - `<colgroup>` tag, HTML B8
  - collapsing table borders, HTML 463–464
  - color
    - borders, HTML 290–291
    - CSS. See color in CSS
    - gradients. See color gradients
    - Section 508 guidelines, HTML D4–D6
  - color blindness, HTML D4–D6
  - color gradients**, HTML 312–322
    - browser extensions, HTML 320
    - color stops, HTML 315–316
    - creating, HTML 321
    - linear, HTML 312–315
    - radial, HTML 316–319
    - repeating, HTML 320–321
    - transparency, HTML 314
  - color in CSS, HTML 98–106
    - choosing color schemes, HTML 99
    - color names, HTML 98
    - defining semi-opaque colors, HTML 102
    - HSL color values, HTML 101–102
    - progressive enhancement, HTML 106
    - RGB color values, HTML 99–101
    - setting text and background colors, HTML 102–105
  - color names with color values and HTML character entities, HTML A1–A8
  - color pickers**, HTML 520
  - color property**, HTML 86
  - color stops, gradients, HTML 315–316
  - color values**
    - HSL, HTML 101–102
    - RGB, HTML 99–101
  - color-stop**, HTML 302
  - colspan attribute**, HTML 452, HTML 464–466
  - column(s)
    - applying layout, HTML 497–498
    - attributes, HTML C10
    - banded, creating, HTML 485
    - creating layout, HTML 504
    - gap between, HTML 498–501
    - setting number, HTML 496–498
    - spanning, HTML 464–466, HTML 503–504
  - column breaks, HTML 501–503
  - column groups, HTML 482–484
    - defining, HTML 483
    - formatting, HTML 483–484
    - identifying, HTML 482
  - column width
    - defining, HTML 498–501
    - setting, HTML 486, HTML 489
  - column-count property, HTML 496, HTML 498–501

column-gap property, HTML 499  
 column-rule property, HTML 500  
 columns property, HTML 498–501  
 command(s). *See also specific commands*  
   JavaScript, writing, HTML 690–691  
   running at specified intervals, HTML 734–736  
   time-delayed, HTML 734  
**command blocks**, HTML 773  
**command buttons**, HTML 572  
 <command> element, HTML B8  
 comments, HTML 18–20  
   adding to JavaScript code, HTML 689–690  
   conditional, HTML 20  
   style sheets, HTML 96–97  
**Common Gateway Interface (CGI)**, HTML 522  
**compare functions**, HTML 764–765  
**comparison operators**, HTML 776  
**compilers**, HTML 685  
 complementary color scheme, HTML 106  
 compressing, speeding up websites, HTML 416  
 concat() method, HTML 768  
**conditional comments**, HTML 20  
**conditional expressions**, HTML 786  
**conditional operators**, HTML 791  
**conditional statements**, HTML 786–809  
 constants, Math object, HTML 728–730  
**container(s)**, HTML 604  
**container collapse**, HTML 201–203  
**content**  
   assigning to grid cells, HTML 234  
   attributes, HTML C10–C11  
   clipping, HTML 258  
   CSS, generating, HTML 155–156  
   CSS, inserting, HTML 156  
   floating, HTML 189–204  
   generating with lorem ipsum, HTML 232  
   reordering using flexboxes, HTML 407–408  
**content box model**, HTML 197  
**content property**, HTML 136, HTML 155–156  
   attribute values, HTML 156  
**content-box keyword**, HTML 274  
**contextual selectors**, HTML 110–112  
 continue **expression**, HTML 770  
**continue statement**, HTML 806–807  
 contrast, HTML 259  
 contrast function, HTML 326, HTML 338  
**controls**, HTML 520. *See also widgets*  
**controls attribute**, HTML 602  
 copyWithin() method, HTML 768  
 core attributes, HTML B2  
 core event attributes, HTML B3  
**counter variables**, HTML 772, HTML 773, HTML 774  
**cover keyword**, HTML 274  
 createCalendar() function, HTML 752  
 creating using dynamic pseudo-classes, HTML 152  
**cross axis**, flexboxes, HTML 394  
   aligning items along, HTML 410–411  
 cross-browser flexboxes, HTML 395  
 CSS(s). *See* Cascading Style Sheets (CSSs)  
**CSS at-rules**, HTML 98, HTML C4  
 CSS display property, HTML 490  
**CSS grid model**, HTML 210  
 CSS grids, HTML 210–213  
   creating, HTML 213–215  
   defining, HTML 224  
**CSS pixels**, HTML 375

CSS typography, HTML 109–135  
   fonts. *See* font(s); font size; font styles  
   selector patterns. *See* selector patterns  
   spacing and indentation, HTML 127–129  
**CSS**, HTML 88  
 cubic-bezier function, HTML 646  
 cue label, HTML 618  
 cue **pseudo-element**, HTML 619, HTML 630–632  
 cue text, HTML 618, HTML 619  
 curly braces {}, command blocks, HTML 773  
**cursive fonts**, HTML 118  
 custom form buttons, designing, HTML 575  
**customized objects**, HTML 700  
**D**  
**data attributes**, HTML 494  
 data cells, tables, marking, HTML 458  
**data fields**, HTML 521  
 <data> tag, HTML 29  
**data types**, HTML B1  
   validating based on, HTML 577–578  
   variables, HTML 710  
 data validation, HTML 563–585  
   data lists, HTML 569–571  
   form buttons. *See* form buttons  
   numeric data. *See* numeric data validation  
 datalist, HTML 569  
**datalist element**, HTML 562  
 <datalist> tag, HTML B8  
 date(s), writing for global marketplace, HTML 715  
**Date objects**, HTML 698, HTML 711–716  
   applying Date methods, HTML 713–715  
   creating, HTML 712  
   setting date and time values, HTML 716  
   storing dates, HTML 712  
 days left in year, calculating, HTML 721–723  
 <dd> tag, HTML 27, HTML B8  
**debugging**, HTML 692–696  
   applying strict usage of JavaScript, HTML 695–696  
   error types, HTML 692  
   inserting breakpoints, HTML 694–695  
   opening debugging tool, HTML 692–693  
**declaring variables**, HTML 709  
**decrement operator** (--), HTML 720  
 default field values, HTML 539–542  
**default namespace**, HTML F9  
 default pseudo-class, HTML 582  
 <del> tag, HTML B9  
 delaying transitions, HTML 647  
**deprecated**, HTML 6, HTML B1  
**descendant elements**, HTML 110  
**description lists**, HTML 51–54  
 design principles, HTML 259  
 desktop designs, HTML 387–389  
 <details> tag, HTML B9  
 deuteranopia, HTML D4, HTML D5  
**device pixels**, HTML 375  
**device-pixel ratio**, HTML 375  
 <dfn> tag, HTML 29, HTML B9  
 dir attribute, HTML 11  
 <dir> tag, HTML B9  
 disabled pseudo-class, HTML 582, HTML C3  
**display property**, HTML 176, HTML 178, HTML 392, HTML 418  
 display styles, attributes, HTML C11–C12

displaying. *See also* viewing  
   attribute values, HTML 156  
   values, HTML 156  
 <div> tag, HTML 26, HTML 27, HTML B9  
 <dl> tag, HTML 27, HTML 51–54, HTML B9  
 D-links, HTML D3  
 DOCTYPE declaration, HTML F8–F9  
 !doctype tag, HTML B5  
**document body**, HTML 2  
 document event attributes, HTML B3  
**document head**, HTML 2, HTML 15–18  
   adding metadata, HTML 16–18  
   setting page title, HTML 16  
**document object(s)**, HTML 700  
**document object model (DOM)**, HTML 700  
**document type declaration**, HTML 2, HTML 8–9  
**document type definitions (DTDs)**, HTML F4–F7  
   HTML and XHTML versions, HTML F9  
 document.write() method, HTML 708  
 DOM. *See* document object model (DOM)  
**domain names**, HTML 65  
 do/while loop, HTML 775–776  
 drag and drop event attributes, HTML B4  
**drop caps**, HTML 193  
 drop shadows, HTML 304–311, HTML 341  
   box, HTML 306–311  
   text, HTML 304–306  
 drop-shadow function, HTML 338, HTML 341  
 <dt> tag, HTML 27, HTML B9  
**DTD files**, HTML F4  
 DTDs. *See* document type definitions  
 dynamic content, HTML D11  
**dynamic pseudo-classes**, HTML 152–154

## E

**elastic layout**, HTML 183  
 element(s), HTML B5–B21. *See also specific element names*  
   attributes. *See* element attributes  
   clipping, HTML 257–258  
   embedded, HTML 36  
   empty, HTML 9  
   floating, HTML 190–193  
   grouping, HTML 26–28  
   hierarchy, HTML 10  
   inline, HTML 29  
   interactive, HTML 36  
   list, HTML B5–B21  
   metadata, HTML 16  
   nested, HTML 9  
   presentational, HTML 36  
   rounded corners, HTML 293–296  
   sectioning, HTML 24–26  
   semantic, HTML 24  
   stacking, HTML 258–260  
   text-level, HTML 29–31  
   width and height, HTML 184–189  
**element attributes**, HTML 11–12  
   adding, HTML 12  
   list, HTML B5–B21  
**element tags**, HTML 9–10  
   one-sided, HTML 9  
 else if statements, multiple, HTML 794  
 <em> tag, HTML 22, HTML 23, HTML 29, HTML 30, HTML B9  
 em unit, HTML 108  
 email addresses, linking to, HTML 65–67

email harvesters, HTML 67  
 embed element, HTML 615  
 <embed> tag, HTML 36, HTML B9  
 embedded content, HTML 36  
 embedded elements, HTML 36  
 embedded objects, HTML 605, HTML 615–616  
 embedded script, HTML 686  
 embedded style(s), HTML 89  
 embedded style sheets, style rules, HTML 93  
 emphasis, HTML 259  
 empty elements, HTML 9  
 empty pseudo-class, HTML 149, HTML C3  
 enabled pseudo-class, HTML 582, HTML C3  
 enctype attribute, HTML 523–524  
 ending tags, HTML 9  
 equal sign (=)  
     assignment operators, HTML 721  
     comparison operators, HTML 776, HTML 786  
 equals operator (= = =), HTML 786  
 errors, types, HTML 692  
 event attributes, HTML B3  
 every() method, HTML 783  
 exclamation point (!)  
     comparison operators, HTML 776  
     logical operators, HTML 777  
 explicit grid, HTML 216  
 Extensible Hypertext Markup Language. See XHTML  
 (Extensible HyperText Markup Language)  
 Extensible Markup Language (XML), HTML F1  
 extensions, HTML 65  
 external styles, HTML 89

## F

fallback, audio clips, HTML 613–614  
 fantasy fonts, HTML 118  
 fax scheme, HTML 64  
 field(s), HTML 521  
     hidden, HTML 552  
 field labels, HTML 532–533  
 field sets, HTML 525  
     legends, HTML 526–527  
     marking, HTML 525–526  
 field values  
     default, HTML 539–542  
     defining length, HTML 580  
     validating, HTML 579  
 fieldset element, HTML 518, HTML 525, HTML 553  
 <fieldset> tag, HTML B9  
 FIFO. See first-in first-out (FIFO) principle  
 <figcaption> tag, HTML 27, HTML B9  
 figure boxes, HTML 276–279  
 <figure> tag, HTML 27, HTML B9  
 file scheme, HTML 64  
 fill() method, HTML 768  
 filter() method, HTML 783  
 filter property, HTML 326, HTML 337–341  
 filtering arrays, HTML 782–783  
 filters, HTML 337–341  
 find() method, HTML 783  
 findIndex() method, HTML 783  
 finding information on networks, HTML 4  
 first pseudo-class, HTML C3  
 first-child pseudo-class, HTML 149, HTML C3  
 first-in first-out (FIFO) principle, HTML 766  
 first-letter pseudo-element, HTML 154, HTML C2  
 first-line pseudo-element, HTML 154, HTML C2  
 first-node pseudo-class, HTML C3  
 first-of-type pseudo-class, HTML 136, HTML 149, HTML C3  
 fixed grids, HTML 209  
 fixed layouts, HTML 182–183  
 fixed positioning, HTML 244  
 FLAC format. See Free Lossless Audio Codec (FLAC)  
 format  
     Flash player, HTML 635–636  
     flex basis, setting, HTML 397–398  
     flex growth, defining, HTML 398–399  
     flex items, sizing, HTML 401  
     flex lines, aligning, HTML 410  
     flex property, HTML 392, HTML 401  
     flex-basis property, HTML 397–398  
     flex-basis value, HTML 392  
     flexbox(es), HTML 392, HTML 534–535  
         aligning flex lines, HTML 410  
         aligning items along cross axis, HTML 410–411  
         aligning items along main axis, HTML 409  
         applying flexbox layouts, HTML 402–407  
         centering elements vertically, HTML 412  
         cross-browser, HTML 395  
         defining, HTML 394, HTML 396  
         defining flex growth, HTML 398–399  
         defining shrink rate, HTML 399–401  
         flex property, HTML 401  
         reordering page content, HTML 407–408  
         setting flex basis, HTML 397–398  
         setting flexbox flow, HTML 395–396  
         sizing flex items, HTML 402  
     flexbox flow, setting, HTML 395–396  
     flexbox layouts, applying, HTML 402–407  
     flex-direction property, HTML 395, HTML 396  
     flex-flow property, HTML 392, HTML 395  
     flex-grow property, HTML 398–399, HTML 401  
     flex-grow value, HTML 392  
     flexible layouts, image maps, HTML 346  
     flex-shrink property, HTML 401  
     flex-shrink value, HTML 392  
     flex-wrap property, HTML 395, HTML 396, HTML 399  
     float property, HTML 176  
 floating, HTML 189–193  
     clearing a float, HTML 193–197  
 floating elements, HTML 176–205  
     container collapse, HTML 201–203  
     content, HTML 189–204  
     display style, HTML 178  
     negative space, HTML 204  
     page layout designs, HTML 182–183  
     refining layouts, HTML 197–201  
     reset style sheets, HTML 178–182  
     width and height, HTML 184–189  
 Flowplayer, HTML 637  
 fluid grids, HTML 209  
 fluid layout, HTML 183  
 focus, HTML 582  
 focus pseudo-class, HTML 152, HTML 581–583, HTML C3  
 folder path, specifying with links, HTML 60–62  
 font(s), HTML 117–127  
     attributes, HTML C12–C14  
     choosing, HTML 117–119  
     cursive, HTML 118  
     fantasy, HTML 118  
     @font-face rule, HTML 120–122  
     generic, HTML 117–118  
     Google, HTML 123  
     monospace, HTML 117

sans-serif, HTML 117, HTML 133  
 selecting, HTML 133  
 serif, HTML 117, HTML 133  
 size. See font size  
 specific, HTML 117  
 styles. See font styles  
 web, HTML 120–122  
 font families, specifying, HTML 119  
 font size, HTML 123–127  
     absolute units, HTML 123, HTML 133  
     page elements, setting, HTML 128–129  
     readability, HTML 133  
     relative units, HTML 123–124, HTML 133  
     scaling with ems and rems, HTML 124–125  
     sizing keywords, HTML 125–127  
     viewport units, HTML 125  
 font stacks, HTML 117  
 font styles, HTML 129–133  
     aligning text horizontally and vertically, HTML 130–131  
     combining all text formatting in single style, HTML 131–133  
 <font> tag, HTML B9  
 @font-face rule, HTML 108, HTML 120–122, HTML C4  
 font-family property, HTML 108  
 font-size property, HTML 108  
 <footer> tag, HTML 24, HTML B10  
 for attribute, HTML 518, HTML 532  
 for loop, HTML 770, HTML 772–773  
 forEach() method, HTML 783  
 form attributes, HTML B2  
 form buttons, HTML 572–575  
     command, HTML 572  
     custom, designing, HTML 575  
     submit and reset, HTML 563, HTML 572–575  
 form controls, tools, HTML 585  
 form element, HTML 518, HTML 522  
 form event attributes, HTML B4  
 Form Stack, HTML 585  
 <form> tag, HTML B10  
 formatting  
     captions, HTML 473  
     hyperlinks for printing, HTML 428–430  
     lists. See formatting lists  
     row groups, HTML 480–481  
     style, HTML 131–133  
     tables, using HTML attributes, HTML 492  
 formatting lists, HTML 138–143  
     images as list markers, HTML 141–142  
     list marker position, HTML 141, HTML 142–143  
     list style type, HTML 138  
     outline style, HTML 138–141  
 forward slash (/), JavaScript operators, HTML 720  
 fr (fractional) unit, HTML 217  
     track sizes with, HTML 217–218  
 frame sites, Section 508 guidelines, HTML D10  
 <frame> tag, HTML B10, HTML B11–B12  
 frameset DTDs, HTML F5–F6  
 <frameset> tag, HTML B10  
 frameworks, HTML 210  
 Free Lossless Audio Codec (FLAC) format, HTML 608  
 ftp scheme, HTML 64  
 function(s), HTML 730  
     JavaScript. See JavaScript functions  
     running for each array item, HTML 781  
 function keyword, HTML 718

**G**

**generic fonts**, HTML 117

geo scheme, HTML 64

**get method**, HTML 523

**getElementById()** method, HTML 698

**getFullYear()** method, HTML 718

**GIF (Graphics Interchange Format)**, HTML 280

**global scope**, HTML 733

**global variables**, HTML 733

Google Chrome device emulator, HTML 380–381

Google Fonts, HTML 123

Google Forms, HTML 585

gradients. *See* color gradients

graphic design, legacy browsers, HTML 300

graphic design with CSS, HTML 273–360

- backgrounds. *See* background
- borders. *See* border(s)
- drop shadows, HTML 304–311
- file formats, HTML 280
- filters, HTML 337–341
- gradients. *See* color gradients
- image maps, HTML 341–347
- transformations. *See* transformations

graphics. *See also* image(s)

- Section 508 guidelines, HTML D2–D4

Graphics Interchange Format. *See* GIF (Graphics Interchange Format)

grayscale function, HTML 326, HTML 338

grid(s)

- attributes, HTML C14–C15
- gap, HTML 232–234

**grid area**, HTML 211

**grid cell**, HTML 224

- alignment for single, HTML 235

**grid columns**, HTML 207

- placing items by, HTML 224–226
- repeating, HTML 218–219
- working with, HTML 215–221

**grid layouts**, HTML 206–237

- aligning grid, HTML 235–236
- alignment for single grid cell, HTML 235
- applying, HTML 219–221
- creating CSS, HTML 213–215
- CSS frameworks, HTML 210
- CSS grids. *See* CSS grids
- defining grid gap, HTML 232–234
- fixed, HTML 209
- fluid, HTML 209
- introducing CSS, HTML 210–213
- managing space within grid, HTML 234–236
- outlining a grid, HTML 221–223
- overview, HTML 208–209
- placing grid items by area, HTML 228–232
- placing items by row and column, HTML 224–226
- placing items within, HTML 221–232
- repeating columns and rows, HTML 218–219
- track sizes with fractional units, HTML 217–218
- using span keyword, HTML 226–227
- working with grid rows and columns, HTML 215–221

**grid rows**, HTML 207

- placing items by, HTML 224–226
- repeating, HTML 218–219
- working with, HTML 215–221

**grid tracks**, HTML 211

**gridline names**, HTML 226

grouping, selection options, HTML 551–552

**grouping elements**, HTML 26–28

**H**

**<h1>** tag, HTML 22, HTML 23

h1–h6 elements, HTML 24

**H.264 codec**, HTML 620

**hanging indents**, HTML 128

**<head>** tag, HTML 2, HTML 10, HTML 15, HTML B11

header cells, tables, marking, HTML 456–459

**<header>** tag, HTML 24, HTML B11

headers attribute, HTML D9

headings, column-spanning, HTML 503–504

hearing disability, HTML D1

height

- elements, HTML 184–186
- table rows, setting, HTML 487–488

**hexadecimal numbers**, HTML 100

**<hgroup>** tag, HTML B11

**<hi>** tag, HTML B11

hidden attribute, HTML 11

hidden borders, tables, reconciling, HTML 462

**hidden fields**, HTML 552

**hierarchical structures**, HTML E2–E3

**hosts**, HTML 4

hotspots, HTML 341

hover event, touch devices, HTML 152

**hover pseudo-class**, HTML 136, HTML 152, HTML 154, HTML C3

hover transitions, HTML 647–652

**<hr>** tag, HTML 27, HTML 39, HTML B11

href attribute, HTML 46

**HSL color value**, HTML 86, HTML 101–102

**HTML (Hypertext Markup Language)**

- comments, HTML 2
- definition, HTML 5
- documents. *See* HTML documents
- effective code, HTML 15
- history, HTML 5–6
- supporting with legacy browsers, HTML 39
- testing code, HTML 7
- tools, HTML 6–7

**HTML 4.01**, HTML 5

HTML code, writing with JavaScript, HTML 705–708

**HTML comments**, HTML 2

HTML documents, HTML 8–15

- basic structure, creating, HTML 10
- creating, HTML 13–14
- document type declaration, HTML 8–9
- element attributes, HTML 11–12
- element hierarchy, HTML 10
- element tags, HTML 9–10
- linking to style sheets, HTML 32–33
- viewing in browsers, HTML 12–13
- white space, HTML 12

**HTML elements and attributes**, HTML B5–B21

**<html>** tag, HTML 2, HTML 10, HTML B11

**HTML 5**, HTML 5–6

- video element, HTML 621–624
- video players, HTML 637

**HTML 5 Shiv**, HTML 39

**HTTP (Hypertext Transfer Protocol)**, HTML 64

http scheme, HTML 64

https scheme, HTML 64

**hue**, HTML 101

hue-rotate function, HTML 338

**hyperlinks**, HTML 4, HTML 57–68

- applying pseudo-classes, HTML 153
- creating, HTML 58
- effective, HTML 69
- formatting for printing, HTML 428–430
- Internet and other resources, HTML 64–68
- locations within documents, HTML 63–64
- Section 508 guidelines, HTML D12
- setting base path, HTML 62
- specifying folder path, HTML 60–62
- turning inline images into, HTML 59–60
- URLs, HTML 57–68

**hypertext**, HTML 4. *See also* HTML (Hypertext Markup Language)

- creating using dynamic pseudo-classes, HTML 152

hypertext attributes, HTML 68–69

Hypertext Markup Language. *See* HTML (Hypertext Markup Language)

Hypertext Transfer Protocol. *See* HTTP (Hypertext Transfer Protocol)

**I**

**<i>** tag, HTML 29, HTML B11

id attribute, HTML 11, HTML 522, HTML 528

- attribute selectors, HTML 115

**IDE (Integrated Development Environment)**, HTML 6–7

**if else statement**, HTML 786, HTML 793–794

**if statement**, HTML 786, HTML 789–790

- nesting, HTML 791–793

**iframe element**, HTML 36, HTML 637

**<iframe>** tag, HTML B11–B12

image(s)

- background. *See* background images
- list markers, HTML 141–142
- navicon, HTML 412–415
- Section 508 guidelines, HTML D2–D4

image buttons, HTML D11

**image maps**, HTML 341–347

- applying, HTML 345–346
- creating, HTML 344–345
- flexible layouts, HTML 346
- Section 508 guidelines, HTML D6–D7

image rollovers, HTML D11

**<img>** tag, HTML 22, HTML 36, HTML B12

**implicit grid**, HTML 216

**@import rule**, HTML C4

**!important keyword**, HTML 96, HTML C4

importing style sheets, HTML 98

**increment operator (++)**, HTML 720

indentation, HTML 128

indeterminate pseudo-class, HTML 582

**indexes, arrays**, HTML 757

**indexOf()** method, HTML 768

inheritance, styles, HTML 94

inherited positioning, HTML 244

**inline elements**, HTML 29

**inline frames**, HTML 637

**inline images**, turning into links, HTML 59–60

inline styles, HTML 93–94

**inline validation**, HTML 563, HTML 581–585

- focus pseudo-class, HTML 581–583
- valid and invalid pseudo-classes, HTML 583–585

**innerHTML property**, HTML 698

**input boxes**, HTML 520, HTML 528–531, HTML D11

- input types, HTML 528–531
- virtual keyboards, HTML 531–532

**input element**, HTML 518, HTML 532  
 <input> tag, HTML B12–B13  
 in-range pseudo-class, HTML 582  
 <ins> tag, HTML B13  
**inset keyword**, HTML 302  
 installing web fonts, HTML 121  
 Integrated Development Environment. *See* IDE (Integrated Development Environment)  
**interactive elements**, HTML 36  
 interactive form elements, HTML D11  
**Internet**, HTML 4  
**Internet Assigned Numbers Authority (IANA)**, HTML 65  
 Internet Explorer, conditional comments, HTML 20  
**interpreted languages**, HTML 685  
 invalid pseudo-class, HTML 583–585  
 invert function, HTML 338  
 irregular line wraps, HTML 254  
**ISO 8859-1**, HTML 33

## J

**JavaScript**, HTML 681–738  
   adding comments, HTML 689–690  
   converting between numbers and text, HTML 737–738  
   debugging code. *See* debugging  
   defining number format, HTML 737  
   development, HTML 685  
   fixing common programming mistakes, HTML 738  
   functions. *See* JavaScript functions  
   illegal operations, HTML 736–737  
   mathematical calculations, HTML 736–738  
   syntax, HTML 691–692  
   writing better code, HTML 696  
   writing commands, HTML 690–691  
 JavaScript functions, HTML 730–733  
   calling, HTML 732  
   to return a value, creating, HTML 733  
   scope, HTML 733  
 Joint Photographic Experts Group. *See* JPEG (Joint Photographic Experts Group)  
 Jotform, HTML 585  
**JPEG (Joint Photographic Experts Group)**, HTML 280  
 justify-content property, HTML 409  
 JWPlayer, HTML 637

## K

Kaltura Player, HTML 637  
 <kbd> tag, HTML 29, HTML B13  
**kerneling**, HTML 108  
**key frames**, HTML 652  
   stepping between, HTML 658  
 @keyframes rule, HTML 641, HTML 652–654  
 <keygen> tag, HTML B13  
 keywords. *See also* specific keyword names  
   font sizes, HTML 125–127  
**kind attribute**, HTML 618, HTML 625

## L

label(s), HTML D11  
**label element**, HTML 518, HTML 532  
 <label> tag, HTML B13  
 lang attribute, HTML 11  
 lang pseudo-class, HTML 149, HTML C3  
 language attributes, HTML B2  
 LAN(s). *See* local area networks (LANs)  
 last pseudo-class, HTML C3

last-child pseudo-class, HTML 149, HTML C3  
**last-in first-out (LIFO) principle**, HTML 766  
 lastIndexOf() method, HTML 768  
 last-of-type pseudo-class, HTML 136, HTML 149, HTML C3  
**Latin-1**, HTML 33  
 layout  
   forms, designing, HTML 534–539  
   pages. *See* page layout  
**layout viewports**, HTML 372, HTML 373  
**leading**, HTML 127  
 left angle bracket (<), comparison operators, HTML 776  
**left property**, HTML 238  
 left pseudo-class, HTML C3  
 legacy browsers  
   graphic design, HTML 300  
   supporting HTML, HTML 39  
 legend(s), field sets, HTML 526–527  
**legend element**, HTML 518, HTML 526  
 <legend> tag, HTML B14  
**letter-spacing property**, HTML 108  
 <li> tag, HTML 27, HTML 46, HTML 48, HTML 49, HTML 50, HTML B14  
 LIFO. *See* last-in first-out (LIFO) principle  
**lightness**, HTML 101  
**line attribute**, HTML 618  
 line breaks, HTML 38–39  
 line wraps, irregular, HTML 254  
 linear gradients, HTML 312–315, HTML 321  
**linear structures**, HTML E1–E2  
**linear-gradient function**, HTML 302, HTML 312–313, HTML 315–316, HTML 321  
**linearizing**, HTML D7–D8  
**line-height property**, HTML 108  
 link(s). *See* hyperlinks  
**link pseudo-class**, HTML 152, HTML C3  
 <link> tag, HTML 15, HTML 32, HTML B14  
 list(s), HTML 48–57  
   attributes, HTML C16  
   description, HTML 51–54  
   formatting. *See* formatting lists  
   navigation, HTML 55–57  
   nested, HTML 50  
   ordered, HTML 48–49  
   unordered. *See* unordered lists  
**list markers**, HTML 138  
   images, HTML 141–142  
   position, HTML 141, HTML 142–143  
**list-style-image property**, HTML 136  
**list-style-type property**, HTML 136  
**load-time errors**, HTML 692  
**local area networks (LANs)**, HTML 4  
**local scope**, HTML 733  
**local variables**, HTML 733  
**logical errors**, HTML 692  
**logical operators**, HTML 776–777  
 longdesc attribute, HTML D2, HTML D3  
**lorem ipsum**, HTML 232  
**lossless compression**, HTML 604  
**lossy compression**, HTML 604

## M

mailto scheme, HTML 46, HTML 64  
**main axis, flexboxes**, HTML 394  
   aligning items along, HTML 409  
 main element, HTML 27

map() method, HTML 783  
 <map> tag, HTML B14  
 mapping arrays, HTML 781–782  
 Marcotte, Ethan, HTML 365  
**margin area**, HTML 422  
**margin space**, HTML 143, HTML 146–148  
**margin-top property**, HTML 136  
 <mark> tag, HTML B14  
 <marks> tag, HTML 29  
**markup languages**, HTML 5  
 Math methods, HTML 723–727  
**Math object**, HTML 723–730  
   constants, HTML 728–730  
   Math methods, HTML 723–727  
**Math.floor() method**, HTML 718  
**matrix**, HTML 763  
 matrix3d function, HTML 333  
**max attribute**, HTML 562  
**max-width property**, HTML 176  
 measuring units, CSS, HTML C5–C6  
 media attribute, HTML 365–366  
**media players**, HTML 605  
   applying styles, HTML 610–613  
**media queries**, HTML 362–391  
   applying to style sheets, HTML 369–372  
   creating a pulldown menu with CSS, HTML 376–379  
   desktop designs, HTML 387–389  
   device features, HTML 367–368  
   @media rule, HTML 366–367  
   for printed output, applying, HTML 421–422  
   tablet designs, HTML 383–386  
   testing mobile websites, HTML 379–383  
   viewports and device width, HTML 372–375  
 @media rule, HTML 366–367, HTML C4  
 <menu> tag, HTML B14  
 <meta> tag, HTML 2, HTML 15, HTML 16–18, HTML B14  
**metadata**, HTML 15  
   adding to document, HTML 16–18  
 metadata elements, HTML 15  
 <meter> tag, HTML B14  
**method(s)**, HTML 700. *See also* specific methods  
   applying, HTML 704  
 method attribute, HTML 523  
 MIME type. *See* Multipurpose Internet Mail Extension (MIME type)  
**min attribute**, HTML 562  
**minifying**, HTML 416  
 minmax function in grid, using, HTML 219  
 minus sign (–), JavaScript operators, HTML 720  
**min-width property**, HTML 176  
 mixed structures, HTML E3–E5  
 mobile device(s), web tables, HTML 492–495  
**mobile device emulators**, HTML 379–382  
**mobile first**, HTML 370  
 mobile web, HTML 361–450  
   creating a pulldown menu with CSS, HTML 376–379  
   flexbox layouts. *See* flexbox layouts  
   media queries. *See* media queries  
   optimizing sites for, HTML 390  
   print styles. *See* print style(s)  
   support, HTML 7  
   testing websites, HTML 379–383  
   website design, HTML 375–383  
**Modernizr**, HTML 39  
**modules**, HTML 88  
**modulus operator**, HTML 790

monochrome color scheme, HTML 106  
**monospace fonts**, HTML 117  
 motion sensitivity, animations, HTML 666  
 motor disability, HTML D1  
**MP3 format**, HTML 608  
**MP4 format**, HTML 618, HTML 620  
**MPEG-1 Audio Layer 3 format**, HTML 608  
**MPEG-4 format**, HTML 620  
 multi-column layouts, attributes, HTML C10  
**multidimensional arrays**, HTML 763  
 multimedia, Section 508 guidelines, HTML D4  
 multimedia event attributes, HTML B4–B5  
**multiple attribute**, HTML 544  
 multiple backgrounds, HTML 288–290  
**Multipurpose Internet Mail Extension (MIME type)**, HTML 609

## N

**name attribute**, HTML 518, HTML 528, HTML D10  
**namespace**  
   default, HTML F9  
   XHTML, setting, HTML F9–F10  
 @namespace rule, HTML C4  
 naming gridlines, HTML 226  
**nav > ul selector**, HTML 108  
 <nav> tag, HTML 24, HTML 46, HTML B14  
**navicon(s)**, HTML 412  
 navicon menus, HTML 412–415  
 navigating forms with access keys, HTML 531  
**navigation lists**, HTML 55–57  
 &nbsp; character encoding reference, HTML 23, HTML 33, HTML 34  
 negative space, HTML 204  
**nested elements**, HTML 9  
**nested lists**, HTML 50  
 nesting if statements, HTML 791–793  
**networks**, HTML 4  
   locating information, HTML 4  
 <nobr> tag, HTML B15  
**nodes**, HTML 4  
 <noembed> tag, HTML B15  
 <noframe> tag, HTML B15  
**no-repeat keyword**, HTML 274  
 <noscript> tag, HTML B15  
 not pseudo-class, HTML 149, HTML C3  
 nth-child pseudo-class, HTML C3  
 nth-last-child pseudo-class, HTML C3  
 nth-last-of-type pseudo-class, HTML 149, HTML C3  
 nth-of-type pseudo-class, HTML 136, HTML 149, HTML 151  
**number data type**, HTML 562  
**numeric character references**, HTML 22  
 numeric data validation, HTML 564–569  
   range sliders, HTML 566–569  
   spinner controls, HTML 564–566  
**numeric value**, HTML 710

## O

**object(s)**, HTML 700–703  
   applying methods, HTML 704  
   properties, HTML 704  
   references, HTML 701, HTML 703  
   referencing by ID and name, HTML 703  
   referencing collections, HTML 701–703  
**object collections**, HTML 701  
   referencing, HTML 701–703

<object> tag, HTML 36, HTML B15  
**object-based languages**, HTML 700  
**OGG format**, HTML 608  
**Ogg format**, HTML 608, HTML 620  
 <ol> tag, HTML 27, HTML 48–49, HTML B15  
 one-sided element tags, HTML 9  
 only-child pseudo-class, HTML 149, HTML C3  
 only-of-type pseudo-class, HTML 149, HTML C3  
**opacity**, HTML 102  
 opacity function, HTML 338  
**opacity property**, HTML 302, HTML 322  
 opening tags, HTML 2  
**operands**, HTML 720–723  
**operators**, HTML 720–723  
 <optgroup> tag, HTML B15  
**option buttons**, HTML 520, HTML 553–555  
**option element**, HTML 544  
 <option> tag, HTML B15  
 optional pseudo-class, HTML 582  
 or operator (||), HTML 787  
 order property, HTML 407  
**ordered lists**, HTML 48–49  
 orphans, HTML 434–435  
**orphans property**, HTML 418, HTML 434–435, HTML 501, HTML 503  
 outline(s)  
   attributes, HTML C16  
   grids, HTML 221–223  
**outline property**, HTML 206  
 outline style, lists, HTML 138–141  
 out-of-range pseudo-class, HTML 582  
 <output> tag, HTML B16  
 overflow, HTML 254–256  
**overflow property**, HTML 238

## P

<p> tag, HTML 22, HTML 23, HTML 27, HTML B16  
**padding space**, HTML 143, HTML 144–146  
**padding-box keyword**, HTML 274  
**page area**, HTML 422  
**page boxes**, HTML 422  
 page break(s), HTML 431–435  
   adding, HTML 431  
   automatic, set by browsers, HTML 432  
   preventing, HTML 432–434  
   widows and orphans, HTML 434–435  
 page groups, HTML 27  
 page layout, HTML 175–272  
   attributes, HTML C14  
   effective, HTML 236  
   elastic, HTML 183  
   fixed, HTML 182–183  
   flexbox. See flexbox(es)  
   flexible, image maps, HTML 346  
   floating elements. See floating elements  
   fluid, HTML 183  
   grid layouts. See grid layouts  
   positioning styles. See positioning styles  
   responsive design, HTML 183  
 page names, HTML 423–424  
 page property, HTML 423–427  
**@page rule**, HTML 418, HTML 422–430, HTML C4  
   formatting hypertext links for printing, HTML 428–430  
   page names and page property, HTML 423–427  
   page pseudo-classes, HTML 423  
   setting page size, HTML 423  
 page size, setting, HTML 423  
 page styles, creating and applying, HTML 424  
 page validation with XHTML, HTML F1–F13  
   files on web, HTML F10–F12  
   frameset DTD, HTML F5–F6  
   inserting DOCTYPE declaration, HTML F8–F9  
   setting the XHTML namespace, HTML F9–F10  
   strict DTD, HTML F5–F7  
   transitional DTD, HTML F5–F6  
   valid use of attributes, HTML F7–F8  
   well-formed documents, HTML F2–F4  
 page-break-after property, HTML 431  
**page-break-before property**, HTML 418, HTML 431–432  
**page-break-inside property**, HTML 418  
 paragraphs, grouping content by, HTML 28  
**parallel arrays**, HTML 788  
 <param> tag, HTML B16  
**parameters**, HTML 730  
**parent elements**, HTML 110  
**pattern attribute**, HTML 562  
 percent sign (%), JavaScript operators, HTML 720  
**Perl**, HTML 522  
 perspective, HTML 333–336  
   setting in 3D, HTML 334  
**perspective function**, HTML 333–336  
**perspective property**, HTML 326, HTML 333, HTML 334  
 phone numbers, linking to, HTML 67–68  
 pipe (|), logical operators, HTML 777, HTML 787  
**pixels**, HTML 124  
   device and CSS, HTML 375  
**placeholder(s)**, HTML 540–542  
**placeholder attribute**, HTML 518, HTML 540, HTML 558  
**plug-ins**, HTML 605–606  
   attributes, HTML 615–616  
   as fallback options, HTML 616  
   Section 508 guidelines, HTML D10–D11  
 plus sign (+), JavaScript operators, HTML 720  
**PNG (Portable Network Graphics)**, HTML 280  
 pop() method, HTML 767, HTML 768  
 position, list markers, HTML 141, HTML 142–143  
**position attribute**, HTML 618  
 positioning, setting background image position, HTML 283–284  
**positioning styles**, HTML 239  
   absolute positioning, HTML 241–244  
   clipping elements, HTML 257–258  
   CSS, HTML 240  
   fixed positioning, HTML 244  
   inherited positioning, HTML 244  
   overflow, HTML 254–256  
   relative positioning, HTML 240–241  
   stacking elements, HTML 258–260  
   static positioning, HTML 240  
   using, HTML 244–254  
**post method**, HTML 523  
**poster attribute**, HTML 618  
 pound symbol (#), character encoding references, HTML 35  
 <pre> tag, HTML 27, HTML B16  
 precedence, styles, HTML 94  
**presentational attributes**, HTML 36  
**presentational elements**, HTML 36

print style(s), HTML 418–436

- formatting hyperlinks for printing, HTML 428–430
- media queries for printed output, HTML 421–422
- page breaks, HTML 431–435
- page names, HTML 423–424
- page property, HTML 423–427
- page pseudo-classes, HTML 423
- @page rule, HTML 422–430
- previewing the print version, HTML 420–421
- setting page size, HTML 423

printing

- attributes, HTML C16–C17
- effective, HTML 436

**program loops**, HTML 770–785. *See also specific loops*

- arrays, HTML 777–784
- command blocks, HTML 773
- comparison operators, HTML 776
- creating, HTML 777
- efficient, HTML 784
- logical operators, HTML 776–777

<progress> tag, HTML B16

**progressive enhancement**, HTML 106

**prologs**, HTML F2

**properties**, HTML 700

protanopia, HTML D4, HTML D5

protected structures, HTML E5–E6

**protocols**, HTML 64

**pseudo-classes**, HTML 149–151, HTML B3. *See also specific pseudo-class names*

- applying to hypertext links, HTML 153–154
- applying to unordered lists, HTML 150
- dynamic, HTML 152–154
- @page rule, HTML 423
- structural, HTML 149

**pseudo-elements**, HTML 154–155, HTML B2

pull-down menus, HTML D11

- creating with CSS, HTML 376–379

push buttons, HTML D11

push() method, HTML 767, HTML 768

## Q

<q> tag, HTML 29, HTML 30, HTML B16

queries. *See* media queries

**queues**, HTML 766

**quirks mode**, HTML 9

quotation marks, HTML 157–158

quotes, block, HTML 39–41

**quotes property**, HTML 136

## R

**radial gradient(s)**, HTML 316–319, HTML 321

**radial-gradient property**, HTML 302, HTML 317–319, HTML 321

**radio buttons**, HTML 520, HTML 553–555

**radio data type**, HTML 544

random numbers, generating, HTML 729

random shuffle, arrays, HTML 765

**range data type**, HTML 562

range slider controls, HTML 563, HTML 566–569

readability, font size, HTML 133

**read-only properties**, HTML 704

reduce() method, HTML 783

reduceRight() method, HTML 783

reflections, HTML 311

**regular expressions (regex)**, HTML 578

Rehabilitation Act, HTML D2. *See also* Section 508

**relative paths**, HTML 61–62

**relative positioning**, HTML 238, HTML 240–241

relative units, font size, HTML 123–124, HTML 133

**rem unit**, HTML 124–125

reordering content using flexboxes, HTML 407–408

repeating gradients, HTML 320–321

**required attribute**, HTML 562

required pseudo-class, HTML 582

**reset buttons**, HTML 563, HTML 572–575

**reset data type**, HTML 562

**reset style sheets**, HTML 178–182

**responsive design**, HTML 183, HTML 364–365

reverse() method, HTML 767, HTML 768

reversing arrays, HTML 763–764

**RGB color values**, HTML 86, HTML 99–101

**RGB triplets**, HTML 100

rhythm, HTML 259

right angle bracket (>) comparison operators, HTML 776

right pseudo-class, HTML C3

**rollover effect**, HTML 59

**root elements**, HTML F3

**root em unit**, HTML 124–125

**root folder**, HTML 60

root pseudo-class, HTML 149, HTML C3

rotate function, HTML 328

rotate3d function, HTML 333

rotateX function, HTML 326, HTML 333

rotateY function, HTML 326, HTML 333

rotateZ function, HTML 326, HTML 333

rounded corners, borders, HTML 293–296

row(s)

- banded, creating, HTML 485
- cells spanning, HTML 464, HTML 466–468

row groups, HTML 478–481

- formatting, HTML 480–481

row height, setting, HTML 487–488

**rowspan attribute**, HTML 452, HTML 464, HTML 466–468

<rp> tag, HTML B16

<rt> tag, HTML B16

ruby tag, HTML B16

rules, columns, HTML 500

**run-time errors**, HTML 692

## S

<s> tag, HTML 29, HTML B16

<samp> tag, HTML 29, HTML B16

**sans-serif fonts**, HTML 117, HTML 133

saturate function, HTML 326, HTML 338

**saturation**, HTML 101

**scalable text**, HTML 124–125

Scalable Vector Graphics. *See* SVG (Scalable Vector Graphics)

scale function, HTML 326, HTML 328

scale3d function, HTML 333

scaleX function, HTML 328, HTML 333

scaleY function, HTML 328, HTML 333

scaleZ function, HTML 333

**scope**, HTML 733

scope attribute, HTML D8–D9

screen readers, HTML D1

**script(s)**, HTML 39

- inserting in forms, HTML 525
- Section 508 guidelines, HTML D10–D11

script element, HTML 686–689

- inserting, HTML 686–688
- loading, HTML 686–687
- using with other programming languages, HTML 689

<script> tag, HTML 15, HTML B16

scrolling text, Section 508 guidelines, HTML D10

**Section 508**, HTML D2–D13

- animation, HTML D10
- applets, HTML D10–D11
- color, HTML D4–D6
- frame sites, HTML D10
- graphics, HTML D2–D4
- image maps, HTML D6–D7
- images, HTML D2–D4
- links, HTML D12
- multimedia, HTML D4
- plug-ins, HTML D10–D11
- scripts, HTML D10–D11
- scrolling text, HTML D10
- style sheets, HTML D6
- tables, HTML D7–D9
- text-only equivalents, HTML D13
- timed responses, HTML D12
- web forms, HTML D11–D12

<section> tag, HTML 24, HTML B16

**sectioning elements**, HTML 24–26

**select element**, HTML 544

<select> tag, HTML B16–B17

**selected attribute**, HTML 544

**selection lists**, HTML 520, HTML 547–552

- attributes, HTML 549–551
- creating, HTML 547–552
- grouping selection options, HTML 551–552

selection pseudo-element, HTML C2

**selector**, HTML 86

**selector patterns**, HTML 110–117

- attribute selectors, HTML 113–116
- calculating selector specificity, HTML 117
- contextual selectors, HTML 110–112

**semantic elements**, HTML 24

semi-opaque colors, defining, HTML 102

semi-transparent objects, HTML 322–323

sepia function, HTML 326, HTML 338

**serif fonts**, HTML 117, HTML 133

**server(s)**, HTML 4

server-based programs, forms, HTML 521–522

**server-side image maps**, HTML 341

**server-side programming**, HTML 684–685

**server-side validation**, HTML 575

**setFullYear() method**, HTML 718

**setInterval() method**, HTML 718

shift() method, HTML 768

shrink rate, flexboxes, defining, HTML 399–401

**sibling selectors**, HTML 111

**site indexes**, HTML E4

size

- attributes, HTML C12–C14
- scrolling, Section 508 guidelines, HTML D10

**size attribute**, HTML 544

sizing

- background images, HTML 285
- flex items, HTML 401

skew function, HTML 328, HTML 329

skewX function, HTML 328

skewY function, HTML 328

slice() method, HTML 767, HTML 768

**slider controls**, HTML 520, HTML 566

<small> tag, HTML 29, HTML B17

sms scheme, HTML 64

some() method, HTML 783

sort() method, HTML 767, HTML 768

sorting arrays, HTML 764–765

- source element**, HTML 602
  - `<source>` tag, HTML B17
  - spacing, text, HTML 127–129
  - spaghetti code**, HTML 808
  - spam**, HTML 67
  - `<span>` tag, HTML 29, HTML B17
  - sparse arrays**, HTML 761
  - special effects, attributes, HTML C17–C18
  - specific fonts**, HTML 117
  - specificity
    - selectors, calculating, HTML 117
    - styles, HTML 94
  - spin boxes**, HTML 520
  - spinner controls**, HTML 563, HTML 564
  - `splice()` method, HTML 767, HTML 768
  - sprites**, HTML 658
  - square brackets (`[]`), arrays, HTML 758
  - stacking elements, HTML 258–260
  - stack(s)**, arrays used as, HTML 766–768
  - standards mode**, HTML 9
  - start expression**, HTML 770
  - starting tags**, HTML 9
  - statement labels**, HTML 807
  - static positioning**, HTML 240
  - step attribute**, HTML 562
  - storyboards**, HTML E1
  - strict DTDs**, HTML F5–F7
  - strict mode**, HTML 695–696
  - `<strong>` tag, HTML 22, HTML 29, HTML 30, HTML B17
  - strongly typed languages**, HTML 711
  - structural pseudo-classes**, HTML 149
  - style(s)**, HTML 86
    - applying to media player, HTML 610–613
    - applying to track cues, HTML 630–634
    - background. *See* background images
    - browser, HTML 89
    - defining, HTML 96
    - embedded, HTML 89
    - external, HTML 89
    - flexible form layouts, HTML 535–536
    - fonts. *See* font styles
    - inline, HTML 89
    - page, creating and applying, HTML 244
    - positioning. *See* positioning styles
    - print. *See* print style(s)
    - specificity and precedence, HTML 84
    - tables. *See* table styles
    - user agent, HTML 89
    - user-defined, HTML 89
    - viewing pages, HTML 89–91
    - widgets, HTML 569
  - style attribute, HTML 11
  - style comments**, HTML 86, HTML 96–97
  - style inheritance**, HTML 94
  - style rules**, HTML 86, HTML 92–96
    - browser developer tools, HTML 95–96
    - browser extensions, HTML 92–93
    - creating with contextual selectors, HTML 112
    - embedded style sheets, HTML 93
    - inline styles, HTML 93–94
    - style inheritance, HTML 94
    - style specificity and precedence, HTML 94
  - style sheets**, HTML 88–91
    - creating, HTML 96–98
    - embedded, HTML 93
    - `@font-face` rule, HTML 120–122
  - importing, HTML 98
  - linking HTML documents, HTML 32–33
  - managing, HTML 160
  - reset, HTML 178–182
  - Section 508 guidelines, HTML D6
  - viewing pages, HTML 89–91
  - `<style>` tag, HTML 15, HTML B17
  - `<sub>` tag, HTML 29, HTML B17
  - subarrays**, HTML 765
  - submit buttons**, HTML 563, HTML 572–575
  - submit data type**, HTML 562
  - summary attribute**, HTML D9
  - `<summary>` tag, HTML B17
  - `<sup>` tag, HTML 29, HTML B17
  - SVG (Scalable Vector Graphics)**, HTML 280
  - switch statement**, HTML 796
  - symmetric transitions**, HTML 652
  - symmetrical balance, HTML 259
  - syntax**, HTML 5
    - JavaScript, HTML 691–692
- ## T
- tab indexing, HTML 557
  - tabindex attribute**, HTML 11, HTML 557
  - table(s)**
    - attributes, HTML C18
    - narrow, creating, HTML 487
    - Section 508 guidelines, HTML D7–D9
  - table element**, HTML 452, HTML 454–456
  - table styles, HTML 485–492
    - applying to other elements, HTML 490–491
    - width and height, HTML 486–490
  - `<table>` tag, HTML B17–B18
  - tablet designs, HTML 383–386
  - target attribute**, HTML 69
  - target pseudo-class**, HTML C3
  - tbody element**, HTML 476, HTML 478
  - `<tbody>` tag, HTML B18
  - td element**, HTML 452
  - `<td>` tag, HTML B18
  - tel scheme**, HTML 46, HTML 64
  - ternary operators**, HTML 791
  - testing mobile websites, HTML 379–383
  - tetrad color scheme, HTML 106
  - text. *See also* CSS typography; font(s); font styles;
    - selector patterns
    - aligning horizontally and vertically, HTML 131–133
    - quotation marks, HTML 158
    - scalable, HTML 124
    - scrolling, Section 508 guidelines, HTML 128–129
    - setting color, HTML 102–105
    - spacing HTML 128
  - text area boxes**, HTML 520, HTML 558–560, HTML D11
  - text editors, HTML 6–7
  - text shadows, HTML 304–306
  - text strings**, HTML 710
  - text tracks, HTML 624–634
    - applying styles, HTML 630–634
    - placing cue text, HTML 628–630
    - WebVTT, HTML 625–628
  - text-align property**, HTML 108
  - textarea element**, HTML 544
  - `<textarea>` tag, HTML B18–B19
  - textContent property**, HTML 698
  - text-level elements**, HTML 29–31
  - text-only equivalents, accessibility, HTML D13
  - text-shadow property**, HTML 302, HTML 304–306
  - tfoot element**, HTML 476, HTML 478
  - `<tfoot>` tag, HTML B19
  - th element**, HTML 452
  - `<th>` tag, HTML B19
  - thead element**, HTML 476, HTML 478, HTML 479
  - `<thead>` tag, HTML B20
  - Theora codec**, HTML 620
  - 3D transformations**, HTML 332–333
    - applying, HTML 335–336
  - tiling**, HTML 281–283
  - time(s), writing for global marketplace, HTML 715
  - `<time>` tag, HTML 29, HTML 55, HTML B20
  - timed responses, Section 508 guidelines, HTML D12
  - time-delayed commands**, HTML 734
  - time-stamping, HTML 55
  - timing, transitions, setting, HTML 644–647
  - title, setting, HTML 16
  - title attribute, HTML 11, HTML D10
  - Title cue text, HTML 619
  - `<title>` tag, HTML 2, HTML 15, HTML 17, HTML B20
  - toLocaleDateString() method**, HTML 698
  - toLocaleTimeString() method**, HTML 698
  - top property**, HTML 238
  - toString() method**, HTML 768
  - touch devices, hover event, HTML 154
  - tr element**, HTML 452, HTML 454–456
  - `<tr>` tag, HTML B20
  - track cues, HTML 618
  - track element**, HTML 618, HTML 624
  - `<track>` tag, HTML B20
  - tracking**, HTML 127
  - tracks**, HTML 211
  - transform property**, HTML 326
  - transformations, HTML 328–337
    - applying, HTML 329, HTML 331–332
    - 3D, HTML 332–333
  - transition(s)**, HTML 641–652
    - delaying, HTML 647
    - hover, HTML 647–652
    - properties affected, HTML 644
    - setting timing, HTML 644–647
    - symmetric and asymmetric, HTML 652
  - transition property, HTML 642
  - transition style**, HTML 640, HTML 642, HTML 644
  - transitional DTDs**, HTML F5–F6
  - translate function**, HTML 328, HTML 329
  - translate3d function**, HTML 333
  - translateX function**, HTML 328, HTML 333
  - translateY function**, HTML 326, HTML 328, HTML 333
  - translateZ function**, HTML 333
  - transparency, gradients, HTML 314
  - triad color scheme, HTML 106
  - tritanopia, HTML D4, HTML D5
  - `<tt>` tag, HTML B20
  - type attribute, HTML 528–531, HTML 602
  - typography**. *See also* CSS typography; font size; selector patterns
    - definition, HTML 117
- ## U
- `<u>` tag, HTML 29, HTML B20
  - `<ul>` tag, HTML 27, HTML 46, HTML 49, HTML 50, HTML B20
  - unary operators**, HTML 720
  - Unicode**, HTML 33

## units

- font size, HTML 123–125, HTML 133
- of measure, CSS, HTML C5–C6

## unity, HTML 259

**Universal Resource Locators (URLs)**, HTML 57–68**unordered lists**, HTML 49

- applying pseudo-classes, HTML 150

## unshift() method, HTML 768

**unstacking**, HTML 766**update expression**, HTML 770

## url function, HTML 338

URL(s). See **Universal Resource Locators (URLs)****use strict statement**, HTML 683**user agent styles**, HTML 89**user-defined styles**, HTML 89**UTF-8**, HTML 17**V****valid documents**, HTML F4–F9

- frameset DTD, HTML F5–F6
- inserting DOCTYPE declaration, HTML F8–F9
- strict DTD, HTML F5–F7
- transitional DTD, HTML F5–F6
- valid use of attributes, HTML F7–F8

## valid pseudo-class, HTML 583–585

## validation

- client-side, HTML 575
- data. See **data validation**; **numeric data validation**
- field values, HTML 579
- inline. See **inline validation**
- server-side, HTML 575
- web forms. See **web form validation**

**validators**, HTML 7**value attribute**, HTML 518, HTML 539, HTML 556, HTML 564**vanishing point**, HTML 333**var keyword**, HTML 698

## &lt;var&gt; tag, HTML 29, HTML B20

**variables**, HTML 709–711

- data types, HTML 710
- declaring, HTML 709
- using, HTML 711

**vector images**, HTML 280**vendor prefixes**, HTML 92

## vertical centering, HTML 188–189

## vertical-align property, HTML 488

**video element**, HTML 607, HTML 618  
HTML 5, HTML 621–624

## video formats, browser support, HTML 621

## video players, third-party, HTML 634–637

## &lt;video&gt; tag, HTML 36, HTML B20

## VideoJS, HTML 637

viewing. See also **displaying**

- HTML files in browsers, HTML 12–13
- pages using different style sheets, HTML 89–91

## viewport(s), HTML 372–375

## viewport meta tag, HTML 362

**viewport units**, HTML 125**virtual keyboards**, HTML 531–532**visited pseudo-class**, HTML 136, HTML 152, HTML C3

## visual disability, HTML D1

## visual effects, effective use, HTML 324

**visual viewports**, HTML 372, HTML 373–374**VP8 codec**, HTML 620**VP9 codec**, HTML 620**W**WAI. See **Web Accessibility Initiative (WAI)**WANs. See **wide area networks (WANs)****watermarks**, HTML 283**WAV format**, HTML 608

## &lt;wbr&gt; tag, HTML 29, HTML 38–39, HTML B21

**weakly typed languages**, HTML 711

## Web Accessibility Initiative (WAI), HTML D13–D16

## web audio, HTML 603–616

- applying styles to media player, HTML 610–613
- audio element, HTML 607–615
- browsers and audio formats, HTML 607–610
- codecs, HTML 604
- containers, HTML 604
- effective, HTML 615
- embedded objects, HTML 615–616
- fallback to audio clips, HTML 613–614
- plug-in attributes, HTML 615–616
- plug-ins, HTML 605–606
- plug-ins as fallback options, HTML 616

**web browsers**, HTML 4–5. See also **entries beginning with term browser**

- attributes, HTML C9–C10
- audio format support, HTML 607–610
- aural, attributes, HTML C6–C7
- automatic page breaks, HTML 432
- cross-browser compatible forms, HTML 542
- legacy, graphic design, HTML 300
- legacy, supporting HTML, HTML 39
- video format support, HTML 621
- viewing HTML files, HTML 12–13

**web fonts**, HTML 119–122**web form(s)**, HTML 517–591

- cross-browser compatible, HTML 542
- default values, HTML 539–542
- effective, creating, HTML 560
- field labels, HTML 532–533
- field sets. See **field sets**
- input boxes. See **input boxes**
- interacting with web server, HTML 521, HTML 523–525
- layout, designing, HTML 534–539
- parts, HTML 520–521
- placeholders, HTML 539–542
- scripts, inserting, HTML 525
- Section 508 guidelines, HTML D11–D12
- server-based programs, HTML 521–522
- starting, HTML 522–525
- structure of, HTML 519
- widgets. See **widgets**

## web form validation, HTML 575–580

- based on data type, HTML 577–578
- defining field value length, HTML 580
- identifying required values, HTML 575–577
- testing for valid patterns, HTML 578–580

**Web Hypertext Application Technology Working Group (WHATWG)**, HTML 5**web pages**, HTML 4–5

- accessibility, HTML 44

## web resources, linking to, HTML 65

**web safe fonts**, HTML 118**web servers**, HTML 4–5

- interacting with, HTML 521, HTML 523–525
- server-based programs, HTML 521–522

**web tables**, HTML 452–474

- accessibility, HTML 474
- adding borders with CSS, HTML 459–464
- cell types, HTML 456
- creating captions, HTML 471–473
- effective, designing, HTML 495
- marking table headings and table data, HTML 456–459

## marking tables and table rows, HTML 454–456

## mobile devices, HTML 492–495

## spanning rows and columns, HTML 464–470

## web video, HTML 619–638

- animations. See **animation(s)**
- codecs, HTML 620–621
- effective, HTML 638
- text tracks. See **text tracks**
- third-party video players, HTML 634–637
- transitions. See **transition(s)**
- video element, HTML 621–624
- video formats, HTML 620–621

**Web Video Text Tracks (WebVTT)**, HTML 618, HTML 625–628

- cue attributes, HTML 629

**WebM format**, HTML 608, HTML 618, HTML 620

## websites

- managing, HTML 62
- with no coherent structure, HTML E5
- speeding up by minifying and compressing, HTML 416
- structure, HTML E1–E6

WebVTT. See **Web Video Text Tracks (WebVTT)****well-formed documents**, HTML F2–F4**while loop**, HTML 774–775

## white space, HTML 257

**white-space characters**, HTML 12**wide area networks (WANs)**, HTML 4**widgets**, HTML 520, HTML 545–561

- check boxes, HTML 556–557
- entering time and date values, HTML 546–547
- option buttons, HTML 553–555
- selection lists. See **selection lists**
- styles, HTML 569
- text area boxes, HTML 558–560

## widows, HTML 434–435

**widows property**, HTML 418, HTML 434–435, HTML 501, HTML 503

## width

- borders, HTML 290–291
- elements, maximum and minimum dimensions, HTML 184–186
- table columns, setting, HTML 486, HTML 489

**width property**, HTML 176, HTML 486**wildcard selector (\*)**, HTML 111**window.alert command**, HTML 683

## Wistia, HTML 637

**World Wide Web**, HTML 4–5. See also **mobile web****World Wide Web Consortium (W3C)**, HTML 5

## Wufoo, HTML 585

**X****XHTML (Extensible HyperText Markup Language)**, HTML 5

- page validation. See **page validation with XHTML**

XML. See **Extensible Markup Language (XML)****XML parsers**, HTML F2

## &lt;xm: tag, HTML B21

**XML vocabularies**, HTML F1

## &lt;xmp&gt; tag, HTML B21

**Y**

## YouTube, embedding videos from, HTML 636–637

**Z**

## z-index property, HTML 258–259



