A BEGINNER'S GUIDE

Fourth Edition

JavaScript

- Create dynamic Web pages with special effects
- Learn the latest JavaScript standard
- Work with HTML5 and jQuery

John Pollock

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To my wife Heather, daughters Eva and Elizabeth,
Bruce and Joy Anderson, and Dr. J. D. and Linda Andrews

In memory of James D. and Livian Anderson, John William and Edith Hopkins,
Burley T. and Aline Price, "Doc" Flores, and Clifton Idom

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John Pollock is employed as a Web Administrator during the day and works on Web sites and other projects during the evening. He runs a Web site devoted to Web development and design: Script the Web (www.scriptttheweb.com). He also is a contributor to Web Xpertz (www.webxpertz.net), a help community for Web developers. John holds a Bachelor of Arts in English from Sam Houston State University and currently lives in Huntsville, Texas with his wife, Heather, and his daughters, Eva and Elizabeth.

About the Technical Editor

Christie Sorenson is a senior software engineer at ZingChart. She has worked on JavaScript-based systems in analytics, content management, and business applications since 1997 and has been fascinated with the evolution of the language and its users. She has collaborated on several books, including *Ajax: The Complete Reference* and *HTML & CSS: The Complete Reference* and was also the tech editor on *JavaScript: The Complete Reference* and *HTML: A Beginner's Guide.* She holds a Bachelor of Science in Computer Science from University of California, San Diego, and now lives in San Francisco with her husband, Luke, and daughters, Ali and Keira.

Contents at a Glance

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Acknowledgments

I would like to begin by thanking my wonderful wife, Heather Pollock, for all of her love, support, and encouragement in all I do. I love you! I would also like to thank my two daughters, Eva and Elizabeth. I love both of you!

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I would like to thank God for the ability He has given me to help and teach people by my writing. “In all your ways acknowledge Him, and He shall direct your paths.” (Proverbs 3:6).

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Introduction

Welcome to *JavaScript: A Beginner's Guide, Fourth Edition*! Years ago, I was surfing the Web and noticed that people were publishing pages about themselves and calling them homepages. After viewing a number of these, I decided to create a homepage myself. I had no idea where to begin but, through trial and error, I figured out how to code HTML and publish my documents on a Web server. Over time, I saw some interesting effects used on other homepages (like alert messages that popped up out of nowhere or images that would magically change when I moved my mouse over them). I was curious and just *had* to know what was being done to create those effects. Were these page creators using HTML tags I did not know about?

Eventually, one site revealed what they were using to create those effects: *JavaScript*. I went in search of information on it, and came across a few tutorials and scripts on the Web. Since I had programmed in other languages (such as a relatively obscure language called Ada), I was able to catch on to JavaScript fairly quickly by looking at these tutorials and scripts.

I learned enough that I decided to create a Web site that would teach HTML and JavaScript to beginners. As soon as I began the project, I received questions from visitors that were way over my head—forcing me to dig deeper and learn more about JavaScript. As a result, I became completely familiar with this scripting language and what it can do. Not only can you add fun effects to a Web page, you can create scripts that will perform useful tasks, like validate form input, add navigational elements to documents, or react to user events.

The goal of this book is to help you to learn the basics of the JavaScript language with as little hair pulling and monitor smashing as possible. You do not need any prior programming experience to learn JavaScript from this book. All you need is knowledge of HTML and/or XHTML, Cascading Style Sheets (CSS), and how to use your favorite text editor and Web browser (see Chapter 1 for more information).

What This Book Covers

The 16 chapters of this book cover specific topics on the JavaScript language. The first two chapters cover the most basic aspects of the language: what it is, what you need to know to begin using JavaScript, and how to place JavaScript into an HTML file. The middle of the book (Chapters 3–14) covers beginning JavaScript topics from variables all the way to using JavaScript with forms. The final two chapters (Chapters 15–16) introduce some advanced techniques, and point you toward resources if you want to learn more about JavaScript once you have completed the book.

This book includes a number of special features in each chapter to assist you in learning JavaScript. These features include

- **Key Skills & Concepts** Each chapter begins with a set of key skills and concepts that you will understand by the end of the chapter.
- **Ask the Expert** The Ask the Expert sections present commonly asked questions about topics covered in the preceding text, with responses from the author.
- **Try This** These sections get you to practice what you have learned using a hands-on approach. Each Try This will have you code a script through step-by-step directions on what you need to do to in order to accomplish the goal. You can find solutions to each project on the McGraw-Hill/Professional Web site at www.mhprofessional.com/computingdownload.
- **Notes, Tips, and Cautions** Notes, Tips, and Cautions call your attention to noteworthy statements that you will find helpful as you move through the chapters.
- **Code** Code listings display example source code used in scripts or programs.
- **Callouts** Callouts display helpful hints and notes about the example code, pointing to the relevant lines in the code.
- **Self Test** Each chapter ends with a Self Test, a series of 15 questions to see if you have mastered the topics covered in the chapter. The answers to each Self Test can be found in the appendix.

That is it! You are now familiar with the organization and special features of this book to start your journey through JavaScript. If you find that you are stuck and need help, feel free to get online and visit the JavaScript discussion forums on the Web Xpertz Web site at www.webxpertz.net/forums. The forums will allow you to interact with other JavaScript coders who may be able to help you with your questions. If you would like to contact me, you can send me a message on my Web site (www.scripttheweb.com/about/contact.html) or you can find me on Twitter (@ScripttheWeb).

Now it is time to learn JavaScript. Get ready, get set, and have fun!

Chapter 1

Introduction to JavaScript

Key Skills & Concepts

- Using Text Editors, WYSIWYG Editors, and Web Browsers
- Defining JavaScript
- Differences Between JavaScript and Other Languages

Welcome to *JavaScript: A Beginner's Guide, Fourth Edition*! You're obviously interested in learning JavaScript, but perhaps you're not sure what you need to know to use it. This chapter answers some basic questions about what JavaScript is, discusses its advantages and limitations, explains how you can use it to create more dynamic and inviting Web pages, and provides a brief history of the language.

JavaScript is ubiquitous on the World Wide Web. You can use JavaScript both to make your Web pages more interactive, so that they react to a viewer's actions, and to give your Web pages some special effects (visual or otherwise).

JavaScript often gets thrown in with Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS) as one of the recommended languages for beginning Web developers (whether you build Web sites for business or pleasure). Of course, you can build a Web page by using only HTML and CSS, but JavaScript allows you to add additional features that a static page of HTML can't provide without some sort of scripting or programming help.

What You Need to Know

Before you begin learning about JavaScript, you should have (or obtain) a basic knowledge of the following:

- HTML and Cascading Style Sheets (CSS)
- Text editors
- Web browsers
- The different versions of JavaScript

If you have this basic knowledge (the different versions of JavaScript will be discussed in this chapter), then you'll do just fine as you work through this book. Knowing another programming/scripting language or having previous experience with JavaScript isn't required. This book is a *beginner's* guide to JavaScript.

If you think you don't have enough experience in one of the aforementioned areas, a closer look at each one may help you decide what to do.

Basic HTML and CSS Knowledge

While you don't need to be an HTML guru, you do need to know where to place certain elements (like the head and body elements) and how to add your own attributes. This book will reference scripts in the head section (between the <head> and </head> tags) and the body section (between the <body> and </body> tags).

Sometimes, you will also need to add an attribute to a tag for a script to function properly. For example, you may need to name a form element using the id attribute, as shown in the following code:

```
<input type="text" id="thename">
```

If you know the basics of using tags and attributes, the HTML portion shouldn't pose any problems in learning JavaScript.

If you don't have a basic knowledge of HTML, you can learn it fairly quickly through a number of media. For example, you can buy a book or look for some helpful information on the Web. A good book is *HTML: A Beginner's Guide, Fourth Edition* by Wendy Willard (McGraw-Hill Professional, 2009). To find information about HTML on the Web, check out these sites: www.scripttheweb.com/html and www.w3.org/wiki/The_basics_of_HTML.

Occasionally, you will need to use CSS to add or change presentation features on a Web page. We will mainly use CSS for the purposes of dynamically changing CSS properties via JavaScript in this book. Two good places to learn CSS are www.scripttheweb.com/css/ and www.w3.org/wiki/CSS_basics.

Basic Text Editor and Web Browser Knowledge

Before jumping in and coding with JavaScript, you must be able to use a text editor or HTML editor, and a Web browser. You'll use these tools to code your scripts.

Text Editors

A number of text editors and HTML editors support JavaScript. If you know HTML, you've probably already used an HTML editor to create your HTML files, so you might not have to change.

However, some HTML editors have problems related to adding JavaScript code (such as changing where the code is placed or altering the code itself when you save the file). This is more often the case when using WYSIWYG (What You See Is What You Get) editors. It is best to use an HTML editor that allows the option to write your own code (such as Adobe Dreamweaver), a code editor such as NetBeans, or a plain text editor. Some examples of text editors are Notepad, TextPad, and Simple Text.

Web Browsers

Again, if you've been coding in HTML, you probably won't need to change your browser. However, some browsers have trouble with the newer versions of JavaScript. The choice of

Web browser is ultimately up to you, as long as it's compatible with JavaScript. I recommend one of the following browsers to test your JavaScript code:

- Microsoft Internet Explorer version 9.0 or later (or 8 if you are not able to upgrade on your operating system, for example, Windows XP)
- Mozilla Firefox version 14.0 or later
- Google Chrome version 20.0 or later
- Opera version 12.0 or later

New versions of these browsers continue to be produced. The newest versions will continue to support more features.

To give you an idea of what some browsers look like, Figure 1-1 shows a Web page when viewed in Microsoft Internet Explorer, and Figure 1-2 shows the same page when viewed in Mozilla Firefox.

If you have an older browser and you can't upgrade, a number of features (mostly discussed later in the book) may not work in that browser. Even so, the book can still help you learn the JavaScript language itself, so you don't need to give up if you have an older browser.

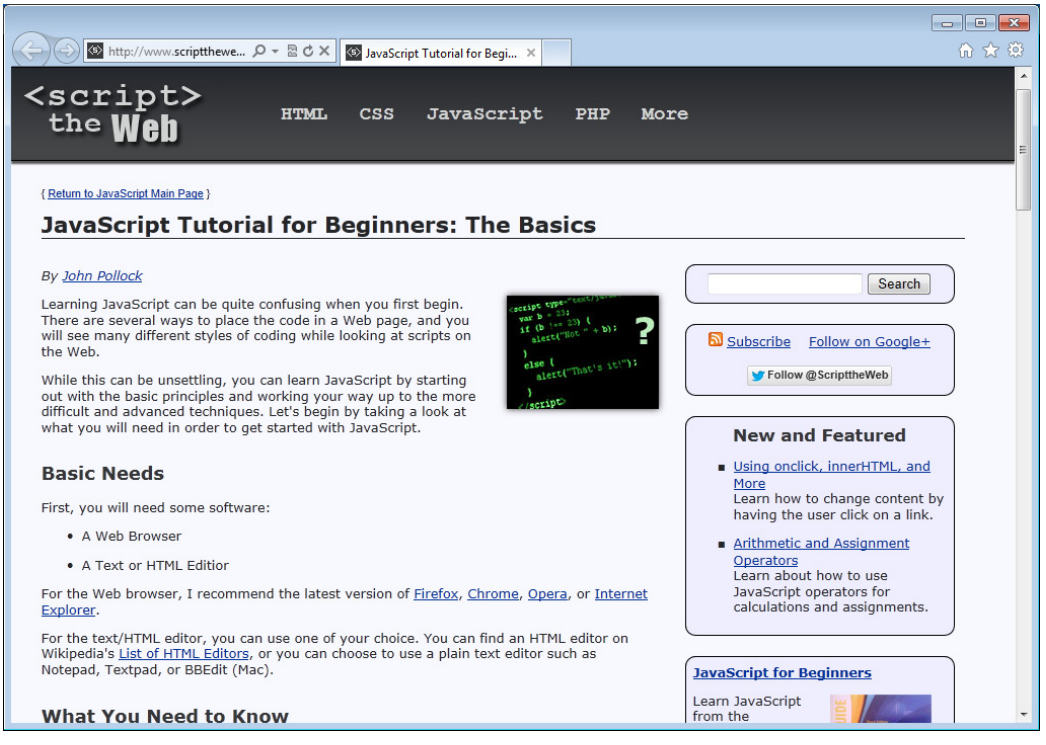


Figure 1-1 A Web page viewed in Microsoft Internet Explorer

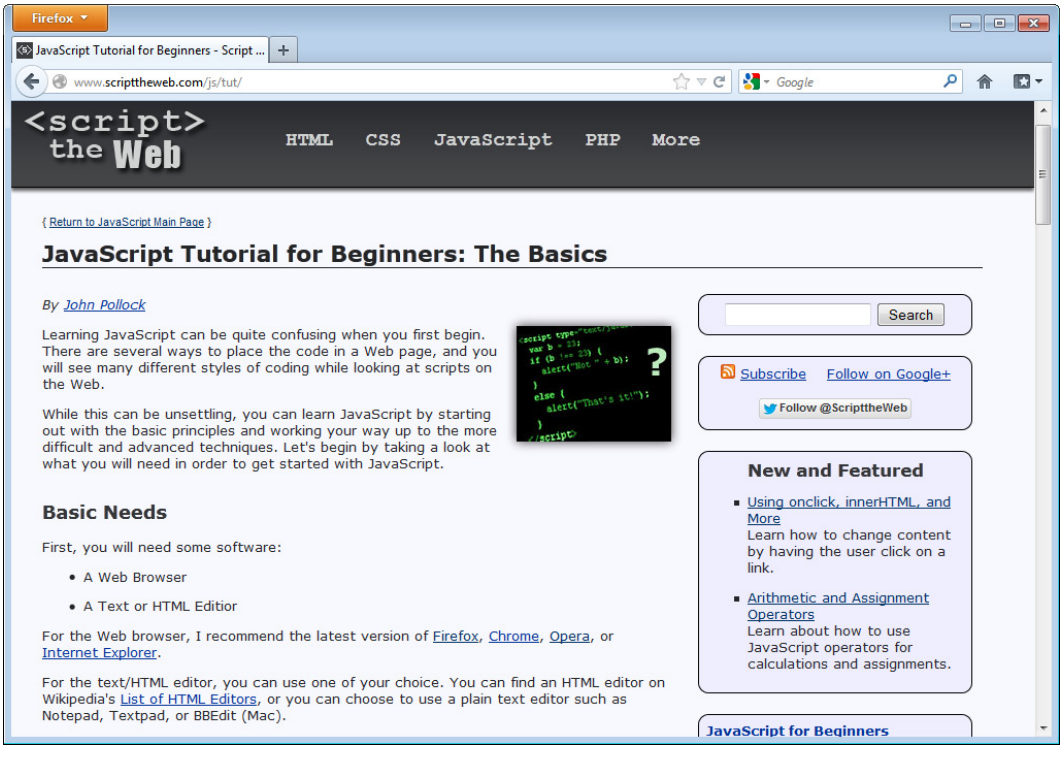


Figure 1-2 A Web page viewed in Mozilla Firefox

NOTE

Even if you have one of the latest browsers, your viewers may not, so it is always appropriate to understand what features may not be supported in older browsers. This book will cover how to handle a number of these issues.

Which Version?

The version of JavaScript being used by a browser (or other software) can be a difficult number to identify, since different browsers may have different names for the language (for example, JScript in Microsoft Internet Explorer) and each of these can follow its own set of version numbers. To find out what standard conventions are being followed, it is best to look at what version of ECMAScript is supported in each browser. You can see what versions are supported by each browser at en.wikipedia.org/wiki/ECMAScript#Dialects.

ECMAScript is the international standard name and specification used for the JavaScript language, so it's not a new language but a standard that is set for JavaScript, JScript, and other implementations of the language. For more on ECMAScript, see www.ecmascript.org/docs.php.

At the time of this writing, the browsers recommended earlier in this chapter should support at least ECMAScript 5.

Remember, It's Not Java

JavaScript and Java are two different languages. Java is a programming language that must be compiled (running a program through software that converts the higher-level code to machine language) before a program can be executed. More information on the Java language can be found at docs.oracle.com/javase/tutorial/.

Similarities to Other Languages

JavaScript does have similarities to other programming and scripting languages. If you have experience with Java, C++, or C, you'll notice some similarities in the syntax, which may help you to learn more quickly. Because it's a scripting language, JavaScript also has similarities to languages like Perl—which can also be run through an interpreter rather than being compiled.

If you have programming or scripting experience in any language, it will make learning JavaScript easier—but it isn't required.

Ask the Expert

Q: You mentioned that I could use a text editor or HTML editor of my choice, but I'm not quite sure what that means. What is a text editor and where can I find one?

A: A text editor is a program that you can use to save and edit written text. Text editors range from simple to complex, and a number of choices are available: Notepad, WordPad, and Simple Text, to name a few. You can also purchase and download some from the Web, like NoteTab or TextPad.

An HTML editor is either a more complex text editor or an editor that allows you to add code by clicking buttons or by other means—often called a What You See Is What You Get (WYSIWYG) editor. I recommend a plain text editor or an HTML editor that doesn't change any code you add to it manually. Some examples of HTML editors are Adobe Dreamweaver and Softpress Freeway.

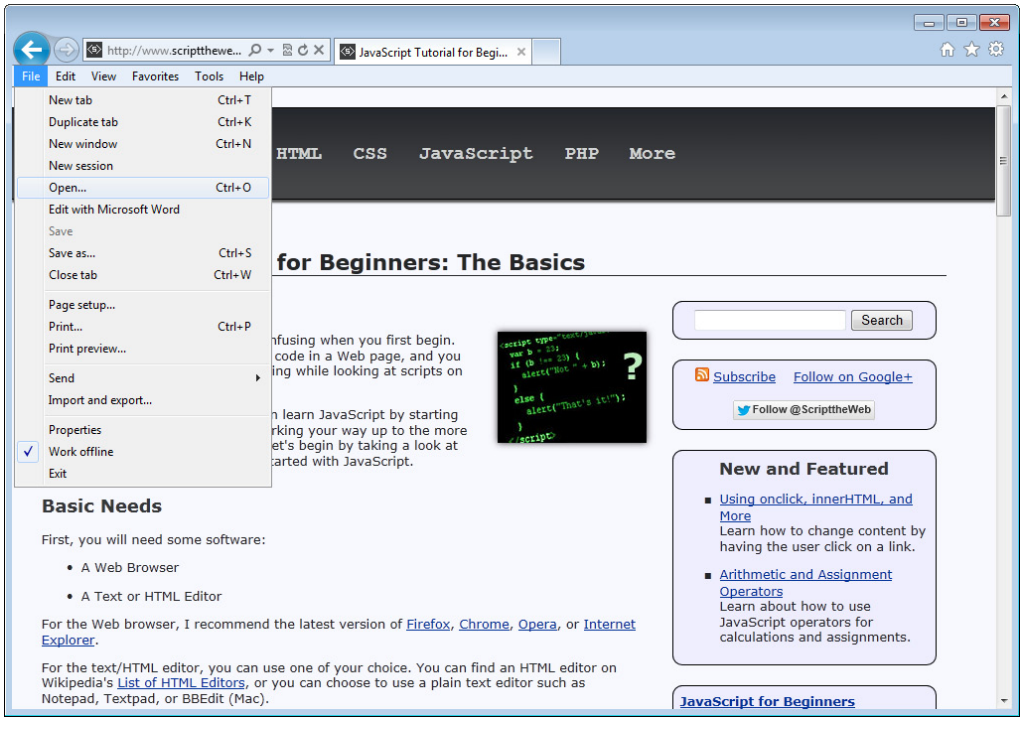
For the purposes of JavaScript coding, you may decide to use a more code-oriented program that can offer features such as code highlighting, completion, debugging tools, and more, such as NetBeans IDE.

Q: What exactly do I need to know about using a text editor?

A: Basically, you only need to know how to type plain text into the editor, save the file with an .html, .css, or .js extension, and be able to open it again and edit it if necessary. Special features aren't needed because HTML, CSS, and JavaScript files are made up of plain text.

Q: What do I need to know about using a browser?

A: All you absolutely need to know is how to open a local HTML file on your computer (or on the Web) and how to reload a page. If you don't know how to open an HTML file from your own computer, open your browser and go to the File menu. Look for an option that says something like Open, or Open File, and select it. You should be able to browse for the file you want to open, as you would with other programs. The following illustration shows where the option is in Microsoft Internet Explorer:



Q: Where do I get those browsers you mentioned?

A: Here are links for the browsers:

- **Microsoft Internet Explorer** www.microsoft.com/ie
- **Mozilla Firefox** www.mozilla.com/firefox
- **Google Chrome** www.google.com/chrome/
- **Opera** www.opera.com

Beginning with JavaScript

JavaScript came about as a joint effort between Netscape Communications Corporation and Sun Microsystems, Inc. The news release of the new language was issued on December 4, 1995, back when Netscape Navigator 2.0 was still in its beta version. JavaScript version 1.0 became available with the new browser. (Before its release as JavaScript, it was called LiveScript.)

JavaScript is a prototype-based, client-side scripting language that can be used in numerous environments. To make sense of such a definition, let's look at its important parts one by one.

Prototype-Based

Prototype-based means that JavaScript is an object-oriented programming language that can use items called *objects*. However, the objects are not *class-based*, so no distinction is made between a class and an instance; instead, objects inherit from other objects via the prototype property. You'll learn how to work with JavaScript objects in Chapter 8. You don't need to understand them in detail until you know a few other features of the language.

Client-Side

Client-side means that JavaScript runs in the *client* (software) that the viewer is using, rather than on the Web server of the site serving the page. In this case, the client will most often be a Web browser (though ECMAScript can be run in other environments as well, such as Adobe Acrobat, Adobe Flash, and others). To make more sense of this, let's take a look at how a server-side language works and how a client-side language works.

Server-Side Languages

A *server-side language* needs to get information from the Web page or the Web browser, send it to a program that is run on the host's server, and then send the information back to the browser. Therefore, an intermediate step must send and retrieve information from the server before the results of the program are seen in the browser.

A server-side language often gives the programmer options that a client-side language doesn't have, such as saving information on the Web server for later use, or using the new information to update a Web page and save the updates.

However, a server-side language is likely to be limited in its ability to deal with special features of the client that can be accessed with a client-side language (like the width of the browser window or the contents of a form before it's submitted to the server).

Client-Side Languages

A *client-side language* is run directly through the client being used by the viewer. In the case of JavaScript, the client is typically a Web browser. Therefore, JavaScript is run directly in the Web browser and doesn't need to go through the extra step of sending and retrieving information from the Web server.

With a client-side language, the browser reads and interprets the code, and the results can be given to the viewer without getting information from the server first. This process can make certain tasks run more quickly.

A client-side language can also access special features of a browser window that may not be accessible with a server-side language. However, a client-side language lacks the ability to save files or updates to files on a Web server as a server-side language can.

NOTE

Using the XMLHttpRequest object allows JavaScript to send and request data from the server. This will be covered briefly in Chapter 15.

A client-side language is useful for tasks that deal with the content of a document or that allow information to be validated before it is sent to a server-side program or script. For instance, JavaScript can change the content of one or more elements on a Web page when the user clicks a link or presses a button (many other user actions can also be activated).

JavaScript can also be used to check the information entered into a form before the form is sent to a server-side program to be processed. This information check can prevent strain on the Web server by preventing submissions with inaccurate or incomplete information. Rather than running the program on the server until the information is correct, that data can be sent to the server just once with correct information.

NOTE

While JavaScript is able to *help* validate information sent to the server, it cannot replace server-side validation since users may have JavaScript disabled or unavailable in the device being used (which allows them to bypass the JavaScript validation). For security reasons, you should always use server-side validation, regardless of whether or not you incorporate JavaScript validation.

Scripting Language

A scripting language doesn't require a program to be compiled before it is run. All the interpretation is done on-the-fly by the client.

With a regular programming language, before you can run a program you have written, you must compile it using a special compiler to be sure there are no syntax errors. With a scripting language, the code is interpreted as it is loaded in the client. Thus, you can test the results of your code more quickly. However, errors won't be caught before the script is run and could cause problems with the client if it can't handle the errors well. In the case of JavaScript, the error handling is up to the browser or other client being used by the viewer.

Putting It All Together

With all this in mind, you might wonder how JavaScript is run in a browser. You might wonder where to write your JavaScript code and what tells the browser it is different from anything else on a Web page. The answers are general for now, but the next chapter provides more details.

JavaScript runs in the browser by being added into an existing HTML document (either directly or by referring to an external script file). You can add special tags and commands to the HTML code that will tell the browser that it needs to run a script. When the browser sees

these special tags, it interprets the JavaScript commands and will do what you have directed it to do with your code. Thus, by simply editing an HTML document, you can begin using JavaScript on your Web pages and see the results.

For example, the following code adds some JavaScript to an HTML file that writes some text onto the Web page. Notice the addition of <script> and </script> tags. The code within them is JavaScript.

```
<html>
<body>
<script>
document.write("This writes text to the page");
</script>
</body>
</html>
```

This tag tells the browser that JavaScript follows

This line writes the text inside the quote marks on the page

This line tells the browser that this is the end of the script

The next chapter looks at how to add JavaScript in an HTML file by using the <script> and </script> HTML tags. This will be your first step on the road to becoming a JavaScript coder!

Online Resources

To find additional information online to help you with JavaScript, here are some useful resources:

- A place to find tutorials with working examples of the results: www.scripttheweb.com/js/
- An excellent tutorial site that includes cut-and-paste scripts: www.javascriptkit.com
- A place where you can address questions about JavaScript to fellow coders: www.webxpertz.net/forums

Try This 1-1 Use JavaScript to Write Text

`pr1_1.html`

This project shows you JavaScript in action by loading an HTML document in your browser. The script writes a line of text in the browser using JavaScript.

Step by Step

1. Copy and paste the code shown here into your text editor:

```
<html>
<body>
<script>
document.write("This text was written with JavaScript!");
</script>
</body>
</html>
```

2. Save the file as pr1_1.html and open it in your Web browser. You should see a single line of text that was written with JavaScript. (To open a file in your Web browser, go to the File menu and look for an option that says something like Open, or Open File, and select it. You should be able to browse for the file you want to open as you would with other programs.)

Try This Summary

In this project, you copied and pasted a section of code into a text editor and saved the file. When you opened the saved file in your Web browser, a line of text was displayed in the browser. This text was written in the browser window using JavaScript. You will see more about how this type of script works in Chapter 2.

Chapter 1 Self Test

1. You must know which of the following to be able to use JavaScript?
   - **A.** Perl
   - **B.** C++
   - **C.** HTML
   - **D.** SGML
2. Which of the following is something you should have to use JavaScript?
   - **A.** A Web browser
   - **B.** A C++ compiler
   - **C.** A 500GB hard drive
   - **D.** A DVD-RW drive
3. The choice of a Web browser is up to you, as long it's compatible with _____.
   - **A.** Flash
   - **B.** VBScript
   - **C.** JavaScript
   - **D.** Windows XP
4. JavaScript and Java are the same language.
   - **A.** True
   - **B.** False

5. _____ is the international standard name and specification used for the JavaScript language.
   - **A.** JScript
   - **B.** LiveScript
   - **C.** ECMAScript
   - **D.** ActionScript
6. JavaScript has similarities to other programming and scripting languages.
   - **A.** True
   - **B.** False
7. Before its release as JavaScript, JavaScript was called _____.
   - **A.** Java
   - **B.** JavaCup
   - **C.** LiveScript
   - **D.** EasyScript
8. JavaScript is _____.
   - **A.** prototype-based
   - **B.** class-based
   - **C.** object deficient
   - **D.** not a language that uses objects
9. A client-side language is run directly through the _____ being used by the viewer.
   - **A.** server
   - **B.** client
   - **C.** monitor
   - **D.** lawyer
10. How can a client-side language help when using forms on a Web page?
    - **A.** It can save the information on the server.
    - **B.** It can validate the information before it is sent to the server.
    - **C.** It can update a file and save the file with the new information.
    - **D.** It can't help at all.

11. A _____ language doesn't require a program to be compiled before it is run.

- **A.** programming
- **B.** server-side
- **C.** scripting
- **D.** computer

12. With a scripting language, the code is interpreted as it is loaded in the client.

- **A.** True
- **B.** False

13. In JavaScript, what handles errors in a script?

- **A.** The Web server
- **B.** A compiler
- **C.** A program on the Web server
- **D.** The client/Web browser

14. How is JavaScript added to a Web page?

- **A.** It isn't. It must be compiled and loaded separately.
- **B.** It is taken from a compiled program on the server.
- **C.** You place the code in a file by itself and open that file.
- **D.** It is added to an HTML document.

15. What is added to a Web page to insert JavaScript code?

- **A.** <script> and </script> HTML tags
- **B.** The JavaScript code word
- **C.** <javascript> and </javascript> HTML tags
- **D.** <java> and </java> HTML tags

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Chapter 2

Placing JavaScript in an HTML File

Key Skills & Concepts

- Using the HTML Script Tags
- Creating Your First Script
- Using External JavaScript Files
- Using JavaScript Comments

Now that you have been introduced to JavaScript, you're ready to start coding. Since JavaScript code is run from HTML documents, you need to know how to tell browsers to run your scripts. The most common way to set off a script is to use the HTML <script> and </script> tags in your document. You can place your script tags in either the head or the body section of an HTML document.

This chapter first shows you how to use the script tags to begin and end a segment of JavaScript code. Then, you will get started creating and running your first scripts. At the end of the chapter, you will learn how to add JavaScript comments to document your scripts.

Using the HTML Script Tags

Script tags are used to tell the browser where code for a scripting language will begin and end in an HTML document. In their most basic form, script tags appear just like any other set of HTML tags:

```
<script>
JavaScript code here
</script>
```

Tells the browser where script code begins

Tells the browser where script code ends

As you can see, there is the opening <script> tag, the JavaScript code, and then the closing </script> tag. When you use just the basic opening and closing tags like this, almost all browsers will assume that the scripting language to follow will be JavaScript.

In HTML, the script tag is not case sensitive. However, in XHTML, the script tag must be in lowercase. JavaScript is case sensitive in all versions, so you will need to be more careful with it. In this book, I will use HTML5 for the HTML code (even though HTML5 is not case sensitive, I will write the tag and attribute names in lowercase). For the JavaScript code, I will use the case that is needed for it to function correctly.

The <script> tag has six possible attributes: *type*, *language* (deprecated), *charset*, *src*, *defer*, and *async*. These attributes give the browser additional information about when the script should load, the scripting language, and the location of an external JavaScript file (if any).

Identifying the Scripting Language

The scripting language between the opening and closing script tags could be JavaScript, VBScript, or some other language, though JavaScript is almost always set as the default scripting language in browsers. If desired, you can explicitly identify JavaScript as the scripting language by adding the type attribute with the value of "text/javascript" to the opening script tag:

```
<script type="text/javascript">
JavaScript code here
</script>
```

Tells the browser the scripting language will be JavaScript

NOTE

The type attribute in the opening script tag is required in XHTML in order for the Web page to validate, but is optional in HTML.

In the past, the language attribute was used to identify the scripting language, but is ignored in modern browsers and will cause the page to be invalid in XHTML and HTML5. It should no longer be used.

The charset attribute, which allows for the character set of the JavaScript code to be specified, is not recognized by most browsers and is not recommended.

Calling External Scripts

Script tags allow you to call an external JavaScript file in your document. An *external JavaScript file* is a text file that contains nothing but JavaScript code, and it is saved with the .js file extension. By calling an external file, you can save the time of coding or copying a long script into each page in which the script is needed. Instead, you can use a single line on each page that points to the JavaScript file with all of the code.

You can call external scripts by adding the src (source) attribute to the opening script tag:

```
<script type="text/javascript" src="yourfile.js"></script>
```

This example calls a JavaScript file named yourfile.js from any page on which you place this tag. Be sure there are no spaces or code between the opening and closing script tags, as this may cause the script call to fail.

If the script is extremely long, using the src attribute to add the script to multiple pages can be much quicker than inserting the entire code on each page. Also, the browser will cache the external JavaScript file the first time it is loaded, making subsequent Web pages that use the script render faster. Using an external script is also helpful when dealing with page validation and when trying to keep script code separated from markup (HTML) code.

By default, script files are loaded in the order in which they are placed in the HTML code (synchronously). There are some options for altering this behavior, which are described in the next section.

Specifying When the Script Should Load

The last two attributes, defer and async, allow you to specify when an external script should be loaded. These attributes are not fully supported by older browsers, or may behave differently, so be aware that an older browser may not execute the script when it is expected to do so.

The defer Attribute

The defer attribute allows you to specify that an external script file should be loaded, but should not execute until the page has completed parsing (the </html> tag has loaded). The following <script> tag would defer the execution of the external JavaScript code:

```
<script type="text/javascript" src="file.js" defer></script>
```

NOTE

If you are using XHTML, set this attribute using defer="defer".

Support for this attribute is available in Internet Explorer 4+, Firefox 3.5+, and Chrome 7+. Internet Explorer 4–7 will allow this attribute to work on inline scripts as well, but versions 8 and above only support this attribute on external scripts as other browsers do.

The async Attribute

When the async attribute is set, the page can continue to load without waiting for the script to load, and the script will execute before the document completes loading. Here is an example:

```
<script type="text/javascript" src="file.js" async></script>
```

NOTE

If you are using XHTML, set this attribute using async="async".

Support for this attribute is available in Firefox 3.5+ and Chrome 7+.

Using <noscript></noscript> Tags

One way of providing alternate content for those viewers without JavaScript (or with JavaScript turned off) is to use the noscript tag. The <noscript></noscript> tags may be placed anywhere in the HTML document and can contain any content needed for those viewers browsing without JavaScript. For example:

```
<script type="text/javascript">
  document.write("The color is red.");
</script>
<noscript>
  The color is red.
</noscript>
```

Displays for those viewers with JavaScript

Begins noscript content for those viewers without JavaScript

Ends noscript content

This example displays the phrase "The color is red." to the viewer either through JavaScript or through the text within the <noscript></noscript> tags.

CAUTION

Some older browsers may not handle the noscript tag correctly and won't display the content in either section. If your users have older browsers, another alternative is to display the content on the page and then use JavaScript to enhance the content for those who are able to display it with JavaScript on.

The <noscript> tag can be useful at times, but there are often better ways to provide the same content to those without JavaScript (avoiding the document.write() method, for instance). You will learn more about accessible JavaScript as you progress through this book.

Ask the Expert

Q: Do I always need to use script tags to add JavaScript to a page?

A: It's possible to use *event handlers* that allow you to write short bits of script within the event-handling attribute of an HTML tag. You'll learn about event handlers in Chapter 8.

Q: What about the language attribute?

A: The language attribute once was used to specify the scripting language to be used, and for a time some browsers allowed a JavaScript version to be specified (for example, language="JavaScript1.2"). This is no longer the case, and the attribute has been deprecated. Since it is completely ignored in modern browsers and causes pages not to validate in XHTML and HTML5, it should no longer be used.

Q: My page won't validate in XHTML strict (or transitional) when I add a script to it. How do I get the page to validate?

A: If the script contains characters used in XHTML such as < (which is used for "less than" in JavaScript but is seen as the beginning of a new tag in XHTML), then the page won't validate with the script directly in the document without adding a CDATA section:

```
<script type="text/javascript">
<![CDATA[ ◄──────────────────────── Begins the CDATA section
var x  = 5;
var y = 10;
if (x < y) {
window.alert("x is less than y");
}
]]> ◄──────────────────────── Ends the CDATA section
</script>
```

(continued)

This will allow the page to validate, but because the <![CDATA[and]]> characters are in the script, the script will no longer work. To fix this, you need JavaScript comments (/* and */) around those characters when they are within the script tags:

```
<script type="text/javascript">
/*<![CDATA[*/
var x  = 5;
var y = 10;
if (x < y) {
window.alert("x is less than y");
}
/*]]>*/
</script>
```

Opening and closing JavaScript comments are placed around <![CDATA[

Opening and closing JavaScript comments are placed around]]>

As you can see, this can get quite tedious very quickly! Typically, the better option is to use an external script file, which eliminates this problem because only the script tags themselves are needed in the XHTML document.

Creating Your First Script

Now that you know how to use the HTML script tags to tell browsers about the JavaScript in a document, you're ready to learn how to add the actual JavaScript code between those script tags. The first coding example often given to teach any language is one that writes some sort of text to the default output area, commonly known as a basic "Hello World" script. Following that convention, your first script will write a string of text to a Web page.

Writing a "Hello World" Script

Rather than write "Hello World," you'll use another line of text for this script: "Yes! I am now a JavaScript coder!" This requires only a single line of code, using the document.write() method, which writes a string of text to the document:

```
<script type="text/javascript">
  document.write("Yes! I am now a JavaScript coder!");
</script>
```

Notice the parentheses and the quotation marks around the text. The parentheses are required because the document.write() method is a JavaScript *function*, which takes an *argument* contained in parentheses. You will learn more about JavaScript functions in Chapter 4.

The quotation marks denote a *string* of text. A string is a type of variable that is defined in JavaScript by placing it inside quotation marks. Chapter 3 provides details on strings and other types of JavaScript variables.

The last thing to notice about your script is the semicolon at the end of the line. The semicolon signals the end of a JavaScript statement. A *statement* is a portion of code that does not need anything added to it to be complete in its syntax (its form and order). A statement can be used to perform a single task, to perform multiple tasks, or to make calls to other parts of the script that perform several statements. Most JavaScript statements end with a semicolon, so it is a good idea to get in the habit of remembering to add one.

NOTE

In later chapters, you will see various lines that do not end in semicolons because they open or close a block of code. Also, many scripts you encounter may not end statements with semicolons. JavaScript is lenient about the use of a semicolon in most cases; however, it is best to use the semicolon to end a statement because it can prevent possible errors and aid in debugging (removing errors from) the script later.

So, to write a text string to the page, you use the document.write() method, followed by the text, surrounded by quotation marks and enclosed in parentheses. End the line (the statement) with a semicolon. JavaScript will handle the rest of the job.

Creating an HTML Document for the Script

In order to make this example complete and test the script, you need to insert it into an HTML document. First, create the following HTML document with the basic tags (using any text editor you prefer):

```
<!DOCTYPE html>
<html>
<head>
<title>Untitled Document</title>
</head>
<body>
</body>
</html>
```

Save the document as test1.html in your text editor. You will call it later with a Web browser to see the results of the script. Next, you'll add the script to this HTML document, so leave the file open.

Inserting the Script into the HTML Document

Now you need to insert the script in the document. Where should it go? You can place a script between the <head> and </head> tags, or between the <body> and </body> tags. Since this example writes a text string directly to the page, you want to insert the script between the <body> and </body> tags, wherever you want the text string to appear. It can come before, after, or between any HTML code on the page.

To make it clear how the script results appear, you'll add HTML code to write lines of text before and after the script. The script tags and the script itself are inserted between those lines. Add the lines shown next between the <body> and </body> tags:

```
<p>This is the first line, before the script results.</p>
<p>
<script type="text/javascript">
  document.write("Yes! I am now a JavaScript coder!");
</script>
</p>
<p>This line comes after the script.</p>
```

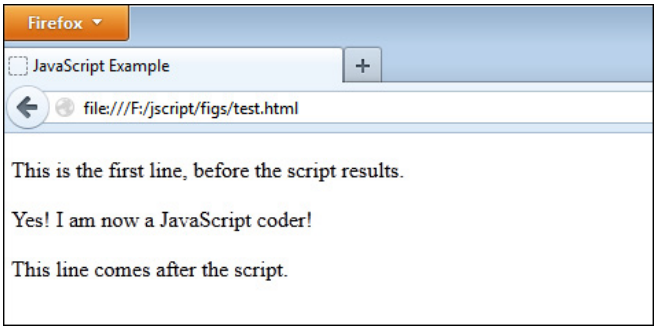

Figure 2-1 The test.html file in a Web browser

Save the test1.html document again. You should now be able to open the document in your Web browser to see the results of the script. Figure 2-1 shows how the text should look in your browser when you load the Web page.

Congratulations, you have now finished your first script!

NOTE

The example code in this section uses the entire HTML document and all of its tags. In order to keep things as relevant as possible, from this point on the example code will use only the HTML tags involved with the scripts rather than the entirety of its tags. Project code may use entire HTML documents as needed.

Ask the Expert

Q: Why is there a dot (.) in the document.write() command?

A: Document is one of JavaScript's predefined objects, and write() is a predefined method of the document object. The dot puts the object and the method together to make the function work. Chapter 9 explains JavaScript objects, and Chapter 10 is devoted to the document object.

Q: How do I know when to add the script inside the head section and when to add it inside the body section?

A: In the past, JavaScript code was almost always placed inside the head section, which kept it in a separate area from the rest of the HTML code. Modern coding practice is typically to place all JavaScript code in an external .js file and to place the <script> tag(s) right before the closing </body> tag. This ensures that the HTML page has loaded in the browser (since large scripts can delay the loading of the page if placed elsewhere), giving the user a better experience.

Try This 2-1 Insert a Script into an HTML Document

pr2_1.html

This project gives you practice adding a script to your page. You will create an HTML document and insert a script that displays a short sentence in the browser window when the page loads.

Step by Step

1. Set up an HTML document so that you have a simple file with nothing between the <body> and </body> tags yet.
2. Put the following line of text into the Web page within a paragraph:

   I am part of the HTML document!

3. Insert a tag after this line.
4. After the tag, insert a script that will write the following line on the page:

   This came from my script, and is now on the page!

5. After the script, add a tag. Add another opening tag.
6. Put the following line of text into the Web page after the last tag, and make it emphasized (using tags):

   I am also part of the HTML document, after the script results!

7. Add a tag to complete the paragraph.
8. Here is what your HTML document should look like:

```
<!DOCTYPE html>
<html>
<head>
<title>JavaScript Project 2-1</title>
</head>
<body>
<p>I am part of the HTML document!</p>
<p>
<script type="text/javascript">
  document.write("This came from my script, and is now on the page!");
</script>
</p>
<p><em>I am also part of the HTML document, after the script results!</em></p>
</body>
</html>
```

9. Save the file as pr2_1.html and view the page in your browser to see the results.

(continued)

Try This Summary

In this project, you created an HTML file. Using the knowledge that you acquired thus far in this chapter, you inserted within the HTML file a script that writes a specific line of text on the page. When the HTML page is opened in a Web browser, the result of the script is displayed between two lines of text.

Using External JavaScript Files

Now suppose that you want to use your "Hello World" script (the one you created earlier in this chapter) on more than one page, but you do not want to write it out on each page. You can do this by putting the script in an external script file and calling it with the src attribute of the script tag. For this method, you need to create a JavaScript text file to hold your script. You also need one or more HTML files into which you will place the script tags to call your external script file.

Creating a JavaScript File

For this example, you will create a JavaScript file that contains only one line. For practical applications, you would use this approach for lengthier scripts—the longer the script is, the more useful this technique becomes (especially if you are trying to validate your Web pages or you are separating your script code from your markup).

Open a new file in your text editor and insert only the JavaScript code (the document.write() statement) itself. The script tags are not needed in the external JavaScript file. The file should appear like this:

```
document.write("Yes! I am now a JavaScript coder!");
```

Save the file as jsfile1.js in your text editor. To do this, you may need to use the Save As option on the File menu and place quotation marks around your filename, as shown in Figure 2-2 (using Notepad with Windows).

Once the file has been saved, you can move on to the next step, which is to create the HTML files in which to use the script.

Creating the HTML Files

You will create two files in which to place your script. The technique should work for any number of HTML files, though, as long as you add the required script tags to each file.

For the first file, create your base HTML document and insert the script tags into the body section of the document, using the src attribute to point to the jsfile1.js file, and add some HTML text to the body of the page to identify it as the first HTML document:

```
<body>
<script type="text/javascript" src="jsfile1.js"></script>
<p>
  This is page 1, and the script works here!
</p>
</body>
```

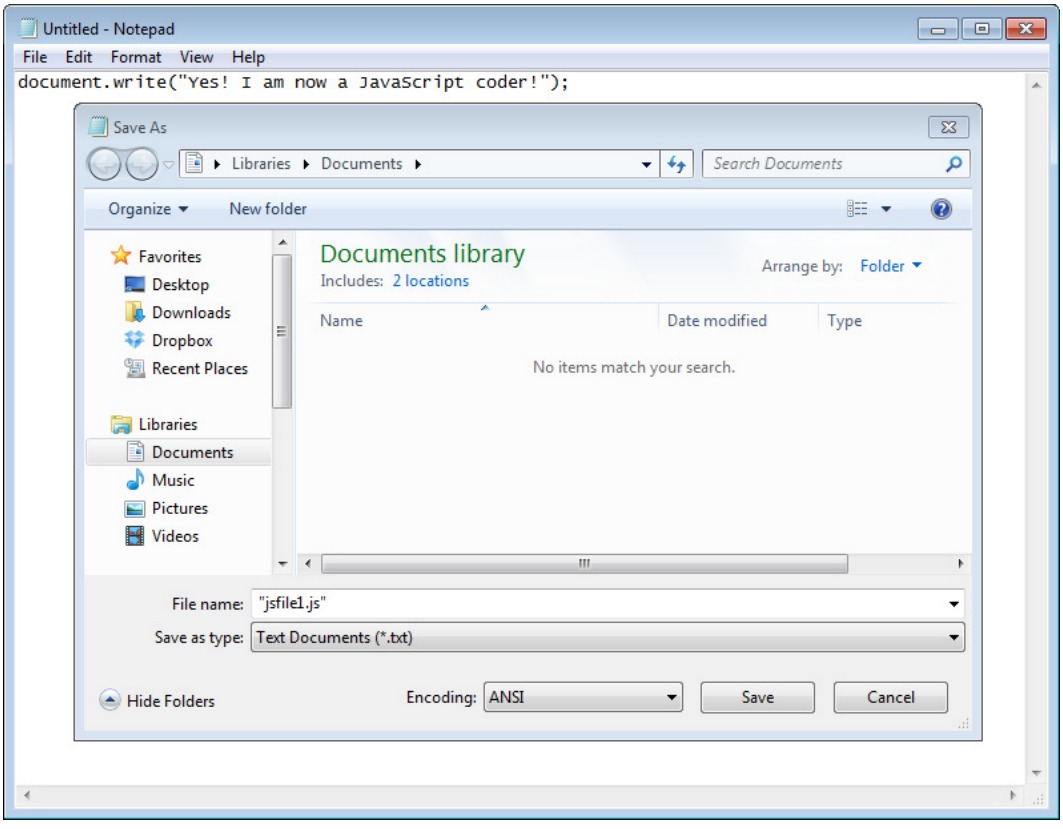

Figure 2-2 An example of saving a file with a .js extension using quote marks so it will save with the correct file extension

Save this file as jsext1.html in your text editor. Be sure to save it in the same directory as your jsfile1.js file.

The second HTML document looks the same as the first one, except that the HTML text says that it's page 2:

```
<body>
<script type="text/javascript" src="jsfile1.js"></script>
<p>
  This is page 2, and the script also works here!
</p>
</body>
```

Save this file as jsext2.html in your text editor. Again, be sure to place it in the same directory as the other files.

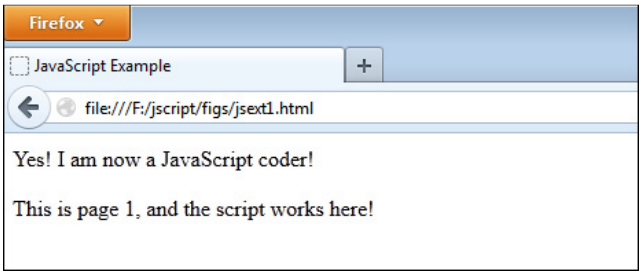

Figure 2-3 The result of calling the script in the jsext1.html file, the first HTML page

Viewing the Pages in Your Browser

Open the jsext1.html file in your Web browser. It should appear as shown in Figure 2-3, with the JavaScript inserted in the page from the external script file.

Next, open the jsext2.html file in your Web browser. It should appear as shown in Figure 2-4, with only the small difference of the text you added to the HTML file to say that this is page 2. The JavaScript should write the same text to this page as it did to the first HTML page.

Although we used a short script in this example, it should give you an idea of how using an external file could be a great time-saver when you have a large script.

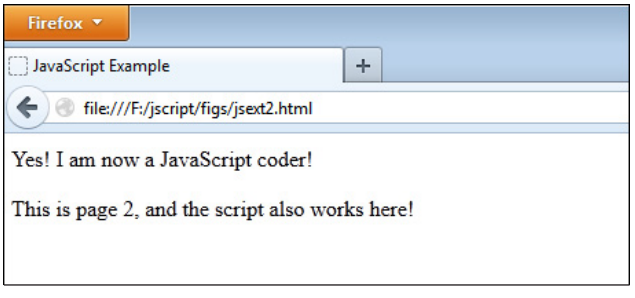

Figure 2-4 The result of calling the script in the jsext2.html file, the second HTML page

Try This 2-2 Call an External Script from an HTML Document

pr2_2.html
prjs2_2.js

This project will allow you to practice creating external JavaScript files and using them to insert a script into a Web page.

Step by Step

1. Set up a simple HTML document with nothing between the <body> and </body> tags.
2. Place the following line of text between the body tags of the page:

   This text is from the HTML document!
3. Place a tag after this text.
4. Save it as pr2_2.html.
5. Create an external JavaScript file that will write the following line when it is executed:

   I love writing JavaScript and using external files!
6. Here is how your JavaScript file should look:

```
document.write("I love writing JavaScript, and using external files!");
```

7. Save the JavaScript file as prjs2_2.js.
8. Go back to the HTML document. Place the script tags after the tag in the document so that the external JavaScript file will write its sentence on the page.
9. Insert a tag after the script tags.
10. The body of your HTML document should look like this:

```
<body>
This text is from the HTML document!
<p>
<script type="text/javascript" src="prjs2_2.js"></script>
</p>
</body>
```

11. Save the HTML file and view the results in your browser.

Try This Summary

In this project, you created an HTML page. Using your knowledge of external JavaScript files from the previous section, you created an external JavaScript file and placed the necessary code into the HTML file to include the external JavaScript file. When the HTML file is displayed in a Web browser, a line of plain text is shown, followed by the results of the external JavaScript file.

Using JavaScript Comments

You may need to make notes in your JavaScript code, such as to describe what a line of code is supposed to do. It's also possible that you will want to disable a line of the script for some reason. For instance, if you are looking for an error in a script, you may want to disable a line in the script to see if it is the line causing the error. You can accomplish these tasks by using JavaScript comments. You can insert comments that appear on one line or run for numerous lines.

Inserting Comments on One Line

If you want to add commentary on a single line in your code, place a pair of forward slashes before the text of the comment:

```
// Your comment here
```

In this format, anything preceding the two slashes on that line is "live" code—code that will be executed—and anything after the slashes on that line is ignored. For example, suppose that you wrote this line in your code:

```
document.write("This is cool!"); // writes out my opinion
```

The document.write() method will be run by the browser, so the text "This is cool!" will be written to the page. However, the comment after the slashes will be ignored by the browser.

If you place the forward slashes at the beginning of a line, the browser will ignore the entire line. Suppose that you move the slashes in the previous example to be the first items on the line:

```
// document.write("This is cool!"); writes out my opinion
```

In this format, the entire line is ignored, since it begins with the two slashes that represent a JavaScript comment. The text will not be written to the page, since the code will not be executed by the browser. In effect, you are disabling the document.write() statement. You may wish to do this if the script containing this line has an error and you want to know whether or not this line is causing the problem.

Adding Multiple-Line Comments

Comments denoted by a pair of forward slashes apply only to the line on which they appear; their effects are cut off at the end of the line. You can span multiple lines with this type of comment by adding the slashes to each line of code, as in this example:

```
// Deleted my commentary.
// document.write("This is cool!"); writes out my opinion
// End of commentary deletion.
```

To add comments that span any number of lines without placing slashes on every line, you can use a different comment format: a forward slash followed by an asterisk at the beginning of the

comment, then the text of the comment, and then an asterisk followed by a forward slash at the end of the comment. Here's an example:

```
/*
My script will write some text into my HTML document!
All of this text is ignored by the browser.
*/
document.write("You can see me!");
```

Using this format, you can begin the comment on one line and end it on another line.

Multiple-line comments can be handy when you want to insert lengthier descriptions or other text, but you need to be careful when you use them. Look at this example to see if you can find a problem with it:

```
<script type="text/javascript">
/*
This code won't work for some reason.
document.write("I want someone to see me!");
</script>
```

Did you notice that the closing JavaScript comment symbols are missing? When you use multiple-line comments, you need to be careful to close them. Otherwise, you might accidentally comment out code you need executed! In this example, the comment just keeps going on with no end in sight. To fix this, you need to close the JavaScript comments before the document.write() method is used:

```
<script type="text/javascript">
/*
The JavaScript code is now working! This text is hidden.
*/
document.write("Now everyone can see me!");
</script>
```

Note, however, that multiple-line comments cannot be placed inside other multiple-line comments, since the closing comment code for the inner comment will close the comment early. For example, consider this code:

```
/*
Comment out some code
document.write("I cannot be seen!");
/*
document.write("I also cannot be seen.");
*/
document.write("Oops! I can be seen!");
*/
```

Outside comment started

This code won't be executed

Inside comment started (isn't recognized as a new comment, since it is already commented out)

This code also won't be executed

This ends the entire comment!

This code will execute!

As you can see, the first instance of the ending */ causes the entire comment to end, and the code afterward could be executed.

In the preceding examples, you saw how comments can be used to provide some documentation of what to expect from each script. In Chapter 16, you will learn how using comments can help you debug your JavaScript code. For now, you should get in the habit of adding comments to your scripts as short documentation or instructions.

Chapter 2 Self Test

1. What is the purpose of the <script> and </script> tags?
   - **A.** To tell the browser where a script begins and ends
   - **B.** To let the browser know when the script should be loaded
   - **C.** To point to an external JavaScript file
   - **D.** All of the above
2. Why would you use the type attribute in the opening script tag?
   - **A.** To let the browser know what type of coder you are
   - **B.** To ensure the Web page validates when using XHTML
   - **C.** To create a typing script
   - **D.** To make sure the script does not make a grammatical error
3. Is JavaScript code case sensitive?
   - **A.** Yes
   - **B.** No
4. The noscript tag provides _____ for those without _____.
5. An external JavaScript file commonly uses a filename extension of _____.
   - **A.** .js
   - **B.** .html
   - **C.** .jav
   - **D.** .java
6. Which of the following correctly points to an external JavaScript file named yourfile.js?
   - **A.** <extscript type="text/javascript" src="yourfile.js"></extscript>
   - **B.** <script type= "text/javascript" src="yourfile.js"></script>
   - **C.** <script language="yourfile.js"></script>
   - **D.** <script type="text/javascript" link="yourfile.js"></script>

7. In HTML, the script tag is not case sensitive. However, with XHTML, the script tag must be in _____.

8. The _____ signals the end of a JavaScript statement.

   A. colon

   B. period

   C. question mark

   D. semicolon

9. To write a string of text on a Web page, the _____ method can be used.

   A. document.write()

   B. document.print()

   C. document.type()

   D. window.print()

10. When would it be a good idea to use an external JavaScript file?

    A. When the script is short and going to be used in only one HTML document

    B. When your Web site viewers have older browsers

    C. When the script is very long or needs to be placed in more than one HTML document

    D. External files are not a good idea

11. JavaScript comments can be very useful for the purpose of _____ or _____ your code.

12. Which of the following indicates that a single line of commentary will follow it within JavaScript code?

    A. /*

    B. /-

    C. //

    D. <!--

13. Which of the following indicates that more than one line of commentary will follow it within JavaScript code?

    A. /*

    B. /-

    C. //

    D. <!--

14. Which of the following indicates the end of a multiple-line JavaScript comment?

A. \\

B. -->

C. /*

D. */

15. When you use multiple-line JavaScript comments, you need to be careful to _____ them.

A. close

B. read

C. program

D. compile

Chapter 3

Using Variables