SOLUTIONS MANUAL

Sixth Edition

Programming the **World Wide Web**

Robert W. Sebesta

Instructor's Resource Manual

to

Programming the World Wide Web

Sixth Edition

R.W. Sebesta

Preface

It is difficult to overestimate the effect the World Wide Web has had on the day-to-day lives of people, at least those in the developed countries. In just fifteen years, we have learned to use the Web for a myriad of disparate tasks, ranging from the mundane task of shopping for airline tickets to the crucial early--morning gathering of business news for a high-stakes day trader.

The speed at which millions of Web sites appeared in the last decade would seem to indicate that the technologies used to build them were sitting on the shelf, fully developed and ready to use, even before the Web was developed. Also, one might guess that the tens of thousands of people who built those sites were sitting around unemployed, waiting for an opportunity and already possessing the knowledge and abilities required to carry out this mammoth construction task when it appeared. Neither of these was true. The need for new technologies was quickly filled by a large number of entrepreneurs, some at existing companies and some who started new companies. A large part of the programmer need was filled, at least to the extent to which it was filled, by new programmers, some straight from high school. Many, however, were previously employed by other sectors of the software development industry. All of them had to learn to use new languages and technologies.

A visit to a bookstore, either a bricks-and-mortar store or a Web site, will turn up a large supply of books on Web technologies aimed at the practicing professional. One difficulty encountered by those teaching courses in Web programming technologies in colleges is the lack of textbooks that are targeted to their needs. Most of the books that discuss Web programming were written for professionals, rather than college students. Such books are written to fulfill the needs of professionals, which are quite different from those of college students. One major difference between an academic book and a professional book lies in the assumptions made by the author about the prior knowledge and experience of the audience. The backgrounds of professionals vary widely, making it difficult to assume much of anything. On the other hand, a book written for junior computer science majors can make some definite assumptions about the background of the reader.

This book is aimed at college students, not necessarily only computer science majors, but anyone who has taken at least two courses in programming. Although students are the primary target, the book is also useful for professional programmers who wish to learn Web programming.

The goal of this book is to provide the reader with a comprehensive introduction to the programming tools and skills required to build and maintain server sites on the Web. A wide variety of technologies are used in the construction of a Web site. There are now many books available for professionals that focus on these technologies. For example, there are dozens of books that specifically address only XHTML. The same is true for a half-dozen other Web technologies. This book provides an overview of how the Web works, as well as descriptions of many of the most widely used Web technologies.

The first five editions of this book were used to teach a junior-level Web programming course at the University of Colorado at Colorado Springs. The challenge for students in the course is to learn to use several different - programming languages and technologies in one semester. A heavy load of programming exercises is essential to the success of the course. Students in the course build a basic, static Web site using only XHTML as the first assignment. Throughout the remainder of the semester they add features to their site as the new technologies are discussed in the course. Our students' prior course work in Java, data structures, as well as C and assembly language, is helpful, as is the fact that many of them have learned some XHTML on their own before taking the course.

The most important prerequisite to the material of this book is a solid background in programming in some language that supports object-oriented programming. It is helpful to have some knowledge of a second programming

language and a bit of UNIX, particularly if a UNIX-based Web server is used for the course. Familiarity with a second language makes learning the new languages easier.

Table of Contents

The book is organized into three parts, introduction (Chapter 1), client-side technologies (Chapters 2–8), and server-side technologies (Chapters 9–15).

Chapter 1 lays the groundwork for the rest of the book. A few fundamentals are introduced, including the history and nature of the Internet, the World Wide Web, browsers, servers, URLs, MIME types, and HTTP. Also included in Chapter 1 are brief overviews of the most important topics of the rest of the book.

Chapter 2 provides an introduction to XHTML, including images, links, lists, tables, and forms. Small examples are used to illustrate many of the XHTML elements that are discussed in this chapter.

The topic of Chapter 3 is Cascading Style Sheets, which provide the standard way of imposing style on the content specified in XHTML tags. Because of the size and complexity of the topic, the chapter does not cover all of the aspects of style sheets. The topics discussed are levels of style sheets, style specification formats, selector formats, property values, and color. Among the properties covered are those for fonts, lists, and margins. Small examples are used to illustrate the subjects that are discussed.

Chapter 4 introduces the core of JavaScript, a powerful language that could be used for a variety of different applications. Our interest, of course, is its use in Web programming. Although JavaScript has become a large and complex language, we use the student's knowledge of programming in other languages to leverage the discussion, thereby providing a useful introduction to the language in a manageably small number of pages. Topics covered are the object model of JavaScript, its control statements, objects, arrays, functions, constructors, and pattern matching.

Chapter 5 discusses some of the features of JavaScript that are related to XHTML documents. Included is the use of the basic and DOM 2 event and event-handling model, which can be used in conjunction with some of the elements of XHTML documents.

One of the interesting applications of JavaScript is building dynamic XHTML documents using the Document Object Model (DOM). Chapter 6 provides descriptions of a collection of some of the document changes that can be made using JavaScript and the DOM. Included are element positioning, moving elements, changing the visibility of elements, changing the color, style, and size of text, changing the content of tags, changing the stacking order of overlapped elements, slow movement of elements, and dragging and dropping elements.

Chapter 7 presents an introduction to XML, which provides the means to design topic-specific markup languages that can be shared among users with common interests. Included are the syntax and document structure used by XML, data type definitions, namespaces, XML schemas, and the display of XML documents with both Cascading Style Sheets and XML Transformations. Also included is an introduction to Web services and XML processors.

Chapter 8 introduces the Flash authoring environment, which is used to create a wide variety of visual and audio presentations, in particular those that include animation. A series of examples is used to illustrate the development processes, including drawing figures, creating text, using color, creating motion and shape animations, adding sound tracks to presentations, and designing components that allow the user to control the Flash movie.

Chapter 9 introduces PHP, a server-side scripting language that enjoys wide popularity, especially as a database access language for Web applications. The basics of the language are discussed, as well as the use of cookies and session tracking. The use of PHP as a Web database access language is covered in Chapter 13.

Chapter 10 introduces Ajax, the relatively recent technology that is used to build Web applications with extensive user interactions that are more efficient. In addition to a thorough introduction to the concept and implementation of Ajax interactions, the chapter includes discussions of return document forms, Ajax toolkits, and Ajax security. Serveral examples are used to illustrate approaches to using Ajax.

Java Web software is discussed in Chapter 11. The chapter introduces the mechanisms for building Java servlets and presents several examples of how servlets can be used to present interactive Web documents. The NetBeans framework is introduced and used throughout the chapter. Support for cookies in servlets is introduced and illustrated with an example. Then JSP is introduced through a series of examples, including the use of code-behind files. This is followed by a discussion of JavaBeans and JavaServer Faces, along with examples to illustrate their use.

Chapter 12 is an introduction to ASP.NET, though it begins with a brief introduction to the .NET Framework and C#. ASP.NET Web controls and some of the events they can raise and how those events can be handled are among the topics discussed in this chapter. ASP.NET AJAX is also discussed. Finally, constructing Web services with ASP.NET is introduced. Visual Studio is introduced and used to develop all ASP.NET examples.

Chapter 13 provides an introduction to database access through the Web. This chapter includes a brief discussion of the nature of relational databases, architectures for database access, the structured query language (SQL) and the free database system, MySQL. Then, three approaches to Web access to databases are discussed: using PHP, using Java JDBC, and using ASP.NET. All three are illustrated with complete examples. All of the program examples in the chapter use MySQL.

Chapter 14 introduces the Ruby programming language. Included are the scalar types and their operations, control statements, arrays, hashes, methods, classes, code blocks and iterators, and pattern matching. There is, of course, much more to Ruby, but the chapter includes sufficient material to allow the student to use Ruby for building simple programs and Rails applications.

Chapter 15 introduces the Rails framework, designed to make the construction of Web applications relatively quick and easy. Covered are simple document requests, both static and dynamic, applications that use databases, including the use of scaffolding, and Rails support for Ajax. Rails 2.0, which is not compatible with earlier versions of Rails, is used.

Appendix A introduces Java to those who have experience with C++ and object-oriented programming, but who do not know Java. Such students can learn enough of the language from this appendix to allow them to understand the Java applets, servlets, JSP, and JDBC that appear in this book.

Appendix B is a list of 140 named colors, along with their hex codings.

Appendix C discusses Java applets. First, the fundamentals of applet activities and the `paintComponent` method are introduced. Then, the `<object>` tag and applet parameters are discussed. Next, the appendix introduces the graphics that can be created by applets. Applets that can interact with the user through Swing widgets are then covered.

Support Materials

The supplements for the book are available at Addison-Wesley's Web site www.aw.com/cssupport. Support materials available to all readers of this book include

- A set of lecture notes in the form of PowerPoint files. The notes were developed to be the basis for class lectures on the book material.
- Code for example programs
- A Word document listing errors found in the book

Additional support material including solutions to selected exercises and figures from the book are available only to instructors adopting this textbook for classroom use. Please contact your school's Pearson Education representative for information on obtaining access to this material.

Software Availability

Most of the software systems described in this book are available free to students. These include browsers, which provide interpreters for JavaScript and parsers for XML. Also, PHP, Ruby, and Java language processors, as well as the Rails framework, Java class libraries to support servlets, and Java JDBC, are available and free. ASP.NET is supported by the .NET software available from Microsoft. The Visual Web Developer 2008, a noncommercial version of Visual Studio, is available free from Microsoft. This is The Flash development environment is available for 30 days free from Adobe.

Differences Between the Fifth Edition and the Sixth Edition

The Sixth Edition differs significantly from the Fifth. Chapter 8, which covers Flash, was extensively changed to reflect changes in the CS4 version of the Flash authoring environment.

Chapter 11, "Java Web Software," was revised to use version 6.7 of the NetBeans development system. Also, example programs in this chapter were modified to take into account contemporary Java coding practices.

Chapter 12, "Introduction to ASP.NET," was revised to use version 8 of Visual Studio. Also, the introduction to Visual Studio in the chapter was moved earlier in the chapter and is now used for most of the examples. Finally, the coverage of Web services using ASP.NET in the chapter was significantly increased.

A new section was added to Chapter 13, "Database Access through the Web". The section introduces and discusses database access from ASP.NET using ADO.NET and data controls.

Throughout the book, numerous small changes were made to improve the correctness and clarity of the material.

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Solutions to Selected Exercises

Chapter 2

Exercise 2.1

```
<?xml version = "1.0"  encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_1.html
     This is a solution to Exercise 2.1
     -->

<html xmlns = "http://www.w3.org/1999/xhtml">
<head>
<title> Exercise 2.1 </title>
</head>
<body>
<h2> Ruper B. Baggins </h2>
<p>
1321 Causeway Circle <br />
Middle, Earth <br />
rbaggins@miderth.net<br />
</p>
<hr />
<h3> Bush Watcher </h3>
<p>
<em> Forest Keepers, Limited </em> <br />
14 Cranberry Way <br />
Middle, Earth <br />
<strong> (no web site yet) </strong>
</p>
</body>
</html>
```

Exercise 2.3

```
<?xml version = "1.0"  encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_3.html
     This is a solution to Exercise 2.3
     -->

<html xmlns = "http://www.w3.org/1999/xhtml">
<head>
<title> Exercise 2.3 </title>
</head>
<body>
<h2> Ruper B. Baggins </h2>
<p>
```

```
1321 Causeway Circle <br />
Middle, Earth <br />
rbaggins@miderth.net<br /><br />
<a href = "e2_31.html"> Mr. Baggins' Background </a>
</p>
<hr />
<h3> Bush Watcher </h3>
<p>
<em> Forest Keepers, Limited </em> <br />
14 Cranberry Way <br />
Middle, Earth <br />
<strong> (no web site yet) </strong>
</p>
</body>
</html>


<?xml version = "1.0"  encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_31.html
     This is part of the solution to Exercise 2.3
     (The second document for the background info)
     -->
<html xmlns = "http://www.w3.org/1999/xhtml">
<head>
<title> Exercise 2.3 (background) </title>
</head>
<body>
<p>
Although we share the same family name, I am not in any way
related to the famous (or is it infamous) adventurer, Bilbo.
I have a lovely wife, Elvira, and two grown children, Max
and Miriam. Max has chosen to follow me in my profession,
which is described below. Miriam is a beekeeper for the town
bookkeeper, who keeps bees as a second job.
</p>
<p>
I am employed by Forest Keepers, Limited. My job, as I understand
it, is to keep an eye on the 4 acres of wild cranberries that
grow in the swamp at the edge of the village forest. I am required
to file a daily report, in triplicate, on the condition of the
cranberry bushes. To accomplish my task, I walk by and inspect
every cranberry bush in the swamp every workday. My employer provides
me with wading boots for my job. I pick up the boots at the office
every weekday morning and turn them back in, after a thorough
cleaning, after each workday.
</p>
</body>
</html>
```

Exercise 2.4

```
<?xml version = "1.0"  encoding = "utf-8"?>
```

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_4.html
     A solution to Exercise 2.4 - an unordered list
     -->
<html xmlns = "http://www.w3.org/1999/xhtml">
<head>
<title> Unordered List </title>
</head>
<body>
<h3> Grocery List </h3>
<ul>
    <li> milk - 2%, 2 gallons </li>
    <li> bread - butter top wheat </li>
    <li> cheddar cheese - sharp, 1 lb. </li>
    <li> soup - vegetable beef, 3 cans </li>
    <li> hamburger - 80% fat free, 2 lbs. </li>
    <li> orange juice - not from concentrate, 1/2 gallon </li>
    <li> eggs - large, 1 dozen </li>
</ul>
</body>
</html>
```

Exercise 2.8

```
<?xml version = "1.0"  encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_8.html
     A solution to Exercise 2.8 - a nested, ordered list
     -->
<html xmlns = "http://www.w3.org/1999/xhtml">
<head>
<title> An Ordered List </title>
</head>
<body>
<h3> My Uncles, Aunts, and Cousins </h3>
<ol>
   <li> Violet Vinelli (my mother) </li>
   <li> Frederick Vinelli
     <ol>
        <li> Mary Vinelli </li>
        <li> Betty Ann Boop </li>
        <li> Bob Vinelli </li>
        <li> Roger Vinelli </li>
     </ol>
   </li>
   <li> Maxine Robinson
     <ol>
        <li> John Robinson </li>
        <li> Patty Robinson </li>
        <li> Lucille Robinson </li>
     </ol>
```

```
      </li>
      <li> Thomas Vinelli
         <ol>
            <li> Albert Vinelli </li>
            <li> Alison MacKinsey </li>
            <li> Alton Vinelli </li>
         </ol>
      </li>
</ol>

<ol>
   <li> Albert Alphonso (my father) </li>
   <li> Herbert Alphonso
      <ol>
         <li> Louise Alphonso </li>
         <li> Pam Alphonso </li>
         <li> Fred Alphonso </li>
      </ol>
   </li>
   <li> Ann Marie Predicate
      <ol>
         <li> George Predicate </li>
         <li> Michael Predicate </li>
         <li> Darcie Predicate </li>
      </ol>
   </li>
   <li> Ferdinand Alphonso
      <ol>
         <li> Noah Alphonso </li>
         <li> Leah Alphonso </li>
         <li> Jo Alphonso </li>
      </ol>
   </li>
</ol>
</body>
</html>
```

Exercise 2.9

```
<?xml version = "1.0"  encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
   "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_9.html
     A solution to Exercise 2.9 - a simple table
     -->
<html xmlns = "http://www.w3.org/1999/xhtml">
<head>
<title> A simple table </title>
</head>
<body>
<table border = "border">
<caption> Trees </caption>
    <tr>
        <th> </th>
```

```
            <th> Pine </th>
            <th> Maple </th>
            <th> Oak </th>
            <th> Fir </th>
        </tr>
        <tr>
            <th> Average Height (feet) </th>
            <td> 55 </td>
            <td> 50 </td>
            <td> 50 </td>
            <td> 65 </td>
        </tr>
        <tr>
            <th> Average Width (inches) </th>
            <td> 18 </td>
            <td> 26 </td>
            <td> 24 </td>
            <td> 28 </td>
        </tr>
        <tr>
            <th> Typical Lifespan (years) </th>
            <td> 150 </td>
            <td> 230 </td>
            <td> 310 </td>
            <td> 135 </td>
        </tr>
        <tr>
            <th> Leaf Type </th>
            <td> Long needles </td>
            <td> Broadleaf </td>
            <td> Split leaf </td>
            <td> Short needles </td>
        </tr>
</table>
</body>
</html>
```

Exercise 2.10

```
<?xml version = "1.0"  encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- e2_10.html
     A solution to Exercise 2.10 - a simple table
     -->
<html xmlns = "http://www.w3.org/1999/xhtml">

<head>
<title> A simple table </title>
</head>
<body>
<table border = "border">
<caption> Tree Characteristics </caption>
    <tr>
```

```
            <td rowspan = "2" colspan = "2"> </td>
            <th colspan = "4"> Tree </th>
        </tr>
        <tr>
            <th> Pine </th>
            <th> Maple </th>
            <th> Oak </th>
            <th> Fir </th>
        </tr>
        <tr>
            <th rowspan = "4"> Characteristic </th>
            <th> Average Height (feet) </th>
            <td> 55 </td>
            <td> 50 </td>
            <td> 50 </td>
            <td> 65 </td>
        </tr>
        <tr>
            <th> Average Width (inches) </th>
            <td> 18 </td>
            <td> 26 </td>
            <td> 24 </td>
            <td> 28 </td>
        </tr>
        <tr>
            <th> Typical Lifespan (years) </th>
            <td> 150 </td>
            <td> 230 </td>
            <td> 310 </td>
            <td> 135 </td>
        </tr>
        <tr>
            <th> Leaf Type </th>
            <td> Long needles </td>
            <td> Broadleaf </td>
            <td> Split leaf </td>
            <td> Short needles </td>
        </tr>
    </table>
</body>
</html>
```

Chapter 3