

# 10

## Document Object Model (DOM): Objects and Collections

### OBJECTIVES

In this chapter you'll learn:

- To use JavaScript and the W3C Document Object Model to create dynamic web pages.
- The concepts of DOM nodes and DOM trees.
- To traverse, edit and modify elements in an XHTML document.
- To change CSS styles dynamically.
- To create JavaScript animations.

*Our children may learn about heroes of the past. Our task is to make ourselves architects of the future.*

—Jomo Mzee Kenyatta

*Though leaves are many, the root is one.*

—William Butler Yeats

*The thing that impresses me most about America is the way parents obey their children.*

—Duke of Windsor

*Most of us become parents long before we have stopped being children.*

—Mignon McLaughlin

*To write it, it took three months; to conceive it three minutes; to collect the data in it—all my life.*

—F. Scott Fitzgerald

*Sibling rivalry is inevitable. The only sure way to avoid it is to have one child.*

—Nancy Samalin

## Outline

- 10.1 Introduction
- 10.2 Modeling a Document: DOM Nodes and Trees
- 10.3 Traversing and Modifying a DOM Tree
- 10.4 DOM Collections
- 10.5 Dynamic Styles
- 10.6 Summary of the DOM Objects and Collections

## 10.1 Introduction

In this chapter we introduce the *Document Object Model (DOM)*. The DOM gives you access to all the elements on a web page. Inside the browser, the whole web page—paragraphs, forms, tables, etc.—is represented in an *object hierarchy*. Using JavaScript, you can create, modify and remove elements in the page dynamically.

Previously, both Internet Explorer and Netscape had different versions of Dynamic HTML, which provided similar functionality to the DOM. However, while they provided many of the same capabilities, these two models were incompatible with each other. In an effort to encourage cross-browser websites, the W3C created the standardized Document Object Model. Firefox, Internet Explorer 7, and many other major browsers implement *most* of the features of the W3C DOM.

This chapter begins by formally introducing the concept of DOM nodes and DOM trees. We then discuss properties and methods of DOM nodes and cover additional methods of the document object. We also discuss how to dynamically change style properties, which enables you to create many types of effects, such as user-defined background colors and animations. Then, we present a diagram of the extensive object hierarchy, with explanations of the various objects and properties, and we provide links to websites with further information on the topic.



### Software Engineering Observation 10.1

*With the DOM, XHTML elements can be treated as objects, and many attributes of XHTML elements can be treated as properties of those objects. Then, objects can be scripted (through their id attributes) with JavaScript to achieve dynamic effects.*

## 10.2 Modeling a Document: DOM Nodes and Trees

As we saw in previous chapters, the document's `getElementById` method is the simplest way to access a specific element in a page. In this section and the next, we discuss more thoroughly the objects returned by this method.

The `getElementById` method returns objects called *DOM nodes*. Every element in an XHTML page is modeled in the web browser by a DOM node. All the nodes in a document make up the page's *DOM tree*, which describes the relationships among elements. Nodes are related to each other through child-parent relationships. An XHTML element inside another element is said to be a *child* of the containing element. The containing element is known as the *parent*. A node may have multiple children, but only one parent. Nodes with the same parent node are referred to as *siblings*.

Some browsers have tools that allow you to see a visual representation of the DOM tree of a document. When installing Firefox, you can choose to install a tool called the *DOM Inspector*, which allows you to view the DOM tree of an XHTML document. To inspect a document, Firefox users can access the **DOM Inspector** from the **Tools** menu of Firefox. If the DOM inspector is not in the menu, run the Firefox installer and choose **Custom** in the **Setup Type** screen, making sure the **DOM Inspector** box is checked in the **Optional Components** window.

Microsoft provides a *Developer Toolbar* for Internet Explorer that allows you to inspect the DOM tree of a document. The toolbar can be downloaded from Microsoft at [go.microsoft.com/fwlink/?LinkId=92716](http://go.microsoft.com/fwlink/?LinkId=92716). Once the toolbar is installed, restart the browser, then click the » icon at the right of the toolbar and choose **IE Developer Toolbar** from the menu. Figure 10.1 shows an XHTML document and its DOM tree displayed in Firefox's DOM Inspector and in IE's Web Developer Toolbar.

The XHTML document contains a few simple elements. We explain the example based on the Firefox DOM Inspector—the IE Toolbar displays the document with only minor differences. A node can be expanded and collapsed using the + and - buttons next to the node's name. Figure 10.1(b) shows all the nodes in the document fully expanded. The document node (shown as **#document**) at the top of the tree is called the *root node*, because it has no parent. Below the document node, the **HTML** node is indented from the document node to signify that the **HTML** node is a child of the **#document** node. The **HTML** node represents the `html` element (lines 7–24).

The **HEAD** and **BODY** nodes are siblings, since they are both children of the **HTML** node. The **HEAD** contains two **#comment** nodes, representing lines 5–6. The **TITLE** node

```

1  <?xml version = "1.0" encoding = "utf-8"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 10.1: domtree.html -->
6  <!-- Demonstration of a document's DOM tree. -->
7  <html xmlns = "http://www.w3.org/1999/xhtml">
8    <head>
9      <title>DOM Tree Demonstration</title>
10   </head>
11   <body>
12     <h1>An XHTML Page</h1>
13     <p>This page contains some basic XHTML elements. We use the Firefox
14       DOM Inspector and the IE Developer Toolbar to view the DOM tree
15       of the document, which contains a DOM node for every element in
16       the document.</p>
17     <p>Here's a list:</p>
18     <ul>
19       <li>One</li>
20       <li>Two</li>
21       <li>Three</li>
22     </ul>
23   </body>
24 </html>

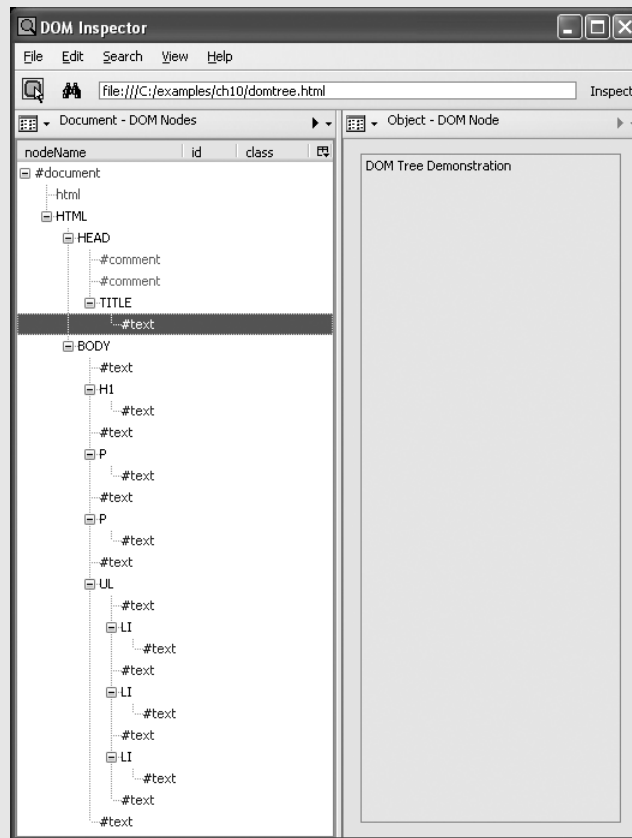
```

**Fig. 10.1** | Demonstration of a document's DOM tree. (Part 1 of 3.)

a) The XHTML document is rendered in Firefox.

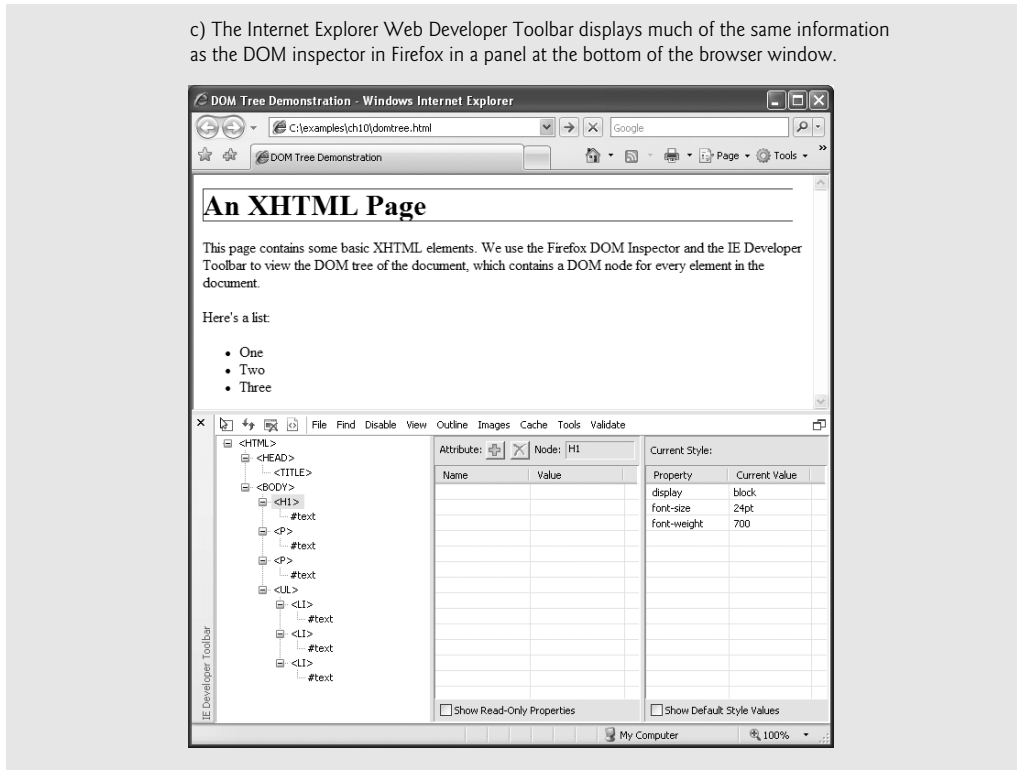


b) The Firefox DOM inspector displays the document tree in the left panel. The right panel shows information about the currently selected node.



**Fig. 10.1** | Demonstration of a document's DOM tree. (Part 2 of 3.)

c) The Internet Explorer Web Developer Toolbar displays much of the same information as the DOM inspector in Firefox in a panel at the bottom of the browser window.



**Fig. 10.1** | Demonstration of a document's DOM tree. (Part 3 of 3.)

has a child text node (**#text**) containing the text **DOM Tree Demonstration**, visible in the right pane of the DOM inspector when the text node is selected. The **BODY** node contains nodes representing each of the elements in the page. Note that the **LI** nodes are children of the **UL** node, since they are nested inside it.

Also, notice that, in addition to the text nodes representing the text inside the body, paragraphs and list elements, a number of other text nodes appear in the document. These text nodes contain nothing but white space. When Firefox parses an XHTML document into a DOM tree, the white space between sibling elements is interpreted as text and placed inside text nodes. Internet Explorer ignores white space and does not convert it into empty text nodes. If you run this example on your own computer, you will notice that the **BODY** node has a **#comment** child node not present above in both the Firefox and Internet Explorer DOM trees. This is a result of the copyright line at the end of the example file that you downloaded.

This section introduced the concept of DOM nodes and DOM trees. The next section considers DOM nodes in more detail, discussing methods and properties of DOM nodes that allow you to modify the DOM tree of a document using JavaScript.

### 10.3 Traversing and Modifying a DOM Tree

The DOM gives you access to the elements of a document, allowing you to modify the contents of a page dynamically using event-driven JavaScript. This section introduces

properties and methods of all DOM nodes that enable you to traverse the DOM tree, modify nodes and create or delete content dynamically.

Figure 10.2 shows some of the functionality of DOM nodes, as well as two additional methods of the document object. The program allows you to highlight, modify, insert and remove elements.

Lines 117–132 contain basic XHTML elements and content. Each element has an `id` attribute, which is also displayed at the beginning of the element in square brackets. For example, the `id` of the `h1` element in lines 117–118 is set to `bigheading`, and the heading text begins with `[bigheading]`. This allows the user to see the `id` of each element in the page. The body also contains an `h3` heading, several `p` elements, and an unordered list.

A `div` element (lines 133–162) contains the remainder of the XHTML body. Line 134 begins a form element, assigning the empty string to the required `action` attribute (because we're not submitting to a server) and returning `false` to the `onsubmit` attribute. When a form's `onsubmit` handler returns `false`, the navigation to the address specified in the `action` attribute is aborted. This allows us to modify the page using JavaScript event handlers without reloading the original, unmodified XHTML.

```

1  <?xml version = "1.0" encoding = "utf-8"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 10.2: dom.html -->
6  <!-- Basic DOM functionality. -->
7  <html xmlns = "http://www.w3.org/1999/xhtml">
8    <head>
9      <title>Basic DOM Functionality</title>
10     <style type = "text/css">
11       h1, h3      { text-align: center;
12                   font-family: tahoma, geneva, sans-serif }
13       p           { margin-left: 5%;
14                   margin-right: 5%;
15                   font-family: arial, helvetica, sans-serif }
16       ul          { margin-left: 10% }
17       a           { text-decoration: none }
18       a:hover     { text-decoration: underline }
19       .nav        { width: 100%;
20                   border-top: 3px dashed blue;
21                   padding-top: 10px }
22       .highlighted { background-color: yellow }
23       .submit     { width: 120px }
24     </style>
25     <script type = "text/javascript">
26       <!--
27       var currentNode; // stores the currently highlighted node
28       var idcount = 0; // used to assign a unique id to new elements
29
30       // get and highlight an element by its id attribute
31       function byId()
32       {

```

Fig. 10.2 | Basic DOM functionality. (Part I of 8.)

```

33     var id = document.getElementById( "gbi" ).value;
34     var target = document.getElementById( id );
35
36     if ( target )
37         switchTo( target );
38 } // end function byId
39
40 // insert a paragraph element before the current element
41 // using the insertBefore method
42 function insert()
43 {
44     var newNode = createNewNode(
45         document.getElementById( "ins" ).value );
46     currentNode.parentNode.insertBefore( newNode, currentNode );
47     switchTo( newNode );
48 } // end function insert
49
50 // append a paragraph node as the child of the current node
51 function appendNode()
52 {
53     var newNode = createNewNode(
54         document.getElementById( "append" ).value );
55     currentNode.appendChild( newNode );
56     switchTo( newNode );
57 } // end function appendNode
58
59 // replace the currently selected node with a paragraph node
60 function replaceCurrent()
61 {
62     var newNode = createNewNode(
63         document.getElementById( "replace" ).value );
64     currentNode.parentNode.replaceChild( newNode, currentNode );
65     switchTo( newNode );
66 } // end function replaceCurrent
67
68 // remove the current node
69 function remove()
70 {
71     if ( currentNode.parentNode == document.body )
72         alert( "Can't remove a top-level element." );
73     else
74     {
75         var oldNode = currentNode;
76         switchTo( oldNode.parentNode );
77         currentNode.removeChild( oldNode );
78     } // end else
79 } // end function remove
80
81 // get and highlight the parent of the current node
82 function parent()
83 {
84     var target = currentNode.parentNode;
85

```

Fig. 10.2 | Basic DOM functionality. (Part 2 of 8.)

```

86         if ( target != document.body )
87             switchTo( target );
88         else
89             alert( "No parent." );
90     } // end function parent
91
92     // helper function that returns a new paragraph node containing
93     // a unique id and the given text
94     function createNewNode( text )
95     {
96         var newNode = document.createElement( "p" );
97         nodeId = "new" + idcount;
98         ++idcount;
99         newNode.id = nodeId;
100        text = "[" + nodeId + " ] " + text;
101        newNode.appendChild( document.createTextNode( text ) );
102        return newNode;
103    } // end function createNewNode
104
105    // helper function that switches to a new currentNode
106    function switchTo( newNode )
107    {
108        currentNode.className = ""; // remove old highlighting
109        currentNode = newNode;
110        currentNode.className = "highlighted"; // highlight new node
111        document.getElementById( "gbi" ).value = currentNode.id;
112    } // end function switchTo
113    // -->
114    </script>
115    </head>
116    <body onload = "currentNode = document.getElementById( 'bigheading' )" >
117        <h1 id = "bigheading" class = "highlighted">
118            [bigheading] DHTML Object Model </h1>
119        <h3 id = "smallheading">[smallheading] Element Functionality </h3>
120        <p id = "para1">[para1] The Document Object Model (DOM) allows for
121            quick, dynamic access to all elements in an XHTML document for
122            manipulation with JavaScript. </p>
123        <p id = "para2">[para2] For more information, check out the
124            "JavaScript and the DOM" section of Deitel's
125            <a id = "link" href = "http://www.deitel.com/javascript">
126                [link] JavaScript Resource Center. </a> </p>
127        <p id = "para3">[para3] The buttons below demonstrate: (list) </p>
128        <ul id = "list">
129            <li id = "item1">[item1] getElementById and parentNode </li>
130            <li id = "item2">[item2] insertBefore and appendChild </li>
131            <li id = "item3">[item3] replaceChild and removeChild </li>
132        </ul>
133        <div id = "nav" class = "nav">
134            <form onsubmit = "return false" action = "">
135                <table>
136                    <tr>
137                        <td><input type = "text" id = "gbi"
138                            value = "bigheading" /></td>

```

Fig. 10.2 | Basic DOM functionality. (Part 3 of 8.)



```

139         <td><input type = "submit" value = "Get By id"
140             onclick = "byId()" class = "submit" /></td>
141     </tr><tr>
142         <td><input type = "text" id = "ins" /></td>
143         <td><input type = "submit" value = "Insert Before"
144             onclick = "insert()" class = "submit" /></td>
145     </tr><tr>
146         <td><input type = "text" id = "append" /></td>
147         <td><input type = "submit" value = "Append Child"
148             onclick = "appendNode()" class = "submit" /></td>
149     </tr><tr>
150         <td><input type = "text" id = "replace" /></td>
151         <td><input type = "submit" value = "Replace Current"
152             onclick = "replaceCurrent()" class = "submit" /></td>
153     </tr><tr><td />
154         <td><input type = "submit" value = "Remove Current"
155             onclick = "remove()" class = "submit" /></td>
156     </tr><tr><td />
157         <td><input type = "submit" value = "Get Parent"
158             onclick = "parent()" class = "submit" /></td>
159     </tr>
160 </table>
161 </form>
162 </div>
163 </body>
164 </html>

```

a) This is the page when it first loads. It begins with the large heading highlighted.

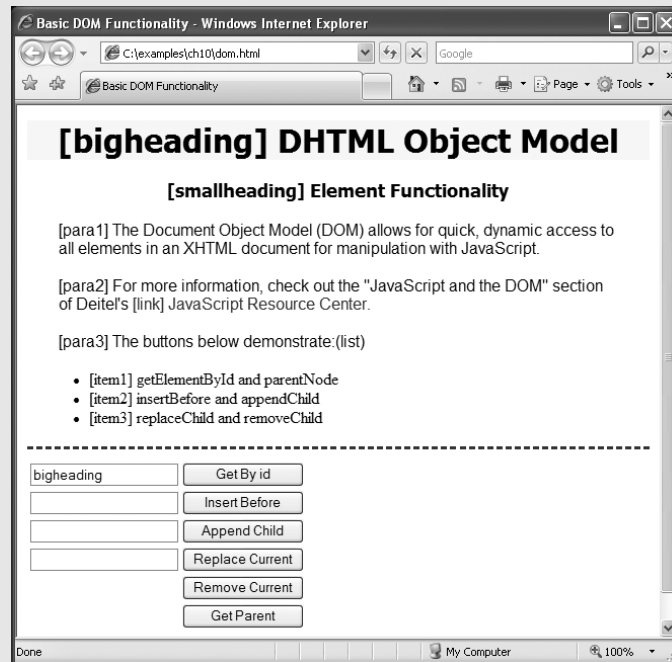
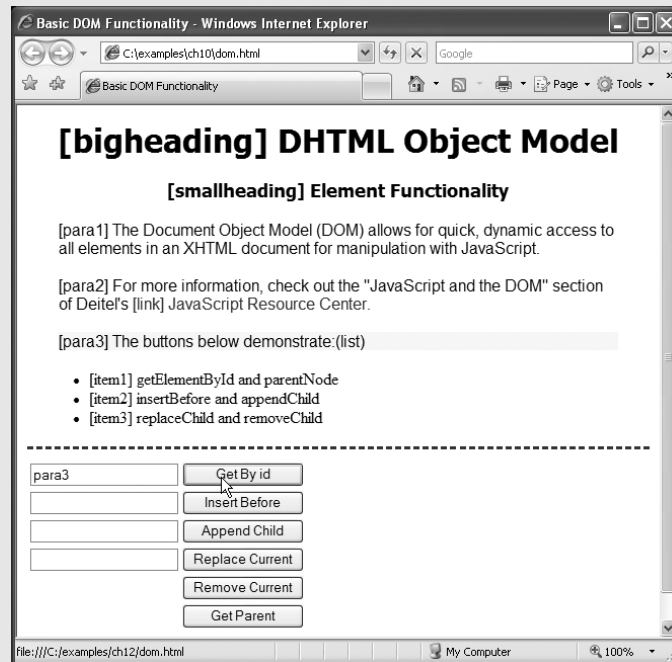
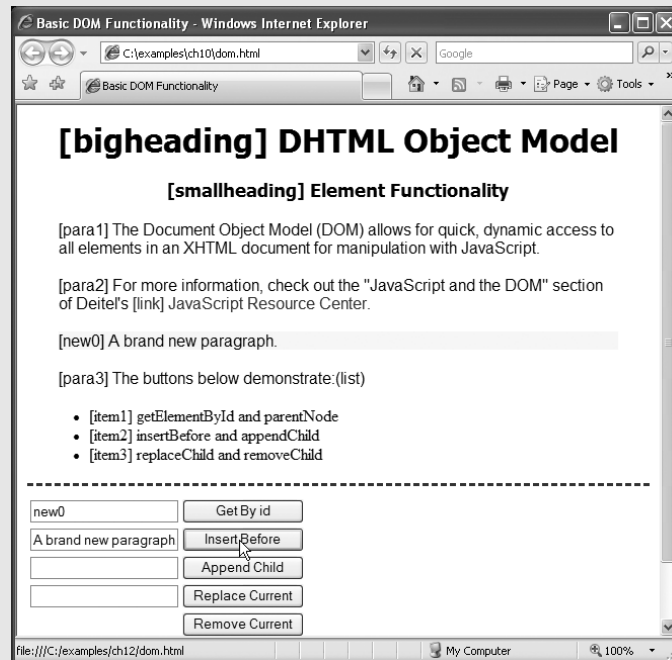


Fig. 10.2 | Basic DOM functionality. (Part 4 of 8.)

b) This is the document after using the **Get By id** button to select para3.

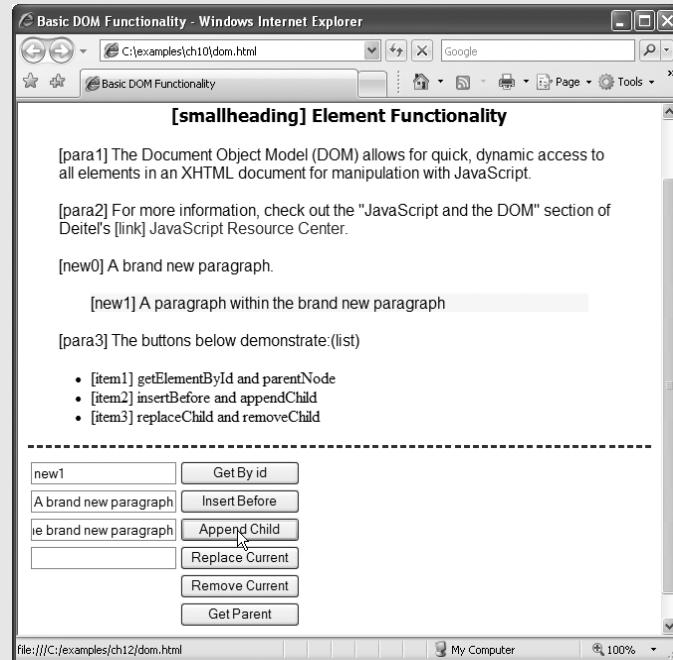


c) This is the document after inserting a new paragraph before the selected one.

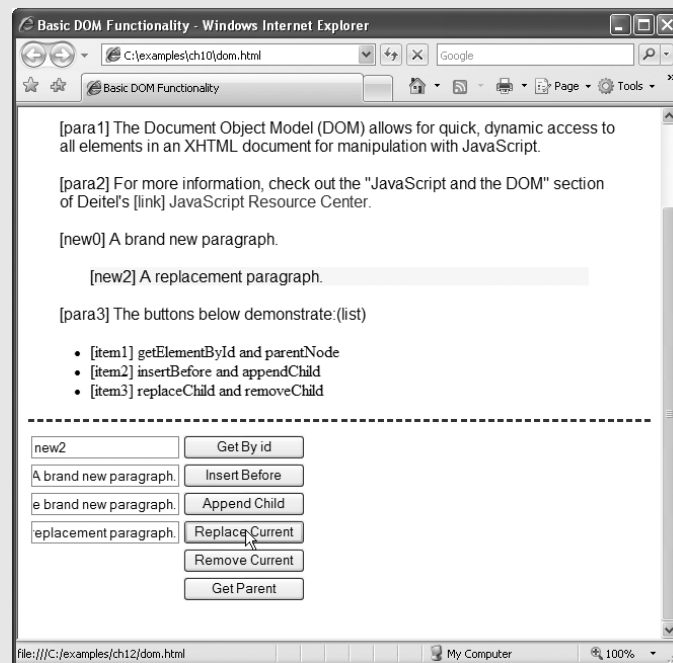


**Fig. 10.2** | Basic DOM functionality. (Part 5 of 8.)

d) Using the **Append Child** button, a child paragraph is created.

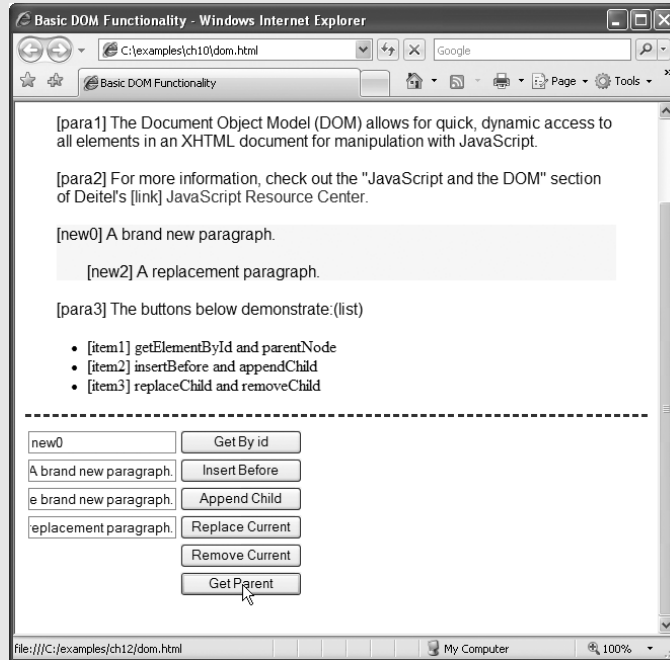


e) The selected paragraph is replaced with a new one.

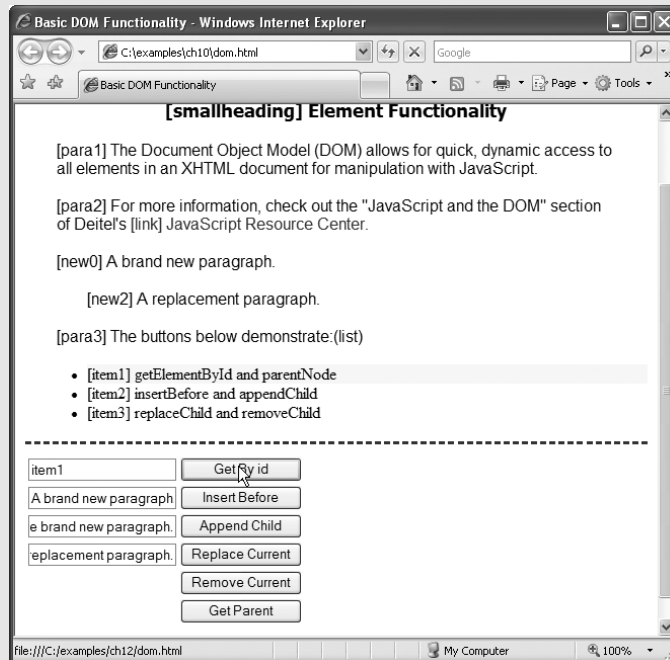


**Fig. 10.2** | Basic DOM functionality. (Part 6 of 8.)

f) The **Get Parent** button gets the parent of the selected node.

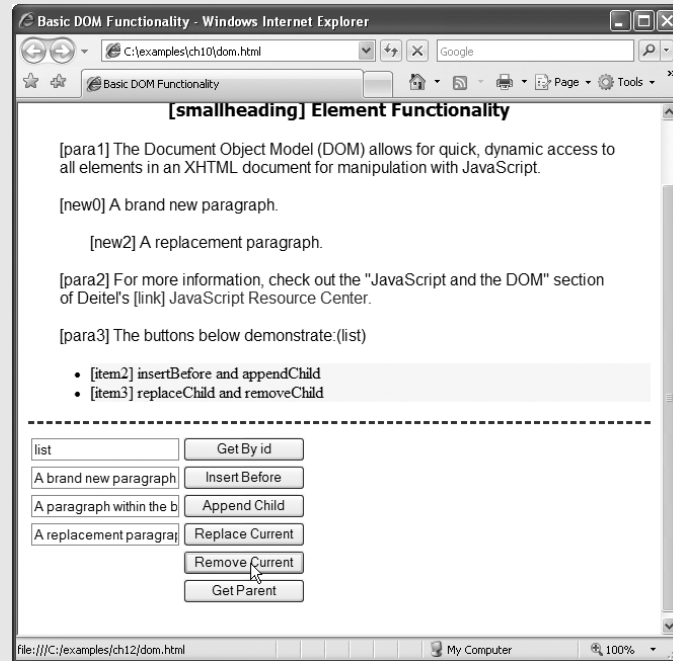


g) Now we select the first list item.



**Fig. 10.2** | Basic DOM functionality. (Part 7 of 8.)

h) The **Remove Current** button removes the current node and selects its parent.



**Fig. 10.2** | Basic DOM functionality. (Part 8 of 8.)

A table (lines 135–160) contains the controls for modifying and manipulating the elements on the page. Each of the six buttons calls its own event-handling function to perform the action described by its value.

The JavaScript code begins by declaring two variables. The variable `currentNode` (line 27) keeps track of the currently highlighted node, because the functionality of the buttons depends on which node is currently selected. The body's `onload` attribute (line 116) initializes `currentNode` to the `h1` element with `id` `bigheading`. Variable `idcount` (line 28) is used to assign a unique `id` to any new elements that are created. The remainder of the JavaScript code contains event handling functions for the XHTML buttons and two helper functions that are called by the event handlers. We now discuss each button and its corresponding event handler in detail.

### ***Finding and Highlighting an Element Using `getElementById` and `className`***

The first row of the table (lines 136–141) allows the user to enter the `id` of an element into the text field (lines 137–138) and click the `Get By Id` button (lines 139–140) to find and highlight the element, as shown in Fig. 10.2(b) and (g). The `onclick` attribute sets the button's event handler to function `byId`.

The `byId` function is defined in lines 31–38. Line 33 uses `getElementById` to assign the contents of the text field to variable `id`. Line 34 uses `getElementById` again to find the element whose `id` attribute matches the contents of variable `id`, and assign it to variable `target`. If an element is found with the given `id`, `getElementById` returns an object rep-

representing that element. If no element is found, `getElementById` returns `null`. Line 36 checks whether `target` is an object—recall that any object used as a boolean expression is `true`, while `null` is `false`. If `target` evaluates to `true`, line 37 calls the `switchTo` function with `target` as its argument.

The `switchTo` function, defined in lines 106–112, is used throughout the program to highlight a new element in the page. The current element is given a yellow background using the style class `highlighted`, defined in line 22. Line 108 sets the current node's `className` property to the empty string. The *className property* allows you to change an XHTML element's `class` attribute. In this case, we clear the `class` attribute in order to remove the `highlighted` class from the `currentNode` before we highlight the new one.

Line 109 assigns the `newNode` object (passed into the function as a parameter) to variable `currentNode`. Line 110 adds the `highlighted` style class to the new `currentNode` using the `className` property.

Finally, line 111 uses the *id property* to assign the current node's `id` to the input field's `value` property. Just as `className` allows access to an element's `class` attribute, the `id` property controls an element's `id` attribute. While this isn't necessary when `switchTo` is called by `byId`, we will see shortly that other functions call `switchTo`. This line makes sure that the text field's value is consistent with the currently selected node's `id`. Having found the new element, removed the highlighting from the old element, updated the `currentNode` variable and highlighted the new element, the program has finished selecting a new node by a user-entered `id`.

### ***Creating and Inserting Elements Using `insertBefore` and `appendChild`***

The next two table rows allow the user to create a new element and insert it before the current node or as a child of the current node. The second row (lines 141–145) allows the user to enter text into the text field and click the Insert Before button. The text is placed in a new paragraph element, which is then inserted into the document before the currently selected element, as in Fig. 10.2(c). The button in lines 143–144 calls the `insert` function, defined in lines 42–48.

Lines 44–45 call the function `createNewNode`, passing it the value of the input field (whose `id` is `ins`) as an argument. Function `createNewNode`, defined in lines 94–103, creates a paragraph node containing the text passed to it. Line 96 creates a `p` element using the document object's *createElement method*. The `createElement` method creates a new DOM node, taking the tag name as an argument. Note that while `createElement` *creates* an element, it does not *insert* the element on the page.

Line 97 creates a unique `id` for the new element by concatenating "new" and the value of `idcount` before incrementing `idcount` in line 98. Line 99 assigns the `id` to the new element. Line 100 concatenates the element's `id` in square brackets to the beginning of `text` (the parameter containing the paragraph's text).

Line 101 introduces two new methods. The document's *createTextNode method* creates a node that can contain only text. Given a string argument, `createTextNode` inserts the string into the text node. In line 101, we create a new text node containing the contents of variable `text`. This new node is then used (still in line 101) as the argument to the *appendChild method*, which is called on the paragraph node. Method `appendChild` is called on a parent node to insert a child node (passed as an argument) after any existing children.

After the `p` element is created, line 102 returns the node to the calling function `insert`, where it is assigned to variable `newNode` in lines 44–45. Line 46 inserts the newly created node before the currently selected node. The **parentNode property** of any DOM node contains the node’s parent. In line 46, we use the `parentNode` property of `currentNode` to get its parent.

We call the `insertBefore` method (line 46) on the parent with `newNode` and `currentNode` as its arguments to insert `newNode` as a child of the parent directly before `currentNode`. The general syntax of the **insertBefore method** is

```
parent.insertBefore( newChild, existingChild );
```

The method is called on a parent with the new child and an existing child as arguments. The node `newChild` is inserted as a child of `parent` directly before `existingChild`. Line 47 uses the `switchTo` function (discussed earlier in this section) to update the `currentNode` to the newly inserted node and highlight it in the XHTML page.

The third table row (lines 145–149) allows the user to append a new paragraph node as a child of the current element, demonstrated in Fig. 10.2(d). This feature uses a similar procedure to the `insertBefore` functionality. Lines 53–54 in function `appendNode` create a new node, line 55 inserts it as a child of the current node, and line 56 uses `switchTo` to update `currentNode` and highlight the new node.

### **Replacing and Removing Elements Using `replaceChild` and `removeChild`**

The next two table rows (lines 149–156) allow the user to replace the current element with a new `p` element or simply remove the current element. Lines 150–152 contain a text field and a button that replaces the currently highlighted element with a new paragraph node containing the text in the text field. This feature is demonstrated in Fig. 10.2(e).

The button in lines 151–152 calls function `replaceCurrent`, defined in lines 60–66. Lines 62–63 call `createNewNode`, in the same way as in `insert` and `appendNode`, getting the text from the correct input field. Line 64 gets the parent of `currentNode`, then calls the `replaceChild` method on the parent. The **replaceChild method** works as follows:

```
parent.replaceChild( newChild, oldChild );
```

The `parent`’s `replaceChild` method inserts `newChild` into its list of children in place of `oldChild`.

The Remove Current feature, shown in Fig. 10.2(h), removes the current element entirely and highlights the parent. No text field is required because a new element is not being created. The button in lines 154–155 calls the `remove` function, defined in lines 69–79. If the node’s parent is the body element, line 72 alerts an error—the program does not allow the entire body element to be selected. Otherwise, lines 75–77 remove the current element. Line 75 stores the old `currentNode` in variable `oldNode`. We do this to maintain a reference to the node to be removed after we’ve changed the value of `currentNode`. Line 76 calls `switchTo` to highlight the parent node.

Line 77 uses the **removeChild method** to remove the `oldNode` (a child of the new `currentNode`) from its place in the XHTML document. In general,

```
parent.removeChild( child );
```

looks in `parent`’s list of children for `child` and removes it.

The final button (lines 157–158) selects and highlights the parent element of the currently highlighted element by calling the `parent` function, defined in lines 82–90. Function `parent` simply gets the parent node (line 84), makes sure it is not the body element, (line 86) and calls `switchTo` to highlight it (line 87). Line 89 alerts an error if the parent node is the body element. This feature is shown in Fig. 10.2(f).

This section introduced the basics of DOM tree traversal and manipulation. Next, we introduce the concept of collections, which give you access to multiple elements in a page.

## 10.4 DOM Collections

Included in the Document Object Model is the notion of *collections*, which are groups of related objects on a page. DOM collections are accessed as properties of DOM objects such as the document object or a DOM node. The document object has properties containing the *images collection*, *links collection*, *forms collection* and *anchors collection*. These collections contain all the elements of the corresponding type on the page. Figure 10.3 gives an example that uses the `links` collection to extract all of the links on a page and display them together at the bottom of the page.

```

1  <?xml version = "1.0" encoding = "utf-8"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 10.3: collections.html -->
6  <!-- Using the links collection. -->
7  <html xmlns = "http://www.w3.org/1999/xhtml">
8    <head>
9      <title>Using Links Collection</title>
10     <style type = "text/css">
11       body      { font-family: arial, helvetica, sans-serif }
12       h1        { font-family: tahoma, geneva, sans-serif;
13                 text-align: center }
14       p         { margin: 5% }
15       p a       { color: #aa0000 }
16       .links    { font-size: 14px;
17                 text-align: justify;
18                 margin-left: 10%;
19                 margin-right: 10% }
20       .link a    { text-decoration: none }
21       .link a:hover { text-decoration: underline }
22     </style>
23     <script type = "text/javascript">
24       <!--
25       function processlinks()
26       {
27         var linkslst = document.links; // get the document's links
28         var contents = "Links in this page:\n<br />| ";
29
30         // concatenate each link to contents
31         for ( var i = 0; i < linkslst.length; i++ )
32         {

```

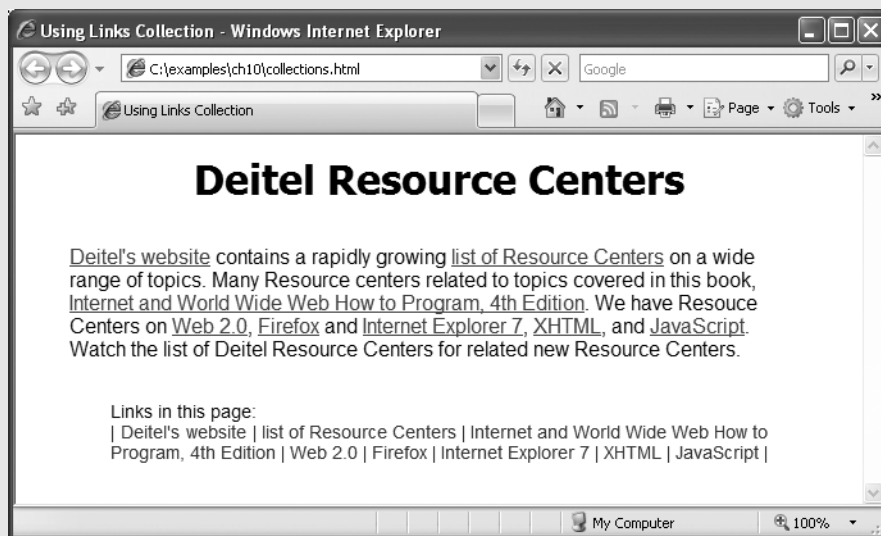
Fig. 10.3 | Using the `links` collection. (Part 1 of 2.)



```

33         var currentLink = linkslist[ i ];
34         contents += "<span class = 'link'" +
35             currentLink.innerHTML.link( currentLink.href ) +
36             "</span> | ";
37     } // end for
38
39     document.getElementById( "links" ).innerHTML = contents;
40 } // end function processlinks
41 // -->
42 </script>
43 </head>
44 <body onload = "processlinks()">
45     <h1>Deitel Resource Centers</h1>
46     <p><a href = "http://www.deitel.com/">Deitel's website</a> contains
47     a rapidly growing
48     <a href = "http://www.deitel.com/ResourceCenters.html">list of
49     Resource Centers</a> on a wide range of topics. Many Resource
50     centers related to topics covered in this book,
51     <a href = "http://www.deitel.com/iw3http4">Internet and World Wide
52     Web How to Program, 4th Edition</a>. We have Resource Centers on
53     <a href = "http://www.deitel.com/Web2.0">Web 2.0</a>,
54     <a href = "http://www.deitel.com/Firefox">Firefox</a> and
55     <a href = "http://www.deitel.com/IE7">Internet Explorer 7</a>,
56     <a href = "http://www.deitel.com/XHTML">XHTML</a>, and
57     <a href = "http://www.deitel.com/JavaScript">JavaScript</a>.
58     Watch the list of Deitel Resource Centers for related new
59     Resource Centers.</p>
60     <div id = "links" class = "links"></div>
61 </body>
62 </html>

```



**Fig. 10.3** | Using the 1inks collection. (Part 2 of 2.)

The XHTML body contains a paragraph (lines 46–59) with links at various places in the text and an empty div (line 60) with id `links`. The body's `onload` attribute specifies that the `processLinks` method is called when the body finishes loading.

Method `processLinks` declares variable `linksList` (line 27) to store the document's links collection, which is accessed as the `links` property of the document object. Line 28 creates the string (`contents`) that will contain all the document's links, to be inserted into the `links` div later. Line 31 begins a `for` statement to iterate through each link. To find the number of elements in the collection, we use the collection's ***length property***.

Line 33 inside the `for` statement creates a variable (`currentLink`) that stores the current link. Note that we can access the collection stored in `linksList` using indices in square brackets, just as we did with arrays. DOM collections are stored in objects which have only one property and two methods—the `length` property, the ***item method*** and the ***namedItem method***. The `item` method—an alternative to the square bracketed indices—can be used to access specific elements in a collection by taking an index as an argument. The `namedItem` method takes a name as a parameter and finds the element in the collection, if any, whose `id` attribute or `name` attribute matches it.

Lines 34–36 add a `span` element to the `contents` string containing the current link. Recall that the `link` method of a string object returns the string as a link to the URL passed to the method. Line 35 uses the `link` method to create an `a` (anchor) element containing the proper text and `href` attribute.

Notice that variable `currentLink` (a DOM node representing an `a` element) has a specialized ***href property*** to refer to the link's `href` attribute. Many types of XHTML elements are represented by special types of nodes that extend the functionality of a basic DOM node. Line 39 inserts the `contents` into the empty div with id `"links"` (line 60) in order to show all the links on the page in one location.

Collections allow easy access to all elements of a single type in a page. This is useful for gathering elements into one place and for applying changes across an entire page. For example, the `forms` collection could be used to disable all form inputs after a submit button has been pressed to avoid multiple submissions while the next page loads. The next section discusses how to dynamically modify CSS styles using JavaScript and DOM nodes.

## 10.5 Dynamic Styles

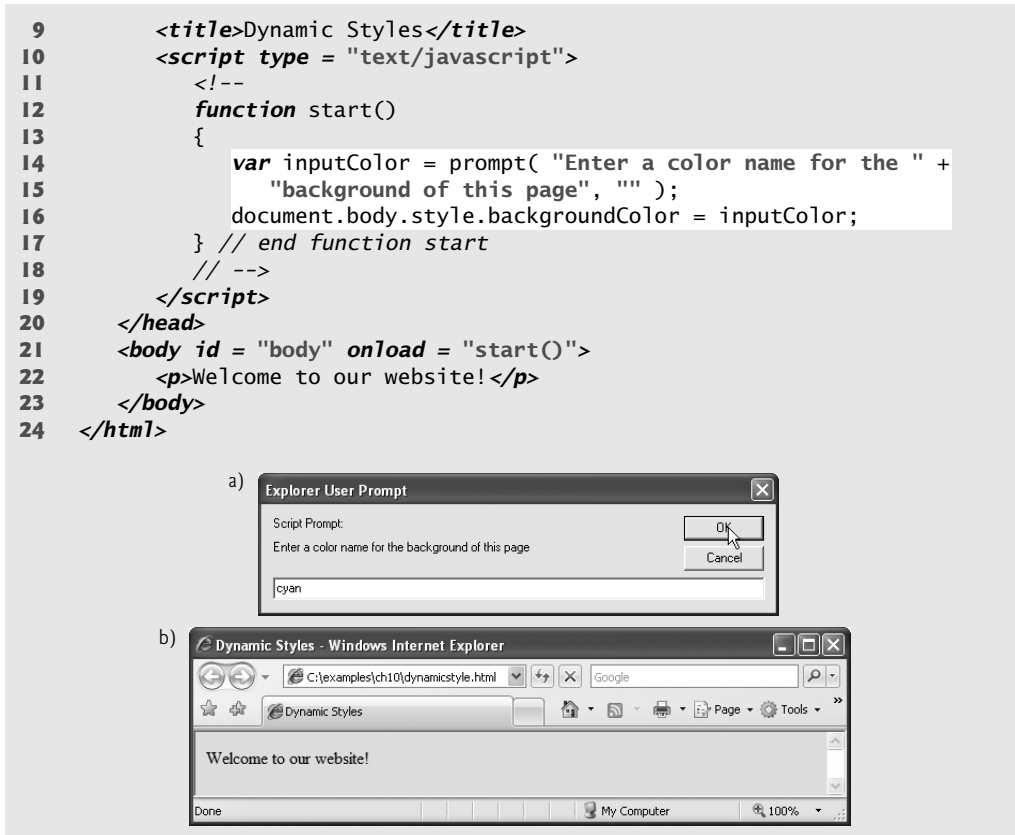
An element's style can be changed dynamically. Often such a change is made in response to user events, which we discuss in Chapter 11. Such style changes can create many effects, including mouse hover effects, interactive menus, and animations. Figure 10.4 is a simple example that changes the `background-color` style property in response to user input.

```

1  <?xml version = "1.0" encoding = "utf-8"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 10.4: dynamicstyle.html -->
6  <!-- Dynamic styles. -->
7  <html xmlns = "http://www.w3.org/1999/xhtml">
8    <head>

```

Fig. 10.4 | Dynamic styles. (Part I of 2.)



**Fig. 10.4** | Dynamic styles. (Part 2 of 2.)

Function `start` (lines 12–17) prompts the user to enter a color name, then sets the background color to that value. [Note: An error occurs if the value entered is not a valid color.] We refer to the background color as `document.body.style.backgroundColor`—the **body property** of the document object refers to the body element. We then use the `style` property (a property of most XHTML elements) to set the background-color CSS property. This is referred to as `backgroundColor` in JavaScript—the hyphen is removed to avoid confusion with the subtraction (`-`) operator. This naming convention is consistent for most CSS properties. For example, `borderWidth` correlates to the `border-width` CSS property, and `fontFamily` correlates to the `font-family` CSS property. In general, CSS properties are accessed in the format `node.style.styleproperty`.

Figure 10.5 introduces the `setInterval` and `clearInterval` methods of the window object, combining them with dynamic styles to create animated effects. This example is a basic image viewer that allows you to select a Deitel book cover and view it in a larger size. When one of the thumbnail images on the right is clicked, the larger version grows from the top-left corner of the main image area.

The body (lines 66–85) contains two `div` elements, both floated `left` using styles defined in lines 14 and 17 in order to present them side by side. The left `div` contains the full-size image `iw3htp4.jpg`, which appears when the page loads. The right `div` contains

six thumbnail images which respond to the click event by calling the `display` method and passing it the filename of the corresponding full-size image.

The `display` function (lines 46–62) dynamically updates the image in the left div to the one corresponding to the user's click. Lines 48–49 prevent the rest of the function from executing if `interval` is defined (i.e., an animation is in progress.) Line 51 gets the left div by its id, `imgCover`. Line 52 creates a new `img` element. Lines 53–55 set its id to `imgCover`, set its `src` to the correct image file in the `fullsize` directory, and set its required `alt` attribute. Lines 56–59 do some additional initialization before beginning the animation in line 61. To create the growing animation effect, lines 57–58 set the image width and height to 0. Line 59 replaces the current `bigImage` node with `newNode` (created in line 52), and line 60 sets `count`, the variable that controls the animation, to 0.

Line 61 introduces the window object's ***setInterval method***, which starts the animation. This method takes two parameters—a statement to execute repeatedly, and an integer specifying how often to execute it, in milliseconds. We use `setInterval` to call

```

1  <?xml version = "1.0" encoding = "utf-8"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 10.5: coverviewer.html -->
6  <!-- Dynamic styles used for animation. -->
7  <html xmlns = "http://www.w3.org/1999/xhtml">
8    <head>
9      <title>Deitel Book Cover Viewer</title>
10     <style type = "text/css">
11       .thumbs { width: 192px;
12                height: 370px;
13                padding: 5px;
14                float: left }
15     .mainimg { width: 289px;
16                padding: 5px;
17                float: left }
18     .imgCover { height: 373px }
19     img { border: 1px solid black }
20   </style>
21   <script type = "text/javascript">
22     <!--
23     var interval = null; // keeps track of the interval
24     var speed = 6; // determines the speed of the animation
25     var count = 0; // size of the image during the animation
26
27     // called repeatedly to animate the book cover
28     function run()
29     {
30       count += speed;
31
32       // stop the animation when the image is large enough
33       if ( count >= 375 )
34       {

```

**Fig. 10.5** | Dynamic styles used for animation. (Part I of 4.)

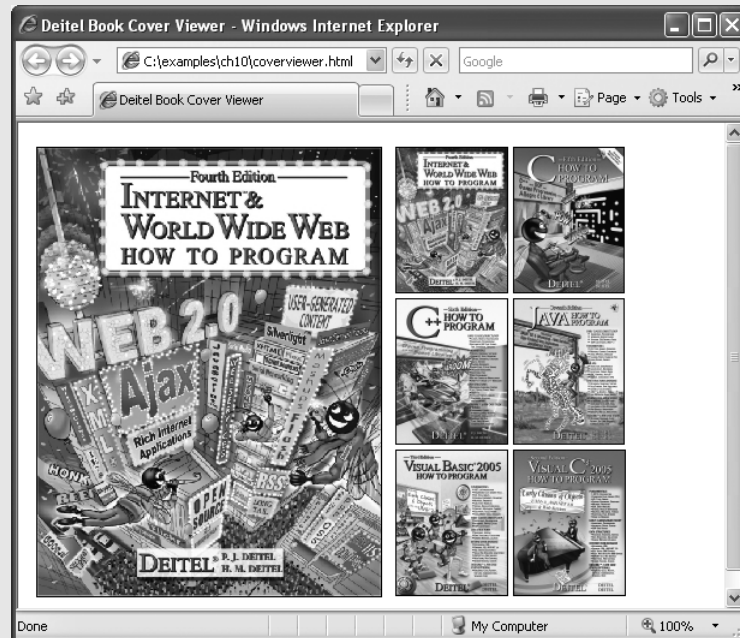
```

35         window.clearInterval( interval );
36         interval = null;
37     } // end if
38
39     var bigImage = document.getElementById( "imgCover" );
40     bigImage.style.width = .7656 * count + "px";
41     bigImage.style.height = count + "px";
42 } // end function run
43
44 // inserts the proper image into the main image area and
45 // begins the animation
46 function display( imgfile )
47 {
48     if ( interval )
49         return;
50
51     var bigImage = document.getElementById( "imgCover" );
52     var newNode = document.createElement( "img" );
53     newNode.id = "imgCover";
54     newNode.src = "fullsize/" + imgfile;
55     newNode.alt = "Large image";
56     newNode.className = "imgCover";
57     newNode.style.width = "0px";
58     newNode.style.height = "0px";
59     bigImage.parentNode.replaceChild( newNode, bigImage );
60     count = 0; // start the image at size 0
61     interval = window.setInterval( "run()", 10 ); // animate
62 } // end function display
63 // -->
64 </script>
65 </head>
66 <body>
67     <div id = "mainimg" class = "mainimg">
68         <img id = "imgCover" src = "fullsize/iw3htp4.jpg"
69             alt = "Full cover image" class = "imgCover" />
70     </div>
71     <div id = "thumbs" class = "thumbs" >
72         <img src = "thumbs/iw3htp4.jpg" alt = "iw3htp4"
73             onclick = "display( 'iw3htp4.jpg' )" />
74         <img src = "thumbs/chtp5.jpg" alt = "chtp5"
75             onclick = "display( 'chtp5.jpg' )" />
76         <img src = "thumbs/cpphtp6.jpg" alt = "cpphtp6"
77             onclick = "display( 'cpphtp6.jpg' )" />
78         <img src = "thumbs/jhtp7.jpg" alt = "jhtp7"
79             onclick = "display( 'jhtp7.jpg' )" />
80         <img src = "thumbs/vbhtp3.jpg" alt = "vbhtp3"
81             onclick = "display( 'vbhtp3.jpg' )" />
82         <img src = "thumbs/vcsharphtp2.jpg" alt = "vcsharphtp2"
83             onclick = "display( 'vcsharphtp2.jpg' )" />
84     </div>
85 </body>
86 </html>

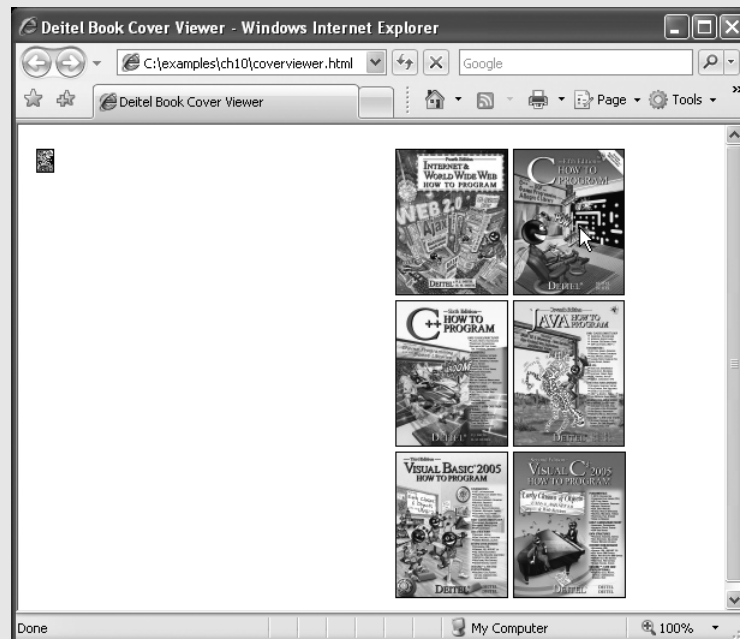
```

Fig. 10.5 | Dynamic styles used for animation. (Part 2 of 4.)

a) The cover viewer page loads with the cover of this book.

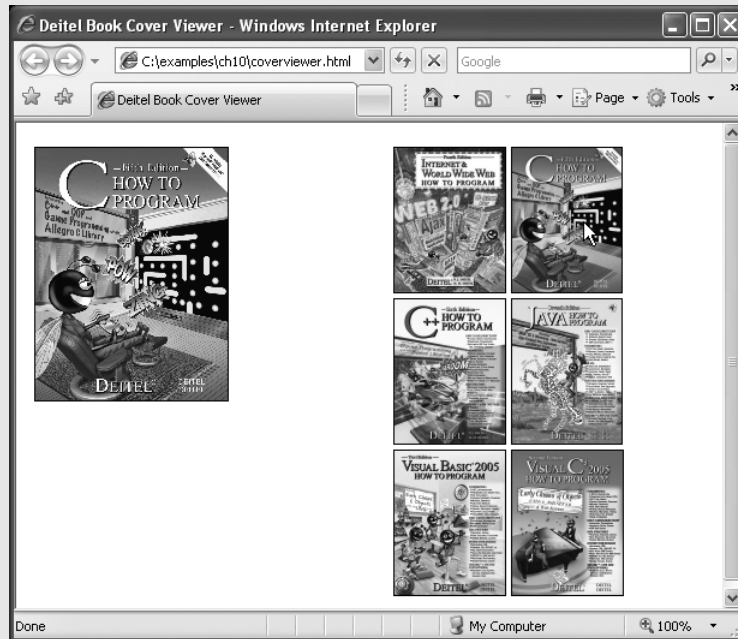


b) When the user clicks the thumbnail of *C How to Program*, the full-size image begins growing from the top-left corner of the window.



**Fig. 10.5** | Dynamic styles used for animation. (Part 3 of 4.)

c) The cover continues to grow.



d) The animation finishes when the cover reaches its full size.



**Fig. 10.5** | Dynamic styles used for animation. (Part 4 of 4.)

function run every 10 milliseconds. The `setInterval` method returns a unique identifier to keep track of that particular interval—we assign this identifier to the variable `interval`. We use this identifier to stop the animation when the image has finished growing.

The `run` function, defined in lines 28–42, increases the height of the image by the value of `speed` and updates its width accordingly to keep the aspect ratio consistent. Because the `run` function is called every 10 milliseconds, this increase happens repeatedly to create an animated growing effect. Line 30 adds the value of `speed` (declared and initialized to 6 in line 24) to `count`, which keeps track of the animation’s progress and dictates the current size of the image. If the image has grown to its full height (375), line 35 uses the window’s ***clearInterval*** method to stop the repetitive calls of the `run` method. We pass to `clearInterval` the interval identifier (stored in `interval`) that `setInterval` created in line 61. Although it seems unnecessary in this script, this identifier allows the script to keep track of multiple intervals running at the same time and to choose which interval to stop when calling `clearInterval`.

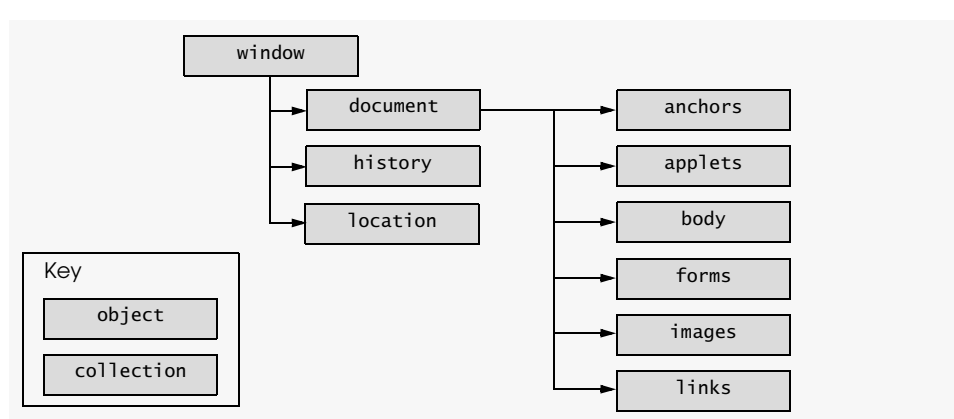
Line 39 gets the image and lines 40–41 set its width and height CSS properties. Note that line 40 multiplies `count` by a scaling factor of `.7656` in order to keep the ratio of the image’s dimensions consistent with the actual dimensions of the image. Run the code example and click on a thumbnail image to see the full animation effect.

This section demonstrated the concept of dynamically changing CSS styles using JavaScript and the DOM. We also discussed the basics of how to create scripted animations using `setInterval` and `clearInterval`.

## 10.6 Summary of the DOM Objects and Collections

As you’ve seen in the preceding sections, the objects and collections in the W3C DOM give you flexibility in manipulating the elements of a web page. We’ve shown how to access the objects in a page, how to access the objects in a collection, and how to change element styles dynamically.

The W3C DOM allows you to access every element in an XHTML document. Each element in a document is represented by a separate object. The diagram in Fig. 10.6 shows many of the important objects and collections provided by the W3C DOM. Figure 10.7 provides a brief description of each object and collection in Fig. 10.6.



**Fig. 10.6** | W3C Document Object Model.



Object or collection	Description
<i>Objects</i>	
window	Represents the browser window and provides access to the window's document object. Also contains history and location objects.
document	Represents the XHTML document rendered in a window. Provides access to every element in the document and allows dynamic modification of it. Contains collections for accessing all elements of a given type.
body	Provides access to the body element of an XHTML document.
history	Keeps track of the sites visited by the browser user. The object provides a script programmer with the ability to move forward and backward through the visited sites.
location	Contains the URL of the rendered document. When this object is set to a new URL, the browser immediately navigates to the new location.
<i>Collections</i>	
anchors	Collection contains all the anchor elements (a) that have a name or id attribute. The elements appear in the collection in the order in which they were defined in the XHTML document.
forms	Contains all the form elements in the XHTML document. The elements appear in the collection in the order in which they were defined in the XHTML document.
images	Contains all the img elements in the XHTML document. The elements appear in the collection in the order in which they were defined in the XHTML document.
links	Contains all the anchor elements (a) with an href property. The elements appear in the collection in the order in which they were defined in the XHTML document.

**Fig. 10.7** | Objects and collections in the W3C Document Object Model.

For a complete reference on the W3C Document Object Model, see the DOM Level 3 recommendation from the W3C at <http://www.w3.org/TR/DOM-Level-3-Core/>. The DOM Level 2 HTML Specification (the most recent HTML DOM standard), available at <http://www.w3.org/TR/DOM-Level-2-HTML/>, describes additional DOM functionality specific to HTML, such as objects for various types of XHTML elements. Keep in mind that not all web browsers implement all features included in the specification.