HTML5, CSS3, and JavaScript

6th Edition

Tutorial 9

Getting Started with JavaScript

Carey

Objectives

- Insert a script element
- Write JavaScript comments
- Display an alert dialog box
- Use browser debugging tools
- Reference browser and page objects
- Use JavaScript properties and methods

Objectives (continued)

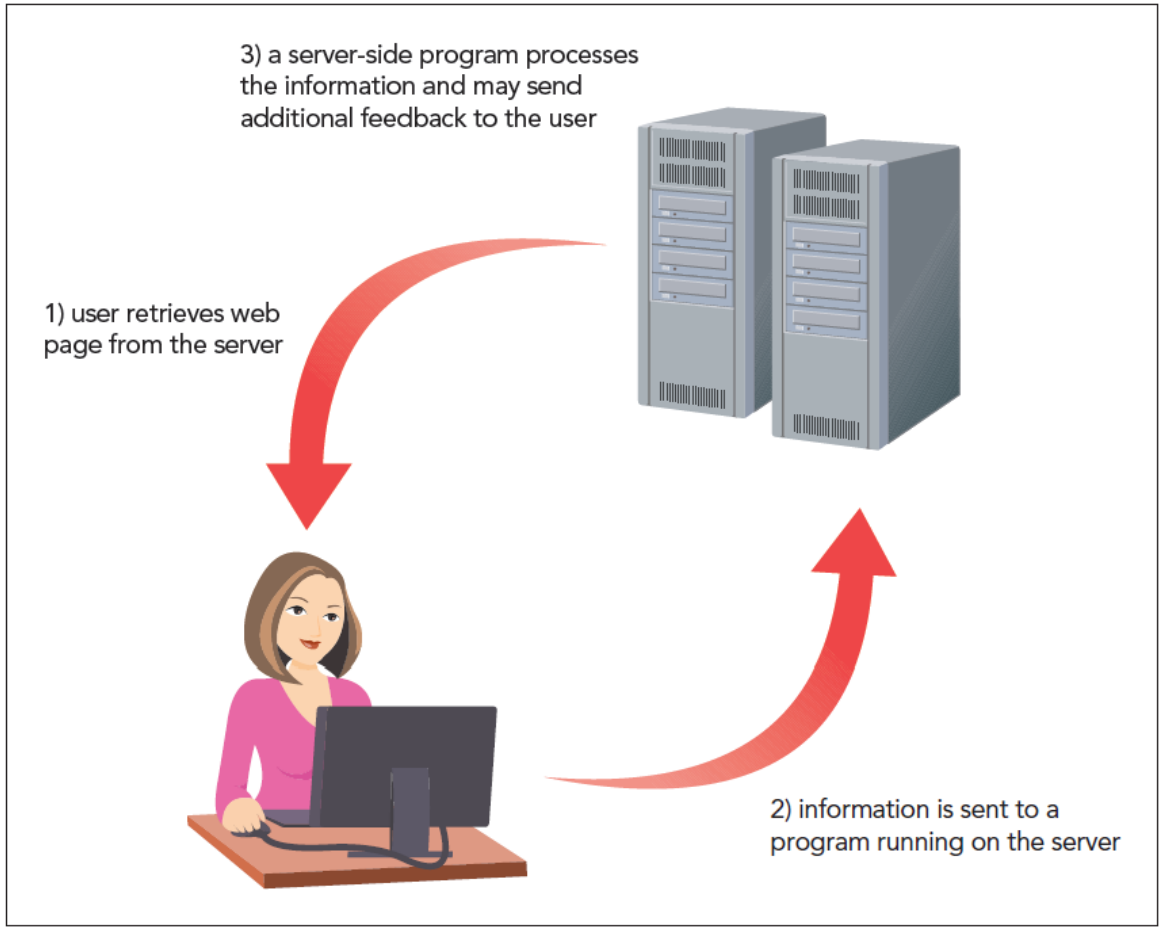
- Write HTML code and text content into a page
- Work with a Date object
- Use JavaScript operators
- Create a JavaScript function
- Create timed commands

Server-Side and Client-Side Programming

- **Server-side programming:** Program code runs from the server hosting the website
- Advantage
  - Connects a server to an online database containing information not directly accessible to end users
- Disadvantages
  - Use server resources and requires Internet access
  - Long delays in cases of system over-load

Server-Side and Client-Side Programming (continued 1)

Figure 9-1 Server-side programming



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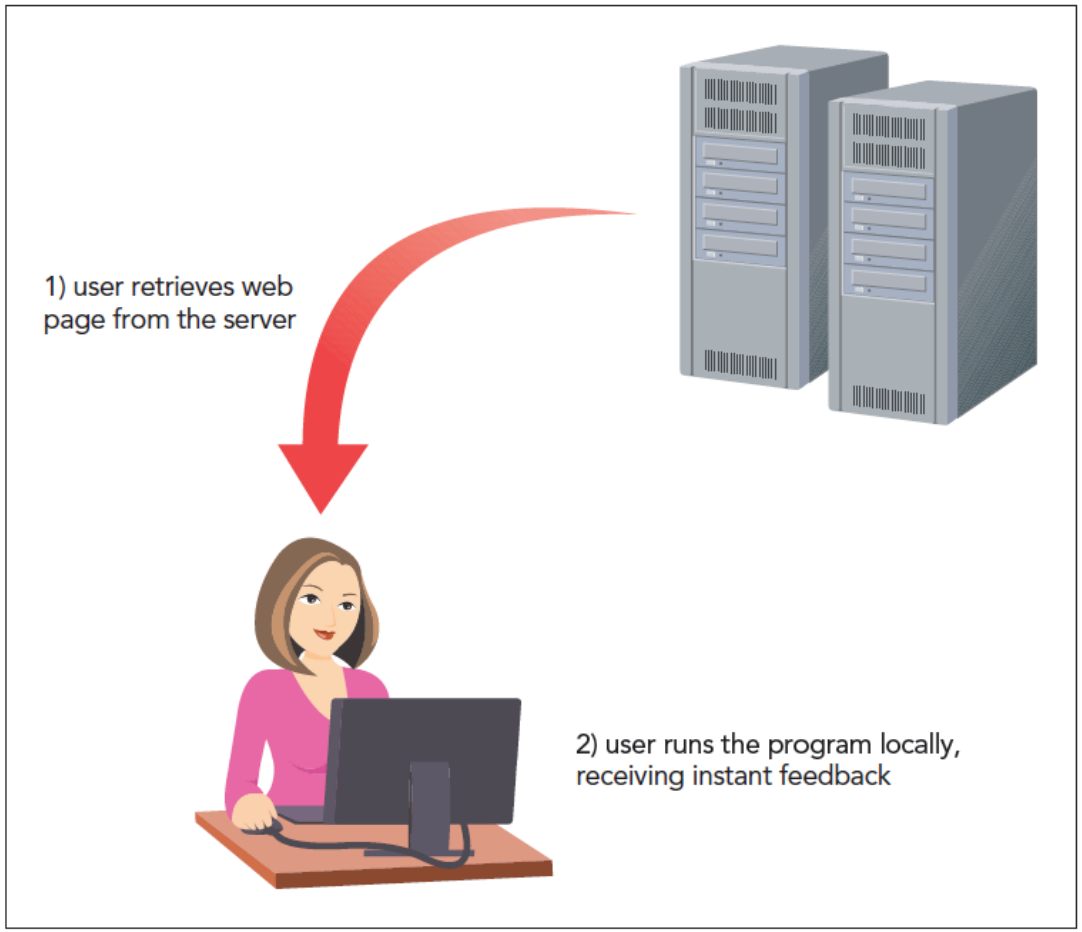
Server-Side and Client-Side Programming (continued 2)

- **Client-side programming:** Programs run on the user's computer using downloaded scripts with HTML and CSS files
- Distributes load to avoid overloading of program-related requests
- Client-side programs can never replace server-side programming

Server-Side and Client-Side Programming (continued 3)

Figure 9-2 Client-side programming



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The Development of JavaScript

- **JavaScript** is a programming language for client-side programs
- It is an **interpreted language** that executes a program code without using an application
- **Compiler** is an application that translates a program code into machine language
- JavaScript code can be directly inserted into or linked to an HTML file

Working with the `script` Element

- JavaScript code is attached to an HTML file using the `script` element

  ```
  <script src="url"></script>
  ```

  where *`url`* is the URL of the external file containing the JavaScript code

- An **embedded script** can be used instead of an external file by omitting the `src` attribute

  ```
  <script>
      code
  </script>
  ```

Loading the `script` Element

- `script` element can be placed anywhere within an HTML document
- When a browser encounters a script, it immediately stops loading the page and begins loading and then processing the script commands
- `async` and `defer` attributes can be added to `script` element to modify its sequence of processing

Loading the `script` Element (continued)

- `async` attribute tells a browser to parse the HTML and JavaScript code together
- `defer` attribute defers script processing until after the page has been completely parsed and loaded
- `async` and `defer` attributes are ignored for embedded scripts

Inserting the `script` Element

Figure 9-4 Inserting the script element

```
    <title>Tulsa's New Year's Bash</title>
    <link href="tny_reset.css" rel="stylesheet" />
    <link href="tny_styles.css" rel="stylesheet" />
    <script src="tny_script.js" defer></script>
</head>
```

source of the JavaScript file

defers loading the script file until after the rest of the page is loaded by the browser

Creating a JavaScript Program

- JavaScript programs are created using a standard text editor
- Adding Comments to your JavaScript Code
  - Comments help understand the design and purpose of programs
  - JavaScript comments can be entered on single or multiple lines

Creating a JavaScript Program (continued 1)

- Syntax of a single-line comment is as follows:

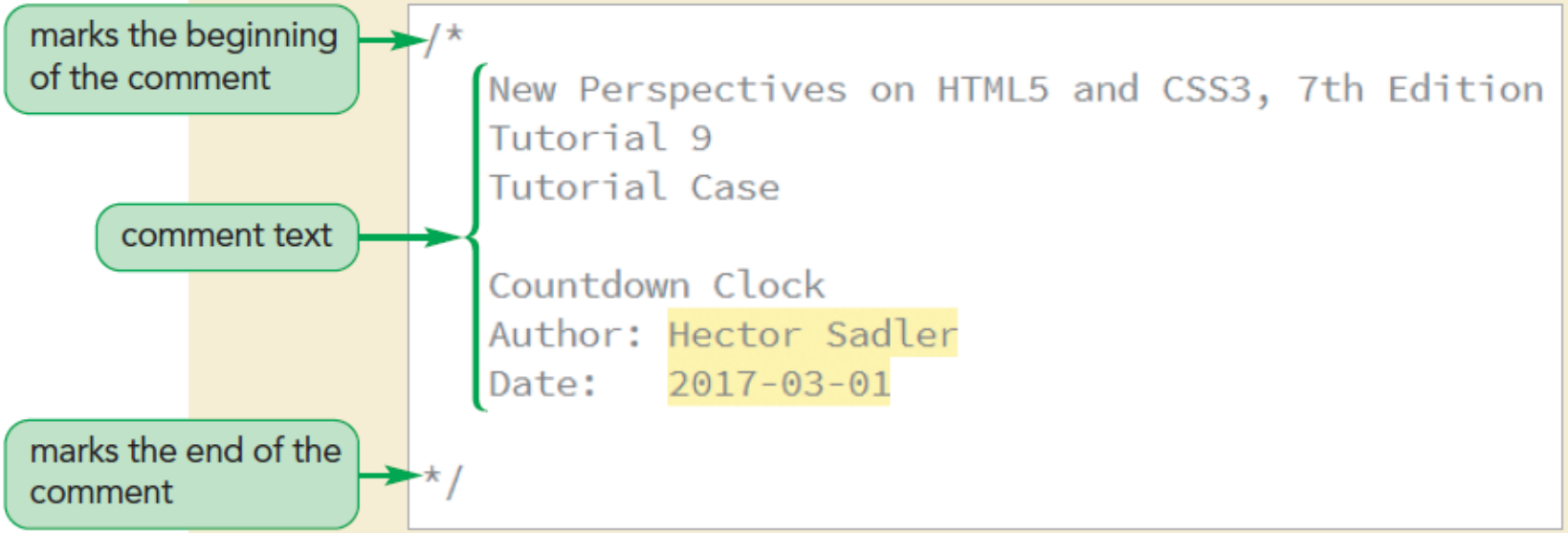
```
// comment text
```

- Syntax of multiple-line comments is as follows:

```
/*
      comment text spanning
      several lines
*/
```

Creating a JavaScript Program (continued 2)

Figure 9-6 Adding a JavaScript comment



Creating a JavaScript Program (continued 3)

- Writing a JavaScript Command
  - A command indicates an action for a browser to take
  - A command should end in a semicolon

```
JavaScript command;
```

Creating a JavaScript Program (continued 4)

Figure 9-7 Displaying a dialog box

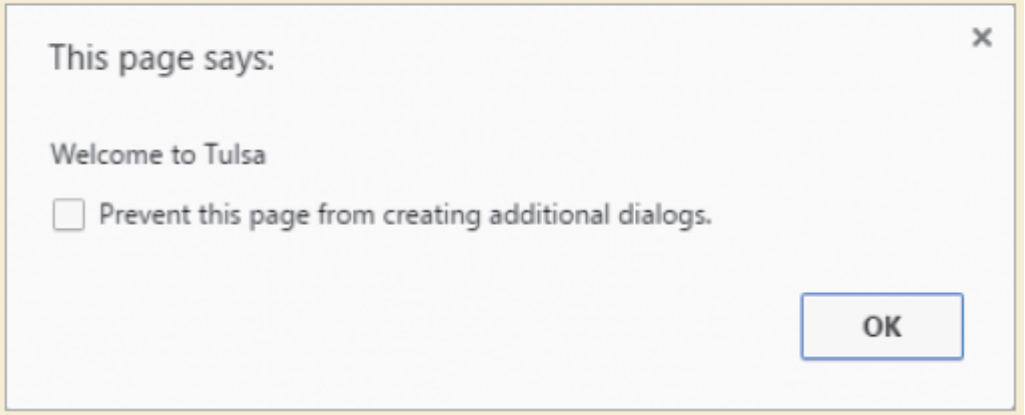
```
*/

window.alert("Welcome to Tulsa");
```

runs an alert dialog box in the browser window

text displayed in the dialog box

Figure 9-8 Google Chrome dialog box



Creating a JavaScript Program (continued 5)

- Understanding JavaScript Syntax
  - JavaScript is case sensitive
  - Extra white space between commands is ignored
  - Line breaks placed within the name of a JavaScript command or a quoted text string cause an error

Debugging your Code

- **Debugging:** Process of locating and fixing a programming error
- Types of errors
  - Load-time errors – occur when a script is first loaded by a browser
  - Run-time errors – occur during execution of a script without syntax errors
  - Logical errors – are free from syntax and executable mistakes but result in an incorrect output

Opening a Debugger

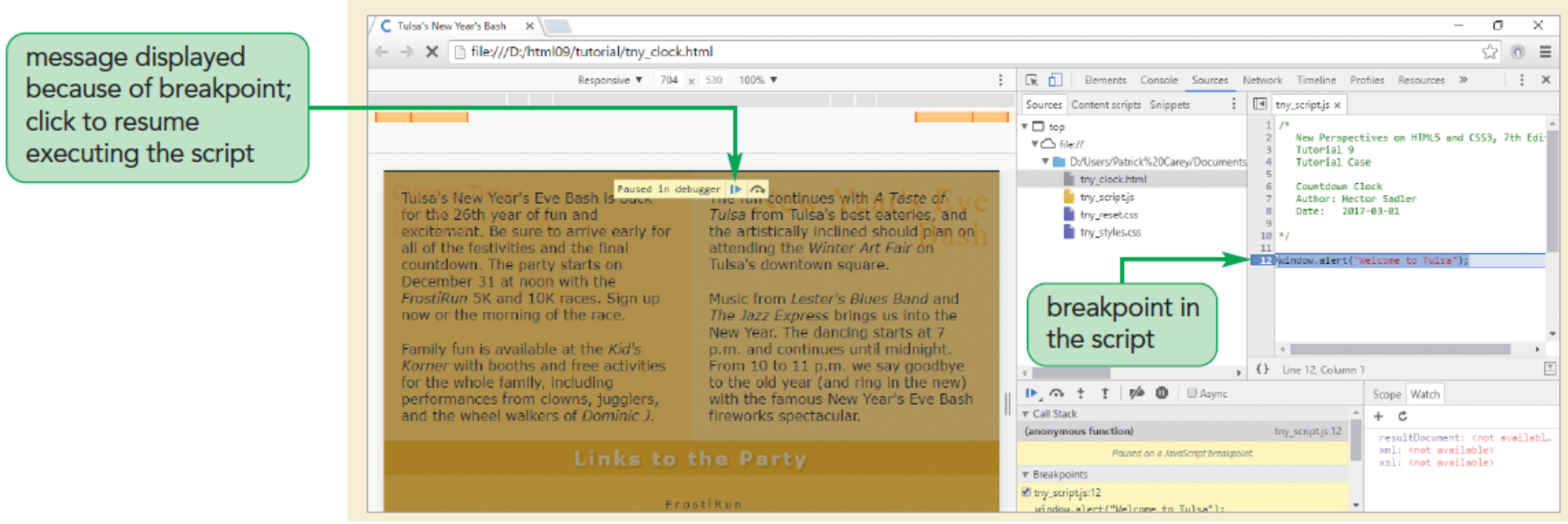
- Debugging tools locate and fix errors in JavaScript codes
- Shortcut to open a debugging tool is F12 key
- The tools can also be opened by selecting Developer Tools from the browser menu

Inserting a Breakpoint

- A useful technique to locate the source of an error is to set up **breakpoints**
- **Breakpoints** are locations where a browser pauses a program to determine whether an error has occurred at that point during execution

Inserting a Breakpoint (continued)

Figure 9-10 Setting a breakpoint in Google Chrome



Applying Strict Usage of JavaScript

- **Strict mode** enables all lapses in syntax to result in load-time or run-time errors
- To run a script in strict mode, add the following statement to the first line of the file:

```
"use strict";
```

Introducing Objects

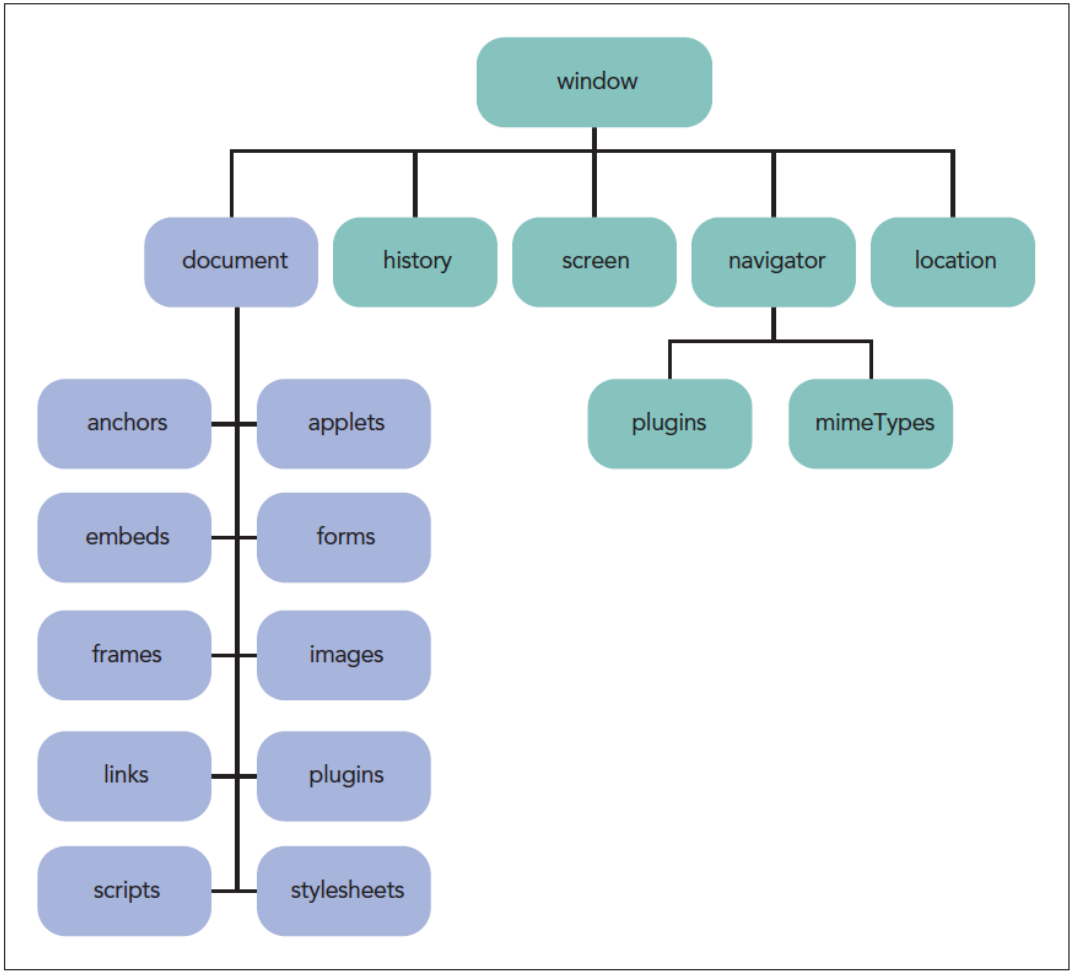
- **Object:** Entity within a browser or web page that has **properties** and **methods**
- **Properties:** Define objects
- **Methods:** Act upon objects
- JavaScript is an **object-based language** that manipulates an object by changing one or more of its properties

Introducing Objects (continued 1)

- Types of JavaScript objects
  - **Built-in objects** – intrinsic to JavaScript language
  - **Browser objects** – part of browser
  - **Document objects** – part of web document
  - **Customized objects** – created by a programmer to use in an application
- **Browser object model (BOM)** and **document object model (DOM)** organize browser and document objects in hierarchical structures, respectively

Introducing Objects (continued 2)

Figure 9-12 Object hierarchy



Object References

- Objects within the object hierarchy are referenced by their object names such as `window`, `document`, or `navigator`
- Objects can be referenced using the notation

  `object1.object2.object3`…

  where *`object1`* is at the top of the hierarchy, *`object2`* is a child of *`object1`*, and so on

Referencing Object Collections

- **Object collections:** Objects organized into groups
- To reference a specific member of an object collection, use

  collection[*idref*]

  or *collection.idref*

  where *collection* is a reference to the object collection and *idref* is either an index number or the value of `id` attribute

Referencing Object Collections (continued)

Figure 9-13 Document object collections

Object Collection	References
document.anchors	All elements marked with the <a> tag
document.applets	All `applet` elements
document.embeds	All `embed` elements
document.forms	All web forms
document.frames	All `frame` elements
document.images	All inline images
document.links	All hypertext links
document.plugins	All plug-ins supported by the browser
document.scripts	All `script` elements
document.styleSheets	All `stylesheet` elements

Referencing an Object by ID and Name

- An efficient approach to reference an element is to use its `id` attribute using the expression

  `document.getElementById(`*`id`*`)`

  where *`id`* is the value of `id` attribute

Changing Properties and Applying Methods

- Object Properties
  - Object property is accessed using

    object.property

    where *object* is a reference to an object and *property* is a property associated with that object
  - **Read-only properties** cannot be modified

Changing Properties and Applying Methods (continued)

- Applying a Method
  - Objects can be modified using methods
  - Methods are applied using the expression

    object.*method*(*values*)

    where *object* is a reference to an object, *method* is the name of the method applied to the object, and *values* is a comma-separated list of values associated with the method

Writing HTML Code

- HTML code stored within a page element is referenced using

  element.innerHTML

  where *element* is an object reference to an element within a web document

Writing HTML Code (continued 1)

- HTML code stored within a page element is referenced using

  element.innerHTML

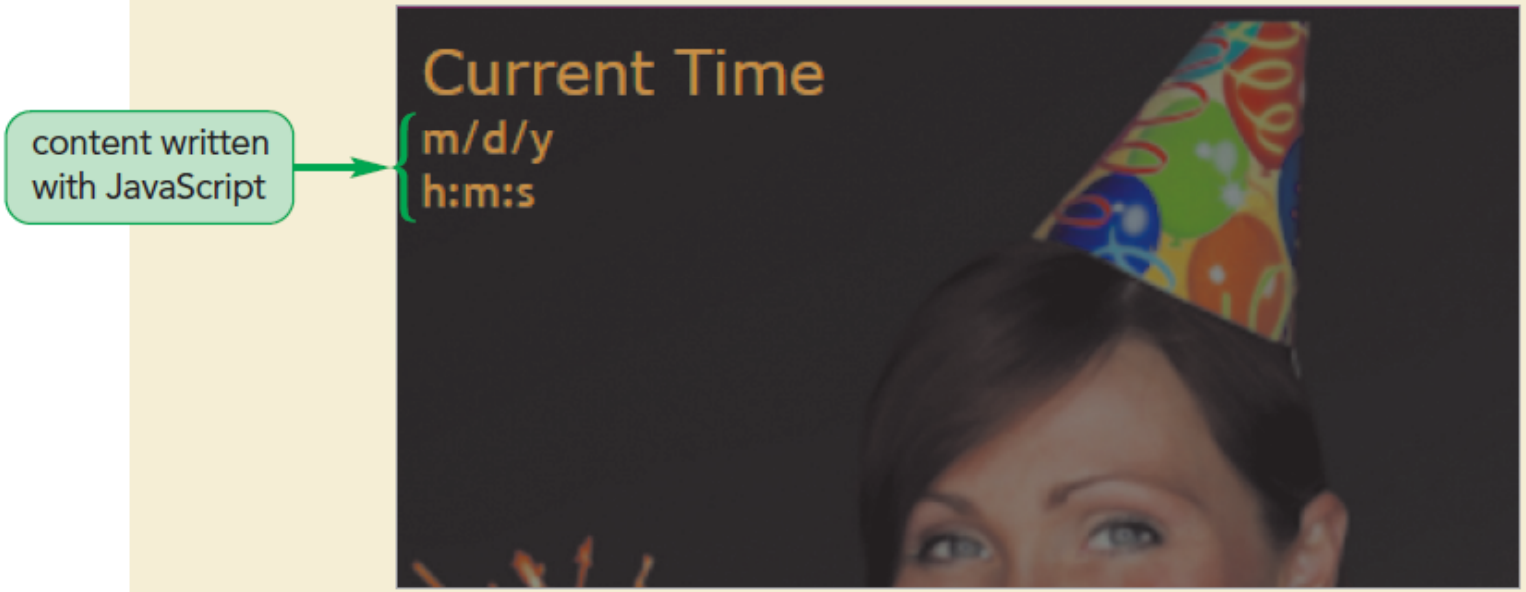
  where *element* is an object reference to an element within a web document

- For example,

```
/* Display the current date and time */
document.getElementById("dateNow").innerHTML = "m/d/y<br />h:m:s";
```

Writing HTML Code (continued 2)

Figure 9-15 Revised date and time content



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Writing HTML Code (continued 3)

Figure 9-16 Properties and methods to insert content

Property or Method	Description
element.innerHTML	Returns the HTML code within *element*
element.outerHTML	Returns the HTML code within *element* as well as the HTML code of *element* itself
element.textContent	Returns the text within *element* disregarding any HTML tags
element.insertAdjacentHTML (*position*, *text*)	Inserts HTML code defined by *text* into *element* at *position*, where *position* is one of the following: 'beforeBegin' (before the element's opening tag), 'afterBegin' (right after the element's opening tag), 'beforeEnd' (just before the element's closing tag), or 'afterEnd' (after the element's closing tag)

Working with Variables

- **Variable:** Named item in a program that stores a data value
- Declaring a Variable
  - Introduced into a script by **declaring** the variable using the `var` keyword

    ```
    var variable = value;
    ```

    where *`variable`* is the name assigned to the variable and *`value`* is the variable's initial value

Working with Variables (continued)

- Conditions to assign variable names in JavaScript
  - First character must be either a letter or an underscore character (_)
  - The characters after the first character can be letters, numbers, or underscore characters
  - No spaces
  - No using names that are part of JavaScript language

Variables and Data Types

- **Data type:** Type of information stored in a variable
- Supported data types
  - Numeric value
  - Text string
  - Boolean value
  - Object
  - null value

Variables and Data Types (continued)

- **Numeric value:** Any number
- **Text string:** Group of characters enclosed within either double or single quotation marks
- **Boolean value:** Indicates the truth or falsity of a statement

Variables and Data Types (continued 1)

- Object – Simplifies code by removing the need to rewrite complicated object references
- `null` value – Indicates that no value has yet been assigned to a variable

Working with Date Objects

- **Date object:** Built-in JavaScript object used to store information about dates and times

Figure 9-19 Creating a Date object

```
*/

/* Store the current date and time */
var currentDay = new Date("May 23, 2018 14:35:05");
```

declares the currentDay variable

creates a Date object

date and time stored in the Date object

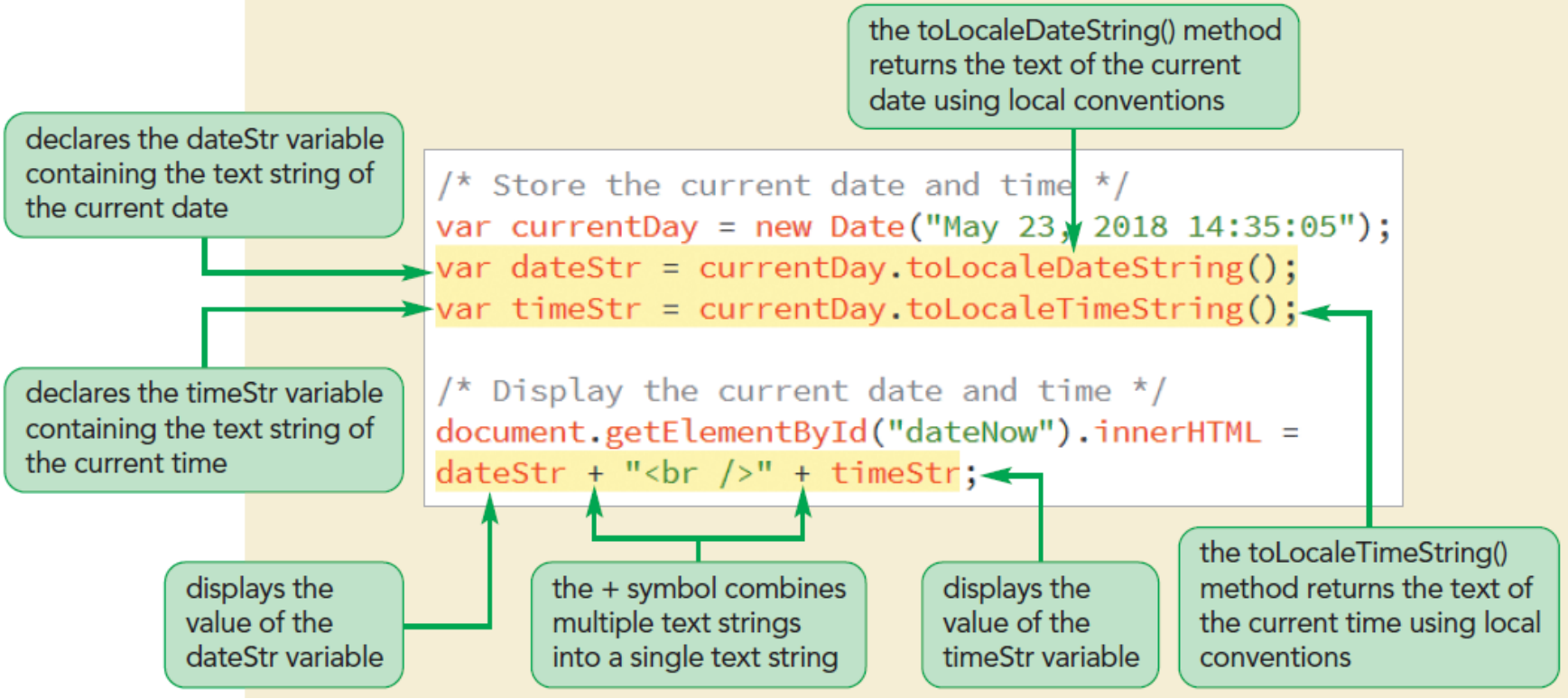
Working with Date Objects (continued 1)

Figure 9-20 Methods of the Date object

Date	Method	Description	Result
var thisDay = new Date("May 23, 2018 14:35:05");	thisDay.getSeconds()	seconds	5
	thisDay.getMinutes()	minutes	35
	thisDay.getHours()	hours	14
	thisDay.getDate()	day of the month	23
	thisDay.getMonth()	month number, where January = 0, February =1, etc.	4
	thisDay.getFullYear()	year	2018
	thisDay.getDay()	day of the week, where Sunday = 0, Monday = 1, etc.	3
	thisDay.toLocaleDateString()	text of the date using local conventions	"5/23/2018"
	thisDay.toLocaleTimeString()	text of the time using local conventions	"2:35:05 PM"

Working with Date Objects (continued 2)

Figure 9-21 Displaying dates and times



Setting Date and Time Values

Figure 9-23 JavaScript methods to set values of the Date object

Date Method	Description
date.setDate(*value*)	Sets the day of the month of *date*, where *value* is an integer, ranging from 1 up to 31 (for some months)
date.setFullYear(*value*)	Sets the four-digit year value of *date*, where *value* is an integer
date.setHours(*value*)	Sets the 24-hour value of *date*, where *value* is an integer ranging from 0 to 23
date.setMilliseconds(*value*)	Sets the millisecond value of *date*, where *value* is an integer between 9 and 999
date.setMinutes(*value*)	Sets the minutes value of *date*, where *value* is an integer ranging from 0 to 59
date.setMonth(*value*)	Sets the month value of *date*, where *value* is an integer ranging from 0 (January) to 11 (December)
date.setSeconds(*value*)	Sets the seconds value of *date*, where *value* is an integer ranging from 0 to 59
date.setTime(*value*)	Sets the time value of *date*, where *value* is an integer representing the number of milliseconds since midnight on January 1, 1970

Working with Operators and Operands

- **Operator:** Symbol used to act upon an item or a variable within an expression
- **Operands**: Variables or expressions that operators act upon
- Types of operators
  - **Binary operators** – require two operands in an expression

Working with Operators and Operands (continued)

- **Unary operators** – require only one operand
  - **Increment operator (++) –** increases the value of an operand by 1
  - **Decrement operator (--) –** decreases the value of an operand by 1

Using Assignment Operators

- **Assignment operator:** Assigns a value to an item

Figure 9-25 JavaScript assignment operators

Operator	Example	Equivalent To
=	x = y	x = y
+=	x += y	x = x + y
–=	x –= y	x = x – y
*=	x *= y	x = x * y
/=	x /= y	x = x /y
%=	x %= y	x = x % y

Working with the Math Object

- **Math object:** Built-in object used to perform mathematical tasks and store mathematical values
- Syntax to apply a Math method is

  `Math.`*`method`*`(`*`expression`*`)`

  where *`method`* is the method applied to a mathematical expression

Working with the Math Object (continued 1)

Figure 9-28 Methods of the Math object

Method	Description	Example	Returns
Math.abs(*x*)	Returns the absolute value of *x*	Math.abs(–5)	5
Math.ceil(*x*)	Rounds *x* up to the next highest integer	Math.ceil(3.58)	4
Math.exp(*x*)	Raises *e* to the power of *x*	Math.exp(2)	e^2 (approximately 7.389)
Math.floor(*x*)	Rounds *x* down to the next lowest integer	Math.floor(3.58)	3
Math.log(*x*)	Returns the natural logarithm of *x*	Math.log(2)	0.693
Math.max(*x*, *y*)	Returns the larger of *x* and *y*	Math.max(3, 5)	5
Math.min(*x*, *y*)	Returns the smaller of *x* and *y*	Math.min(3, 5)	3
Math.pow(*x*, *y*)	Returns *x* raised to the power of *y*	Math.pow(2,3)	2^3 (or 8)
Math.rand()	Returns a random number between 0 and 1	Math.rand()	Random number between 0 and 1
Math.round(*x*)	Rounds *x* to the nearest integer	Math.round(3.58)	4
Math.sqrt(*x*)	Returns the square root of *x*	Math.sqrt(2)	approximately 1.414

Working with the Math Object (continued 2)

Figure 9-30 Calculating the hours left in the current day

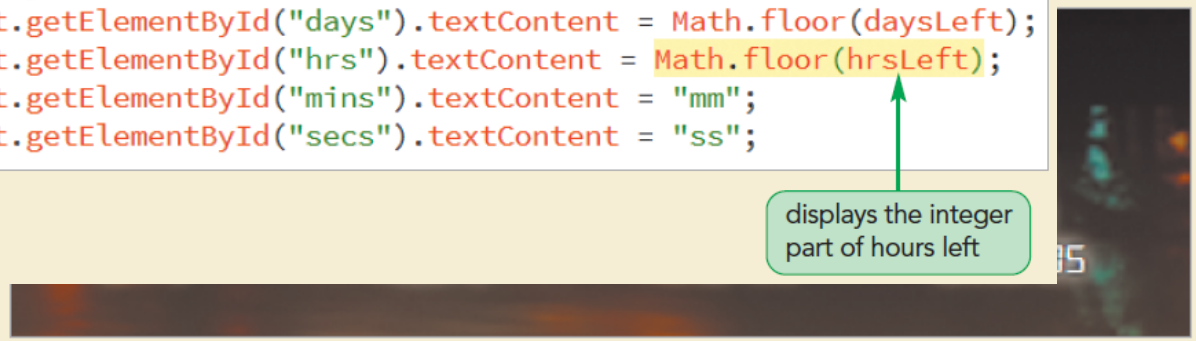
```
var daysLeft = (newYear - currentDay)/(1000*60*60*24);

/* Calculate the hours left in the current day */
var hrsLeft = (daysLeft - Math.floor(daysLeft))*24;


/* Display the time left until New Year's Eve */
document.getElementById("days").textContent = Math.floor(daysLeft);
document.getElementById("hrs").textContent = Math.floor(hrsLeft);
document.getElementById("mins").textContent = "mm";
document.getElementById("secs").textContent = "ss";
```

calculates the fractional part of the current day in terms of hours

displays the integer part of hours left



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Using Math Constants

- Math functions refer to built-in constants stored in JavaScript Math object
- Syntax to access mathematical constants is

  `Math.`*`CONSTANT`*

  where *`CONSTANT`* is the name of one of the mathematical constants supported by `Math` object

Using Math Constants (continued)

Figure 9-34 Math constants

Constant	Description
Math.E	The base of the natural logarithms (2.71828…)
Math.LN10	The natural logarithm of 10 (2.3026…)
Math.LN2	The natural logarithm of 2 (0.6931…)
Math.LOG10E	The base 10 logarithm of *e* (0.4343…)
Math.LOG2E	The base 2 logarithm of *e* (1.4427…)
Math.PI	The value of π (3.14159…)
Math.SQRT1_2	The value of 1 divided by the square root of 2 (0.7071…)
Math.SQRT2	The square root of 2 (1.4142 …)

Working with JavaScript Functions

- **Function:** Collection of commands that performs an action or returns a value
- A function name identifies a function and a set of commands that are run when the function is called
- **Parameters:** Variables associated with the function

Working with JavaScript Functions (continued)

- General syntax of a JavaScript function is

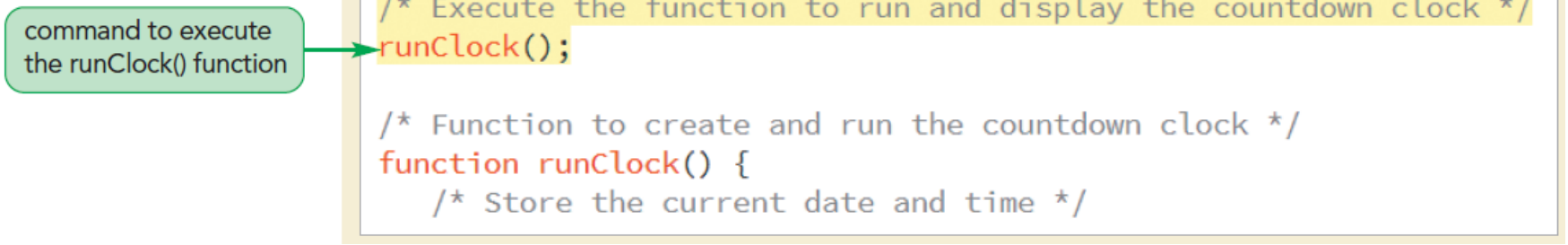
```
function function_name(parameters){
    commands
}
```

where,

- *function_name* is the name of the function
- *parameters* is a comma-separated list of variables used in the function
- *commands* is the set of statements run by the function

Calling a Function

Figure 9-37 Calling the runClock() function



Creating a Function to Return a Value

- Functions return values using `return` statement

```
function function_name(parameters){
    commands
    return value;
}
```

where *value* is the calculated value that is returned by the function

Running Timed Commands

- Methods to update the current and the remaining time constantly
  - Time-delayed commands
  - Timed-interval commands
- Working with Time-Delayed Commands
  - **Time-delayed commands:** JavaScript commands run after a specified amount of time has passed

Running Timed Commands (continued 1)

- Time delay is defined using

  `setTimeout("command", delay);`

  where *command* is a JavaScript command and *delay* is the delay time in milliseconds before a browser runs the command

- Running Commands at Specified Intervals
  - The timed-interval command instructs browsers to run a command repeatedly at a specified interval

Running Timed Commands (continued 2)

- Timed-interval commands are applied using `setInterval()` method

  `setInterval("command", interval);`

  where *`interval`* is the interval in milliseconds before the command is run again

Running Timed Commands (continued 3)

Figure 9-38 Repeating the runClock() function

```
/* Execute the function to run and display the countdown clock */
runClock();
setInterval("runClock()", 1000);
```

repeats the runClock() function every second

Controlling How JavaScript Works with Numeric Values

- Handling Illegal Operations
  - Mathematical operations can return results that are not numeric values
  - JavaScript returns NaN if an operation does not involve only numeric values

Controlling How JavaScript Works with Numeric Values (continued)

- `isNaN()` function returns a Boolean value of `true` if the value is not numeric and `false` if otherwise
- `Infinity` value is generated for an operation whose result is less than the smallest numeric value and greater than the largest numeric value supported by JavaScript

Defining a Number Format

- JavaScript stores a numeric value to 16 decimal places of accuracy
- The number of digits displayed by browsers is controlled using `toFixed()` method

  value`.toFixed(`*n*`)`

  where *value* is the value or variable and *n* is the number of decimal places displayed in the output

Defining a Number Format (continued)

- `toFixed()` limits the number of decimals displayed by a value and converts the value into a text string
- `toFixed()` rounds the last digit in an expression rather than truncating it

Converting Between Numbers and Text

- + operator adds a text string to a number
- For example,

```
testNumber = 123; // numeric value
testString = testNumber + “”; // text string
```

where + operator concatenates a numeric value with an empty text string resulting in a text string

Converting Between Numbers and Text (continued 1)

- `parseInt()` function extracts the leading integer value from a text string
- It returns the integer value from the text string by discarding any non-integer characters
- Example,

```
parseInt("120.88 lbs"); // returns 120
parseInt("weight equals 120 lbs"); //
returns NaN
```

Converting Between Numbers and Text (continued 2)

Figure 9-39 Numerical functions and methods

Numerical Function	Description
`isFinite(value)`	Indicates whether *value* is finite and a real number
`isNaN(value)`	Indicates whether *value* is a number
`parseFloat(string)`	Extracts the first numeric value from the text *string*
`parseInt(string)`	Extracts the first integer value from the text *string*

Numerical Method	Description
`value.toExponential(n)`	Returns a text string displaying *value* in exponential notation with *n* digits to the right of the decimal point
`value.toFixed(n)`	Returns a text string displaying *value* to *n* decimal places
`value.toPrecision(n)`	Returns a text string displaying *value* to *n* significant digits either to the left or to the right of the decimal point