JavaScript: Control Statements I

Outline

1. Introduction
2. Algorithms
3. Pseudocode
4. Control Structures
5. if Selection Statement
6. if…else Selection Statement
7. while Repetition Statement
8. Formulating Algorithms: Case Study 1 (Counter-Controlled Repetition)
9. Formulating Algorithms with Top-Down, Stepwise Refinement: Case Study 2 (Sentinel-Controlled Repetition)
10. Formulating Algorithms with Top-Down, Stepwise Refinement: Case Study 3 (Nested Control Structures)
11. Assignment Operators
12. Increment and Decrement Operators
13. Note on Data Types
14. Web Resources

Objectives

- In this lesson, you will learn:
  - To understand basic problem-solving techniques.
  - To be able to develop algorithms through the process of top-down, stepwise refinement.
  - To be able to use the `if` and `if…else` selection statements to choose among alternative actions.
  - To be able to use the `while` repetition statement to execute statements in a script repeatedly.
  - To understand counter-controlled repetition and sentinel-controlled repetition.
  - To be able to use the increment, decrement and assignment operators.

1 Introduction

- Writing a script
  - Thorough understanding of problem
  - Carefully planned approach
  - Understand the types of building blocks that are available
  - Employ proven program-construction principles

2 Algorithms

- Actions to be executed
- Order in which the actions are to be executed

3 Pseudocode

- Artificial
- Informal
- Helps programmers develop algorithms

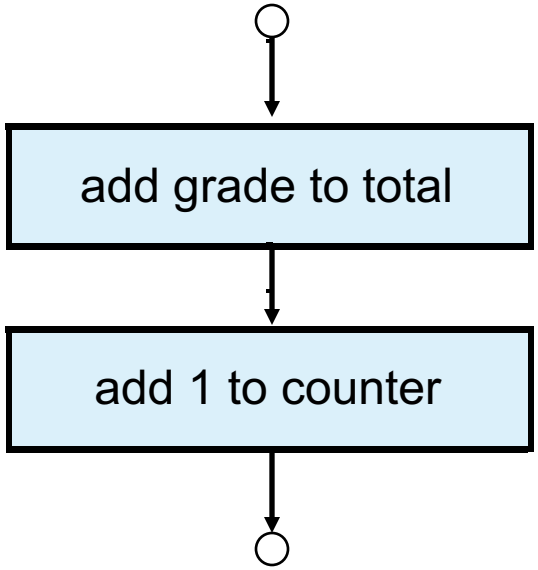
4 Control Structures

- Sequential execution
  - Statements execute in the order they are written
- Transfer of control
  - Next statement to execute may not be the next one in sequence
- Three control structures
  - Sequence structure
  - Selection structure
    - `if`
    - `if…else`
    - `switch`
  - Repetition structure
    - `while`
    - `do…while`
    - `for`
    - `for…in`
    - `for…of`

4 Control Structures

- Flowchart
  - Graphical representation of algorithm or portion of algorithm
  - Flowlines
    - Indicate the order the actions of the algorithm execute
  - Rectangle symbol
    - Indicate any type of action
  - Oval symbol
    - A complete algorithm
  - Small circle symbol
    - A portion of algorithm
  - Diamond symbol
    - Indicates a decision is to be made

4 Control Structures




```
total = total + grade;
```

```
counter = counter + 1;
```

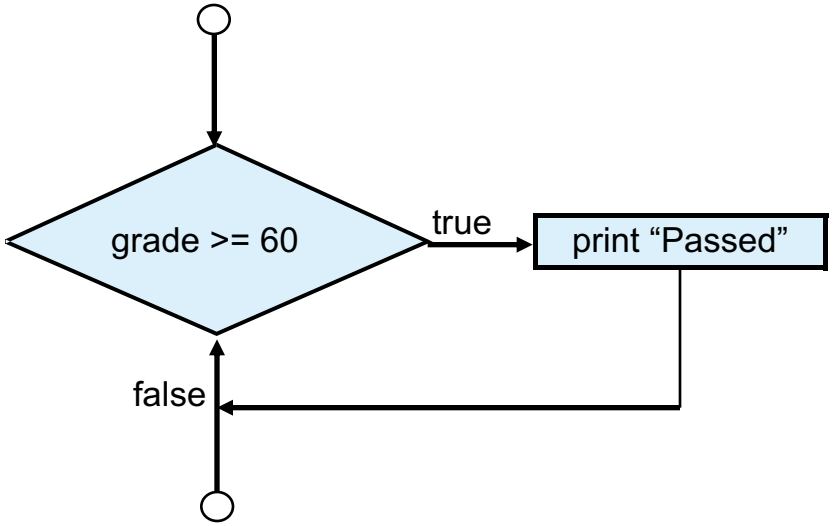
4 Control Structures

JavaScript Keywords				
break	case	catch	continue	default
delete	do	else	finally	for
function	if	in	instanceof	new
return	switch	this	throw	try
typeof	var	void	while	with
Keywords that are reserved but not currently used by JavaScript				
abstract	boolean	byte	char	class
const	debugger	double	enum	export
extends	final	float	goto	implements
import	int	interface	long	native
package	private	protected	public	short
static	super	synchronized	throws	transient
volatile				

5 `if` Selection Statement

- Single-entry/single-exit structure
- Indicate action only when the condition evaluates to `true`

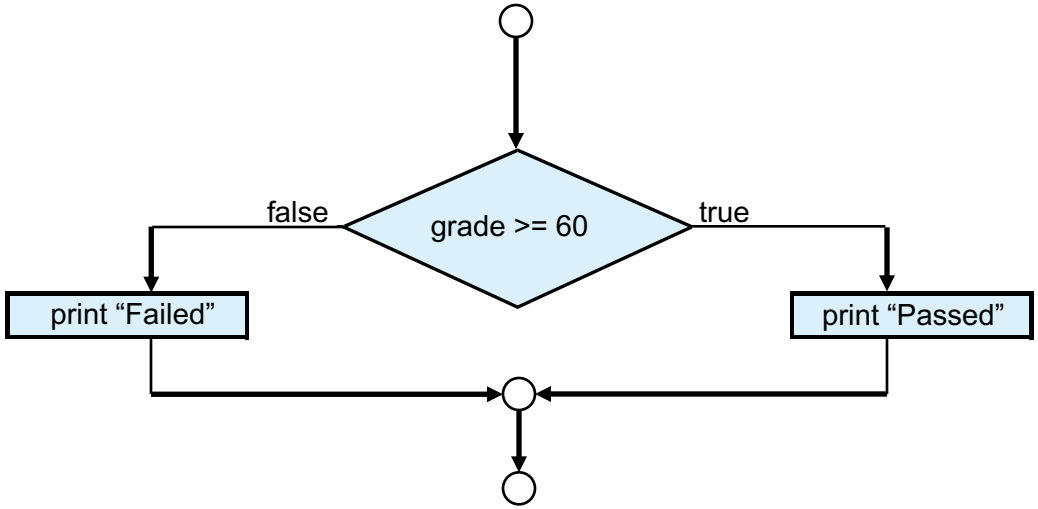
5 `if` Selection Statement



6 `if…else` Selection Statement

- Indicate different actions to be perform when condition is `true` or `false`
- Conditional operator (`?:`)
  - JavaScript's only ternary operator
    - Three operands
    - Forms a conditional expression
- Dangling-else problem

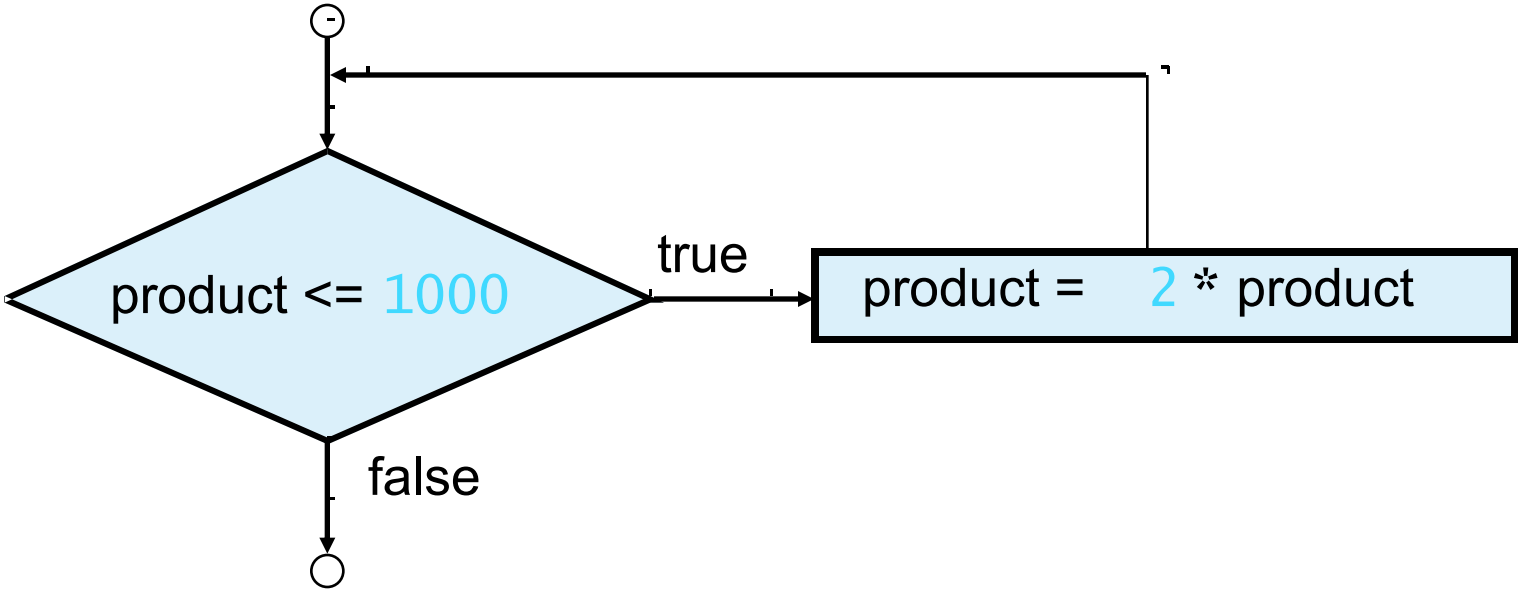
6 `if…else` Selection Statement



7 while Repetition Statement

- Repetition structure (loop)
  - Repeat action while some condition remains true

7 while Repetition Statement



8 Formulating Algorithms: Case Study 1 (Counter-Controlled Repetition)

- Counter-controlled repetition
  - Counter
    - Control the number of times a set of statements executes
  - Definite repetition

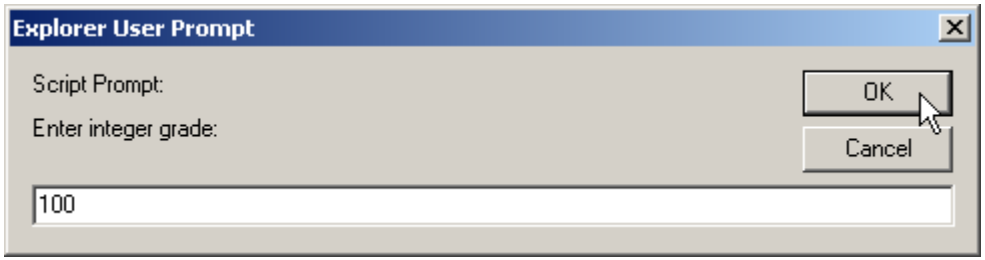
```
1  <?xml version = "1.0"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3     "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 8.7: average.html -->
6  <!-- Class Average Program  -->
7
8  <html xmlns = "http://www.w3.org/1999/xhtml">
9     <head>
10       <title>Class Average Program</title>
11
12       <script type = "text/javascript">
13          <!--
14          var total,          // sum of grades
15              gradeCounter,   // number of grades entered
16              gradeValue,     // grade value
17              average,        // average of all grades
18              grade;          // grade typed by user
19
20          // Initialization Phase
21          total = 0;          // clear total
22          gradeCounter = 1;   // prepare to loop
23
```

```
24          // Processing Phase
25          while ( gradeCounter <= 10 ) {   // loop 10 times
26
27             // prompt for input and read grade from user
28             grade = window.prompt( "Enter integer grade:", "0" );
29
30             // convert grade from a string to an integer
31             gradeValue = parseInt( grade );
32
33             // add gradeValue to total
34             total = total + gradeValue;
35
36             // add 1 to gradeCounter
37             gradeCounter = gradeCounter + 1;
38          }
39
40          // Termination Phase
41          average = total / 10;  // calculate the average
42
43          // display average of exam grades
44          document.writeln(
45             "<h1>Class average is " + average + "</h1>" );
46          // -->
47       </script>
48
49    </head>
50    <body>
51       <p>Click Refresh (or Reload) to run the script again<p>
52    </body>
53 </html>
```

Outline

average.html
(2 of 3)

average.html
(3 of 3)



9 Formulating Algorithms with Top-Down, Stepwise Refinement: Case Study 2 (Sentinel-Controlled Repetition)

- Indefinite repetition
  - Sentinel value

```
1  <?xml version = "1.0"?>
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. 8.9: average2.html        -->
6  <!-- Sentinel-controlled Repetition -->
7
8  <html xmlns = "http://www.w3.org/1999/xhtml">
9     <head>
10       <title>Class Average Program:
11           Sentinel-controlled Repetition</title>
12
13       <script type = "text/javascript">
14          <!--
15          var gradeCounter,  // number of grades entered
16              gradeValue,    // grade value
17              total,         // sum of grades
18              average,       // average of all grades
19              grade;         // grade typed by user
20
21          // Initialization phase
22          total = 0;         // clear total
23          gradeCounter = 0;  // prepare to loop
24
```

Outline

average2.html
(1 of 3)

```
25          // Processing phase
26          // prompt for input and read grade from user
27          grade = window.prompt(
28               "Enter Integer Grade, -1 to Quit:", "0" );
29
30          // convert grade from a string to an integer
31          gradeValue = parseInt( grade );
32
33          while ( gradeValue != -1 ) {
34             // add gradeValue to total
35             total = total + gradeValue;
36
37             // add 1 to gradeCounter
38             gradeCounter = gradeCounter + 1;
39
40             // prompt for input and read grade from user
41             grade = window.prompt(
42                  "Enter Integer Grade, -1 to Quit:", "0" );
43
44             // convert grade from a string to an integer
45             gradeValue = parseInt( grade );
46          }
47
```

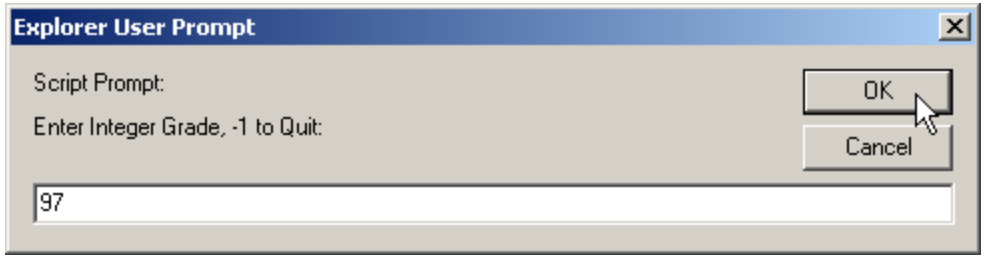
Outline

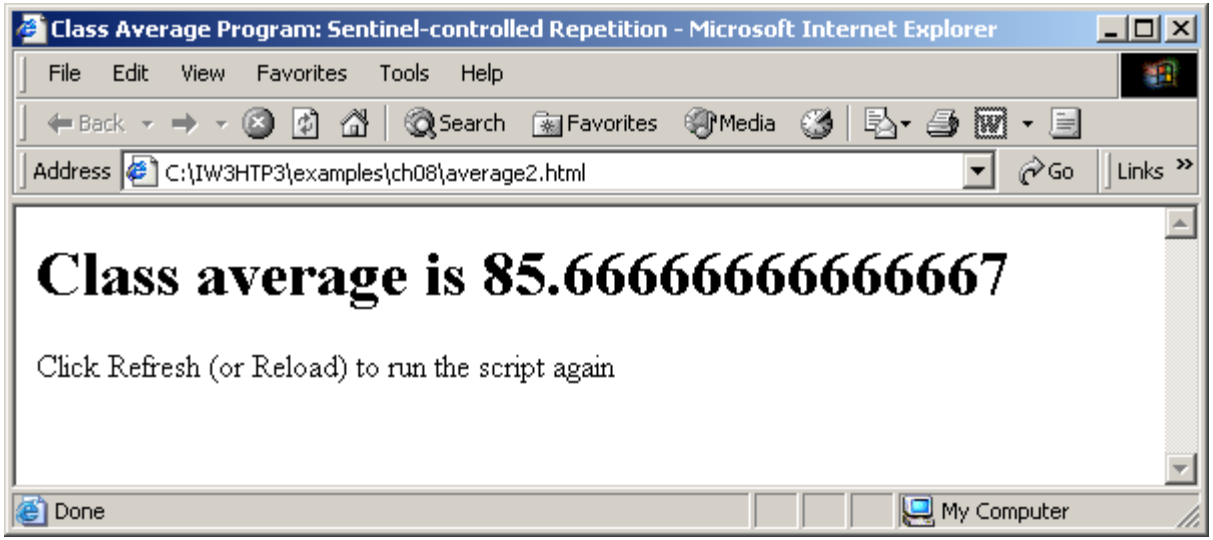
average2.html
(2 of 3)

```
48          // Termination phase
49          if ( gradeCounter != 0 ) {
50             average = total / gradeCounter;
51
52             // display average of exam grades
53             document.writeln(
54                "<h1>Class average is " + average + "</h1>" );
55          }
56          else
57             document.writeln( "<p>No grades were entered</p>" );
58          // -->
59       </script>
60    </head>
61
62    <body>
63       <p>Click Refresh (or Reload) to run the script again</p>
64    </body>
65 </html>
```

Outline

average2.html
(3 of 3)


Explorer User Prompt
Script Prompt:
Enter Integer Grade, -1 to Quit:
OK
Cancel
97


Class Average Program: Sentinel-controlled Repetition - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address C:\IW3HTP3\examples\ch08\average2.html
Go Links
Class average is 85.66666666666667
Click Refresh (or Reload) to run the script again
Done
My Computer

10 Formulating Algorithms with Top-Down, Stepwise Refinement: Case Study 3 (Nested Control Structures)

- Consider problem
- Make observations
- Top-down, stepwise refinement

Outline

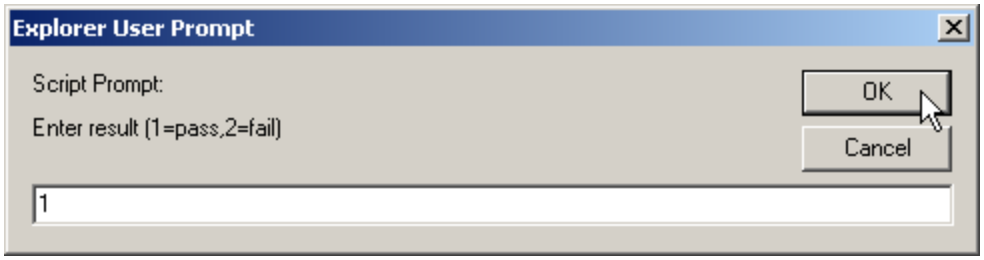
analysis.html
(1 of 2)

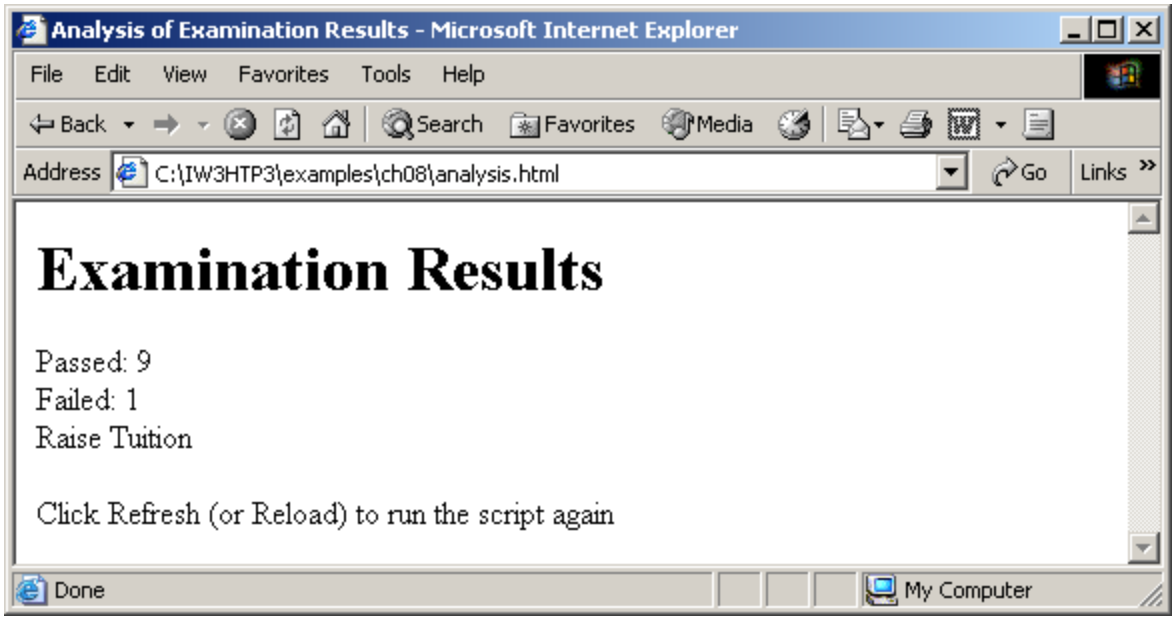
```
1  <?xml version = "1.0"?>
2  <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
3     "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
4
5  <!-- Fig. 8.11: analysis.html -->
6  <!-- Analyzing Exam Results   -->
7
8  <html xmlns = "http://www.w3.org/1999/xhtml">
9     <head>
10       <title>Analysis of Examination Results</title>
11
12       <script type = "text/javascript">
13          <!--
14          // initializing variables in declarations
15          var passes = 0,      // number of passes
16              failures = 0,    // number of failures
17              student = 1,     // student counter
18              result;          // one exam result
19
20          // process 10 students; counter-controlled loop
21          while ( student <= 10 ) {
22             result = window.prompt(
23                "Enter result (1=pass,2=fail)", "0" );
24
```

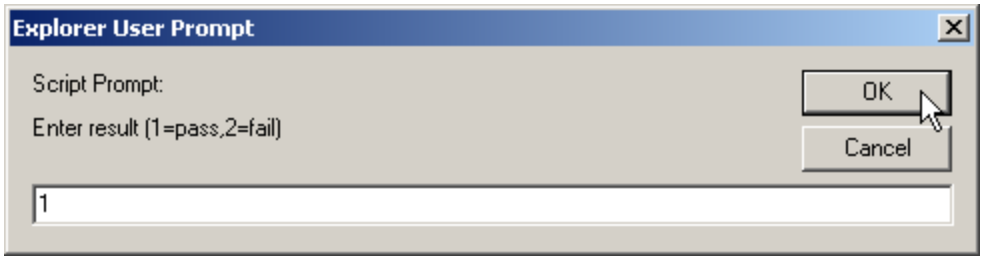
```
25            if ( result == "1" )
26               passes = passes + 1;
27            else
28               failures = failures + 1;
29
30            student = student + 1;
31         }
32
33         // termination phase
34         document.writeln( "<h1>Examination Results</h1>" );
35         document.writeln(
36            "Passed: " + passes + "<br />Failed: " + failures );
37
38         if ( passes > 8 )
39            document.writeln( "<br />Raise Tuition" );
40         // -->
41      </script>
42
43   </head>
44   <body>
45      <p>Click Refresh (or Reload) to run the script again</p>
46   </body>
47 </html>
```

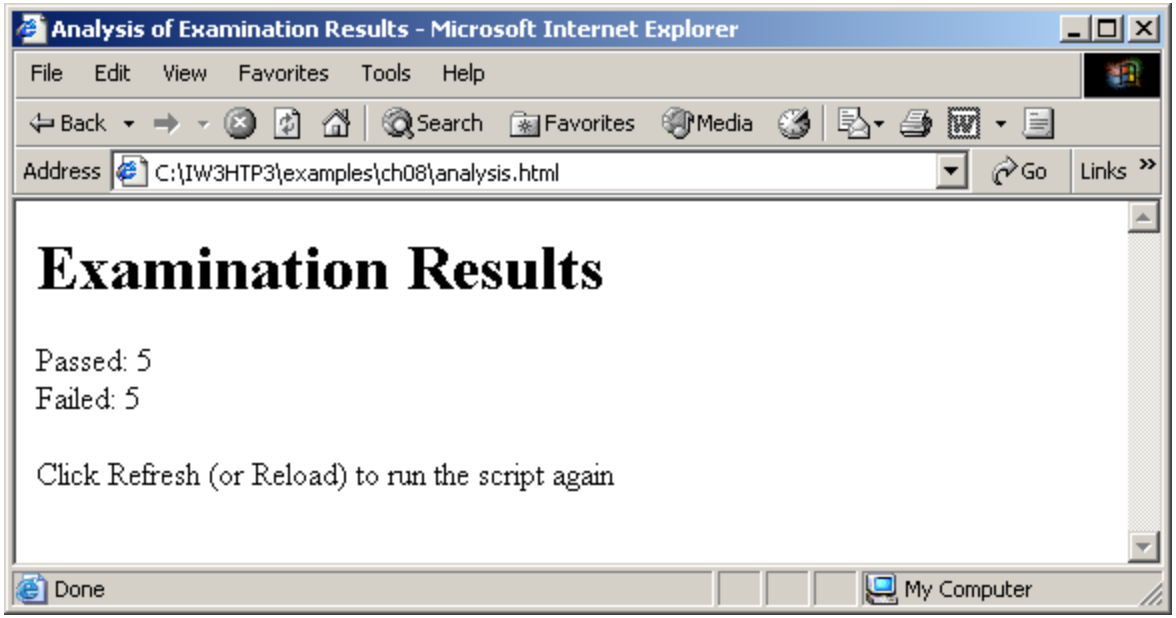
Outline

analysis.html
(2 of 2)


Explorer User Prompt
Script Prompt:
Enter result (1=pass,2=fail)
OK
Cancel
1


Analysis of Examination Results - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address C:\IW3HTP3\examples\ch08\analysis.html
Go Links
Examination Results
Passed: 9
Failed: 1
Raise Tuition
Click Refresh (or Reload) to run the script again
Done
My Computer


Explorer User Prompt
Script Prompt:
Enter result (1=pass,2=fail)
OK
Cancel
1


Analysis of Examination Results - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address C:\IW3HTP3\examples\ch08\analysis.html
Go Links
Examination Results
Passed: 5
Failed: 5
Click Refresh (or Reload) to run the script again
Done
My Computer

11 Assignment Operators

- Compound assignment operators
  - Abbreviate assignment expressions

11 Assignment Operators

Assignment operator	Initial value of variable	Sample expression	Explanation	Assigns
+=	c = 3	c += 7	c = c + 7	10 to c
-=	d = 5	d -= 4	d = d - 4	1 to d
*=	e = 4	e *= 5	e = e * 5	20 to e
/=	f = 6	f /= 3	f = f / 3	2 to f
%=	g = 12	g %= 9	g = g % 9	3 to g

12 Increment and Decrement Operators

- Preincrement or predecrement operator
  - Increment of decrement operator placed before a variable
- Postincrement or postdecrement operator
  - Increment of decrement operator placed after a variable

12 Increment and Decrement Operators

Operator	Called	Sample expression	Explanation
`++`	preincrement	`++a`	Increment `a` by 1, then use the new value of `a` in the expression in which `a` resides.
`++`	postincrement	`a++`	Use the current value of `a` in the expression in which `a` resides, then increment `a` by 1.
`--`	predecrement	`--b`	Decrement `b` by 1, then use the new value of `b` in the expression in which `b` resides.
`--`	postdecrement	`b--`	Use the current value of `b` in the expression in which `b` resides, then decrement `b` by 1.

```
1  <?xml version = "1.0"?>
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. 8.14: increment.html            -->
6  <!-- Preincrementing and Postincrementing -->
7
8  <html xmlns = "http://www.w3.org/1999/xhtml">
9     <head>
10       <title>Preincrementing and Postincrementing</title>
11
12       <script type = "text/javascript">
13          <!--
14          var c;
15
16          c = 5;
17          document.writeln( "<h3>Postincrementing</h3>" );
18          document.writeln( c );              // print 5
19          // print 5 then increment
20          document.writeln( "<br />" + c++ );
21          document.writeln( "<br />" + c );   // print 6
22
23          c = 5;
24          document.writeln( "<h3>Preincrementing</h3>" );
25          document.writeln( c );              // print 5
```

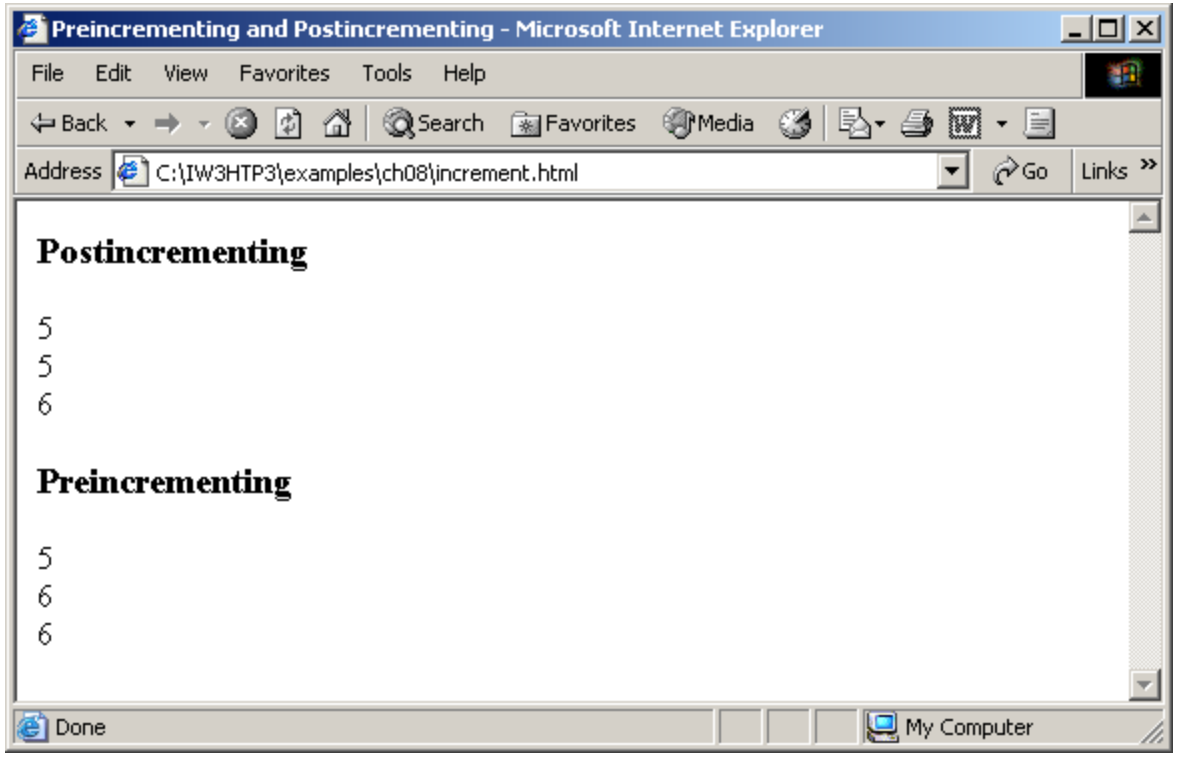
Outline

increment.html
(1 of 2)

```
26          // increment then print 6
27          document.writeln( "<br />" + ++c );
28          document.writeln( "<br />" + c );    // print 6
29          // -->
30       </script>
31
32    </head><body></body>
33 </html>
```

Outline

increment.html
(2 of 2)



12 Increment and Decrement Operators

Operator	Associativity	Type
++ --	right to left	unary
* / %	left to right	multiplicative
+ -	left to right	additive
< <= > >=	left to right	relational
== !=	left to right	equality
?:	right to left	conditional
= += -= *= /= %=	right to left	assignment

13 Note on Data Types

- Loosely typed
  - Automatically converts between values of different types

14 Web Resources

- www.javascriptmall.com
- developer.netscape.com/tech/javascript
- www.mozilla.org/js/language
- Deitel and deitel, Internet and World Wide Web How to Program: Third Edition