

Chapter 2

Introducing JavaScript

1. What are the two attributes that define a data type?

A domain and a set of operations

2. Identify which of the following are legal numbers in JavaScript:

The following numbers are illegal for the reason cited:

- | | |
|--------------|--|
| c) 2+3 | Operators are not allowed in a number |
| g) 1,000,000 | Commas are not allowed in a number |
| l) 1.1x+11 | The x is not a legal exponent character |

3. Rewrite the following numbers using JavaScript's form for scientific notation:

- | | |
|-----------------------------|------------------------|
| a) 6.02252×10^{23} | 6.02252E+23 |
| b) 29979250000.0 | 2.997925E+10 |
| c) 0.00000000529167 | 5.29167E-9 |
| d) 3.1415926535 | 3.1415926535E+0 |

4. Indicate which of the following are legal variable names in JavaScript:

The following variable names are illegal for the reason cited:

- | | |
|------------------|--|
| d) %correct | The % is not legal in a variable name |
| e) short | The identifier short is a keyword |
| g) total output | Spaces are not legal in a variable name |
| i) 12MonthTotal | Names cannot start with digits |
| j) marginal-cost | The - is not legal in a variable name |

5. What does the % operator signify in JavaScript?

The % operator calculates the remainder. To avoid introducing too much complexity—and also because JavaScript's definition is at odds with the mathematical definition of a modulus—the examples in this book ensure that the left operand to % is nonnegative and the right operand is positive.

6. True or false: The - operator has the same precedence when it is used before an operand to indicate negation as it does when it is used to indicate subtraction.

False. The - operator used before an operand, which is called a *unary minus*, has very high precedence. When - is written between two operands to indicate subtraction, it has the same precedence as addition.

7. By applying the appropriate precedence rules, calculate the result of each of the following expressions:

- a) $6 + 5 / 4 - 3 \rightarrow 4.25$
- b) $2 + 2 * (2 * 2 - 2) \% 2 / 2 \rightarrow 2$
- c) $10 + 9 * ((8 + 7) \% 6) + 5 * 4 \% 3 * 2 + 1 \rightarrow 42$
- d) $1 + 2 + (3 + 4) * ((5 * 6 \% 7 * 8) - 9) - 10 \rightarrow 42$

8. What shorthand assignment statement would you use to multiply the value of the variable `salary` by 2?

`salary *= 2`

9. What is the most common way in JavaScript to write a statement that has the same effect as the statement `x = x + 1`?

`x++`

10. In your own words, explain the difference between the prefix and suffix forms of the increment and decrement operators.

The ++ and -- operators can each be written in two different ways. The operator can come *after* the operand to which it applies, as in the expression `x++`, or *before* the operand, as in `++x`. The first form, in which the operator follows the operand, is called the *suffix* form; the second, in which the operator precedes the operand, is called the *prefix* form. The placement of the operator determines what value is returned to the enclosing expression. In the prefix form, the enclosing expression uses the value *after* it is updated. In the suffix form, the enclosing expression uses the value *before* the update.

11. What is the value of each of the following expressions:

- a) `Math.round(5.99) \rightarrow 6`
- b) `Math.floor(5.99) \rightarrow 5`
- c) `Math.ceil(5.99) \rightarrow 6`
- d) `Math.floor(-5.99) \rightarrow -6`
- e) `Math.sqrt(Math.pow(3, 2) + Math.pow(4, 2)) \rightarrow 5`

12. What is the possible range of values returned by the function `Math.random`?

A number that is at least 0 but strictly less than 1

13. How do you specify a string value in JavaScript?

You specify a string value by enclosing its characters in quotation marks. JavaScript allows the use of either single or double quotation marks. To maintain a consistent style, this text uses double-quotation marks throughout.

14. If a string is stored in the variable `str`, how would you determine its length?

`str.length`

15. What is meant by the term *concatenation*?

Concatenation is the process of joining two strings together end to end.

16. How does JavaScript decide whether to interpret the `+` operator as addition or concatenation?

If either operands to `+` is a string, JavaScript automatically converts the other operand to a string and applies concatenation. If neither operand is a string, Java applies addition.

17. Given the definition of the `doubleString` function on page 55, what value does JavaScript produce if you call `doubleString(2)`? In light of this behavior, would it be reasonable to shorten the name of the function to `double`? Why or why not?

The name `double` is a reserved word, which means that it is illegal to use it as a function name.

18. Evaluate each of the following expressions:

- a) `123 + 456` → `579`
- b) `123 + "456"` → `"123456"`
- c) `"Catch-" + 2 + 2` → `"Catch22"`
- d) `"Citizen" + 2 * 2` → `"Citizen4"`

19. What did Brian Kernighan and Dennis Ritchie suggest should be the first program you write in any language? What reasons did they offer for starting with a program that simple?

A program that prints the words `"hello, world"` on the console

20. What are the three technologies used to specify a web page? What aspects of the web page do each of these technologies control?

1. **The structure and contents of the page are defined using a file written using the *Hypertext Markup Language* or *HTML*.**
2. **The visual appearance of the page is specified using *Cascading Style Sheets* or *CSS*.**
3. **Any interactive behavior of the page is represented using one or more files, which are conventionally written in JavaScript.**

21. What is the conventional name of the HTML file that defines a web page?

`index.html`

22. What is the syntax of the HTML tag used to load JavaScript files into the browser?

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

23. What is the name of the JavaScript library used in this chapter to implement programs that write output to the console? What reasons does the chapter give for using this library to replace the standard system console?

The `JSConsole.js` library ensures that the console log is displayed as part of the web page, guaranteeing that it appears in a predictable place.

24. How can you enable rigorous error checking in a JavaScript program?

Add the following line to the beginning of the file:

```
"use strict";
```

25. What are the four phases of the programming process identified in this chapter? For each of those phases, what professional role does the chapter offer as a model for how to perform that phase?

The four phases are *design*, *coding*, *testing*, and *debugging*. In the design phase, your role is similar to that of an *architect*. In the coding phase, you act as an *engineer*, applying your specialized knowledge to create a workable solution. During testing, your job is to find as many errors and vulnerabilities in the code as you can, making you something of a *vandal*. In debugging, you must employ the skills of a *detective* as you assemble the clues you need to discover the errors in the code.

26. True or false: Professional programmers work through the four phases of the programming process in order, finishing each one before moving on to the next.

False. Professional programmers develop a preliminary design, write some pieces of the code, test those pieces to see if they work as intended, and then fix the bugs that the testing uncovers. Only when that individual piece is working do professional programmers return to code, test, and debug the next section of the program. From time to time, they go back and revisit the design as they learn from the experience of seeing how well the original design works in practice. You must learn to work in much the same way.

27. True or false: When you are testing your program, your primary goal is to show that it works.

False. Your job is to break it.

28. What piece of advice does the chapter offer to help you think effectively about debugging?

When you are trying to find a bug, it is more important to understand what your program *is* doing than to understand what it *isn't* doing.

29. What built-in function does the text identify as the most useful debugging tool?

The built-in function `console.log`

30. In your own words, explain what is meant by *program maintenance*.

Programs require maintenance for two principal reasons. First, even after considerable testing and, in some cases, years of field use, bugs can still survive in the original code. Second, programs need to change in response to changing requirements. Users want new features in their applications, and software developers try to provide those features to maintain customer loyalty.

31. What guidelines does this chapter offer to improve your programming style?

- **Write your code and comments with future maintainers in mind.**
- **Choose names to convey the purpose of your variables and functions.**
- **Use indentation to highlight the structure of your programs.**
- **Design your programs so that they are easy to modify as needed.**