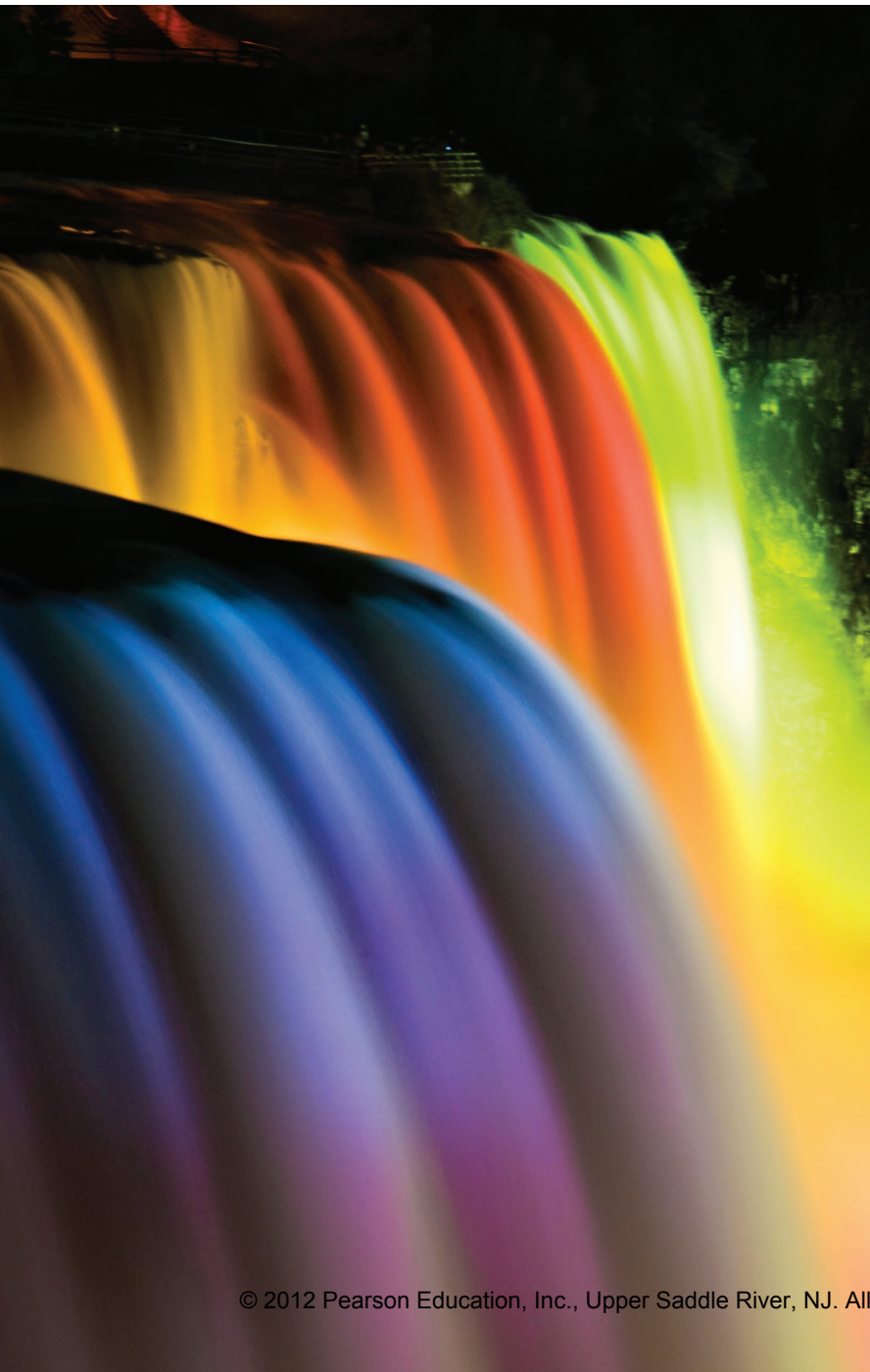# Introduction to Java Applications: Solutions

2

*What's in a name? That which we call a rose
By any other name would smell as sweet.*
—William Shakespeare

When faced with a decision, I always ask, "What would be the most fun?"
—Peggy Walker

"Take some more tea," the March Hare said to Alice, very earnestly. "I've had nothing yet," Alice replied in an offended tone: "so I can't take more." "You mean you can't take less," said the Hatter: "It's very easy to take more than nothing."
—Lewis Carroll

Objectives

In this chapter you'll learn:

- To write simple Java applications.
- To use input and output statements.
- Java's primitive types.
- Basic memory concepts.
- To use arithmetic operators.
- The precedence of arithmetic operators.
- To write decision-making statements.
- To use relational and equality operators.

Self-Review Exercises

2.1 Fill in the blanks in each of the following statements:

a) A(n) _____ begins the body of every method, and a(n) _____ ends the body of every method.

ANS: left brace ({), right brace (}).

b) The _____ statement is used to make decisions.

ANS: if.

c) _____ begins an end-of-line comment.

ANS: //.

d) _____, _____ and _____ are called white space.

ANS: Space characters, newlines and tabs.

e) _____ are reserved for use by Java.

ANS: Keywords.

f) Java applications begin execution at method _____.

ANS: main.

g) Methods _____, _____ and _____ display information in a command window.

ANS: System.out.print, System.out.println and System.out.printf.

2.2 State whether each of the following is *true* or *false*. If *false*, explain why.

a) Comments cause the computer to print the text after the // on the screen when the program executes.

ANS: False. Comments do not cause any action to be performed when the program executes. They are used to document programs and improve their readability.

b) All variables must be given a type when they are declared.

ANS: True.

c) Java considers the variables number and NuMbEr to be identical.

ANS: False. Java is case sensitive, so these variables are distinct.

d) The remainder operator (%) can be used only with integer operands.

ANS: False. The remainder operator can also be used with noninteger operands in Java.

e) The arithmetic operators *, /, %, + and – all have the same level of precedence.

ANS: False. The operators *, / and % are on the same level of precedence, and the operators + and – are on a lower level of precedence.

2.3 Write statements to accomplish each of the following tasks:

a) Declare variables c, thisIsAVariable, q76354 and number to be of type int.

ANS: int c, thisIsAVariable, q76354, number;

    or

    int c;
    int thisIsAVariable;
    int q76354;
    int number;

b) Prompt the user to enter an integer.

ANS: System.out.print("Enter an integer: ");

c) Input an integer and assign the result to int variable value. Assume Scanner variable input can be used to read a value from the keyboard.

ANS: value = input.nextInt();

d) Print "This is a Java program" on one line in the command window. Use method System.out.println.

ANS: System.out.println("This is a Java program");

e) Print "This is a Java program" on two lines in the command window. The first line
should end with Java. Use method System.out.println.
ANS: System.out.println("This is a Java\nprogram");
f) Print "This is a Java program" on two lines in the command window. The first line
should end with Java. Use method System.out.printf and two %s format specifiers.
ANS: System.out.printf("%s\n%s\n", "This is a Java", "program");
g) If the variable number is not equal to 7, display "The variable number is not equal to 7".
ANS: if (number != 7)
           System.out.println("The variable number is not equal to 7");

2.4   Identify and correct the errors in each of the following statements:
a) if (c < 7);
           System.out.println("c is less than 7");
ANS: Error: Semicolon after the right parenthesis of the condition (c < 7) in the if.
Correction: Remove the semicolon after the right parenthesis. [*Note:* As a result, the
output statement will execute regardless of whether the condition in the if is true.]
b) if (c => 7)
           System.out.println("c is equal to or greater than 7");
ANS: Error: The relational operator => is incorrect. Correction: Change => to >=.

2.5   Write declarations, statements or comments that accomplish each of the following tasks:
a) State that a program will calculate the product of three integers.
ANS: // Calculate the product of three integers
b) Create a Scanner called input that reads values from the standard input.
ANS: Scanner input = new Scanner(System.in);
c) Declare the variables x, y, z and result to be of type int.
ANS: int x;
         int y;
         int z;
         int result;
         or
         int x, y, z, result;
d) Prompt the user to enter the first integer.
ANS: System.out.print("Enter first integer: ");
e) Read the first integer from the user and store it in the variable x.
ANS: x = input.nextInt();
f) Prompt the user to enter the second integer.
ANS: System.out.print("Enter second integer: ");
g) Read the second integer from the user and store it in the variable y.
ANS: y = input.nextInt();
h) Prompt the user to enter the third integer.
ANS: System.out.print("Enter third integer: ");
i) Read the third integer from the user and store it in the variable z.
ANS: z = input.nextInt();
j) Compute the product of the three integers contained in variables x, y and z, and assign
the result to the variable result.
ANS: result = x * y * z;
k) Display the message "Product is" followed by the value of the variable result.
ANS: System.out.printf("Product is %d\n", result);

2.6   Using the statements you wrote in Exercise 2.5, write a complete program that calculates and prints the product of three integers.
        ANS: The solution to Self-Review Exercise 2.6 is as follows:

```java
1   // Ex. 2.6: Product.java
2   // Calculate the product of three integers.
3   import java.util.Scanner; // program uses Scanner
4
5   public class Product
6   {
7      public static void main( String[] args )
8      {
9         // create Scanner to obtain input from command window
10        Scanner input = new Scanner( System.in );
11
12        int x; // first number input by user
13        int y; // second number input by user
14        int z; // third number input by user
15        int result; // product of numbers
16
17        System.out.print( "Enter first integer: " ); // prompt for input
18        x = input.nextInt(); // read first integer
19
20        System.out.print( "Enter second integer: " ); // prompt for input
21        y = input.nextInt(); // read second integer
22
23        System.out.print( "Enter third integer: " ); // prompt for input
24        z = input.nextInt(); // read third integer
25
26        result = x * y * z; // calculate product of numbers
27
28        System.out.printf( "Product is %d\n", result );
29     } // end method main
30  } // end class Product
```

```
Enter first integer: 10
Enter second integer: 20
Enter third integer: 30
Product is 6000
```

Exercises

NOTE: Solutions to the programming exercises are located in the `ch02solutions` *folder. Each exercise has its own folder named* **ex02_##** *where ## is a two-digit number represent-ing the exercise number. For example, exercise 2.14's solution is located in the folder* **ex02_14.**

2.7   Fill in the blanks in each of the following statements:
        a)   _____ are used to document a program and improve its readability.
        ANS: Comments.
        b)   A decision can be made in a Java program with a(n) _____.
        ANS: `if` statement.
        c)   Calculations are normally performed by _____ statements.
        ANS: assignment statements.
        d)   The arithmetic operators with the same precedence as multiplication are _____ and
        _____.

ANS: division (/), remainder (%)

    e) When parentheses in an arithmetic expression are nested, the _____ set of parentheses is evaluated first.

ANS: innermost.

    f) A location in the computer's memory that may contain different values at various times throughout the execution of a program is called a(n) _____.

ANS: variable.

2.8 Write Java statements that accomplish each of the following tasks:

    a) Display the message "Enter an integer: ", leaving the cursor on the same line.

ANS: `System.out.print( "Enter an integer: " );`

    b) Assign the product of variables b and c to variable a.

ANS: `a = b * c;`

    c) State that a program performs a sample payroll calculation (i.e., use text that helps to document a program).

ANS: `// This program performs a simple payroll calculation.`

2.9 State whether each of the following is *true* or *false*. If *false*, explain why.

    a) Java operators are evaluated from left to right.

ANS: False. Some operators (e.g., assignment, =) evaluate from right to left.

    b) The following are all valid variable names: `_under_bar_`, `m928134`, `t5`, `j7`, `her_sales$`, `his_$account_total`, `a`, `b$`, `c`, `z` and `z2`.

ANS: True.

    c) A valid Java arithmetic expression with no parentheses is evaluated from left to right.

ANS: False. The expression is evaluated according to operator precedence.

    d) The following are all invalid variable names: `3g`, `87`, `67h2`, `h22` and `2h`.

ANS: False. Identifier `h22` is a valid variable name.

2.10 Assuming that x = 2 and y = 3, what does each of the following statements display?

    a) `System.out.printf( "x = %d\n", x );`

ANS: `x = 2`

    b) `System.out.printf( "Value of %d + %d is %d\n", x, x, ( x + x ) );`

ANS: `Value of 2 + 2 is 4`

    c) `System.out.printf( "x =" );`

ANS: `x =`

    d) `System.out.printf( "%d = %d\n", ( x + y ), ( y + x ) );`

ANS: `5 = 5`

2.11 Which of the following Java statements contain variables whose values are modified?

    a) `p = i + j + k + 7;`

    b) `System.out.println( "variables whose values are modified" );`

    c) `System.out.println( "a = 5" );`

    d) `value = input.nextInt();`

ANS: (a), (d).

2.12 Given that $y = ax^3 + 7$, which of the following are correct Java statements for this equation?

    a) `y = a * x * x * x + 7;`

    b) `y = a * x * x * ( x + 7 );`

    c) `y = ( a * x ) * x * ( x + 7 );`

    d) `y = ( a * x ) * x * x + 7;`

    e) `y = a * ( x * x * x ) + 7;`

    f) `y = a * x * ( x * x + 7 );`

ANS: (a), (d), (e)

2.13 State the order of evaluation of the operators in each of the following Java statements, and show the value of x after each statement is performed:

> a) x = 7 + 3 * 6 / 2 - 1;
> **ANS:** *, /, +, -; Value of x is 15.
> b) x = 2 % 2 + 2 * 2 - 2 / 2;
> **ANS:** %, *, /, +, -; Value of x is 3.
> c) x = (3 * 9 * (3 + (9 * 3 / (3))));
> **ANS:** x = (3 * 9 * (3 + (9 * 3 / (3))));
>   4 5   3   1 2
>   Value of x is 324.

2.19 What does the following code print?

```
System.out.println( "*\n**\n***\n****\n*****" );
```

ANS:

```
*
**
***
****
*****
```

2.20 What does the following code print?

```
System.out.println( "*" );
System.out.println( "***" );
System.out.println( "*****" );
System.out.println( "****" );
System.out.println( "**" );
```

ANS:

```
*
***
*****
****
**
```

2.21 What does the following code print?

```
System.out.print( "*" );
System.out.print( "***" );
System.out.print( "*****" );
System.out.print( "****" );
System.out.println( "**" );
```

ANS:

```
***************
```

2.22   What does the following code print?

```
System.out.print( "*" );
System.out.println( "***" );
System.out.println( "*****" );
System.out.print( "****" );
System.out.println( "**" );
```

ANS:

```
****
*****
******
```

2.23   What does the following code print?

```
System.out.printf( "%s\n%s\n%s\n", "*", "***", "*****" );
```

ANS:

```
*
***
*****
```