


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);`

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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:

```
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 representing 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)

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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:

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