Chapter 6
More Conditionals and Loops

Java Software Solutions
Foundations of Program Design
9th Edition

John Lewis
William Loftus

PEARSON

Copyright © 2017 Pearson Education, Inc.

More Conditionals and Loops

- Now we can fill in some additional details regarding Java conditional and repetition statements
- Chapter 6 focuses on:
  - the switch statement
  - the conditional operator
  - the do loop
  - the for loop

Copyright © 2017 Pearson Education, Inc.

Outline

Copyright © 2017 Pearson Education, Inc.

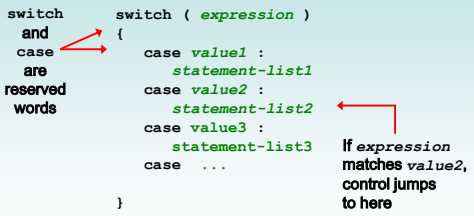
The switch Statement

- The *switch statement* provides another way to decide which statement to execute next
- The `switch` statement evaluates an expression, then attempts to match the result to one of several possible *cases*
- Each case contains a value and a list of statements
- The flow of control transfers to statement associated with the first case value that matches

Copyright © 2017 Pearson Education, Inc.

The switch Statement

- The general syntax of a `switch` statement is:



Copyright © 2017 Pearson Education, Inc.

The switch Statement

- Often a *break statement* is used as the last statement in each case's statement list
- A `break` statement causes control to transfer to the end of the `switch` statement
- If a `break` statement is not used, the flow of control will continue into the next case
- Sometimes this may be appropriate, but often we want to execute only the statements associated with one case

Copyright © 2017 Pearson Education, Inc.

The switch Statement

- An example of a switch statement:

```
switch (option)
{
   case 'A':
      aCount++;
      break;
   case 'B':
      bCount++;
      break;
   case 'C':
      cCount++;
      break;
}
```

Copyright © 2017 Pearson Education, Inc.

The switch Statement

- A `switch` statement can have an optional *default case*
- The default case has no associated value and simply uses the reserved word `default`
- If the default case is present, control will transfer to it if no other case value matches
- If there is no default case, and no other value matches, control falls through to the statement after the switch

Copyright © 2017 Pearson Education, Inc.

The switch Statement

- The type of a switch expression must be integers, characters, or enumerated types
- As of Java 7, a switch can also be used with strings
- You cannot use a switch with floating point values
- The implicit boolean condition in a `switch` statement is equality
- You cannot perform relational checks with a `switch` statement
- See `GradeReport.java`

Copyright © 2017 Pearson Education, Inc.

```
//********************************************************************
//  GradeReport.java       Author: Lewis/Loftus
//
//  Demonstrates the use of a switch statement.
//********************************************************************

import java.util.Scanner;

public class GradeReport
{
   //-----------------------------------------------------------------
   //  Reads a grade from the user and prints comments accordingly.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      int grade, category;

      Scanner scan = new Scanner(System.in);

      System.out.print("Enter a numeric grade (0 to 100): ");
      grade = scan.nextInt();

      category = grade / 10;

      System.out.print("That grade is ");
```

continue

Copyright © 2017 Pearson Education, Inc.

continue

```
      switch (category)
      {
         case 10:
            System.out.println("a perfect score. Well done.");
            break;
         case 9:
            System.out.println("well above average. Excellent.");
            break;
         case 8:
            System.out.println("above average. Nice job.");
            break;
         case 7:
            System.out.println("average.");
            break;
         case 6:
            System.out.println("below average. You should see the");
            System.out.println("instructor to clarify the material "
                               + "presented in class.");
            break;
         default:
            System.out.println("not passing.");
      }
   }
}
```

Copyright © 2017 Pearson Education, Inc.

continue

Sample Run

```
Enter a numeric grade (0 to 100): 91
That grade is well above average. Excellent.
```

Copyright © 2017 Pearson Education, Inc.

Outline

- The `switch` Statement
- **The Conditional Operator**
- The `do` Statement
- The `for` Statement

Copyright © 2017 Pearson Education, Inc.

The Conditional Operator

- The *conditional operator* evaluates to one of two expressions based on a boolean condition
- Its syntax is:

```
condition ? expression1 : expression2
```

- If the ***condition*** is true, ***expression1*** is evaluated; if it is false, ***expression2*** is evaluated
- The value of the entire conditional operator is the value of the selected expression

Copyright © 2017 Pearson Education, Inc.

The Conditional Operator

- The conditional operator is similar to an `if-else` statement, except that it is an expression that returns a value
- For example:

```
larger = ((num1 > num2) ? num1 : num2);
```

- If `num1` is greater than `num2`, then `num1` is assigned to `larger`; otherwise, `num2` is assigned to `larger`
- The conditional operator is *ternary* because it requires three operands

Copyright © 2017 Pearson Education, Inc.

The Conditional Operator

- Another example:

```
System.out.println("Your change is " + count +
   ((count == 1) ? "Dime" : "Dimes"));
```

- If `count` equals 1, the "Dime" is printed
- If `count` is anything other than 1, then "Dimes" is printed

Copyright © 2017 Pearson Education, Inc.

Quick Check

Express the following logic in a succinct manner using the conditional operator.

```
if (val <= 10)
   System.out.println("It is not greater than 10.");
else
   System.out.println("It is greater than 10.");
```

```
System.out.println("It is" +
   ((val <= 10) ? " not" : "") +
   " greater than 10.");
```

Copyright © 2017 Pearson Education, Inc.

Outline

Copyright © 2017 Pearson Education, Inc.

The do Statement

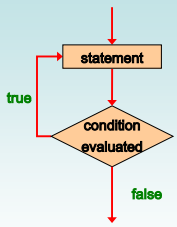
- A *do statement* has the following syntax:

```
do
{
   statement-list;
}
while (condition);
```

- The **statement-list** is executed once initially, and then the **condition** is evaluated
- The statement is executed repeatedly until the condition becomes false

Copyright © 2017 Pearson Education, Inc.

Logic of a do Loop



Copyright © 2017 Pearson Education, Inc.

The do Statement

- An example of a `do` loop:

```
int count = 0;
do
{
   count++;
   System.out.println(count);
} while (count < 5);
```

- The body of a `do` loop executes at least once
- See `ReverseNumber.java`

Copyright © 2017 Pearson Education, Inc.

```
//********************************************************************
//  ReverseNumber.java       Author: Lewis/Loftus
//
//  Demonstrates the use of a do loop.
//********************************************************************

import java.util.Scanner;

public class ReverseNumber
{
   //-----------------------------------------------------------------
   //  Reverses the digits of an integer mathematically.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      int number, lastDigit, reverse = 0;

      Scanner scan = new Scanner(System.in);
```

continue

Copyright © 2017 Pearson Education, Inc.

continue

```
      System.out.print("Enter a positive integer: ");
      number = scan.nextInt();

      do
      {
         lastDigit = number % 10;
         reverse = (reverse * 10) + lastDigit;
         number = number / 10;
      }
      while (number > 0);

      System.out.println("That number reversed is " + reverse);
   }
}
```

Copyright © 2017 Pearson Education, Inc.

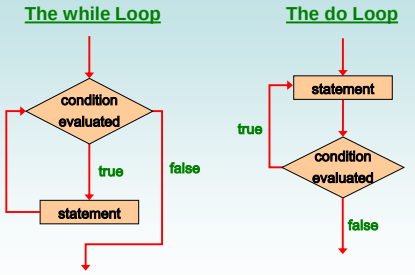
continue

Sample Run

```
Enter a positive integer: 2896
That number reversed is 6982
```

Copyright © 2017 Pearson Education, Inc.

Comparing while and do



Copyright © 2017 Pearson Education, Inc.

Outline

- The `switch` Statement
- The Conditional Operator
- The `do` Statement
- ⇨ The `for` Statement

Copyright © 2017 Pearson Education, Inc.

The for Statement

- A *for statement* has the following syntax:

The *initialization* is executed once before the loop begins

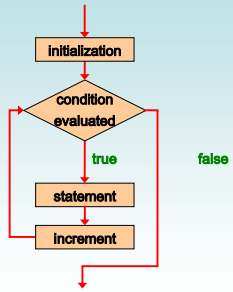
The *statement* is executed until the *condition* becomes false

```
for ( initialization ; condition ; increment )
   statement;
```

The *increment* portion is executed at the end of each iteration

Copyright © 2017 Pearson Education, Inc.

Logic of a for loop



Copyright © 2017 Pearson Education, Inc.

The for Statement

- A `for` loop is functionally equivalent to the following `while` loop structure:

```
initialization;
while ( condition )
{
   statement;
   increment;
}
```

Copyright © 2017 Pearson Education, Inc.

The for Statement

- An example of a `for` loop:

```
for (int count=1; count <= 5; count++)
   System.out.println(count);
```

- The initialization section can be used to declare a variable
- Like a `while` loop, the condition of a `for` loop is tested prior to executing the loop body
- Therefore, the body of a `for` loop will execute zero or more times

Copyright © 2017 Pearson Education, Inc.

The for Statement

- The increment section can perform any calculation:

```
for (int num=100; num > 0; num -= 5)
   System.out.println(num);
```

- A `for` loop is well suited for executing statements a specific number of times that can be calculated or determined in advance
- See `Multiples.java`
- See `Stars.java`

Copyright © 2017 Pearson Education, Inc.

```
//********************************************************************
//  Multiples.java       Author: Lewis/Loftus
//
//  Demonstrates the use of a for loop.
//********************************************************************

import java.util.Scanner;

public class Multiples
{
   //-----------------------------------------------------------------
   //  Prints multiples of a user-specified number up to a user-
   //  specified limit.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      final int PER_LINE = 5;
      int value, limit, mult, count = 0;

      Scanner scan = new Scanner(System.in);

      System.out.print("Enter a positive value: ");
      value = scan.nextInt();
```

continue

Copyright © 2017 Pearson Education, Inc.

continue

```
      System.out.print("Enter an upper limit: ");
      limit = scan.nextInt();

      System.out.println();
      System.out.println("The multiples of " + value + " between " +
                         value + " and " + limit + " (inclusive) are:");

      for (mult = value; mult <= limit; mult += value)
      {
         System.out.print(mult + "\t");

         // Print a specific number of values per line of output
         count++;
         if (count % PER_LINE == 0)
            System.out.println();
      }
   }
}
```

Copyright © 2017 Pearson Education, Inc.

Sample Run

```
Enter a positive value: 7
Enter an upper limit: 400

The multiples of 7 between 7 and 400 (inclusive) are:
7       14      21      28      35
42      49      56      63      70
77      84      91      98      105
112     119     126     133     140
147     154     161     168     175
182     189     196     203     210
217     224     231     238     245
252     259     266     273     280
287     294     301     308     315
322     329     336     343     350
357     364     371     378     385
392     399
```

Copyright © 2017 Pearson Education, Inc.

```
//********************************************************************
//  Stars.java       Author: Lewis/Loftus
//
//  Demonstrates the use of nested for loops.
//********************************************************************

public class Stars
{
   //-----------------------------------------------------------------
   //  Prints a triangle shape using asterisk (star) characters.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      final int MAX_ROWS = 10;

      for (int row = 1; row <= MAX_ROWS; row++)
      {
         for (int star = 1; star <= row; star++)
            System.out.print("*");

         System.out.println();
      }
   }
}
```

Copyright © 2017 Pearson Education, Inc.

Output

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

Copyright © 2017 Pearson Education, Inc.

Quick Check

Write a code fragment that rolls a die 100 times and counts the number of times a 3 comes up.

```
Die die = new Die();
int count = 0;
for (int num=1; num <= 100; num++)
   if (die.roll() == 3)
      count++;
Sytem.out.println(count);
```

Copyright © 2017 Pearson Education, Inc.

The for Statement

- Each expression in the header of a `for` loop is optional
- If the initialization is left out, no initialization is performed
- If the condition is left out, it is always considered to be true, and therefore creates an infinite loop
- If the increment is left out, no increment operation is performed

Copyright © 2017 Pearson Education, Inc.

For-each Loops

- A variant of the `for` loop simplifies the repetitive processing of items in an iterator
- For example, suppose `bookList` is an `ArrayList<Book>` object
- The following loop will print each book:

```
for (Book myBook : bookList)
   System.out.println(myBook);
```

- This version of a for loop is often called a *for-each loop*

Copyright © 2017 Pearson Education, Inc.

For-each Loops

- A for-each loop can be used on any object that implements the `Iterable` interface
- It eliminates the need to retrieve an iterator and call the `hasNext` and `next` methods explicitly
- It also will be helpful when processing arrays, which are discussed in Chapter 8

Copyright © 2017 Pearson Education, Inc.

Quick Check

Write a for-each loop that prints all of the `Student` objects in an `ArrayList<Student>` object called `roster`.

```
for (Student student : roster)
   System.out.println(student);
```

Copyright © 2017 Pearson Education, Inc.

Summary

- Chapter 6 focused on:
  - the switch statement
  - the conditional operator
  - the do loop
  - the for loop

Copyright © 2017 Pearson Education, Inc.