Chapter 8

What Java Does (and When)

In This Chapter

- Making decisions with Java statements
- Repeating actions with Java statements

Human thought centers around nouns and verbs. Nouns are the "stuff," and verbs are the stuff's actions. Nouns are the pieces, and verbs are the glue. Nouns are, and verbs do. When you use nouns, you say "book," "room," or "stuff." When you use verbs, you say "do this," "do that," "tote that barge," or "lift that bale."

Java also has nouns and verbs. Java's nouns include `int`, `JOptionPane`, and `String`, along with Android-specific terms such as `Activity`, `Application`, and `Bundle`. Java's verbs involve assigning values, choosing among alternatives, repeating actions, and taking other courses of action.

This chapter covers some of Java's verbs. (In the next chapter, I bring in the nouns.)

Making Decisions

When you're writing computer programs, you're continually hitting forks in roads. Did the user type the correct password? If the answer is yes, let the user work; if it's no, kick the bum out. The Java programming language needs a way to make a program branch in one of two directions. Fortunately, the language has a way: It's the `if` statement. The use of the `if` statement is illustrated in Listing 8-1.

Listing 8-1: Using an if Statement

```
package com.allmycode.tickets;

import javax.swing.JOptionPane;

public class TicketPrice {

  public static void main(String[] args) {
    String ageString;
    int age;
    String specialShowingString;
    String price;

    ageString = JOptionPane.showInputDialog("Age?");
    age = Integer.parseInt(ageString);

    specialShowingString = JOptionPane.showInputDialog
        ("Special showing (y/n)?");

    if ((age < 18 || 65 <= age) &&
        specialShowingString.equals("n")) {
      price = "$7.00";
    } else {
      price = "$10.00";
    }

    JOptionPane.showMessageDialog(null,
        price, "Ticket price",
        JOptionPane.INFORMATION_MESSAGE);
  }

}
```

Listing 8-1 revives a question that I pose originally in Chapter 6: How much should a person pay for a movie ticket? Most people pay $10. But when the movie has no special showings, youngsters (under 18) and seniors (65 and older) pay only $7.

In Listing 8-1, a Java `if` statement determines a person's eligibility for the discounted ticket. If this condition is true:

```
(age < 18 || 65 <= age) && specialShowingString.
          equals("n")
```

the `price` becomes `"$7.00"`; otherwise, the `price` becomes `"$10.00"`. In either case, the code displays the `price` in a message box. (See Figure 8-1.)

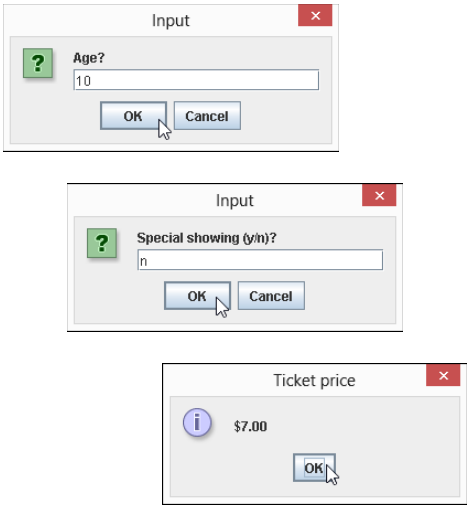


Figure 8-1: Checking the ticket price.

Testing for equality

Java has several ways to test for equality: "Is this value the same as that value?" None of these ways is the first one you'd consider. In particular, to find out whether someone's age is 35, you *don't* write `if (age = 35)`. Instead, you use a double equal sign (==): `if (age == 35)`. In Java, the single equal sign (=) is reserved for *assignment*. So `age = 35` means "Let `age` stand for the value `35`", and `age == 35` means "True or false: Does `age` stand for the value `35`?"

Comparing two strings is a different story. When you compare two strings, you don't use the double equal sign. Using it would ask a question that's usually not what you want to ask: "Is this string stored in exactly the same place in memory as that other string?" Instead, you usually ask, "Does this string have the same characters in it as that other string?" To ask the second question (the more appropriate one), use Java's `equals` method. To call this `equals` method, follow one of the two strings with a dot and the word `equals`, and then with a parameter list containing the other string:

```
if (specialShowingString.equals("n")) {
```

The `equals` method compares two strings to see whether they have the same characters in them. In this paragraph's tiny example, the variable `specialShowingString` refers to a string, and the text `"n"` refers to a string. The condition `specialShowingString.equals("n")` is true if `specialShowingString` refers to a string whose only character is the letter `n`.

Java if statements

An `if` statement has this form:

```
if (condition) {
    statements to be executed when the condition is true
} else {
    statements to be executed when the condition is false
}
```

In Listing 8-1, the condition being tested is

```
(age < 18 || 65 <= age) &&
specialShowingString.equals("n")
```

The condition is either `true` or `false` — `true` for youngsters and seniors when there's no special showing and `false` otherwise.

Conditions in if statements

The condition in an `if` statement must be enclosed in parentheses. The condition must be a `boolean` expression — an expression whose value is either `true` or `false`. For example, the following condition is okay:

```
if (numberOfTries < 17) {
```

But the strange kind of condition that you can use in other (non-Java) languages — languages such as C++ — is not okay:

```
if (17) { //This is incorrect.
```

See Chapter 6 for information about Java's primitive types, including the `boolean` type.

Omitting braces

You can omit an `if` statement's curly braces when only one statement appears between the condition and the word `else`. You can also omit braces when only one statement appears after the word `else`. For example, the following chunk of code is right and proper:

```
if ((age < 18 || 65 <= age) &&
    specialShowingString.equals("n"))
  price = "$7.00";
else
  price = "$10.00";
```

The code is correct because only one statement (`price = "$7.00"`) appears between the condition and the `else`, and only one statement (`price = "$10.00"`) appears after the word `else`.

An `if` statement can also enjoy a full and happy life without an `else` part. The following example contains a complete `if` statement:

```
price = "$10.00";
if ((age < 18 || 65 <= age) &&
    specialShowingString.equals("n"))
  price = "$7.00";
```

Compound statements

An `if` statement is one of Java's *compound* statements because an `if` statement normally contains other Java statements. For example, the `if` statement in Listing 8-1 contains the assignment statement `price = "$7.00"` and the other assignment statement contains `price = "$10.00"`.

A compound statement might even contain other compound statements. In this example:

```
price = "$10.00";
if (age < 18 || 65 <= age) {
  if (specialShowingString.equals("n")) {
    price = "$7.00";
  }
}
```

one `if` statement (with the condition `age < 18 || 65 <= age`) contains another `if` statement (with the condition `specialShowingString.equals("n")`).

A detour concerning Android screen densities

A device's *screen density* is the number of pixels squeezed into each inch of the screen. Older devices and less expensive devices have low screen densities, and newer, more expensive devices compete to have increasingly higher screen densities.

Android supports a wide range of screen densities. It also goes to the trouble of grouping the densities, as I show in Table 8-1.

Table 8-1 Android Screen Densities

Name	*Acronym*	*Approximate* Number of Dots per Inch (dpi)*	*Fraction of the Default Density*
DENSITY_LOW	ldpi	120	¾
DENSITY_MEDIUM	mdpi	160	1
DENSITY_HIGH	hdpi	240	1½
DENSITY_XHIGH	xhdpi	320	2
DENSITY_XXHIGH	xxhdpi	480	3

** When the screen density of a device doesn't match a number in Column 3 of Table 8-1, Android does its best with the existing categories. For example, Android classifies density 265 dpi in the hdpi group.*

Fun facts: DENSITY_XHIGH is the same as 1080p high-definition television in the United States. A seldom-used Android density, DENSITY_TV with 213 dpi, represents 720p television.

Screen densities can make a big difference. An image that looks good on a low-density screen might look choppy on a high-density screen. And an image designed for a high-density screen might be much too large for a low-density screen. That's why, when you create a new application, Android offers to create several different icons for your app. (See Figure 8-2. And I'm sorry, Paul — it's another cat picture!)

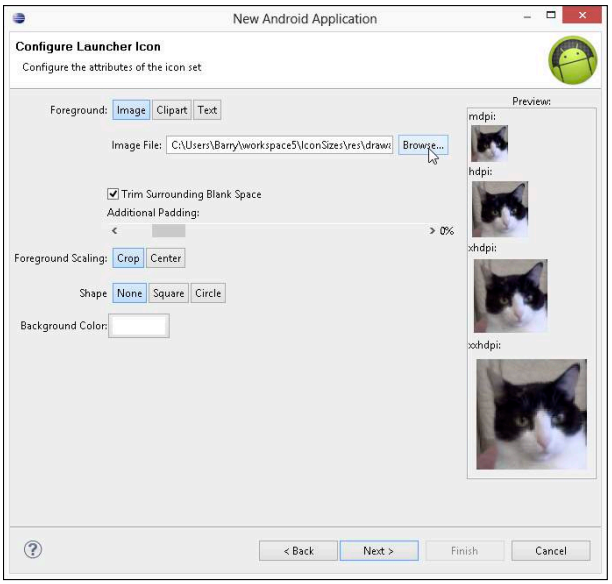


Figure 8-2: One icon; many sizes.

Choosing among many alternatives

A Java `if` statement creates a fork in the road: The computer chooses between two alternatives. But some problems lend themselves to forks with many prongs. What's the best way to decide among five or six alternative actions?

For me, multipronged forks are scary. In my daily life, I hate making decisions. (If a problem crops up, I would rather have it be someone else's fault.) So, writing the previous sections (on making decisions with Java's `if` statement) knocked the stuffing right out of me. That's why my mind boggles as I begin this section on choosing among many alternatives.

To prepare for this section's example, I created the four icons shown in Figure 8-2. The icons are for four of the densities depicted in Table 8-1. I have a medium-density icon, a high-density icon, an extra-high-density icon, and an extra-extra-high-density icon.

I named each icon `cat.png` and placed the four icons into four different folders. I added a fifth folder for the `ic_dialog_alert.png` icon, as shown in Figure 8-3.

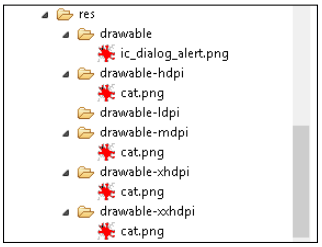


Figure 8-3: Folders containing images.

The folder structure matches the one you'd see in an Android app. To keep the example simple, I created a plain, old Java program to display the icons. The program is shown in Listing 8-2.

Listing 8-2: Switching from One Icon to Another

```
package com.allmycode.icons;

import javax.swing.ImageIcon;
import javax.swing.JOptionPane;

public class ShowIcons {

  public static void main(String[] args) {
    String densityCodeString = JOptionPane
```

(continued)

Listing 8-2 *(continued)*

```
        .showInputDialog("Density?");

    int densityCode =
        Integer.parseInt(densityCodeString);
    String iconFileName = null, message = null;

    switch (densityCode) {
    case 160:
      iconFileName = "res/drawable-mdpi/cat.png";
      message = "mdpi";
      break;
    case 240:
      iconFileName = "res/drawable-hdpi/cat.png";
      message = "hdpi";
      break;
    case 320:
      iconFileName = "res/drawable-xhdpi/cat.png";
      message = "xhdpi";
      break;
    case 480:
      iconFileName = "res/drawable-xxhdpi/cat.png";
      message = "xxhdpi";
      break;
    default:
      iconFileName = "res/drawable/ic_dialog_alert.png";
      message =  "No suitable icon";
      break;
    }

    ImageIcon icon = new ImageIcon(iconFileName);
    JOptionPane.showMessageDialog(null, message,
        "Icon", JOptionPane.INFORMATION_MESSAGE, icon);
  }
}
```

The code in Listing 8-2 is a standard Oracle Java program. The code illustrates some ideas about Android screen densities, but the program is *not* an Android application. This program can't run on an Android device. In Chapter 10, I begin building some examples that run on Android devices.

In Listing 8-2, the program asks the user to enter a screen-density value. If the user types 160, for example, the program responds by displaying my medium-density icon (the image in the `cat.png` file in my `res/drawable-mdpi` directory). Two runs of the program are shown in Figure 8-4.

Why the medium-density icon? The program enters the `switch` statement in Listing 8-2. The `switch` statement contains an expression (the value of `densityCode`). The `switch` statement also contains `case` clauses, followed

(optionally) by a `default` clause. The program compares the value of `densityCode` with `160` (the number in the first of the `case` clauses). If the value of `densityCode` is equal to `160`, the program executes the statements after the words `case 160`.

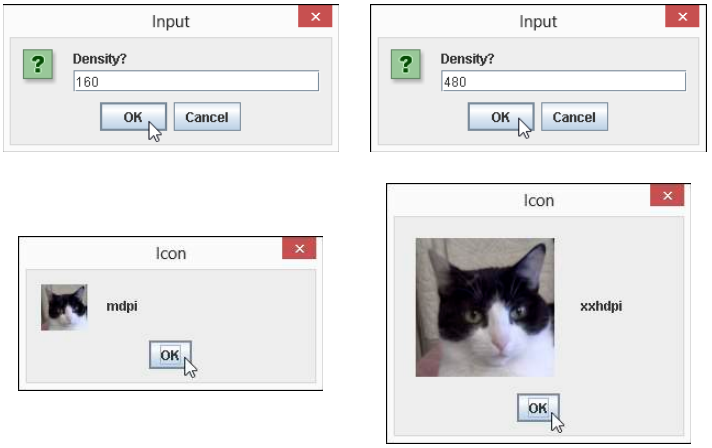


Figure 8-4: Running the code shown in Listing 8-2.

In Listing 8-2, the statements after `case 160` are

```
iconFileName = "res/drawable-mdpi/cat.png";
message = "mdpi";
break;
```

The first two statements set the values of `iconFileName` and `message` in preparation for the display of a message box. The third statement (the `break` statement) jumps out of the entire `switch` statement, skipping past all the other `case` clauses and past the `default` clause to get to the last part of the program.

After the `switch` statement, the statement

```
ImageIcon icon = new ImageIcon(iconFileName);
```

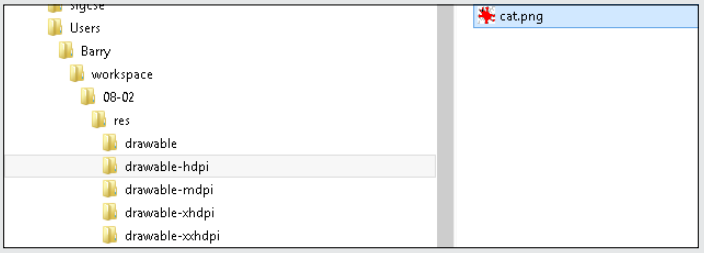
creates a new `icon` variable to refer to the image in the `iconFileName` file. (I have more to say about this kind of statement in Chapter 9.) Finally, the statement

```
JOptionPane.showMessageDialog(null, message,
    "Icon", JOptionPane.INFORMATION_MESSAGE, icon);
```

displays the `icon` image in a message box on the user's screen. (Refer to Figure 8-4.)

A simple slash?

Both the Windows and Macintosh operating systems have directories (also known as *folders*), and these directories may contain subdirectories, which in turn may contain their own subdirectories. At the bottom of the food chain is the humble file containing a document, an image, a sound, or whatever. On my Windows computer, one of my `cat.png` files lives in a directory named `drawable-hdpi`, which is inside a directory named `res`, which is inside an Eclipse project directory named `08-02`. The Eclipse project directory is inside my Eclipse `workspace` directory, which in turn is inside my `Barry` directory, which is inside my `Users` directory, as shown in the sidebar figure. It's a long chain of stuff leading eventually to a picture of a cat.



When you're visiting Times Square in New York City, you can say, "I'm walking to the McDonald's on 34th Street." You don't have to say "I'm walking to the McDonald's on 34th Street in New York City, USA." In a similar way, my code doesn't have to refer to the `cat.png` file by naming a whole bunch of directories and subdirectories. Instead, I can take advantage of the fact that Listing 08-02 is in my `08-02` directory. From the viewpoint of the `08-02` directory, I can refer directly to the `res` directory, which is contained immediately inside the `08-02` directory. In both the Windows and Macintosh operating system, I can use the forward slash character (`/`) to point from the `08-02` directory to my cat picture:

```
res/drawable-hdpi/cat.png
```

In Windows, the forward slash works in many directory-and-file situations. But the backslash (`\`) is used more commonly than the forward slash in Windows. So in Windows, I usually refer to my cat picture this way:

```
res\drawable-hdpi\cat.png
```

But there's a problem. In a Java string, a single backslash (`\`) has a special meaning. That special meaning depends on whatever character appears immediately after the backslash. For example, `\n` stands for "Go to a new line," `\t` stands for "Go to the next tab stop," and `\\` stands for "A single backslash." In Listing 8-2, a double-quoted string such as `"res\\drawable-mdpi\\cat.png"` stands for `res\drawable-mdpi\cat.png`. To the Windows operating system, this double-backslash business is another way to refer to the `cat.png` file that's in the `drawable-mdpi` subdirectory of the `res` directory.

Once again, if you're a Mac user, you use a forward slash (`/`) to separate directory names, and a forward slash has no special meaning inside a Java string. Mac users don't have to worry about doubling up on slashes.

Take a break

This news might surprise you: The end of a `case` clause (the beginning of another `case` clause) doesn't automatically make the program jump out of the `switch` statement. If you forget to add a `break` statement at the end of a `case` clause, the program finishes the statements in the `case` clause *and then continues executing the statements in the next* `case` *clause*. Imagine that I write the following code (and omit a `break` statement):

```
switch (densityCode) {
case 160:
  iconFileName = "res/drawable-mdpi/cat.png";
  message = "mdpi";
case 240:
  iconFileName = "res/drawable-hdpi/cat.png";
  message = "hdpi";
  break;
... Etc.
```

With this modified code (and with `densityCode` equal to 160), the program sets `iconFileName` to `"res/drawable-mdpi/cat.png"`, sets `message` to `"mdpi"`, sets `iconFileName` to `"res/drawable-hdpi/cat.png"`, sets `message` to `"hdpi"`, and, finally, breaks out of the `switch` statement (skipping past all other `case` clauses and the `default` clause). The result is that `iconFileName` has the value `"res/drawable-hdpi/cat.png"` (not `"res/drawable-mdpi/cat.png"`) and that `message` has the value `"hdpi"` (not `"mdpi"`).

This phenomenon of jumping from one `case` clause to another in the absence of a `break` statement) is called *fall-through,* and, occasionally, it's useful. Imagine a dice game in which 7 and 11 are instant wins; 2, 3, and 12 are instant losses; and any other number (from 4 to 10) tells you to continue playing. The code for such a game might look like this:

```
switch (roll) {
case 7:
case 11:
  message = "win";
  break;
case 2:
case 3:
case 12:
  message = "lose";
  break;
case 4:
case 5:
case 6:
case 8:
case 9:
```

```
case 10:
  message = "continue";
  break;
default:
  message = "not a valid dice roll";
  break;
}
```

If you roll a 7, you execute all the statements immediately after `case 7` (of which there are none), and then you fall-through to `case 11`, executing the statement that assigns `"win"` to the variable `message`.

Every beginning Java programmer forgets to put a `break` statement at the end of a `case` clause. When you make this mistake, don't beat yourself up about it. Just remember what's causing your program's unexpected behavior, add `break` statements to your code, and move on. As you gain experience in writing Java programs, you'll make this mistake less and less frequently. (You'll still make the mistake occasionally, but not as often.)

The computer selects a case clause

When you run the code in Listing 8-2, the user doesn't have to enter the number 160. If the user enters 320, the program skips past the statements in the `case 160` clause and then skips past the statements in the `240 clause`. The program hits pay dirt when it reaches the `case 320` clause, and executes that clause's statements, making `iconFileName` be `"res/drawable-xhdpi/cat.png"` and making `message` be `xhdpi`. The `case` clause's `break` statement makes the program skip the rest of the stuff in the `switch` statement.

The default clause

A `switch` statement's optional `default` clause is a catchall for values that don't match any of the `case` clauses' values. For example, if you run the program and the user enters the number 265, the program doesn't fix on any of the `case` clauses. (To select a `switch` statement's `case` clause, the value after the word `switch` has to be an exact match of the value after the word `case`.) So if `densityCode` is 265, the program skips past all the `case` clauses and executes the code in the `default` clause, making `iconFileName` be `"res/drawable/ic_dialog_alert.png"` and making `message` be `"No suitable icon"`. In this way, the program in Listing 8-2 doesn't mirror Android's screen-resolution tricks. (Android uses an existing icon even if the screen's density doesn't exactly match one of the numbers 160, 240, 320, or 480.)

The last `break` statement in Listing 8-2 tells the computer to jump to the end of the `switch` statement, skipping any statements after the `default` clause. But look again. Nothing comes after the `default` clause in the `switch` statement! Which statements are being skipped? The answer is none. I put a `break` at the end of the `default` clause for good measure. This extra `break` statement doesn't do anything, but it doesn't do any harm, either.

Some formalities concerning Java switch statements

A `switch` statement has the following form:

```
switch (expression) {
case constant1:
    statements to be executed when the
    expression has value contstant1
case constant2:
    statements to be executed when the
    expression has value contstant2
case ...

default:
    statements to be executed when the
    expression has a value different from
    any of the constants
}
```

You can't put any old expression in a `switch` statement. The expression that's tested at the start of a `switch` statement must have one of these elements:

- A primitive type: `char`, `byte`, `short`, or `int`
- A reference type: `Character`, `Byte`, `Short`, or `Integer`
- An `enum` type

An `enum` type is a type whose values are limited to the few that you declare. For example, the line

```
enum TrafficSignal {GREEN, YELLOW, RED};
```

defines a type whose only values are `GREEN`, `YELLOW`, and `RED`. Elsewhere in your code, you can write

```
TrafficSignal signal;
signal = TrafficSignal.GREEN;
```

to make use of the `TrafficSignal` type.

Starting with Java 7, you can put a `String` type expression at the start of a `switch` statement. But the last time I checked, Java 5 or 6 is required for developing Android code. You can't use Java 7 or later to create an Android app. So with `densityCodeString` declared to be of type `String`, you can't create a `switch` statement whose first line is `switch (displayCodeString)`, and you can't have a `case` clause that begins with `case "hdpi"`.

Repeating Instructions Over and Over Again

In 1966, the company that brings you Head & Shoulders shampoo made history. On the back of the bottle, the directions for using the shampoo read, "Lather, rinse, repeat." Never before had a complete set of directions (for doing anything, let alone shampooing hair) been summarized so succinctly. People in the direction-writing business hailed it as a monumental achievement. Directions like these stood in stark contrast to others of the time. (For instance, the first sentence on a can of bug spray read, "Turn this can so that it points away from your face." Duh!)

Aside from their brevity, the characteristic that made the Head & Shoulders directions so cool was that, with three simple words, they managed to capture a notion that's at the heart of all instruction-giving: repetition. That last word, *repeat,* turned an otherwise bland instructional drone into a sophisticated recipe for action.

The fundamental idea is that when you're following directions, you don't just follow one instruction after another. Instead, you make turns in the road. You make decisions ("If HAIR IS DRY, then USE CONDITIONER,") and you repeat steps ("LATHER-RINSE, and then LATHER-RINSE again."). In application development, you use decision-making and repetition all the time.

Check, and then repeat

The program in Listing 8-2 is nice (if I say so myself). But the program has its flaws. I expect the user to type a number and for things to go wrong if the user doesn't type a number, as shown in Figure 8-5. The program doesn't even like numbers with decimal points.

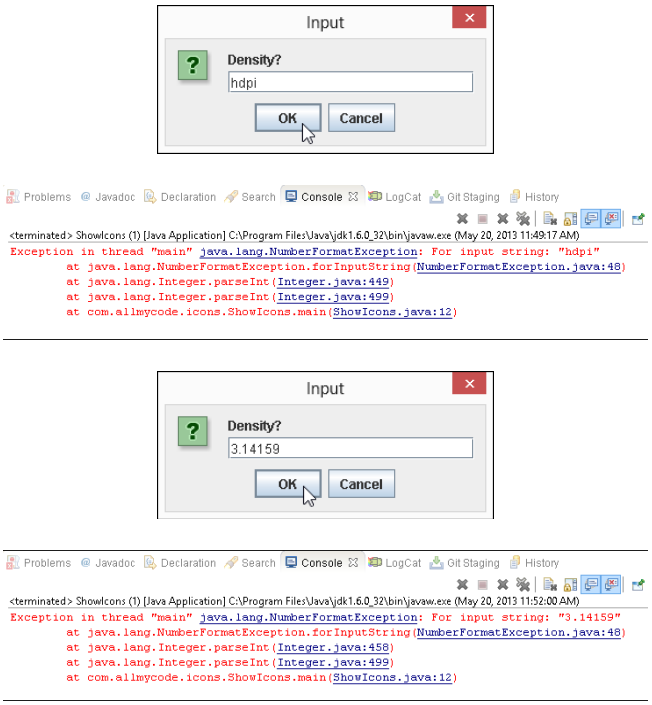


Figure 8-5: My program wants integers!

You should anticipate all kinds of user input. To do that, you have several alternatives. One thing you can do is to dismiss bad input and ask the user for better input — so you might have to repeat your input request over and over again. Listing 8-3 shows you one way to do it.

Listing 8-3: Look Before You Leap

```
package com.allmycode.icons;

import javax.swing.ImageIcon;
import javax.swing.JOptionPane;

public class ShowIconsWithWhile {

  public static void main(String[] args) {
    String densityCodeString =
        JOptionPane.showInputDialog("Density?");

    while ( !densityCodeString.equals("160") &&
            !densityCodeString.equals("240") &&
            !densityCodeString.equals("320") &&
            !densityCodeString.equals("480")    ) {

        densityCodeString = JOptionPane
          .showInputDialog("Invalid input. Try again:");

    }

    int densityCode =
        Integer.parseInt(densityCodeString);
    String iconFileName = null, message = null;

    switch (densityCode) {
    case 160:
      iconFileName = „res/drawable-mdpi/cat.png";
      message = „mdpi";
      break;
    case 240:
      iconFileName = „res/drawable-hdpi/cat.png";
      message = „hdpi";
      break;
    case 320:
      iconFileName = „res/drawable-xhdpi/cat.png";
      message = „xhdpi";
      break;
    case 480:
      iconFileName = „res/drawable-xxhdpi/cat.png";
      message = „xxhdpi";
      break;
    default:
      iconFileName = „res/drawable/ic_dialog_alert.png";
      message =  „No suitable icon";
      break;
    }

    ImageIcon icon = new ImageIcon(iconFileName);
    JOptionPane.showMessageDialog(null, message,
        „Icon", JOptionPane.INFORMATION_MESSAGE, icon);
  }
}
```

A run of the code in Listing 8-3 is shown in Figure 8-6.

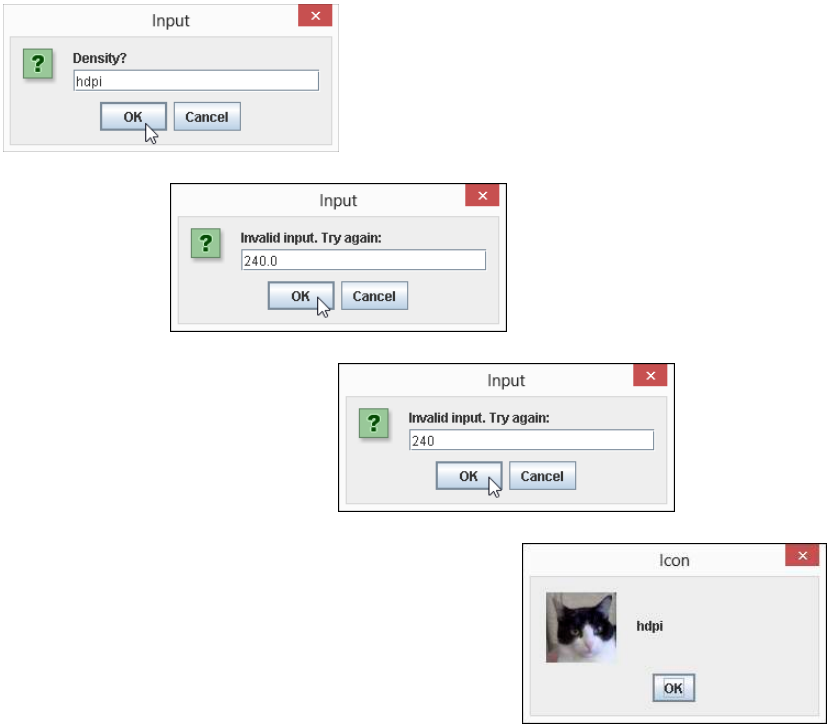


Figure 8-6: Try, try, try again.

The code in Listing 8-3 begins by displaying an input dialog box with the `"Density?"` message. If the user responds with a value other than 160, 240, 320, or 480, the code dives into its `while` statement, displaying the message `"Invalid input. Try again:"` in the input dialog box over and over again. The code continues displaying this input dialog box until the user responds with one of the four valid values — 160, 240, 320, or 480.

In plain language, the `while` statement in Listing 8-3 says:

```
while ( densityCodeString isn't 160 and
        densityCodeString isn't 240 and
        densityCodeString isn't 320 and
        densityCodeString isn't 480     ) {

  get a value for the densityCodeString

}
```

In even plainer language, the `while` statement says:

```
while ( densityCodeString isn't acceptable ) {

  get a value for the densityCodeString

}
```

The `while` statement is one of Java's compound statements. It's also one of Java's *looping* statements because, when executing a `while` statement, the computer can go into a loop, spinning around and around, executing a certain chunk of code over and over again.

In a looping statement, each go-around is an *iteration*.

If you stare at Listing 8-3, you might notice this peculiarity: The `while` statement at the top of the program ensures that the density is either 160, 240, 320, or 480. But toward the end of the program, the `switch` statement's `default` clause provides for the possibility that the density isn't one of those 160, 240, 320, or 480 values. What gives? The answer is that it never hurts to double-check. You may think that your `while` statement can spit out only 160, 240, 320, or 480, but you might have forgotten about an unusual scenario that causes the density to be another, strange number. And what happens if another developer (someone trying to improve on your code) messes with your `while` statement and lets bad density values trickle over to the `switch` statement? Adding a `default` clause to a `switch` statement is never costly, and the `default` clause always adds an extra layer of protection from errors.

Some formalities concerning Java while statements

A `while` statement has this form:

```
while (condition) {
    statements inside the loop
}
```

The computer repeats the *statements inside the loop* over and over again as long as the condition in parentheses is true:

```
Check to make sure that the condition is true;
Execute the statements inside the loop.

Check again to make sure that the condition is true;
Execute the statements inside the loop.

Check again to make sure that the condition is true;
Execute the statements inside the loop.

And so on.
```

At some point, the `while` statement's condition becomes false. (Generally, this happens because one of the statements in the loop changes one of the program's values.) When the condition becomes false, the computer stops repeating the statements in the loop. (That is, the computer stops *iterating*.) Instead, the computer executes whatever statements appear immediately after the end of the `while` statement:

```
Check again to make sure that the condition is true;
Execute the statements inside the loop.

Check again to make sure that the condition is true;
Execute the statements inside the loop.

Check again to make sure that the condition is true;
Oops! The condition is no longer true!
Execute the code immediately after the while statement.
```

In Listing 8-3, the code

```
int densityCode =
    Integer.parseInt(densityCodeString);
```

comes immediately after the end of the `while` statement.

Variations on a theme

Many of the `if` statement's tricks apply to `while` statements as well. A `while` statement is a compound statement, so it might contain other compound statements. And when a `while` statement contains only one statement, you can omit curly braces. So the following code is equivalent to the `while` statement in Listing 8-3:

```
while ( !densityCodeString.equals("160") &&
        !densityCodeString.equals("240") &&
        !densityCodeString.equals("320") &&
        !densityCodeString.equals("480")    )

  densityCodeString = JOptionPane
    .showInputDialog("Density?");
```

After all, the code

```
  densityCodeString = JOptionPane
    .showInputDialog("Density?");
```

is only one (admittedly large) assignment statement.

A `while` statement's condition might become false in the middle of an iteration, before all the iteration's statements have been executed. When this happens, the computer doesn't stop the iteration dead in its tracks. Instead, the computer executes the rest of the loop's statements. After executing the rest of the loop's statements, the computer checks the condition (finding the condition to be false) and marches on to whatever code comes immediately after the `while` statement.

The previous icon should come with some fine print. To be painfully accurate, I should point out a few ways for you to stop abruptly in the middle of a loop iteration. You can execute a `break` statement to jump out of a `while` statement immediately. (It's the same `break` statement that you use in a `switch` statement.) Alternatively, you can execute a `continue` statement (the word `continue`, followed by a semicolon) to jump abruptly out of an iteration. When you jump out with a `continue` statement, the computer ends the current iteration immediately and then checks the `while` statement's condition. A true condition tells the computer to begin the next loop iteration. A false condition tells the computer to go to whatever code comes after the `while` statement.

Priming the pump

Java's `while` statement uses the policy "Look before you leap." The computer always checks a condition before executing the statements inside the loop. Among other things, this forces you to prime the loop. When you prime a loop, you create statements that affect the loop's condition before the beginning of the loop. (Think of an old-fashioned water pump and how you have to prime the pump before water comes out.) In Listing 8-3, the initialization in

```
String densityCodeString =
    JOptionPane.showInputDialog("Density?");
```

primes the loop. This initialization — the = part — gives `densityCodeString` its first value so that when you check the condition `!densityCodeString.equals("160") && ...` *Etc.* for the first time, the variable `densityCodeString` has a value that's worth comparing.

Here's something you should consider when you create a `while` statement: The computer can execute a while statement without ever executing the statements inside the loop. For example, the code in Listing 8-3 prompts the user one time before the `while` statement. If the user enters a good density value, the `while` statement's condition is false. The computer skips past the statement inside the loop and goes immediately to the code after the `while` statement. The computer never displays the `Invalid input. Try again` prompt.

Repeat, and then check

The `while` statement (which I describe in the previous section) is the workhorse of repetition in Java. Using `while` statements, you can do any kind of looping that you need to do. But sometimes it's convenient to have other kinds of looping statements. For example, occasionally you want to structure the repetition so that the first iteration takes place without checking a condition. In that situation, you use Java's `do` statement. Listing 8-4 is almost the same as Listing 8-3. But in Listing 8-4, I replace a `while` statement with a `do` statement.

Listing 8-4: Leap before You Look

```
package com.allmycode.icons;

import javax.swing.ImageIcon;
import javax.swing.JOptionPane;

public class ShowIconsWithDo {

  public static void main(String[] args) {
    String densityCodeString =
        JOptionPane.showInputDialog("Density?");

    do {

        densityCodeString = JOptionPane
          .showInputDialog("Density?");

    } while ( !densityCodeString.equals("160") &&
              !densityCodeString.equals("240") &&
              !densityCodeString.equals("320") &&
              !densityCodeString.equals("480")    );

    int densityCode =
        Integer.parseInt(densityCodeString);
    String iconFileName = null, message = null;

    switch (densityCode) {
    case 160:
      iconFileName = "res/drawable-mdpi/cat.png";
      message = "mdpi";
      break;
    case 240:
      iconFileName = "res/drawable-hdpi/cat.png";
      message = "hdpi";
      break;
    case 320:
```

(continued)

Listing 8-4 *(continued)*

```
      iconFileName = "res/drawable-xhdpi/cat.png";

      message = "xhdpi";
      break;
    case 480:
      iconFileName = "res/drawable-xxhdpi/cat.png";
      message = "xxhdpi";
      break;
    default:
      iconFileName = "res/drawable/ic_dialog_alert.png";
      message =  "No suitable icon";
      break;
    }

    ImageIcon icon = new ImageIcon(iconFileName);
    JOptionPane.showMessageDialog(null, message,
        "Icon", JOptionPane.INFORMATION_MESSAGE, icon);
  }
}
```

With a `do` statement, the computer jumps right in, takes action, and then checks a condition to see whether the result of the action is what you want. If it is, execution of the loop is done. If not, the computer goes back to the top of the loop for another go-round.

Some formalities concerning Java do statements

A `do` statement has the following form:

```
do {
    statements inside the loop
} while (condition)
```

The computer executes the *statements inside the loop* and then checks to see whether the condition in parentheses is true. If the condition in parentheses is true, the computer executes the *statements inside the loop* again. And so on.

Java's `do` statement uses the policy "Leap before you look." The statement checks a condition immediately *after* each iteration of the statements inside the loop.

A `do` statement is good for situations in which you know for sure that you should perform the loop's statements at least once. Unlike a `while` statement, a `do` statement generally doesn't need to be primed. On the downside, a `do` statement doesn't lend itself to situations in which the first occurrence of an action is slightly different from subsequent occurrences. For example, with the properly primed `while` statement in Listing 8-3, the message in the first input dialog box is `Density?` and all subsequent messages say `Invalid input. Try again`. With the `do` statement in Listing 8-4, all input dialog boxes simply say `Density?`.

Count, count, count

This section's example is a kludge.

> *kludge (klooj) n. Anything that solves a problem in an awkward way, either to fix the problem quickly or (in Chapter 8 of Java Programming For Android Developers For Dummies) to illustrate a point.*

In fact, after examining this example, you might wonder whether anyone ever uses the Java feature that's illustrated in this section. Well, this section's feature (the `for` statement) appears quite frequently in Java programs. Life is filled with examples of counting loops, and app development mirrors life — or is it the other way around? When you tell a device what to do, you're often telling it to display three lines, process ten accounts, dial a million phone numbers, or whatever.

For example, to display the first thousand rows of an Android data table, you might use this Java `for` statement:

```
cursor.moveToFirst();

for (int i = 0; i < 999; i++) {
    String _id = cursor.getString(0);
    String name = cursor.getString(1);
    String amount = cursor.getString(2);
    textViewDisplay.append(i + ": " + _id + " " +
                           name + " " + amount + "\n");
    cursor.moveToNext();
}
```

Unfortunately, examples involving Android's data tables and phone numbers can be quite complicated. Start with a simple example — one that displays icons in three different sizes. Listing 8-5 has the code.

Listing 8-5: A Loop That Counts

```
package com.allmycode.icons;

import javax.swing.ImageIcon;
import javax.swing.JOptionPane;

public class ShowIconsWithFor {

  public static void main(String[] args) {

    int densityCode;
    String iconFileName = null, message = null;

    for (int i = 1; i <= 3; i++) {
      densityCode = i * 160;

      switch (densityCode) {
      case 160:
        iconFileName = "res/drawable-mdpi/cat.png";
        message = "mdpi";
        break;
      case 240:
        iconFileName = "res/drawable-hdpi/cat.png";
        message = "hdpi";
        break;
      case 320:
        iconFileName = "res/drawable-xhdpi/cat.png";
        message = "xhdpi";
        break;
      case 480:
        iconFileName = "res/drawable-xxhdpi/cat.png";
        message = "xxhdpi";
        break;
      default:
        iconFileName = "res/drawable/ic_dialog_alert.png";
        message = "No suitable icon";
        break;
      }

      ImageIcon icon = new ImageIcon(iconFileName);
      JOptionPane.showMessageDialog(null, message,
          "Icon", JOptionPane.INFORMATION_MESSAGE, icon);
    }
  }
}
```

Listing 8-5 declares an `int` variable named `i`. The starting value of `i` is `1`. As long as the condition `i <= 3` is true, the computer executes the statements inside the loop and then executes `i++` (adding 1 to the value of `i`). After three iterations, the value of `i` gets to be `4`, in which case the condition `i <= 3` is no longer true. At that point, the program stops repeating the statements inside the loop and moves on to execute any statements that come after the `for` statement. (Ha-ha! Listing 8-5 has no statements after the `for` statement!)

In this example, the statements inside the loop include

```
densityCode = i * 160;
```

which makes `densityCode` be either 160, 320, or 480 (depending on the value of `i`). The loop's statements also include a big `switch` statement (which creates `icon` and `message` values from the `densityCode`) and a couple of statements to display the icon and the message. The result is the display, one after another, of the three icons for the three densities 160, 320, and 480. Listing 8-5 displays all three icons, one after another, without ever getting input from the user, as shown in Figure 8-7.

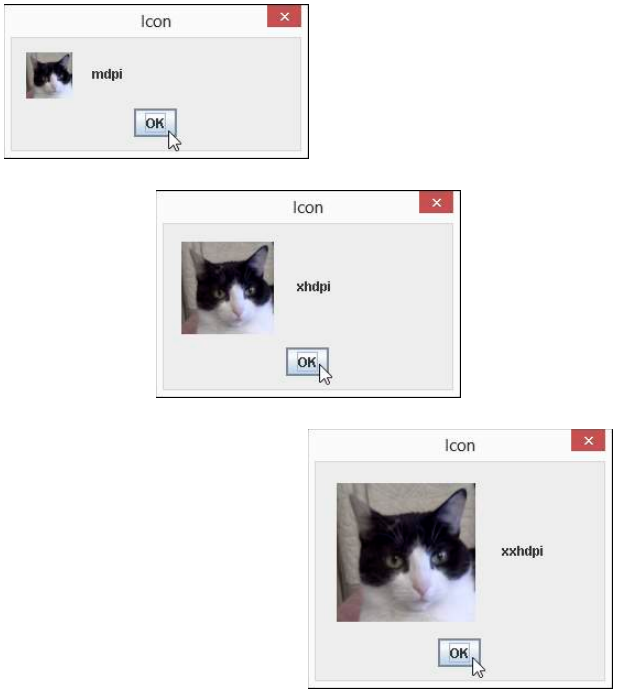


Figure 8-7: One run of the code in Listing 8-5.

Some formalities concerning Java for statements

A `for` statement has the following form:

```
for (initialization ; condition ; update) {
    statements inside the loop
}
```

- An *initialization* (such as `int i = 1` in Listing 8-5) defines the action to be taken before the first loop iteration.
- A *condition* (such as `i <= 3` in Listing 8-5) defines the element to be checked before an iteration. If the condition is `true`, the computer executes the iteration. If the condition is `false`, the computer doesn't execute the iteration, and it moves on to execute whatever code comes after the `for` statement.
- An *update* (such as `i++` in Listing 8-5) defines an action to be taken at the end of each loop iteration.

You can omit the curly braces when only one statement is inside the loop.

What's Next?

This chapter describes several ways to jump from one place in your code to another.

Java provides other ways to move from place to place in a program, including enhanced `for` statements and `try` statements. But descriptions of these elements don't belong in this chapter. To understand the power of enhanced `for` statements and `try` statements, you need a firm grasp of classes and objects, so Chapter 9 dives fearlessly into the classes-and-objects waters.

I'm your swimming instructor. Everyone into the pool!