JAVA Textbook

Chapter 7

File Handling in Java Programs

Objectives

In this chapter, you will learn about:

- File operations in Java.

File Handling

- Business applications often need to work with data stored in files.
- To work with data stored in a file, the following operations are commonly needed:
  - Open a file
  - Read data from a file
  - Write data to a file
  - Close a file
- Prewritten classes in the Java Standard Edition Development Kit (JDK) are used to accomplish the file operations.

Importing Packages and Classes

- The JDK contains many classes that are prewritten by the Java development team, which you can use to simplify your work.
- Prewritten classes must be imported into a Java program that uses them.
  - Use the *import* keyword to include a class from a Java package.
- The classes needed for file operations are part of the package *java.io*.
  - A package is a group of related classes.
  - To import the *BufferedReader* class

    import java.io.BufferedReader;
  - To import all classes from the java.io package

    import java.io.*;

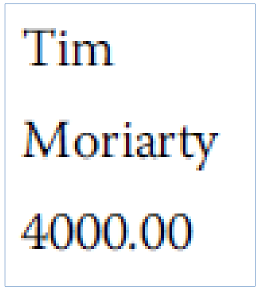
Opening a File for Reading

- First, create a *FileReader* object and specify the name of the file to associate with the object.
  - If the file is located in the same folder as the Java program:

    FileReader fr = new FileReader("inputFile.txt");
  - If not in the same folder, need to include its complete path:

    FileReader fr = new FileReader(
    "C:\myJavaPrograms\Chapter7\inputFile.txt");
- Then, create a *BufferedReader* object to read more efficiently.
  - A *FileReader* object reads one character at a time, whereas a *BufferedReader* object reads a line at a time.
  - Create a *BufferedReader* object by decorating the *FileReader* object.
  - Decorating is a way of adding functionality to objects in

Reading Data from an Input File



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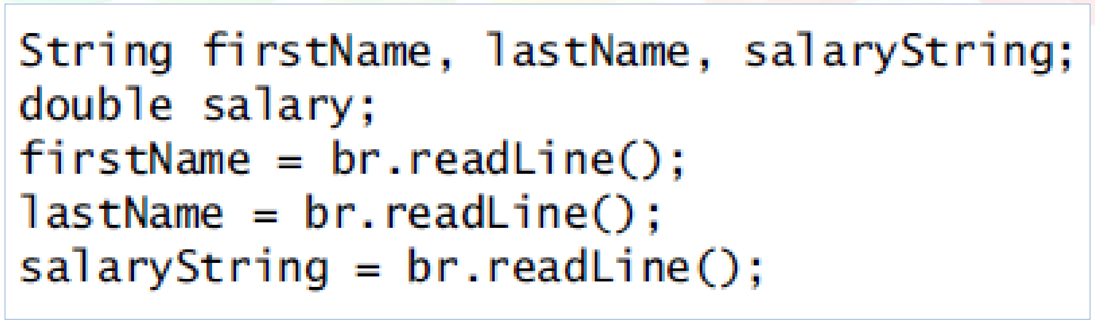
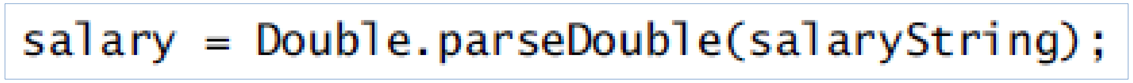
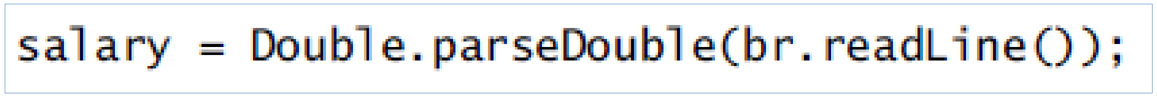


```
String firstName, lastName, salaryString;
double salary;
firstName = br.readLine();
lastName = br.readLine();
salaryString = br.readLine();
```



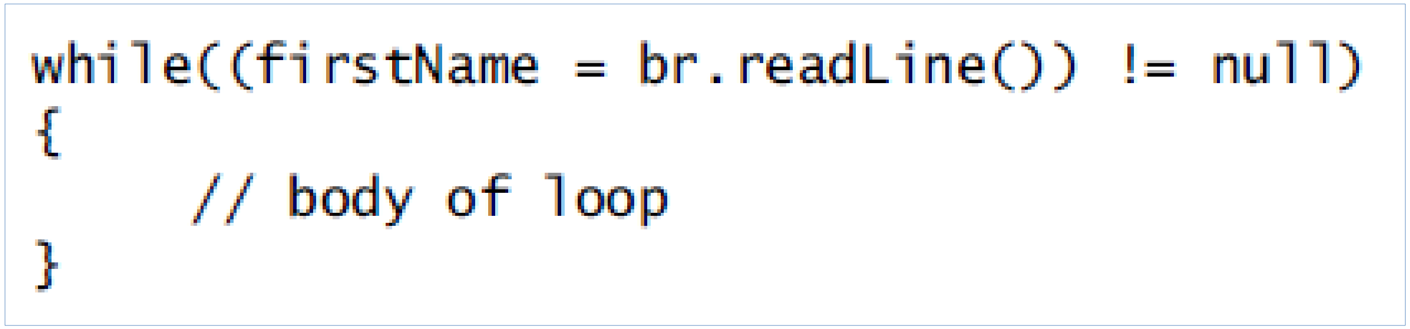
```
salary = Double.parseDouble(salaryString);
```



```
salary = Double.parseDouble(br.readLine());
```

- The *BufferedReader* class reads data from a file with the *readLine()* method.
  - The *readLine()* method reads a line from an input file.
  - A line is defined as all of the characters up to a newline character or up to the End Of File (EOF) marker.
  - The newline character is generated when the Enter key on the keyboard is pressed.
  - The EOF marker is automatically placed at the end of a file when it is saved.

Reading Data Using a Loop and EOF



```
while((firstName = br.readLine()) != null)
{
      // body of loop
}
```

- Use a loop to read large amounts of data from a file.
- The *readLine()* method returns a null value when EOF is reached.

Opening a File for Writing

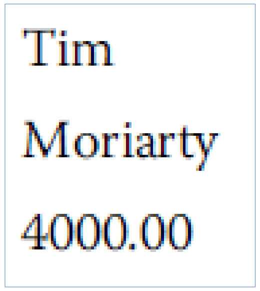
- First, create a *FileWriter* object and specify the name of the file to associate with the object.
  - If the file is in the same folder as the Java program:

    FileWriter fw = new FileWriter("outputFile.txt");
  - Need to include the file's complete path if not in the same folder:

    FileWriter fw = new FileWriter("C:\myJavaPrograms\Chapter7\outputFile.txt");
- Then, create a *PrintWriter* object to decorate the *FileWriter* object for more efficient operations.
  - The *PrintWriter* class provides the ability to flush (that is, empty) and close an output file.
  - In Java, a write operation is not complete until the buffer associated with an output file is flushed (emptied) and closed, thus being made unavailable for further output.

    PrintWriter pw = new PrintWriter(fw);

Writing Data to an Output File



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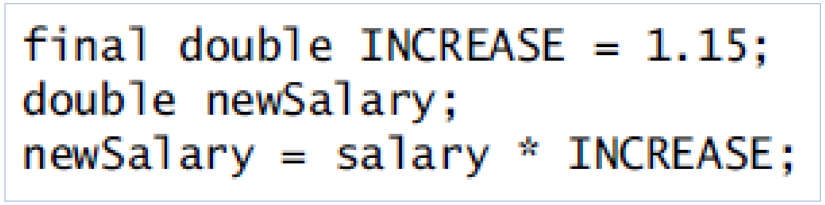
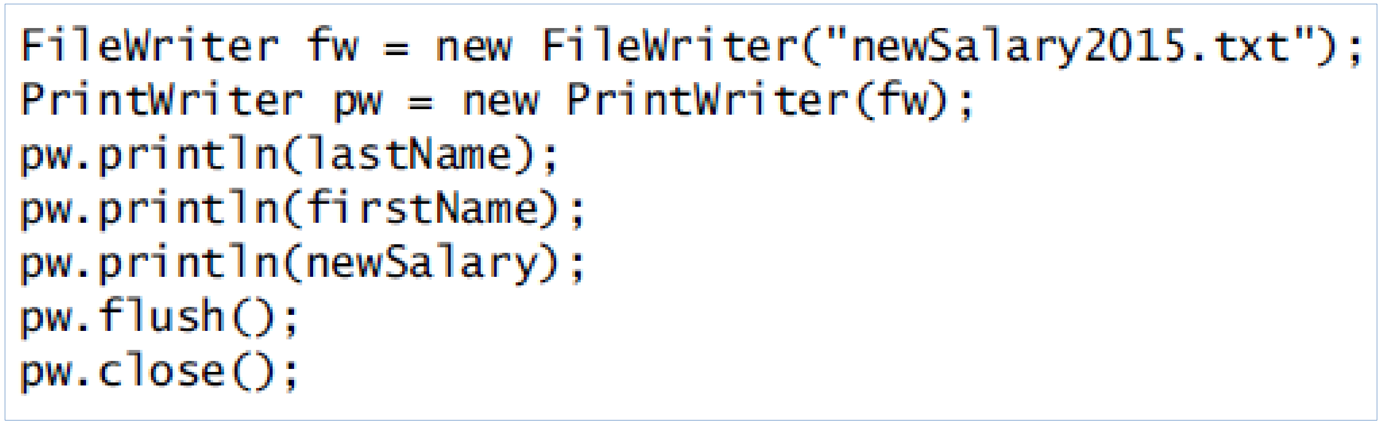


```
final double INCREASE = 1.15;
double newSalary;
newSalary = salary * INCREASE;
```

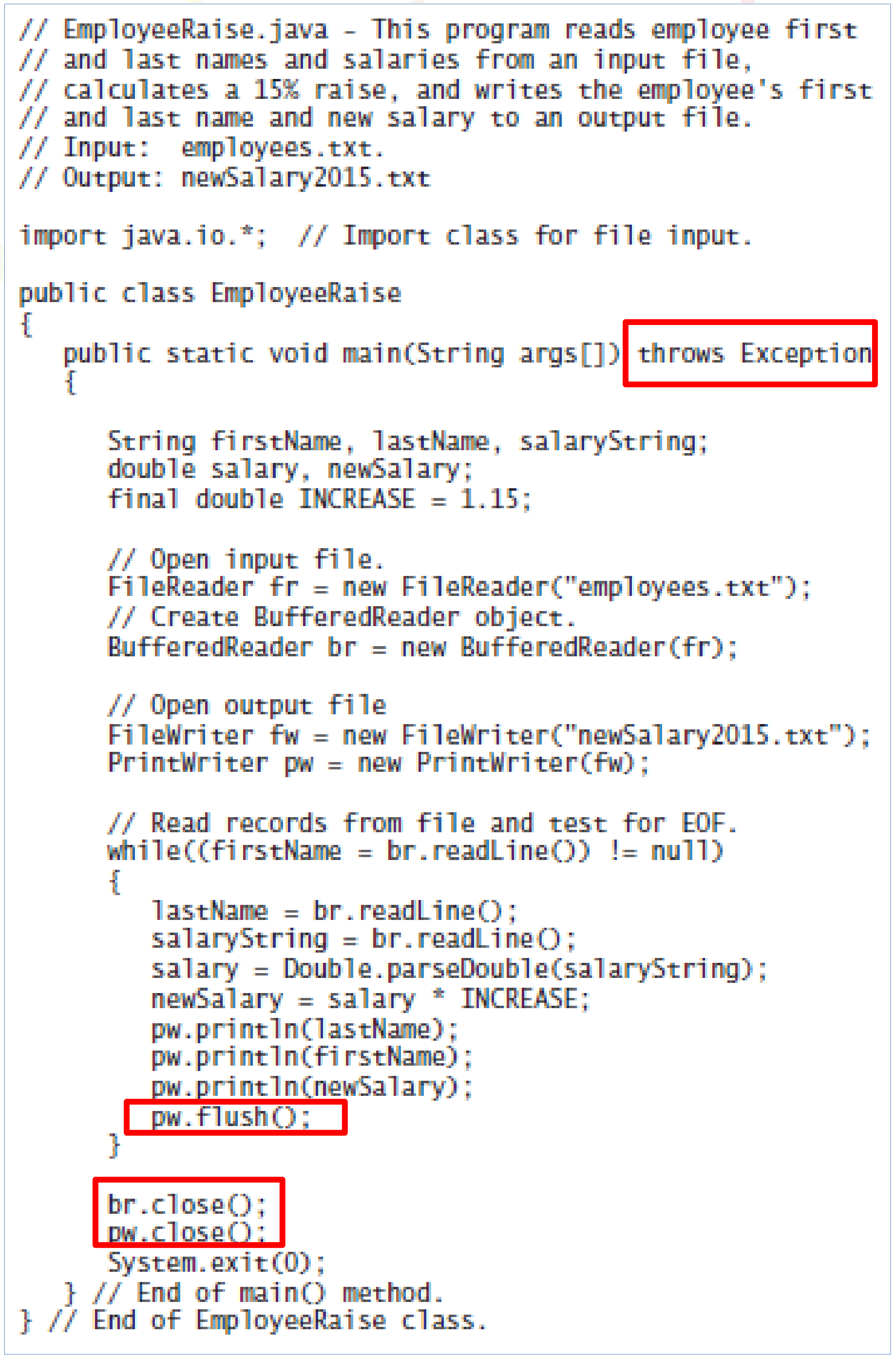


```
FileWriter fw = new FileWriter("newSalary2015.txt");
PrintWriter pw = new PrintWriter(fw);
pw.println(lastName);
pw.println(firstName);
pw.println(newSalary);
pw.flush();
pw.close();
```

- The *PrintWriter* class writes a line to an output file with the *println()* method.
- Example above assumes that data needed have already been read from the file.

Reading/Writing: A Complete Example

- There may be potential problems with file operations.
  - May try to open a nonexistent file, to read beyond EOF, etc.
- Such a problem will generate an exception.
  - An exception is an event that disrupts the normal flow of execution, and is handled by an exception handler.
- Java compiler won't compile programs with such operations unless



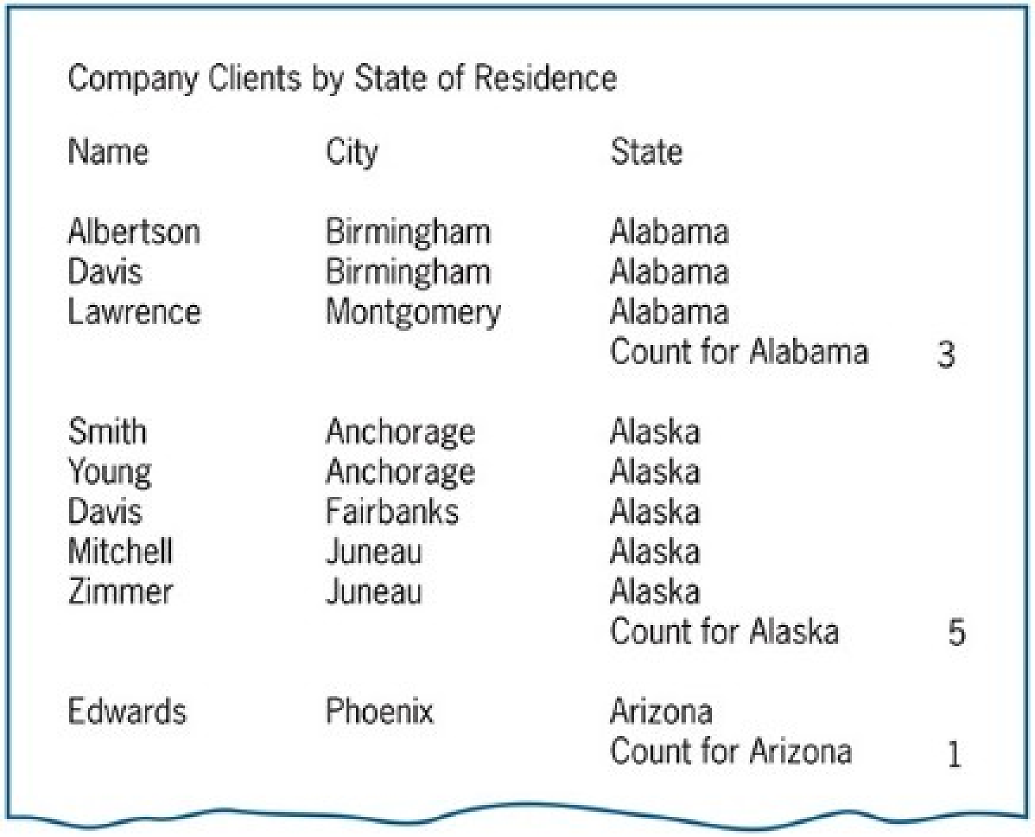
```java
// EmployeeRaise.java - This program reads employee first
// and last names and salaries from an input file,
// calculates a 15% raise, and writes the employee's first
// and last name and new salary to an output file.
// Input:  employees.txt.
// Output: newSalary2015.txt

import java.io.*;  // Import class for file input.

public class EmployeeRaise
{
   public static void main(String args[]) throws Exception
   {

      String firstName, lastName, salaryString;
      double salary, newSalary;
      final double INCREASE = 1.15;

      // Open input file.
      FileReader fr = new FileReader("employees.txt");
      // Create BufferedReader object.
      BufferedReader br = new BufferedReader(fr);

      // Open output file
      FileWriter fw = new FileWriter("newSalary2015.txt");
      PrintWriter pw = new PrintWriter(fw);

      // Read records from file and test for EOF.
      while((firstName = br.readLine()) != null)
      {
         lastName = br.readLine();
         salaryString = br.readLine();
         salary = Double.parseDouble(salaryString);
         newSalary = salary * INCREASE;
         pw.println(lastName);
         pw.println(firstName);
         pw.println(newSalary);
         pw.flush();
      }

      br.close();
      pw.close();
      System.exit(0);
   } // End of main() method.
} // End of EmployeeRaise class.
```

Sequential Files and Control Break Logic

- A sequential file is a file in which records are stored one after another in certain order.
  - Records in a sequential file are organized according to one or more fields, such as ID numbers, part numbers, last names, etc.
- A single-level control break program reads data from a sequential file, and causes a break in the logic based on the value of a single variable.

Control Break Logic: Example

- A single-level control break program that produces a report of customers by state.
  - Reads a record for each client;
  - Keeps a count of the number of clients in each state;



Company Clients by State of Residence

Name	City	State	
Albertson	Birmingham	Alabama	
Davis	Birmingham	Alabama	
Lawrence	Montgomery	Alabama	
		Count for Alabama	3
Smith	Anchorage	Alaska	
Young	Anchorage	Alaska	
Davis	Fairbanks	Alaska	
Mitchell	Juneau	Alaska	
Zimmer	Juneau	Alaska	
		Count for Alaska	5
Edwards	Phoenix	Arizona	
		Count for Arizona	1

Figure 7-5 A control break report with totals after each state

Control Break Logic: Example

```
// ClientByState.java - This program creates a report that
// lists clients with a count of the number of clients for
// each state.
// Input:  client.dat
// Output:  Report

import java.io.*;

public class ClientByState
{
   public static void main(String args[]) throws Exception
   {
      // Declarations
      FileReader fr = new FileReader("client.dat");
      BufferedReader br = new BufferedReader(fr);
      final String TITLE =
            "\n\nCompany Clients by State of Residence\n\n";
      String name = "", city = "", state = "";
      int count = 0;
      String oldState = "";
      boolean done;

      // Work done in the getReady() method
      System.out.println(TITLE);
      if((name = br.readLine()) != null)
      {
         city = br.readLine();
         state = br.readLine();
         done = false;
         oldState = state;
      }
      else
         done = true;
      while(done == false)
      {
         // Work done in the produceReport() method
         if(state.compareTo(oldState) != 0)
         {
            // Work done in the controlBreak() method
            System.out.println("\t\t\tCount for " +
                                   oldState + " " + count);
            count = 0;
            oldState = state;
         }
         System.out.println(name + " " + city + " " +
                                 state);
         count++;
         if((name = br.readLine()) != null)
         {
            city = br.readLine();
            state = br.readLine();
            done = false;
         }
         else
            done = true;
      }
      // Work done in the finishUp() method
      System.out.println("\t\t\tCount for " +
                              oldState + " " + count);
      br.close();
      System.exit(0);

   } // End of main() method
} // End of ClientByState class
```

Thank You!