```
//  joi/6/juno/Juno.java
//
//
//  Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.*;
import java.util.*;
import java.lang.*;

/**
 * Juno (Juno's Unix NOt) mimics a command line operating system
 * like Unix.
 * <p>
 * A Juno system has a name, a set of Users, a JFile system,
 * a login process and a set of shell commands.
 *
 * @see User
 * @see JFile
 * @see ShellCommand
 *
 * @version 6
 */

public class Juno
{
    private final static String os      = "Juno";
    private final static String version = "6";

    private String    hostName;   // host machine name
    private Map       users;      // lookup table for Users
    private Terminal  console;    // for input and output

    private Directory slash;      // root of JFile system
    private Directory userHomes;  // for home directories

    private ShellCommandTable commandTable; // shell commands

    /**
     * Construct a Juno (operating system) object.
     *
     * @param hostName  the name of the host on which it's running.
     * @param echoInput should all input be echoed as output?
     */

    public Juno( String hostName, boolean echoInput )
    {
        // initialize the Juno environment ...

        this.hostName = hostName;
        console       = new Terminal( echoInput );
        users         = new TreeMap();           // for registered Users
        commandTable  = new ShellCommandTable(); // for shell commands

        // the file system

        slash     = new Directory( "", null, null );
```



```
        User root = new User( "root", slash, "Rick Martin" );
        users.put( "root", root );
        slash.setOwner(root);
        userHomes = new Directory( "users", root, slash );

        // create, then start a command line login interpreter

        LoginInterpreter interpreter
            = new LoginInterpreter( this, console );
        interpreter.CLILogin();
    }

    /**
     * The name of the host computer on which this system
     * is running.
     *
     * @return the host computer name.
     */

    public String getHostName()
    {
        return hostName;
    }

    /**
     * The name of this operating system.
     *
     * @return the operating system name.
     */

    public String getOS()
    {
        return os;
    }

    /**
     * The version number for this system.
     *
     * @return the version number.
     */

    public String getVersion()
    {
        return version;
    }

    /**
     * The directory containing all user homes for this system.
     *
     * @return the directory containing user homes.
     */

    public Directory getUserHomes()
    {
        return userHomes;
    }
```

```
113
114     /**
115      * The shell command table for this system.
116      *
117      * @return the shell command table.
118      */
119
120     public ShellCommandTable getCommandTable()
121     {
122         return commandTable;
123     }
124
125     /**
126      * Look up a user by user name.
127      *
128      * @param username the user's name.
129      * @return the appropriate User object.
130      */
131
132     public User lookupUser( String username )
133     {
134         return (User) users.get( username );
135     }
136
137     /**
138      * Create a new User.
139      *
140      * @param userName the User's login name.
141      * @param home her home Directory.
142      * @param realName her real name.
143      * @return newly created User.
144      */
145
146     public User createUser( String userName, Directory home,
147                             String realName )
148     {
149         User newUser = new User( userName, home, realName );
150         users.put( userName, newUser );
151         return newUser;
152     }
153
154     /**
155      * The Juno system may be given the following command line
156      * arguments.
157      * <pre>
158      *
159      * -e:         Echo all input (useful for testing).
160      *
161      * -version:   Report the version number and exit.
162      *
163      * [hostname]: The name of the host on which
164      *             Juno is running (optional).
165      * </pre>
166      */
167
168     public static void main( String[] args )
```



```
169     {
170         // Parse command line options
171
172         boolean echoInput = false;
173         String  hostName  = "mars";
174
175         for (int i=0; i < args.length; i++) {
176             if (args[i].equals("-version")) {
177                 System.out.println( os + " version " + version );
178                 System.exit(0);
179             }
180             if (args[i].equals("-e")) {
181                 echoInput = true;
182             }
183             else {
184                 hostName = args[i];
185             }
186         }
187
188         // create a Juno instance, which will start itself
189
190         new Juno( hostName, echoInput );
191     }
192 }
```

```
// joi/6/juno/LoginInterpreter.java
//
//
// Copyright 2003 Ethan Bolker and Bill Campbell

import java.util.*;

/**
 * Interpreter for Juno login commands.
 *
 * There are so few commands that if-then-else logic is OK.
 *
 * @version 6
 */

public class LoginInterpreter
{
    private static final String LOGIN_COMMANDS =
        "help, register, <username>, exit";

    private Juno     system;  // the Juno object
    private Terminal console; // for i/o

    /**
     * Construct a new LoginInterpreter for interpreting
     * login commands.
     *
     * @param system the system creating this interpreter.
     * @param console the Terminal used for input and output.
     */

    public LoginInterpreter( Juno system, Terminal console)
    {
        this.system  = system;
        this.console = console;
    }

    /**
     * Set the console for this interpreter.  Used by the
     * creator of this interpreter.
     *
     * @param console the Terminal to be used for input and output.
     */

    public void setConsole( Terminal console )
    {
        this.console = console;
    }

    /**
     * Simulates behavior at login: prompt.
     * CLI stands for "Command Line Interface".
     */

    public void CLILogin()
    {
```



```
        welcome();
        boolean moreWork = true;
        while( moreWork ) {
            moreWork = interpret( console.readLine( "Juno login: " ) );
        }
    }

    // Parse user's command line and dispatch appropriate
    // semantic action.
    //
    // return true unless "exit" command or null inputLine.

    private boolean interpret( String inputLine )
    {
        if (inputLine == null) return false;
        StringTokenizer st =
            new StringTokenizer( inputLine );
        if (st.countTokens() == 0) {
            return true; // skip blank line
        }
        String visitor = st.nextToken();
        if (visitor.equals( "exit" )) {
            return false;
        }
        if (visitor.equals( "register" )) {
            register( st );
        }
        else if (visitor.equals( "help" )) {
            help();
        }
        else {
            User user = system.lookupUser(visitor);
            new Shell( system, user, console );
        }
        return true;
    }

    // Register a new user, giving him or her a login name and a
    // home directory on the system.
    //
    // StringTokenizer argument contains the new user's login name
    // followed by full real name.

    private void register( StringTokenizer st )
    {
        String userName = st.nextToken();
        String realName = st.nextToken("").trim();
        Directory home  = new Directory( userName, null,
                                         system.getUserHomes() );
        User user = system.createUser( userName, home, realName );
        home.setOwner( user );
    }

    // Display a short welcoming message, and remind users of
    // available commands.

```

```
   113      private void welcome()
   114      {
   115          console.println( "Welcome to " + system.getHostName() +
   116                           " running " + system.getOS() +
   117                           " version " + system.getVersion() );
   118          help();
   119      }
   120
   121      // Remind user of available commands.
   122
   123      private void help()
   124      {
   125          console.println( LOGIN_COMMANDS );
   126          console.println("");
   127      }
   128  }
```

```
 1  // joi/6/juno/Shell.java
 2  //
 3  //
 4  // Copyright 2003, Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * Models a shell (command interpreter)
10   *
11   * The Shell knows the (Juno) system it's working in,
12   * the User who started it,
13   * and the console to which to send output.
14   *
15   * It keeps track of the the current working directory (.) .
16   *
17   * @version 6
18   */
19
20  public class Shell
21  {
22      private Juno system;       // the operating system object
23      private User user;         // the user logged in
24      private Terminal console;  // the console for this shell
25      private Directory dot;     // the current working directory
26
27      /**
28       * Construct a login shell for the given user and console.
29       *
30       * @param system a reference to the Juno system.
31       * @param user the User logging in.
32       * @param console a Terminal for input and output.
33       */
34
35      public Shell( Juno system, User user, Terminal console )
36      {
37          this.system  = system;
38          this.user    = user;
39          this.console = console;
40          dot          = user.getHome(); // default current directory
41          CLIShell(); // start the command line interpreter
42      }
43
44      // Run the command line interpreter
45
46      private void CLIShell()
47      {
48          boolean moreWork = true;
49          while(moreWork) {
50              moreWork = interpret( console.readLine( getPrompt() ) );
51          }
52          console.println("goodbye");
53      }
54
55      // Interpret a String of the form
56      //     shellcommand command-arguments
```



```
57      //
58      // return true, unless shell command is logout.
59
60      private boolean interpret( String inputLine )
61      {
62          StringTokenizer st = stripComments(inputLine);
63          if (st.countTokens() == 0) {
64              return true;             // skip blank line
65          }
66          String commandName = st.nextToken();
67          if (commandName.equals( "logout" )) {
68              return false;            // user is done
69          }
70          ShellCommand commandObject =
71              system.getCommandTable().lookup( commandName );
72          if (commandObject == null ) {
73              console.errPrintln( "Unknown command: " + commandName );
74          }
75          else {
76              commandObject.doIt( st, this );
77          }
78          return true;
79      }
80
81      // Strip characters from '#' to end of line, create and
82      // return a StringTokenizer for what's left.
83
84      private StringTokenizer stripComments( String line )
85      {
86          int commentIndex = line.indexOf('#');
87          if (commentIndex >= 0) {
88              line = line.substring(0,commentIndex);
89          }
90          return new StringTokenizer(line);
91      }
92
93      /**
94       * The prompt for the CLI.
95       *
96       * @return the prompt string.
97       */
98
99      public String getPrompt()
100     {
101         return system.getHostName() + "> ";
102     }
103
104     /**
105      * The User associated with this Shell.
106      *
107      * @return the user.
108      */
109
110     public User getUser()
111     {
112         return user;
```

```
113      }
114
115      /**
116       * The current working directory for this Shell.
117       *
118       * @return the current working directory.
119       */
120
121      public Directory getDot()
122      {
123          return dot;
124      }
125
126      /**
127       * Set the current working directory for this Shell.
128       *
129       * @param dot the new working directory.
130       */
131
132      public void setDot(Directory dot)
133      {
134          this.dot = dot;
135      }
136
137      /**
138       * The console associated with this Shell.
139       *
140       * @return the console.
141       */
142
143      public Terminal getConsole()
144      {
145          return console;
146      }
147
148      /**
149       * The Juno object associated with this Shell.
150       *
151       * @return the Juno instance that created this Shell.
152       */
153
154      public Juno getSystem()
155      {
156          return system;
157      }
158  }
```

```
 1  // joi/6/juno/ShellCommand.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * Model those features common to all ShellCommands.
10   *
11   * Each concrete extension of this class provides a constructor
12   * and an implementation for method doIt.
13   *
14   * @version 6
15   */
16
17  public abstract class ShellCommand
18  {
19      private String helpString;   // documents the command
20      private String argString;    // any args to the command
21
22      /**
23       * A constructor, always called (as super()) by the subclass.
24       * Used only for commands that have arguments.
25       *
26       * @param helpString a brief description of what the command does.
27       * @param argString a prototype illustrating the required arguments.
28       */
29
30      protected ShellCommand( String helpString, String argString )
31      {
32          this.argString  = argString;
33          this.helpString = helpString;
34      }
35
36      /**
37       * A constructor for commands having no arguments.
38       *
39       * @param helpString a brief description of what the command does.
40       */
41
42      protected ShellCommand( String helpString )
43      {
44          this( helpString, "" );
45      }
46
47      /**
48       * Execute the command.
49       *
50       * @param args the remainder of the command line.
51       * @param sh   the current shell
52       */
53
54      public abstract void doIt( StringTokenizer args, Shell sh );
55
56      /**
```



```
57       * Help for this command.
58       *
59       * @return the help string.
60       */
61
62      public String getHelpString()
63      {
64          return helpString;
65      }
66
67      /**
68       * The argument string prototype.
69       *
70       * @return the argument string prototype.
71       */
72
73      public String getArgString()
74      {
75          return argString;
76      }
77  }
```

```
 1  // joi/6/juno/MkdirCommand.java
 2  //
 3  //
 4  // Copyright 2003, Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to create a new directory.
10   * Usage:
11   * <pre>
12   *     mkdir directory-name
13   * </pre>
14   *
15   * @version 6
16   */
17
18  public class MkdirCommand extends ShellCommand
19  {
20      /**
21       * Construct a MkdirCommand object.
22       */
23
24      public MkdirCommand()
25      {
26          super( "create a subdirectory of the current directory",
27                 "directory-name" );
28      }
29
30      /**
31       * Create a new Directory in the current Directory.
32       *
33       * @param args the remainder of the command line.
34       * @param sh the current shell
35       */
36
37      public void doIt( StringTokenizer args, Shell sh )
38      {
39          String filename = args.nextToken();
40          new Directory( filename, sh.getUser(), sh.getDot() );
41      }
42  }
```

```
 1  // joi/6/juno/TypeCommand.java
 2  //
 3  //
 4  // Copyright 2003, Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to display the contents of a
10   * text file.
11   * Usage:
12   * <pre>
13   *     type textfile
14   * </pre>
15   *
16   * @version 6
17   */
18
19  public class TypeCommand extends ShellCommand
20  {
21      /**
22       * Construct a TypeCommand object.
23       */
24
25      TypeCommand()
26      {
27          super( "display contents of a TextFile", "textfile" );
28      }
29
30      /**
31       * Display the contents of a TextFile.
32       *
33       * @param args the reminder of the command line.
34       * @param sh the current Shell
35       */
36
37      public void doIt( StringTokenizer args, Shell sh )
38      {
39          String filename = args.nextToken();
40          sh.getConsole().println(
41              ( (TextFile) sh.getDot().
42                retrieveJFile( filename ) ).getContents() );
43      }
44  }
```

```
 1  // joi/6/juno/HelpCommand.java
 2  //
 3  //
 4  // Copyright 2003, Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to display help on the shell commands.
10   * Usage:
11   * <pre>
12   *     help
13   * </pre>
14   *
15   * @version 6
16   */
17
18  public class HelpCommand extends ShellCommand
19  {
20      /**
21       * Construct a HelpCommand object.
22       */
23
24      HelpCommand()
25      {
26          super( "display ShellCommands" );
27      }
28
29      /**
30       * Display help for all commands.
31       *
32       * @param args the remainder of the command line.
33       * @param sh the current shell
34       */
35
36      public void doIt( StringTokenizer args, Shell sh )
37      {
38          // Get command keys from global table, print them out,
39          // followed by command's help string.
40
41          sh.getConsole().println( "shell commands" );
42          ShellCommandTable table = sh.getSystem().getCommandTable();
43          String[] names = table.getCommandNames();
44          for (int i = 0; i < names.length; i++ ) {
45              String cmdname = names[i];
46              ShellCommand cmd = table.lookup( cmdname );
47              sh.getConsole().
48                  println( "  " + cmdname + ": " + cmd.getHelpString() );
49          }
50      }
51  }
```

```
 1  // joi/6/juno/NewfileCommand.java
 2  //
 3  //
 4  // Copyright 2003, Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to create a text file.
10   * Usage:
11   * <pre>
12   *     newfile filename contents
13   * </pre>
14   *
15   * @version 6
16   */
17
18  public class NewfileCommand extends ShellCommand
19  {
20      /**
21       * Construct a NewfileCommand object.
22       */
23
24      public NewfileCommand()
25      {
26          super( "create a new TextFile", "filename contents" );
27      }
28
29      /**
30       * Create a new TextFile in the current Directory.
31       *
32       * @param args the remainder of the command line.
33       * @param sh the current shell
34       */
35
36      public void doIt( StringTokenizer args, Shell sh )
37      {
38          String filename = args.nextToken();
39          String contents = args.nextToken("").trim(); // rest of line
40          new TextFile( filename, sh.getUser(), sh.getDot(), contents );
41      }
42  }
```

```
// joi/6/juno/ShellCommandTable.java (version 6)
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * A ShellCommandTable object maintains a dispatch table of
 * ShellCommand objects keyed by the command names used to invoke
 * them.
 *
 * To add a new shell command to the table, install it from
 * method fillTable().
 *
 * @see ShellCommand
 *
 * @version 6
 */

public class ShellCommandTable
{
    private Map table = new TreeMap();

    /**
     * Construct and fill a shell command table.
     */

    public ShellCommandTable()
    {
        fillTable();
    }

    /**
     * Get a ShellCommand, given the command name key.
     *
     * @param key the name associated with the command we're
     *            looking for.
     *
     * @return the command we're looking for, null if none.
     */

    public ShellCommand lookup( String key )
    {
        return (ShellCommand)table.get( key );
    }

    /**
     * Get an array of the command names.
     *
     * @return the array of command names.
     */

    public String[] getCommandNames()
    {
        return (String[]) table.keySet().toArray( new String[0] );
```



```
    }

    // Associate a command name with a ShellCommand.

    private void install( String commandName, ShellCommand command )
    {
        table.put( commandName, command );
    }

    // Fill the dispatch table with ShellCommands, keyed by their
    // command names.

    private void fillTable()
    {
        install( "newfile", new NewfileCommand() );
        install( "type", new TypeCommand() );
        install( "mkdir", new MkdirCommand() );
        install( "help", new HelpCommand() );
    }
}
```

```
// joi/6/jfiles/JFile.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.Date;
import java.io.File;

/**
 * A JFile object models a file in a hierarchical file system.
 * <p>
 * Extend this abstract class to create particular kinds of JFiles,
 * e.g.:<br>
 * Directory  -
 *    a JFile that maintains a list of the files it contains.<br>
 * TextFile  -
 *    a JFile containing text you might want to read.<br>
 *
 * @see Directory
 * @see TextFile
 *
 * @version 6
 */

public abstract class JFile
{
    /**
     * The separator used in pathnames.
     */

    public static final String separator = File.separator;

    private String    name;       // a JFile knows its name
    private User      owner;      // the owner of this file
    private Date      createDate; // when this file was created
    private Date      modDate;    // when this file was last modified
    private Directory parent;     // the Directory containing this file

    /**
     * Construct a new JFile, set owner, parent, creation and
     * modification dates. Add this to parent (unless this is the
     * root Directory).
     *
     * @param name     the name for this file (in its parent directory).
     * @param creator  the owner of this new file.
     * @param parent   the Directory in which this file lives.
     */

    protected JFile( String name, User creator, Directory parent )
    {
        this.name   = name;
        this.owner  = creator;
        this.parent = parent;
        if (parent != null) {
            parent.addJFile( name, this );
        }
```



```
        createDate  = modDate = new Date(); // set dates to now
    }

    /**
     * The name of the file.
     *
     * @return the file's name.
     */

    public String getName()
    {
        return name;
    }

    /**
     * The full path to this file.
     *
     * @return the path name.
     */

    public String getPathName()
    {
        if (this.isRoot()) {
            return separator;
        }
        if (parent.isRoot()) {
            return separator + getName();
        }
        return parent.getPathName() + separator + getName();
    }

    /**
     * The size of the JFile
     * (as defined by the child class)..
     *
     * @return the size.
     */

    public abstract int getSize();

    /**
     * Suffix used for printing file names
     * (as defined by the child class).
     *
     * @return the file's suffix.
     */

    public abstract String getSuffix();

    /**
     * Set the owner for this file.
     *
     * @param owner the new owner.
     */

    public void setOwner( User owner )
```

```
113      {
114          this.owner = owner;
115      }
116
117      /**
118       * The file's owner.
119       *
120       * @return the owner of the file.
121       */
122
123      public User getOwner()
124      {
125          return owner;
126      }
127
128      /**
129       * The date and time of the file's creation.
130       *
131       * @return the file's creation date and time.
132       */
133
134      public String getCreateDate()
135      {
136          return createDate.toString();
137      }
138
139      /**
140       * Set the modification date to "now".
141       */
142
143      protected void setModDate()
144      {
145          modDate = new Date();
146      }
147
148      /**
149       * The date and time of the file's last modification.
150       *
151       * @return the date and time of the file's last modification.
152       */
153
154      public String getModDate()
155      {
156          return modDate.toString();
157      }
158
159      /**
160       * The Directory containing this file.
161       *
162       * @return the parent directory.
163       */
164
165      public Directory getParent()
166      {
167          return parent;
168      }
```



```
169
170      /**
171       * A JFile whose parent is null is defined to be the root
172       * (of a tree).
173       *
174       * @return true when this JFile is the root.
175       */
176
177      public boolean isRoot()
178      {
179          return (parent == null);
180      }
181
182      /**
183       * How a JFile represents itself as a String.
184       * That is,
185       * <pre>
186       *    owner   size    modDate    name+suffix
187       * </pre>
188       *
189       * @return the String representation.
190       */
191
192      public String toString()
193      {
194          return getOwner() + "\t" +
195              getSize()  + "\t" +
196              getModDate()  + "\t" +
197              getName() + getSuffix();
198      }
199  }
```

```
// joi/6/jfiles/Directory.java
//
//
// Copyright 2003 Ethan Bolker and Bill Campbell

import java.util.*;

/**
 * Directory of JFiles.
 *
 * A Directory is a JFile that maintains a
 * table of the JFiles it contains
 *
 * @version 6
 */

public class Directory extends JFile
{
    private TreeMap jfiles;  // table for JFiles in this Directory

    /**
     * Construct a Directory.
     *
     * @param name     the name for this Directory (in its parent Directo
     * @param creator  the owner of this new Directory
     * @param parent   the Directory in which this Directory lives.
     */

    public Directory( String name, User creator, Directory parent)
    {
        super( name, creator, parent );
        jfiles = new TreeMap();
    }

    /**
     * The size of a directory is the number of TextFiles it contains.
     *
     * @return the number of TextFiles.
     */

    public int getSize()
    {
        return jfiles.size();
    }

    /**
     * Suffix used for printing Directory names;
     * we define it as the (system dependent)
     * name separator used in path names.
     *
     * @return the suffix for Directory names.
     */

    public String getSuffix()
    {
        return  JFile.separator;
```



```
    }

    /**
     * Add a JFile to this Directory. Overwrite if a JFile
     * of that name already exists.
     *
     * @param name the name under which this JFile is added.
     * @param afile the JFile to add.
     */

    public void addJFile(String name, JFile afile)
    {
        jfiles.put( name, afile );
        setModDate();
    }

    /**
     * Get a JFile in this Directory, by name .
     *
     * @param filename the name of the JFile to find.
     * @return the JFile found.
     */

    public JFile retrieveJFile( String filename )
    {
        JFile aFile = (JFile)jfiles.get( filename );
        return aFile;
    }

    /**
     * Get the contents of this Directory as an array of
     * the file names, each of which is a String.
     *
     * @return the array of names.
     */

    public String[] getFileNames()
    {
        return (String[])jfiles.keySet().toArray( new String[0] );
    }
}
```

```
// joi/6/jfiles/TextFile.java
//
//
// Copyright 2003 Ethan Bolker and Bill Campbell

/**
 * A TextFile is a JFile that holds text.
 *
 * @version 6
 */

public class TextFile extends JFile
{
    private String contents;  // The text itself

    /**
     * Construct a TextFile with initial contents.
     *
     * @param name    the name for this TextFile (in its parent Directory
     * @param creator the owner of this new TextFile
     * @param parent  the Directory in which this TextFile lives.
     * @param initialContents the initial text
     */

    public TextFile( String name, User creator, Directory parent,
              String initialContents )
    {
        super( name, creator, parent );
        setContents( initialContents );
    }

    /**
     * Construct an empty TextFile.
     *
     * @param name    the name for this TextFile (in its parent Directory
     * @param creator the owner of this new TextFile
     * @param parent  the Directory in which this TextFile lives
     */

    TextFile( String name, User creator, Directory parent )
    {
        this( name, creator, parent, "" );
    }

    /**
     * The size of a text file is the number of characters stored.
     *
     * @return the file's size.
     */

    public int getSize()
    {
        return contents.length();
    }

    /**
```



```
     * Suffix used for printing text file names is "".
     *
     * @return an empty suffix (for TextFiles).
     */

    public String getSuffix()
    {
        return "";
    }

    /**
     * Replace the contents of the file.
     *
     * @param contents the new contents.
     */

    public void setContents( String contents )
    {
        this.contents = contents;
        setModDate();
    }

    /**
     * The contents of a text file.
     *
     * @return String contents of the file.
     */

    public String getContents()
    {
        return contents;
    }

    /**
     * Append text to the end of the file.
     *
     * @param  text the text to be appended.
     */

    public void append( String text )
    {
        setContents( contents + text );
    }


    /**
     * Append a new line of text to the end of the file.
     *
     * @param  text the text to be appended.
     */

    public void appendLine( String text )
    {
        this.setContents(contents + '\n' + text);
    }
}
```

```
 1  // joi/6/juno/User.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * Model a Juno user.  Each User has a login name,
 8   * a home directory, and a real name.
 9   *
10   * @version 6
11   */
12
13  public class User
14  {
15      private String name;     // the User's login name
16      private Directory home;  // her home Directory
17      private String realName; // her real name
18
19      /**
20       * Construct a new User.
21       *
22       * @param name     the User's login name.
23       * @param home     her home Directory.
24       * @param realName her real name.
25       */
26
27      public User( String name, Directory home, String realName )
28      {
29          this.name     = name;
30          this.home     = home;
31          this.realName = realName;
32      }
33
34      /**
35       * Get the User's login name.
36       *
37       * @return the name.
38       */
39
40      public String getName()
41      {
42          return name;
43      }
44
45      /**
46       * Convert the User to a String.
47       * The String representation for a User is her
48       * login name.
49       *
50       * @return the User's name.
51       */
52
53      public String toString()
54      {
55          return getName();
56      }
```



```
57
58      /**
59       * Get the User's home Directory.
60       *
61       * @return the home Directory.
62       */
63
64      public Directory getHome()
65      {
66          return home;
67      }
68
69      /**
70       * Get the user's real name.
71       *
72       * @return the real name.
73       */
74
75      public String getRealName()
76      {
77          return realName;
78      }
79  }
```

```
// joi/7/bank/Bank.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * A Bank object simulates the behavior of a simple bank/ATM.
 * It contains a Terminal object and a collection of
 * BankAccount objects.
 *
 * The visit method opens this Bank for business,
 * prompting the customer for input.
 *
 * To create a Bank and open it for business issue the command
 * <code>java Bank</code>.
 *
 * @see BankAccount
 * @version 7
 */

public class Bank
{
    private String bankName;           // the name of this Bank
    private Terminal atm;              // for talking with the customer
    private int balance = 0;           // total cash on hand
    private int transactionCount = 0;  // number of Bank transactions
    private Month month;               // the current month.
    private Map accountList;           // mapping names to accounts.

    private int checkFee = 2;            // cost for each check
    private int transactionFee = 1;      // fee for each transaction
    private int monthlyCharge = 5;       // monthly charge
    private double interestRate = 0.05;  // annual rate paid on savings
    private int maxFreeTransactions = 3; // for savings accounts

    // what the banker can ask of the bank

    private static final String BANKER_COMMANDS =
    "Banker commands: " +
        "exit, open, customer, nextmonth, report, help.";

    // what the customer can ask of the bank

    private static final String CUSTOMER_TRANSACTIONS =
    "    Customer transactions: " +
    "deposit, withdraw, transfer, balance, cash check, quit, help.";

    /**
     * Construct a Bank with the given name and Terminal.
     *
     * @param bankName the name for this Bank.
     * @param atm  this Bank's Terminal.
     */

```



```
    public Bank( String bankName, Terminal atm )
    {
        this.atm      = atm;
        this.bankName = bankName;
        accountList   = new TreeMap();
        month         = new Month();
    }

    /**
     * Simulates interaction with a Bank.
     * Presents the user with an interactive loop, prompting for
     * banker transactions and in the case of the banker
     * transaction "customer", an account id and further
     * customer transactions.
     */

    public void visit()
    {
        instructUser();

        String command;
        while (!(command =
                 atm.readWord("banker command: ")).equals("exit")) {

            if (command.startsWith("h")) {
                help( BANKER_COMMANDS );
            }
            else if (command.startsWith("o")) {
                openNewAccount();
            }
            else if (command.startsWith("n")) {
                newMonth();
            }
            else if (command.startsWith("r")) {
                report();
            }
            else if (command.startsWith( "c" ) ) {
                BankAccount acct = whichAccount();
                if ( acct != null ) {
                        processTransactionsForAccount( acct );
                }
            }
            else {
                // Unrecognized Request
                atm.println( "unknown command: " + command );
            }
        }
        report();
        atm.println( "Goodbye from " + bankName );
    }


    // Open a new bank account,
    // prompting the user for information.

    private void openNewAccount()
```

```
113      {
114          String accountName = atm.readWord("Account name: ");
115          char accountType =
116              atm.readChar( "Type of account (r/c/f/s): " );
117          try {
118              int startup = readPosAmt( "Initial deposit: " );
119              BankAccount newAccount;
120              switch( accountType ) {
121              case 'c':
122                  newAccount = new CheckingAccount(startup, this);
123                  break;
124              case 'f':
125                  newAccount = new FeeAccount(startup, this);
126                  break;
127              case 's':
128                  newAccount = new SavingsAccount(startup, this);
129                  break;
130              case 'r':
131                  newAccount = new RegularAccount( startup, this );
132                  break;
133              default:
134                  atm.println("invalid account type: " + accountType);
135                  return;
136              }
137              accountList.put( accountName, newAccount );
138              atm.println( "opened new account " + accountName
139                           + " with $" + startup );
140          } // end of try block
141          catch (NegativeAmountException e) {
142              atm.errPrintln(
143                "can't start with a negative balance");
144          }
145          catch (InsufficientFundsException e) {
146              atm.errPrintln("Initial deposit less than fee");
147          }
148      }
149
150      // Prompt the customer for transaction to process.
151      // Then send an appropriate message to the account.
152
153      private void processTransactionsForAccount( BankAccount acct )
154      {
155          help( CUSTOMER_TRANSACTIONS );
156
157          String transaction;
158          while (!(transaction =
159                   atm.readWord("    transaction: ")).equals("quit")) {
160
161              try {
162                  if ( transaction.startsWith( "h" ) ) {
163                      help( CUSTOMER_TRANSACTIONS );
164                  }
165                  else if ( transaction.startsWith( "d" ) ) {
166                      int amount = readPosAmt( "    amount: " );
167                      atm.println("    deposited "
168                                  + acct.deposit( amount ));
```



```
169                  }
170                  else if ( transaction.startsWith( "w" ) ) {
171                      int amount = readPosAmt( "    amount: " );
172                      atm.println("    withdrew "
173                                  + acct.withdraw( amount ));
174                  }
175                  else if ( transaction.startsWith( "c" ) ) {
176                      int amount = readPosAmt( "    amount of check: " );
177                      try { // to cast acct to CheckingAccount ...
178                          atm.println("    cashed check for " +
179                             ((CheckingAccount) acct).honorCheck( amount ))
180                      }
181                      catch (ClassCastException e) {
182                          // if not a checking account, report error
183                          atm.errPrintln(
184                              "    Sorry, not a checking account." );
185                      }
186                  }
187                  else if (transaction.startsWith("t")) {
188                      atm.print( "    to ");
189                      BankAccount toacct = whichAccount();
190                      if (toacct != null) {
191                      int amount = readPosAmt("    amount to transfer: ");
192                      atm.println("    transfered "
193                          + toacct.deposit(acct.withdraw(amount)));
194                      }
195                  }
196                  else if (transaction.startsWith("b")) {
197                      atm.println("    current balance "
198                                  + acct.requestBalance());
199                  }
200                  else {
201                      atm.println("    sorry, unknown transaction" );
202                  }
203              }
204              catch (InsufficientFundsException e) {
205                  atm.errPrintln( "    Insufficient funds " +
206                                  e.getMessage() );
207              }
208              catch (NegativeAmountException e) {
209                atm.errPrintln("    Sorry, negative amounts disallowed." );
210              }
211              atm.println();
212          }
213      }
214
215      // Prompt for an account name (or number), look it up
216      // in the account list. If it's there, return it;
217      // otherwise report an error and return null.
218
219      private BankAccount whichAccount()
220      {
221          String accountName = atm.readWord( "account name: " );
222          BankAccount account = (BankAccount) accountList.get(accountName);
223          if (account == null) {
224              atm.println( "not a valid account" );
```

```
225          }
226          return account;
227      }
228
229      // Action to take when a new month starts.
230      // Update the month field by sending a next message.
231      // Loop on all accounts, sending each a newMonth message.
232
233      private void newMonth()
234      {
235          month.next();
236          Iterator i = accountList.keySet().iterator();
237          while ( i.hasNext() ) {
238              String name = (String) i.next();
239              BankAccount acct = (BankAccount)accountList.get(name);
240              try {
241                  acct.newMonth();
242              }
243              catch (InsufficientFundsException exception) {
244                  atm.errPrintln(
245                     "Insufficient funds in account \"" +
246                     name + "\" for monthly fee" );
247              }
248          }
249      }
250
251      // Report bank activity. For each BankAccount,
252      // print the customer id (name or number), balance, and
253      // the number of transactions. Then print Bank totals.
254
255      private void report()
256      {
257          atm.println( bankName + " report for " + month );
258          atm.println( "\nSummaries of individual accounts:" );
259          atm.println( "account  balance   transaction count" );
260          for (Iterator i = accountList.keySet().iterator();
261               i.hasNext(); ) {
262              String accountName = (String) i.next();
263              BankAccount acct = (BankAccount) accountList.get(accountName)
264              atm.println(accountName + "\t$" + acct.getBalance() + "\t\t"
265                          + acct.getTransactionCount());
266          }
267          atm.println( "\nBank totals");
268          atm.println( "open accounts: " + getNumberOfAccounts() );
269          atm.println( "cash on hand: $" + getBalance());
270          atm.println( "transactions:  " + getTransactionCount());
271          atm.println();
272      }
273
274
275      // Welcome the user to the bank and instruct her on
276      //  her options.
277
278      private void instructUser()
279      {
280          atm.println( "Welcome to " + bankName );
```



```
281          atm.println( month.toString() );
282          atm.println( "Open some accounts and work with them." );
283          help( BANKER_COMMANDS );
284      }
285
286      // Display a help string.
287
288      private void help( String helpString )
289      {
290          atm.println( helpString );
291          atm.println();
292      }
293
294      // Read amount prompted for from the atm.
295      // Throw a NegativeAmountException if amount < 0
296
297      private int readPosAmt( String prompt )
298           throws NegativeAmountException
299      {
300          int amount = atm.readInt( prompt );
301          if (amount < 0) {
302              throw new NegativeAmountException();
303          }
304          return amount;
305      }
306
307      /**
308       * Increment bank balance by given amount.
309       *
310       * @param amount the amount increment.
311       */
312
313      public void incrementBalance(int amount)
314      {
315          balance += amount;
316      }
317
318      /**
319       * Increment by one the count of transactions,
320       * for this bank.
321       */
322
323      public void countTransaction()
324      {
325          transactionCount++;
326      }
327
328      /**
329       * Get the number of transactions performed by this bank.
330       *
331       * @return number of transactions performed.
332       */
333
334      public int getTransactionCount( )
335      {
336          return transactionCount ;
```

```
337      }
338
339      /**
340       * The charge this bank levies for cashing a check.
341       *
342       * @return check fee
343       */
344
345      public int getCheckFee( )
346      {
347          return checkFee ;
348      }
349
350      /**
351       * The charge this bank levies for a transaction.
352       *
353       * @return the transaction fee
354       */
355
356      public int getTransactionFee( )
357      {
358          return transactionFee ;
359      }
360
361      /**
362       * The charge this bank levies each month.
363       *
364       * @return the monthly charge
365       */
366
367      public int getMonthlyCharge( )
368      {
369          return monthlyCharge;
370      }
371
372      /**
373       * The current interest rate on savings.
374       *
375       * @return the interest rate
376       */
377
378      public double getInterestRate( )
379      {
380          return interestRate;
381      }
382
383      /**
384       * The number of free transactions per month.
385       *
386       * @return the number of transactions
387       */
388
389      public int getMaxFreeTransactions()
390      {
391          return maxFreeTransactions;
392      }
```



```
393
394      /**
395       * Get the current bank balance.
396       *
397       * @return current bank balance.
398       */
399
400      public int getBalance()
401      {
402          return balance;
403      }
404
405      /**
406       * Get the current number of open accounts.
407       *
408       * @return number of open accounts.
409       */
410
411      public int getNumberOfAccounts()
412      {
413          return accountList.size();
414      }
415
416      /**
417       * Run the simulation by creating and then visiting a new Bank.
418       * <p>
419       * A -e argument causes the input to be echoed.
420       * This can be useful for executing the program against
421       * a test script, e.g.,
422       * <pre>
423       *   java Bank -e < Bank.in
424       * </pre>
425       *
426       * @param args the command line arguments:
427       *         <pre>
428       *         -e echo input.
429       *         bankName any other command line argument.
430       *         </pre>
431       */
432
433      public static void main( String[] args )
434      {
435          // parse the command line arguments for the echo
436          // flag and the name of the bank
437
438          boolean echo    = false;         // default does not echo
439          String bankName = "River Bank";  // default bank name
440
441          for (int i = 0; i < args.length; i++ ) {
442              if (args[i].equals("-e")) {
443                  echo = true;
444              }
445              else {
446                  bankName = args[i];
447              }
448          }
```

```
449          Bank aBank = new Bank( bankName, new Terminal(echo) );
450          aBank.visit();
451      }
452  }
```

```
// joi/7/bank/BankAccount.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

/**
 * A BankAccount object has private fields to keep track
 * of its current balance, the number of transactions
 * performed and the Bank in which it is an account, and
 * and public methods to access those fields appropriately.
 *
 * @see Bank
 * @version 7
 */

public abstract class BankAccount
{
    private int  balance = 0;          // Account balance (whole dollars)
    private int  transactionCount = 0; // Number of transactions performe
    private Bank issuingBank;          // Bank issuing this account

    /**
     * Construct a BankAccount with the given initial balance and
     * issuing Bank. Construction counts as this BankAccount's
     * first transaction.
     *
     * @param initialBalance the opening balance.
     * @param issuingBank the bank that issued this account.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    protected BankAccount( int initialBalance, Bank issuingBank )
        throws InsufficientFundsException
    {
        this.issuingBank = issuingBank;
        deposit( initialBalance );
    }

    /**
     * Get transaction fee.  By default, 0.
     * Override this for accounts having transaction fees.
     *
     * @return the fee.
     */

    protected int getTransactionFee()
    {
        return 0;
    }

    /**
     * The bank that issued this account.
     *
     * @return the Bank.
     */
```



```

    protected Bank getIssuingBank()
    {
        return issuingBank;
    }

    /**
     * Withdraw the given amount, decreasing this BankAccount's
     * balance and the issuing Bank's balance.
     * Counts as a transaction.
     *
     * @param amount the amount to be withdrawn
     * @return amount withdrawn
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int withdraw( int amount )
        throws InsufficientFundsException
    {
        incrementBalance( -amount - getTransactionFee() );
        countTransaction();
        return amount ;
    }

    /**
     * Deposit the given amount, increasing this BankAccount's
     * balance and the issuing Bank's balance.
     * Counts as a transaction.
     *
     * @param amount the amount to be deposited
     * @return amount deposited
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int deposit(int amount)
        throws InsufficientFundsException
    {
        incrementBalance( amount - getTransactionFee() );
        countTransaction();
        return amount ;
    }

    /**
     * Request for balance. Counts as a transaction.
     *
     * @return current account balance.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int requestBalance()
        throws InsufficientFundsException
    {
        incrementBalance( - getTransactionFee() );
```

```
113          countTransaction();
114          return getBalance() ;
115      }
116
117      /**
118       * Get the current balance.
119       * Does NOT count as a transaction.
120       *
121       * @return current account balance
122       */
123
124      public int getBalance()
125      {
126          return balance;
127      }
128
129      /**
130       * Increment account balance by given amount.
131       * Also increment issuing Bank's balance.
132       * Does NOT count as a transaction.
133       *
134       * @param amount the amount of the increment.
135       *
136       * @exception InsufficientFundsException when appropriate.
137       */
138
139      public final void incrementBalance( int amount )
140          throws InsufficientFundsException
141      {
142          int newBalance = balance + amount;
143          if (newBalance < 0) {
144              throw new InsufficientFundsException(
145                          "for this transaction" );
146          }
147          balance = newBalance;
148          getIssuingBank().incrementBalance( amount );
149      }
150
151      /**
152       * Get the number of transactions performed by this
153       * account. Does NOT count as a transaction.
154       *
155       * @return number of transactions performed.
156       */
157
158      public int getTransactionCount()
159      {
160          return transactionCount;
161      }
162
163      /**
164       * Increment by 1 the count of transactions, for this account
165       * and for the issuing Bank.
166       * Does NOT count as a transaction.
167       *
168       * @exception InsufficientFundsException when appropriate.
```



```
169       */
170
171      public void countTransaction()
172          throws InsufficientFundsException
173      {
174          transactionCount++;
175          this.getIssuingBank().countTransaction();
176      }
177
178      /**
179       * Action to take when a new month starts.
180       *
181       * @exception InsufficientFundsException thrown when funds
182       *            on hand are not enough to cover the fees.
183       */
184
185      public abstract void newMonth()
186          throws InsufficientFundsException;
187  }
```

```
// joi/7/bank/CheckingAccount.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

/**
 * A CheckingAccount is a BankAccount with one new feature:
 * the ability to cash a check by calling the honorCheck method.
 * Each honored check costs the customer a checkFee.
 *
 * @see BankAccount
 *
 * @version 7
 */

public class CheckingAccount extends BankAccount
{
    /**
     * Constructs a CheckingAccount with the given
     * initial balance and issuing Bank.
     * Counts as this account's first transaction.
     *
     * @param initialBalance the opening balance for this account.
     * @param issuingBank the bank that issued this account.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public CheckingAccount( int initialBalance, Bank issuingBank )
        throws InsufficientFundsException
    {
        super( initialBalance, issuingBank );
    }

    /**
     * Honor a check:
     * Charge the account the appropriate fee
     * and withdraw the amount.
     *
     * @param amount amount (in whole dollars) to be withdrawn.
     * @return the amount withdrawn.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int honorCheck( int amount )
        throws InsufficientFundsException
    {
        // careful error checking logic:
        // first try to deduct the check fee
        // if you succeed, try to honor check
        // if that fails, remember to add back the check fee!

        try {
            incrementBalance( - getIssuingBank().getCheckFee() );
        }
```



```
        catch (InsufficientFundsException e) {
            throw new InsufficientFundsException(
                        "to cover check fee" );
        }
        try {
            withdraw( amount );
        }
        catch (InsufficientFundsException e) {
            incrementBalance( getIssuingBank().getCheckFee() );
            throw new InsufficientFundsException(
                        "to cover check + check fee" );
        }
        return amount;
    }

    /**
     *  Nothing special happens to a CheckingAccount on the
     *  first day of the month.
     */

    public void newMonth()
    {
        return;
    }
}
```

```
// joi/7/bank/SavingsAccount.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

/**
 * A SavingsAccount is a BankAccount that bears interest.
 * A fee is charged for too many transactions in a month.
 *
 * @see BankAccount
 *
 * @version 7
 */

public class SavingsAccount extends BankAccount
{
    private int transactionsThisMonth;

    /**
     * Override getTransactionFee() to return a non-zero fee
     * after the appropriate number of free monthly transactions.
     *
     * @return the fee for current transaction.
     */

    protected int getTransactionFee()
    {
        if (transactionsThisMonth >
            getIssuingBank().getMaxFreeTransactions()) {
            return getIssuingBank().getTransactionFee();
        }
        else {
            return 0;
        }
    }

    /**
     * Increment count of transactions, for this account for
     * this Month and in total  and for the issuing Bank, by one.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public void countTransaction()
        throws InsufficientFundsException
    {
        transactionsThisMonth++;
        super.countTransaction();
    }

    /**
     * Constructor, accepting an initial balance.
     * @param initialBalance the opening balance.
     *
     * @param issuingBank the bank that issued this account.
     *
```



```
     * @exception InsufficientFundsException when appropriate.
     */

    public SavingsAccount( int initialBalance, Bank issuingBank )
         throws InsufficientFundsException
    {
        super( initialBalance, issuingBank);
        transactionsThisMonth = 1;
    }

    /**
     * A SavingsAccount earns interest each month.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public void newMonth()
         throws InsufficientFundsException
    {
        double monthlyRate = getIssuingBank().getInterestRate()/12;
        incrementBalance( (int)(monthlyRate * getBalance()));
        transactionsThisMonth = 0;
    }
}
```

```
// joi/7/bank/FeeAccount.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

/**
 * A FeeAccount is a BankAccount with one new feature:
 * the user is charged for each transaction.
 *
 * @see BankAccount
 *
 * @version 7
 */

public class FeeAccount extends BankAccount
{
    /**
     * Constructor, accepting an initial balance and issuing Bank.
     *
     * @param initialBalance the opening balance.
     * @param issuingBank the bank that issued this account.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public FeeAccount( int initialBalance, Bank issuingBank )
        throws InsufficientFundsException
    {
        super( initialBalance, issuingBank);
    }

    /**
     * The Bank's transaction fee.
     *
     * @return the fee.
     */

    protected int getTransactionFee()
    {
        return getIssuingBank().getTransactionFee();
    }

    /**
     * The way a transaction is counted for a FeeAccount: it levies
     * a transaction fee as well as counting the transaction.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public void countTransaction()
        throws InsufficientFundsException
    {
        incrementBalance( - getTransactionFee() );
        super.countTransaction();
    }

```



```
    /**
     * A FeeAccount incurs a monthly charge.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public void newMonth()
         throws InsufficientFundsException
    {
        incrementBalance( - getIssuingBank().getMonthlyCharge());
    }
}
```

```
 1  // joi/5/bank/RegularAccount.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * A RegularAccount is a BankAccount that has no special behavior.
 8   *
 9   * It does what a BankAccount does.
10   */
11
12  public class RegularAccount extends BankAccount
13  {
14
15      /**
16       * Construct a BankAccount with the given initial balance and
17       * issuing Bank. Construction counts as this BankAccount's
18       * first transaction.
19       *
20       * @param initialBalance the opening balance.
21       * @param issuingBank the bank that issued this account.
22       *
23       * @exception InsufficientFundsException when appropriate.
24       */
25
26      public RegularAccount( int initialBalance, Bank issuingBank )
27          throws InsufficientFundsException
28      {
29          super( initialBalance, issuingBank );
30      }
31
32      /**
33       * Action to take when a new month starts.
34       *
35       * A RegularAccount does nothing when the next month starts.
36       */
37
38      public void newMonth() {
39          // do nothing
40      }
41
42  }
```

```
 1  // joi/7/bank/class Month
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.io.*;
 7  import java.util.Calendar;
 8
 9  /**
10   * The Month class implements an object that keeps
11   * track of the month of the year.
12   *
13   * @version 7
14   */
15
16  public class Month
17  {
18      private static final String[] monthName =
19          {"Jan", "Feb", "Mar", "Apr", "May", "Jun",
20           "Jul", "Aug", "Sep", "Oct", "Nov", "Dec"};
21
22      private int month;
23      private int year;
24
25      /**
26       *  Month constructor constructs a Month object
27       *  initialized to the current month and year.
28       */
29
30      public Month()
31      {
32          Calendar rightNow = Calendar.getInstance();
33          month = rightNow.get( Calendar.MONTH );
34          year  = rightNow.get( Calendar.YEAR );
35      }
36
37      /**
38       *  Advance to next month.
39       */
40
41      public void next()
42      {
43          month = (month + 1) % 12;
44          if (month == 0) {
45              year++;
46          }
47      }
48
49      /**
50       * How a Month is displayed as a String -
51       * for example, "Jan, 2003".
52       *
53       * @return String representation of the month.
54       */
55
56      public String toString()
```



```
57      {
58          return monthName[month] + ", " + year;
59      }
60
61      /**
62       * For unit testing.
63       */
64
65      public static void main( String[] args )
66      {
67          Month m = new Month();
68          for (int i=0; i < 14; i++, m.next()) {
69              System.out.println(m);
70          }
71          for (int i=0; i < 35; i++, m.next()); // no loop body
72          System.out.println( "three years later: " + m );
73          for (int i=0; i < 120; i++, m.next());// no loop body
74          System.out.println( "ten years later: " + m );
75      }
76  }
```

```
 1  // joi/7/bank/InsufficientFundsException.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * Thrown when there is an attempt to spend money that is not there.
 8   *
 9   * @version 7
10   */
11
12  public class InsufficientFundsException extends Exception
13  {
14      /**
15       * Construct an InsufficientFundsException
16       * with a String description.
17       *
18       * @param msg a more specific description.
19       */
20
21      public InsufficientFundsException( String msg )
22      {
23          super( msg );
24      }
25
26      /**
27       * Construct an InsufficientFundsException
28       * with no description.
29       */
30
31      public InsufficientFundsException()
32      {
33          this( "" );
34      }
35  }
```

```
 1  // joi/7/bank/NegativeAmountException.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * Thrown when attempting to work with a negative amount.
 8   *
 9   * @version 7
10   */
11
12  public class NegativeAmountException extends Exception
13  {
14  }
```

```
// joi/7/juno/Juno.java
//
//
//  Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.*;
import java.util.*;
import java.lang.*;

/**
 * Juno (Juno's Unix NOt) mimics a command line operating system
 * like Unix.
 * <p>
 * A Juno system has a name, a set of Users, a JFile system,
 * a login process and a set of shell commands.
 *
 * @see User
 * @see JFile
 * @see ShellCommand
 *
 * @version 7
 */

public class Juno
{
    private final static String OS      = "Juno";
    private final static String VERSION = "7";

    private String    hostName;   // host machine name
    private Map       users;      // lookup table for Users
    private Terminal  console;    // for input and output

    private Directory slash;      // root of JFile system
    private Directory userHomes;  // for home directories

    private ShellCommandTable commandTable; // shell commands

    /**
     * Construct a Juno (operating system) object.
     *
     * @param hostName  the name of the host on which it's running.
     * @param echoInput should all input be echoed as output?
     */

    public Juno( String hostName, boolean echoInput )
    {
        // initialize the Juno environment ...

        this.hostName = hostName;
        console       = new Terminal( echoInput );
        users         = new TreeMap();           // for registered Users
        commandTable  = new ShellCommandTable(); // for shell commands

        // the file system

        slash     = new Directory( "", null, null );
```



```
        User root = new User( "root", slash, "Rick Martin" );
        users.put( "root", root );
        slash.setOwner(root);
        userHomes = new Directory( "users", root, slash );

        // create, then start a command line login interpreter

        LoginInterpreter interpreter
            = new LoginInterpreter( this, console );
        interpreter.CLILogin();
    }

    /**
     * The name of the host computer on which this system
     * is running.
     *
     * @return the host computer name.
     */

    public String getHostName()
    {
        return hostName;
    }

    /**
     * The name of this operating system.
     *
     * @return the operating system name.
     */

    public String getOS()
    {
        return OS;
    }

    /**
     * The version number for this system.
     *
     * @return the version number.
     */

    public String getVersion()
    {
        return VERSION;
    }

    /**
     * The directory containing all user homes for this system.
     *
     * @return the directory containing user homes.
     */

    public Directory getUserHomes()
    {
        return userHomes;
    }
```

```
113
114     /**
115      * The shell command table for this system.
116      *
117      * @return the shell command table.
118      */
119
120     public ShellCommandTable getCommandTable()
121     {
122         return commandTable;
123     }
124
125     /**
126      * Look up a user by user name.
127      *
128      * @param username the user's name.
129      * @return the appropriate User object.
130      */
131
132     public User lookupUser( String username )
133     {
134         return (User) users.get( username );
135     }
136
137     /**
138      * Create a new User.
139      *
140      * @param userName the User's login name.
141      * @param home her home Directory.
142      * @param realName her real name.
143      * @return newly created User.
144      */
145
146     public User createUser( String userName, Directory home,
147                             String realName )
148     {
149         User newUser = new User( userName, home, realName );
150         users.put( userName, newUser );
151         return newUser;
152     }
153
154     /**
155      * The Juno system may be given the following command line
156      * arguments.
157      * <pre>
158      *
159      * -e:         Echo all input (useful for testing).
160      *
161      * -version:   Report the version number and exit.
162      *
163      * [hostname]: The name of the host on which
164      *             Juno is running (optional).
165      * </pre>
166      */
167
168     public static void main( String[] args )
```



```
169     {
170         // Parse command line options
171
172         boolean echoInput = false;
173         String  hostName  = "mars";
174
175         for (int i=0; i < args.length; i++) {
176             if (args[i].equals("-version")) {
177                 System.out.println( OS + " version " + VERSION );
178                 System.exit(0);
179             }
180             if (args[i].equals("-e")) {
181                 echoInput = true;
182             }
183             else {
184                 hostName = args[i];
185             }
186         }
187
188         // create a Juno instance, which will start itself
189
190         new Juno( hostName, echoInput );
191     }
192 }
```

```
// joi/7/juno/LoginInterpreter.java
//
//
// Copyright 2003 Ethan Bolker and Bill Campbell

import java.util.*;

/**
 * Interpreter for Juno login commands.
 *
 * There are so few commands that if-then-else logic is OK.
 *
 * @version 7
 */

public class LoginInterpreter
{
    private static final String LOGIN_COMMANDS =
        "help, register, <username>, exit";

    private Juno     system;  // the Juno object
    private Terminal console; // for i/o

    /**
     * Construct a new LoginInterpreter for interpreting
     * login commands.
     *
     * @param system the system creating this interpreter.
     * @param console the Terminal used for input and output.
     */

    public LoginInterpreter( Juno system, Terminal console)
    {
        this.system  = system;
        this.console = console;
    }

    /**
     * Set the console for this interpreter.  Used by the
     * creator of this interpreter.
     *
     * @param console the Terminal to be used for input and output.
     */

    public void setConsole( Terminal console )
    {
        this.console = console;
    }

    /**
     * Simulates behavior at login: prompt.
     * CLI stands for "Command Line Interface".
     */

    public void CLILogin()
    {
```



```
        welcome();
        boolean moreWork = true;
        while( moreWork ) {
            moreWork = interpret( console.readLine( "Juno login: " ) );
        }
    }

    // Parse user's command line and dispatch appropriate
    // semantic action.
    //
    // return true unless "exit" command or null inputLine.

    private boolean interpret( String inputLine )
    {
        if (inputLine == null) return false;
        StringTokenizer st =
            new StringTokenizer( inputLine );
        if (st.countTokens() == 0) {
            return true; // skip blank line
        }
        String visitor = st.nextToken();
        if (visitor.equals( "exit" )) {
            return false;
        }
        if (visitor.equals( "register" )) {
            register( st );
        }
        else if (visitor.equals( "help" )) {
            help();
        }
        else {
            User user = system.lookupUser(visitor);
            new Shell( system, user, console );
        }
        return true;
    }

    // Register a new user, giving him or her a login name and a
    // home directory on the system.
    //
    // StringTokenizer argument contains the new user's login name
    // followed by full real name.

    private void register( StringTokenizer st )
    {
        String userName = st.nextToken();
        String realName = st.nextToken("").trim();
        Directory home  = new Directory( userName, null,
                                         system.getUserHomes() );
        User user = system.createUser( userName, home, realName );
        home.setOwner( user );
    }

    // Display a short welcoming message, and remind users of
    // available commands.

```

```
   113      private void welcome()
   114      {
   115          console.println( "Welcome to " + system.getHostName() +
   116                           " running " + system.getOS() +
   117                           " version " + system.getVersion() );
   118          help();
   119      }
   120
   121      // Remind user of available commands.
   122
   123      private void help()
   124      {
   125          console.println( LOGIN_COMMANDS );
   126          console.println("");
   127      }
   128  }
```

```
// joi/7/juno/Shell.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * Models a shell (command interpreter)
 *
 * The Shell knows the (Juno) system it's working in,
 * the User who started it,
 * and the console to which to send output.
 *
 * It keeps track of the the current working directory (.) .
 *
 * @version 7
 */

public class Shell
{
    private Juno system;       // the operating system object
    private User user;         // the user logged in
    private Terminal console;  // the console for this shell
    private Directory dot;     // the current working directory

    /**
     * Construct a login shell for the given user and console.
     *
     * @param system a reference to the Juno system.
     * @param user the User logging in.
     * @param console a Terminal for input and output.
     */

    public Shell( Juno system, User user, Terminal console )
    {
        this.system  = system;
        this.user    = user;
        this.console = console;
        dot          = user.getHome(); // default current directory
        CLIShell();
    }

    // Run the command line interpreter

    private void CLIShell()
    {
        boolean moreWork = true;
        while(moreWork) {
            moreWork = interpret( console.readLine( getPrompt() ) );
        }
        console.println("goodbye");
    }

    // Interpret a String of the form
    //     shellcommand command-arguments
```



```
    //
    // return true, unless shell command is logout.

    private boolean interpret( String inputLine )
    {
        StringTokenizer st = stripComments(inputLine);
        if (st.countTokens() == 0) {           // skip blank line
            return true;
        }
        String commandName = st.nextToken();
        ShellCommand commandObject =
            system.getCommandTable().lookup( commandName );
        if (commandObject == null ) {                              // EEE
            console.errPrintln("Unknown command: " + commandName);// EEE
            return true;
        }                                                          // EEE
        try {                                                      // EEE
            commandObject.doIt( st, this );                        // EEE
        }                                                          // EEE
        catch (ExitShellException e) {
            return false;
        }
        catch (BadShellCommandException e) {                       // EEE
            console.errPrintln( "Usage: " + commandName + " " +  // EEE
                                e.getCommand().getArgString() ); // EEE
        }                                                          // EEE
        catch (JunoException e) {                                  // EEE
            console.errPrintln( e.getMessage() );                  // EEE
        }                                                          // EEE
        catch (Exception e) {                                      // EEE
            console.errPrintln( "you should never get here" );   // EEE
            console.errPrintln( e.toString() );                    // EEE
        }                                                          // EEE
        return true;
    }

    // Strip characters from '#' to end of line, create and
    // return a StringTokenizer for what's left.

    private StringTokenizer stripComments( String line )
    {
        int commentIndex = line.indexOf('#');
        if (commentIndex >= 0) {
            line = line.substring(0,commentIndex);
        }
        return new StringTokenizer(line);
    }

    /**
     * The prompt for the CLI.
     *
     * @return the prompt string.
     */

    public String getPrompt()
    {
```

```
113          return system.getHostName() + "> ";
114      }
115
116      /**
117       * The User associated with this shell.
118       *
119       * @return the user.
120       */
121
122      public User getUser()
123      {
124          return user;
125      }
126
127      /**
128       * The current working directory for this shell.
129       *
130       * @return the current working directory.
131       */
132
133      public Directory getDot()
134      {
135          return dot;
136      }
137
138      /**
139       * Set the current working directory for this Shell.
140       *
141       * @param dot the new working directory.
142       */
143
144      public void setDot(Directory dot)
145      {
146          this.dot = dot;
147      }
148
149      /**
150       * The console associated with this Shell.
151       *
152       * @return the console.
153       */
154
155      public Terminal getConsole()
156      {
157          return console;
158      }
159
160      /**
161       * The Juno object associated with this Shell.
162       *
163       * @return the Juno instance that created this Shell.
164       */
165
166      public Juno getSystem()
167      {
168          return system;
```



```
169      }
170  }
```

```
 1  // joi/7/juno/ShellCommand.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * Model those features common to all ShellCommands.
10   *
11   * Each concrete extension of this class provides a constructor
12   * and an implementation for method doIt.
13   *
14   * @version 7
15   */
16
17  public abstract class ShellCommand
18  {
19      private String helpString;   // documents the command
20      private String argString;    // any args to the command
21
22      /**
23       * A constructor, always called (as super()) by the subclass.
24       * Used only for commands that have arguments.
25       *
26       * @param helpString a brief description of what the command does.
27       * @param argString a prototype illustrating the required arguments.
28       */
29
30      protected ShellCommand( String helpString, String argString )
31      {
32          this.argString  = argString;
33          this.helpString = helpString;
34      }
35
36      /**
37       * A constructor for commands having no arguments.
38       *
39       * @param helpString a brief description of what the command does.
40       */
41
42      protected ShellCommand( String helpString )
43      {
44          this( helpString, "" );
45      }
46
47      /**
48       * Execute the command.
49       *
50       * @param args the remainder of the command line.
51       * @param sh   the current shell
52       *
53       * @exception JunoException for reporting errors
54       */
55
56      public abstract void doIt( StringTokenizer args, Shell sh )
```



```
57          throws JunoException;
58
59      /**
60       * Help for this command.
61       *
62       * @return the help string.
63       */
64
65      public String getHelpString()
66      {
67          return helpString;
68      }
69
70      /**
71       * The argument string prototype.
72       *
73       * @return the argument string prototype.
74       */
75
76      public String getArgString()
77      {
78          return argString;
79      }
80  }
```

```
// joi/7/juno/ShellCommandTable.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * A ShellCommandTable object maintains a dispatch table of
 * ShellCommand objects keyed by the command names used to invoke
 * them.
 *
 * To add a new shell command to the table, install it from
 * method fillTable().
 *
 * @see ShellCommand
 *
 * @version 7
 */

public class ShellCommandTable
{
    private Map table = new TreeMap();

    /**
     * Construct and fill a shell command table.
     */

    public ShellCommandTable()
    {
        fillTable();
    }

    /**
     * Get a ShellCommand, given the command name key.
     *
     * @param key the name associated with the command we're
     *            looking for.
     *
     * @return the command we're looking for, null if none.
     */

    public ShellCommand lookup( String key )
    {
        ShellCommand commandObject = (ShellCommand) table.get( key );
        if (commandObject != null) {
            return commandObject;
        }

        // try to load dynamically
        // construct classname = "KeyCommand"
        char[] chars = (key + "Command").toCharArray();
        chars[0] = key.toUpperCase().charAt(0);
        String classname = new String(chars);
        try {
            commandObject =
```



```
                (ShellCommand)Class.forName(classname).newInstance();
        }
        catch (Exception e) { // couldn't find class
            return null;
        }
        install(key, commandObject); // put it in table for next time
        return commandObject;
    }

    /**
     * Get an array of the command names.
     *
     * @return the array of command names.
     */

    public String[] getCommandNames()
    {
        return (String[]) table.keySet().toArray( new String[0] );
    }

    // Associate a command name with a ShellCommand.

    private void install( String commandName, ShellCommand command )
    {
        table.put( commandName, command );
    }

    // Fill the dispatch table with ShellCommands, keyed by their
    // command names.

    private void fillTable()
    {
        install( "list", new ListCommand() );
        install( "cd", new CdCommand() );
        install( "newfile", new NewfileCommand() );
        install( "remove", new RemoveCommand() );
        install( "help", new HelpCommand() );
        install( "mkdir", new MkdirCommand() );
        install( "type", new TypeCommand() );
        install( "logout", new LogoutCommand() );
    }
}
```

```
 1  // joi/7/juno/MkdirCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to create a new directory.
10   * Usage:
11   * <pre>
12   *     mkdir directory-name
13   * </pre>
14   *
15   * @version 7
16   */
17
18  public class MkdirCommand extends ShellCommand
19  {
20      MkdirCommand()
21      {
22          super( "create a subdirectory of the current directory",
23                 "directory-name" );
24      }
25
26      /**
27       * Create a new Directory in the current Directory.
28       *
29       * @param args the remainder of the command line.
30       * @param sh the current shell.
31       *
32       * @exception JunoException for reporting errors.
33       */
34
35      public void doIt( StringTokenizer args, Shell sh )
36           throws JunoException
37      {
38          String filename = args.nextToken();
39          new Directory( filename, sh.getUser(), sh.getDot() );
40      }
41  }
```

```
// joi/7/juno/TypeCommand.java
//
//
// Copyright 2003, Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * The Juno shell command to display the contents of a
 * text file.
 * Usage:
 * <pre>
 *     type textfile
 * </pre>
 *
 * @version 7
 */

public class TypeCommand extends ShellCommand
{
    TypeCommand()
    {
        super( "display contents of a TextFile", "textfile" );
    }

    /**
     * Display the contents of a TextFile.
     *
     * @param args the remainder of the command line.
     * @param sh the current Shell
     *
     * @exception JunoException for reporting errors
     */

    public void doIt( StringTokenizer args, Shell sh )
        throws JunoException                                // EEE
    {
        String filename;
        try {                                               // EEE
            filename = args.nextToken();
        }                                                   // EEE
        catch (NoSuchElementException e) {
            throw new BadShellCommandException( this );     // EEE
        }                                                   // EEE
        try {                                               // EEE
            sh.getConsole().println(
                ( (TextFile) sh.getDot().
                  retrieveJFile( filename ) ).getContents() );
        }                                                   // EEE
        catch (NullPointerException e) {                    // EEE
            throw new JunoException( "JFile does not exist: "  // EEE
                                   + filename);               // EEE
        }                                                     // EEE
        catch (ClassCastException e) {                        // EEE
            throw new JunoException( "JFile not a text file: " // EEE
                                   + filename);               // EEE
        }                                                     // EEE
    }                                                         // EEE
}
```

```
 1  // joi/7/juno/HelpCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to display help on the shell commands.
10   * Usage:
11   * <pre>
12   *     help
13   * </pre>
14   *
15   * @version 7
16   */
17
18  public class HelpCommand extends ShellCommand
19  {
20      HelpCommand()
21      {
22          super( "display ShellCommands" );
23      }
24
25      /**
26       * Print out help for all commands.
27       *
28       * @param args the remainder of the command line.
29       * @param sh   the current shell
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          // Get command keys from global table, print them out.
38
39          sh.getConsole().println( "shell commands" );
40          ShellCommandTable table = sh.getSystem().getCommandTable();
41          String[] names = table.getCommandNames();
42          for (int i = 0; i < names.length; i++ ) {
43              String cmdname = names[i];
44              ShellCommand cmd =
45                  (ShellCommand) table.lookup( cmdname );
46              sh.getConsole().
47                  println( "  " + cmdname + ": " + cmd.getHelpString() );
48          }
49      }
50  }
```

```
 1  // joi/7/juno/NewfileCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to create a text file.
10   * Usage:
11   * <pre>
12   *     newfile filename contents
13   * </pre>
14   *
15   * @version 7
16   */
17
18  public class NewfileCommand extends ShellCommand
19  {
20      NewfileCommand()
21      {
22          super( "create a new TextFile", "filename contents" );
23      }
24
25      /**
26       * Create a new TextFile in the current Directory.
27       *
28       * @param args the remainder of the command line.
29       * @param sh the current shell.
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          String filename;
38          String contents;
39          filename = args.nextToken();
40          contents  = args.nextToken("").trim(); // rest of line
41          new TextFile( filename, sh.getUser(),
42                        sh.getDot(), contents );
43      }
44  }
```

```
// joi/7/juno/CdCommand.java
//
//
// Copyright 2003, Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * The Juno shell command to change directory.
 * Usage:
 * <pre>
 *     cd [directory]
 * </pre>
 * for moving to the named directory.
 *
 * @version 7
 */

class CdCommand extends ShellCommand
{
    CdCommand()
    {
        super( "change current directory", "[ directory ]" );
    }

    /**
     * Move to the named directory
     *
     * @param args the remainder of the command line.
     * @param sh   the current shell
     *
     * @exception JunoException for reporting errors
     */

    public void doIt( StringTokenizer args, Shell sh )
         throws JunoException
    {
        String dirname = "";
        Directory d = sh.getUser().getHome(); // default
        if ( args.hasMoreTokens() ) {
            dirname = args.nextToken();
            if (dirname.equals("..")) {
                if (sh.getDot().isRoot()) {
                    d = sh.getDot(); // no change
                }
                else {
                    d = sh.getDot().getParent();
                }
            }
            else if (dirname.equals(".")) {
                d = sh.getDot(); // no change
            }
            else {
                d = (Directory)(sh.getDot().retrieveJFile(dirname));
            }
        }
```



```
            sh.setDot( d );
        }
    }
```

```
 1  // joi/7/juno/ListCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to list contents of the current directory.
10   * Usage:
11   * <pre>
12   *     list
13   * </pre>
14   *
15   * @version 7
16   */
17
18  public class ListCommand extends ShellCommand
19  {
20      // The constructor adds this object to the global table.
21
22      ListCommand()
23      {
24          super( "list contents of current directory" );
25      }
26
27      /**
28       * List contents of the current working directory.
29       *
30       * @param args the remainder of the command line.
31       * @param sh   the current shell
32       *
33       * @exception JunoException for reporting errors
34       */
35
36      public void doIt( StringTokenizer args, Shell sh )
37          throws JunoException
38      {
39          Terminal terminal = sh.getConsole();
40          Directory dir     = sh.getDot();
41          String[] fileNames = dir.getFileNames();
42
43          terminal.println( dir.getPathName() );
44          for ( int i = 0; i < fileNames.length; i++ ) {
45              String fileName = fileNames[i];
46              JFile  jfile    = dir.retrieveJFile( fileName );
47              terminal.println( jfile.toString() );
48          }
49      }
50  }
```

```
 1  // joi/7/juno/LogoutCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to log out.
10   * Usage:
11   * <pre>
12   *     logout
13   * </pre>
14   *
15   * @version 7
16   */
17
18  public class LogoutCommand extends ShellCommand
19  {
20      LogoutCommand()
21      {
22          super( "log out, return to login: prompt" );
23      }
24
25      /**
26       * Log out from the current shell.
27       *
28       * @param args the remainder of the command line.
29       * @param sh   the current shell
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          throw new ExitShellException();
38      }
39  }
```

```
 1  // joi/7/juno/RemoveCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to remove a text file.
10   * Usage:
11   * <pre>
12   *     remove textfile
13   * </pre>
14   *
15   * @version 7
16   */
17
18  public class RemoveCommand extends ShellCommand
19  {
20      RemoveCommand()
21      {
22          super( "remove a TextFile", "textfile" );
23      }
24
25      /**
26       * Remove a TextFile.
27       *
28       * @param args the remainder of the command line.
29       * @param sh   the current Shell
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          String filename = args.nextToken();
38          sh.getDot().removeJFile(filename);
39      }
40  }
```

```
// joi/7/jfiles/JFile.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.Date;
import java.io.File;

/**
 * A JFile object models a file in a hierarchical file system.
 * <p>
 * Extend this abstract class to create particular kinds of JFiles,
 * e.g.:<br>
 * Directory  -
 *    a JFile that maintains a list of the files it contains.<br>
 * TextFile  -
 *    a JFile containing text you might want to read.<br>
 *
 * @see Directory
 * @see TextFile
 *
 * @version 7
 */

public abstract class JFile
{
    /**
     * The separator used in pathnames.
     */

    public static final String separator = File.separator;

    private String    name;       // a JFile knows its name
    private User      owner;      // the owner of this file
    private Date      createDate; // when this file was created
    private Date      modDate;    // when this file was last modified
    private Directory parent;     // the Directory containing this file

    /**
     * Construct a new JFile, set owner, parent, creation and
     * modification dates. Add this to parent (unless this is the
     * root Directory).
     *
     * @param name     the name for this file (in its parent directory).
     * @param creator  the owner of this new file.
     * @param parent   the Directory in which this file lives.
     */

    protected JFile( String name, User creator, Directory parent )
    {
        this.name   = name;
        this.owner  = creator;
        this.parent = parent;
        if (parent != null) {
            parent.addJFile( name, this );
        }
```



```
        createDate  = modDate = new Date(); // set dates to now
    }

    /**
     * The name of the file.
     *
     * @return the file's name.
     */

    public String getName()
    {
        return name;
    }

    /**
     * The full path to this file.
     *
     * @return the path name.
     */

    public String getPathName()
    {
        if (this.isRoot()) {
            return separator;
        }
        if (parent.isRoot()) {
            return separator + getName();
        }
        return parent.getPathName() + separator + getName();
    }

    /**
     * The size of the JFile
     * (as defined by the child class)..
     *
     * @return the size.
     */

    public abstract int getSize();

    /**
     * Suffix used for printing file names
     * (as defined by the child class).
     *
     * @return the file's suffix.
     */

    public abstract String getSuffix();

    /**
     * Set the owner for this file.
     *
     * @param owner the new owner.
     */

    public void setOwner( User owner )
```

```
113      {
114          this.owner = owner;
115      }
116
117      /**
118       * The file's owner.
119       *
120       * @return the owner of the file.
121       */
122
123      public User getOwner()
124      {
125          return owner;
126      }
127
128      /**
129       * The date and time of the file's creation.
130       *
131       * @return the file's creation date and time.
132       */
133
134      public String getCreateDate()
135      {
136          return createDate.toString();
137      }
138
139      /**
140       * Set the modification date to "now".
141       */
142
143      protected void setModDate()
144      {
145          modDate = new Date();
146      }
147
148      /**
149       * The date and time of the file's last modification.
150       *
151       * @return the date and time of the file's last modification.
152       */
153
154      public String getModDate()
155      {
156          return modDate.toString();
157      }
158
159      /**
160       * The Directory containing this file.
161       *
162       * @return the parent directory.
163       */
164
165      public Directory getParent()
166      {
167          return parent;
168      }
```



```
169
170      /**
171       * A JFile whose parent is null is defined to be the root
172       * (of a tree).
173       *
174       * @return true when this JFile is the root.
175       */
176
177      public boolean isRoot()
178      {
179          return (parent == null);
180      }
181
182      /**
183       * How a JFile represents itself as a String.
184       * That is,
185       * <pre>
186       *    owner   size    modDate    name+suffix
187       * </pre>
188       *
189       * @return the String representation.
190       */
191
192      public String toString()
193      {
194          return getOwner() + "\t" +
195              getSize()  + "\t" +
196              getModDate()  + "\t" +
197              getName() + getSuffix();
198      }
199  }
```

```
// joi/7/juno/Directory.java
//
//
// Copyright 2003 Ethan Bolker and Bill Campbell

import java.util.*;

/**
 * Directory of JFiles.
 *
 * A Directory is a JFile that maintains a
 * table of the JFiles it contains.
 *
 * @version 7
 */

public class Directory extends JFile
{
    private TreeMap jfiles;  // table for JFiles in this Directory

    /**
     * Construct a Directory.
     *
     * @param name the name for this Directory (in its parent Directory)
     * @param creator the owner of this new Directory
     * @param parent the Directory in which this Directory lives.
     */

    public Directory( String name, User creator, Directory parent)
    {
        super( name, creator, parent );
        jfiles = new TreeMap();
    }

    /**
     * The size of a Directory is the number of JFiles it contains.
     *
     * @return the Directory's size.
     */

    public int getSize()
    {
        return jfiles.size();
    }

    /**
     * Suffix used for printing Directory names;
     * we define it as the (system dependent)
     * name separator used in path names.
     *
     * @return the suffix for Directory names.
     */

    public String getSuffix()
    {
        return  JFile.separator;
```



```
    }

    /**
     * Add a JFile to this Directory. Overwrite if a JFile
     * of that name already exists.
     *
     * @param name the name under which this JFile is added.
     * @param afile the JFile to add.
     */

    public void addJFile(String name, JFile afile)
    {
        jfiles.put( name, afile );
        setModDate();
    }

    /**
     * Get a JFile in this Directory, by name .
     *
     * @param filename the name of the JFile to find.
     * @return the JFile found.
     */

    public JFile retrieveJFile( String filename )
    {
        JFile aFile = (JFile)jfiles.get( filename );
        return aFile;
    }

    /**
     * Remove a JFile in this Directory, by name .
     *
     * @param filename the name of the JFile to remove
     */

    public void removeJFile( String filename )
    {
        jfiles.remove( filename );
    }

    /**
     * Get the contents of this Directory as an array of
     * the file names, each of which is a String.
     *
     * @return the array of names.
     */

    public String[] getFileNames()
    {
        return (String[])jfiles.keySet().toArray( new String[0] );
    }
}
```

```
 1  // joi/7/juno/TextFile.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * A TextFile is a JFile that holds text.
 8   *
 9   * @version 7
10   */
11
12  public class TextFile extends JFile
13  {
14      private String contents;  // The text itself
15
16      /**
17       * Construct a TextFile with initial contents.
18       *
19       * @param name the name for this TextFile (in its parent Directory)
20       * @param creator the owner of this new TextFile
21       * @param parent  the Directory in which this TextFile lives.
22       * @param initialContents the initial text
23       */
24
25      public TextFile( String name, User creator, Directory parent,
26                       String initialContents )
27      {
28          super( name, creator, parent );
29          setContents( initialContents );
30      }
31
32      /**
33       * Construct an empty TextFile.
34       *
35       * @param name the name for this TextFile (in its parent Directory)
36       * @param creator the owner of this new TextFile
37       * @param parent  the Directory in which this TextFile lives
38       */
39
40      TextFile( String name, User creator, Directory parent )
41      {
42          this( name, creator, parent, "" );
43      }
44
45      /**
46       * The size of a text file is the number of characters stored.
47       *
48       * @return the file's size.
49       */
50
51      public int getSize()
52      {
53          return contents.length();
54      }
55
56      /**
```



```
57       * Suffix used for printing text file names is "".
58       *
59       * @return an empty suffix (for TextFiles).
60       */
61
62      public String getSuffix()
63      {
64          return "";
65      }
66
67      /**
68       * Replace the contents of the file.
69       *
70       * @param contents the new contents.
71       */
72
73      public void setContents( String contents )
74      {
75          this.contents = contents;
76          setModDate();
77      }
78
79      /**
80       * The contents of a text file.
81       *
82       * @return String contents of the file.
83       */
84
85      public String getContents()
86      {
87          return contents;
88      }
89
90      /**
91       * Append text to the end of the file.
92       *
93       * @param  text the text to be appended.
94       */
95
96      public void append( String text )
97      {
98          setContents( contents + text );
99      }
100
101
102     /**
103      * Append a new line of text to the end of the file.
104      *
105      * @param  text the text to be appended.
106      */
107
108     public void appendLine( String text )
109     {
110         this.setContents(contents + '\n' + text);
111     }
112 }
```

```
 1  // joi/7/juno/User.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * Model a Juno user.  Each User has a login name,
 8   * a home directory, and a real name.
 9   *
10   * @version 7
11   */
12
13  public class User
14  {
15      private String name;     // the User's login name
16      private Directory home;  // her home Directory
17      private String realName; // her real name
18
19      /**
20       * Construct a new User.
21       *
22       * @param name     the User's login name.
23       * @param home     her home Directory.
24       * @param realName her real name.
25       */
26
27      public User( String name, Directory home, String realName )
28      {
29          this.name     = name;
30          this.home     = home;
31          this.realName = realName;
32      }
33
34      /**
35       * Get the User's login name.
36       *
37       * @return the name.
38       */
39
40      public String getName()
41      {
42          return name;
43      }
44
45      /**
46       * Convert the User to a String.
47       * The String representation for a User is her
48       * login name.
49       *
50       * @return the User's name.
51       */
52
53      public String toString()
54      {
55          return getName();
56      }
```



```
57
58      /**
59       * Get the User's home Directory.
60       *
61       * @return the home Directory.
62       */
63
64      public Directory getHome()
65      {
66          return home;
67      }
68
69      /**
70       * Get the user's real name.
71       *
72       * @return the real name.
73       */
74
75      public String getRealName()
76      {
77          return realName;
78      }
79  }
```

```
 1  // joi/7/juno/JunoException.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * A general Juno Exception.
 8   *
 9   * @version 7
10   */
11
12  public class JunoException extends Exception
13  {
14      /**
15       * The default (no argument) constructor.
16       */
17
18      public JunoException()
19      {
20      }
21
22      /**
23       * A general Juno exception holding a String message.
24       *
25       * @param message the message.
26       */
27
28      public JunoException( String message )
29      {
30          // Exception (actually Throwable, Exceptions's superclass)
31          // can remember the String passed its constructor.
32
33          super( message );
34      }
35
36      // Note, to get the message stored in a JunoException
37      // we can just use the (inherited) methods getMessage(),
38      // and toString().
39  }
```

```
 1  // joi/7/juno/BadShellCommandException.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * The Exception generated when a ShellCommand is misused.
 8   *
 9   * @version 7
10   */
11
12  class BadShellCommandException extends JunoException
13  {
14      private ShellCommand command;
15
16      /**
17       * Construct a new BadShellCommandException
18       * containing the badly used command.
19       *
20       * @param the ShellCommand being misused.
21       */
22
23      public BadShellCommandException( ShellCommand command )
24      {
25          this.command = command;
26      }
27
28      /**
29       * Get the command.
30       */
31
32      public ShellCommand getCommand()
33      {
34          return command;
35      }
36  }
```

```
 1  // joi/7/juno/ExitShellException.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * Exception raised for exiting a shell.
 8   *
 9   * @version 7
10   */
11
12  public class ExitShellException extends JunoException
13  {
14  }
```

```
// joi/8/terminal/Terminal.java
// (and terminal/Terminal.java)
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.*;

/**
 * Terminal provides a user-friendly interface to the standard System
 * input and output streams (in, out, and err).
 * <p>
 * A Terminal is an object.  In general, one is expected to instantiate
 * just one Terminal.  Although one might instantiate several, all will
 * share the same System streams.
 * <p>
 * A Terminal may either explicitly echo input, or not.  Echoing input
 * is useful, for example, when testing with I/O redirection.
 * <p>
 * Inspired by Cay Horstmann's Console Class.
 */

public class Terminal
{
    private boolean echo = false;
    private static BufferedReader in =
        new BufferedReader(new FileReader(FileDescriptor.in));


    // Print a prompt to the console without a newline.

    private void printPrompt( String prompt )
    {
        print( prompt );
        System.out.flush();
    }

    /**
     * Construct a Terminal that doesn't echo input.
     */

    public Terminal()
    {
        this( false );
    }

    /**
     * Construct a Terminal.
     *
     * @param echo whether or not input should be echoed.
     */

    public Terminal( boolean echo )
    {
        this.echo = echo;
    }

```



```
    /**
     * Read a line (terminated by a newline) from the Terminal.
     * @param prompt output string to prompt for input.
     *
     * @return the string (without the newline character),
     *  null if eof.
     */

    public String readLine( String prompt )
    {
        printPrompt(prompt);
        try {
            String line = in.readLine();
            if (echo) {
                println(line);
            }
            return line;
        }
        catch (IOException e) {
            return null;
        }
    }

    /**
     * Read a line (terminated by a newline) from the Terminal.
     *
     * @return the string (without the newline character).
     */

    public String readLine()
    {
        return readLine( "" );
    }

    // Read a line from the Terminal.  An end of file,
    // indicated by a null, raises a runtime exception.
    // Used only internally.

    private String readNonNullLine()
    {
        return readNonNullLine( "" );
    }

    // Read a line from the Terminal.  An end of file,
    // indicated by a null, raises a runtime exception.
    // Used only internally.

    private String readNonNullLine( String prompt )
    {
        String line = readLine( prompt );
        if (line == null ) {
            throw new RuntimeException( "End of File encountered." );
        }
        return line;
    }

```

```
113      /**
114       * Read a word from the Terminal.
115       * If an empty line is entered, try again.
116       * Words are terminated by whitespace.
117       * Leading whitespace is trimmed; the rest of the line
118       * is disposed of.
119       *
120       * @param prompt output string to prompt for input.
121       *
122       * @return the word read.
123       */
124
125      public String readWord( String prompt )
126      {
127          String line = readNonNullLine( prompt );
128          if (line.length() == 0) {
129              println( "Empty line.  Please try again." );
130              return readWord("");
131          }
132          line = line.trim();
133          for ( int i = 0; i < line.length(); i++ ) {
134              if ( Character.isWhitespace( line.charAt(i) ) ) {
135                  return line.substring( 0, i );
136              }
137          }
138          return line;
139      }
140
141      /**
142       * Read a word from the Terminal.
143       * If an empty line is entered, try again.
144       * Words are terminated by whitespace.
145       * Leading whitespace is trimmed; the rest of the line
146       * is disposed of.
147       *
148       * @return the word read.
149       */
150
151      public String readWord()
152      {
153          return readWord( "" );
154      }
155
156      /**
157       * Read a word from the Terminal.
158       * If an empty line is entered, throw an exception.
159       * Words are terminated by whitespace.
160       * Leading whitespace is trimmed; the rest of the line
161       * is disposed of.
162       *
163       * @param prompt output string to prompt for input.
164       * @return the word read.
165       *
166       * @throws RuntimeException if it reads an empty line.
167       */
168
```



```
169      public String readWordOnce( String prompt )
170      {
171          String line = readNonNullLine( prompt );
172          if (line.length() == 0) {
173              throw new RuntimeException("Empty line encountered.");
174          }
175          line = line.trim();
176          for ( int i = 0; i < line.length(); i++ ) {
177              if ( Character.isWhitespace( line.charAt(i) ) ) {
178                  return line.substring( 0, i );
179              }
180          }
181          return line;
182      }
183
184      /**
185       * Read a word from the Terminal.
186       * If an empty line is entered, throw an exception.
187       * Words are terminated by whitespace.
188       * Leading whitespace is trimmed; the rest of the line
189       * is disposed of.
190       *
191       * @return the word read.
192       *
193       * @throws RuntimeException if it reads an empty line.
194       */
195
196      public String readWordOnce()
197      {
198          return readWordOnce( "" );
199      }
200
201      /**
202       * Read a character from the Terminal.
203       * Prompt again when an empty line is read.
204       *
205       * @param prompt output string to prompt for input.
206       *
207       * @return the character read.
208       */
209
210      public char readChar( String prompt )
211      {
212          String line = readNonNullLine(prompt);
213          if (line.length() == 0) {
214              println( "No character on line.  Please try again." );
215              return readChar("");
216          }
217          return line.charAt(0);
218      }
219
220      /**
221       * Read a character from the Terminal.
222       * Throw an exception if an empty line is read.
223       *
224       * @param prompt output string to prompt for input.
```

```
225       * @return the character read.
226       *
227       * @throws RuntimeException if it reads an empty line.
228       */
229
230      public char readCharOnce( String prompt )
231      {
232          String line = readNonNullLine(prompt);
233          if (line.length() == 0) {
234              throw new RuntimeException("Empty line encountered.");
235          }
236          return line.charAt(0);
237      }
238
239      /**
240       * Read a character from the Terminal.
241       * Prompt again when an empty line is read.
242       *
243       *
244       *
245       * @return the character read.
246       */
247
248      public char readChar()
249      {
250          return readChar("");
251      }
252
253      /**
254       * Read a character from the Terminal.
255       * Throw an exception if an empty line is read.
256       *
257       * @return the character read.
258       *
259       * @throws RuntimeException if it reads an empty line.
260       */
261
262      public char readCharOnce()
263      {
264          return readCharOnce("");
265      }
266
267      /**
268       * Read "yes" or "no" from the Terminal.
269       * If an empty line or improper character is read,
270       * try again.
271       * Look only at first character and accept any case.
272       *
273       * @param prompt output string to prompt for input.
274       * @return true if yes, false if no.
275       */
276
277      public boolean readYesOrNo( String prompt )
278      {
279          printPrompt( prompt );
280          while ( true ) {
```



```
281              char answer = readChar( " (y or n): ");
282              if ( answer == 'y' || answer == 'Y' ) {
283                  return true;
284              }
285              else if ( answer == 'n' || answer == 'N' ) {
286                  return false;
287              }
288              else {
289                  printPrompt( "oops!" );
290              }
291          }
292      }
293
294      /**
295       * Read "yes" or "no" from the Terminal.
296       * If an empty line or improper character is read,
297       * throw an exception.
298       * Look only at first character and accept any case.
299       *
300       * @param prompt output string to prompt for input.
301       * @return true if yes, false if no.
302       *
303       * @throws RuntimeException on improper input.
304       */
305
306      public boolean readYesOrNoOnce( String prompt )
307      {
308          printPrompt( prompt );
309          while ( true ) {
310              char answer = readCharOnce( " (y or n): ");
311              if ( answer == 'y' || answer == 'Y' ) {
312                  return true;
313              }
314              else if ( answer == 'n' || answer == 'N' ) {
315                  return false;
316              }
317              else {
318                  throw new RuntimeException( "Must be y or n." );
319              }
320          }
321      }
322
323      /**
324       * Read "yes" or "no" from the Terminal.
325       * If an empty line or improper character is read,
326       * try again. No prompting is done.
327       * Look only at first character and accept any case.
328       *
329       * @return true if yes, false if no.
330       */
331
332      public boolean readYesOrNo()
333      {
334          while ( true ) {
335              char answer = readChar();
336              if ( answer == 'y' || answer == 'Y' ) {
```

```
337                 return true;
338             }
339             else if ( answer == 'n' || answer == 'N' ) {
340                 return false;
341             }
342         }
343     }
344
345     /**
346      * Read "yes" or "no" from the Terminal.
347      * If an empty line or improper character is read,
348      * throw an exception.
349      * Look only at first character and accept any case.
350      *
351      * @return true if yes, false if no.
352      *
353      * @throws RuntimeException on improper input.
354      */
355
356     public boolean readYesOrNoOnce()
357     {
358         char answer = readCharOnce( " (y or n): ");
359         if ( answer == 'y' || answer == 'Y' ) {
360             return true;
361         }
362         else if ( answer == 'n' || answer == 'N' ) {
363             return false;
364         }
365         else {
366             throw new RuntimeException( "Must be y or n." );
367         }
368     }
369
370     /**
371      * Read an integer, terminated by a new line, from the Terminal.
372      * If a NumberFormatException is encountered, try again.
373      *
374      * @param prompt output string to prompt for input.
375      * @return the input value as an int.
376      */
377
378     public int readInt( String prompt )
379     {
380         while( true ) {
381             try {
382                 return Integer.
383                     parseInt(readNonNullLine( prompt ).trim());
384             }
385             catch (NumberFormatException e) {
386                 println( "Not an integer.  Please try again." );
387             }
388         }
389     }
390
391     /**
392      * Read an integer, terminated by a new line, from the Terminal.
```



```
393      *
394      * @param prompt output string to prompt for input.
395      * @return the input value as an int.
396      *
397      * @throws NumberFormatException for a badly formed integer.
398      */
399
400     public int readIntOnce( String prompt )
401         throws NumberFormatException
402     {
403         return Integer.parseInt(readNonNullLine( prompt ).trim());
404     }
405
406     /**
407      * Read an integer, terminated by a new line, from the Terminal.
408      * If a NumberFormatException is encountered, try again.
409      *
410      * @return the input value as an int.
411      */
412
413     public int readInt()
414     {
415         return readInt("");
416     }
417
418     /**
419      * Read an integer, terminated by a new line, from the Terminal.
420      *
421      * @return the input value as an int.
422      *
423      * @throws NumberFormatException for a badly formed integer.
424      */
425
426     public int readIntOnce()
427         throws NumberFormatException
428     {
429         return readIntOnce("");
430     }
431
432     /**
433      * Read a double-precision floating point number,
434      * terminated by a newline, from the Terminal.
435      * If a NumberFormatException is encountered, try again.
436      *
437      * @param prompt output string to prompt for input.
438      * @return the input value as a double.
439      */
440
441     public double readDouble( String prompt )
442     {
443         while( true ) {
444             try {
445                 return Double.
446                     parseDouble(readNonNullLine( prompt ).trim());
447             }
448             catch (NumberFormatException e) {
```

```
449                println("Not a floating point number. Please try again.");
450               }
451           }
452       }
453
454       /**
455        * Read a double-precision floating point number,
456        * terminated by a newline, from the Terminal.
457        *
458        * @param prompt output string to prompt for input.
459        * @return the input value as a double.
460        *
461        * @throws NumberFormatException for a badly formed number.
462        */
463
464       public double readDoubleOnce( String prompt )
465           throws NumberFormatException
466       {
467           return Double.parseDouble(readNonNullLine( prompt ).trim());
468       }
469
470       /**
471        * Read a double-precision floating point number,
472        * terminated by a newline, from the Terminal.
473        * If a NumberFormatException is encountered, try again.
474        *
475        * @return the input value as a double.
476        */
477
478       public double readDouble()
479       {
480           return readDouble("");
481       }
482
483       /**
484        * Read a double-precision floating point number,
485        * terminated by a newline, from the Terminal.
486        *
487        * @return the input value as a double.
488        *
489        * @throws NumberFormatException for a badly formed number.
490        */
491
492       public double readDoubleOnce()
493           throws NumberFormatException
494       {
495           return readDouble("");
496       }
497
498       /**
499        * Print a Boolean value
500        * (<code>true</code> or <code>false</code>)
501        * to standard output (without a newline).
502        *
503        * @param b Boolean to print.
504        */
```



```
505
506       public void print( boolean b )
507       {
508           System.out.print( b );
509       }
510
511       /**
512        * Print character to standard output (without a newline).
513        *
514        * @param ch character to print.
515        */
516
517       public void print( char ch )
518       {
519           System.out.print( ch );
520       }
521
522       /**
523        * Print character array to standard output (without a newline).
524        *
525        * @param s character array to print.
526        */
527
528       public void print( char[] s )
529       {
530           System.out.print( s );
531       }
532
533       /**
534        * Print a double-precision floating point number to standard
535        * output (without a newline).
536        *
537        * @param val number to print.
538        */
539
540       public void print( double val )
541       {
542           System.out.print( val );
543       }
544
545       /**
546        * Print a floating point number to standard output
547        * (without a newline).
548        *
549        * @param val number to print.
550        */
551
552       public void print( float val )
553       {
554           System.out.print( val );
555       }
556
557       /**
558        * Print integer to standard output (without a newline).
559        *
560        * @param val integer to print.
```

```
561       */
562
563      public void print( int val )
564      {
565          System.out.print( val );
566      }
567
568      /**
569       * Print a long integer to standard output (without a newline).
570       *
571       * @param val integer to print.
572       */
573
574      public void print( long val )
575      {
576          System.out.print( val );
577      }
578
579      /**
580       * Print Object to standard output (without a newline).
581       *
582       * @param val Object to print.
583       */
584
585      public void print( Object val )
586      {
587          System.out.print( val.toString() );
588      }
589
590      /**
591       * Print string to standard output (without a newline).
592       *
593       * @param str String to print.
594       */
595
596      public void print( String str )
597      {
598          System.out.print( str );
599      }
600
601      /**
602       * Print a newline to standard output,
603       * terminating the current line.
604       */
605
606      public void println()
607      {
608          System.out.println();
609      }
610
611      /**
612       * Print a Boolean value
613       * (<code>true</code> or <code>false</code>)
614       * to standard output, followed by a newline.
615       * @param b Boolean to print.
616       */
```



```
617
618      public void println( boolean b )
619      {
620          System.out.println( b );
621      }
622
623      /**
624       * Print character to standard output, followed by a newline.
625       *
626       * @param ch character to print.
627       */
628
629      public void println( char ch )
630      {
631          System.out.println( ch );
632      }
633
634      /**
635       * Print a character array to standard output,
636       * followed by a newline.
637       *
638       * @param s character array to print.
639       */
640
641      public void println( char[] s )
642      {
643          System.out.println( s );
644      }
645
646      /**
647       * Print floating point number to standard output,
648       * followed by a newline.
649       *
650       * @param val number to print.
651       */
652
653      public void println( float val )
654      {
655          System.out.println( val );
656      }
657
658      /**
659       * Print a double-precision floating point number to standard
660       * output, followed by a newline.
661       *
662       * @param val number to print.
663       */
664
665      public void println( double val )
666      {
667          System.out.println( val );
668      }
669
670      /**
671       * Print integer to standard output, followed by a newline.
672       *
```

```
673       * @param val integer to print.
674       */
675
676      public void println( int val )
677      {
678          System.out.println( val );
679      }
680
681      /**
682       * Print a long integer to standard output,
683       * followed by a newline.
684       *
685       * @param val long integer to print.
686       */
687
688      public void println( long val )
689      {
690          System.out.println( val );
691      }
692
693      /**
694       * Print Object to standard output, followed by a newline.
695       *
696       * @param val Object to print
697       */
698
699      public void println( Object val )
700      {
701          System.out.println( val.toString() );
702      }
703
704      /**
705       * Print string to standard output, followed by a newline.
706       *
707       * @param str String to print
708       */
709
710      public void println( String str )
711      {
712          System.out.println( str );
713      }
714
715      /**
716       * Print a Boolean value
717       * (<code>true</code> or <code>false</code>)
718       * to standard err (without a newline).
719       *
720       * @param b Boolean to print.
721       */
722
723      public void errPrint( boolean b )
724      {
725          System.err.print( b );
726      }
727
728      /**
```



```
729       * Print character to standard err (without a newline).
730       *
731       * @param ch character to print.
732       */
733
734      public void errPrint( char ch )
735      {
736          System.err.print( ch );
737      }
738
739      /**
740       * Print character array to standard err (without a newline).
741       *
742       * @param s character array to print.
743       */
744
745      public void errPrint( char[] s )
746      {
747          System.err.print( s );
748      }
749
750      /**
751       * Print a double-precision floating point number to standard
752       * err (without a newline).
753       *
754       * @param val number to print.
755       */
756
757      public void errPrint( double val )
758      {
759          System.err.print( val );
760      }
761
762      /**
763       * Print a floating point number to standard err
764       * (without a newline).
765       *
766       * @param val number to print.
767       */
768
769      public void errPrint( float val )
770      {
771          System.err.print( val );
772      }
773
774      /**
775       * Print integer to standard err (without a newline).
776       *
777       * @param val integer to print.
778       */
779
780      public void errPrint( int val )
781      {
782          System.err.print( val );
783      }
784
```

```
785      /**
786       * Print a long integer to standard err (without a newline).
787       *
788       * @param val integer to print.
789       */
790
791      public void errPrint( long val )
792      {
793          System.err.print( val );
794      }
795
796      /**
797       * Print Object to standard err (without a newline).
798       *
799       * @param val Object to print.
800       */
801
802      public void errPrint( Object val )
803      {
804          System.err.print( val.toString() );
805      }
806
807      /**
808       * Print string to standard err (without a newline).
809       *
810       * @param str String to print.
811       */
812
813      public void errPrint( String str )
814      {
815          System.err.print( str );
816      }
817
818      /**
819       * Print a newline to standard err,
820       * terminating the current line.
821       */
822
823      public void errPrintln()
824      {
825          System.err.println();
826      }
827
828      /**
829       * Print a Boolean value
830       * (<code>true</code> or <code>false</code>)
831       * to standard err, followed by a newline.
832       *
833       * @param b Boolean to print.
834       */
835
836      public void errPrintln( boolean b )
837      {
838          System.err.println( b );
839      }
840
```



```
841      /**
842       * Print character to standard err, followed by a newline.
843       *
844       * @param ch character to print.
845       */
846
847      public void errPrintln( char ch )
848      {
849          System.err.println( ch );
850      }
851
852      /**
853       * Print a character array to standard err,
854       * followed by a newline.
855       *
856       * @param s character array to print.
857       */
858
859      public void errPrintln( char[] s )
860      {
861          System.err.println( s );
862      }
863
864      /**
865       * Print floating point number to standard err,
866       * followed by a newline.
867       *
868       * @param val number to print.
869       */
870
871      public void errPrintln( float val )
872      {
873          System.err.println( val );
874      }
875
876      /**
877       * Print a double-precision floating point number to
878       * standard err, followed by a newline.
879       *
880       * @param val number to print.
881       */
882
883      public void errPrintln( double val )
884      {
885          System.err.println( val );
886      }
887
888      /**
889       * Print integer to standard err, followed by a newline.
890       *
891       * @param val integer to print.
892       */
893
894      public void errPrintln( int val )
895      {
896          System.err.println( val );
```

```
897      }
898
899      /**
900       * Print a long integer to standard err, followed by a newline.
901       *
902       * @param val long integer to print.
903       */
904
905      public void errPrintln( long val )
906      {
907          System.err.println( val );
908      }
909
910      /**
911       * Print Object to standard err, followed by a newline.
912       *
913       * @param val Object to print
914       */
915
916      public void errPrintln( Object val )
917      {
918          System.err.println( val.toString() );
919      }
920
921      /**
922       * Print string to standard err, followed by a newline.
923       *
924       * @param str String to print
925       */
926
927      public void errPrintln( String str )
928      {
929          System.err.println( str );
930      }
931
932      /**
933       * Unit test for Terminal.
934       *
935       * @param args command line arguments:
936       * <pre>
937       *    -e echo all input.
938       * </pre>
939       */
940
941      public static void main( String[] args )
942      {
943          Terminal t =
944              new Terminal( args.length == 1 && args[0].equals("-e") );
945
946          String line = t.readLine( "line:" );
947          String word = t.readWord( "word:" );
948          char   c    = t.readChar( "char:" );
949          boolean yn  = t.readYesOrNo( "yorn:" );
950          double d    = t.readDouble( "double:" );
951          int    i    = t.readInt( "int:" );
952
```



```
953          t.print("  line:[");  t.print(line);    t.print("]");
954          t.print("  line:[");  t.println(line);  t.print("]");
955
956          t.print("  word:[");  t.print(word);    t.print("]");
957          t.print("  word:[");  t.println(word);  t.print("]");
958
959          t.print("  char:[");  t.print(c);       t.print("]");
960          t.print("  char:[");  t.println(c);     t.print("]");
961
962          t.print("  yorn:[");  t.print(yn);      t.print("]");
963          t.print("  yorn:[");  t.println(yn);    t.print("]");
964
965          t.print("  doub:[");  t.print(d);       t.print("]");
966          t.print("  doub:[");  t.println(d);     t.print("]");
967
968          t.print("  int:[");   t.print(i);       t.print("]");
969          t.print("  int:[");   t.println(i);     t.print("]");
970
971          t.errPrint("  line:[");  t.errPrint(line);    t.errPrint("]");
972          t.errPrint("  line:[");  t.errPrintln(line);  t.errPrint("]");
973
974          t.errPrint("  word:[");  t.errPrint(word);    t.errPrint("]");
975          t.errPrint("  word:[");  t.errPrintln(word);  t.errPrint("]");
976
977          t.errPrint("  char:[");  t.errPrint(c);       t.errPrint("]");
978          t.errPrint("  char:[");  t.errPrintln(c);     t.errPrint("]");
979
980          t.errPrint("  yorn:[");  t.errPrint(yn);      t.errPrint("]");
981          t.errPrint("  yorn:[");  t.errPrintln(yn);    t.errPrint("]");
982
983          t.errPrint("  doub:[");  t.errPrint(d);       t.errPrint("]");
984          t.errPrint("  doub:[");  t.errPrintln(d);     t.errPrint("]");
985
986          t.errPrint("  int:[");   t.errPrint(i);       t.errPrint("]");
987          t.errPrint("  int:[");   t.errPrintln(i);     t.errPrint("]");
988      }
989  }
```

```
// joi/8/juno/Password.java//
//
//  Copyright 2003 Bill Campbell and Ethan Bolker

/**
 * Model a good password.
 *
 * <p>
 * A password is a String satisfying the following conditions
 * (close to those required of Unix passwords, according to
 * the <code> man passwd </code> command in Unix):
 * <br>
 * <ul>
 * <li> A password must have at least PASSLENGTH characters, where
 *      PASSLENGTH defaults to 6. Only the first eight characters
 *      are significant.
 *
 * <li> A password must contain at least two alphabetic characters
 *      and at least one numeric or special character. In this  case,
 *      "alphabetic" refers to all upper or lower case letters.
 *
 * <li> A password must not contain a specified string as a substring
 *      For comparison purposes, an upper case letter and its
 *      corresponding lower case letter are equivalent.
 *
 * <li> A password must not be a substring of a specified string.
 *      For comparison purposes, an upper case letter and its
 *      corresponding lower case letter are equivalent.
 *
 * </ul>
 * <br>
 * A password string may be stored in a Password object only in
 * encrypted form.
 */

public class Password
{
    private String password;

    /**
     * Construct a new Password.
     *
     * @param password the new password.
     * @param notSubstringOf a String that may not contain the password.
     * @param doesNotContain a String the password may not contain.
     *
     * @exception BadPasswordException when password is unacceptable.
     */

    public Password(String password, String notSubstringOf,
                    String doesNotContain)
         throws BadPasswordException
    {
        // if password is not acceptable
        // throw new BadPasswordException( reason )
```



```
        this.password = encrypt(password);
    }

    // Rewrite s in a form that makes it hard to guess s.

    private String encrypt( String s )
    {
        return Integer.toHexString(s.hashCode());
    }

    /**
     * See whether a supplied guess matches this password.
     *
     * @param guess the trial password.
     *
     * @exception BadPasswordException when match fails.
     */

    public void match(String guess)
         throws BadPasswordException
    {
    }

    /**
     * Unit test for Password objects.
     */

    public static void main( String[] args )
    {
    }
}
```

```
 1  // joi/8/juno/BadPasswordException.java
 2  //
 3  //
 4  //  Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * The exception thrown when an initial password is unacceptable
 8   * or a match against an existing password fails.
 9   */
10
11  public class BadPasswordException extends Exception
12  {
13      BadPasswordException()
14      {
15          super();
16      }
17
18      BadPasswordException(String message)
19      {
20          super(message);
21      }
22  }
```

```
 1  // joi/9/copy/Copy1.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.io.*;
 7
 8  /**
 9   * Simple read-a-char, write-a-char loop to exercise file I/O.
10   *
11   * Usage: java Copy1 inputfile outputfile
12   */
13
14  public class Copy1
15  {
16      private static final int EOF = -1;  // end of file character rep.
17
18      /**
19       * All work is done here.
20       *
21       * @param args names of the input file and output file.
22       */
23
24      public static void main( String[] args )
25      {
26          FileReader inStream  = null;
27          FileWriter outStream = null;
28          int ch;
29
30          try {
31              // open the files
32              inStream  = new FileReader( args[0] );
33              outStream = new FileWriter( args[1] );
34
35              // copy
36              while ((ch = inStream.read()) != EOF) {
37                  outStream.write( ch );
38              }
39          }
40          catch (IndexOutOfBoundsException e) {
41              System.err.println(
42                  "usage: java Copy1 sourcefile targetfile" );
43          }
44          catch (FileNotFoundException e) {
45              System.err.println( e );  // rely on e's toString()
46          }
47          catch (IOException e) {
48              System.err.println( e );
49          }
50          finally { // close the files
51              try {
52                  if (inStream != null) {
53                      inStream.close();
54                  }
55              }
56              catch (Exception e) {
```



```
57                  System.err.println("Unable to close input stream.");
58              }
59              try {
60                  if (outStream != null) {
61                      outStream.close();
62                  }
63              }
64              catch (Exception e) {
65                  System.err.println("Unable to close output stream.");
66              }
67          }
68      }
69  }
```

```
 1  // joi/9/copy/Copy2.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.io.*;
 7
 8  /**
 9   * Simple read-a-line write-a-line loop to exercise file I/O.
10   *
11   * Usage: java Copy2 inputfile outputfile
12   */
13
14  public class Copy2
15  {
16      /**
17       * All work is done here.
18       *
19       * @param args names of the input file and output file.
20       */
21
22      public static void main( String[] args )
23      {
24          BufferedReader inStream  = null;
25          BufferedWriter outStream = null;
26          String line;
27
28          try {
29              // open the files
30              inStream =  new BufferedReader(new FileReader(args[0]));
31              outStream = new BufferedWriter(new FileWriter(args[1]));
32
33              // copy
34              while ((line = inStream.readLine()) != null) {
35                  outStream.write( line );
36                  outStream.newLine();
37              }
38          }
39          catch (IndexOutOfBoundsException e) {
40              System.err.println(
41                  "usage: java Copy2 sourcefile targetfile" );
42          }
43          catch (FileNotFoundException e) {
44              System.err.println( e );  // rely on e's toString()
45          }
46          catch (IOException e) {
47              System.err.println( e );
48          }
49          finally { // close the files
50              try {
51                  if (inStream != null) {
52                      inStream.close();
53                  }
54              }
55              catch (Exception e) {
56                  System.err.println("Unable to close input stream.");
```



```
57              }
58              try {
59                  if (outStream != null) {
60                      outStream.close();
61                  }
62              }
63              catch (Exception e) {
64                  System.err.println("Unable to close output stream.");
65              }
66          }
67      }
68  }
```

```
// joi/9/bank/Bank.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.*;
import java.io.*;

/**
 * A Bank object simulates the behavior of a simple bank/ATM.
 * It contains a Terminal object and a collection of
 * BankAccount objects.
 *
 * The visit method opens this Bank for business,
 * prompting the customer for input.
 *
 * It is persistent: it can save its state to a file and read it
 * back at a later time.
 *
 * To create a Bank and open it for business issue the command
 * <code>java Bank</code> with appropriate arguments.
 *
 * @see BankAccount
 * @version 9
 */

public class Bank
    implements Serializable
{
    private String bankName;           // the name of this Bank
    private transient Terminal atm;   // for communication with world
    private int balance = 0;           // total cash on hand
    private int transactionCount = 0;  // number of Bank transactions
    private Month month;               // the current month.
    private Map accountList;           // mapping names to accounts.

    private int checkFee = 2;            // cost for each check
    private int transactionFee = 1;      // fee for each transaction
    private int monthlyCharge = 5;       // monthly charge
    private double interestRate = 0.05;  // annual rate paid on savings
    private int maxFreeTransactions = 3; // for savings accounts

    // what the banker can ask of the bank

    private static final String BANKER_COMMANDS =
    "Banker commands: " +
        "exit, open, customer, nextmonth, report, help.";

    // what the customer can ask of the bank

    private static final String CUSTOMER_TRANSACTIONS =
    "    Customer transactions: deposit, withdraw, transfer,\n" +
    "     balance, cash check, quit, help.";

    /**
     * Construct a Bank with the given name.
```



```
     *
     * @param bankName the name for this Bank.
     */

    public Bank( String bankName )
    {
        this.atm      = atm;
        this.bankName = bankName;
        accountList   = new TreeMap();
        month         = new Month();
    }

    /**
     * Simulates interaction with a Bank.
     * Presents the user with an interactive loop, prompting for
     * banker transactions and in the case of the banker
     * transaction "customer", an account id and further
     * customer transactions.
     */

    public void visit()
    {
        instructUser();

        String command;
        while (!(command =
                 atm.readWord("banker command: ")).equals("exit")) {

            if (command.startsWith("h")) {
                help( BANKER_COMMANDS );
            }
            else if (command.startsWith("o")) {
                openNewAccount();
            }
            else if (command.startsWith("n")) {
                newMonth();
            }
            else if (command.startsWith("r")) {
                report();
            }
            else if (command.startsWith( "c" ) ) {
                BankAccount acct = whichAccount();
                if ( acct != null ) {
                        processTransactionsForAccount( acct );
                }
            }
            else {
                // Unrecognized Request
                atm.println( "unknown command: " + command );
            }
        }
        report();
        atm.println( "Goodbye from " + bankName );
    }
```

```
113      // Open a new bank account,
114      // prompting the user for information.
115
116      private void openNewAccount()
117      {
118          String accountName = atm.readWord( "Account name: " );
119          char accountType =
120              atm.readChar( "Type of account (r/c/f/s): " );
121          try {
122              int startup = readPosAmt( "Initial deposit: " );
123              BankAccount newAccount;
124              switch( accountType ) {
125              case 'c':
126                  newAccount = new CheckingAccount( startup, this );
127                  break;
128              case 'f':
129                  newAccount = new FeeAccount( startup, this );
130                  break;
131              case 's':
132                  newAccount = new SavingsAccount( startup, this );
133                  break;
134              case 'r':
135                  newAccount = new RegularAccount( startup, this );
136                  break;
137              default:
138                  atm.println("invalid account type: " + accountType);
139                  return;
140              }
141              accountList.put( accountName, newAccount );
142              atm.println( "opened new account " + accountName
143                           + " with $" + startup );
144          }
145          catch (NegativeAmountException e) {
146              atm.errPrintln(
147                "You cannot open an account with a negative balance");
148          }
149          catch (InsufficientFundsException e) {
150              atm.errPrintln( "Initial deposit doesn't cover fee" );
151          }
152      }
153
154      // Prompt the customer for transaction to process.
155      // Then send an appropriate message to the account.
156
157      private void processTransactionsForAccount( BankAccount acct )
158      {
159          help( CUSTOMER_TRANSACTIONS );
160
161          String transaction;
162          while (!(transaction =
163                   atm.readWord("    transaction: ")).equals("quit")) {
164
165              try {
166                  if ( transaction.startsWith( "h" ) ) {
167                      help( CUSTOMER_TRANSACTIONS );
168                  }
```



```
169                  else if ( transaction.startsWith( "d" ) ) {
170                      int amount = readPosAmt( "    amount: " );
171                      atm.println("    deposited "
172                                  + acct.deposit( amount ));
173                  }
174                  else if ( transaction.startsWith( "w" ) ) {
175                      int amount = readPosAmt( "    amount: " );
176                      atm.println("    withdrew "
177                                  + acct.withdraw( amount ));
178                  }
179                  else if ( transaction.startsWith( "c" ) ) {
180                      int amount = readPosAmt( "    amount of check: " );
181                      try { // to cast acct to CheckingAccount ...
182                          atm.println("    cashed check for " +
183                             ((CheckingAccount) acct).honorCheck( amount ))
184                      }
185                      catch (ClassCastException e) {
186                          // if not a checking account, report error
187                          atm.errPrintln(
188                              "    Sorry, not a checking account." );
189                      }
190                  }
191                  else if (transaction.startsWith("t")) {
192                      atm.print( "    to ");
193                      BankAccount toacct = whichAccount();
194                      if (toacct != null) {
195                      int amount = readPosAmt("    amount to transfer: ");
196                      atm.println("    transfered "
197                          + toacct.deposit(acct.withdraw(amount)));
198                      }
199                  }
200                  else if (transaction.startsWith("b")) {
201                      atm.println("    current balance "
202                                  + acct.requestBalance());
203                  }
204                  else {
205                      atm.println("    sorry, unknown transaction" );
206                  }
207              }
208              catch (InsufficientFundsException e) {
209                  atm.errPrintln( "    Insufficient funds " +
210                                  e.getMessage() );
211              }
212              catch (NegativeAmountException e) {
213                atm.errPrintln("    Sorry, negative amounts disallowed." );
214              }
215              atm.println();
216          }
217      }
218
219      // Prompt for an account name (or number), look it up
220      // in the account list. If it's there, return it;
221      // otherwise report an error and return null.
222
223      private BankAccount whichAccount()
224      {
```

```
225          String accountName = atm.readWord( "account name: " );
226          BankAccount account = (BankAccount) accountList.get(accountName);
227          if (account == null) {
228              atm.println( "not a valid account" );
229          }
230          return account;
231      }
232
233      // Action to take when a new month starts.
234      // Update the month field by sending a next message.
235      // Loop on all accounts, sending each a newMonth message.
236
237      private void newMonth()
238      {
239          month.next();
240          Iterator i = accountList.keySet().iterator();
241          while ( i.hasNext() ) {
242              String name = (String) i.next();
243              BankAccount acct = (BankAccount) accountList.get( name );
244              try {
245                  acct.newMonth();
246              }
247              catch (InsufficientFundsException exception) {
248                  atm.errPrintln( "Insufficient funds in account \"" +
249                                  name + "\" for monthly fee" );
250              }
251          }
252      }
253
254      // Report bank activity.
255      // For each BankAccount, print the customer id (name or number),
256      // account balance and the number of transactions.
257      // Then print Bank totals.
258
259      private void report()
260      {
261          atm.println( bankName + " report for " + month );
262          atm.println( "\nSummaries of individual accounts:" );
263          atm.println( "account  balance   transaction count" );
264          for (Iterator i = accountList.keySet().iterator();
265               i.hasNext(); ) {
266              String accountName = (String) i.next();
267              BankAccount acct = (BankAccount) accountList.get(accountName)
268              atm.println(accountName + "\t$" + acct.getBalance() + "\t\t"
269                          + acct.getTransactionCount());
270          }
271          atm.println( "\nBank totals");
272          atm.println( "open accounts: " + getNumberOfAccounts() );
273          atm.println( "cash on hand: $" + getBalance());
274          atm.println( "transactions:  " + getTransactionCount());
275          atm.println();
276      }
277
278
279      // Welcome the user to the bank and instruct her on
280      //  her options.
```



```
281
282      private void instructUser()
283      {
284          atm.println( "Welcome to " + bankName );
285          atm.println( month.toString() );
286          atm.println( "Open some accounts and work with them." );
287          help( BANKER_COMMANDS );
288      }
289
290      // Display a help string.
291
292      private void help( String helpString )
293      {
294          atm.println( helpString );
295          atm.println();
296      }
297
298      // Read amount prompted for from the atm.
299      // Throw a NegativeAmountException if amount < 0
300
301      private int readPosAmt( String prompt )
302           throws NegativeAmountException
303      {
304          int amount = atm.readInt( prompt );
305          if (amount < 0) {
306              throw new NegativeAmountException();
307          }
308          return amount;
309      }
310
311      /**
312       * Increment bank balance by given amount.
313       *
314       * @param amount the amount increment.
315       */
316
317      public void incrementBalance(int amount)
318      {
319          balance += amount;
320      }
321
322      /**
323       * Increment by one the count of transactions,
324       * for this bank.
325       */
326
327      public void countTransaction()
328      {
329          transactionCount++;
330      }
331
332      /**
333       * Get the number of transactions performed by this bank.
334       *
335       * @return number of transactions performed.
336       */
```

```
337
338     public int getTransactionCount( )
339     {
340         return transactionCount ;
341     }
342
343     /**
344      * The charge this bank levies for cashing a check.
345      *
346      * @return check fee
347      */
348
349     public int getCheckFee( )
350     {
351         return checkFee ;
352     }
353
354     /**
355      * The charge this bank levies for a transaction.
356      *
357      * @return the transaction fee
358      */
359
360     public int getTransactionFee( )
361     {
362         return transactionFee ;
363     }
364
365     /**
366      * The charge this bank levies each month.
367      *
368      * @return the monthly charge
369      */
370
371     public int getMonthlyCharge( )
372     {
373         return monthlyCharge;
374     }
375
376     /**
377      * The current interest rate on savings.
378      *
379      * @return the interest rate
380      */
381
382     public double getInterestRate( )
383     {
384         return interestRate;
385     }
386
387     /**
388      * The number of free transactions per month.
389      *
390      * @return the number of transactions
391      */
392
```



```
393     public int getMaxFreeTransactions()
394     {
395         return maxFreeTransactions;
396     }
397
398     /**
399      * Get the current bank balance.
400      *
401      * @return current bank balance.
402      */
403
404     public int getBalance()
405     {
406         return balance;
407     }
408
409     /**
410      * Get the current number of open accounts.
411      *
412      * @return number of open accounts.
413      */
414
415     public int getNumberOfAccounts()
416     {
417         return accountList.size();
418     }
419
420     /**
421      * Set the atm for this Bank.
422      *
423      * @param atm the Bank's atm.
424      */
425
426     public void setAtm( Terminal atm ) {
427         this.atm = atm;
428     }
429
430
431     /**
432      * Run the simulation by creating and then visiting a new Bank.
433      * <p>
434      * A -e argument causes the input to be echoed.
435      * This can be useful for executing the program against
436      * a test script, e.g.,
437      * <pre>
438      *   java Bank -e < Bank.in
439      * </pre>
440      *
441      * The -f argument reads the bank's state from the specified
442      * file, and writes it to that file when the program exits.
443      *
444      * @param args the command line arguments:
445      *         <pre>
446      *         -e echo input.
447      *         -f filename
448      *         bankName any other command line argument.
```

```
449       *         </pre>
450       */
451
452      public static void main( String[] args )
453      {
454          boolean echo        = false;
455          String bankFileName = null;
456          String bankName     = "Persistent Bank";
457          Bank theBank        = null;
458
459          // parse the command line arguments
460          for (int i = 0; i < args.length; i++ ) {
461              if (args[i].equals("-e")) { // echo input to output
462                  echo = true;
463                  continue;
464              }
465              if (args[i].equals("-f")) { // read/write Bank from/to file
466                  bankFileName = args[++i];
467                  continue;
468              }
469          }
470
471          // create a new Bank or read one from a file
472          if (bankFileName == null) {
473              theBank = new Bank( bankName );
474          }
475          else {
476              theBank = readBank( bankName, bankFileName );
477          }
478
479          // give the Bank a Terminal, then visit
480          theBank.setAtm(new Terminal(echo));
481          theBank.visit();
482
483          // write theBank's state to a file if required
484          if (bankFileName != null) {
485              writeBank(theBank, bankFileName);
486          }
487      }
488
489      // Read a Bank from a file (create it if file doesn't exist).
490      //
491      // @param bankName     the name of the Bank
492      // @param bankFileName the name of the file containing the Bank
493      //
494      // @return the Bank
495
496      private static Bank readBank(String bankName, String bankFileName)
497      {
498          File file = new File( bankFileName );
499          if (!file.exists()) {
500              return new Bank( bankName );
501          }
502          ObjectInputStream inStream = null;
503          try {
504              inStream = new ObjectInputStream(
```



```
505                              new FileInputStream( file ) );
506              Bank bank = (Bank)inStream.readObject();
507              System.out.println(
508                 "Bank state read from file " + bankFileName);
509              return bank;
510          }
511          catch (Exception e ) {
512              System.err.println(
513                  "Problem reading " + bankFileName );
514              System.err.println(e);
515              System.exit(1);
516          }
517          finally {
518              try {
519                  inStream.close();
520              }
521              catch (Exception e) {
522              }
523          }
524          return null; // you can never get here
525      }
526
527
528      // Write a Bank to a file.
529      //
530      // @param bank     the Bank
531      // @param fileName the name of the file to write the Bank to
532
533      private static void writeBank( Bank bank, String fileName)
534      {
535          ObjectOutputStream outStream = null;
536          try {
537              outStream = new ObjectOutputStream(
538                              new FileOutputStream( fileName ) );
539              outStream.writeObject( bank );
540              System.out.println(
541                 "Bank state written to file " + fileName);
542          }
543          catch (Exception e ) {
544              System.err.println(
545                 "Problem writing " + fileName );
546          }
547          finally {
548              try {
549                  outStream.close();
550              }
551              catch (Exception e ) {
552              }
553          }
554      }
555  }
```

```
// joi/9/bank/BankAccount.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.Serializable;

/**
 * A BankAccount object has private fields to keep track
 * of its current balance, the number of transactions
 * performed and the Bank in which it is an account, and
 * and public methods to access those fields appropriately.
 *
 * @see Bank
 * @version 9
 */

public abstract class BankAccount
    implements Serializable
{
    private int  balance = 0;          // Account balance (whole dollars)
    private int  transactionCount = 0; // Number of transactions performe
    private Bank issuingBank;          // Bank issuing this account

    /**
     * Construct a BankAccount with the given initial balance and
     * issuing Bank. Construction counts as this BankAccount's
     * first transaction.
     *
     * @param initialBalance the opening balance.
     * @param issuingBank the bank that issued this account.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    protected BankAccount( int initialBalance, Bank issuingBank )
        throws InsufficientFundsException
    {
        this.issuingBank = issuingBank;
        deposit( initialBalance );
    }

    /**
     * Get transaction fee.  By default, 0.
     * Override this for accounts having transaction fees.
     *
     * @return the fee.
     */

    protected int getTransactionFee()
    {
        return 0;
    }

    /**
     * The bank that issued this account.
```



```
     *
     * @return the Bank.
     */

    protected Bank getIssuingBank()
    {
        return issuingBank;
    }

    /**
     * Withdraw the given amount, decreasing this BankAccount's
     * balance and the issuing Bank's balance.
     * Counts as a transaction.
     *
     * @param amount the amount to be withdrawn
     * @return amount withdrawn
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int withdraw( int amount )
        throws InsufficientFundsException
    {
        incrementBalance( -amount - getTransactionFee() );
        countTransaction();
        return amount ;
    }

    /**
     * Deposit the given amount, increasing this BankAccount's
     * balance and the issuing Bank's balance.
     * Counts as a transaction.
     *
     * @param amount the amount to be deposited
     * @return amount deposited
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int deposit(int amount)
        throws InsufficientFundsException
    {
        incrementBalance( amount - getTransactionFee() );
        countTransaction();
        return amount ;
    }

    /**
     * Request for balance. Counts as a transaction.
     *
     * @return current account balance.
     *
     * @exception InsufficientFundsException when appropriate.
     */

    public int requestBalance()
```

```
113          throws InsufficientFundsException
114      {
115          incrementBalance( - getTransactionFee() );
116          countTransaction();
117          return getBalance() ;
118      }
119
120      /**
121       * Get the current balance.
122       * Does NOT count as a transaction.
123       *
124       * @return current account balance
125       */
126
127      public int getBalance()
128      {
129          return balance;
130      }
131
132      /**
133       * Increment account balance by given amount.
134       * Also increment issuing Bank's balance.
135       * Does NOT count as a transaction.
136       *
137       * @param amount the amount of the increment.
138       *
139       * @exception InsufficientFundsException when appropriate.
140       */
141
142      public final void incrementBalance( int amount )
143          throws InsufficientFundsException
144      {
145          int newBalance = balance + amount;
146          if (newBalance < 0) {
147              throw new InsufficientFundsException(
148                          "for this transaction" );
149          }
150          balance = newBalance;
151          getIssuingBank().incrementBalance( amount );
152      }
153
154      /**
155       * Get the number of transactions performed by this
156       * account. Does NOT count as a transaction.
157       *
158       * @return number of transactions performed.
159       */
160
161      public int getTransactionCount()
162      {
163          return transactionCount;
164      }
165
166      /**
167       * Increment by 1 the count of transactions, for this account
168       * and for the issuing Bank.
```



```
169       * Does NOT count as a transaction.
170       *
171       * @exception InsufficientFundsException when appropriate.
172       */
173
174      public void countTransaction()
175          throws InsufficientFundsException
176      {
177          transactionCount++;
178          this.getIssuingBank().countTransaction();
179      }
180
181      /**
182       * Action to take when a new month starts.
183       *
184       * @exception InsufficientFundsException thrown when funds
185       *             on hand are not enough to cover the fees.
186       */
187
188      public abstract void newMonth()
189          throws InsufficientFundsException;
190  }
```

```
// joi/9/bank/class Month
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.*;
import java.util.Calendar;

/**
 * The Month class implements an object that keeps
 * track of the month of the year.
 *
 * @version 9
 */

public class Month
    implements Serializable
{
    private static final String[] monthName =
        {"Jan", "Feb", "Mar", "Apr", "May", "Jun",
         "Jul", "Aug", "Sep", "Oct", "Nov", "Dec"};

    private int month;
    private int year;

    /**
     *  Month constructor constructs a Month object
     *  initialized to the current month and year.
     */

    public Month()
    {
        Calendar rightNow = Calendar.getInstance();
        month = rightNow.get( Calendar.MONTH );
        year  = rightNow.get( Calendar.YEAR );
    }

    /**
     *  Advance to next month.
     */

    public void next()
    {
        month = (month + 1) % 12;
        if (month == 0) {
            year++;
        }
    }

    /**
     * How a Month is displayed as a String -
     * for example, "Jan, 2003".
     *
     * @return String representation of the month.
     */

```



```
    public String toString()
    {
        return monthName[month] + ", " + year;
    }

    /**
     * For unit testing.
     */

    public static void main( String[] args )
    {
        Month m = new Month();
        for (int i=0; i < 14; i++, m.next()) {
            System.out.println(m);
        }
        for (int i=0; i < 35; i++, m.next()); // no loop body
        System.out.println( "three years later: " + m );
        for (int i=0; i < 120; i++, m.next());// no loop body
        System.out.println( "ten years later: " + m );
    }
}
```

```
// joi/10/joi/JOIPanel.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.applet.*;
import java.awt.*;
import java.awt.event.*;

/**
 * A JOIPanel displays a button and a message.
 * Pushing the button changes the message.
 *
 * This panel can be displayed either from an applet
 * in a browser or by the JVM as an application.
 *
 * @version 10
 */

public class JOIPanel extends Applet
{
    private static final String MESSAGE1 = "Java Outside In";
    private static final String MESSAGE2 = "Java Inside Out";
    private String currentMessage = MESSAGE1; // currently displayed

    private Font font;                // for printing the message
    private Button button;            // for changing messages

    /**
     * Equip this Panel with a Button
     * and an associated ButtonListener, and
     * set the font for the message.
     */

    public void init()
    {
        // what this Panel looks like
        button = new Button( "Press Me" );
        this.add( button );
        font = new Font("Garamond", Font.BOLD, 48);

        // how this Panel behaves
        button.addActionListener( new JOIButtonListener( this ) );
    }

    /**
     * Method that responds when the ButtonListener sends a
     * changeMessage message.
     */

    public void changeMessage()
    {
        currentMessage =
            currentMessage.equals(MESSAGE1) ? MESSAGE2 : MESSAGE1;
        this.repaint();
    }
```



```

    /**
     * Draw the current message on this Panel.
     *
     * (The button is already there.)
     *
     * @param g an object encapsulating the graphics (e.g. pen)
     *          properties.
     */

    public void paint(Graphics g)
    {
        g.setColor(Color.black);
        g.setFont(font);
        g.drawString(currentMessage, 40, 75);
    }

    /**
     * Ask the JVM to display this Panel.
     */

    public static void main( String[] args )
    {
        Terminal t     = new Terminal();
        Frame frame    = new Frame();
        JOIPanel panel = new JOIPanel();
        panel.init();
        frame.add(panel);
        frame.setSize(400,120);
        frame.show();
        t.readLine("Type return to close the window ... ");
        System.exit(0);
    }
}
```

```
 1  // joi/10/joi/JOIButtonListener.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.awt.event.*;
 7
 8  /**
 9   * A simple listener for responding to button presses.
10   * It knows the Panel on which the button lives, and
11   * responds to button events by sending a changeMessage()
12   * to that Panel.
13   *
14   * @version 10
15   */
16
17  public class JOIButtonListener implements ActionListener
18  {
19      private JOIPanel panel;  // the Panel containing the Button
20
21      /**
22       * Construct the ButtonListener.
23       *
24       * @param panel the Panel on which this Button will act.
25       */
26
27      public JOIButtonListener( JOIPanel panel )
28      {
29          this.panel = panel;
30      }
31
32      /**
33       * Defines the ActionListener behavior that must be implemented.
34       *
35       * When a user pushes the Button that we're listening to,
36       * send a changeMessage() message to the Panel.
37       *
38       * @param e the "event" when the button is pressed.
39       */
40
41      public void actionPerformed( ActionEvent e )
42      {
43          panel.changeMessage();
44      }
45  }
```

```
<!-- joi/10/joi/joi.html-->
<!-- -->
<!-- -->
<!-- Copyright 2002 Bill Campbell and Ethan Bolker-->

<html>
<body>

<applet
code="JOIPanel.class" height=100 width=400>
</applet>

</html>
</body>
```

```
// joi/10/joiapplet/JOIApplet.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.applet.*;
import java.awt.*;
import java.awt.event.*;

/**
 * A JOIPanel displays a button and a message.
 * Pushing the button changes the message.
 *
 * This class provides both the panel and the listener for
 * the button on the panel - a common GUI programming idiom.
 *
 * The panel can be displayed either from an applet
 * in a browser or by the JVM as an application.
 *
 * @version 10
 *
 */

public class JOIApplet extends Applet implements ActionListener
{
    private static final String MESSAGE1 = "Java Outside In";
    private static final String MESSAGE2 = "Java Inside Out";
    private String currentMessage = MESSAGE1; // currently displayed

    private Font font;                // for printing the message
    private Button button;            // for changing messages

    /**
     * Equip this Panel with a Button
     * and an associated ButtonListener, and
     * set the font for the message.
     */

    public void init()
    {
        // what this Panel looks like
        button = new Button( "Press Me" );
        this.add( button );
        font = new Font("Garamond", Font.BOLD, 48);

        // how this Panel behaves
        button.addActionListener( this );
    }

    /**
     * Defines the ActionListener behavior that must be
     * implemented.
     *
     * When a user pushes the Button that we're listening to,
     * send a changeMessage() message to the Panel.
     *
```



```
     * @param e the "event" when the button is pressed.
     */

    public void actionPerformed( ActionEvent e )
    {
        currentMessage =
            currentMessage.equals(MESSAGE1) ? MESSAGE2 : MESSAGE1;
        this.repaint();
    }

    /**
     * Draw the current message on this Panel.
     *
     * (The button is already there.)
     *
     * @param g an object encapsulating the graphics (e.g. pen)
     *          properties.
     */

    public void paint(Graphics g)
    {
        g.setColor(Color.black);
        g.setFont(font);
        g.drawString(currentMessage, 40, 75);
    }

    /**
     * Ask the JVM to display this Panel.
     */

    public static void main( String[] args )
    {
        Terminal t     = new Terminal();
        Frame frame    = new Frame();
        JOIApplet panel = new JOIApplet();
        panel.init();
        frame.add(panel);
        frame.setSize(400,120);
        frame.show();
        t.readLine("Type return to close the window ... ");
        System.exit(0);
    }
}
```

```
 1  <!-- joi/10/joiapplet/classes/joiapplet.html-->
 2  <!-- -->
 3  <!-- -->
 4  <!-- Copyright 2002 Bill Campbell and Ethan Bolker-->
 5
 6  <html>
 7  <body>
 8
 9  <applet
10  code="JOIApplet.class" height=100 width=400>
11  </applet>
12
13  </html>
14  </body>
```

```
// joi/10/juno/Juno.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.*;
import java.util.*;
import java.lang.*;

/**
 * Juno (Juno's Unix NOt) mimics a command line operating system
 * such as Unix.
 * <p>
 * A Juno system has a name, a set of Users, a JFile system,
 * a login process and a set of shell commands.
 *
 * @see User
 * @see JFile
 * @see ShellCommand
 *
 * @version 10
 **/

public class Juno
    implements Serializable
{
    private final static String OS      = "Juno";
    private final static String VERSION = "10";

    private String    hostName;   // host machine name
    private Map       users;      // lookup table for Users
    private transient OutputInterface  console;

    private Directory slash;      // root of JFile system
    private Directory userHomes;  // for home directories

    private ShellCommandTable commandTable; // shell commands

    // file containing Juno state
    private transient String fileName = null;

    // port used by Juno server for remote login
    private int junoPort = 2001;

    /**
     * Construct a Juno (operating system) object.
     *
     * @param hostName  the name of the host on which it's running.
     * @param echoInput should all input be echoed as output?
     * @param isGUI graphical user interface?
     * @param isRemote running as a server?
     */

    public Juno( String hostName, boolean echoInput,
                 boolean isGUI, boolean isRemote )
    {
```



```
        // Initialize the Juno environment ...

        this.hostName     = hostName;
        users             = new TreeMap();
        commandTable      = new ShellCommandTable();

        // the file system

        slash = new Directory( "", null, null );
        User root = new User( "root", "swordfish", slash,
                              "Rick Martin" );
        users.put( "root", root );
        slash.setOwner(root);
        userHomes = new Directory( "users", root, slash );
    }

    // Set up the correct console:
    // command line (default), graphical or remote.

    private void setupConsole( boolean echoInput, boolean isGUI,
                               boolean isRemote )
    {
        LoginInterpreter interpreter
            = new LoginInterpreter( this, null );

        if (isGUI) {
            console = new GUILoginConsole( hostName,
                                           this, interpreter, echoInput);
        }
        else if (isRemote) {
            console = new RemoteConsole( this, echoInput, junoPort );
        }
        else {
            console = new JunoTerminal( echoInput );
        }

        // Tell the interpreter about the console
        interpreter.setConsole( console );

        // If we're using a simple command line interface,
        // start that.  (Constructing a GUI starts the GUI.)
        // Shut down Juno when done

        if (!isGUI && !isRemote) {
            interpreter.CLILogin();
            shutDown();
        }
    }

    /**
     * Shut down this Juno system.
     *
     * Save state if required.
     */

    public void shutDown( )
```

```
113     {
114         if (fileName != null) {
115             writeJuno( );
116         }
117     }
118
119     /**
120      * Set the name of file in which system state is kept.
121      *
122      * @param fileName the file name.
123      */
124
125     public void setFileName(String fileName)
126     {
127         this.fileName = fileName;
128     }
129
130     /**
131      * The name of the host computer on which this system
132      * is running.
133      *
134      * @return the host computer name.
135      */
136
137     public String getHostName()
138     {
139         return hostName;
140     }
141
142     /**
143      * The name of this operating system.
144      *
145      * @return the operating system name.
146      */
147
148     public String getOS()
149     {
150         return OS;
151     }
152
153     /**
154      * The version number for this system.
155      *
156      * @return the version number.
157      */
158
159     public String getVersion()
160     {
161         return VERSION;
162     }
163
164     /**
165      * The directory containing all user homes for this system.
166      *
167      * @return the directory containing user homes.
168      */
```



```
169
170     public Directory getUserHomes()
171     {
172         return userHomes;
173     }
174
175     /**
176      * The shell command table for this system.
177      *
178      * @return the shell command table.
179      */
180
181     public ShellCommandTable getCommandTable()
182     {
183         return commandTable;
184     }
185
186     /**
187      * Look up a user by user name.
188      *
189      * @param username the user's name.
190      * @return the appropriate User object.
191      */
192
193     public User lookupUser( String username )
194     {
195         return (User) users.get( username );
196     }
197
198     /**
199      * Create a new User.
200      *
201      * @param userName the User's login name.
202      * @param home her home Directory.
203      * @param password her password.
204      * @param realName her real name.
205      * @return newly created User.
206      */
207
208     public User createUser( String userName, Directory home,
209                             String password, String realName )
210     {
211         User newUser = new User( userName, password,
212                                  home, realName );
213         users.put( userName, newUser );
214         return newUser;
215     }
216
217     /**
218      * The Juno system may be given the following command line
219      * arguments:
220      *
221      * -e:         Echo all input (useful for testing).
222      *
223      * -version:   Report the version number and exit.
224      *
```

```
225       * -g:         Support a GUI console.
226       *
227       * -remote     Start Juno server.
228       *
229       * -f filename File to read/write system state from/to
230       *
231       * [hostname]: The name of the host on which
232       *             Juno is running (optional).
233       */
234
235      public static void main( String[] args )
236      {
237          // Parse command line options
238
239          boolean echoInput    = false;
240          boolean versionQuery = false;
241          boolean isGUI        = false;
242          boolean isRemote     = false;
243          String  hostName     = "mars";
244          String  junoFileName = null;
245
246          for (int i=0; i < args.length; i++) {
247              if (args[i].equals("-e")) {
248                  echoInput = true;
249              }
250              else if (args[i].equals("-version")) {
251                  versionQuery = true;
252              }
253              else if (args[i].equals("-g")) {
254                  isGUI = true;
255              }
256              else if (args[i].equals( "-remote" )) {
257                  isRemote = true;
258              }
259              else if (args[i].equals("-f")) {
260                  junoFileName = args[++i];
261              }
262              else {
263                  hostName = args[i];
264              }
265          }
266
267          // If it's  a version query give the version and exit
268          if ( versionQuery ) {
269              System.out.println( OS + " version " + VERSION );
270              System.exit(0);
271          }
272
273          // Create a new Juno or read one from a file.
274          Juno junoSystem = null;
275          if (junoFileName != null) {
276              junoSystem = readJuno( junoFileName );
277          }
278          if (junoSystem == null) {
279              junoSystem = new Juno( hostName, echoInput,
280                                     isGUI, isRemote );
```



```
281          }
282          junoSystem.setFileName( junoFileName );
283          junoSystem.setupConsole( echoInput, isGUI, isRemote );
284      }
285
286      // Read Juno state from a file.
287      //
288      // @param junoFileName the name of the file containing the system.
289      // @return the system, null if file does not exist.
290
291      private static Juno readJuno(String junoFileName)
292      {
293          File file = new File( junoFileName );
294          if (!file.exists()) {
295              return null;
296          }
297          ObjectInputStream inStream = null;
298          try {
299              inStream = new ObjectInputStream(
300                                     new FileInputStream( file ) );
301              Juno juno = (Juno)inStream.readObject();
302              System.out.println(
303                 "Juno state read from file " + junoFileName);
304              return juno;
305          }
306          catch (Exception e ) {
307              System.err.println("Problem reading " + junoFileName );
308              System.err.println(e);
309              System.exit(1);
310          }
311          finally {
312              try {
313                  inStream.close();
314              }
315              catch (Exception e) {
316              }
317          }
318          return null; // you can never get here
319      }
320
321      // Write Juno state to a file.
322
323      private void writeJuno()
324      {
325          ObjectOutputStream outStream = null;
326          try {
327              outStream = new ObjectOutputStream(
328                                     new FileOutputStream( fileName ) );
329              outStream.writeObject( this );
330              System.out.println(
331                 "Juno state written to file " + fileName);
332          }
333          catch (Exception e ) {
334              System.err.println("Problem writing " + fileName);
335              System.err.println(e);
336          }
```

```
   337          finally {
   338              try {
   339                  outStream.close();
   340              }
   341              catch (Exception e ) {
   342              }
   343          }
   344      }
   345  }
```

```
// joi/10/juno/LoginInterpreter.java
//
//
// Copyright 2003 Ethan Bolker and Bill Campbell

import java.util.*;

/**
 * Interpreter for Juno login commands.
 *
 * There are so few commands that if-then-else logic is OK.
 *
 * @version 10
 */

public class LoginInterpreter
    implements InterpreterInterface
{
    private static final String LOGIN_COMMANDS =
        "help, register, <username>, exit";

    private Juno system;             // the Juno object
    private OutputInterface console; // where output goes

    /**
     * Construct a new LoginInterpreter for interpreting
     * login commands.
     *
     * @param system the system creating this interpreter.
     * @param console the Terminal used for input and output.
     */

    public LoginInterpreter( Juno system, OutputInterface console)
    {
        this.system  = system;
        this.console = console;
    }

    /**
     * Set the console for this interpreter.  Used by the
     * creator of this interpreter.
     *
     * @param console the Terminal to be used for input and output.
     */

    public void setConsole( OutputInterface console)
    {
        this.console = console;
    }

    /**
     * Simulates behavior at login: prompt.
     */

    public void CLILogin()
    {
```



```
        welcome();
        boolean moreWork = true;
        while( moreWork ) {
            moreWork = interpret(((InputInterface)console).
                                 readLine( "Juno login: " ) );
        }
    }


    /**
     * Parse user's command line and dispatch appropriate
     * semantic action.
     *
     * @param  inputLine the User's instructions.
     * @return true except for "exit" command
     *         or null inputLine.
     */

    public boolean interpret( String inputLine )
    {
        if (inputLine == null) {
            return false;
        }
        StringTokenizer st =
            new StringTokenizer( inputLine );
        if (st.countTokens() == 0) {
            return true; // skip blank line
        }
        String visitor = st.nextToken();
        if (visitor.equals( "exit" )) {
            return false;
        }
        if (visitor.equals( "register" )) {
            register( st );
        }
        else if (visitor.equals( "help" )) {
            help();
        }
        else {
            String password;
            try {
                if (console.isGUI()) {
                    password = st.nextToken();
                }
                else {;
                    password = readPassword( "password: " );
                }
                User user = system.lookupUser(visitor);
                user.matchPassword( password );
                new Shell( system, user, console );
            }
            catch (Exception e) {

                // NullPointerException if no such user,
                // JunoException if password fails to match -
                // message to user doesn't give away which.
```

```
                // The sysadmin would probably want a log
                // that did keep track.
                //
                // Other exceptions should be caught in shell()

                console.println("sorry");
            }
        }
        return true;
    }

    // Register a new user, giving him or her a login name and a
    // home directory on the system.
    //
    // StringTokenizer argument contains the new user's login name
    // followed by full real name.

    private void register( StringTokenizer line )
    {
        String username = "";
        String password = "";
        String realname = "";
        try {
            username = line.nextToken();
            password = line.nextToken();
            realname = line.nextToken("").trim();
        }
        catch (NoSuchElementException e) {
        }

        if (username.equals("") || password.equals("")
            || realname.equals("") ) {
            console.println(
                  "please supply username, password, real name");
            return;
        }
        User user = system.lookupUser(username);

        if (user != null) {  // user already exists
            console.println("sorry");
            return;
        }
        if (badPassword( password )) {
            console.println("password too easy to guess");
            return;
        }
        Directory home = new Directory( username, null,
                                        system.getUserHomes() );

        user = system.createUser( username, home, password, realname );
        home.setOwner( user );
    }

    // test to see if password is unacceptable:
    //   fewer than 6 characters
    //   contains only alphabetic characters
```



```

    private boolean badPassword( String pwd )
    {
        if (pwd.length() < 6) {
            return true;
        }
        int nonAlphaCount = 0;
        for (int i=0; i < pwd.length(); i++) {
            if (!Character.isLetter(pwd.charAt(i))) {
                nonAlphaCount++;
            }
        }
        return (nonAlphaCount == 0);
    }

    // Used for reading the user's password in CLI.

    private String readPassword( String prompt )
    {
        String line =
            ((InputInterface) console).readLine( prompt );
        StringTokenizer st = new StringTokenizer( line );
        try {
            return st.nextToken();
        }
        catch ( NoSuchElementException e )  {}
        return ""; // keeps compiler happy
    }


    // Display a short welcoming message, and remind users of
    // available commands.

    private void welcome()
    {
        console.println( "Welcome to " + system.getHostName() +
                         " running "   + system.getOS() +
                         " version "   + system.getVersion() );
        help();
    }

    // Remind user of available commands.

    private void help()
    {
        console.println( LOGIN_COMMANDS );
        console.println("");
    }
}
```

```
// joi/10/juno/Shell.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.*;

/**
 * Models a shell (command interpreter)
 *
 * The Shell knows the (Juno) system it's working in,
 * the User who started it,
 * and the console to which to send output.
 *
 * It keeps track of the the current working directory (.) .
 *
 * @version 10
 */

public class Shell
    implements InterpreterInterface
{
    private Juno system;             // The operating system object
    private User user;               // The user logged in
    private OutputInterface console; // The console for this shell
    private Directory dot;           // The current working directory

    /**
     * Construct a login shell for the given user and console.
     *
     * @param system a reference to the Juno system.
     * @param user the User logging in.
     * @param console a Terminal for input and output.
     */

    Shell( Juno system, User user, OutputInterface console )
    {
        this.system  = system;
        this.user    = user;
        this.console = console;
        dot          = user.getHome(); // default current directory

        if (!console.isGUI()) {
            this.console = console;
            CLIShell();
        }
        else
            this.console =
                new GUIShellConsole("Juno shell for " + user,
                                    this, console.isEchoInput());
    }

    // Run the command line interpreter

    private void CLIShell()
    {
```



```
        boolean moreWork = true;
        while(moreWork) {
            moreWork = interpret( ((InputInterface) console).
                                  readLine( getPrompt() ) );
        }
        console.println("goodbye");
    }

    /**
     * Interpret a String.
     *
     * Syntax
     * <pre>
     *     shellcommand command-arguments
     * </pre>
     *
     * @param inputLine the String to interpret.
     * @return true unless shell command is logout.
     */

    public boolean interpret( String inputLine )
    {
        StringTokenizer st = stripComments(inputLine);
        if (st.countTokens() == 0) {           // skip blank line
            return true;
        }
        String commandName = st.nextToken();
        ShellCommand commandObject =
            system.getCommandTable().lookup( commandName );
        if (commandObject == null ) {
            console.errPrintln( "Unknown command: " + commandName );
            return true;
        }
        try {
            commandObject.doIt( st, this );
        }
        catch (ExitShellException e) {
            return false;
        }
        catch (BadShellCommandException e) {
            console.errPrintln( "Usage: " + commandName + " " +
                                e.getCommand().getArgString() );
        }
        catch (JunoException e) {
            console.errPrintln( e.getMessage() );
        }
        catch (Exception e) {
            console.errPrintln( "you should never get here" );
            console.errPrintln( e.toString() );
        }
        return true;
    }

    // Strip characters from '#' to end of line, create and
    // return a StringTokenizer for what's left.

```

```
113      private StringTokenizer stripComments( String line )
114      {
115          int commentIndex = line.indexOf('#');
116          if (commentIndex >= 0) {
117              line = line.substring(0,commentIndex);
118          }
119          return new StringTokenizer(line);
120      }
121
122      /**
123       * The prompt for the CLI.
124       *
125       * @return the prompt string.
126       */
127
128      public String getPrompt()
129      {
130        return system.getHostName() + ":" + getDot().getPathName() + "> ";
131      }
132
133      /**
134       * The User associated with this shell.
135       *
136       * @return the user.
137       */
138
139      public User getUser()
140      {
141          return user;
142      }
143
144      /**
145       * The current working directory for this shell.
146       *
147       * @return the current working directory.
148       */
149
150      public Directory getDot()
151      {
152          return dot;
153      }
154
155      /**
156       * Set the current working directory for this Shell.
157       *
158       * @param dot the new working directory.
159       */
160
161      public void setDot(Directory dot)
162      {
163          this.dot = dot;
164      }
165
166
167      /**
168       * The console associated with this Shell.
```



```
169       *
170       * @return the console.
171       */
172
173      public OutputInterface getConsole()
174      {
175          return console;
176      }
177
178      /**
179       * The Juno object associated with this Shell.
180       *
181       * @return the Juno instance that created this Shell.
182       */
183
184      public Juno getSystem()
185      {
186          return system;
187      }
188  }
```

```
 1  // joi/10/juno/ShellCommand.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * Model those features common to all ShellCommands.
10   *
11   * Each concrete extension of this class provides a constructor
12   * and an implementation for method doIt.
13   *
14   * @version 10
15   */
16
17  public abstract class ShellCommand
18      implements java.io.Serializable
19  {
20      private String helpString;   // documents the command
21      private String argString;    // any args to the command
22
23      /**
24       * A constructor, always called (as super()) by the subclass.
25       * Used only for commands that have arguments.
26       *
27       * @param helpString a brief description of what the command does.
28       * @param argString a prototype illustrating the required arguments.
29       */
30
31      protected ShellCommand( String helpString, String argString )
32      {
33          this.argString  = argString;
34          this.helpString = helpString;
35      }
36
37      /**
38       * A constructor for commands having no arguments.
39       *
40       * @param helpString a brief description of what the command does.
41       */
42
43      protected ShellCommand( String helpString )
44      {
45          this( helpString, "" );
46      }
47
48      /**
49       * Execute the command.
50       *
51       * @param args the remainder of the command line.
52       * @param sh   the current shell
53       *
54       * @exception JunoException for reporting errors
55       */
56
```



```
57      public abstract void doIt( StringTokenizer args, Shell sh )
58          throws JunoException;
59
60      /**
61       * Help for this command.
62       *
63       * @return the help string.
64       */
65
66      public String getHelpString()
67      {
68          return helpString;
69      }
70
71      /**
72       * The argument string prototype.
73       *
74       * @return the argument string prototype.
75       */
76
77      public String getArgString()
78      {
79          return argString;
80      }
81  }
```

```
 1  // joi/10/juno/ShellCommandTable.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * A ShellCommandTable object maintains a dispatch table of
10   * ShellCommand objects keyed by the command names used to invoke
11   * them.
12   *
13   * To add a new shell command to the table, install it from
14   * method fillTable().
15   *
16   * @see ShellCommand
17   *
18   * @version 10
19   */
20
21  public class ShellCommandTable
22      implements java.io.Serializable
23  {
24      private Map table = new TreeMap();
25
26      /**
27       * Construct and fill a shell command table.
28       */
29
30      public ShellCommandTable()
31      {
32          fillTable();
33      }
34
35      /**
36       * Get a ShellCommand, given the command name key.
37       *
38       * @param key the name associated with the command we're
39       *            looking for.
40       *
41       * @return the command we're looking for, null if none.
42       */
43
44      public ShellCommand lookup( String key )
45      {
46          ShellCommand commandObject = (ShellCommand) table.get( key );
47          if (commandObject != null) {
48              return commandObject;
49          }
50
51          // try to load dynamically
52          // construct classname = "KeyCommand"
53          char[] chars = (key + "Command").toCharArray();
54          chars[0] = key.toUpperCase().charAt(0);
55          String classname = new String(chars);
56          try {
```



```
57              commandObject =
58                  (ShellCommand)Class.forName(classname).newInstance();
59          }
60          catch (Exception e) { // couldn't find class
61              return null;
62          }
63          install(key, commandObject); // put it in table for next time
64          return commandObject;
65      }
66
67      /**
68       * Get an array of the command names.
69       *
70       * @return the array of command names.
71       */
72
73      public String[] getCommandNames()
74      {
75          return (String[]) table.keySet().toArray( new String[0] );
76      }
77
78      // Associate a command name with a ShellCommand.
79
80      private void install( String commandName, ShellCommand command )
81      {
82          table.put( commandName, command );
83      }
84
85      // Fill the dispatch table with ShellCommands, keyed by their
86      // command names.
87
88      private void fillTable()
89      {
90          install( "list", new ListCommand() );
91          install( "cd", new CdCommand() );
92          install( "newfile", new NewfileCommand() );
93          install( "remove", new RemoveCommand() );
94          install( "help", new HelpCommand() );
95          install( "mkdir", new MkdirCommand() );
96          install( "type", new TypeCommand() );
97          install( "logout", new LogoutCommand() );
98      }
99  }
```

```
 1  // joi/10/juno/MkdirCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to create a new directory.
10   * Usage:
11   * <pre>
12   *     mkdir directory-name
13   * </pre>
14   *
15   * @version 10
16   */
17
18  public class MkdirCommand extends ShellCommand
19  {
20      MkdirCommand()
21      {
22          super( "create a subdirectory of the current directory",
23                 "directory-name" );
24      }
25
26      /**
27       * Create a new Directory in the current Directory.
28       *
29       * @param args the remainder of the command line.
30       * @param sh the current shell.
31       *
32       * @exception JunoException for reporting errors.
33       */
34
35      public void doIt( StringTokenizer args, Shell sh )
36           throws JunoException
37      {
38          String filename = args.nextToken();
39          new Directory( filename, sh.getUser(), sh.getDot() );
40      }
41  }
```

```
 1  // joi/10/juno/TypeCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to display the contents of a
10   * text file.
11   * Usage:
12   * <pre>
13   *     type textfile
14   * </pre>
15   *
16   * @version 10
17   */
18
19  public class TypeCommand extends ShellCommand
20  {
21      TypeCommand()
22      {
23          super( "display contents of a TextFile", "textfile" );
24      }
25
26      /**
27       * Display the contents of a TextFile.
28       *
29       * @param args the remainder of the command line.
30       * @param sh the current Shell
31       *
32       * @exception JunoException for reporting errors
33       */
34
35      public void doIt( StringTokenizer args, Shell sh )
36          throws JunoException
37      {
38          String filename;
39          try {
40              filename = args.nextToken();
41          }
42          catch (NoSuchElementException e) {
43              throw new BadShellCommandException( this );
44          }
45          try {
46              sh.getConsole().println(
47                  ( (TextFile) sh.getDot().
48                    retrieveJFile( filename ) ).getContents() );
49          }
50          catch (NullPointerException e) {
51              throw new JunoException( "JFile does not exist: "
52                                       + filename);
53          }
54          catch (ClassCastException e) {
55              throw new JunoException( "JFile not a text file: "
56                                       + filename);
```



```
57          }
58      }
59  }
```

```
 1  // joi/10/juno/HelpCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to display help on the shell commands.
10   * Usage:
11   * <pre>
12   *     help
13   * </pre>
14   *
15   * @version 10
16   */
17
18  public class HelpCommand extends ShellCommand
19  {
20      HelpCommand()
21      {
22          super( "display ShellCommands" );
23      }
24
25      /**
26       * Print out help for all commands.
27       *
28       * @param args the remainder of the command line.
29       * @param sh   the current shell
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          // Get command keys from global table, print them out.
38
39          sh.getConsole().println( "shell commands" );
40          ShellCommandTable table = sh.getSystem().getCommandTable();
41          String[] names = table.getCommandNames();
42          for (int i = 0; i < names.length; i++ ) {
43              String cmdname = names[i];
44              ShellCommand cmd =
45                  (ShellCommand) table.lookup( cmdname );
46              sh.getConsole().
47                  println( "  " + cmdname + ": " + cmd.getHelpString() );
48          }
49      }
50  }
```

```
 1  // joi/10/juno/NewfileCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to create a text file.
10   * Usage:
11   * <pre>
12   *     newfile filename contents
13   * </pre>
14   *
15   * @version 10
16   */
17
18  public class NewfileCommand extends ShellCommand
19  {
20      NewfileCommand()
21      {
22          super( "create a new TextFile", "filename contents" );
23      }
24
25      /**
26       * Create a new TextFile in the current Directory.
27       *
28       * @param args the remainder of the command line.
29       * @param sh the current shell.
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          String filename;
38          String contents;
39          filename = args.nextToken();
40          contents  = args.nextToken("").trim(); // rest of line
41          new TextFile( filename, sh.getUser(),
42                        sh.getDot(), contents );
43      }
44  }
```

```
 1  // joi/10/juno/CdCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to change directory.
10   * Usage:
11   * <pre>
12   *     cd [directory]
13   * </pre>
14   * for moving to the named directory.
15   *
16   * @version 10
17   */
18
19  class CdCommand extends ShellCommand
20  {
21      CdCommand()
22      {
23          super( "change current directory", "[ directory ]" );
24      }
25
26      /**
27       * Move to the named directory
28       *
29       * @param args the remainder of the command line.
30       * @param sh   the current shell
31       *
32       * @exception JunoException for reporting errors
33       */
34
35      public void doIt( StringTokenizer args, Shell sh )
36           throws JunoException
37      {
38          String dirname = "";
39          Directory d = sh.getUser().getHome(); // default
40          if ( args.hasMoreTokens() ) {
41              dirname = args.nextToken();
42              if (dirname.equals("..")) {
43                  if (sh.getDot().isRoot())
44                      d = sh.getDot(); // no change
45                  else
46                      d = sh.getDot().getParent();
47              }
48              else if (dirname.equals(".")) {
49                  d = sh.getDot(); // no change
50              }
51              else {
52                  d = (Directory)(sh.getDot().retrieveJFile(dirname));
53              }
54          }
55          sh.setDot( d );
56      }
```



```
57  }
```

```
 1  // joi/10/juno/ListCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to list contents of the current directory.
10   * Usage:
11   * <pre>
12   *     list
13   * </pre>
14   *
15   * @version 10
16   */
17
18  public class ListCommand extends ShellCommand
19  {
20      // The constructor adds this object to the global table.
21
22      ListCommand()
23      {
24          super( "list contents of current directory" );
25      }
26
27      /**
28       * List contents of the current working directory.
29       *
30       * @param args the remainder of the command line.
31       * @param sh   the current shell
32       *
33       * @exception JunoException for reporting errors
34       */
35
36      public void doIt( StringTokenizer args, Shell sh )
37          throws JunoException
38      {
39          OutputInterface terminal = sh.getConsole();
40          Directory dir            = sh.getDot();
41          String[] fileNames       = dir.getFileNames();
42
43          terminal.println( dir.getPathName() );
44          for ( int i = 0; i < fileNames.length; i++ ) {
45              String fileName = fileNames[i];
46              JFile  jfile    = dir.retrieveJFile( fileName );
47              terminal.println( jfile.toString() );
48          }
49      }
50  }
```

```
 1  // joi/10/juno/GetfileCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7  import java.io.*;
 8
 9  /**
10   * The Juno shell command to get a text file from the underlying
11   * operating system and copy it to a Juno text file.
12   * Usage:
13   * <pre>
14   *     getfile native-filename juno-filename
15   * </pre>
16
17   * <pre>
18   *
19   * @version 10
20   */
21
22  class GetfileCommand extends ShellCommand
23  {
24      GetfileCommand()
25      {
26          super( "download a file to Juno",
27                 "native-filename juno-filename" );
28      }
29
30      /**
31       * Use the getfile command to copy the content of a real
32       * file to a Juno TextFile.
33       * <p>
34       * The command has the form:
35       * <pre>
36       * get nativeFile textfile <&>
37       *
38       * @param args: the reminder of the command line.
39       * @param sh: the current shell
40       *
41       * @exception JunoException for reporting errors
42       */
43
44      public void doIt( StringTokenizer args, Shell sh )
45           throws JunoException
46      {
47          if ( sh.getConsole().isRemote() ) {
48              throw( new JunoException(
49                  "Get not implemented for remote consoles." ) );
50          }
51          String src;
52          String dst;
53          try {
54              src = args.nextToken();
55              dst = args.nextToken();
56          }
```



```
57          catch (NoSuchElementException e) {
58              throw new BadShellCommandException( this );
59          }
60          BufferedReader inStream  = null;
61          Writer         outStream = null;
62          try {
63              inStream  = new BufferedReader( new FileReader( src ) );
64              outStream = new StringWriter();
65              String line;
66
67              while ((line = inStream.readLine()) != null) {
68                  outStream.write( line );
69                  outStream.write( '\n' );
70              }
71              new TextFile( dst, sh.getUser(),
72                            sh.getDot(), outStream.toString() );
73          }
74          catch (IOException e) {
75              throw new JunoException( "IO problem in get" );
76          }
77          finally {
78              try {
79                  inStream.close();
80                  outStream.close();
81              }
82              catch (IOException e) {};
83          }
84      }
85  }
```

```
 1  // joi/10/juno/RemoveCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to remove a text file.
10   * Usage:
11   * <pre>
12   *     remove textfile
13   * </pre>
14   *
15   * @version 10
16   */
17
18  public class RemoveCommand extends ShellCommand
19  {
20      RemoveCommand()
21      {
22          super( "remove a TextFile", "textfile" );
23      }
24
25      /**
26       * Remove a TextFile.
27       *
28       * @param args the remainder of the command line.
29       * @param sh   the current Shell
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          String filename = args.nextToken();
38          sh.getDot().removeJFile(filename);
39      }
40  }
41
```

```
 1  // joi/10/juno/LogoutCommand.java
 2  //
 3  //
 4  // Copyright 2003, Bill Campbell and Ethan Bolker
 5
 6  import java.util.*;
 7
 8  /**
 9   * The Juno shell command to log out.
10   * Usage:
11   * <pre>
12   *     logout
13   * </pre>
14   *
15   * @version 10
16   */
17
18  public class LogoutCommand extends ShellCommand
19  {
20      LogoutCommand()
21      {
22          super( "log out, return to login: prompt" );
23      }
24
25      /**
26       * Log out from the current shell.
27       *
28       * @param args the remainder of the command line.
29       * @param sh   the current shell
30       *
31       * @exception JunoException for reporting errors
32       */
33
34      public void doIt( StringTokenizer args, Shell sh )
35           throws JunoException
36      {
37          throw new ExitShellException();
38      }
39  }
```

```
// joi/10/jfiles/JFile.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.util.Date;
import java.io.File;

/**
 * A JFile object models a file in a hierarchical file system.
 * <p>
 * Extend this abstract class to create particular kinds of JFiles,
 * e.g.:<br>
 * Directory  -
 *    a JFile that maintains a list of the files it contains.<br>
 * TextFile  -
 *    a JFile containing text you might want to read.<br>
 *
 * @see Directory
 * @see TextFile
 *
 * @version 10
 */

public abstract class JFile
    implements java.io.Serializable
{
    /**
     * The separator used in pathnames.
     */

    public static final String separator = File.separator;

    private String    name;       // a JFile knows its name
    private User      owner;      // the owner of this file
    private Date      createDate; // when this file was created
    private Date      modDate;    // when this file was last modified
    private Directory parent;     // the Directory containing this file

    /**
     * Construct a new JFile, set owner, parent, creation and
     * modification dates. Add this to parent (unless this is the
     * root Directory).
     *
     * @param name     the name for this file (in its parent directory).
     * @param creator  the owner of this new file.
     * @param parent   the Directory in which this file lives.
     */

    protected JFile( String name, User creator, Directory parent )
    {
        this.name   = name;
        this.owner  = creator;
        this.parent = parent;
        if (parent != null) {
            parent.addJFile( name, this );
```



```
        }
        createDate  = modDate = new Date(); // set dates to now
    }

    /**
     * The name of the file.
     *
     * @return the file's name.
     */

    public String getName()
    {
        return name;
    }

    /**
     * The full path to this file.
     *
     * @return the path name.
     */

    public String getPathName()
    {
        if (this.isRoot()) {
            return separator;
        }
        if (parent.isRoot()) {
            return separator + getName();
        }
        return parent.getPathName() + separator + getName();
    }

    /**
     * The size of the JFile
     * (as defined by the child class)..
     *
     * @return the size.
     */

    public abstract int getSize();

    /**
     * Suffix used for printing file names
     * (as defined by the child class).
     *
     * @return the file's suffix.
     */

    public abstract String getSuffix();

    /**
     * Set the owner for this file.
     *
     * @param owner the new owner.
     */

```

```
113      public void setOwner( User owner )
114      {
115          this.owner = owner;
116      }
117
118      /**
119       * The file's owner.
120       *
121       * @return the owner of the file.
122       */
123
124      public User getOwner()
125      {
126          return owner;
127      }
128
129      /**
130       * The date and time of the file's creation.
131       *
132       * @return the file's creation date and time.
133       */
134
135      public String getCreateDate()
136      {
137          return createDate.toString();
138      }
139
140      /**
141       * Set the modification date to "now".
142       */
143
144      protected void setModDate()
145      {
146          modDate = new Date();
147      }
148
149      /**
150       * The date and time of the file's last modification.
151       *
152       * @return the date and time of the file's last modification.
153       */
154
155      public String getModDate()
156      {
157          return modDate.toString();
158      }
159
160      /**
161       * The Directory containing this file.
162       *
163       * @return the parent directory.
164       */
165
166      public Directory getParent()
167      {
168          return parent;
```



```
169      }
170
171      /**
172       * A JFile whose parent is null is defined to be the root
173       * (of a tree).
174       *
175       * @return true when this JFile is the root.
176       */
177
178      public boolean isRoot()
179      {
180          return (parent == null);
181      }
182
183      /**
184       * How a JFile represents itself as a String.
185       * That is,
186       * <pre>
187       *    owner   size    modDate    name+suffix
188       * </pre>
189       *
190       * @return the String representation.
191       */
192
193      public String toString()
194      {
195          return getOwner() + "\t" +
196              getSize()  + "\t" +
197              getModDate()  + "\t" +
198              getName() + getSuffix();
199      }
200  }
```

```
 1  // joi/10/juno/Directory.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  import java.util.*;
 7
 8  /**
 9   * Directory of JFiles.
10   *
11   * A Directory is a JFile that maintains a
12   * table of the JFiles it contains.
13   *
14   * @version 10
15   */
16
17  public class Directory extends JFile
18  {
19      private TreeMap jfiles;  // table for JFiles in this Directory
20
21      /**
22       * Construct a Directory.
23       *
24       * @param name the name for this Directory (in its parent Directory)
25       * @param creator  the owner of this new Directory.
26       * @param parent   the Directory in which this Directory lives.
27       */
28
29      public Directory( String name, User creator, Directory parent)
30      {
31          super( name, creator, parent );
32          jfiles = new TreeMap();
33      }
34
35      /**
36       * The size of a Directory is the number of JFiles it contains.
37       *
38       * @return the Directory's size.
39       */
40
41      public int getSize()
42      {
43          return jfiles.size();
44      }
45
46      /**
47       * Suffix used for printing Directory names;
48       * we define it as the (system dependent)
49       * name separator used in path names.
50       *
51       * @return the suffix for Directory names.
52       */
53
54      public String getSuffix()
55      {
56          return  JFile.separator;
```



```
57      }
58
59      /**
60       * Add a JFile to this Directory. Overwrite if a JFile
61       * of that name already exists.
62       *
63       * @param name the name under which this JFile is added.
64       * @param afile the JFile to add.
65       */
66
67      public void addJFile(String name, JFile afile)
68      {
69          jfiles.put( name, afile );
70          setModDate();
71      }
72
73      /**
74       * Get a JFile in this Directory, by name .
75       *
76       * @param filename the name of the JFile to find.
77       * @return the JFile found.
78       */
79
80      public JFile retrieveJFile( String filename )
81      {
82          JFile aFile = (JFile)jfiles.get( filename );
83          return aFile;
84      }
85
86      /**
87       * Remove a JFile in this Directory, by name .
88       *
89       * @param filename the name of the JFile to remove
90       */
91
92      public void removeJFile( String filename )
93      {
94          jfiles.remove( filename );
95      }
96
97      /**
98       * Get the contents of this Directory as an array of
99       * the file names, each of which is a String.
100      *
101      * @return the array of names.
102      */
103
104     public String[] getFileNames()
105     {
106         return (String[])jfiles.keySet().toArray( new String[0] );
107     }
108 }
```

```
 1  // joi/10/juno/TextFile.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * A TextFile is a JFile that holds text.
 8   *
 9   * @version 10
10   */
11
12  public class TextFile extends JFile
13  {
14      private String contents;  // The text itself
15
16      /**
17       * Construct a TextFile with initial contents.
18       *
19       * @param name the name for this TextFile (in its parent Directory).
20       * @param creator the owner of this new TextFile
21       * @param parent  the Directory in which this TextFile lives.
22       * @param initialContents the initial text
23       */
24
25      public TextFile( String name, User creator, Directory parent,
26                String initialContents )
27      {
28          super( name, creator, parent );
29          setContents( initialContents );
30      }
31
32      /**
33       * Construct an empty TextFile.
34       *
35       * @param name the name for this TextFile (in its parent Directory).
36       * @param creator the owner of this new TextFile
37       * @param parent  the Directory in which this TextFile lives
38       */
39
40      TextFile( String name, User creator, Directory parent )
41      {
42          this( name, creator, parent, "" );
43      }
44
45      /**
46       * The size of a text file is the number of characters stored.
47       *
48       * @return the file's size.
49       */
50
51      public int getSize()
52      {
53          return contents.length();
54      }
55
56      /**
```



```
57       * Suffix used for printing text file names is "".
58       *
59       * @return an empty suffix (for TextFiles).
60       */
61
62      public String getSuffix()
63      {
64          return "";
65      }
66
67      /**
68       * Replace the contents of the file.
69       *
70       * @param contents the new contents.
71       */
72
73      public void setContents( String contents )
74      {
75          this.contents = contents;
76          setModDate();
77      }
78
79      /**
80       * The contents of a text file.
81       *
82       * @return String contents of the file.
83       */
84
85      public String getContents()
86      {
87          return contents;
88      }
89
90      /**
91       * Append text to the end of the file.
92       *
93       * @param  text the text to be appended.
94       */
95
96      public void append( String text )
97      {
98          setContents( contents + text );
99      }
100
101
102     /**
103      * Append a new line of text to the end of the file.
104      *
105      * @param  text the text to be appended.
106      */
107
108     public void appendLine( String text )
109     {
110         this.setContents(contents + '\n' + text);
111     }
112 }
```

```
 1  // joi/10/juno/User.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * Model a juno user.  Each User has a login name, password,
 8   * a home directory, and a real name.
 9   * name.
10   *
11   * @version 10
12   */
13
14  public class User
15      implements java.io.Serializable
16  {
17      private String name;     // the User's login name
18      private String password; // The user's login password.
19      private Directory home;  // her home Directory
20      private String realName; // her real name
21
22      /**
23       * Construct a new User.
24       *
25       * @param name      the User's login name.
26       * @param password  the user's login password.
27       * @param home      her home Directory.
28       * @param realName  her real name.
29       */
30
31      public User( String name, String password,
32                   Directory home, String realName )
33      {
34          this.name     = name;
35          this.password = password;
36          this.home     = home;
37          this.realName = realName;
38      }
39
40      /**
41       *   Confirm password. Throw a JunoException on failure.
42       *
43       *   @param guess the string to test against the password.
44       *
45       *   @exception JunoException
46       *      if password fails to match
47       */
48
49      public void matchPassword( String guess ) throws JunoException
50      {
51          if (!guess.equals( password )) {
52              throw new JunoException( "bad password" );
53          }
54      }
55
56      /**
```



```
57       * Get the User's login name.
58       *
59       * @return the name.
60       */
61
62      public String getName()
63      {
64          return name;
65      }
66
67      /**
68       * Convert the User to a String.
69       * The String representation for a User is her
70       * login name.
71       *
72       * @return the User's name.
73       */
74
75      public String toString()
76      {
77          return getName();
78      }
79
80      /**
81       * Get the User's home Directory.
82       *
83       * @return the home Directory.
84       */
85
86      public Directory getHome()
87      {
88          return home;
89      }
90
91      /**
92       * Get the user's real name.
93       *
94       * @return the real name.
95       */
96
97      public String getRealName()
98      {
99          return realName;
100     }
101 }
```

```
 1  // joi/10/juno/JunoException.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * A general Juno Exception.
 8   *
 9   * @version 10
10   */
11
12  public class JunoException extends Exception
13  {
14      /**
15       * The default (no argument) constructor.
16       */
17
18      public JunoException()
19      {
20      }
21
22      /**
23       * A general Juno exception holding a String message.
24       *
25       * @param message the message.
26       */
27
28      public JunoException( String message )
29      {
30          // Exception (actually Throwable, Exceptions's superclass)
31          // can remember the String passed its constructor.
32
33          super( message );
34      }
35
36      // Note, to get the message stored in a JunoException
37      // we can just use the (inherited) methods getMessage(),
38      // and toString().
39  }
```

```
 1  // joi/10/juno/BadShellCommandException.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * The Exception generated when a ShellCommand is misused.
 8   *
 9   * @version 10
10   */
11
12  class BadShellCommandException extends JunoException
13  {
14      private ShellCommand command;
15
16      /**
17       * Construct a new BadShellCommandException
18       * containing the badly used command.
19       *
20       * @param the ShellCommand being misused.
21       */
22
23      public BadShellCommandException( ShellCommand command )
24      {
25          this.command = command;
26      }
27
28      /**
29       * Get the command.
30       */
31
32      public ShellCommand getCommand()
33      {
34          return command;
35      }
36  }
```

```
 1  // joi/10/juno/ExitShellException.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * Exception raised for exiting a shell.
 8   *
 9   * @version 10
10   */
11
12  public class ExitShellException extends JunoException
13  {
14  }
```

```
 1  // joi/10/juno/ShellCommandNotFoundException.java (version 10)
 2  //
 3  //
 4  // Copyright 1997-2001 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * The Exception when a ShellCommand isn't found.
 8   */
 9
10  class ShellCommandNotFoundException extends JunoException
11  {
12      /**
13       * Create a ShellCommandNotFoundException.
14       */
15
16      public ShellCommandNotFoundException()
17      {
18      }
19
20      /**
21       * Create a ShellCommandNotFoundException with
22       * a message reporting the command tried.
23       */
24
25      public ShellCommandNotFoundException(String commandName )
26      {
27          super( "ShellCommand " + commandName + " not found" );
28      }
29  }
```

```
 1  // joi/10/juno/JFileNotFoundException.java (version 10)
 2  //
 3  //
 4  // Copyright 1997-2001 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   * The Exception thrown when a JFile isn't found
 8   *
 9   * @version 10
10   */
11
12  class JFileNotFoundException extends JunoException
13  {
14      String jfilename;
15
16      /**
17       * Construct a new JFileNotFoundException
18       *
19       * @param jfilename the file sought
20       */
21
22      public JFileNotFoundException( String jfilename )
23      {
24          super( "JFile " + jfilename + " not found." );
25          this.jfilename = jfilename;
26      }
27
28      /**
29       * Get the name of the file that wasn't there.
30       *
31       * @return the file name
32       */
33
34      public String getJFilename()
35      {
36          return jfilename;
37      }
38  }
```

```
 1  // joi/10/juno/GUILoginConsole.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  import javax.swing.*;
 7  import javax.swing.event.*;
 8  import java.awt.*;
 9  import java.awt.event.*;
10
11  /**
12   *  The graphical user interface to Juno.
13   */
14
15  public class GUILoginConsole extends JFrame
16      implements OutputInterface
17  {
18      private static final int FIELDWIDTH = 30;
19      private static final int FIELDHEIGHT = 5;
20
21      private final Juno junoSystem;
22      private WindowCloser closeMe; // to shut down Juno
23
24      private String title;  // title for the windows
25
26      // The interpreter interprets one-line commands.
27      private InterpreterInterface interpreter;
28      private boolean echoInput;
29
30      // All output goes to messages.
31      private JTextArea messages;
32
33      /**
34       *  Construct a GUI console for Juno.
35       *
36       *  @param title the title for this window.
37       *  @param junoSystem the Juno system for which this is a GUI
38       *  @param interpreter the object to which to send user input.
39       *  @param echoInput true when input echoes to this console.
40       */
41
42      public GUILoginConsole( String title, Juno junoSystem,
43                              InterpreterInterface interpreter,
44                              boolean echoInput)
45      {
46          super( title );
47          this.title       = title;
48          this.junoSystem  = junoSystem;
49          this.interpreter = interpreter;
50          this.echoInput   = echoInput;
51          this.closeMe = new WindowCloser( junoSystem );
52
53          // Set up the look and feel;
54          // Everthing is placed on a panel (using BorderLayout)
55
56          JPanel panel = new JPanel();
```



```
57          panel.setLayout( new BorderLayout() );
58
59          // First a tabbed pane, with two tabs:
60          //   one for login, one for registration
61
62          JTabbedPane tabs = new JTabbedPane();
63          tabs.addTab( "Login" , null,
64                       new LoginPane( interpreter, echoInput, closeMe ) );
65          tabs.addTab( "Register", null,
66                       new RegisterPane( interpreter, echoInput ) );
67          tabs.setSelectedIndex( 0 );  // Login selected by default
68          panel.add( tabs, BorderLayout.NORTH );
69
70          // and the output messages area.
71          panel.add( new JLabel( "Messages:" ), BorderLayout.CENTER );
72          messages = new JTextArea( FIELDHEIGHT, FIELDWIDTH );
73          panel.add( messages, BorderLayout.SOUTH );
74
75          // Add the panel to this JFrame
76          this.getContentPane().add( panel );
77
78          // Closing this window
79          this.setDefaultCloseOperation(JFrame.DO_NOTHING_ON_CLOSE);
80          this.addWindowListener( closeMe );
81
82          // Size and display this JFrame
83          pack();
84          show();
85      }
86
87      // Implementing the OutputInterface. Everything goes to the
88      // single message area.
89
90      /**
91       * Write a String followed by a newline
92       * to message area.
93       *
94       * @param str - the string to write
95       */
96
97      public void println(String str )
98      {
99          messages.append( str + "\n" );
100     }
101
102     /**
103      * Write a String followed by a newline
104      * to message area.
105      *
106      * @param str - the String to write
107      */
108
109     public void errPrintln(String str )
110     {
111         println( str );
112     }
```

```
113
114     /**
115      * Query what kind of console this is.
116      *
117      * @return true if and only if echoing input.
118      */
119
120     public boolean isEchoInput()
121     {
122         return echoInput;
123     }
124
125     /**
126      * Query what kind of console this is.
127      *
128      * @return true if and only if GUI
129      */
130
131     public boolean isGUI()
132     {
133         return true;
134     }
135
136     /**
137      * Query what kind of console this is.
138      *
139      * @return true if and only if remote
140      */
141
142     public boolean isRemote()
143     {
144         return false;
145     }
146
147     // The Login pane is specified in a private inner class,
148     // visible only here.
149
150     private class  LoginPane extends JPanel
151     {
152         // The login pane has two text fields and two buttons.
153         private JTextField nameField;
154         private JTextField passwordField;
155
156         private JButton ok;
157         private JButton exit;
158
159         private WindowCloser closeMe; // to shut down Juno
160         // Construct the login pane and set up its listeners.
161
162         public LoginPane( InterpreterInterface interpreter,
163                           boolean echoInput, WindowCloser closeMe )
164         {
165             super();
166             this.closeMe = closeMe;
167
168             // Set up the look and feel.
```



```
169             // Everything will go into a vertical Box, a container
170             // whose contents are laid out using BoxLayout
171
172             Box box = Box.createVerticalBox();
173
174             // First a panel, containing the two text fields
175
176             JPanel p  = new JPanel();
177             p.setLayout( new GridLayout( 4 , 1 ) );
178
179             p.add( new JLabel( "Login:" ) );
180             nameField = new JTextField( FIELDWIDTH );
181             p.add( nameField );
182
183             p.add( new JLabel( "Password:" ) );
184             passwordField = new JPasswordField( FIELDWIDTH );
185             p.add( passwordField );
186             box.add( p );
187             box.add( Box.createVerticalStrut( 15 ) );
188
189             // Then a horizontal Box containing the two buttons
190
191             Box row = Box.createHorizontalBox();
192             row.add( Box.createGlue() );
193
194             ok = new JButton( "OK" );
195             row.add( ok );
196             row.add( Box.createGlue() );
197
198             exit = new JButton( "Exit" );
199             row.add( exit );
200             row.add( Box.createGlue() );
201             box.add( row );
202             box.add( Box.createVerticalStrut( 15 ) );
203
204             this.setLayout( new BorderLayout() );
205             this.add( box, BorderLayout.CENTER );
206
207             // Set up the listeners (the semantics)
208
209             ok.addActionListener( new LoginProcessor() );
210             exit.addActionListener( closeMe ); // shuts down Juno
211         }
212
213         // An inner inner class for the semantics
214         // when the user clicks OK.
215
216         private class LoginProcessor implements ActionListener
217         {
218             public void actionPerformed(ActionEvent e)
219             {
220                 String str = nameField.getText() +  " " +
221                     passwordField.getText();
222                 nameField.setText("");
223                 passwordField.setText("");
224                 messages.setText(str+'\n');  // for debugging
```

```
                interpreter.interpret( str );
            }
        }
    }

    // The Register pane is specified in a private inner class,
    // visible only here.

    private class  RegisterPane extends JPanel
    {
        // The register pane has four textfields and two buttons.
        private JTextField chosenName;
        private JTextField fullName;
        private JTextField password1;
        private JTextField password2;

        private JButton register;
        private JButton clear;

        public RegisterPane( InterpreterInterface interpreter,
                             boolean echoInput)
        {
            super();

            // Define the look and feel
            // Everything goes into a vertical Box
            Box box = Box.createVerticalBox();

            // First a panel containing the text fields

            JPanel p  = new JPanel();
            p.setLayout( new GridLayout( 0 , 1 ) );

            p.add( new JLabel( "Choose login name:" ) );
            chosenName = new JTextField( FIELDWIDTH );
            p.add( chosenName );

            p.add( new JLabel( "Give full name:" ) );
            fullName = new JTextField( FIELDWIDTH );
            p.add( fullName );

            p.add( new JLabel( "Choose password:" ) );
            password1  = new JPasswordField( FIELDWIDTH );
            p.add( password1 );

            p.add( new JLabel( "Retype password:" ) );
            password2  = new JPasswordField( FIELDWIDTH );
            p.add( password2 );

            box.add( p );
            box.add( Box.createVerticalStrut( 15 ) );

            // Then a horizontal Box containing the buttons

            Box row = Box.createHorizontalBox();
            row.add( Box.createGlue() );
```



```
            register = new JButton( "Register" );
            row.add( register );
            row.add( Box.createGlue() );
            clear = new JButton( "Clear" );
            row.add( clear );
            row.add( Box.createGlue() );
            box.add( row );
            box.add( Box.createVerticalStrut( 15 ) );

            this.setLayout( new BorderLayout() );
            this.add( box, BorderLayout.CENTER );

            // Set up the listeners (the semantics)

            register.addActionListener( new Registration() );
            clear.addActionListener( new Cleanser() );
        }

        // An inner inner class for the semantics when the user
        // clicks Register.

        private class Registration implements ActionListener
        {
            public void actionPerformed(ActionEvent e)
            {
                if ( password1.getText().trim().equals(
                     password2.getText().trim() ) ) {
                    String str = "register " +
                        chosenName.getText() +  " " +
                        password1.getText() + " " +
                        fullName.getText() ;
                    chosenName.setText("");
                    fullName.setText("");
                    messages.setText(str+'\n');  // for debugging
                    interpreter.interpret(str);
                }
                else {
                    messages.setText(
                        "Sorry, passwords don't match.\n" );
                }
                password1.setText("");
                password2.setText("");
            }
        }

        // An inner inner class for the semantics when the user
        // clicks Clear.

        private class Cleanser implements ActionListener {
            public void actionPerformed(ActionEvent e) {
                chosenName.setText("");
                fullName.setText("");
                password1.setText("");
                password2.setText("");
            }
        }
```

```
337      }
338
339      //  A WindowCloser instance handles close events generated
340      //  by the underlying window system with its windowClosing
341      //  method, and close events from buttons or other user
342      //  components with its actionPerformed method.
343      //
344      //  The action is to shut down Juno.
345
346      private static class WindowCloser extends WindowAdapter
347          implements ActionListener
348      {
349          Juno system;
350
351          public WindowCloser( Juno system )
352          {
353              this.system = system;
354          }
355
356          public void windowClosing (WindowEvent e)
357          {
358              this.actionPerformed( null );
359          }
360
361          public void actionPerformed(ActionEvent e)
362          {
363              if (system != null) {
364                  system.shutDown();
365              }
366              System.exit(0);
367          }
368      }
369
370      /**
371       * main() in GUILoginConsole class for
372       * unit testing during development.
373       */
374
375      public static void main( String[] args )
376      {
377          new GUILoginConsole( "GUItest", null, null, true ).show();
378      }
379  }
380
```

```
// joi/10/juno/GUIShellConsole.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
import java.util.*;

/**
 *  The GUI to the Juno system Shell.
 */

public class GUIShellConsole extends JFrame
    implements OutputInterface
{
    private static final int FIELDWIDTH  = 50;
    private static final int FIELDHEIGHT = 10;

    // the components on the window

    private JLabel promptLabel = new JLabel();
    private JTextField commandLine = new JTextField( FIELDWIDTH );
    private JButton doIt       = new JButton( "Do It" );
    private JButton logout     = new JButton( "Logout" );
    private JTextArea stdout   =
                          new JTextArea( FIELDHEIGHT, FIELDWIDTH );
    private JTextArea stderr   =
                          new JTextArea( FIELDHEIGHT/2, FIELDWIDTH );

    private Shell sh;    // for interpreting shell commands
    private WindowCloser closeMe; // for logging out.

    private boolean echoInput;

    /**
     * Construct a GUI console for a shell.
     *
     * @param title the title to  display in the frame.
     * @param sh the shell to interpret commands.
     * @param echoInput is input to be echoed?
     */

    public GUIShellConsole( String title,
                            Shell sh,
                            boolean echoInput )
    {
        this.sh = sh;
        this.echoInput   = echoInput;

        setTitle( title );
        setPrompt( sh.getPrompt() );

        // set up console's look and feel

```



```
        JPanel outerPanel = new JPanel();
        outerPanel.setLayout( new BorderLayout() );

        Box box = Box.createVerticalBox();

        JPanel commandPanel = new JPanel();
        commandPanel.setLayout( new BorderLayout() );
        commandPanel.add( promptLabel, BorderLayout.NORTH );
        commandPanel.add( commandLine, BorderLayout.CENTER );
        box.add( commandPanel );
        box.add( Box.createVerticalStrut( 10 ) );

        Box buttons = Box.createHorizontalBox();
        buttons.add( Box.createGlue() );
        buttons.add( doIt );
        buttons.add( Box.createGlue() );
        buttons.add( logout );
        buttons.add( Box.createGlue() );
        box.add( buttons );
        box.add( Box.createVerticalStrut( 10 ) );

        JPanel stdoutPanel = new JPanel();
        stdoutPanel.setLayout( new BorderLayout() );
        stdoutPanel.add( new JLabel( "Standard output:"),
                         BorderLayout.NORTH );

        stdoutPanel.add( new JScrollPane( stdout ),
                         BorderLayout.CENTER );

        box.add( stdoutPanel );
        box.add( Box.createVerticalStrut( 10 ) );
        stdout.setEditable( false );

        JPanel stderrPanel = new JPanel();
        stderrPanel.setLayout( new BorderLayout() );
        stderrPanel.add( new JLabel( "Error output:" ),
                         BorderLayout.NORTH );
        stderrPanel.add( new JScrollPane( stderr ),
                         BorderLayout.CENTER );
        box.add( stderrPanel );
        box.add( Box.createVerticalStrut( 10 ) );
        stderr.setEditable( false );

        outerPanel.add( box, BorderLayout.CENTER );
        this.getContentPane().add( outerPanel, BorderLayout.CENTER );

        // Install menus and tool bar.

        JMenuBar menuBar  = new JMenuBar();
        JMenu commandMenu = new JMenu( "Command" );
        JMenu helpMenu    = new JMenu( "Help" );

        JToolBar toolBar  = new JToolBar();

        // Create menu items and tool buttons for each shell command

```

```
113          ShellCommandTable table = sh.getSystem().getCommandTable();
114          String [] commandNames = table.getCommandNames();
115          for ( int i = 0; i < commandNames.length; i++ ) {
116
117              String commandName = commandNames[i];
118              ShellCommand command =
119                  table.lookup( commandName );
120
121              CommandMenuAction commandAction =
122                  new CommandMenuAction( commandName,
123                                         command.getArgString() );
124
125              HelpMenuAction helpAction =
126                  new HelpMenuAction( commandName,
127                                      command.getArgString(),
128                                      command.getHelpString() );
129
130              JMenuItem item1 = commandMenu.add( commandAction );
131              JMenuItem item2 = helpMenu.add( helpAction );
132              JButton button  = toolBar.add( commandAction );
133              button.setToolTipText( command.getHelpString() );
134          }
135
136          this.setJMenuBar( menuBar );
137          this.getContentPane().add( toolBar,
138                                     BorderLayout.NORTH );
139          menuBar.add( commandMenu );
140          menuBar.add( helpMenu );
141
142          pack();
143          show();
144
145          // add Listener to the Do It button
146
147          doIt.addActionListener( new Interpreter() );
148
149          // add listener to the Logout button and window closer
150
151          closeMe = new WindowCloser( this );
152          logout.addActionListener( closeMe );
153          this.addWindowListener( closeMe );
154      }
155
156      // Set the GUI prompt
157
158      private void setPrompt(String prompt)
159      {
160          this.promptLabel.setText(prompt);
161      }
162
163      // Implementing the OutputInterface.
164      // Everything goes to the single message area.
165
166      public void println( String str )
167      {
168          stdout.append(str + "\n");
```



```
169      }
170
171      public void errPrintln( String str )
172      {
173          stderr.append(str + "\n");
174      }
175
176      public boolean isGUI()
177      {
178          return true;
179      }
180
181      public boolean isRemote()
182      {
183          return false;
184      }
185
186      public boolean isEchoInput()
187      {
188          return echoInput;
189      }
190
191      // An inner class for the semantics when the user submits
192      // a ShellCommand for execution.
193
194      private class Interpreter
195          implements ActionListener
196      {
197          public void actionPerformed( ActionEvent e )
198          {
199              String str = commandLine.getText();
200              stdout.append( sh.getPrompt() + str + '\n');
201              if (sh.interpret( str )) {
202                  setPrompt( sh.getPrompt() );
203              }
204              else {
205                  closeMe.actionPerformed(null);
206              }
207          }
208      }
209
210      private class CommandMenuAction extends AbstractAction
211      {
212          private String argString;
213          private String helpString;
214
215          public CommandMenuAction( String text, String argString )
216          {
217              super( text );
218              this. argString = argString;
219          }
220
221          public void actionPerformed( ActionEvent e )
222          {
223              commandLine.setText( getValue( Action.NAME ) +
224                                   " " + argString );
```

```
225         }
226     }
227
228     private class HelpMenuAction extends AbstractAction
229     {
230         private String argString;
231         private String helpString;
232
233         public HelpMenuAction( String text, String argString,
234                                String helpString )
235         {
236             super( text );
237             this. argString = argString;
238             this.helpString = helpString;
239         }
240
241         public void actionPerformed( ActionEvent e )
242         {
243             stdout.append( getValue( Action.NAME ) + ": " +
244                            helpString );
245         }
246     }
247
248     //  A WindowCloser instance handles close events generated
249     //  by the underlying window system with its windowClosing
250     //  method, and close events from buttons or other user
251     //  components with its actionPerformed method.
252     //
253     //  The action is to logout and dispose of this window.
254
255     private static class WindowCloser extends WindowAdapter
256         implements ActionListener
257     {
258         Frame myFrame;
259
260         public WindowCloser( Frame frame ) {
261             myFrame = frame;
262         }
263
264         public void windowClosing (WindowEvent e)
265         {
266             this.actionPerformed( null );
267         }
268
269         public void actionPerformed(ActionEvent e)
270         {
271             myFrame.dispose();
272         }
273     }
274 }
```

```
 1  // joi/10/juno/InterpreterInterface.java
 2  //
 3  //
 4  // Copyright 2003 Bill Campbell and Ethan Bolker
 5
 6  /**
 7   * Juno needs an interpreter to process the user's response to
 8   * the login: prompt (or what she enters on a GUILoginConsole).
 9   *
10   * Each Shell needs an interpreter for shell command lines,
11   * whether entered with a GUI or a CLI.
12   *
13   * @version 10
14   */
15
16  public interface InterpreterInterface
17  {
18      /**
19       * Interpret a command line String.
20       *
21       * @param str the String to interpret
22       * @return true, unless str tells you there's nothing to follow
23       */
24
25      public boolean interpret( String str );
26  }
```

```
 1  // joi/10/juno/InputInterface.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   *  Juno consoles use the same abstract method
 8   *  for input, so it is specified here.
 9   */
10
11  public interface InputInterface
12  {
13     /**
14      * Read a line (terminated by a newline).
15      *
16      * @param promptString output string to prompt for input
17      * @return the string (without the newline character)
18      */
19
20     public String readLine( String promptString );
21  }
22
```

```
 1  // joi/10/juno/OutputInterface.java
 2  //
 3  //
 4  // Copyright 2003 Ethan Bolker and Bill Campbell
 5
 6  /**
 7   *  All Juno consoles use the same abstract methods
 8   *  for output, so they are specified here.
 9   */
10
11  public interface OutputInterface
12  {
13      /**
14       * Write a String followed by a newline
15       * to console output location.
16       *
17       * @param str - the string to write
18       */
19
20      public void println(String str );
21
22      /**
23       * Write a String followed by a newline
24       * to console error output location.
25       *
26       * @param str - the String to write
27       */
28
29      public void errPrintln( String str );
30
31      /**
32       * Query what kind of console this is.
33       *
34       * @return true if and only if echoing input.
35       */
36
37      public boolean isEchoInput();
38
39      /**
40       * Query what kind of console this is.
41       *
42       * @return true if and only if GUI
43       */
44
45      public boolean isGUI();
46
47      /**
48       * Query what kind of console this is.
49       *
50       * @return true if and only if remote
51       */
52
53      public boolean isRemote();
54  }
55
```

```
// joi/10/juno/JunoTerminal.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

/**
 * A Command line interface terminal for Juno.
 *
 * @version 10
 */

public class JunoTerminal
    implements InputInterface, OutputInterface
{
    private Terminal terminal; // the delegate terminal
    private boolean  echo;     // are we echoing input?

    /**
     * Construct a JunoTerminal
     *
     * Allows for input echo, when, for example, input is redirected
     * from a file.
     *
     * @param echo whether or not input should be echoed.
     */

    public JunoTerminal( boolean echo )
    {
        this.echo = echo;
        terminal = new Terminal( echo );
    }

    // Implement InputInterface

   /**
    * Read a line (terminated by a newline).
    *
    * @param promptString output string to prompt for input
    * @return the string (without the newline character)
    */

    public String readLine( String promptString )
    {
        return terminal.readLine( promptString );
    }

    // Implement OutputInterface

   /**
     * Write a String followed by a newline
     * to console output location.
     *
     * @param str - the string to write
     */

    public void println(String str )
```



```
    {
        terminal.println( str );
    }

    /**
     * Write a String followed by a newline
     * to console error output location.
     *
     * @param str - the String to write
     */

    public void errPrintln(String str )
    {
        terminal.errPrintln( str );
    }

    /**
     * Query what kind of console this is.
     *
     * @return true if and only if echoing input.
     */

    public boolean isEchoInput()
    {
        return echo;
    }

    /**
     * Query what kind of console this is.
     *
     * @return false, since it is not a GUI
     */

    public boolean isGUI()
    {
        return false;
    }

    /**
     * Query what kind of console this is.
     *
     * @return false, since it is not remote.
     */

    public boolean isRemote()
    {
        return false;
    }
}
```

```
// joi/10/juno/RemoteConsole.java
//
//
// Copyright 2003 Bill Campbell and Ethan Bolker

import java.io.*;
import java.net.*;
import java.util.*;
import java.text.*;

/**
 * A remote console listens on a port for a remote login to
 * a running Juno system server.
 *
 * @version 10
 */

public class RemoteConsole extends Thread
    implements OutputInterface, InputInterface
{
    // default just logs connection start and end
    // change to true to log all i/o
    private static boolean logall = false;

    private Juno system;
    private boolean echo;
    private InterpreterInterface interpreter;

    private Socket clientSocket;
    private BufferedReader in;
    private PrintWriter out;
    private int sessionCount = 0;

    private PrintWriter junoLog;

    /**
     * Construct a remote console to listen for users trying
     * to connect to Juno.
     *
     * Called from Juno main.
     *
     * @param system the Juno system setting up this console.
     * @param echo whether or not input should be echoed.
     * @param port the port on which to listen for requests.
     */

    public RemoteConsole( Juno system, boolean echo, int port )
    {
        this.echo = echo;
        Date now  = new Date();
        junoLog   = openlog(now);
        log("*** Juno server started " + now + "\n");
        try {
            ServerSocket ss = new ServerSocket(port);
            while (true) {
                clientSocket = ss.accept();
```



```
                new RemoteConsole( system, echo, clientSocket,
                                   junoLog, ++sessionCount).start();
            }
        }
        catch (IOException e) {
            System.out.println("Remote login not supported");
            System.exit(0);
        }
        finally {
            system.shutDown();
        }
    }

    /**
     * Construct a remote console for a single remote user.
     *
     * @param system the Juno system to which the user is connecting.
     * @param echo whether or not input should be echoed.
     * @param clientSocket the socket for the user's connection
     * @param junoLog track all user i/o
     * @param sessionCount this session's number
     */

    public RemoteConsole( Juno system, boolean echo, Socket clientSocket,
                          PrintWriter junoLog, int sessionCount )
    {
        this.system = system;
        this.echo = echo;
        this.clientSocket = clientSocket;
        this.junoLog = junoLog;
        this.sessionCount = sessionCount;
    }

    /**
     * Action when the thread for this session starts.
     */

    public void run()
    {
        log("*** " + sessionCount + ", " +
            clientSocket.getInetAddress()  + ", "  +
            new Date());
        try {
            setUpConnection();
            String s = this.readLine
                ("Please sign the guest book (name, email): ");
            this.println("Thanks, " + s);
            if (!logall) {
                log("guest book: " + s);
            }
            new LoginInterpreter( system, this ).CLILogin();
            clientSocket.close();
        }
        catch (IOException e) {
            log("*** Error " + e);
        }
```

```
113          log("*** end session " + sessionCount);
114      }
115
116      /**
117       * Create the readers and writers for the socket
118       * for this session.
119       */
120
121      private void setUpConnection()
122           throws IOException
123      {
124          in = new BufferedReader(
125                  new InputStreamReader(clientSocket.getInputStream()));
126          out = new PrintWriter(
127                  new OutputStreamWriter(clientSocket.getOutputStream()));
128      }
129
130      // implement the InputInterface
131
132     /**
133      * Read a line (terminated by a newline) from console socket.
134      *
135      * Log the input line before returning it if required.
136      *
137      * @param promptString output string to prompt for input
138      * @return the string (without the newline character)
139      */
140
141      public String readLine( String promptString )
142      {
143          String s = "";
144          this.print(promptString);
145          out.flush();
146          try {
147              s = in.readLine();
148              if (logall) {
149                  log("> " + s);
150              }
151              if (echo) {
152                  out.println(s);
153              }
154          }
155          catch (IOException e) {
156              String msg = "IO error reading from remote console";
157              System.out.println(msg);
158              out.println(msg);
159          }
160          return s;
161      }
162
163      /**
164       * Write a String to console socket.
165       *
166       * Log the output if required.
167       *
168       * @param str - the string to write
```



```
169       */
170
171      public void print( String str )
172      {
173          out.print( str );
174          out.flush();
175          if (logall) {
176              log("< " + str + "\\");
177          }
178      }
179
180      // implement the OutputInterface
181
182      /**
183       * Write a String followed by a newline
184       * to console socket.
185       *
186       * Log the output if required.
187       *
188       * @param str - the string to write
189       */
190
191      public void println( String str )
192      {
193          out.println( str + '\r' );
194          out.flush();
195          if (logall) {
196              log("< " + str);
197          }
198      }
199
200      /**
201       * Write a String followed by a newline
202       * to console error output location. That's
203       * just the socket.
204       *
205       * @param str - the String to write
206       */
207
208      public void errPrintln(String str )
209      {
210          println( str );
211      }
212
213      /**
214       * Query what kind of console this is.
215       *
216       * @return false since it's not a GUI.
217       */
218
219      public boolean isGUI()
220      {
221          return false;
222      }
223
224      /**
```

```
225       * Query what kind of console this is.
226       *
227       * @return true since it is remote.
228       */
229
230      public boolean isRemote()
231      {
232          return true;
233      }
234
235      /**
236       * Query what kind of console this is.
237       *
238       * @return true if and only if echoing input.
239       */
240
241      public boolean isEchoInput()
242      {
243          return echo;
244      }
245
246      /**
247       * Log a String.
248       *
249       * @param str the String to log.
250       */
251
252      private void log(String str)
253      {
254          junoLog.println(sessionCount + ": " + str);
255          junoLog.flush();
256      }
257
258      /**
259       * Open a log for this console.
260       *
261       * @param now the current Date.
262       */
263
264      private PrintWriter openlog(Date now)
265      {
266          PrintWriter out = null;
267          SimpleDateFormat formatter
268              = new SimpleDateFormat ("MMM.dd:hh:mm:ss");
269          String dateString = formatter.format(now);
270          String filename = "log-" + dateString;
271          try { out = new PrintWriter(
272                      new BufferedWriter(
273                      new FileWriter(filename)));
274          }
275          catch (Exception e) {
276              out = new PrintWriter(new FileWriter(FileDescriptor.out));
277          }
278          return out;
279      }
280  }
```