the final will focus on the new material - exceptions

Exceptions

Chapter 10

5TH EDITION

Lewis & Loftus

java

Software Solutions

Foundations of Program Design

Exceptions

- Exception handling is an important aspect of object-oriented design
- Chapter 10 focuses on:
  - the purpose of exceptions
  - exception messages
  - the try-catch statement
  - propagating exceptions
  - the exception class hierarchy
  - GUI mnemonics and tool tips
  - more GUI components and containers

Outline

Exceptions

- **An *exception* is an object that describes an unusual or erroneous situation**
- **Exceptions are *thrown* by a program, and may be *caught* and *handled* by another part of the program**
- **A program can be separated into a normal execution flow and an *exception execution flow***
- **An *error* is also represented as an object in Java, but usually represents a unrecoverable situation and should not be caught**

Exception Handling

- Java has a predefined set of exceptions and errors that can occur during execution
- A program can deal with an exception in one of three ways:
  - ignore it
  - handle it where it occurs
  - handle it an another place in the program
- The manner in which an exception is processed is an important design consideration

Exception Handling

- If an exception is ignored by the program, the program will terminate abnormally and produce an appropriate message
- The message includes a *call stack trace* that:
  - indicates the line on which the exception occurred
  - shows the method call trail that lead to the attempted execution of the offending line
- See `Zero.java` (page 535)

Outline

The try Statement

- **To handle an exception in a program, the line that throws the exception is executed within a *try block***
- **A try block is followed by one or more *catch* clauses**
- **Each catch clause has an associated exception type and is called an *exception handler***
- **When an exception occurs, processing continues at the first catch clause that matches the exception type**
- **See `ProductCodes.java` (page 538)**

The finally Clause

- A try statement can have an optional clause following the catch clauses, designated by the reserved word `finally`
- The statements in the finally clause always are executed
- If no exception is generated, the statements in the finally clause are executed after the statements in the try block complete
- If an exception is generated, the statements in the finally clause are executed after the statements in the appropriate catch clause complete

Exception Propagation

- An exception can be handled at a higher level if it is not appropriate to handle it where it occurs
- Exceptions *propagate* up through the method calling hierarchy until they are caught and handled or until they reach the level of the `main` method
- A try block that contains a call to a method in which an exception is thrown can be used to catch that exception
- See `Propagation.java` (page 541)
- See `ExceptionScope.java` (page 542)

Outline

The Exception Class Hierarchy

- **Classes that define exceptions are related by inheritance, forming an exception class hierarchy**
- **All error and exception classes are descendents of the `Throwable` class**
- **A programmer can define an exception by extending the `Exception` class or one of its descendants**
- **The parent class used depends on how the new exception will be used**

Checked Exceptions

- **An exception is either *checked* or *unchecked***
- **A *checked exception* either must be caught by a method, or must be listed in the *throws clause* of any method that may throw or propagate it**
- **A throws clause is appended to the method header**
- **The compiler will issue an error if a checked exception is not caught or asserted in a throws clause**

Unchecked Exceptions

- **An unchecked exception does not require explicit handling, though it could be processed that way**
- **The only unchecked exceptions in Java are objects of type `RuntimeException` or any of its descendants**
- **Errors are similar to `RuntimeException` and its descendants in that:**
  - **Errors should not be caught**
  - **Errors do not require a throws clause**

The throw Statement

- **Exceptions are thrown using the *throw* statement**
- **Usually a throw statement is executed inside an if statement that evaluates a condition to see if the exception should be thrown**
- **See `CreatingExceptions.java` (page 545)**
- **See `OutOfRangeException.java` (page 546)**

Outline

Exception Handling

The try-catch Statement

Exception Classes

➡ I/O Exceptions

Tool Tips and Mnemonics

Combo Boxes

Scroll Panes and Split Panes

I/O Exceptions

- **Let's examine issues related to exceptions and I/O**
- **A *stream* is a sequence of bytes that flow from a source to a destination**
- **In a program, we read information from an input stream and write information to an output stream**
- **A program can manage multiple streams simultaneously**

Standard I/O

- **There are three standard I/O streams:**
  - ***standard output* – defined by `System.out`**
  - ***standard input* – defined by `System.in`**
  - ***standard error* – defined by `System.err`**
- **We use `System.out` when we execute `println` statements**
- **`System.out` and `System.err` typically represent a particular window on the monitor screen**
- **`System.in` typically represents keyboard input, which we've used many times with `Scanner` objects**

The IOException Class

- **Operations performed by some I/O classes may throw an `IOException`**
  - **A file might not exist**
  - **Even if the file exists, a program may not be able to find it**
  - **The file might not contain the kind of data we expect**
- **An `IOException` is a checked exception**

Writing Text Files

- In Chapter 5 we explored the use of the `Scanner` class to read input from a text file
- Let's now examine other classes that let us write data to a text file
- The `FileWriter` class represents a text output file, but with minimal support for manipulating data
- Therefore, we also rely on `PrintStream` objects, which have `print` and `println` methods defined for them

Writing Text Files

- Finally, we'll also use the `PrintWriter` class for advanced internationalization and error checking
- We build the class that represents the output file by combining these classes appropriately
- See `TestData.java` (page 549)
- Output streams should be closed explicitly

Outline

Tool Tips

- A *tool tip* provides a short pop-up description when the mouse cursor rests momentarily on a component
- A tool tip is assigned using the `setToolTipText` method of a Swing component

```
JButton button = new JButton ("Compute");
button.setToolTipText ("Calculate size");
```

Mnemonics

- A *mnemonic* is a keyboard alternative for pushing a button or selecting a menu option
- The mnemonic character should be chosen from the component's label, and is underlined
- The user activates the component by holding down the ALT key and pressing the mnemonic character
- A mnemonic is established using the `setMnemonic` method:

```
JButton button = new JButton ("Calculate");
button.setMnemonic ("C");
```

Disabled Components

- **Components can be *disabled* if they should not be used**
- **A disabled component is "grayed out" and will not respond to user interaction**
- **The status is set using the `setEnabled` method:**

```
JButton button = new JButton (“Do It”);
button.setEnabled (false);
```

GUI Design

- **The right combination of special features such as tool tips and mnemonics can enhance the usefulness of a GUI**

- **See `LightBulb.java` (page 553)**
- **See `LightBulbPanel.java` (page 554)**
- **See `LightBulbControls.java` (page 556)**

Outline

Exception Handling

The try-catch Statement

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I/O Exceptions

Tool Tips and Mnemonics

Combo Boxes

Scroll Panes and Split Panes

Combo Boxes

- A *combo box* provides a menu from which the user can choose one of several options
- The currently selected option is shown in the combo box
- A combo box shows its options only when the user presses it using the mouse
- Options can be established using an array of strings or using the `addItem` method

The JukeBox Program

- **A combo box generates an action event when the user makes a selection from it**
- **See JukeBox.java (page 559)**
- **See JukeBoxControls.java (page 560)**

Outline

Exception Handling

The try-catch Statement

Exception Classes

I/O Exceptions

Tool Tips and Mnemonics

Combo Boxes

➡ Scroll Panes and Split Panes

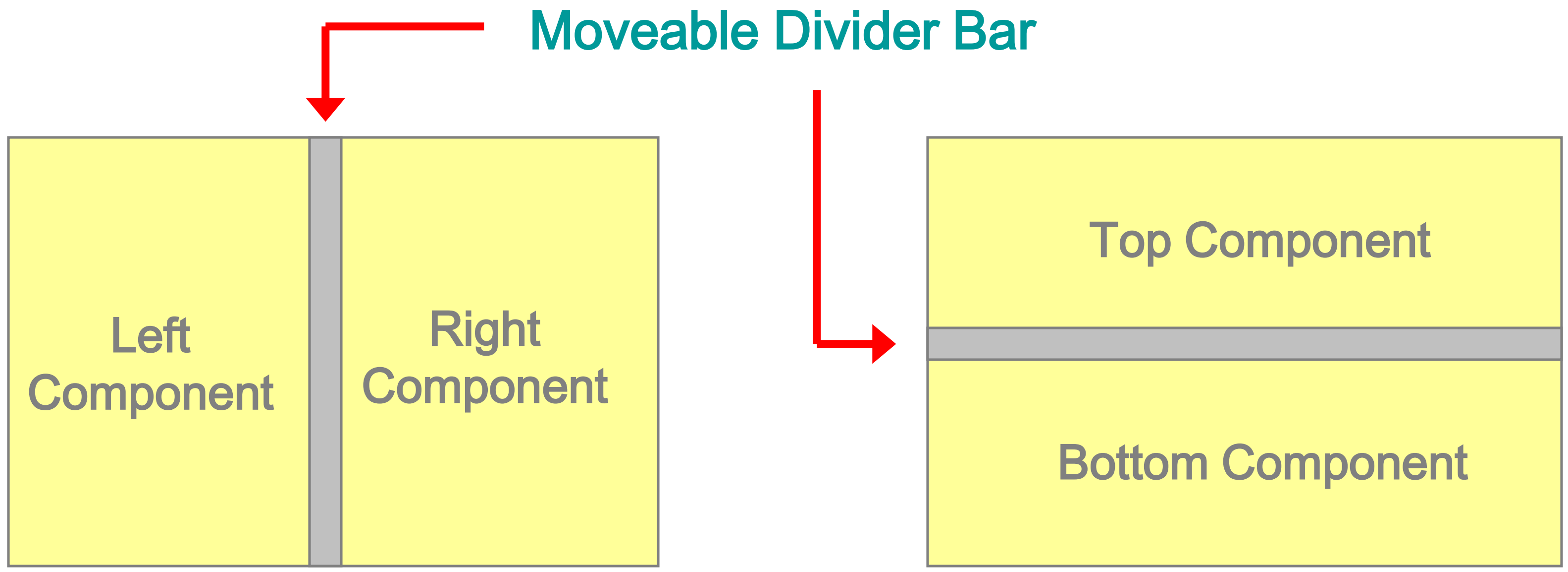
Scroll Panes

- A *scroll pane* is useful for images or information too large to fit in a reasonably-sized area
- A scroll pane offers a limited view of the component it contains
- It provides vertical and/or horizontal scroll bars that allow the user to scroll to other areas of the component
- No event listener is needed for a scroll pane
- See `TransitMap.java` (page 564)

Split Panes

- **A split pane (`JSplitPane`) is a container that displays two components separated by a moveable divider bar**

- **The two components can be displayed side by side, or one on top of the other**



Split Panes

- The orientation of the split pane is set using the `HORIZONTAL_SPLIT` or `VERTICAL_SPLIT` constants
- The divider bar can be set so that it can be fully expanded with one click of the mouse
- The components can be continuously adjusted as the divider bar is moved, or wait until it stops moving
- Split panes can be nested

Lists

- The Swing `Jlist` class represents a list of items from which the user can choose
- The contents of a `JList` object can be specified using an array of objects
- A `JList` object generates a *list selection event* when the current selection changes
- See `PickImage.java` (page 568)
- See `ListPanel.java` (page 570)

Lists

- A `JList` object can be set so that multiple items can be selected at the same time

- The *list selection mode* can be one of three options:
  - single selection – only one item can be selected at a time
  - single interval selection – multiple, contiguous items can be selected at a time
  - multiple interval selection – any combination of items can be selected

- The list selection mode is defined by a `ListSelectionModel` object

Summary

- **Chapter 10 has focused on:**
  - **the purpose of exceptions**
  - **exception messages**
  - **the try-catch statement**
  - **propagating exceptions**
  - **the exception class hierarchy**
  - **GUI mnemonics and tool tips**
  - **more GUI components and containers**