Graphical User Interfaces in Java

Slide credits: Java Software Solutions, 8th Edition, Lewis and Loftus, 2014

Graphical Applications

- The example programs we've explored thus far have been text-based
- They are called *command-line applications*, which interact with the user using simple text prompts
- Let's examine some Java applications that have graphical components
- These components will serve as a foundation to programs that have true graphical user interfaces **(GUIs)**

GUI Components

- A *GUI component* is an object that represents a screen element such as a button or a text field
- GUI-related classes are defined primarily in the `java.awt` and the `javax.swing` packages

GUI Components

- The *Abstract Windowing Toolkit* (AWT) was the original Java GUI package
- The *Swing* package provides additional and more versatile components
- Both packages are needed to create a Java GUI-based program

GUI Containers

- A *GUI container* is a component that is used to hold and organize other components
- A *frame* is a container displayed as a separate window with a title bar
- It can be repositioned and resized on the screen as needed
- A *panel* is a container that cannot be displayed on its own but is used to organize other components
- A panel must be added to another container (like a frame or another panel) to be displayed

GUI Containers

- A GUI container can be classified as either heavyweight or lightweight
- A *heavyweight container* is one that is managed by the underlying operating system
- A *lightweight container* is managed by the Java program itself
- A frame is a heavyweight container and a panel is a lightweight container

Labels

- A *label* is a GUI component that displays a line of text and/or an image
- Labels are usually used to display information or identify other components in the interface
- Let's look at a program that organizes two labels in a panel and displays that panel in a frame
- This program is not interactive, but the frame can be repositioned and resized
- See `Authority.java`

```
//********************************************************************
//  Authority.java       Author: Lewis/Loftus
//
//  Demonstrates the use of frames, panels, and labels.
//********************************************************************

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

public class Authority
{
   //-----------------------------------------------------------------
   //  Displays some words of wisdom.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Authority");

      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      JPanel primary = new JPanel();
      primary.setBackground(Color.yellow);
      primary.setPreferredSize(new Dimension(250, 75));
```

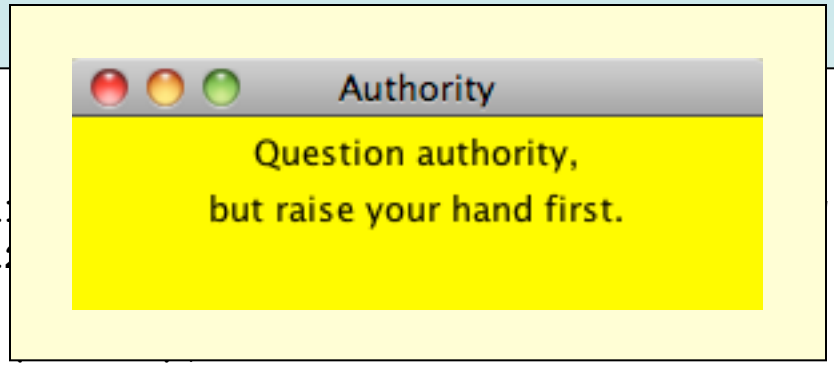
continued

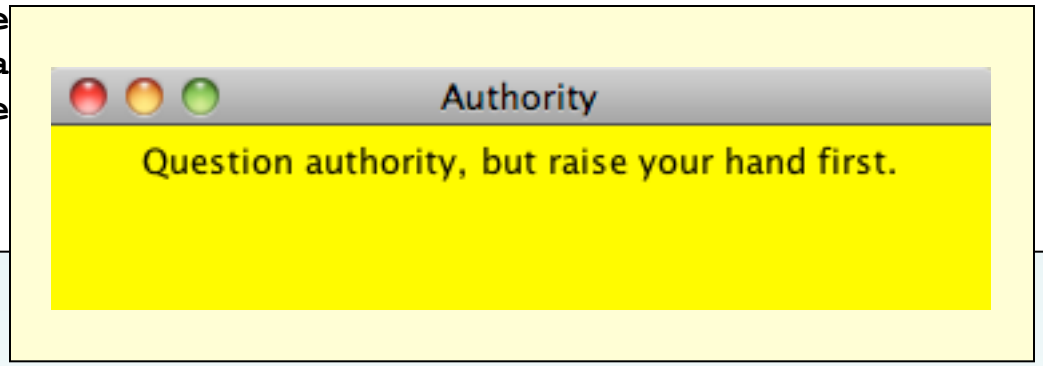
continued

```
        JLabel label1 = new JLabel("Question authority,");
        JLabel label2 = new JLabel("but raise your hand first.");

        primary.add(label1);
        primary.add(label2);

        frame.getContentPane().add(primary);
        frame.pack();
        frame.setVisible(true);
    }
}
```

continued

```
        JLabel label1
        JLabel label2
                                                    );
                                                    first.");

        primary.add
        primary.add(label2);

        frame.ge
        frame.pa
        frame.se
    }
}
```





Nested Panels

- Containers that contain other components make up the *containment hierarchy* of an interface
- This hierarchy can be as intricate as needed to create the visual effect desired
- The following example nests two panels inside a third panel – note the effect this has as the frame is resized
- See `NestedPanels.java`

```
//********************************************************************
//  NestedPanels.java       Author: Lewis/Loftus
//
//  Demonstrates a basic component hierarchy.
//********************************************************************

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

public class NestedPanels
{
   //-----------------------------------------------------------------
   //  Presents two colored panels nested within a third.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Nested Panels");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      // Set up first subpanel
      JPanel subPanel1 = new JPanel();
      subPanel1.setPreferredSize(new Dimension(150, 100));
      subPanel1.setBackground(Color.green);
      JLabel label1 = new JLabel("One");
      subPanel1.add(label1);
```

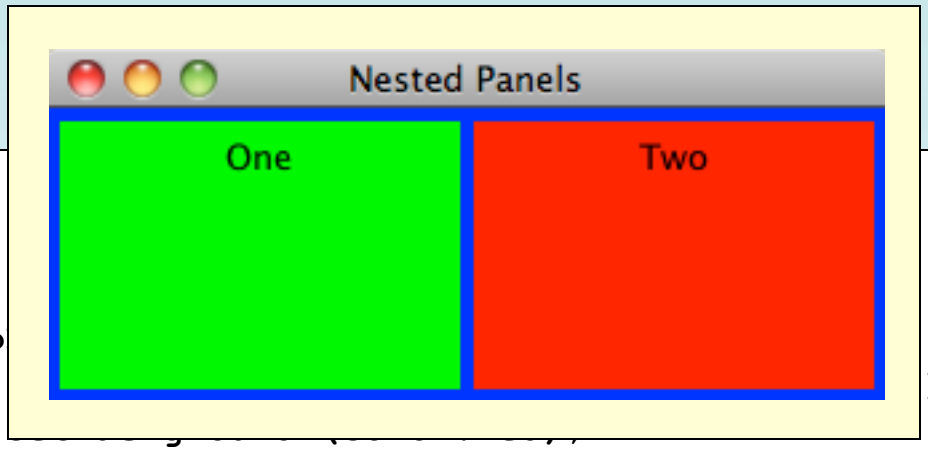
continued

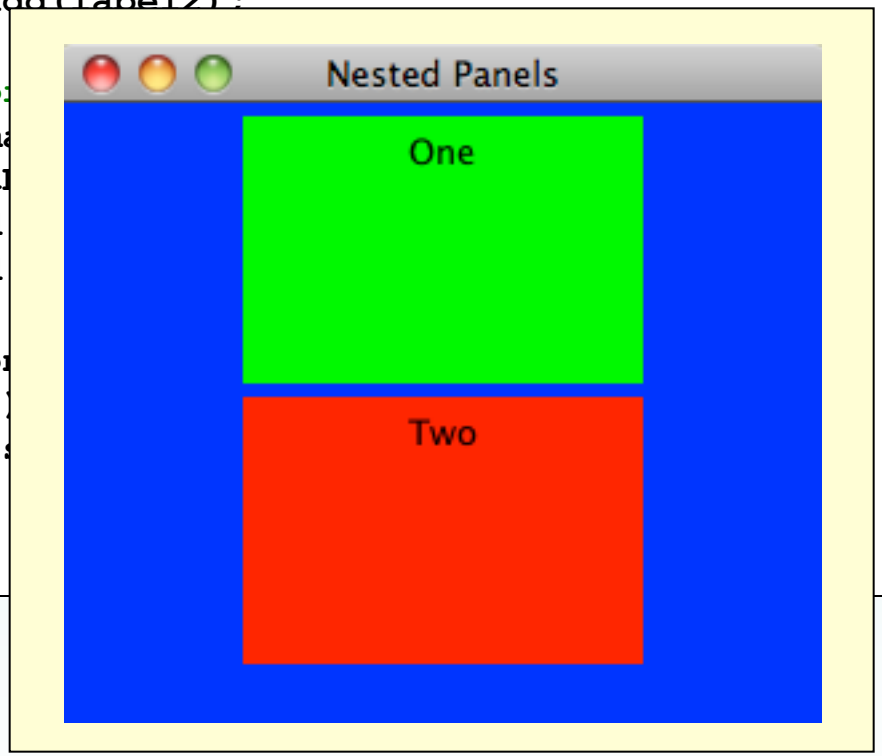
continued

```
        // Set up second subpanel
        JPanel subPanel2 = new JPanel();
        subPanel2.setPreferredSize(new Dimension(150, 100));
        subPanel2.setBackground(Color.red);
        JLabel label2 = new JLabel("Two");
        subPanel2.add(label2);

        // Set up primary panel
        JPanel primary = new JPanel();
        primary.setBackground(Color.blue);
        primary.add(subPanel1);
        primary.add(subPanel2);

        frame.getContentPane().add(primary);
        frame.pack();
        frame.setVisible(true);
    }
}
```

continued

```
        // Set up
        JPanel sub
        subPanel2.                                          );
        subPanel2.
        JLabel label2 = new JLabel("Two");
        subPanel2.add(label2);

        // Set up pr
        JPanel prima
        primary.setL
        primary.add
        primary.add

        frame.getCon
        frame.pack()
        frame.setVis
    }
}
```





Images

- Images can be displayed in a Java program in various ways
- As we've seen, a `JLabel` object can be used to display a line of text
- It can also be used to display an image
- That is, a label can be composed of text, an image, or both at the same time

Images

- The `ImageIcon` class is used to represent the image that is stored in a label
- If text is also included, the position of the text relative to the image can be set explicitly
- The alignment of the text and image within the label can be set as well
- See `LabelDemo.java`

```
//********************************************************************
//  LabelDemo.java       Author: Lewis/Loftus
//
//  Demonstrates the use of image icons in labels.
//********************************************************************

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

public class LabelDemo
{
   //-----------------------------------------------------------------
   //  Creates and displays the primary application frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Label Demo");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      ImageIcon icon = new ImageIcon("devil.gif");

      JLabel label1, label2, label3;

      label1 = new JLabel("Devil Left", icon, SwingConstants.CENTER);
```

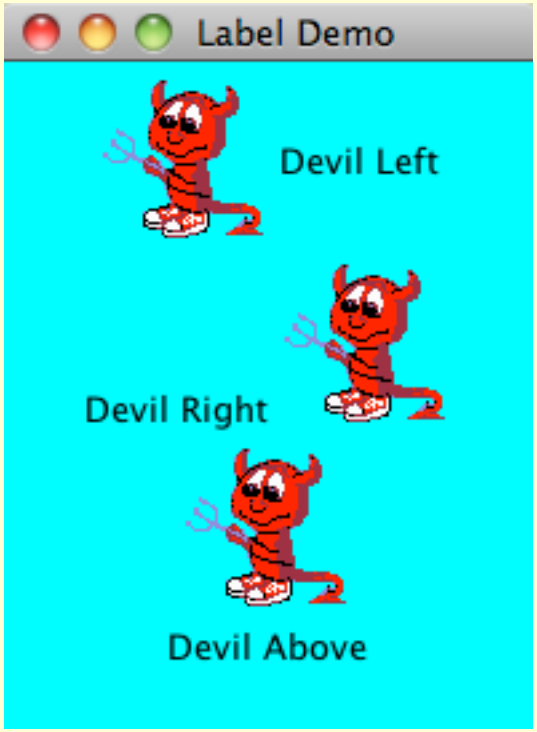
continued

continued

```
        label2 = new JLabel("Devil Right", icon, SwingConstants.CENTER);
        label2.setHorizontalTextPosition(SwingConstants.LEFT);
        label2.setVerticalTextPosition(SwingConstants.BOTTOM);

        label3 = new JLabel("Devil Above", icon, SwingConstants.CENTER);
        label3.setHorizontalTextPosition(SwingConstants.CENTER);
        label3.setVerticalTextPosition(SwingConstants.BOTTOM);

        JPanel panel = new JPanel();
        panel.setBackground(Color.cyan);
        panel.setPreferredSize(new Dimension(200, 250));
        panel.add(label1);
        panel.add(label2);
        panel.add(label3);

        frame.getContentPane().add(panel);
        frame.pack();
        frame.setVisible(true);
    }
}
```

continued

```
        label2 = new JL                                    ingConstants.CENTER);
        label2.setHori                                     ants.LEFT);
        label2.setVert                                     ts.BOTTOM);

        label3 = new JL                                    ingConstants.CENTER);
        label3.setHori                                     ants.CENTER);
        label3.setVert                                     ts.BOTTOM);

        JPanel panel =
        panel.setBackg
        panel.setPrefe                                     250));
        panel.add(label
        panel.add(label
        panel.add(label

        frame.getContentPane().add(panel);
        frame.pack();
        frame.setVisible(true);
    }
}
```



Graphical User Interfaces

- A Graphical User Interface (GUI) in Java is created with at least three kinds of objects:
  - components, events, and listeners
- *Components* are objects that represent screen elements:
  - labels, buttons, text fields, menus, etc.

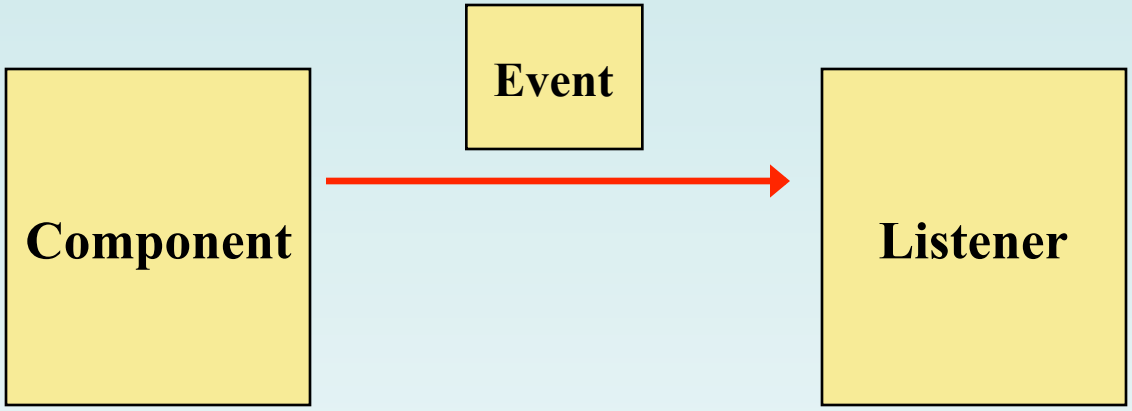
Events

- An *event* is an object that represents some activity to which we may want to respond
- For example, we may want our program to perform some action when the following occurs:
  - the mouse is moved
  - the mouse is dragged
  - a mouse button is clicked
  - a graphical button is pressed
  - a keyboard key is pressed
  - a timer expires

Events and Listeners

- The Java API contains several classes that represent typical events
- Components, such as a graphical button, generate (or fire) an event when it occurs
- We set up a *listener* object to respond to an event when it occurs
- We can design listener objects to take whatever actions are appropriate when an event occurs

Events and Listeners



A component object generates an event

A corresponding listener object is designed to respond to the event

When the event occurs, the component calls the appropriate method of the listener, passing an object that describes the event

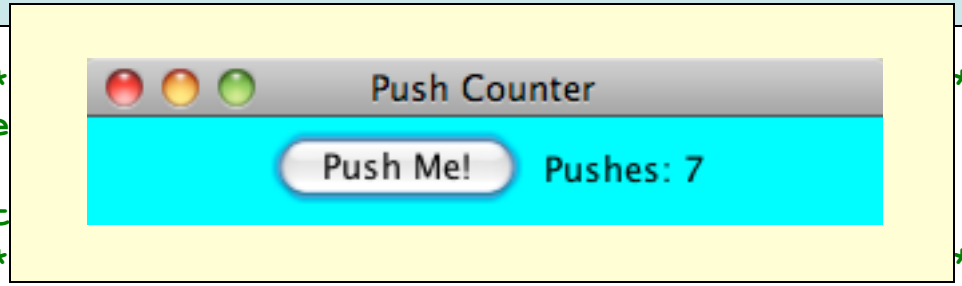
GUI Development

- To create a Java program that uses a GUI we must:
  - instantiate and set up the necessary components
  - implement listener classes for any events we care about
  - establish the relationship between listeners and the components that generate the corresponding events
- Let's now explore some new components and see how this all comes together

Buttons

- A *push button* is defined by the `JButton` class
- It generates an *action event*
- The `PushCounter` example displays a push button that increments a counter each time it is pushed
- See `PushCounter.java`
- See `PushCounterPanel.java`

```
//********************************************************************
//  PushCounter.java       Authors: Lewis/Loftus
//
//  Demonstrates a graphical user interface and an event listener.
//********************************************************************

import javax.swing.JFrame;

public class PushCounter
{
   //-----------------------------------------------------------------
   //  Creates the main program frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Push Counter");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      frame.getContentPane().add(new PushCounterPanel());

      frame.pack();
      frame.setVisible(true);
   }
}
```




```
//************
//  PushCounte                                          **************
//
//  Demonstrat                                           listener.
//************                                          **************

import javax.swing.JFrame;

public class PushCounter
{
   //-----------------------------------------------------------------
   //  Creates the main program frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Push Counter");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      frame.getContentPane().add(new PushCounterPanel());

      frame.pack();
      frame.setVisible(true);
   }
}
```

```
//********************************************************************
//  PushCounterPanel.java       Authors: Lewis/Loftus
//
//  Demonstrates a graphical user interface and an event listener.
//********************************************************************

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

public class PushCounterPanel extends JPanel
{
   private int count;
   private JButton push;
   private JLabel label;

   //-----------------------------------------------------------------
   //  Constructor: Sets up the GUI.
   //-----------------------------------------------------------------
   public PushCounterPanel()
   {
      count = 0;

      push = new JButton("Push Me!");
      push.addActionListener(new ButtonListener());
```

continue

continue

```
        label = new JLabel("Pushes: " + count);

        add(push);
        add(label);

        setPreferredSize(new Dimension(300, 40));
        setBackground(Color.cyan);
    }

    //*****************************************************************
    //  Represents a listener for button push (action) events.
    //*****************************************************************
    private class ButtonListener implements ActionListener
    {
        //--------------------------------------------------------------
        //  Updates the counter and label when the button is pushed.
        //--------------------------------------------------------------
        public void actionPerformed(ActionEvent event)
        {
            count++;
            label.setText("Pushes: " + count);
        }
    }
}
```

Push Counter Example

- The components of the GUI are the button, a label to display the counter, a panel to organize the components, and the main frame
- The `PushCounterPanel` class represents the panel used to display the button and label
- The `PushCounterPanel` class is derived from `JPanel` using inheritance
- The constructor of `PushCounterPanel` sets up the elements of the GUI and initializes the counter to zero

Push Counter Example

- The `ButtonListener` class is the listener for the action event generated by the button
- It is implemented as an *inner class*, which means it is defined within the body of another class
- That facilitates the communication between the listener and the GUI components
- Inner classes should only be used in situations where there is an intimate relationship between the two classes and the inner class is not needed in any other context

Push Counter Example

- Listener classes are written by implementing a *listener interface*
- The `ButtonListener` class implements the `ActionListener` interface
- An interface is a list of methods that the implementing class must define
- The only method in the `ActionListener` interface is the `actionPerformed` method
- The Java API contains interfaces for many types of events
- We discuss interfaces in more detail in Chapter 6

Push Counter Example

- The `PushCounterPanel` constructor:
  - instantiates the `ButtonListener` object
  - establishes the relationship between the button and the listener by the call to `addActionListener`
- When the user presses the button, the button component creates an `ActionEvent` object and calls the `actionPerformed` method of the listener
- The `actionPerformed` method increments the counter and resets the text of the label

Quick Check

Which object in the Push Counter example generated the event?

What did it do then?

Quick Check

Which object in the Push Counter example generated the event?

The button component generated the event.

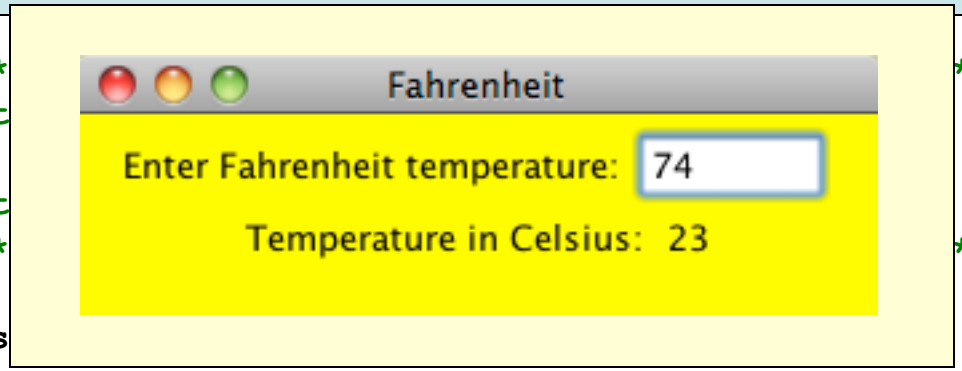
What did it do then?

It called the `actionPerformed` method of the listener object that had been registered with it.

Text Fields

- Let's look at another GUI example that uses another type of component
- A *text field* allows the user to enter one line of input
- If the cursor is in the text field, the text field object generates an action event when the enter key is pressed
- See `Fahrenheit.java`
- See `FahrenheitPanel.java`

```
//********************************************************************
//  Fahrenheit.java       Author: Lewis/Loftus
//
//  Demonstrates the use of text fields.
//********************************************************************

import javax.swing.JFrame;

public class Fahrenheit
{
   //-----------------------------------------------------------------
   //  Creates and displays the temperature converter GUI.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Fahrenheit");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      FahrenheitPanel panel = new FahrenheitPanel();

      frame.getContentPane().add(panel);
      frame.pack();
      frame.setVisible(true);
   }
}
```




```
//************
//  Fahrenheit
//
//  Demonstrat
//************                                    **************

import javax.s

public class Fahrenheit
{
   //-----------------------------------------------------------------
   //  Creates and displays the temperature converter GUI.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Fahrenheit");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      FahrenheitPanel panel = new FahrenheitPanel();

      frame.getContentPane().add(panel);
      frame.pack();
      frame.setVisible(true);
   }
}
```

```
//********************************************************************
//  FahrenheitPanel.java       Author: Lewis/Loftus
//
//  Demonstrates the use of text fields.
//********************************************************************

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

public class FahrenheitPanel extends JPanel
{
   private JLabel inputLabel, outputLabel, resultLabel;
   private JTextField fahrenheit;

   //-----------------------------------------------------------------
   //  Constructor: Sets up the main GUI components.
   //-----------------------------------------------------------------
   public FahrenheitPanel()
   {
      inputLabel = new JLabel("Enter Fahrenheit temperature:");
      outputLabel = new JLabel("Temperature in Celsius: ");
      resultLabel = new JLabel("---");

      fahrenheit = new JTextField(5);
      fahrenheit.addActionListener(new TempListener());
```

continue

continue

```
        add(inputLabel);
        add(fahrenheit);
        add(outputLabel);
        add(resultLabel);

        setPreferredSize(new Dimension(300, 75));
        setBackground(Color.yellow);
    }

    //*****************************************************************
    //  Represents an action listener for the temperature input field.
    //*****************************************************************
    private class TempListener implements ActionListener
    {
        //--------------------------------------------------------------
        //  Performs the conversion when the enter key is pressed in
        //  the text field.
        //--------------------------------------------------------------
        public void actionPerformed(ActionEvent event)
        {
            int fahrenheitTemp, celsiusTemp;

            String text = fahrenheit.getText();
```

continue

continue

```
            fahrenheitTemp = Integer.parseInt(text);
            celsiusTemp = (fahrenheitTemp-32) * 5/9;

            resultLabel.setText(Integer.toString(celsiusTemp));
        }
    }
}
```

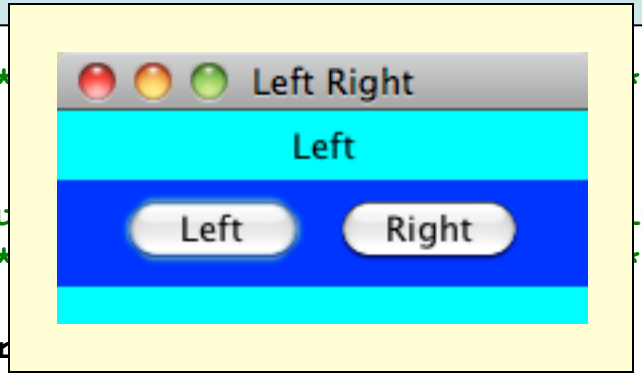
Fahrenheit Example

- Like the `PushCounter` example, the GUI is set up in a separate panel class
- The `TempListener` inner class defines the listener for the action event generated by the text field
- The `FahrenheitPanel` constructor instantiates the listener and adds it to the text field
- When the user types a temperature and presses enter, the text field generates the action event and calls the `actionPerformed` method of the listener

Determining Event Sources

- Recall that interactive GUIs require establishing a relationship between components and the listeners that respond to component events
- One listener object can be used to listen to two different components
- The source of the event can be determined by using the `getSource` method of the event passed to the listener
- See `LeftRight.java`
- See `LeftRightPanel.java`

```
//********************************************************************
//  LeftRight.java       Authors: Lewis/Loftus
//
//  Demonstrates the use of one listener for multiple buttons.
//********************************************************************

import javax.swing.JFrame;

public class LeftRight
{
   //-----------------------------------------------------------------
   //  Creates the main program frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Left Right");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      frame.getContentPane().add(new LeftRightPanel());

      frame.pack();
      frame.setVisible(true);
   }
}
```




```
//********************                                    ********************
//  LeftRight.java
//
//  Demonstrates the u                                  ple buttons.
//********************                                    ********************

import javax.swing.JFr

public class LeftRight
{
   //-----------------------------------------------------------------
   //  Creates the main program frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Left Right");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      frame.getContentPane().add(new LeftRightPanel());

      frame.pack();
      frame.setVisible(true);
   }
}
```

```
//********************************************************************
//  LeftRightPanel.java       Authors: Lewis/Loftus
//
//  Demonstrates the use of one listener for multiple buttons.
//********************************************************************

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

public class LeftRightPanel extends JPanel
{
   private JButton left, right;
   private JLabel label;
   private JPanel buttonPanel;
```

continue

continue

```
//-----------------------------------------------------------------
//  Constructor: Sets up the GUI.
//-----------------------------------------------------------------
public LeftRightPanel()
{
   left = new JButton("Left");
   right = new JButton("Right");

   ButtonListener listener = new ButtonListener();
   left.addActionListener(listener);
   right.addActionListener(listener);

   label = new JLabel("Push a button");

   buttonPanel = new JPanel();
   buttonPanel.setPreferredSize(new Dimension(200, 40));
   buttonPanel.setBackground(Color.blue);
   buttonPanel.add(left);
   buttonPanel.add(right);

   setPreferredSize(new Dimension(200, 80));
   setBackground(Color.cyan);
   add(label);
   add(buttonPanel);
}
```

continue

continue

```
   //*****************************************************************
   //  Represents a listener for both buttons.
   //*****************************************************************
   private class ButtonListener implements ActionListener
   {
      //--------------------------------------------------------------
      //  Determines which button was pressed and sets the label
      //  text accordingly.
      //--------------------------------------------------------------
      public void actionPerformed(ActionEvent event)
      {
         if (event.getSource() == left)
            label.setText("Left");
         else
            label.setText("Right");
      }
   }
}
```

Dialog Boxes

- A *dialog box* is a window that appears on top of any currently active window
- It may be used to:
  - convey information
  - confirm an action
  - allow the user to enter data
  - pick a color
  - choose a file
- A dialog box usually has a specific, solitary purpose, and the user interaction with it is brief

Dialog Boxes

- The `JOptionPane` class provides methods that simplify the creation of some types of dialog boxes
- See `EvenOdd.java`
- Specialized dialog boxes for choosing colors and files are covered in Chapter 9

```
//********************************************************************
//  EvenOdd.java       Author: Lewis/Loftus
//
//  Demonstrates the use of the JOptionPane class.
//********************************************************************

import javax.swing.JOptionPane;

public class EvenOdd
{
   //-----------------------------------------------------------------
   //  Determines if the value input by the user is even or odd.
   //  Uses multiple dialog boxes for user interaction.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      String numStr, result;
      int num, again;
```

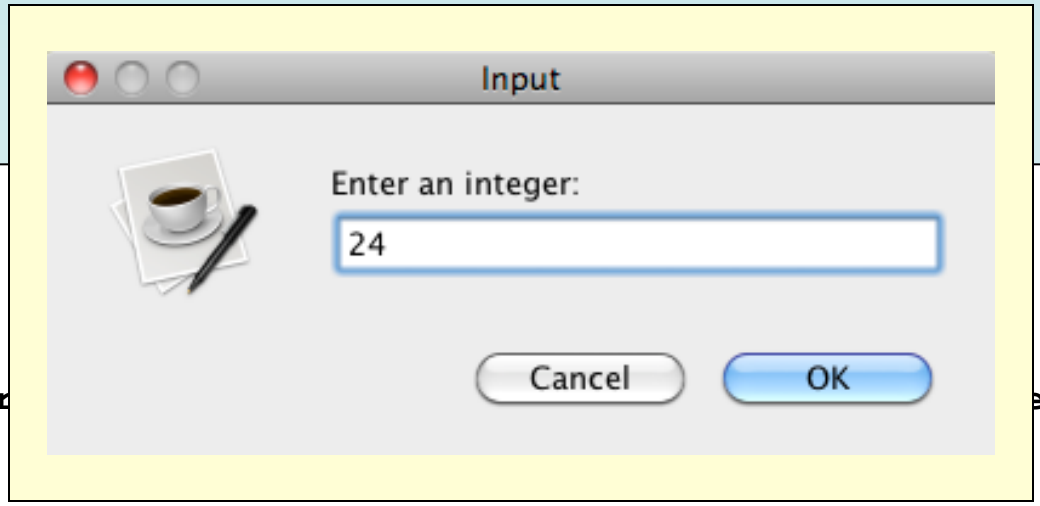
continue

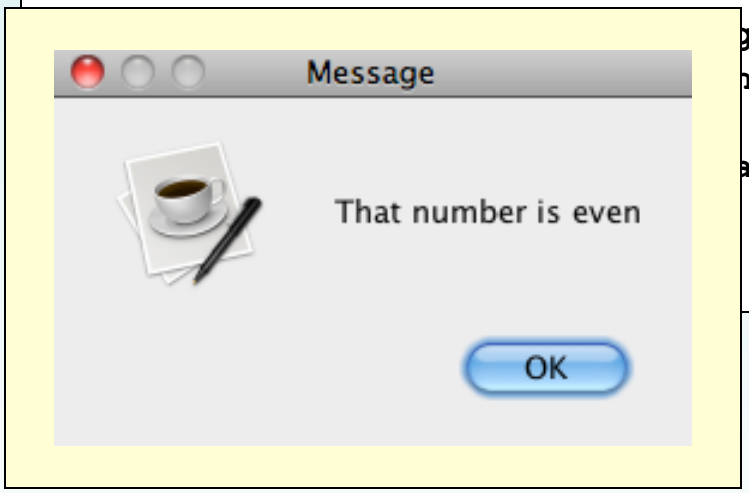
continue

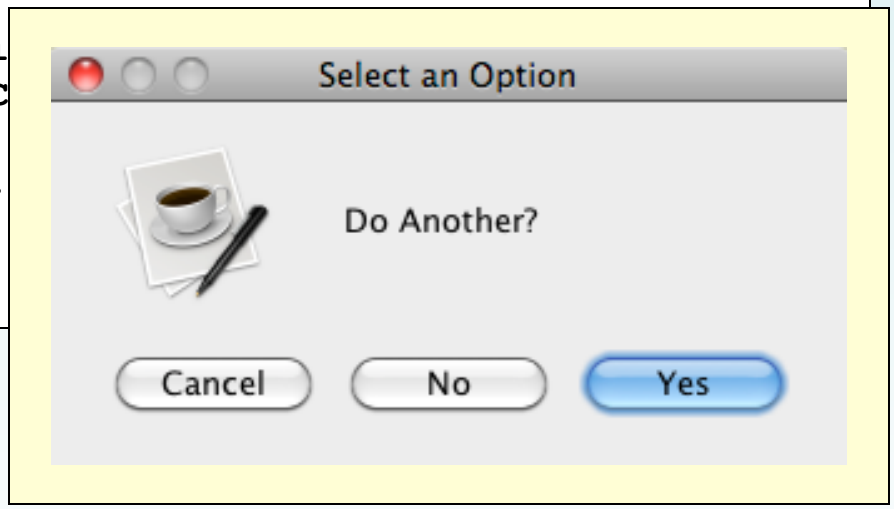
```
        do
        {
            numStr = JOptionPane.showInputDialog("Enter an integer: ");
            num = Integer.parseInt(numStr);

            result = "That number is " + ((num%2 == 0) ? "even" : "odd");

            JOptionPane.showMessageDialog(null, result);
            again = JOptionPane.showConfirmDialog(null, "Do Another?");
        }
        while (again == JOptionPane.YES_OPTION);
    }
}
```

continue

```
do
{
    numStr                                              eger: ");
    num =

    result = "That number is " + ((num%2 == 0) ? "even" : "odd");
```







Check Boxes

- A *check box* is a button that can be toggled on or off
- It is represented by the `JCheckBox` class
- Unlike a push button, which generates an action event, a check box generates an *item event* whenever it changes state
- The `ItemListener` interface is used to define item event listeners
- A check box calls the `itemStateChanged` method of the listener when it is toggled

Check Boxes

- Let's examine a program that uses check boxes to determine the style of a label's text string
- It uses the `Font` class, which embodies a character font's:
  - family name (such as Times or Courier)
  - style (bold, italic, or both)
  - font size
- See `StyleOptions.java`
- See `StyleOptionsPanel.java`

```
//********************************************************************
//  StyleOptions.java       Author: Lewis/Loftus
//
//  Demonstrates the use of check boxes.
//********************************************************************

import javax.swing.JFrame;

public class StyleOptions
{
   //-----------------------------------------------------------------
   //  Creates and presents the program frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Style Options");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      StyleOptionsPanel panel = new StyleOptionsPanel();
      frame.getContentPane().add(panel);

      frame.pack();
      frame.setVisible(true);
   }
}
```

```
//*****************                                    **************
//  StyleOptions.
//
//  Demonstrates
//*****************                                    **************

import javax.swin

public class StyleOptions
{
   //-------------                                     --------------
   //  Creates an
   //-------------                                     --------------
   public static
   {
      JFrame fram
      frame.setDe                                          SE);

      StyleOption
      frame.getContentPane().add(panel);

      frame.pack();
      frame.setVisible(true);
   }
}
```

```
//********************************************************************
//  StyleOptionsPanel.java       Author: Lewis/Loftus
//
//  Demonstrates the use of check boxes.
//********************************************************************

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

public class StyleOptionsPanel extends JPanel
{
   private JLabel saying;
   private JCheckBox bold, italic;
```

continue

continue

```
//-----------------------------------------------------------------
//  Sets up a panel with a label and some check boxes that
//  control the style of the label's font.
//-----------------------------------------------------------------
public StyleOptionsPanel()
{
   saying = new JLabel("Say it with style!");
   saying.setFont(new Font("Helvetica", Font.PLAIN, 36));

   bold = new JCheckBox("Bold");
   bold.setBackground(Color.cyan);
   italic = new JCheckBox("Italic");
   italic.setBackground(Color.cyan);

   StyleListener listener = new StyleListener();
   bold.addItemListener(listener);
   italic.addItemListener(listener);

   add(saying);
   add(bold);
   add(italic);

   setBackground(Color.cyan);
   setPreferredSize(new Dimension(300, 100));
}
```

continue

continue

```
   //*****************************************************************
   //  Represents the listener for both check boxes.
   //*****************************************************************
   private class StyleListener implements ItemListener
   {
      //--------------------------------------------------------------
      //  Updates the style of the label font style.
      //--------------------------------------------------------------
      public void itemStateChanged(ItemEvent event)
      {
         int style = Font.PLAIN;

         if (bold.isSelected())
            style = Font.BOLD;

         if (italic.isSelected())
            style += Font.ITALIC;

         saying.setFont(new Font("Helvetica", style, 36));
      }
   }
}
```

Radio Buttons

- A group of *radio buttons* represents a set of mutually exclusive options – only one can be selected at any given time
- When a radio button from a group is selected, the button that is currently "on" in the group is automatically toggled off
- To define the group of radio buttons that will work together, each radio button is added to a `ButtonGroup` object
- A radio button generates an action event

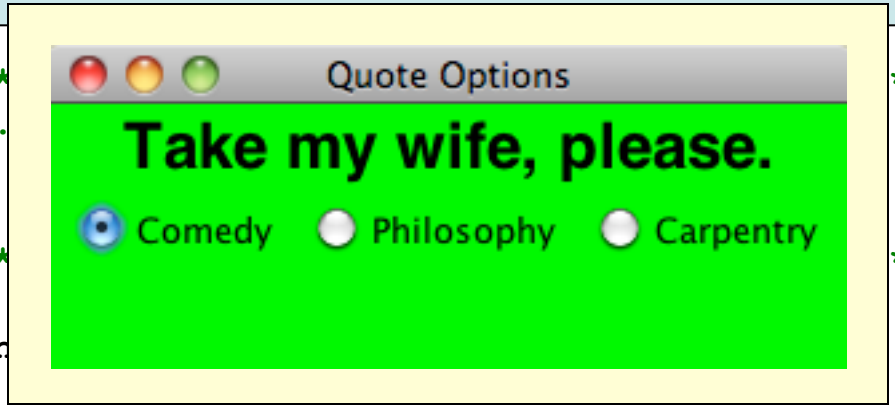
Radio Buttons

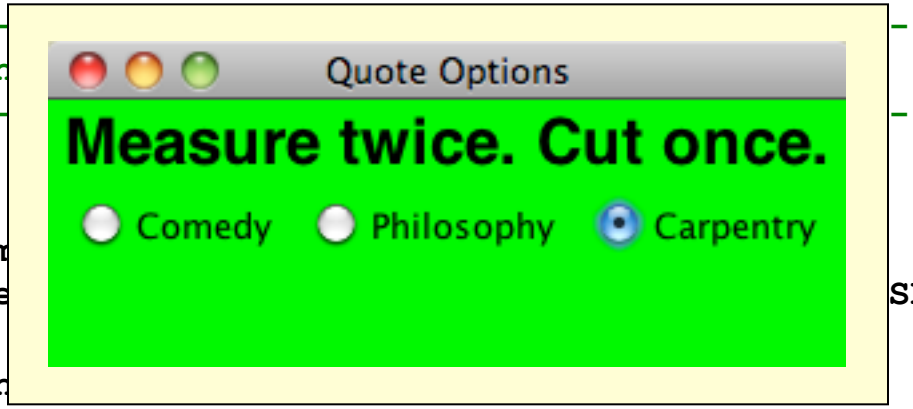
- Let's look at a program that uses radio buttons to determine which line of text to display

- See `QuoteOptions.java`
- See `QuoteOptionsPanel.java`

```
//********************************************************************
//  QuoteOptions.java       Author: Lewis/Loftus
//
//  Demonstrates the use of radio buttons.
//********************************************************************

import javax.swing.JFrame;

public class QuoteOptions
{
   //-----------------------------------------------------------------
   //  Creates and presents the program frame.
   //-----------------------------------------------------------------
   public static void main(String[] args)
   {
      JFrame frame = new JFrame("Quote Options");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

      QuoteOptionsPanel panel = new QuoteOptionsPanel();
      frame.getContentPane().add(panel);

      frame.pack();
      frame.setVisible(true);
   }
}
```

```
//*****************                                    **************
//  QuoteOptions.
//
//  Demonstrates
//*****************                                    **************

import javax.swin

public class QuoteOptions
{
   //-------------                                     --------------
   //  Creates an
   //-------------                                     --------------
   public static
   {
      JFrame fram
      frame.setDe                                          SE);

      QuoteOption
      frame.getContentPane().add(panel);

      frame.pack();
      frame.setVisible(true);
   }
}
```





```
//********************************************************************
//  QuoteOptionsPanel.java       Author: Lewis/Loftus
//
//  Demonstrates the use of radio buttons.
//********************************************************************

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

public class QuoteOptionsPanel extends JPanel
{
   private JLabel quote;
   private JRadioButton comedy, philosophy, carpentry;
   private String comedyQuote, philosophyQuote, carpentryQuote;

   //-----------------------------------------------------------------
   //  Sets up a panel with a label and a set of radio buttons
   //  that control its text.
   //-----------------------------------------------------------------
   public QuoteOptionsPanel()
   {
      comedyQuote = "Take my wife, please.";
      philosophyQuote = "I think, therefore I am.";
      carpentryQuote = "Measure twice. Cut once.";

      quote = new JLabel(comedyQuote);
      quote.setFont(new Font("Helvetica", Font.BOLD, 24));
```

continue

continue

```
        comedy = new JRadioButton("Comedy", true);
        comedy.setBackground(Color.green);
        philosophy = new JRadioButton("Philosophy");
        philosophy.setBackground(Color.green);
        carpentry = new JRadioButton("Carpentry");
        carpentry.setBackground(Color.green);

        ButtonGroup group = new ButtonGroup();
        group.add(comedy);
        group.add(philosophy);
        group.add(carpentry);

        QuoteListener listener = new QuoteListener();
        comedy.addActionListener(listener);
        philosophy.addActionListener(listener);
        carpentry.addActionListener(listener);

        add(quote);
        add(comedy);
        add(philosophy);
        add(carpentry);

        setBackground(Color.green);
        setPreferredSize(new Dimension(300, 100));
    }
```

continue

continue

```
   //*****************************************************************
   //  Represents the listener for all radio buttons
   //*****************************************************************
   private class QuoteListener implements ActionListener
   {
      //--------------------------------------------------------------
      //  Sets the text of the label depending on which radio
      //  button was pressed.
      //--------------------------------------------------------------
      public void actionPerformed(ActionEvent event)
      {
         Object source = event.getSource();

         if (source == comedy)
            quote.setText(comedyQuote);
         else
            if (source == philosophy)
               quote.setText(philosophyQuote);
            else
               quote.setText(carpentryQuote);
      }
   }
}
```