1.00 Lecture 18

Swing Event Model

Reading for next time: Big Java: sections 10.1-10.6, 9.5

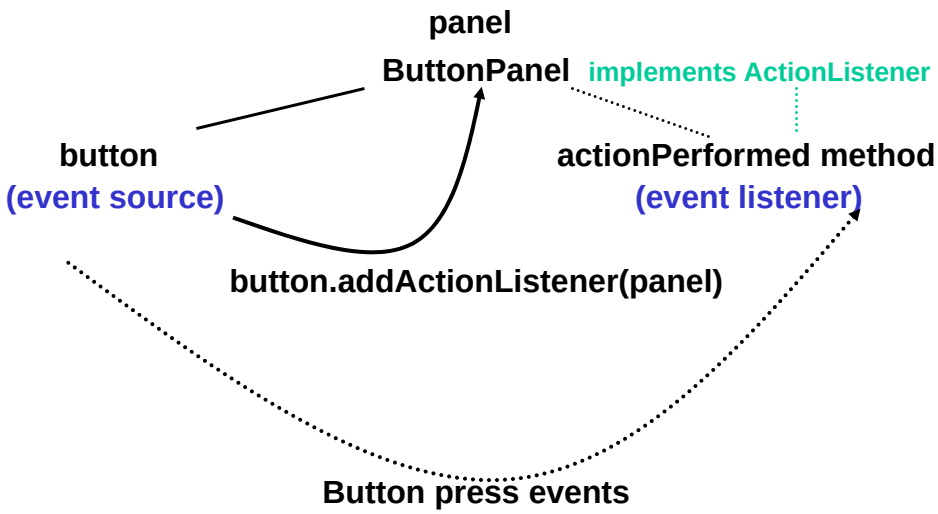
GUI Event Model: Paradigm Shift

- **Operating system (Windows, JVM) runs the show:**
  - **Monitors keystroke, mouse, other I/O events from sources**
  - **Dispatches event messages to programs that need to know**
  - **Each program decides what to do when the event occurs**
- **This is the reverse of console-oriented programming, where the program runs the show, and asks the operating system (OS) to get input when it wants it**
- **Event sources: menus, buttons, scrollbars, etc.**
  - **Have methods allowing event listeners to register with them**
  - **When event occurs, source sends message (an event object) to all registered listener objects**
  - **`EventObject` is the superclass**
    - **`ActionEvent, MouseEvent`, etc. are subclasses that we use**
- **Event listeners: objects in your program that respond to events**

Events: JButton Exercise

- **Download BFrame, ButtonTest, ButtonPanel**
- **We will build an application**
  - **User presses button**
  - **Application shows number of button presses**
- **Demo**

Button Example Framework



Events: JButton Exercise

- **Preliminaries:**
  - **Complete ButtonTest as shown on next page:**
    - **Main():**
      - **Create new BFrame (inherits from JFrame, to be written)**
      - **Sets default close operation**
      - **Sets frame visible**
  - **Complete BFrame:**
    - **Set title**
    - **Set size**
    - **Get contentPane**
    - **Create ButtonPanel object (ButtonPanel written next)**
    - **Add the ButtonPanel object to the contentPane**
  - **Use last lecture's notes as a guide**

Exercise: Button, p.1

```
import javax.swing.*;
public class ButtonTest {
   public static void main(String[] args) {
        // Create new frame
        // Set default close option
        // Show frame (set visible)
   }
}      // main has 1st 3 lines of SwingTest main (last lecture)
```

```
import java.awt.*;
import javax.swing.*;
public class BFrame extends JFrame {
   public BFrame() {
        // Set title of frame (optional)
        // Set size of frame
        // Get content pane
        // Create new panel (ButtonPanel, to be written next)
        // Add panel to content pane
   } }  // BFrame has remainder of SwingTest main(last lecture)
```

Exercise, p.2: ButtonPanel

- **Complete ButtonPanel constructor as shown on next slide:**
  - Create `JButton, JLabel, Font` objects
  - Add the button and label objects to the `ButtonPanel`
  - Tell the `JButton` object to send an `ActionEvent` to the object (ButtonPanel) that is the `ActionListener`. If `panel` is the listener, and `button` is the `JButton` object

    `button.addActionListener(panel);`
    - In this example, since we are in the ButtonPanel constructor, and we need to refer to ButtonPanel itself, we use the keyword `this` as the argument (see the solution)
    - `this` is a reference to the current object; Java provides it automatically for every object
  - Last, read the `actionPerformed` method to understand what it does

Exercise: Button, p.2

```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
public class ButtonPanel extends JPanel implements ActionListener {
    private int i= 0;
    private JLabel countLabel;

    public ButtonPanel() {
        // Create new JButton with prompt: “Show count”
        // Create new JLabel with output:“Count= 0”
        // Create new Font: Monospaced, Font.PLAIN, size 24
        countLabel.setFont(fontShow);
        countButton.setFont(fontShow);
        // Add your button to ButtonPanel (use add() method)
        // Add your label to ButtonPanel
        // Make the ButtonPanel object be the action listener
        // (We’re in the ButtonPanel constructor, so use this)
    }
    public void actionPerformed(ActionEvent e) {
        i++;
        countLabel.setText("Count= " + i);
        repaint();
    }
}
```

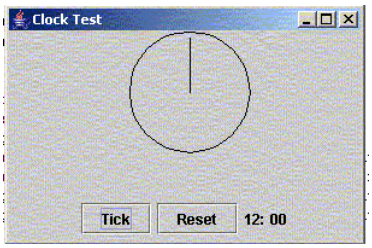
Exercise Solution, p.2

```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
public class ButtonPanel extends JPanel implements ActionListener {
    private int i= 0;
    private JLabel countLabel;

    public ButtonPanel() {
        JButton countButton= new JButton("Show count");
        countLabel=  new JLabel("Count= 0");
        Font fontShow= new Font("Monospaced", Font.PLAIN, 24);
        countLabel.setFont(fontShow);
        countButton.setFont(fontShow);
        add(countButton);
        add(countLabel);
        countButton.addActionListener(this);
    }
    public void actionPerformed(ActionEvent e) {
        i++;
        countLabel.setText("Count= " + i);
        repaint();
    }
}
// Save/compile and run when you have this done!
```

Exercise 2: Clock

- You'll complete a clock:



- ClockFrame: written for you
  - Main: creates new ClockFrame
  - Constructor:
    - Gets contentPane, creates ClockPanel, adds to contentPane
- ClockPanel: complete two blocks of code
  - Constructor: Creates 2 buttons, 2 labels, adds to panel
  - Overrides paintComponent(), has actionPerformed()

Exercise 2: Clock

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

public class ClockFrame extends JFrame{

   public static void main(String[] args) {
        ClockFrame frame = new ClockFrame();
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setVisible(true);
    }

    public ClockFrame() {
        super("Clock Test");          // Or setTitle(…)
        setSize(300, 200);
        ClockPanel clock = new ClockPanel();
        Container contentPane= getContentPane();
        contentPane.add(clock);
    }
}
```

Exercise 2: Clock

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

public class ClockPanel extends JPanel implements ActionListener {
    private JButton tickButton, resetButton;
    private JLabel hourLabel, minuteLabel;
    private int minutes = 720;              // 12 noon

    public ClockPanel(){
        JPanel bottomPanel = new JPanel();
        tickButton = new JButton("Tick");
        resetButton = new JButton("Reset");
        hourLabel = new JLabel("12:");
        minuteLabel = new JLabel("00");
        bottomPanel.add(tickButton);
        bottomPanel.add(resetButton);
        bottomPanel.add(hourLabel);
        bottomPanel.add(minuteLabel);
        setLayout(new BorderLayout());
        add(bottomPanel, BorderLayout.SOUTH);
        // Who will listen to the button events? Your code here
    }
```

Exercise 2: Clock

```
public void paintComponent(Graphics g) {
       super.paintComponent(g);
       g.drawOval(100, 0, 100, 100);
       double hourAngle = 2 * Math.PI * (minutes - 3 * 60)/ (12 * 60);
       double minuteAngle = 2 * Math.PI * (minutes - 15)/ 60;
       g.drawLine(150, 50, 150 + (int)(30 * Math.cos(hourAngle)),
              50 + (int)(30 * Math.sin(hourAngle)));
       g.drawLine(150, 50, 150 + (int)(45 * Math.cos(minuteAngle)),
              50 + (int)(45 * Math.sin(minuteAngle)));  }
public void setLabels(){            // Doesn't handle midnight
       int hours = minutes/60;
       int min = minutes - hours*60;
       hourLabel.setText(hours+ ":");
       if(min<10)                   // Minutes should be two digits
           minuteLabel.setText("0" + min);
       else
           minuteLabel.setText("" + min);  }
public void actionPerformed(ActionEvent e) {
      if(e.getSource().equals(tickButton))
             // Complete this code: update clock and labels
      else   // Reset button
             // Complete this code: update clock and labels
      } } }
```

Clock Example

- **Methods**
  - **paintComponent(Graphics g):**
    - **This method draws the clock and the hours and minutes hands based on `minutes`**
  - **`setLabels()`:**
    - **This method sets the hour and minute labels to the correct values based on `minutes`. It is a helper method you can call when writing `actionPerformed()`**
  - **`actionPerformed()`:**
    - **If the event is from the tick button,**
      - **increment `minutes` by one and repaint the clock**
      - **repaint() will call the paintComponent() method which will redraw the clock with the clock hands adjusted to the new `minutes` value**
      - **We never call paintComponent() directly; always use repaint(). JVM manages the calls to paintComponent() –repaint() is a request to call paintComponent(). JVM must repaint when other apps obscure, etc.**
      - **Update the labels**
    - **If the event is from the reset button**
      - **Reset `minutes` to 720 (noon), repaint the clock and update the labels**

Clock Exercise

- ClockFrame should compile and run after you've placed it in Eclipse
  - It won't, alas, do anything
- To make it do something:
  - Hook up the listener to the buttons in the ClockPanel constructor
  - Complete the actionPerformed() method in class ClockPanel,
    - The ClockPanel object is the listener that updates the display, so use the 'this' keyword