Announcements for This Lecture

Prelim II

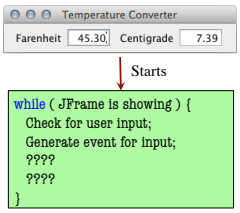
- Grades were a bit low
  - 69 mean, 72 median
  - Historically a 76
  - Culprit is recursion
- But good grade indicator
  - A (mastery) 75+
  - B (compentency) 52+
  - C (awareness) 33+
- Will make final a bit easier

Assignments

- A6 due Tonight at Midnight
  - Hopefully you are done!
  - To be graded this weekend
- Assignment A7 up Tomorrow
  - Last assignment of semester
  - Sizeable project; longer than the previous ones
  - Will give you until Saturday after last day of classes

The Event Loop

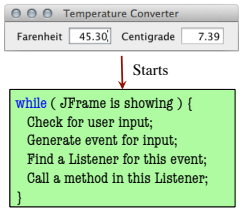
- Instantiating a JFrame creates an "event loop"
  - Runs until window closed
  - Body checks for user input
  - Input generates "events"
- Events are objects
  - Hold input information
  - Mouse location clicked
  - Key typed
- But what to do with events?



Java provides this loop. You do not write it.

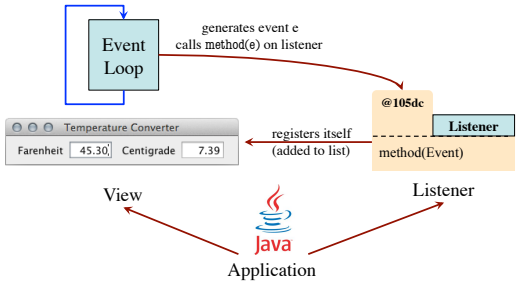
Listeners

- A Listener is a class with methods to respond to input
  - ImageProcessor in A6
  - Each method is a GUI button
  - Support other types of input
- Program registers Listeners with an event type
  - Event loop finds a Listener for the current event type
  - Calls a Listener method
  - Event is passed as argument

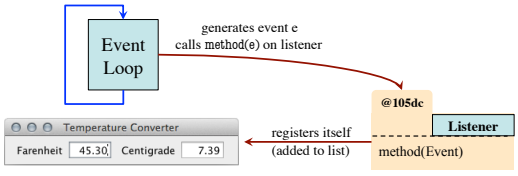


Java provides this loop. You do not write it.

Event-Driven Programming



Event-Driven Programming

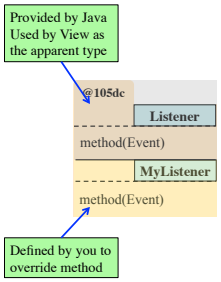


- JFrame has to know
  - Type of the Listener
  - Name of the method
- You did not write JFrame!

Solution: Apparent Types

- Java provides a Listener type
  - Has the method already in it
  - Subclass this as your own class
  - Override method for your usage
- View uses the Listener type
  - Allows it to call the method
  - Uses your version of method (bottom-up rule)
- Designed to be overridden…

Sounds like an abstract class!



Well, Almost

- Listeners are interfaces
  - Like an abstract class
  - But **all methods** abstract!
- What is the difference?
  - Don't extend an interface
  - You implement one
- What the heck????
  - Part of lecture next week
  - Major topic in 2110

```
public interface A {
  public void doIt(); // Abstract
}

public class B implements A {
   public void doIt() {
      ...
   }
}
```

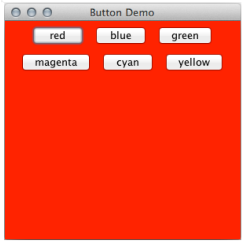
Listeners and Events in Java

In packages:
- javax.swing.event
- java.awt.event

Events	Listeners
• ActionEvent ▪ User clicks a button ▪ User hits return in text field • MouseEvent ▪ User clicks the mouse ▪ User moves the mouse • KeyEvent ▪ User presses a key ▪ User releases a key	• ActionListener ▪ actionPerformed(ActionEvent) • MouseListener ▪ mouseClicked(MouseEvent) ▪ mouseEntered(MouseEvent) • MouseMotionListener ▪ mouseDragged(MouseEvent) • KeyListener ▪ keyPressed(KeyEvent)

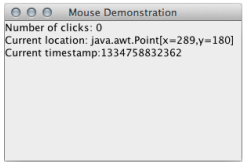
Example: Button Events

- Button generates ActionEvent
- Handle with ActionListener
  - actionPerformed(e)
  - Parameter contain button info
- Implement as separate class
  - A *controller* class
  - ButtonDemoView.java
  - ButtonDemoListener.java
- view.addActionListener(l)
  - Registers the listener
  - Done at start-up



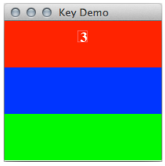
Example: MouseEvents

- MouseListener: simple events
  - Ex: Mouse clicked
  - Stuff that is not updated at "animation frame rate"
- MouseMotionListener: High speed movement
  - Updated 20-30x second
  - Can slow down program!
- Demonstration:
  - MouseDemoView.java
  - MouseDemoListener.java
  - MotionDemoListener.java



Example: KeyEvents

- Only if input has focus
- Motivation:
  - Which text fields gets key?
  - One with the cursor!
  - This is setting focus
- Text fields do automatically
  - Others require `requestFocus()`
- Demonstration:
  - KeyDemoView.java
  - KeyDemoListener.java



TemperatureConverter Revisited

View

Listener

Model