

CSSE 220

Event Based Programming

Check out *EventBasedProgramming2* from SVN

Interfaces - Review

- Interfaces are contracts
 - Any class that *implements* an interface **MUST** provide an implementation for all methods defined in the interface.
- Interfaces represent the abstract idea (and what it can do):
 - Measurable objects (return a measure)
 - NumberSequences (get the next number, reset)
- Classes represent the concrete idea:
 - Country, Bank Account
 - AddOne, PowersOfTwo.

Interfaces – Review (continued)

- The specific method to use at runtime is decided by late-binding

```
Sequence sequence = new PowersOfTwo();
```

```
System.out.println(sequence.next());
```

The *declared type* of operation is **Sequence**

The *instantiation type* is **PowersOfTwo**

At runtime, Java will use the method implementation of next() from the **PowersOfTwo** class, thanks to late-binding.

Finish the sentence

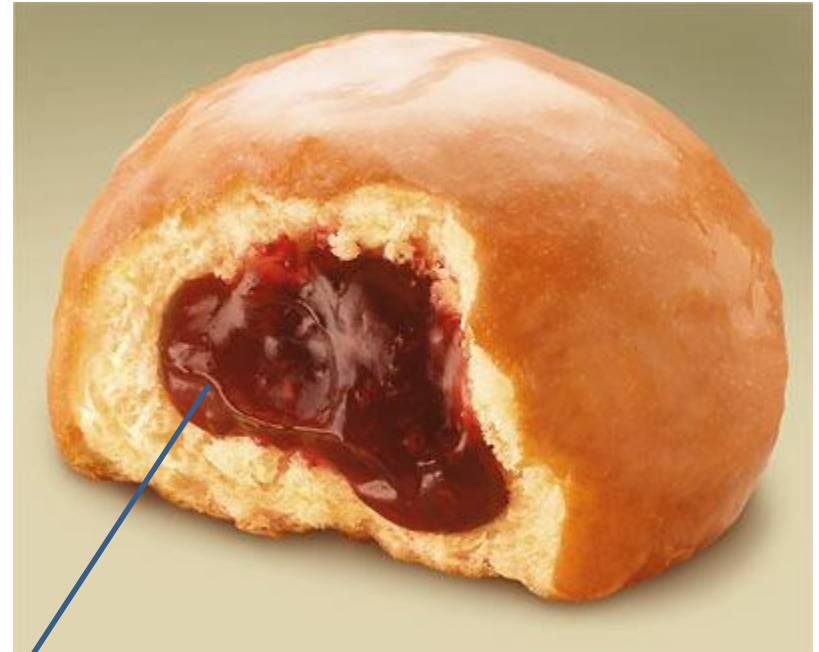
Using interfaces can help reduce _____
between classes.

1. Coupling
2. Cohesion
3. Encapsulation
4. Polymorphism

We need interfaces for event-based programming in Java.

Graphical User Interfaces in Java

- We say what to draw
- Java windowing library:
 - Draws it
 - Gets user input
 - **Calls back** to us with events
- We **handle** events



Hmm, donuts

Gooley

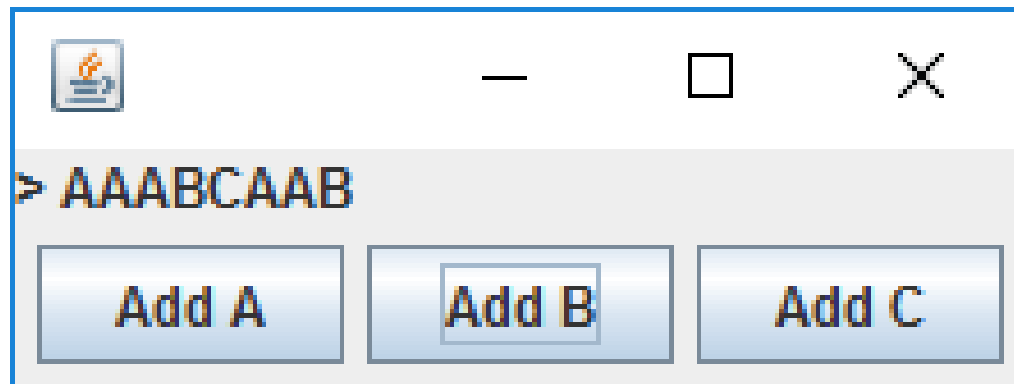
Handling Events

- Many kinds of events:
 - Mouse pressed, mouse released, mouse moved, mouse clicked, button clicked, key pressed, menu item selected, ...
- We create **event listener objects**
 - that implement the right **interface**
 - that handle the event as we wish
- We **register** our listener with an **event source**
 - Sources: buttons, menu items, graphics area, ...

Live Coding

In Class Activity 1

- In pairs or individually
- Look at the code in the capitalization example
- Then solve the addLettersProblem



Key Layout Ideas

- JFrame's `add(Component c)` method
 - Adds a new component to be drawn
 - Throws out the old one!
- JFrame also has method `add(Component c, Object constraint)`
 - Typical constraints:
 - `BorderLayout.NORTH`, `BorderLayout.CENTER`
 - Can add one thing to each “direction”, plus center
- JPanel is a container (a thing!) that can display multiple components

Mouse Listeners



```
public interface MouseListener {  
    public void mouseClicked(MouseEvent e);  
    public void mouseEntered(MouseEvent e);  
    public void mouseExited(MouseEvent e);  
    public void mousePressed(MouseEvent e);  
    public void mouseReleased(MouseEvent e);  
}
```

Repaint (and then no more)

- To update graphics:
 - We tell Java library that we need to be redrawn:
 - `drawComponent.repaint()`
 - Library calls `paintComponent()` when it's ready
- **Don't call `paintComponent()` yourself!
It's just there for Java's call back.**

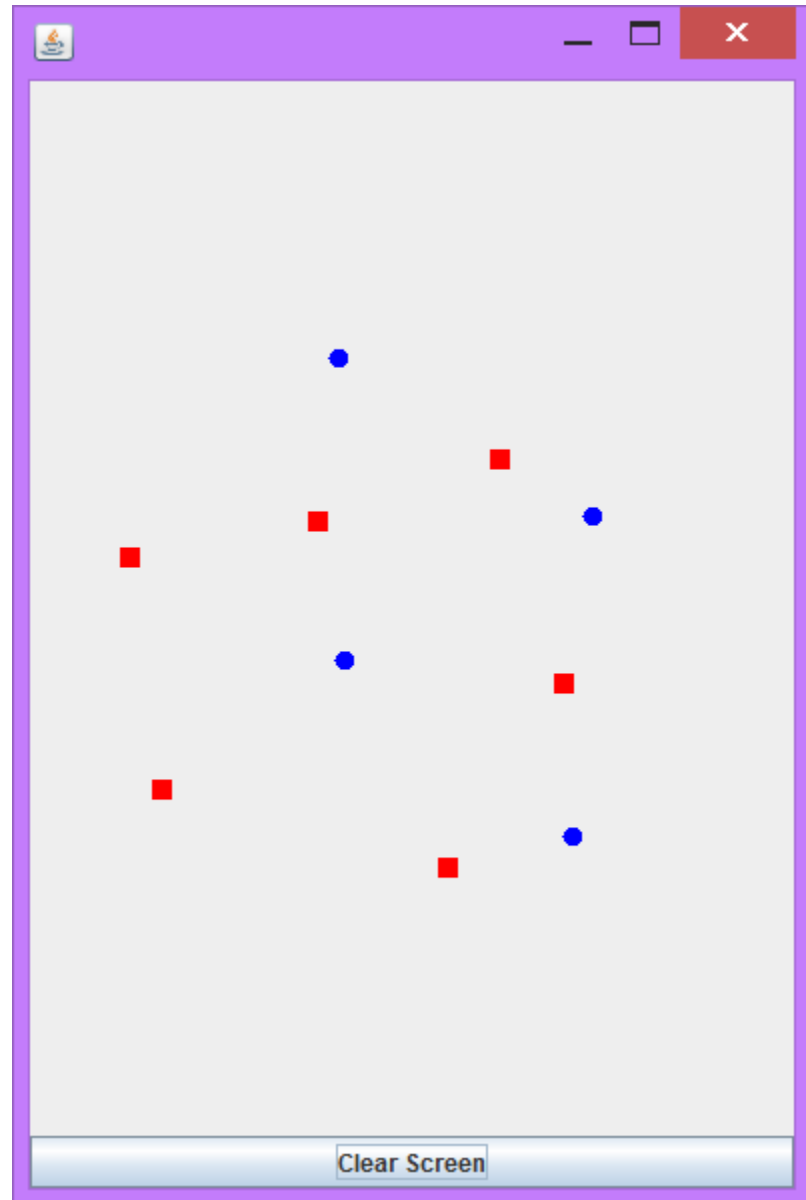
Activity 2

Read the code in the `rectangleExample`, then individually or in pairs solve the `clicksProblem`.

Draw a blue circle on left-click
Each 20x20, centered on click

Clear screen button does what it says.

If you get that working, make a right click make a red rectangle



Using Inner Classes

- Classes can be defined **inside** other classes or methods
- Used for “smallish” helper classes
- Example: **Ellipse2D.Double**



- Often used for **ActionListeners...**
- Add to Breakfast program?

Anonymous Classes

- Sometimes very small helper classes are only used once
 - This is a job for an anonymous class!
- **Anonymous** → no name
- A special case of inner classes
- Used for the simplest **ActionListeners...**

Inner Classes and Scope

- **Inner classes can access any variables in surrounding scope**
- **Caveats:**
 - Can only use instance fields of surrounding scope if we're inside an instance method
- **Example:**
 - Prompt user for what porridge tastes like

Work Time

- LinearLightsOut