CS 106A, Lecture 24
Interactors and NameSurfer

suggested reading:

Java Ch. 10.5-10.6

Plan for today

- Recap: Extending GCanvas
- Interactors
  - JButton
  - JLabel
  - JTextField
- Example: TipCalculator
- NameSurfer

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Extending GCanvas

```
public class Graphics extends Program {
    public void init() {
        // We can make our own GCanvas!
        MyCanvas canvas = new MyCanvas();
        add(canvas);
    }

    public void run() {
        // Operate on this canvas
        GObject obj = canvas.getElementAt(…);
    }
}
```

Extending GCanvas

```
public class MyCanvas extends GCanvas {
    public void addCenteredSquare(int size) {
        GRect rect = new GRect(size, size);
        int x = getWidth() / 2.0 –
            rect.getWidth() / 2.0;
        int y = getHeight() / 2.0 –
            rect.getHeight() / 2.0;
        add(rect, x, y);
    }
}
```

Extending GCanvas

```
public class Graphics extends Program {
    public void init() {
        // We can make our own GCanvas!
        MyCanvas canvas = new MyCanvas();
        add(canvas);
    }

    public void run() {
        canvas.addCenteredSquare(20);
    }
}
```

Common Bugs

- When you are using a custom canvas, make sure to not call **`getWidth`** or **`getHeight`** on the canvas until it is shown onscreen!

```
public class MyProgram extends Program {
        private MyCanvas canvas;
        public void init() {
                // canvas not created yet!
                canvas = new MyCanvas();
                // canvas not added yet!
                add(canvas);
                // window not showing yet!
        }
        public void run() {
                // good to go
        }
}
```

Example: Aquarium

- We used classes to make a graphical program called **Aquarium** that simulates fish swimming around.

Aquarium.java

```
public class Aquarium extends Program {
    private static final int NUM_FISH = 5;
    private FishTank tank;

    public void init() {
        tank = new FishTank();
        add(tank);
    }

...
```

Aquarium.java

```
...
    public void run() {
        tank.initialize();
        for (int i = 0; i < NUM_FISH; i++) {
            tank.addFish();
        }
        while (true) {
            tank.moveFish();
            pause(30);
        }
    }
}
```

FishTank.java

```
public class FishTank extends GCanvas {
  private ArrayList<Fish> fish;

  public FishTank() {
    fish = new ArrayList<>();
  }

  public void initialize() {
    GImage background = new GImage("res/bkrnd.jpg");
    background.setSize(getWidth(), getHeight());
    add(background);
  }
...
```

FishTank.java

```
...
  public void addFish() {
    Fish newFish = new Fish(getWidth(), getHeight());
    fish.add(newFish);
    add(newFish.getImage());
  }

  public void moveFish() {
    for (Fish currentFish : fish) {
      currentFish.swim(getWidth(), getHeight());
    }
  }
}
```

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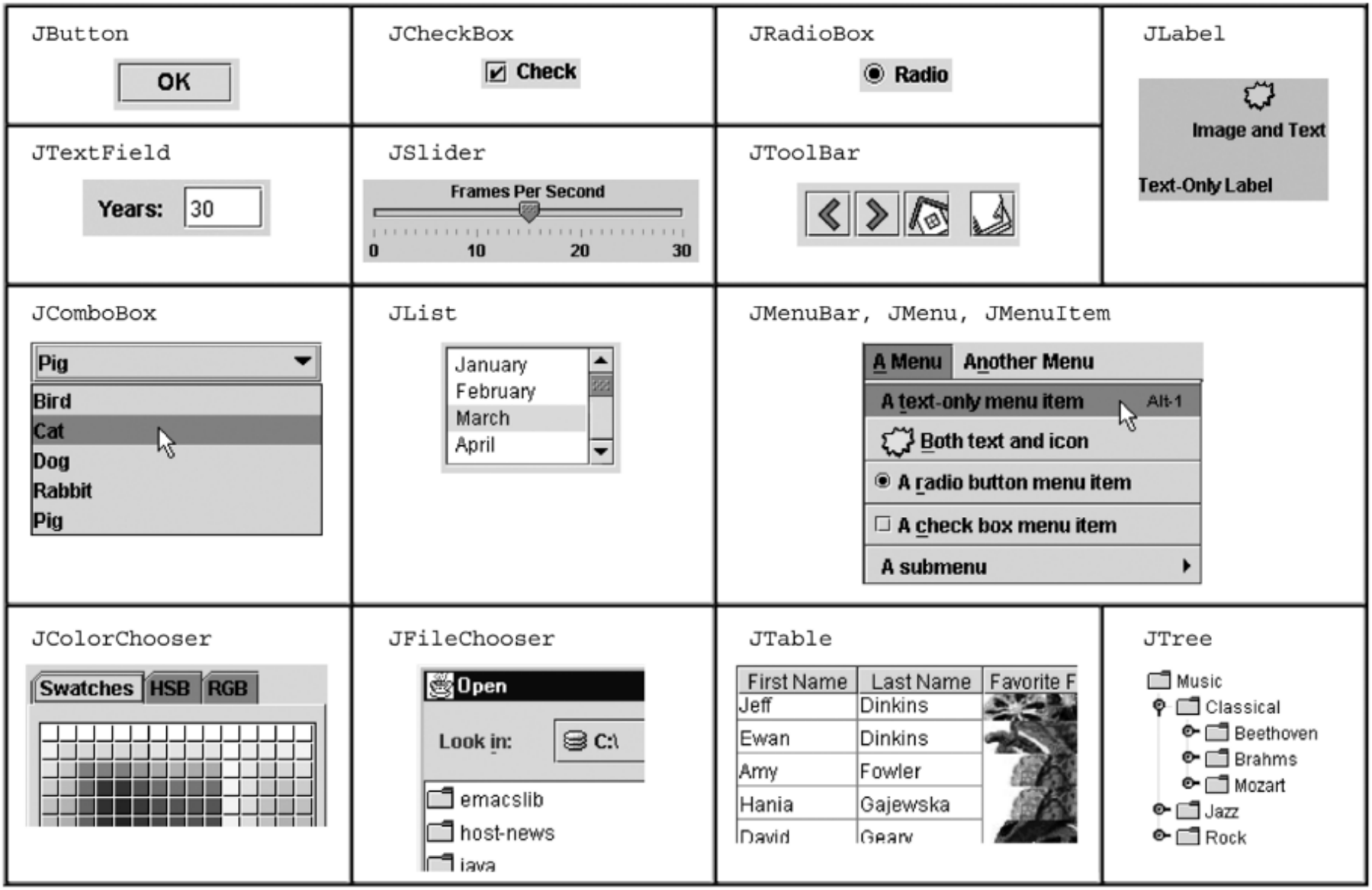
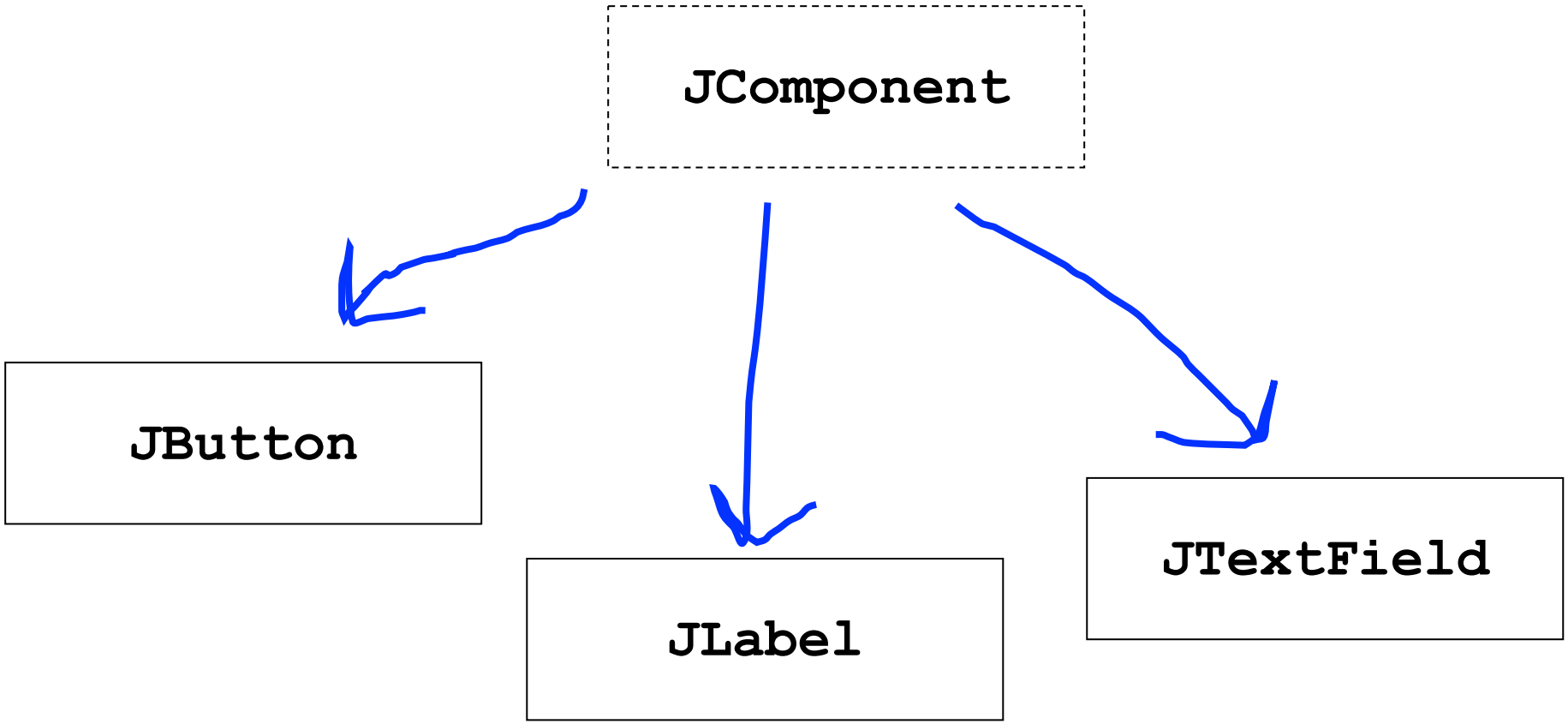
Interactors



Interactors



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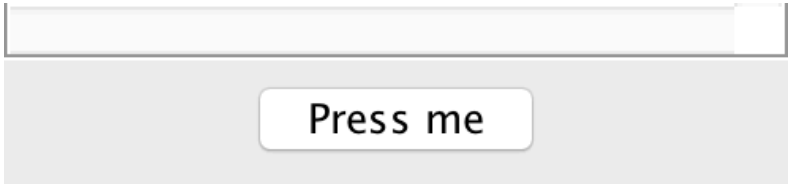
JButton

JButton

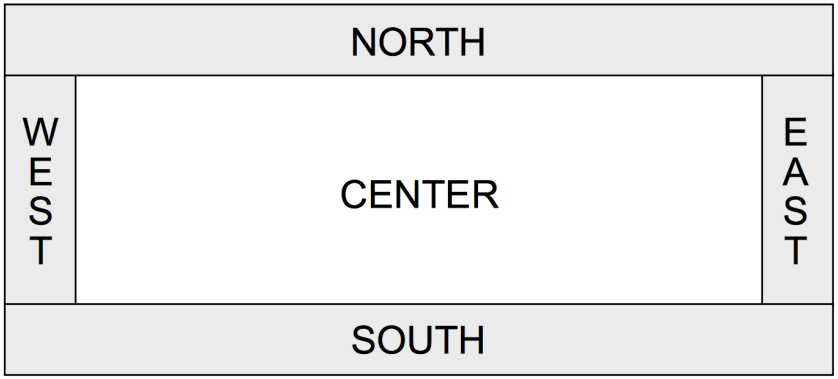
```
import java.awt.event.*;
import javax.swing.*;
```

```
JButton button = new JButton(“Press me”);
add(button, SOUTH);
```



Window Regions

- In graphics or console programs, the window is divided into five regions:



- The **CENTER** region is typically where the action happens.
  - **ConsoleProgram** adds a console there
  - **GraphicsProgram** puts a **GCanvas** there
- Other regions are visible only if you add an interactor to them using `add(`***`component, REGION`***`);`
- Interactors are automatically centered within each region.

Responding To Button Clicks

To respond to events from interactors, we must do the following:

1. Call **`addActionListeners()`** at the end of init, *once we are done adding buttons*. This tells Java to let us know if any of the previous buttons were clicked.
2. Implement the public **`actionPerformed`** method. This method is called whenever a button is clicked.

JButton Example

```
public class Interactors extends ConsoleProgram {
    public void init() {
        JButton yayButton = new JButton("Yay");
        add(yayButton, SOUTH);
        JButton nayButton = new JButton("Nay");
        add(nayButton, SOUTH);
        addActionListeners();
    }

    public void actionPerformed(ActionEvent event) {
        ... // ?
    }
}
```

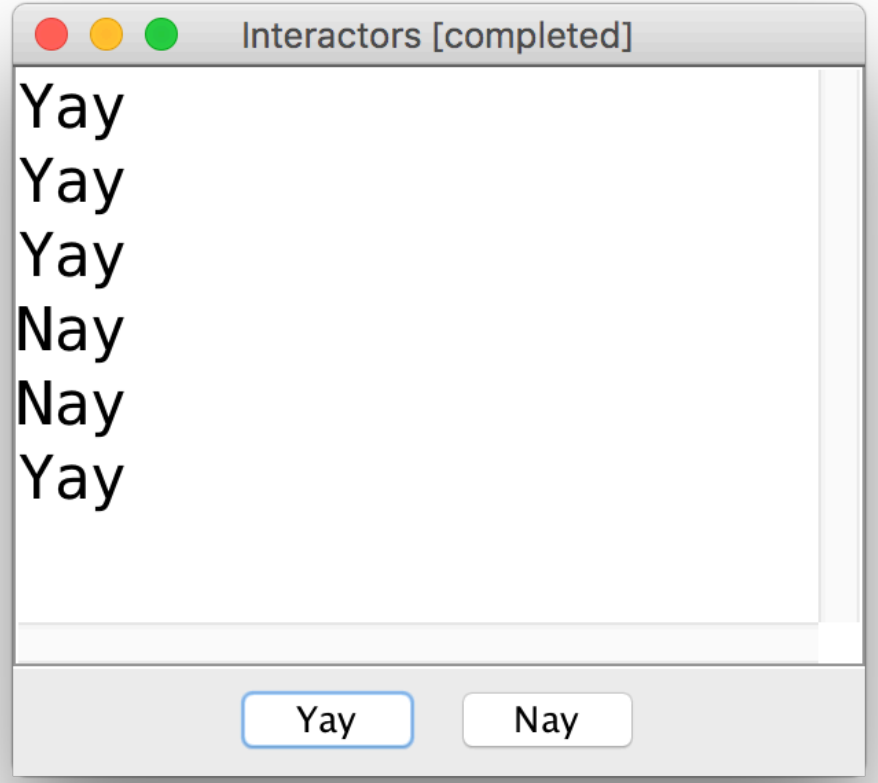
ActionEvent

- The **`ActionEvent`** parameter contains useful event information.
  - Use `getSource` or `getActionCommand` to figure out what button or component was interacted with.

Method	Description
e`.getActionCommand()`	a text description of the event *(e.g. the text of the button clicked)*
e`.getSource()`	the interactor that generated the event

```
public void actionPerformed(ActionEvent event) {
    String command = event.getActionCommand();
    if (command.equals("Save File")) {
        // user clicked the Save File button
        ...
    }
}
```

JButton Example



JButton Example

```
public class Interactors extends ConsoleProgram {
        private JButton yayButton;
        private JButton nayButton;
        public void init() {
                yayButton = new JButton("Yay");
                add(yayButton, SOUTH);
                nayButton = new JButton("Nay");
                add(nayButton, SOUTH);
                addActionListeners();
        }

        public void actionPerformed(ActionEvent event) {
                if (event.getSource() == yayButton) {
                        println("Yay");
                } else if (event.getSource() == nayButton) {
                        println("Nay");
                }
        }
}
```

JButton Example #2

```
public class Interactors extends ConsoleProgram {
        private JButton yayButton;
        private JButton nayButton;
        public void init() {
                JButton yayButton = new JButton("Yay");
                add(yayButton, SOUTH);
                JButton nayButton = new JButton("Nay");
                add(nayButton, SOUTH);
                addActionListeners();
        }

        public void actionPerformed(ActionEvent event) {
                if (event.getActionCommand().equals("Yay")) {
                        println("Yay");
                } else if (event.getActionCommand().equals("Nay")) {
                        println("Nay");
                }
        }
}
```

JButton Example #2

```
public class Interactors extends ConsoleProgram {
	public void init() {
		JButton yayButton = new JButton("Yay");
		add(yayButton, SOUTH);
		JButton nayButton = new JButton("Nay");
		add(nayButton, SOUTH);
		addActionListeners();
	}

	public void actionPerformed(ActionEvent event) {
		println(event.getActionCommand());
	}
}
```

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- Example: TipCalculator
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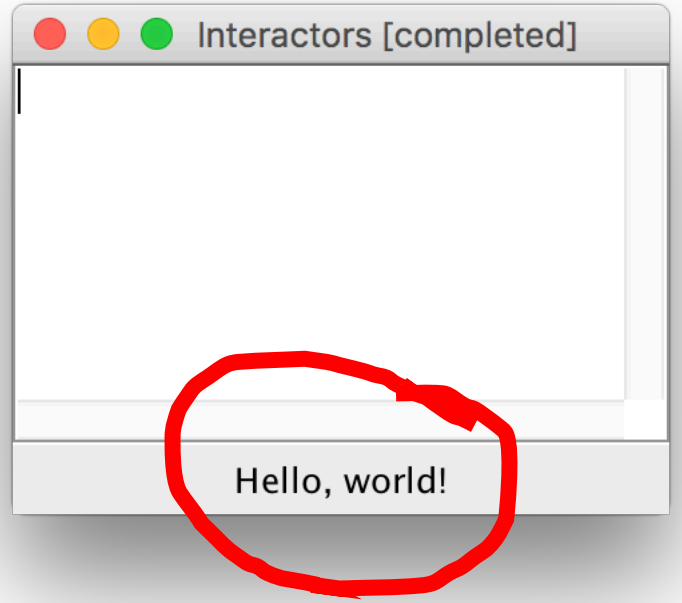
JLabel

```
JLabel label = new JLabel("Hello, world!");
add(label, SOUTH);
```



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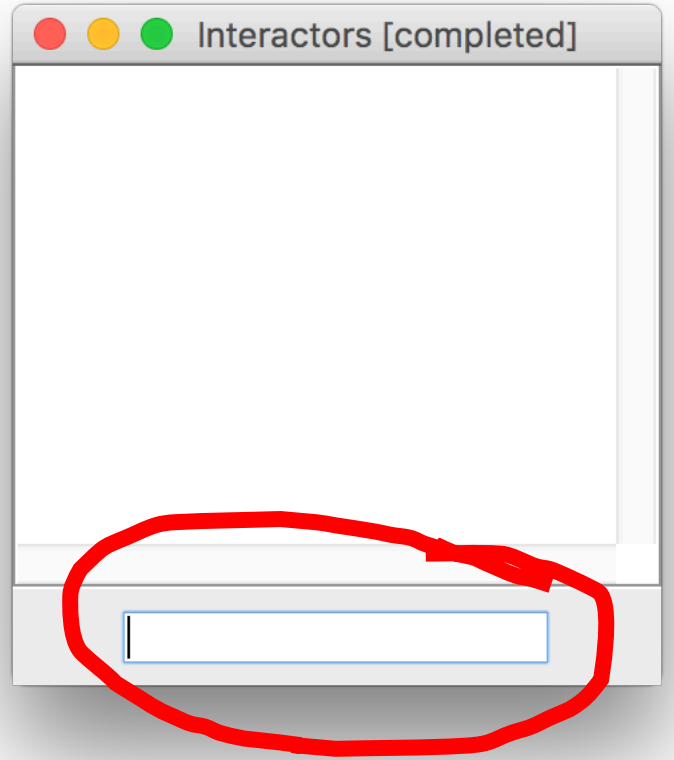
JTextField

```
JTextField field = new JTextField(10);
add(field, SOUTH);
```



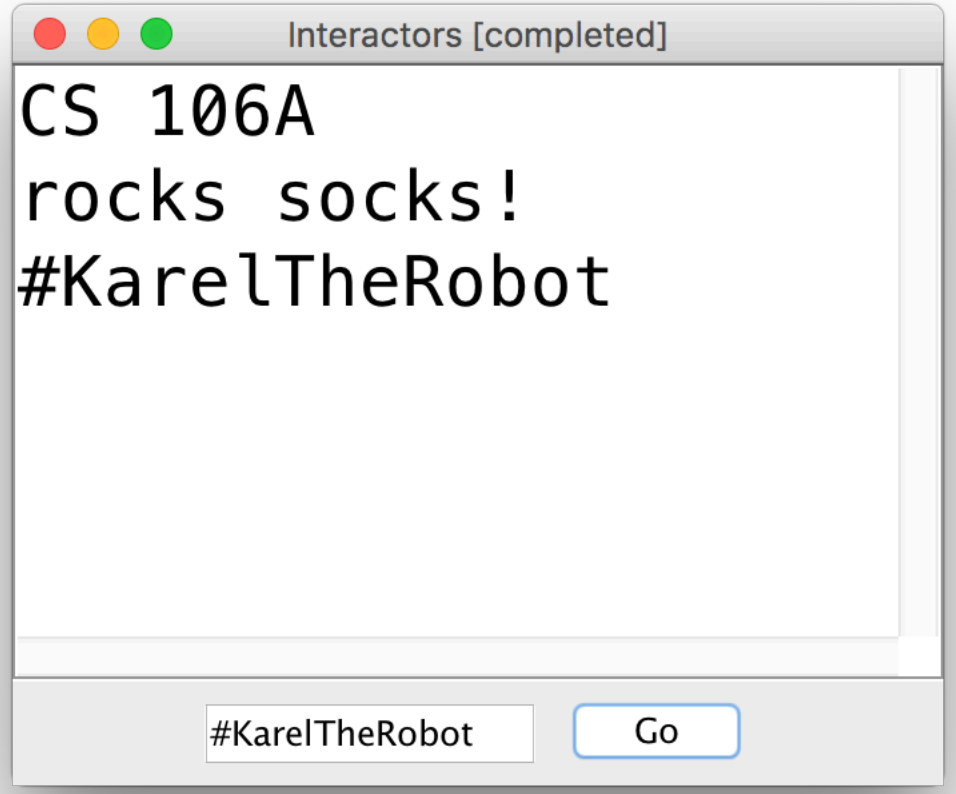
JTextField

```
JTextField field = new JTextField(10);
add(field, SOUTH);

// Set the text in the text field
field.setText("Hello!");

// Get the text currently in the text field
String text = field.getText();
```

JTextField Example



JTextField Example

```
public class Interactors extends ConsoleProgram {
	private JTextField textField;
	public void init() {
		textField = new JTextField(10);
		add(textField, SOUTH);
		JButton goButton = new JButton("Go");
		add(goButton, SOUTH);
		addActionListeners();
	}

	public void actionPerformed(ActionEvent event) {
		println(textField.getText());
	}
}
```

Detecting ENTER Pressed

Detecting the ENTER key pressed in a JTextField requires extra work.

```
JTextField field = new JTextField(10);

// Tells Java to listen for ENTER on the text field
field.addActionListener(this);

// Sets the action command (like JButtons) to “Go”
field.setActionCommand("Go");

add(field, SOUTH);
```

Detecting ENTER Pressed

Detecting the ENTER key pressed in a JTextField requires extra work.

```
JTextField field = new JTextField(10);
field.addActionListener(this);
field.setActionCommand("Go");
add(field, SOUTH);


...
public void actionPerformed(ActionEvent event) {
      if (event.getActionCommand().equals("Go")) {
            ...
      }
}
```

getActionCommand

Oftentimes, a text field has a "corresponding" button that takes action with the entered text. If we set the text field's action command to be the *same* as its corresponding button, we can check for both a click and ENTER at once!

getActionCommand

```
public void init() {
        JButton button = new JButton("Go");
        add(button, SOUTH);
        JTextField field = new JTextField(10);
        field.addActionListener(this);
        field.setActionCommand("Go");
        add(field, SOUTH);
        addActionListeners();
}

public void actionPerformed(ActionEvent event) {
        if (event.getActionCommand().equals(“Go”)) {
                ...
        }
}
```

getActionCommand

```
public void init() {
        JButton button = new JButton("Go");
        add(button, SOUTH);
        JTextField field = new JTextField(10);
        field.addActionListener(this);
        field.setActionCommand("Go");
        add(field, SOUTH);
        addActionListeners();
}

public void actionPerformed(ActionEvent event) {
        if (event.getActionCommand().equals("Go")) {
                ...
        }
}
```

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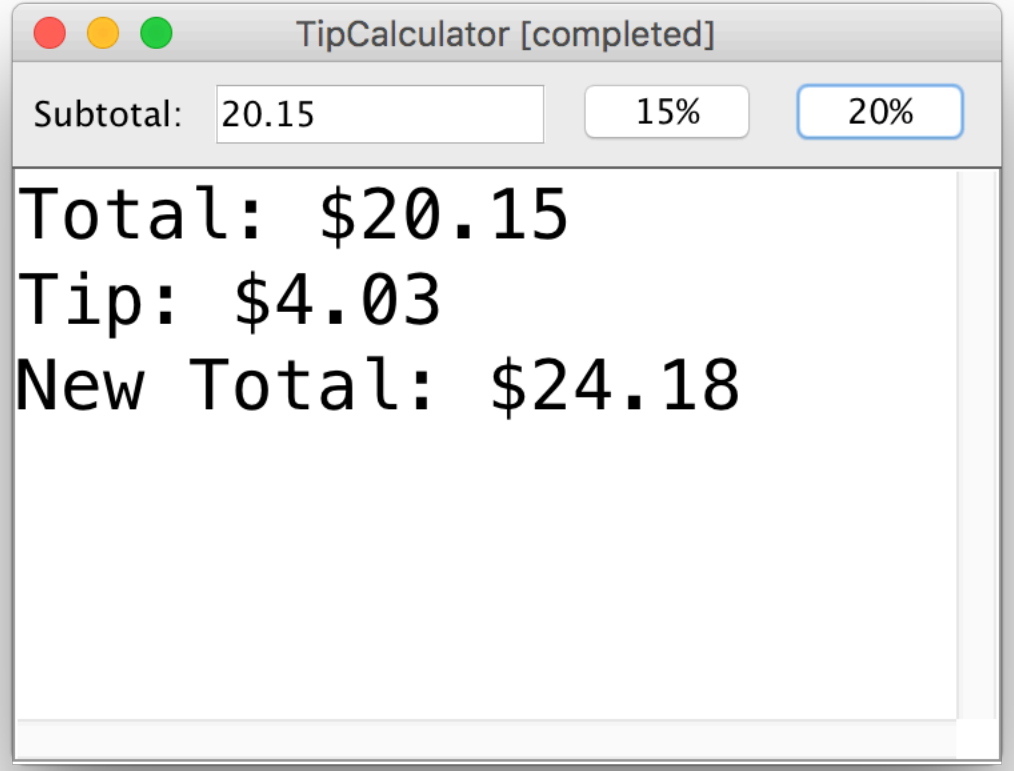
Practice: TipCalculator

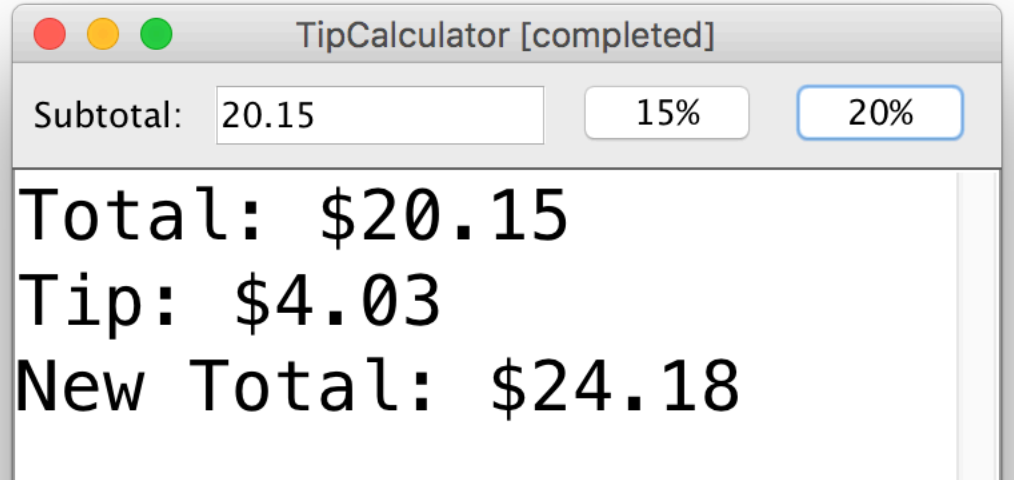
Let's write a program called **TipCalculator** that uses interactors to calculate the tip for a bill.



Practice: TipCalculator

Let's write a program called **TipCalculator** that uses interactors to calculate the tip for a bill.

- The program should calculate the appropriate tip depending on the button the user clicks on
- The console should clear when a new tip is calculated (hint: use **`clearConsole()`**).
- Convert a string into a double using **`Double.parseDouble(str);`**



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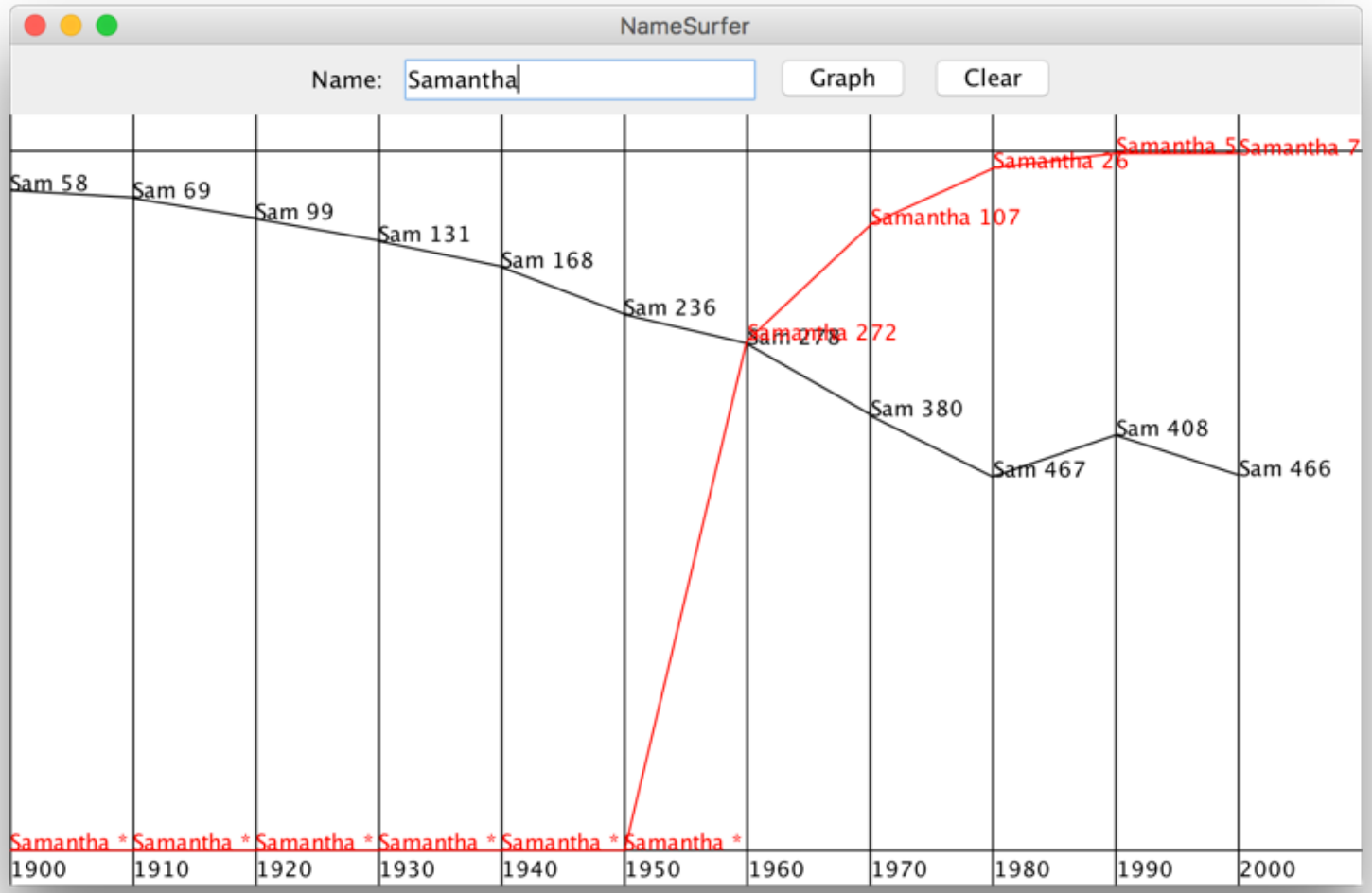
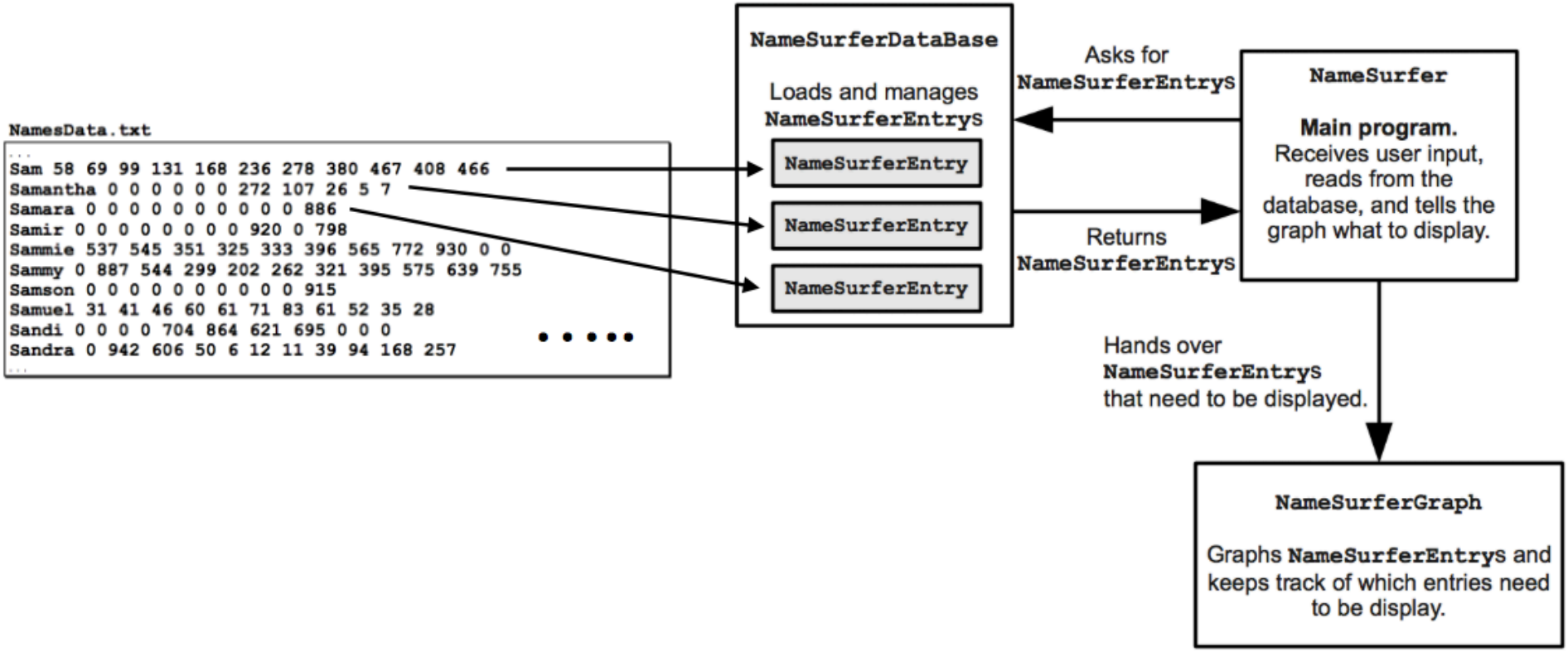
NameSurfer


NameSurfer
Name:
Samantha
Graph
Clear
Sam 58
Sam 69
Sam 99
Sam 131
Sam 168
Sam 236
Sam 278
Sam 380
Sam 467
Sam 408
Sam 466
Samantha 272
Samantha 107
Samantha 26
Samantha 5
Samantha 7
Samantha *
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

NameSurfer Structure

- **NameSurfer.java** – handles the interactors and overall program
- **NameSurferEntry** – handles information about a single name and its ranks
- **NameSurferDatabase** – handles information about all names and their ranks, and looks up info by name
- **NameSurferGraph** – a GCanvas subclass that displays the name plots

NameSurfer Structure



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NameSurfer Structure

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NameSurferEntry

- Responsible for storing the data about **one name/line** in the text file -> name and ranks. (Hint: use a Scanner!)

```
Sam 58 69 99 131 168 236 278 380 467 408 466
```

- What instance variables does a NameSurferEntry need?
- Implement the following methods:
  - `public NameSurferEntry(String dataLine)`
  - `public String getName()`
  - `public int getRank(int decadesSince1900)`
  - `public String toString()`

NameSurfer Structure

- **NameSurfer.java** – handles the interactors and overall program
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NameSurferDatabase

- Responsible for reading in the text file and creating/storing NameSurferEntry objects.
- Needs to be able to find entries **given their name** (case insensitive!). What data structure might be useful here?

NameSurferDatabase

```
// TODO: comment this file
import java.io.*;
import java.util.*;
public class NameSurferDatabase implements NameSurferConstants {

  // TODO: comment this constructor
  public NameSurferDatabase(String filename) {
    // TODO: fill this in
  }

  // TODO: comment this method
  public NameSurferEntry findEntry(String name) {
    // TODO: implement this method
    return null;       // remove this line
  }
}
```

NameSurfer Structure

- **NameSurfer.java** – handles the interactors and overall program
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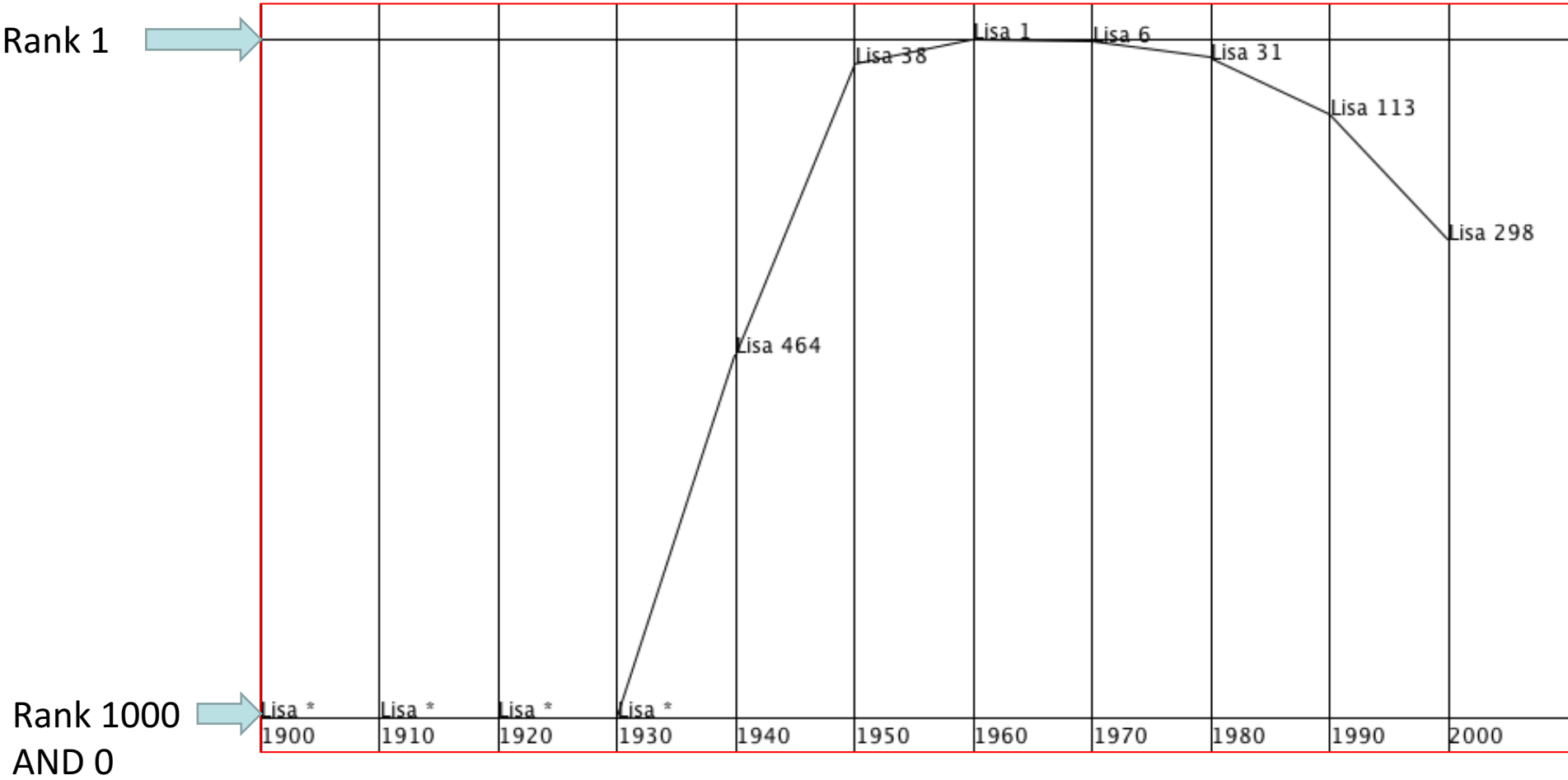
- **NameSurferDatabase** – handles information about all names and their ranks, and looks up info by name
- **NameSurferGraph** – a GCanvas subclass that displays the name plots

NameSurferGraph

- A subclass of **GCanvas** that handles all the graph drawing (similar to **FishTank.java** in our **Aquarium** program)
- Different, cycling colors for each plot line
- Ranks range from 1 to 1000, with rank 0 specially marked at the bottom
- *Tip*: use the output comparison tool!

NameSurferGraph



NameSurferGraph: Resizing

```
// TODO: comment this method
public void update() {
    // TODO: implement this method
}


/* Implementation of the ComponentListener interface for updating when the window is resized */
public void componentHidden(ComponentEvent e) { }
public void componentMoved(ComponentEvent e) { }
public void componentResized(ComponentEvent e) { update(); }
public void componentShown(ComponentEvent e) { }
```

NameSurferGraph: Resizing

- Every time the window resizes, update() is called.
- Therefore, update() *must* clear and redraw the whole graph.
- This means the graph must store the entries being graphed so it can redraw them whenever it needs to. What might be appropriate to help us store this?
- Other required methods:
  - `clear()`
  - `addEntry(NameSurferEntry entry)`
- These methods do NOT actually alter the graphics. You must call `update()` to do that, since `update()` must do all the drawing.

NameSurferConstants

Make sure to *always* use the provided constants! You may add more, but add them in *other* files, not this provided one.

```
public interface NameSurferConstants {

/** The name of the file containing the data */
    public static final String NAMES_DATA_FILE = "res/names-data.txt";

/** The width of the text field in the NORTH of the window */
    public static final int TEXT_FIELD_WIDTH = 16;

/** The first decade in the database */
    public static final int START_DECADE = 1900;

/** The number of decades */
    public static final int NUM_DECADES = 11;

/** The maximum rank in the database */
    public static final int MAX_RANK = 1000;

/** The number of pixels to reserve at the top and bottom */
    public static final int GRAPH_MARGIN_SIZE = 20;

/** The number of pixels between the baseline of the decade labels and the bottom of the window */
    public static final int DECADE_LABEL_MARGIN_SIZE = GRAPH_MARGIN_SIZE / 4;

}
```

Recap

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Next time: Life after CS 106A, Part 1