CSSE 220

Intro to Java Graphics

Check out IntroToJavaGraphics and BiggestFan projects from SVN

Announcement

- Exam 1 Starts Wednesday the 14th
  - We're splitting the exam into written and programming and doing them on separate days
- Before Monday's class
  - Print out and complete the written portion of the 201510 written exam (provided on the schedule page)
  - Bring any questions you have to Monday's class
  - Be sure to time yourself to make sure you can complete it within the given 50 minutes

Outline

- Static (by examples)
- Live coding: a Java graphics program

Understanding static

STATIC

Why fields can't always be static

```
public class Student {
  private String name;
  private char grade;

  public Student(
        String name,
        char grade){
    this.name = name;
    this.grade = grade;
  }

  @Override
  public String toString() {
    return name +
        " has a grade of "
       + grade;
  }
}
```

```
public static void main(String[] args) {
  Student a = new Student("Adam", 'A');
  Student b = new Student("Bryan", 'B');
  Student c = new Student("Chris", 'C');
  System.out.println(a);
  System.out.println(b);
  System.out.println(c);
}
```

OUTPUT:

```
Adam has a grade of A
Bryan has a grade of B
Chris has a grade of C
```

Why not make the grade static?

```
public class Student {
  private String name;
  private static char grade;

  public Student(
        String name,
        char grade){
    this.name = name;
    this.grade = grade;
  }

  @Override
  public String toString() {
    return name+
        " has a grade of "
       + grade;
  }
}
```

```
public static void main(String[] args) {
  Student a = new Student("Adam", 'A');
  Student b = new Student("Bryan", 'B');
  Student c = new Student("Chris", 'C');
  System.out.println(a);
  System.out.println(b);
  System.out.println(c);
}
```

OUTPUT:

```
Adam has a grade of C
Bryan has a grade of C
Chris has a grade of C
```

Static means there's only one instance of a field/method for every instance of a class that's created. So when you change a grade, they all change.

When do we make methods static?

- Utility Methods
  - Things like abs, sqrt, etc.
  - Don’t need an instance of a class to run them
- How do I know?
  - No references to non-static fields/methods
  - No “this” keyword used in method

```java
public class Car {

    double mileage;

    //other stuff

    public double getMilesTravelled() {
        return this.mileage;
    }

    public static double convertMilesToKm(double numberOfMiles) {
        return numberOfMiles * 1.609344f;
    }

}

//Elsewhere…

//requires you to have a car object
Car myCar = new Car();
//requires you to have a car object
System.out.println(myCar.getMilesTravelled());//output depends on code
//can be called on the class Car itself
System.out.println(Car.convertMilesToKm(77));//output is 123.919488
```

```
public class Bicycle {

    private int speed;
    private static int numCreated = 0;

    public Bicycle(int speed) {
        this.speed = speed;
        Bicycle.numCreated++;
    }
    public int getSpeed() {
        return this.speed;
    }
    public static int getNumCreated() {
        return Bicycle.numCreated;
    }

}
//No requirement to have a Bicycle yet…
System.out.println(Bicycle.getNumCreated());
Bicycle myBike1 = new Bicycle(18);
Bicycle myBike2 = new Bicycle(1);
System.out.println(Bicycle.getNumCreated() + " " + myBike1.getSpeed());
```

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Simple Graphics

JAVA GRAPHICS

Simplest Java Graphics Program

```
import javax.swing.JFrame;
/**
 * From Ch 2, Big Java.
 * @author Cay Horstmann
 */
public class EmptyFrameViewer {
   /**
    * Draws a frame.
    * @param args ignored
    */
   public static void main(String[] args) {
      JFrame frame = new JFrame();
      frame.setSize(300,400);
      frame.setTitle("An Empty Frame");
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      frame.setVisible(true);
   }
}
```

This code is already in your project for today

Creates a graphics frame object

Configures it

Tells Java to exit program when user closes the frame

Display the frame

MyViewer and **MyComponent** (Based on **RectangleViewer** and **RectangleComponent** from Big Java)

LIVE CODING

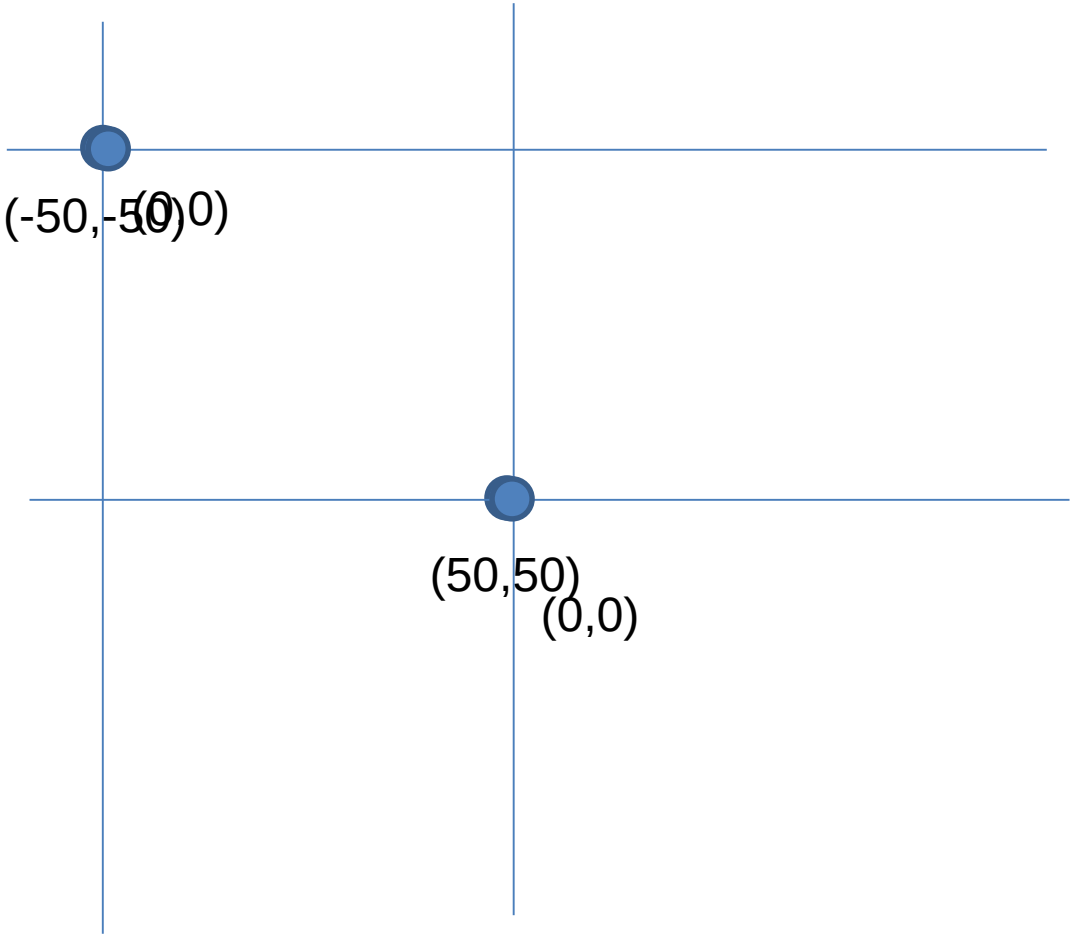
Other Shapes

- `new Ellipse2D.Double(double x, double y, double w, double h)`
- `new Line2D.Double(double x1, double y1, double x2, double y2)`
- `new Point2D.Double(double x, double y)`
- `new Line2D.Double(Point2D p1, Point2D p2)`
- `new Arc2D.Double(double x, double y, double w, double h, double start, double extent, int type)`
- `new Polygon(int[] x, int[] y, int nPoints);`
- Try some of these!
  - Add an ellipse and both kinds of lines to MyComponent

Using translate and rotate successfully

- Translate and rotate to adjust the “state” of the pen
- It is usually easier to move the pen, then draw in a fixed configuration around (0,0), then move the pen back
- Make (0,0) your center of rotation
  - can change the point of origin using translate() so you can rotate different portions of the component

Translate

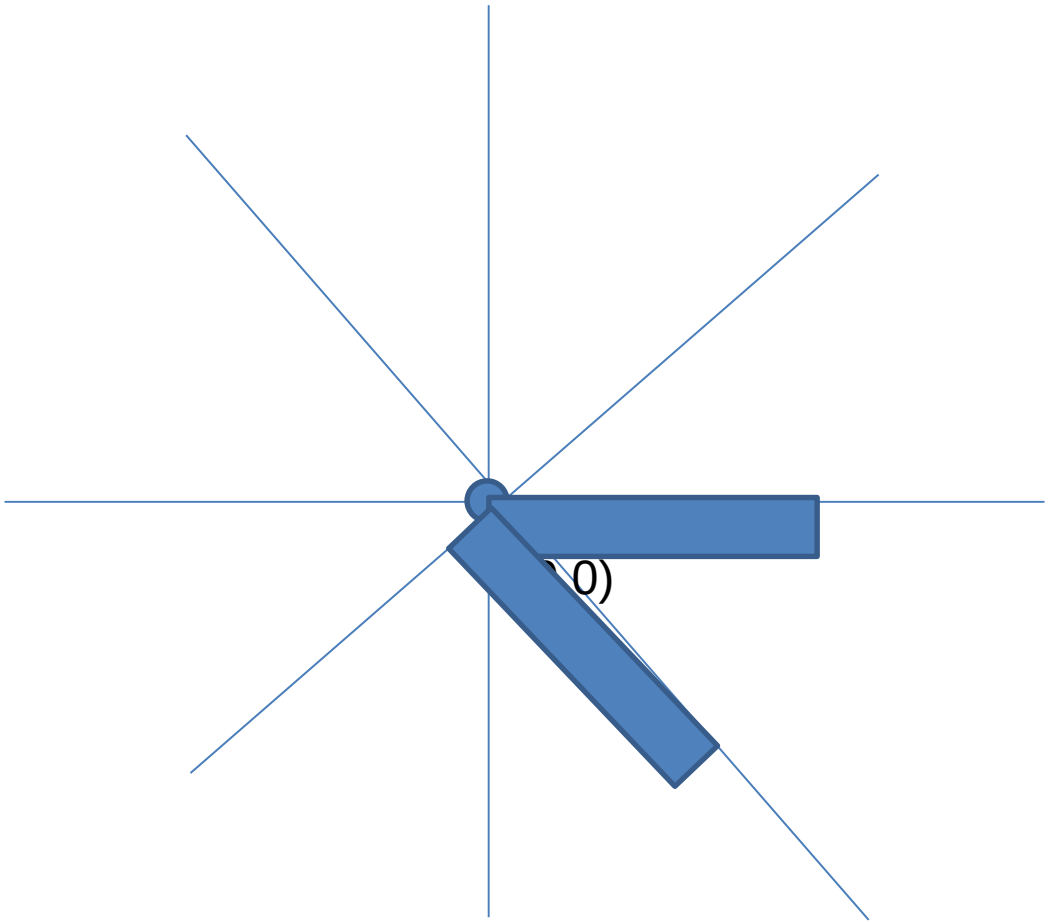


Originally, origin of 0,0
at top left of screen (with (50,50) marked below)

If we called g2.translate(50, 50), here‘s what would happen:

Always want to make sure we reset the pen, so when we’re done, we need to translate back to where we started, in this case: g2.translate(-50,-50)

Rotate



Let's say we've already translated to put the origin at (50,50) (mostly to make the slides look nicer)

If we drew a rectangle here like this:
g2.drawRect(0, 0, 50, 10);, we would get something like…

What would happen if we called g2.rotate(Math.PI/4); (radians) then call g2.drawRect(0, 0, 50, 10); again?

Remember, y is positive down instead of up, so the rotate will go reverse of what you might be expecting

Work on the biggest fan code

- We'll walk through it together to explain how the classes work
- Then you should modify the fan to print one blade vertically – use transform to move (0,0) to the **center** of the fan and then draw from there

Scene project

SCENE INTRODUCTION