Decisions
The Plan

- **Decisions at the Basic Level**
  - `if` `if/else`
  - What is equality?
- **Decisions at the Game/Graphics Level**
  - When do things collide?
- **Go over/write several programs**
  - RoundOffError.java
  - BoundingCircle.java
  - BoundingCircleTest.java
  - BoundingBox.java
  - BoundingBoxTest.java
If Statements

- Have seen two coding forms
  - if(boolean expression) {
    
    do something
  }
  - if(boolean expression) {
    
    do something
  }

  else {
    
    do some alternative
  }

- Often logical (boolean) expression asks about equality
  - Why can this be a problem?
String Equality

- Look at `stringEqualsTest`

```java
String one="happy day";
String two="happy"
  two+=" day";
System.out.println("Don't use == to compare Strings")
System.out.println("Test A: comparing "+one+" and "+two);
if(one==two)
  System.out.println("same object");
else
  System.out.println("different object");
if(one.equals(two))
  System.out.println("same contents");
else
  System.out.println("different contents");
```
String Equality

- Look at `stringEqualsTest` (continued)

two="happy day";
System.out.println("Test B: comparing " + one + " and " + two);

if(one==two)
    System.out.println("same object");
else
    System.out.println("different object");
if(one.equals(two))
    System.out.println("same contents");
else
    System.out.println("different contents");
Floating (double) Equality

- Look at `floatingEqualsTest`

```java
System.out.println(
        "Don't use == to compare floating point numbers");
double x = Math.sqrt(13);
if(x*x==13)
        System.out.println("same");
else
        System.out.println("different: " + x*x + "!=13");
```

- Look at `RoundOffError` in code directory
Game Level Decisions

- Video Game Level Domain: What are we trying to do
- Decide on collision (intersection)
  - Bullet with target
  - Two major objects
  - Beam (line) with target
- Potentially Very Difficult Problem
  - Imagine Complex shaped Space Ship
    - does bullet miss or just hit that fin?
- Different approaches available
  - First decide Exact or Approximate
    - For many games, especially fast moving, short cuts work
  - Exact solution costly:
    - difficult code
    - computer time demands result in sluggish game
Approximate Solutions

- **Approximate Shape of object**
  - Bounding Box
  - Bounding Circle
- **Design code to detect intersection of two rectangles**

```java
public class BoundingBox {
    double x, y, width, height

    public BoundingBox(double px, py, w, h) {
        x = px;
        y = py;
        width = w;
        height = h;
    }
}
```
Rectangle Intersection

```java
public boolean intersect(double px, double py, double w, double h) {
    // write in class...
}

public boolean isPointIn(double px, double py) {
    // write in class...
}
```
Approximate Solutions

- When is a bounding circle better than a bounding rectangle?
- Design code to detect intersection of two circles

- Note that much of this is done for you already if you choose the correct class
Exact Solutions

- Sometimes you can’t approximate
- See java.awt.geom
  - However, consider costs (even if you don't have to code)
  - Just because it’s done for you doesn’t mean it won’t take time

- Using constructive area geometry you can build complex shapes

- Look at API for classes that define intersection, etc.