Classwork today

- Back to bouncing balls
- Create a new BouncingSmiley using inheritance
- Create an Arraylist of bouncing balls and smileys
- Use random numbers for generating the balls and smileys
Random Number Review

- There are two standard ways to get random number
  - Use `random()` method of `Math` class.
  - Use `Random` class
  - Both use same underlying arithmetic.
  - Pseudo-random Numbers

- Using `Math.random()`
  - Returns `double` in range $0 \leq n < 1.0$
    - Does not include 1.0!
  - Simulate Die Roll
    ```java
    int roll = 1 + (int) (Math.random() * 6);
    ```
Random Number Review

- **Why use Random Class?**
  - Provides many methods that are convenient to use.

- **Twenty-sided Die**
  
  ```java
  Random gen = new Random();
  int roll = 1 + gen.nextInt(20);
  ```

- **Some Other Methods Provided**
  - `int nextDouble()`
  - `long nextLong()`
  - `int nextInt()`
  - `boolean nextBoolean()`
  - `void setSeed(long n)`
Using Random Numbers

- How my we create a random color?
  Random generator;
  generator = new Random();
  int red = generator.nextInt(256);
  int green = generator.nextInt(256);
  int blue = generator.nextInt(256);
  Color strange = new Color(red, green, blue);

- How might me generate a warm color?

- How might you generator numbers in the range –5 ... +5
Abstract Class

- A class that cannot be instantiated
- Defines specifications for a class, but doesn’t have all the implementations
- Forces users to redefine (override) methods
- Subclasses extend it
- May have abstract methods
  - There is no code
  - Subclasses that are not abstract must have a method of the same name with code
Inheritance hierarchy

- Mover and Bouncer are abstract classes
- Bouncer extends Mover
- BouncingBall and BouncingSmiley extend Bouncer
Polymorphism

- Ability to refer to objects of multiple types with varying behavior

- ArrayList<\texttt{Mover}> may contain BouncingBalls and BouncingSmileys and RaceCars

- They are all subclasses of Mover

- Can’t create a new Mover. Why?
Classwork Today

- Bouncing Smileys