Arrays:
Using arrays in simulations

Topics

We will be covering the following main topics:

- Introduction to Arrays for simulation

- Random selections into an Array

- Randomly inside some range

- Selections with Distributions

Introduction to Arrays for simulation

- Arrays allow us to store data that we can manipulate. We can randomly select things that we cannot randomly create.

- Random only creates numbers, what if we need a random String or Random BankAccount object.

Creating Random Choices

- Create an Array of objects that we wish to select from

```
// Declare a reference to an array that will hold Strings.
ArrayList<String> names = new ArrayList<String>();
```

- Add elements to the ArrayList

```
names.add("Suzy");
names.add("Sally");
names.add("Suki");
names.add("Sarah");
names.add("Sable");
names.add("Sabia");
```

Suzy	Sally	Suki	Sarah	Sable	Sabia
index 0	index 1	index 2	index 3	index 4	index 5

Creating Random Choices

- We can create random numbers from zero to five using the java Random class

- What would happen if we generated random numbers and used them to index into this array?

Suzy	Sally	Suki	Sarah	Sable	Sabia
index 0	index 1	index 2	index 3	index 4	index 5

Creating Random Choices

```java
public class RandomStuff {
    private java.util.Random rand =
        new java.util.Random();
    private java.util.ArrayList<String> names =
        new java.util.ArrayList<String>();


    public RandomStuff(){
        names.add("Suzy");
        names.add("Sally");
        names.add("Suki");
        names.add("Sarah");
        names.add("Sable");
        names.add("Sabia");
    }
```

```java
public void displayRandomNames(){
    int count = 3;
    int maxCount = 18;
    int randNumber = 0;
    String randName = "";


    while(count < maxCount){
        randNumber =
            rand.nextInt(names.size());
        randName = names.get(randNumber);
        System.out.println(randName);
        count++;
    }
    return;
  }
}
```

Creating Random Choices

Suzy
Sarah
Sable
Suki
Sarah
Sarah
Sable
Suki
Suki
Sabia
Sally
Suki
Suzy
Suki
Sable

This gives us random sample from a group. This is useful for things like lotteries where everything in the list should have an even chance of being picked.

Creating Biased Choices

- What if we want choices that include all possibilities but are more likely to pick some over others.
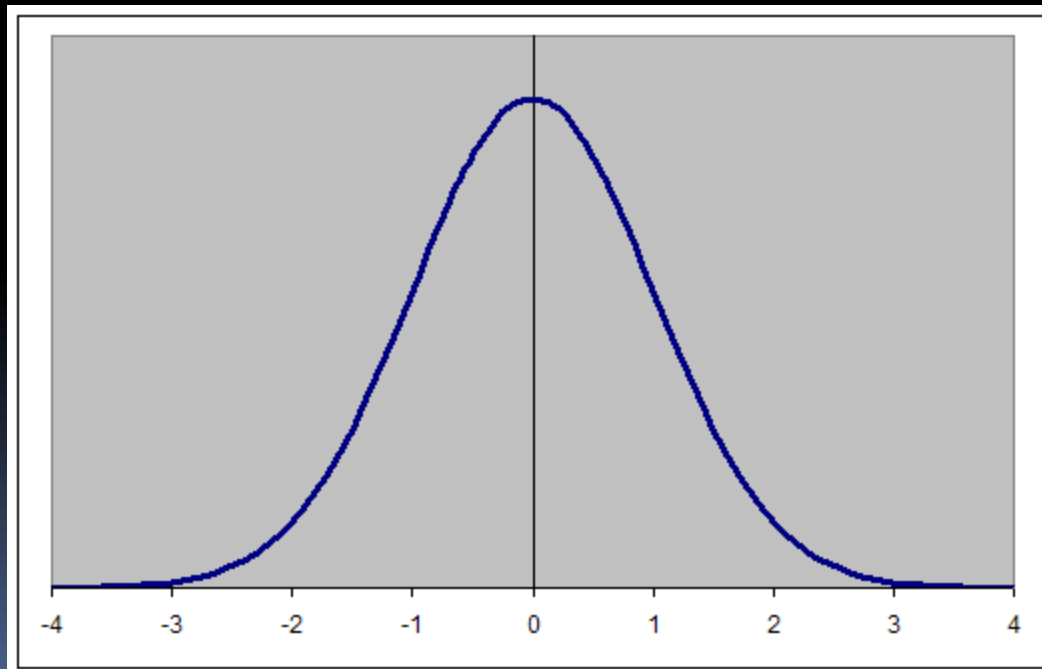
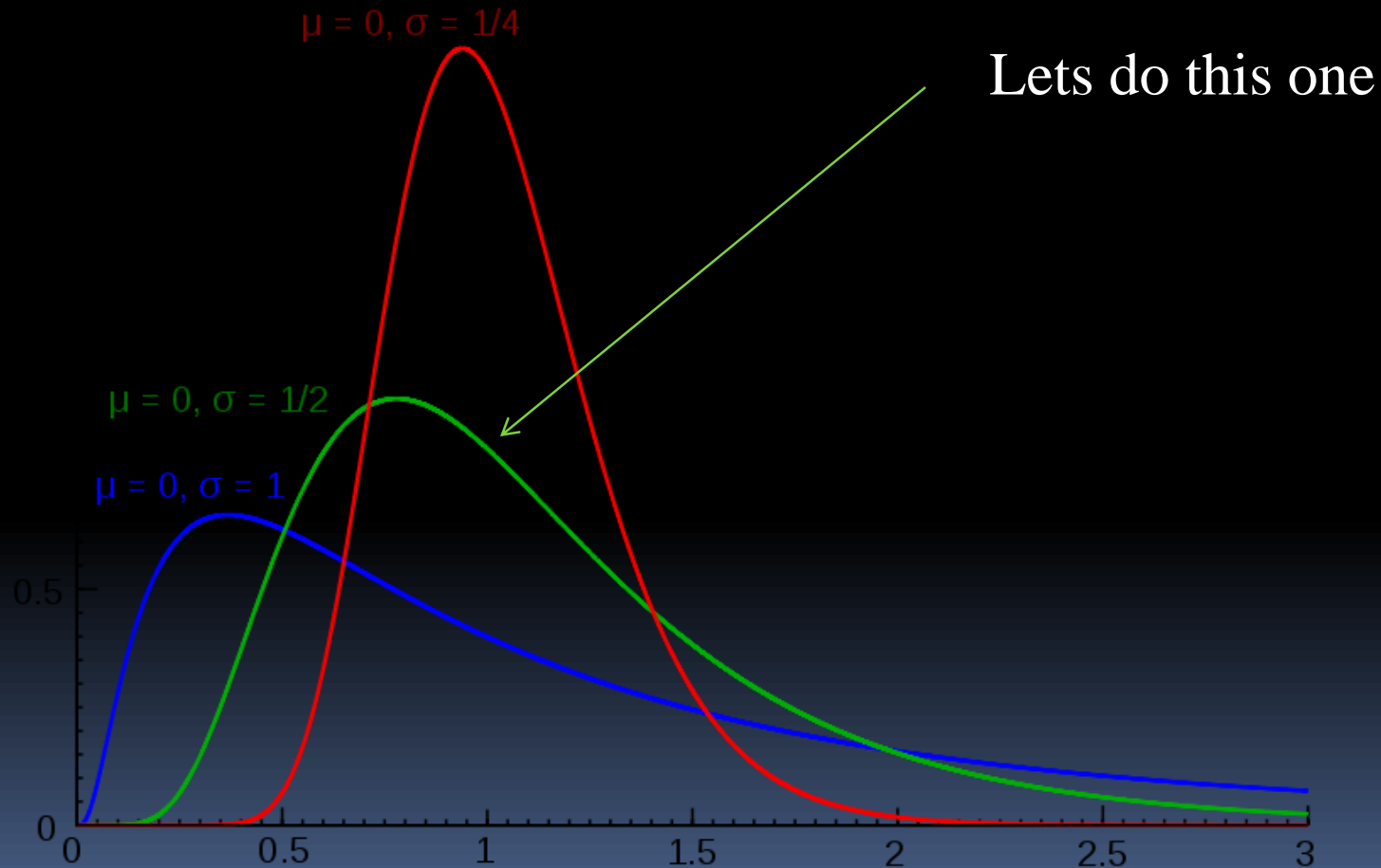# Creating Biased Choices

```
int[] numbers = {   -4,
                    -3,-3,
                    -2,-2,-2,
                    -1,-1,-1,-1,-1,-1,
                    0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                    1, 1, 1, 1, 1, 1,
                    2, 2, 2,
                    3, 3,
                    4
                };
```

Creating Biased Choices

Any type of distribution can be created this way including log-normal ones like this

μ = 0, σ = 1/4

μ = 0, σ = 1/2

μ = 0, σ = 1

Lets do this one

Creating Biased Choices

```
double[] nums = {   0.5,0.5
                    1.0,1.0,1.0,1.0
                    1.5,1.5,1.5, 1.5,1.5,1.5,
                    2.0,2.0,2.0,2.0,
                    2.5,2.5,2.5,
                    3.0,3.0,3.0,
                    3.5,3.5,
                    4.0,
                    4.5
                };
```