GUIDED NOTES: Creating Probability Simulations

*A **simulation** consists of a collection of things that happen at random. There is a situation that is repeated a large number of times, called the **component** of the simulation. Each component has a set of possible outcomes.*

Example: ***Fifty-seven students participate in a lottery for a particularly desirable dorm. Twenty of the participants were members of the same varsity team. All three winners were members of the team. Use a simulation of determine whether an all-team outcome could reasonably be expected to happen.***

The component here is the selection of a student for the room.
Since there are 57 students in the drawing, let's use 1 – 57 to represent the students.
Let's use 1 − 20 represent the team members and 21 − 57 represent the rest of the students.
Run RandInt (1, 57, 3) to simulate drawing names. (eliminate any trials where the same number comes up more than once). If all three numbers are between 1 and 20, then the whole room goes to team members.

You may get something like this:

RandInt (1, 57, 3)	OR	RandInt (1, 57, 3)
23, 51, 19		5, 19, 7
1 team members, 2 non-members		all team members
this counts as "not all team members"		this counts as "all team members"

When you run the trial once, it gives you one possible result, but that's not enough to make a decision. It will take lots of trials to decide whether an all-team outcome would be reasonable. Let's run 10 trials and look at the results:

Trial #	Numbers	Result
1	14, 28, 56	only one team member
2	4, 47, 23	
3	19, 15, 1	
4	45, 32, 11	
5	6, 18, 35	
6	11, 51, 23	
7	42, 27, 20	
8	22, 45, 51	
9	55, 38, 29	
10	6, 22, 54	

Looking at these results, there is 1 trial out of 10 that has the room going to three team members, so the probability would be 10%. Ten trials really isn't enough to make a decision either. It usually takes several hundred trials to get an accurate picture of the situation.

After 100 trials, results could look like this:

Room Selection	*frequency*
all team members	6
not all team members	94

Since the simulation shows that there is a 6% chance that the room will be filled by all team members, it is pretty surprising that this occurred.

You take a quiz with 6 multiple choice questions. Each question has 4 possible answers. Unfortunately, you forgot there was a quiz today, so you didn't study at all, so you have to guess at the answers. Design a simulation for this situation and determine the probability of getting at least half of the questions right.

First, figure out the probabilities we're working with.

P(guessing right) = _____ P(guessing wrong) = _____

Now we have to assign numbers to use in our simulation that will have the same ratio as these probabilities. Since there are 4 options, use the digits 1 – 4. Let one number represent the correct answer, and the other three will represent the wrong answers.

_____ = right answer _____ = wrong answers

Now we will run a random integer generator to simulate one try at the quiz. Since there are 6 questions on the quiz, we need 6 numbers. Run RandInt(1, 4, 6) – this will give us 6 numbers between 1 and 4.

Trial #	Numbers	Number of Right Answers
1	1, 3, 2, 3, 4, 2	
2	3, 4, 4, 2, 1, 1, 4	
3	4, 2, 3, 1, 3, 3	
4	3, 3, 1, 1, 1, 4	
5	1, 3, 4, 3, 1, 2	
6	3, 1, 3, 1, 3, 2	
7	1, 2, 4, 1, 3, 4	
8	2, 4, 4, 2, 4, 3	
9	4, 3, 3, 3, 2, 4	
10	2, 1, 4, 3, 2, 2	

What percentage of the trials had at least three answers correct? _____

1. You take a quiz with 5 multiple choice questions. After you study, you estimate that you would have about an 80% chance of getting any individual question right. What are your chances of getting them all right?

Let 1 – 80 represent a right answer, 81-100 represents a wrong answer. Run RandInt (1, 100, 5) and count how many right answers you receive. Run this 20 times – determine how many of these 20 had 5 correct answers.

2. Joe plays on the basketball team and over the course of the season, makes 71% of his free throws. In the championship game, he is fouled late in the game, with his team down by 1 point. What are his chances of making both free throws and winning the game?

Let 1 – 71 represent a made free throw, 72-100 are misses. Run RandInt(1, 100, 2) to represent two free throw shots. Record how many times Joe made both shots out of 20 trials.

3. A cereal company puts prizes in each box. There are 4 different prizes – 20% of the boxes have a blue bouncy ball, 30% of the boxes have a green bouncy ball, 40% of the boxes have a red bouncy ball, and only 10% of the boxes have a multi-colored sparkly bouncy ball. Design a simulation to determine how many boxes you will need to buy to get all 4 bouncy balls.

Let 0, 1 = blue; 2, 3, 4 = green; 5, 6, 7, 8 = red, and 9 = multi-colored ball. RandInt (0, 9, 1) will give the color of the first ball. Continue running until all 4 colors are received and record the number of tries it took to get all 4 colors. Repeat and find the mean of the number of tries after 20 trials.