# Part III: Gathering Data

## Chapter 11: Understanding Randomness

Obj - SWBAT recognize random outcomes in a real-world situation.

# Why Be Random?

- What is it about chance outcomes being random that makes random selection seem fair? Two things:

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# Why Be Random? (cont.)

- Statisticians don't think of randomness as the annoying tendency of things to be unpredictable or haphazard.
- Statisticians use randomness as a tool.
- But, truly random values are surprisingly hard to get…

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# It's Not Easy Being Random

- It's surprisingly difficult to generate random values even when they're equally likely.
- Computers have become a popular way to generate random numbers.
  - > Even though they often do much better than humans, computers can't generate truly random numbers either.
  - > Since computers follow programs, the "random" numbers we get from computers are really pseudorandom.
  - > Fortunately, pseudorandom values are good enough for most purposes.

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# It's Not Easy Being Random (cont.)

- There are ways to generate random numbers so that they are both equally likely and truly random.
- The best ways we know to generate data that give a fair and accurate picture of the world rely on randomness, and the ways in which we draw conclusions from those data depend on the randomness, too.

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# Practical Randomness

- We need an imitation of a real process so we can manipulate and control it.
- In short, we are going to simulate reality.

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# A Simulation

- The sequence of events we want to investigate is called a trial.
- The basic building block of a simulation is called a component.
- Trials usually involve several components.
- After the trial, we record what happened—our response variable.
- There are seven steps to a simulation…

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# Simulation Steps

- Identify the component to be repeated.
- Explain how you will model the component's outcome.
- Explain how you will combine the components to model a trial.
- State clearly what the response variable is.
- Run several trials.
- Collect and summarize the results of all the trials.
- State your conclusion.

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# What Can Go Wrong?

- Don't overstate your case.
- Beware of confusing what really happens with what a simulation suggests might happen.
- Model outcome chances accurately.
- A common mistake in constructing a simulation is to adopt a strategy that may appear to produce the right kind of results.
- Run enough trials.
- Simulation is cheap and fairly easy to do.

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# What have we learned?

- How to harness the power of randomness.
- A simulation model can help us investigate a question when we can't (or don't want to) collect data, and a mathematical answer is hard to calculate.
- How to base our simulation on random values generated by a computer, generated by a randomizing device, or found on the Internet.
- Simulations can provide us with useful insights about the real world.

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## Coin Tossing Simulation

If someone handed you a coin and told you that it's biased toward usually landing heads, you'd be justly skeptical. What would you do?

- How many tosses would you consider enough?
  - 10, 25, 100 tosses?
- Let's say we decide to toss the coin 100 times: if you had to make up a rule to help convince you that the coin is unfair?
- Using your calculators, perform a simulation!! See how the outcome compares to the rule you made above?

## Basketball Free Throw Rate

Suppose a basketball player has an 80% free throw success rate. How can we use random numbers to simulate whether or not she makes a foul shot? How many shots might she be able to make in a row without missing? Describe the waiting time simulation of having her shoot free throws until she misses, counting the number of successes.

Component:

Trial:

Response variable:

Statistic:

- How would our simulation procedure change if her success rate were only 72%?

- How would a trial and response variable change if we wanted to know how many shots she might make out of 5 chances she gets at a crucial point in the game?

- How would a trial and our response variable change if we want to know her chances of hitting both shots when she goes to the line to shoot two?

- How would the simulation change if we want to know her score in a 1-and-1 situation (Here, she gets to try the second shot *only* if she makes the first.

## Student Speaker at Back to School Night

Suppose we are to randomly select three students from the class to speak at Parents' Night about the joys of taking AP Stats. How likely it is we'll get three boys?

Use your random number table from your book to perform the simulation:

Row 1:

Row 2:

Row 3:

Row 4:

Row 5: