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Unit 7.8, Family Resource

Unit 8 Summary

Prior Learning	Grade 7, Unit 8	Grade 8
Grade 6 • Statistical variability • Data distributions Grade 7, Units 2 and 4 • Proportional reasoning • Percent change	• Probability of single step and multistep events • Sampling • Using samples to compare populations	• Construct and interpret scatter plots • Fit lines to bivariate data • Write and use linear models to make predictions.

Probability

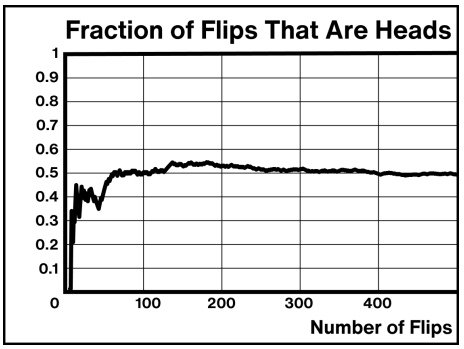
A *probability* is a number that represents how likely something is to happen.

If you flip a coin, the probability of the coin landing heads up is 0.5.

The probability that the coin turns into a bunny is 0.

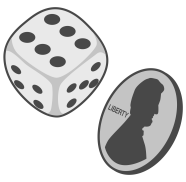
When you repeat an experiment, the results get closer and closer to the probability.

If you flip a coin 100 times, it might land heads up 50 times, 49 times, 52 times, or maybe even 60 times. As you flip the coin more times, the fraction of heads gets closer to 0.5.



In an experiment, it is often helpful to know the *sample space*, a list of every possible outcome.

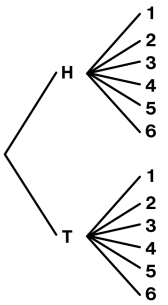
Here are two ways to represent the 12 possible outcomes of flipping a coin and then rolling a number cube.



Table

	1	2	3	4	5	6
H						
T						

Tree



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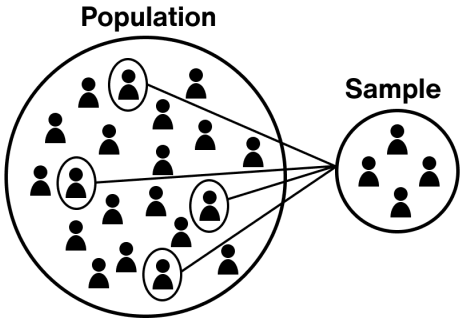
Sampling

Sometimes we want to know information about a group, but the group is too large for us to be able to ask everyone. It can be useful to collect data from a *sample* (some of the group) of the *population* (the whole group).

For example, we might want to know what percentage of Americans work from home. It would be too challenging to ask all Americans, so we can ask a smaller sample of working Americans.



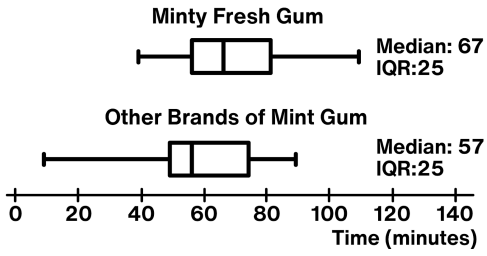
If our sample is some employees at a grocery store, we may get very different results than if our sample is some employees of a technology company. Neither sample is representative of the population of all working Americans.

A sample selected at random is most likely to be *representative* of the population because it has the chance to include all kinds of working adults.

We can use samples to estimate information about a population and to make comparisons.

For example, the Minty Fresh company collects data from a sample of gum buyers to see how many minutes it takes for their mint gum to lose flavor compared to other brands.

These box plots show that the median time for the sample of Minty Fresh Gum is longer than the sample of other brands.



However, there may not be a difference between two populations because there is a lot of overlap between the two samples, and because the difference in the medians is less than one IQR (interquartile range).

If you are interested in learning more about how these statistical measures are calculated, see the Statistics Summary.

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Try This at Home

Probability

DesPops makes a mystery lollipop. Each lollipop is one of these flavors: strawberry, lime, pineapple, or mango, but you don't know which flavor you have until you try it.

1.1 What is the probability of getting a strawberry flavored lollipop?

1.2 Would it be surprising to buy 5 lollipops and none were strawberry? Explain your thinking.

1.3 Hailey says that if she buys 200 lollipops, exactly 50 of them will be mango. Explain to Hailey what is incorrect about her reasoning.

A game uses cards that say "forward" or "backward" and a spinner numbered from 1 to 5. On their turn, a player picks a card and spins the spinner to find out which way and how much to move.

2.1 How many different outcomes are possible?

2.2 What is the probability that the next player will get to move their piece forward 5 spaces?

2.3 What is the probability that the next player will have to move their piece backward an odd number of spaces?

Sampling

A city council wants to know how many buildings in the city have lead paint, but they don't have enough time to test all $100\,000$ buildings in the city. They want to test a sample of buildings that will be representative of the population.

3.1 Describe a way to pick a sample that **is likely** to be representative of the population.

3.2 Describe a way to pick a sample that **is not likely** to be representative of the population.

Each year Brielle measures a random sample of her tomato plants.

Here is her data for the past two years.

4. Brielle is nervous that her garden this year isn't as healthy as last year's. Do you agree? Use at least one piece of evidence to support your claim.

Tomato Plant Heights

Last Year
Mean: 55 inches
MAD: 7.8 inches

This Year
Mean: 50.5 inches
MAD: 8 inches

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Solutions:

1.1 $\frac{1}{4}$ (or equivalent)

1.2 No. *Explanations vary.* With a sample of only 5 lollipops, it isn't surprising. The more lollipops you buy, the closer the fraction of strawberry lollipops will get to the probability.

1.3 *Responses vary.* Even though about 25% of your lollipops will be mango, we do not know exactly how many will be. It might be 50 lollipops, slightly more, or slightly less. There is even a small chance it will be way more or less than 50.

2.1 10 possible outcomes

2.2 $\frac{1}{10}$ (or equivalent)

2.3 $\frac{3}{10}$ (or equivalent)

3.1 *Responses vary.*

- Put the addresses of all the buildings into a computer and have the computer select 50 addresses randomly from the list.
- Put all of the street names in a bag. Pick several streets randomly and then test all the houses on that street.

3.2 *Responses vary.*

- Testing all the same type of buildings (like all the schools or all the gas stations).
- Testing buildings all in the same location, such as the buildings closest to city hall.
- Testing all the newest buildings or all of the oldest buildings.
- Testing a small number of buildings, like 5 or 10.

4. No, she does not need to be nervous.

Explanations vary. Even though this year, the mean height of her sample is less than it was last year, the difference is not that big. This year's plants are 4.5 inches shorter than last year's, which is less than the MAD. This means it's more likely that she just happened to end up with smaller plants in her sample, but that the populations are not that different.