

TOPIC  
8

### Review What You Know!

**Vocabulary**  
 Choose the best term from the box to complete each definition.

center  
 data distribution  
 statistical question  
 variability

1. A \_\_\_\_\_ is how data values are arranged.
2. The part of a data set where the middle values are concentrated is called the \_\_\_\_\_ of the data.
3. A \_\_\_\_\_ anticipates that there will be different answers when gathering information.
4. \_\_\_\_\_ is a measure that describes the spread of values in a data set.

**Statistical Measures**  
 Use the following data to determine each statistical measure.  
 9, 9, 14, 7, 12, 8, 11, 19, 15, 11

5. mean
6. median
7. range
8. mode
9. interquartile range (IQR)
10. mean absolute deviation (MAD)

**Data Representations**  
 Make each data display using the data from Problems 5–7.

11. Box plot
12. Dot plot

**Statistical Questions**

13. Which is *NOT* a statistical question that might be used to gather data from a certain group?

A In what state were you born?    
  C What is the capital of the United States?  
 B How many pets do you have?    
  D Do you like strawberry yogurt?

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 Topic 8 Use Sampling to Draw Inferences About Populations    
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### Build Vocabulary

Use the graphic organizer to record a definition and an example for each vocabulary word in Topic 8.

Vocabulary Word	Definition	Example
inference		
population		
random sample		
representative sample		
sample		
valid inference		

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### Solve & Discuss It!

The table shows the lunch items sold on one day at the middle school cafeteria. Use the given information to help the cafeteria manager complete his food supply order for next week.

Lunch Item	Number Sold
Turkey Sandwich	43
Hot Dog	51
Veggie Burger	14
Fish Taco	27

**Generalize** What conclusions can you draw from the lunch data?

### Lesson 8-1

## Populations and Samples

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**I can...** determine if a sample is representative of a population.

**Focus on math practices**

**Construct Arguments** Why might it be helpful for the cafeteria manager to look at the items ordered on more than one day?

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**Essential Question** How can you determine a representative sample of a population?

INTERACTIVE READINGS

ANSWERS

**EXAMPLE 1** U Understand Populations and Samples Scan for Multimedia

The 2,468 registered voters in Morgan's town are voting on whether to build a new stadium. Morgan and her friends really want the town to vote in favor of the new stadium. How can they determine how the voters will vote before the day of the vote?

**Model with Math**  
How can you represent the problem situation?

Morgan and her friends could ask every registered voter, or the entire **population** of voters in town, how they plan to vote. However, surveying 2,468 people takes a long time. Morgan and her friends may not be able to survey the entire population of voters.

Morgan and her friends could ask a subset, or a **sample**, of the registered voters in town how they plan to vote. Surveying a sample of voters does not take as long and is more reasonable to do. Morgan and her friends would be able to ask 100 or 200 people.

**Try It!**

Miguel thinks the science teachers in his school give more homework than the math teachers. He is researching the number of hours middle school students in his school spend doing math and science homework each night.

**Convince Me!** Why is it more efficient to study a sample rather than an entire population?

The  includes all of the students in Miguel's middle school.

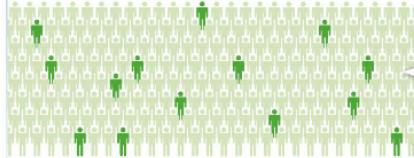
A possible  is some students from each of the grades in the middle school.

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**EXAMPLE 2** Describe a Representative Sample

Morgan decides to survey a sample of the town's voting population. How can she know that the survey results from the sample of voters represent the position of the entire town's population?



Morgan can survey a random sample, or a randomly selected group of voters, to make sure her results represent the position of the entire town.

A **representative sample** accurately reflects the characteristics of the entire population.

In a **random sample**, each member of the population has an equal chance of being included. A random sample tends to be a representative sample.

**Try It!**

A produce manager is deciding whether there is customer demand for expanding the organic food section of her store. How could she obtain the information she needs?

**EXAMPLE 3** Generate a Random Sample

How can Morgan generate a random sample of the town's voting population?

Morgan can follow these steps:

- STEP 1** Define the population.  
The population consists of the registered voters in the town.
- STEP 2** Choose the sample size.  
Morgan plans to survey 100 registered voters.
- STEP 3** Make or acquire a list of all members of the population.
- STEP 4** Assign a number to each member of the population.
- STEP 5** Generate a list of random numbers to select sample members.

The larger the sample, the more confident Morgan can be that the results represent the position of the population.

**Try It!**

Ravi is running against two other candidates for student council president. All of the 750 students in Ravi's school will vote for student council president. How can Ravi generate a representative sample that will help him determine whether he will win the election?

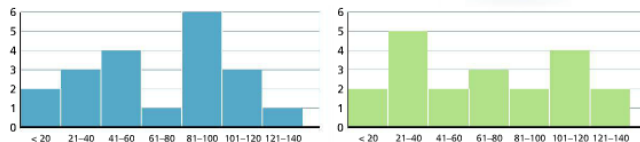
**EXAMPLE 4** Generate Multiple Random Samples

Morgan and Maddy will each generate a random sample of the 138 students in 7th grade at their school. They each write the numbers from 1 to 138 on small pieces of paper and put them in different hats. Then they draw 20 numbers randomly from their hats. What do you notice about the two random samples taken from the same population? What does this tell you about the sampling technique?

Morgan's Sample				Maddy's Sample			
55	49	28	79	38	106	21	102
114	106	18	130	25	35	127	126
97	50	83	109	100	119	27	51
38	91	36	46	135	103	13	72
87	96	15	93	122	7	74	54



- There are 20 members in each sample.
- The only numbers common to both samples are 38 and 106.
- The numbers are distributed differently in each sample.



The sampling method produces random samples that have mostly different members, but that are each likely to be representative of the population.

**Try It!**

The table at the right shows the random sample that Jeremy generated from the same population as Morgan's and Maddy's samples. Compare Jeremy's sample to Morgan's and Maddy's.

Jeremy's Sample			
77	8	32	17
34	95	81	57
125	116	30	126
92	61	22	36
111	68	110	69

**KEY CONCEPT** *whole group*

A **population** is an entire group of objects—people, animals, plants—from which data can be collected. A **sample** is a subset of the population. When you ask a statistical question about a population, it is often more efficient to gather data from a sample of the population.

A **representative sample** of a population has the same characteristics as the population. Generating a **random sample** is one reliable way to produce a representative sample of a population.

You can generate multiple random samples that are different but that are each representative of the population.

A population

A random sample

*small part*

**Do You Understand?**

- Essential Question** How can you determine a representative sample of a population?
- Construct Arguments** Why does a sample need to be representative of a population?
- Be Precise** The quality control manager of a peanut butter manufacturing plant wants to ensure the quality of the peanut butter in the jars coming down the assembly line. Describe a representative sampling method she could use.



**Do You Know How?**

- A health club manager wants to determine whether the members would prefer a new sauna or a new steam room. The club surveys 50 of its 600 members. What is the population of this study?
- A journalism teacher wants to determine whether his students would prefer to attend a national writing convention or tour of a local newspaper press. The journalism teacher has a total of 120 students in 4 different classes. What would be a representative sample in this situation?
- Garret wants to find out which restaurant people think serves the best beef brisket in town.
  - What is the population from which Garret should find a sample?
  - What might be a sample that is not representative of the population?

*All 600 members of the club make up the population.*

Name: \_\_\_\_\_

**Practice & Problem Solving**

**Leveled Practice** In 7 and 8, complete each statement with the correct number.

- Of a group of 200 workers, 15 are chosen to participate in a survey about the number of miles they drive to work each week.  
In this situation, the sample consists of the  workers selected to participate in the survey.  
The population consists of  workers.
- The ticket manager for a minor league baseball team awarded prizes by drawing four numbers corresponding to the ticket stub numbers of four fans in attendance.  
In this situation, the sample consists of the 4 people selected to win a prize. The population consists of all the spectators who purchased tickets to attend the game.
- A supermarket conducts a survey to find the approximate number of its customers who like apple juice. What is the population of the survey?
- A national appliance store chain is reviewing the performances of its 400 sales associate trainees. How can the store choose a representative sample of the trainees?

*→ HEB, Kroger, Safeway*

*The population is made up of all the customers who shop there.*

- Of the 652 passengers on a cruise ship, 30 attended the magic show on board.
  - What is the sample?
  - What is the population?
- Make Sense and Persevere** The owner of a landscaping company is investigating whether his 120 employees would prefer a water cooler or bottled water. Determine the population and a representative sample for this situation.



13. Higher Order Thinking A bag contains 6 yellow marbles and 18 red marbles. If a representative sample contains 2 yellow marbles, then how many red marbles would you expect it to contain? Explain.



$\frac{6Y \div 3}{18R \div 3} = \frac{2Y}{?R}$  We would expect 6 red marbles in the sample.

14. Chung wants to determine the favorite hobbies among the teachers at his school. How could he generate a representative sample? Why would it be helpful to generate multiple samples?

15. The table shows the results of a survey conducted to choose a new mascot. Yolanda said that the sample consists of all 237 students at Tichenor Middle School.

Tichenor M.S. Mascot Survey Results

Mascot	Number of Students
Panthers	24
Lions	6
Cyclones	2
Gemets	8

Yolanda mixed up sample and population. The sample size is 40 students, those who were surveyed.

a. What was Yolanda's error?  
b. What is the sample size? Explain.

16. Reasoning To predict the outcome of the vote for the town budget, the town manager assigned random numbers and selected 125 registered voters. He then called these voters and asked how they planned to vote. Is the town manager's sample representative of the population? Explain.

17. David wants to determine the number of students in his school who like Brussels sprouts. What is the population of David's study?

18. Researchers want to determine the percentage of Americans who have visited the Great Smoky Mountains National Park in Tennessee. The diagram shows the population of this study, as well as the sample used by the researchers. After their study, the researchers conclude that nearly 75% of Americans have visited the park.



- a. What error was likely made by the researchers?
- b. Give an example of steps researchers might take to improve their study.

19. An art teacher asks a sample of students if they would be interested in studying art next year. Of the 30 students he surveys, 81% are already enrolled in one of his art classes this year. Only 11% of the school's students are studying art this year. Did the teacher survey a representative sample of the students in the school? Explain.



No, he or she needs to survey students throughout the school, not just those in art class.

20. Make Sense and Persevere A supermarket wants to conduct a survey of its customers to find whether they enjoy oatmeal for breakfast. Describe how the supermarket could generate a representative sample for the survey.

21. Critique Reasoning Gwen is the manager of a clothing store. To measure customer satisfaction, she asks each shopper who makes big purchases for a rating of his or her overall shopping experience. Explain why Gwen's sampling method may not generate a representative sample.

Assessment Practice

22. Sheila wants to research the colors of houses on a highly populated street. Which of the following methods could Sheila use to generate a representative sample? Select all that apply.
- Assign each house a number and use a random number generator to produce a list of houses for the sample.
  - Choose every house that has at least 3 trees in the front yard.
  - Choose only the houses of the people you know.
  - List the house numbers on slips of paper and draw at least 20% of the numbers out of a box.
  - Choose all of the houses on the street that have shutters.

23. A national survey of middle school students asks how many hours a day they spend doing homework. Which sample best represents the population?

- PART A
- A) A group of 941 students in eighth grade in a certain town
  - B) A group of 886 students in sixth grade in a certain county
  - C) A group of 795 students in seventh grade in different states
  - D) A group of 739 students in different middle school grade levels from various states

PART B  
Explain the reasoning for your answer in Part A.

