

# Samples



## Getting the Idea

Statistics can be used to make generalizations about a population. A **population** is the group of interest. It is usually not possible to gather data from each member of a population, so the generalizations are often based upon a sample. A **sample** is a smaller group taken from the population.

Samples allow researchers to save time and money when gathering information. Samples are only useful if they are representative of the population. A **representative sample** is a portion of the population that is similar to the entire population. A **biased sample** is one in which some members of the population have a greater chance of being selected for the sample than other members. Because of bias, the sample does not fairly represent the population.

One way to gather information is by surveying the members of the sample. A **survey** is a question or set of questions used to gather **data**, or pieces of information. A survey can also be biased.

## Example 1

Reggie thinks that more students in his school are right-handed than left-handed. He surveys the students in his class and finds that 23 of the 27 students are right-handed. Do the results of Reggie's survey support his inference that more students in his school are right-handed than left-handed?

**Strategy** Use the definition of a representative sample to evaluate Reggie's sample.

A sample should be representative of the population.

The population being studied is the students in Reggie's school.

The students in Reggie's class are representative of all students in his school.

More students in his class are right-handed than left-handed.

The results of the survey support his inference.

**Solution** The results of Reggie's survey support his inference that more students in his school are right-handed than left-handed.

**Random samples** are usually preferred when gathering information about a population. In a random sample, each individual in the population has an equal chance of being part of the sample.

## Example 2

Collin asked every eighth student entering the school which of four subjects was his or her favorite. Can the results of Collin's survey be used to draw inferences about students' favorite subjects at the school?

**Strategy**     **Decide if the sample is representative and the survey is unbiased.**

**Step 1**

Decide if the sample is a random sample.

In a random sample, each individual in the population has the same chance of being part of the sample. Each student entering the school has the same chance of being one of every eight students entering the school.

**Step 2**

Decide if the sample is representative of the population.

The students in the school are the population.

The random sample is representative of the school population.

**Step 3**

Decide if the survey is biased.

The results are only representative of the four subjects included in the survey. It is biased toward these four subjects since other subjects are not included. The results can only be used to draw inferences about student preferences for the four subjects included in the survey.

**Solution**     **The results of Collin's survey can be used to draw inferences about student preferences for the four subjects included in the survey.**

You can use the results of a survey to make predictions about a population.

## Example 3

The table below shows the results of Collin's survey from Example 2.

**Favorite Subject**

Subject	Number of Students
Math	15
Science	20
Language Arts	10
Social Studies	5

There are 400 students at Collin's school. How many students would you predict prefer language arts?

**Strategy**     **Write and solve a proportion.**

**Step 1**

Add to find the total number of students Collin surveyed.

$$15 + 20 + 10 + 5 = 50$$

**Step 2**

Write a proportion.

Have each ratio show the number of students who prefer language arts to the total number of students. Let  $x$  represent all of the students at the school who prefer language arts.

$$\frac{10}{50} = \frac{x}{400}$$

**Step 3**

Cross multiply and solve for  $x$ .

$$\frac{10}{50} = \frac{x}{400}$$

$$10 \times 400 = 50 \times x$$

$$4,000 = 50x$$

$$x = 80$$

**Solution** Out of 400 students, 80 students would probably say they prefer language arts.

**Example 4**

Which two of the following samples are **not** good samples? Explain why.

- A. Every third shopper at a clothing store is asked whether he or she owns a pet.
- B. Every third shopper at a pet store is asked whether he or she owns a pet.
- C. At the beach in the summer, 150 people are asked to name their favorite vacation spot.
- D. A survey is mailed to 50 homes in a neighborhood, asking residents to name their favorite vacation spot.

**Strategy** Read each sample description and decide whether it is random or biased.

**Step 1**

In sample A, people shopping for clothes are chosen randomly to answer a question about pets, so this is a representative sample.

**Step 2**

Sample B is a biased sample. It is likely that most people who enter a pet store go there to purchase something for their pet.

**Step 3**

Sample C is biased since these people are probably already at a vacation spot.

**Step 4**

For sample D, the survey is randomly mailed to people in the neighborhood. The random sample is representative of the people in the neighborhood.

**Solution** Samples B and C are not good samples because each sample is biased.

The greater the number of participants in a survey, the closer the predictions will be to the actual choices of the population.

## Example 5

Tory and Flavia each surveyed students in their school about how they would vote for the student council representative from the seventh grade. Tory surveyed the students in her homeroom. Flavia randomly surveyed 10 students from each of the five seventh-grade homeroom classes. Their results are shown in the tables below.

**Tory's Results**

Candidate	Number of Students
Timothy	8
Andrew	9
Lea	7

**Flavia's Results**

Candidate	Number of Students
Timothy	14
Andrew	21
Lea	15

Use their results to predict the winner of the election.

**Step 1**

Identify the population.

The population is the seventh graders at the school.

**Step 2**

Decide if the samples are representative samples.

Both samples appear to be representative samples.

**Step 3**

Compare the data in the tables.

In both tables, Andrew has the greatest number of votes.

**Step 4**

Use the results to predict the winner.

It appears likely that Andrew will win the election.

Notice that Andrew has a bigger lead in Flavia's table than in Tory's.

Since Flavia's sample size is greater than Tory's, her results make it seem more likely that Andrew will win than Tory's table. Her results also predict that Andrew will win by a larger margin than Tory's results.

**Solution**

**From the survey results, Andrew is the predicted winner.**



## Coached Example

Victoria randomly surveyed every tenth student who came to school on Monday. She asked each student to name his or her least favorite vegetable. The table below shows the results of her survey.

Vegetable	Number of Students
Broccoli	3
Asparagus	5
Spinach	12
Turnips	5

In a survey of 100 students at her school, how many students would you predict to choose spinach as their least favorite vegetable?

Victoria surveyed a total of \_\_\_\_\_ students.

Write a proportion in which each ratio shows the number of students who chose \_\_\_\_\_ as their least favorite vegetable to the \_\_\_\_\_ number of students.

Let  $s$  equal the number of students out of 100 who would choose spinach.

Cross multiply and solve for  $s$ .

$$s = \underline{\hspace{2cm}}$$

In a survey of 100 students, \_\_\_\_\_ students would probably choose spinach as their least favorite vegetable.



## Lesson Practice

Choose the correct answer.

- Martha is planning to survey people at a water park to determine the most popular water slide at the park. Which would be the best sample for her survey to draw a valid inference?
  - children at the park between the ages of 3 and 5
  - children at the park between the ages of 6 and 10
  - adults at the park between the ages of 20 and 30
  - adults and children of all ages at the park
- A newspaper is conducting a survey to determine which American professional baseball team is most popular. How would it most likely get a random sample that is representative of the population?
  - by asking people at a Florida Marlins game
  - by calling people from around the country
  - by asking every fifth person entering the stadium at a Red Sox game
  - by asking people at a Cincinnati Reds game

Use the information below for questions 3 and 4.

Mr. Callahan just opened a flower shop. He took a random survey of shoppers to find out their favorite flowers and recorded the results in the table below.

Favorite Flower

Type	Shoppers
Daffodil	14
Lily	10
Rose	24
Daisy	12

- What is the size of the sample?
  - 4
  - 50
  - 60
  - 64
- If Mr. Callahan expects to sell 150 bunches of flowers next week, which is the best prediction of how many bunches of daffodils he should have in his shop?
  - 28
  - 35
  - 42
  - 60

5. Which of these is **not** a random sample that would be valid to determine the favorite food of students in your school?
- A. five students at a local pizza parlor
  - B. every sixth student on the school roster
  - C. every tenth student entering school in the morning
  - D. three students from each table in the lunchroom
6. Miko took a survey of the students in her grade to see how many are likely to join a book club if she starts one. She surveyed 48 students, and ten said they would join. If there are 240 students in her grade, how many students might Miko expect to join the club?
- A. 28
  - B. 38
  - C. 48
  - D. 50

7. A survey asked students at a middle school which of four after-school sports they would most like to have at their school. The students who participated in the survey were randomly selected during their lunch period. The results are shown in the table below.

After-School Sports

Sport	Number of Students
Track	22
Cross-Country	15
Lacrosse	48
Tennis	15

- A. Identify the population and the sample. Is the sample representative of the population? Explain your thinking.

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- B. If you assume that the sample is representative of the population, how many students would you predict to choose lacrosse in a school of 750 students? Is the prediction a good prediction? Explain.

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8. Carson is going to survey students in his school to determine how many students use social media. Is each a good sampling method? Select Yes or No.

A. Carson will survey random students in the computer club.  Yes  No

B. Carson will survey three random students from each homeroom.  Yes  No

C. Carson will survey every third student leaving school in the afternoon.  Yes  No

D. Carson will survey all of his friends.  Yes  No

9. George took a survey of students in his grade to see how many are likely to go to the championship basketball game. He surveyed 52 students, and 32 said they would go to the game. Circle the number that makes the statement true.

Based on George's survey, if there are 260 students in his grade, he might expect them to go to the game.

160

165

170

175

of

10. Teresa plans to survey people to determine their favorite type of movie. Is each a good sampling method? Select True or False.

A. Survey every fifth person in line for the opening of an action movie.  True  False

B. Survey every fifth person entering supermarket in the morning.  True  False

C. Survey every tenth person in the phone book.  True  False

D. Survey four students from each table in the lunch room.  True  False

E. Survey every third person entering the science fiction club meeting.  True  False



11. Which sample is **not** a good sample? Circle all that apply.
- A. Every fourth student coming out of a college cafeteria is asked about his or her favorite college.
  - B. Every fourth person in line at an airport in New York City is asked about his or her favorite college.
  - C. Every fourth person at a grocery store is asked about his or her favorite college.
  - D. Every fourth person in a college dormitory is asked about his or her favorite college.
12. Stacey took a survey of students in her grade to estimate the number of students who have cell phones. She surveyed 70 students, and 45 said they have cell phones. Circle the number that makes the statement true.

Based on Stacey's survey, if there are 300 students in her grade, she might expect about of them have cell phones.

45
120
183
193

13. Kenesha surveyed random students in her school about their choice for the prom queen. The results are shown in the table below. Is each a good prediction based on the survey results? Select Yes or No.

**Prom Queen**

Candidate	Number of Students
Hana	9
Cindy	11
Mavis	18
Bala	7
Diane	5

- A. If 120 vote for prom queen, Mavis would get approximately 43 votes.       Yes     No
- B. If 80 vote for prom queen, Diane would get approximately 8 votes.       Yes     No
- C. If 150 vote for prom queen, Bala would get approximately 21 votes.       Yes     No
- D. If 180 vote for prom queen, Hana would get approximately 18 votes.       Yes     No
- E. If 210 vote for prom queen, Cindy would get approximately 26 votes.       Yes     No