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33 Making Inferences Based on Samples

PART 1

Introduction

The purpose of collecting samples is to study a larger population. Based on the sample data, **inferences**, or predictions, about a population can be made.

Last year, 18 students in a class of 30 seniors said they planned to go to college. If there are a total of 400 students in the school this year, what prediction could be made about the total number of students who plan to go to college?

You can use a proportion to find out. One ratio represents the sample, and the other the population. Let x represent the unknown number, which is the number of students who plan to go to college out of the entire population of students.

A proportion is an equation that says two ratios are equal: $\frac{a}{b} = \frac{c}{d}$.

$$\frac{\text{students planning to go to college}}{\text{total students}} \rightarrow \frac{18}{30} = \frac{x}{400}$$

$$\begin{aligned} \text{Solve the proportion for } x: (30)(x) &= (18)(400) \\ 30x &= 7,200 \\ x &= 240 \end{aligned}$$

So, given that 18 students in a sample of 30 plan to go to college, you can predict that from the population of 400 students, 240 of them plan to go to college.

To gauge the variation in predictions, you can generate multiple samples of the same size. For example, suppose you want to determine students' favorite lunches in the school cafeteria. You survey two different groups of 25 random students.

Sample	Chicken Strips	Pizza Sticks	Turkey Wrap
1	8	12	5
2	14	8	2

If you analyze sample 1 only, you would conclude that the most popular school lunch is pizza sticks. If instead you analyze sample 2 only, you would conclude that the most popular school lunch is chicken strips. To be sure that your predictions are reasonable, you can generate additional samples.

Think About It

Can you think of time in your life when you conducted a survey or a poll? What were you studying?



Focused Instruction

When sample data is given as a percentage, multiply it and the population to find the prediction.

- ▶ On a school baseball team, 30% of the players have a batting average over 0.325. Given this information, out of 200 players in a countywide baseball league, how many are expected to bat over 0.325?

What is the population for this situation?

What is the size of the sample?

What is being predicted in this problem?

How do you find a percent of a number?

What is 30% as a decimal?

Write and solve an equation to find the prediction.

How many players in the league are expected to bat over 0.325?

To find a percent of a number, multiply by the equivalent decimal. So, 30% of x would be 0.3 times x .

Read carefully to be sure you are answering the question that is asked.

- A survey of families who took a summer vacation found that $\frac{3}{4}$ of them traveled by car. If 10,860 families in one city take a summer vacation, how many would be expected to **not** travel by car?

What question is being studied?

What is the population? _____

Does the information about the sample tell you the fraction that traveled by car or that did **not** travel by car?

What fraction describes the part of the sample that did **not** travel by car?

Write this fraction as a decimal. _____

Calculate the number of families in the population that did **not** travel by car. Show your work.

About _____ families would be expected to not travel by car.

The fraction that describes the total number of families in the population is $\frac{4}{4}$.

You can generate samples for comparison in order to refine predictions. Work with a partner to answer these questions.

- Generate three samples of data to estimate the average sentence length in a nonfiction book or a novel. How do the samples compare?

Select a book. What is its title?

Collect sample 1. Open the book and point to a paragraph at random. Count the number of words in the paragraph. Count the number of sentences. Calculate the average number of words per sentence. Record your data in the table on the next page.

Repeat on two different pages for samples 2 and 3.

Divide the total number of words by the number of sentences to find the average.

	Number of Words	Number of Sentences	Average Words/Sentence
Sample 1			
Sample 2			
Sample 3			

Were the averages all the same? _____

Explain how your inference about the average sentence length in the book depends on the sample you analyze.

How could you determine the average sentence length for the book using all three of your samples?

Use what you know about making inferences to answer these questions.

- 1 There is a 20% chance that customers at a café will order pie. If the café has 650 customers this week, how many can be expected to order pie?

- 2 In a sample of 50 students, 40 travel to school by bus. If the school has 350 students, how many will travel by bus?

Solve the following problems.

- 1** A car lot sells 5 luxury cars the first month, 3 luxury cars the second month, and 2 luxury cars the third month.

Add up the number of cars sold each month.

Part A If there were 20 total luxury cars on the lot in the first 3 months, what percent of them sold?

Answer _____ %

Part B The car lot gets in 60 more luxury cars. Based on the first 3 months, how many of them should sell within 3 months?

Answer _____ cars

- 2** Four out of 10 people who visit a certain social media site join the site within the first 6 months. If 1,260 people visit the site, how many of them would be expected to join the site within 6 months?

Set up a proportion to compare people who join to people who visit.

Answer _____ people

- 3** Abe weighed two samples of 10 apples each to find the average apple weight. His data is shown.

	Sample 1	Sample 2
Average apple weight	7.5 ounces	4.2 ounces

What inference could you make using both samples?

Solve the following problems.

- Out of 275 firefighter candidates that take the physical exam, 60% are expected to pass. Based on these predictions, how many candidates will pass?
 - 46
 - 110
 - 165
 - 215
- The table lists data collected from two random samples of 100 moviegoers about their movie preferences.

Sample	Drama	Action	Comedy	Horror
1	18	60	8	14
2	15	58	10	17

Make two inferences based on the data.

Inference 1 _____

Inference 2 _____

- Researchers estimate that 15 out of every 25 customers at a store make purchases with a credit card. If the store has 600 customers tomorrow, how many credit card charges can be expected? Show your work.

Answer _____ charges

- 4 A shipment of 12 boxes of 50 magazines each arrives at a newsstand. Vijay opens up several boxes and looks at the top 5 magazines for damaged covers.

Part A Will this give Vijay a reliable way to predict the total number of damaged magazines in the entire shipment? Why or why not?

Part B Suppose the chance of a cover being damaged is 3%. How many magazines in the shipment could Vijay expect to have damaged covers? Show your work.

Answer _____ magazines

- 5 In a sample of 25 students at a music school, 11 students play more than one instrument. There are 300 total students at the music school. Based on the sample, how many students would probably play more than one instrument?

Answer _____ students

- 6 Sophie surveyed 30 random students in her school. Of these, 18 said they enjoy watching soccer. A total of 1,050 students are in the school. How many students would be expected to enjoy soccer?

- A 126
B 504
C 630
D 735