8-3 Inferences

What You'll Learn

To use data from random samples to draw inferences about populations

🔊 **New Vocabulary** inference

Why Learn This?

You can use data from a random sample of a population to draw inferences about the entire population. When you draw an **inference**, you make a prediction or conclusion based on data or reasoning.

Please put the definition in your notes

Drawing Inferences about a Population

① **Multiple Choice** A restaurant manager selected a random sample of 20 customers and recorded the amount they spent on their meal. Based on the sample, which is the best estimate of the average, or mean, amount that customers spend on a meal at the restaurant?

Ⓐ $14   Ⓑ $16   Ⓒ $18   Ⓓ $20

Step 1 Find the average, or mean, of the sample data.

$$\text{mean} = \frac{\text{sum of the data values}}{\text{number of data values}}$$

$$= \frac{320}{20}$$

$$= 16$$

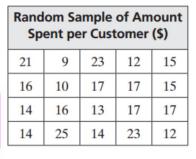| Random Sample of Amount Spent per Customer ($)				
21	9	23	12	15
16	10	17	17	15
14	16	13	17	17
14	25	14	23	12

Step 2 Use the average of the sample data to draw an inference.

The average amount spent by customers in the sample is $16, so the average amount spent by all customers is likely close to $16. The answer is B.

Example

① **Drawing Inferences about a Population** A clothing store selected a random sample of 20 customers and recorded the amount they spent on clothes. Based on the sample, what is the average, or mean, amount that customers spent on clothing?

Step 1 Find the average, or mean, of the sample data.

$$\text{mean} = \frac{\text{sum of the data}}{\text{number of data items}}$$

$$= \frac{\boxed{}}{\boxed{}}$$

$$= \boxed{}$$

Random Sample of Amount Spent per Customer ($)				
25	72	10	125	29
96	46	21	17	31
84	63	19	35	9
146	28	57	82	65

Step 2 Use the average of the sample data to make an inference.

The average amount spent by customers in the sample is $\boxed{}$ so the average amount spent by all customers is likely close to $\boxed{}$

1. A restaurant manager selected a random sample of
   20 customers and recorded the amount they spent on their
   meal. Draw an inference about the percent of customers at the
   restaurant who spend more than $20.

Random Sample of Amount Spent per Customer ($)				
21	9	23	12	15
16	10	17	17	15
14	16	13	17	17
14	25	14	23	12

Different random samples from the same population may give different
results. By comparing the samples, you can determine how much
estimates or predictions made from the samples will vary.

2 **Student Government** There are 360 students at a middle school. Sonya, Jane, and Danny each survey a random sample of 25 students about whom they plan to vote for in the election for student council president. Their results are shown in the table.

Votes for Student Council President

Candidate	Sonya's Sample	Jane's Sample	Danny's Sample
Emma	6	7	6
Ty	7	5	4
Carlos	12	13	15

a. For each sample, predict how many votes Carlos will get.

Use a proportion: $\dfrac{\text{votes for Carlos in sample}}{\text{students in sample}} = \dfrac{\text{predicted votes for Carlos}}{\text{students in school}}$

Sonya's Sample:

$\dfrac{12}{25} = \dfrac{x}{360}$

$12 \cdot 360 = 25x$

$4{,}320 = 25x$

$173 \approx x$

about 173 votes

Jane's Sample:

$\dfrac{13}{25} = \dfrac{x}{360}$

$13 \cdot 360 = 25x$

$4{,}680 = 25x$

$187 \approx x$

about 187 votes

Danny's Sample:

$\dfrac{15}{25} = \dfrac{x}{360}$

$15 \cdot 360 = 25x$

$5{,}400 = 25x$

$216 = x$

about 216 votes

b. Describe the variation in the predictions.

The greatest prediction is 216 votes, and the least prediction is 173 votes. So the predictions vary by $216 - 173 = 43$ votes.

c. Draw an inference about the number of votes Carlos will get.

Carlos is likely to get about 187 votes, the median prediction.

Vocabulary Tip

The *median* of a data set is the middle value, or the mean of the two middle values, when the data are listed in numerical order.

Example

2 **Comparing Random Samples** There are 240 workers in a local factory. The factory owner surveys 3 random samples of 25 people each about which new work schedule they would like to adopt. The results are shown in the table.

Schedule	Sample 1	Sample 2	Sample 3
Schedule A	4	7	2
Schedule B	12	10	14
Schedule C	9	8	9

a. For each sample, predict how many votes Schedule B will get.

Use a proportion: $\dfrac{\text{votes for Schedule B in sample}}{\text{people in sample}} = \dfrac{\text{predicted votes for Schedule B}}{\text{people in factory}}$

Sample 1: $\dfrac{12}{25} = \dfrac{x}{240}$

$\boxed{12} \cdot 240 = 25x$

$\boxed{2{,}880} = 25x$

$\boxed{115} \approx x$

Sample 2: $\dfrac{10}{25} = \dfrac{x}{240}$

$10 \cdot 240 = 25x$

$2{,}400 = 25x$

$96 = x$

Sample 3: $\dfrac{14}{25} = \dfrac{x}{240}$

$14 \cdot \boxed{240} = 25x$

$\boxed{3{,}360} = 25x$

$\boxed{134} \approx x$

Based on Sample 1, Schedule B will get about $\boxed{115}$ votes. Based on Sample 2, Schedule B will get about 96 votes, and based on Sample 3, it will get about $\boxed{134}$ votes.

b. Describe the variation in the predictions.

The greatest prediction is $\boxed{134}$ votes, and the least prediction is 96 votes. So the predictions vary by $\boxed{134} - 96 = \boxed{38}$ votes.

c. Make an inference about the number of votes Schedule B will get.

Find the mean of the predictions: $\dfrac{\boxed{115} + 96 + \boxed{134}}{3} = \dfrac{\boxed{345}}{3} = \boxed{115}$.

Schedule B will get about $\boxed{115}$ votes.

2. The table shows the results of 3 random samples of 30 students each at a middle school with 420 students. The students were asked how many hours they spend online each week.

Hours Spent Online Per Week

Time (h)	Sample 1	Sample 2	Sample 3
< 5	16	13	11
≥ 5	14	17	19

    a. For each sample, predict how many students in the school spend at least 5 hours online per week. [_____]; [_____]; [_____]

    b. Describe the variation in the predictions. [_____]

    c. Draw an inference about the number of students in at the school who spend at least 5 hours online per week.

[_____]

Without looking at your notes, table talk about this vocabulary word.

Vocabulary

An inference is [_____]

You have a guided problem solving worksheet, and time to begin working on it now.

You are allowed use of calculators of this assignment.

Name_____ Class_____ Date_____

8-3 • Guided Problem Solving

GPS **Student Page 295, Exercise 13:**

Reasoning A government inspector takes 5 random samples of the same size from a shipment of eggs. She determines the mean weight of a dozen eggs in each sample. What can the inspector conclude if the mean weights of the samples are very close to each other?

Understand

1. What are you being asked to do? _____
_____

2. How will you find the answer? _____
_____

Plan and Carry Out

3. How do you find the mean weight of one sample of eggs? _____
_____

4. What does the mean tell you about a sample?
_____

5. What can you tell by comparing the means of all the samples? _____
_____

6. What can you conclude if the mean weights of all the samples are very close to each other?
_____
_____
_____

Check

7. How can you be sure your answer is correct? _____
_____

Solve Another Problem

8. A poll taker interviews 10 random samples of 20 people each about the number of minutes they spend exercising each day. What can the poll taker conclude if the mean numbers of minutes spent exercising per day are very far apart? _____
_____