LESSON MAKER PRO

Estimate the Unknown

Use resampling to estimate a population mean.

HIGH SCHOOL · MT.PLUS.DATA.INF.2

MT.PLUS.DATA.INF.2 "Estimate a population parameter from a representative sample by: Understanding why the sample statistic is the best estimate for the associated population parameter..."

NAME _____ DATE _____

THE BIG IDEA

A representative sample mean is your best estimate of the population mean, but another sample could give a different result. To estimate that variation, repeatedly choose values from the sample with replacement, keeping the sample size the same. For a large enough sample with an approximately normal distribution of means, an approximate 95% confidence interval is the sample mean plus or minus two standard deviations of the resampled means.

WORKED EXAMPLE

A large representative sample has the results shown. Find an approximate 95% confidence interval for the population mean.

TIME IN MINUTES

Measure	Minutes
Sample mean	37
Bootstrap SD	7

1. Multiply the bootstrap SD by 2: 2 × 7 = 14.
2. Lower end: 37 - 14 = 23.
3. Upper end: 37 + 14 = 51.

Answer: 23 to 51 minutes

PRACTICE 4 problems

1 A sample is 6, 8, 10, 12. Find the mean of this resample: 6, 6, 10, 12.

ANSWER _____

2 A large representative sample has mean 15 and bootstrap SD 1. Find an approximate 95% confidence interval.

ANSWER _____

3 A sample is 7, 9, 11. Is 7, 7, 11 a valid resample with replacement? Explain.

ANSWER _____

4 A population has mean 50. Means from four independent samples are 46, 48, 52, 54. Find their average. Is it centered at the population mean?

ANSWER _____

APPLY IT Show your work

1 A large representative sample of students reports a mean of 42 minutes of gaming on a school day. The bootstrap SD is 5 minutes. Find an approximate 95% confidence interval and state what it estimates.

WORK SPACE

ANSWER _____

2 A large representative sample has a mean bus wait of 18 minutes and a bootstrap SD of 3 minutes. Find an approximate 95% confidence interval. Why can a student appear more than once in a resample?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A population has mean 100. In 100 simulated samples, the SD of the sample means is 10. Use the table to find the percent of sample means within two SDs of the population mean. A separate large representative sample has mean 104 and bootstrap SD 10. Give its approximate 95% confidence interval.

SIMULATED SAMPLE MEANS

Sample mean	Count
Below 80	2
80 to under 100	48
100 to 120	47
Over 120	3

WORK SPACE AND ANSWER

Estimate the Unknown

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A sample is 6, 8, 10, 12. Find the mean of this resample: 6, 6, 10, 12.	**8.5**
2	A large representative sample has mean 15 and bootstrap SD 1. Find an approximate 95% confidence interval.	**13 to 17**
3	A sample is 7, 9, 11. Is 7, 7, 11 a valid resample with replacement? Explain.	**Yes. It has three values from the sample, and replacement allows 7 to appear twice.**
4	A population has mean 50. Means from four independent samples are 46, 48, 52, 54. Find their average. Is it centered at the population mean?	**The average is 50, so these sample means are centered at the population mean.**

PART 2 · APPLY IT

1. **32 to 52 minutes. It estimates the mean school-day gaming time for all students in the population.** Compute 42 ± 2 × 5. The interval estimates a population mean, not each student's gaming time.
2. **12 to 24 minutes. Resampling with replacement allows the same student's wait time to be selected again.** Compute 18 ± 2 × 3. With replacement, each selected value remains available for the next draw.

CHALLENGE

95% lie within 80 to 120. The approximate 95% confidence interval is 84 to 124.

Accept interval endpoints written with brackets. The simulated sampling distribution is centered on the population mean, while the bootstrap interval is centered on the observed sample mean.