LESSON MAKER PRO

Mean Estimate Lab

Use resampling to show uncertainty in a mean.

HIGH SCHOOL · MT.PLUS.DATA.INF.2.b

MT.PLUS.DATA.INF.2.b "Estimate a population parameter from a representative sample by: Understanding that sampling variability introduces uncertainty in the estimate..."

NAME _____ DATE _____

FROM SAMPLE TO INTERVAL

Means from repeated random samples center at the population mean. With large enough samples, their distribution is roughly bell-shaped, and about 95% of the means fall within 2 standard deviations of the population mean. Resample with replacement from your observed sample to estimate that standard deviation, then use observed mean ± 2 × bootstrap SD for an approximate 95% confidence interval.

WORKED EXAMPLE

A representative sample of 100 students has a mean of 51 minutes. Many resamples are drawn with replacement. Use the results to estimate a 95% confidence interval for the population mean.

RESAMPLING RESULTS

Measure	Minutes
Observed mean	51
Bootstrap center	51
Bootstrap SD	3

1. The bootstrap means center at the observed mean, 51.
2. Margin of error: 2 × 3 = 6.
3. Endpoints: 51 - 6 = 45 and 51 + 6 = 57.

Answer: Approximately 45 to 57 minutes.

PRACTICE 4 problems

1 Observed sample: 5, 8, 11. One resample with replacement is 5, 5, 11. Find the resample mean.

ANSWER _____

2 An observed mean is 40, and the bootstrap SD is 4. Find an approximate 95% confidence interval.

ANSWER _____

3 A sampling distribution has population mean 100 and SD 5. About 95% of its sample means lie between what values?

ANSWER _____

4 Of 20 simulated sample means, 19 are within 2 SDs of the population mean. What percent is this, and does it match the 95% rule?

ANSWER _____

APPLY IT Show your work

1 A random sample of 100 students reports their daily gaming time. Use the resampling results to give an approximate 95% confidence interval and say what it estimates.

GAMING TIME

Measure	Minutes
Observed mean	20
Bootstrap SD	2

ANSWER _____

2 A random sample of 80 shoppers gives an observed mean sneaker price of $60. The plot shows 20 of many bootstrap means; the bootstrap SD is about $4. Describe the plot's shape and give an approximate 95% confidence interval for the population mean price.

Bootstrap mean sneaker prices



ANSWER _____

CHALLENGE One step up

Two representative samples estimate the same population mean. Sample A has 64 people, an observed mean of 70, and a bootstrap SD of 5. Sample B has 16 people, an observed mean of 70, and a bootstrap SD of 10. Find both approximate 95% intervals and explain which is narrower.

WORK SPACE AND ANSWER

ANSWER KEY

Mean Estimate Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Observed sample: 5, 8, 11. One resample with replacement is 5, 5, 11. Find the resample mean.	**7**
2	An observed mean is 40, and the bootstrap SD is 4. Find an approximate 95% confidence interval.	**32 to 48**
3	A sampling distribution has population mean 100 and SD 5. About 95% of its sample means lie between what values?	**90 and 110**
4	Of 20 simulated sample means, 19 are within 2 SDs of the population mean. What percent is this, and does it match the 95% rule?	**95%; yes.**

PART 2 · APPLY IT

1. **16 to 24 minutes; the interval estimates the population mean daily gaming time.** The margin is 2 × 2 = 4 minutes. Subtract and add 4 to the observed mean of 20.
2. **Roughly symmetric and bell-shaped, centered at $60; approximately $52 to $68.** The plotted means cluster around $60. The margin is about 2 × $4 = $8, giving $60 - $8 to $60 + $8.

CHALLENGE

A: 60 to 80. B: 50 to 90. A is narrower because its bootstrap SD, and therefore its margin of error, is smaller.

Accept reversed endpoint order when both values are clear. Intervals are approximate because the 2-SD rule is an approximation.