

Workbook



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Confidence Intervals for Sample Means

Known Population Variance

Questions

- 1) A researcher is estimating the average salary in Wisconsin. Based on a sample, she determines with a 95% level of certainty that the average weekly salary is between \$1,000 and \$1,400.
 - a. What is the length of the confidence interval?
 - b. What are the chances that the sample error is greater than \$300?

- 2) The average output of a factory is 4,950 products per day over a random set of 100 days. Assume that the population standard deviation is known to be 150 products per day. Estimate the average daily output of a certain factory at a 95% confidence level.

- 3) We want to estimate a battery's average lifespan. Assume that the battery's lifespan follows a normal probability distribution with a standard deviation of 20 hours. We sample 25 devices and find their average lifespan to be 230 hours.
 - a. Construct a 90% confidence interval for the battery's average lifespan.
 - b. Will a 95% confidence interval be shorter or longer? Explain.

- 4) The average monthly salary of 200 employees in Ohio is found to be \$5,000. Assume that the population standard deviation of salaries is \$1,000.
 - a. Construct a 95% confidence interval for the actual average salary.
 - b. What sample size is needed to shorten the confidence interval by 50%?
 - c. If we expand the sample size from 200 and construct a 95% confidence interval, what happens to the interval?

- 5) A company is studying the recovery time of a new drug. 60 people participated in the study, with an average recovery of 4 days. The population standard deviation is 2 days.
 - a. Construct a confidence interval for the mean recovery time at a 90% level of confidence.
 - b. What happens to the length of the confidence interval, if the sample were four times as large? Explain.
 - c. What happens to the length of the confidence interval, if we use a higher level of confidence? Explain.

- 6) A researcher constructs a confidence interval for an average, using a sample of 16 observations and obtains $82 < \mu < 92$.

Assume that the variable follows a normal distribution and that its standard deviation is 10.

- a. What is the sample average?
 - b. What is the level of confidence for this confidence interval?
 - c. What are the chances that the estimation error is greater than 5?
- 7) Which of the following factors does not affect the length of the confidence interval (when the population variance is known)?
- a. The confidence level.
 - b. The population standard deviation.
 - c. The sample size.
 - d. The sample standard deviation.
- 8) A researcher constructs a confidence interval for the average and obtains the following confidence interval: $63 < \mu < 83$.
- Assume a known population standard deviation, and a sample size of 40.
- a. What sample size is needed for a confidence interval of length 10?
 - b. The original confidence level was 95%. Construct a confidence interval at a 98% level of confidence.

Unknown Population Variance

Questions

- 1) A study investigates how a certain drug affects pulse rate. A sample of 5 participants measured their pulse and recorded the number of beats per minute: 89, 79, 84, 88, 84. Assume that pulse rate is approximately normal.
 - a. Construct a 95% confidence interval for the expected pulse rate among all users of this drug.
 - b. Assuming that the average pulse rate for people who do not take the drug is 70, does the drug affect pulse rate, at a 95% level of certainty?
 - c. In continuation of part a: if we were to construct a confidence interval at a 99% level of certainty instead, what will happen to the confidence interval?

- 2) In a sample of 25 college students, the average height was 178cm , with a standard deviation of 13cm .
Create a confidence interval at a 90% level of confidence for the expected height of college students.

- 3) Steve wants to estimate the average time (in minutes) that it takes him to get to work. He samples his commute time for five days, with the following results: 27, 34, 32, 40, 30.
 - a. Estimate the average travel time at a 95% level of certainty.
 - b. How would the size of the confidence interval change, if Steve sampled more days?

- 4) Scores on an intelligence test follow a normal probability distribution. The scores of 25 people averaged 102, with a sample standard deviation of 13.
 - a. Construct a confidence interval for the population average score at a 95% level of certainty.
 - b. Repeat part a, assuming that the obtained standard deviation of 13 is the population standard deviation.
 - c. Explain the differences in the answers to parts a and b.

- 5) 60 babies were weighed at birth, with an average of 7.7 lbs and a sample standard deviation of 1 lb .
Construct a confidence interval for birth weight at 95% confidence.
Explain what this means.

- 6) Two statisticians constructed 95% confidence intervals for the same parameter μ . Each statistician had a different sample of 10 observations. Statistician A assumed that $\sigma = 20$. Statistician B calculated the sample standard deviation, and found that $\sigma = 20$. Which of the statisticians will have a longer confidence interval (select the correct answer)?
- Statistician A.
 - Statistician B.
 - Both statisticians will have confidence intervals of the same length.
 - It depends on the sample results of each statistician.

Answer Key:

- 1) a. (79.88, 89.72); b. Yes. c. Interval will be longer.
- 2) (173.55, 182.45)
- 3) a. (26.543, 38.657); b. Interval will be shorter.
- 4) a. (96.634, 107.37); b. Interval will be shorter.
- 5) (7.4417, 7.9583)
- 6) b. Statistician B.