
Homework for Lecture 13

The following homework assignment should be completed as an RMarkdown Document. Only show your working code and place comments/explanations in the “white space” to help me evaluate your work. Please submit both the knitted RMarkdown document (.doc) and the .Rmd file. You may discuss the assignment with your classmates, but your write-up and work should be done independently of your classmates. The use of AI is considered a violation of academic policy for this assignment. When in doubt, ask me what is and is not allowed.

1. Conceptual Questions

Answer the following theoretical questions about confidence intervals:

- (a) What is a confidence interval actually telling us?
- (b) If we increase the confidence level, for example from 80% to 95%, how will the interval change? Explain why.
- (c) If the sample size increases, for example from 100 people to 200 people, how will the interval change? Explain why.
- (d) When do we use a normal distribution, and when do we use a Student’s t -distribution?

2. Discrete Math Exam Scores

You are interested in estimating the average score on an exam in a Discrete Math class. You sample 15 classmates and find that the sample mean is 74. Assume the exam scores are approximately normally distributed.

- (a) Calculate a 90% confidence interval if the sample standard deviation is 12.5.
- (b) Calculate a 90% confidence interval if the population standard deviation is known to be 12.5.
- (c) The results you got in parts (a) and (b) should be different from each other. How do they differ, and why do they differ?

3. Confidence Intervals Using the cherry Dataset

Using the `cherry` dataset in the `openintro` library, use the `volume` variable to answer the following questions.

- (a) Manually construct an 80% confidence interval for the mean of `volume`. After doing this manually, confirm your result using the `t.test()` function.
- (b) Manually construct a 92% confidence interval for the mean of `volume`. After doing this manually, confirm your result using the `t.test()` function.
- (c) Manually construct a 99% confidence interval for the mean of `volume`. After doing this manually, confirm your result using the `t.test()` function.
- (d) Compare the three confidence intervals. What happens to the width of the interval as the confidence level increases? Explain why this makes sense.