

Your name(s):

DAY 8: STATISTICAL INFERENCE, CONFIDENCE INTERVALS
SEC 4.1-4.2

1. One hundred random samples of water were taken from a fresh water lake, and the calcium concentrations (mg/L) were measured. A 95% CI on the mean calcium concentration is $0.49 \leq \mu \leq 0.82$.
 - (a) Would a 99% CI calculated from the same sample data have been longer or shorter?
 - (b) Consider the following statement: There is a 95% chance that μ is between 0.49 and 0.82. Is this statement correct? Explain your answer.
 - (c) Consider the following statement: If $n = 100$ random samples of water from the same lake were taken and the 95% CI on μ computed and this process was repeated 1000 times, 950 of the CIs will contain the true value of μ . Is this statement correct? Explain your answer.
2. The wall thickness of 25 glass 2-liter bottles was measured by a quality-control engineer. The sample mean wall thickness was 4.05 mm and the sample standard deviation was 0.08 mm. Find a 95% lower confidence bound (one-sided) for mean wall thickness. Interpret the interval you have obtained.
3. The following data represent the tensile strength of $n = 20$ samples of a certain rubber material (in units of MPa)

| TENSILE STRENGTH (MPa) | | | | |
|------------------------|-------|-------|-------|-------|
| 11.66 | 6.94 | 9.74 | 7.76 | 8.31 |
| 11.97 | 13.35 | 11.47 | 9.29 | 6.84 |
| 7.84 | 6.89 | 8.07 | 12.21 | 7.66 |
| 10.01 | 12.47 | 11.18 | 10.52 | 10.28 |

Determine a 95% two-sided confidence interval for the mean μ of the population from which these samples were drawn. Previous testing on a large scale has established that the tensile strength is normally distributed in this population with a standard deviation of 2 MPa.

4. A 2009 Zogby poll of likely voters in Pennsylvania called 100 voters and asked them whether they preferred Clinton or Obama in the primary election. A total of 52 favored Clinton. Build a 95% confidence interval for the true proportion of voters that favor Clinton. As her campaign advisor, what news do you deliver to her on her prospects next Tuesday?
Suppose that Mrs. Clinton is unhappy with the news, and wants more voters called. How many voters would need to be called in order to build a confidence interval ± 0.025 in width, at the 95% level?
5. A manufacturer of car batteries guarantees that his batteries will last, on average, 3 years with a standard deviation of 1 year. Assume the lifetimes of batteries are normally distributed. Five of these batteries are randomly sampled and their lifetimes of 1.9, 2.4, 3.0, 3.5, and 4.2 years are recorded. Is the manufacturer's claim regarding variation in the lifetimes of his batteries valid? Answer your question by computing an appropriate confidence interval using a 90% level.

6. Two methods of teaching reading were applied to two randomly selected groups of elementary schoolchildren and then compared on the basis of a reading comprehension test given at the end of the learning period. The sample means and sample variances computed from the test scores are shown below. Do the data present sufficient evidence to indicate a difference in the mean scores for the populations associated with the two teaching methods? Answer your question by computing an appropriate confidence interval using a 99% level.

| | Method 1 | Method 2 |
|-----------------------------|----------|----------|
| Number of children in group | 11 | 14 |
| \bar{x} | 64 | 69 |
| s^2 | 52 | 71 |