

ST511 HW #3

Reading: Read Chapter 5 of Ott & Longnecker.

See Canvas Calendar for due date.

34 points total, 2 points per problem part unless otherwise noted.

1. Suppose the oxygen level of a certain lake was of interest. A total of $n=10$ samples were taken (from randomly selected locations) and oxygen level was measured in ppm. The sample mean oxygen level was found to be 8.9 and the sample standard deviation was found to be 1.1.
 - A. Construct a 95% confidence interval for μ (population mean oxygen level). **(4 pts)**
 - B. Using $\alpha = .05$, test $H_0: \mu = 8.5$ and $H_A: \mu \neq 8.5$. Be sure to define your rejection region, calculate your test statistic, and state your conclusion. **(4pts)**
 - C. In order for the confidence interval and test to be “valid”, what assumption is required?
 - D. Now suppose that the summary statistics were based on a sample of size $n=100$. Rerun the hypothesis test from part B based on this larger sample size. The hypotheses will be the same, but be sure to define your rejection region, calculate the test statistic and state your conclusion. **(4 pts)**
2. How accurate are home radon detectors? To answer this question, university researchers (from Purdue) placed 12 detectors in a chamber that exposed them to 105 pCi/l of radon over 3 days. Here are the readings given by the detectors:

91.9	97.8
111.4	107.5
105.4	95.0
103.8	99.6
96.6	115.3
104.8	101.7

- A. Do the data appear to be normally distributed? Justify your response based on a qqplot and test of normality. **(4 pts)** Include the qqplot in your assignment.
 - B. Give an estimate of the mean radon and corresponding 95% confidence interval. **(4 pts)**
 - C. Is there significant evidence at the $\alpha = 0.05$ level that the mean reading differs from that of the true value of 105? Be sure to state the hypotheses, give the test statistic and p-value and state your conclusion. **(4 pts)**
3. Refer to Problem 5.34 dealing with nicotine content of cigarettes. (Problem 5.46 from the 5th edition.) Using the given summary statistics, run a hypothesis test at the $\alpha=0.01$ level. Be sure to state the hypotheses, define your rejection region, show your test statistic and state your conclusion. Assume the agency will take action if there is evidence that $\mu>14$. **(4 pts)**
4. An investigator is interested in estimating the mean concentration of a certain hormone in cows. Before collecting any data, they conjecture that the standard deviation is 2.9 units.
 - A. Find the sample size such that the expected 95% ME will be 2 units or less.
 - B. Revise your sample size to achieve an expected 95% ME of 1 unit or less.NOTE: You should have found that you need to more than double your sample size to reduce the expected ME by half.