Homework 4

Due 2/13/25. Chapter 4, and lectures 7-8 will help in doing this problem set. Unless otherwise noted, write out by hand how to calculate the desired values.

ALSO: remember to include a sketch of the reference distribution complete with all of the proper labels (see guidelines in HW3) for your hypothesis tests.

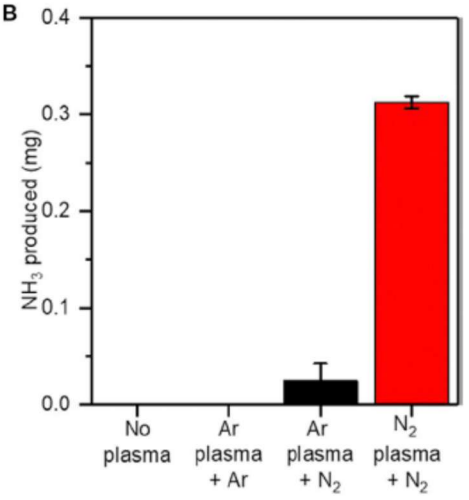
1) Do problem 4.8 in the book (4.11 in 7th edition). Do parts a and b by hand (write out how you would find average and standard deviation, but feel free to use the (….) notation frequently used in class.) For part c use Minitab to check the normality assumption and also check your answers in part a and b. Comment on the normality assumption. Use 4 significant figures.
2) Consider the following computer output (assume 3 significant figures).
    a. How many degrees of freedom would you use to find your critical value?
    b. Fill in the missing values by hand. You may find the bounds on the P-value using the table in the back of the book. What conclusions could you draw?
    c. If the hypothesis is H_0: $\mu = 12$ versus H_1: $\mu > 12$ would your conclusions change?

One-Sample T:

Test of mu = 12 vs not = 12

Variable	N	Mean	StDev	SE Mean	T	P
x	10	12.564	.936	0.296	?	?

3) This is real data an undergraduate in the CWRU chemical engineering department gathered for a paper in *Science Advances.* The student was measuring plasma-generated ammonia in a lab scale apparatus. They wanted to test the hypothesis the mean of the ammonia generated under the conditions (Ar plasma + N_2) is greater than zero. The following data for that group (black bar in graph) were obtained (in mg of ammonia made in 45 min): 0.007, 0.059, 0.023, 0.001, 0.049, 0.010 mg of ammonia. Describe the appropriate test to conduct for this hypothesis (write out H_o and H_1), and do the calculation in Minitab. Check the normality assumption in Minitab. Explain what conclusion you would come to after this analysis.



4) A research engineer for a tire manufacturer is investigating tire life for a new rubber compound and has built 16 tires and tested them to end-of-life in a road test. The sample mean and standard deviation are 60139.7 and 3645.94 kilometers.

a. Can you conclude using $\alpha = 0.05$ that the standard deviation of tire life is less than 4000 kilometers? State any assumptions about the underlying distribution of the data and find the P-value for the test (estimate the range from the table in the back of the book).
b. Construct a 95% upper bound confidence interval
c. Show how you would solve this problem in Minitab

5) The output voltage of a power supply is assumed to be normally distributed. Sixteen observations taken at random on voltage are as follows: 10.35, 9.30, 10.00, 9.96, 11.65, 12.00, 11.25, 9.58, 11.54, 9.95, 10.28, 8.37, 10.44, 9.25, 9.38, 10.85.
   a. Test the hypothesis that the mean voltage equals 12V against a two-sided hypothesis assuming alpha =0.05 (do this in Minitab).
   b. Construct a 95% two-sided confidence interval on μ using Minitab.
   c. Test the hypothesis that $\sigma^2 = 11$ using alpha =0.05 (by hand, then check this in Minitab)
   d. Construct a 95% two-sided confidence interval on σ (by hand, and then check in Minitab)
   e. Does the assumption of normality seem reasonable for the output voltage? (use Minitab to answer)
   f. Assuming the specification limits are 10 volts over or under the target, use the CI for σ to determine if this is a “six sigma” process.