Homework5

Due 2/20/25. Chapter 4, and lectures 9-10 will help in doing this problem set. Unless otherwise noted, write out by hand how to calculate the desired values. Remember to include all printouts and answers in 1 file!

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) The concentration of an active ingredient in a liquid laundry detergent is thought to be affected by the type of catalyst used in the process. The standard deviation of active concentration is known to be 3 g/L regardless of the catalyst type. 10 observations on concentration are taken with each catalyst, and the data follow:

Catalyst 1	Catalyst 2
57.9	66.4
66.2	71.7
65.4	70.3
65.4	69.3
65.2	64.8
62.6	69.6
67.6	68.6
63.7	69.4
67.2	65.3
71.0	68.8

a) Use Minitab to gather the descriptive statistics on these samples and determine if the normality assumption is appropriate.

b) Is there any evidence to indicate that the mean active concentrations depend on the choice of the catalyst? (use $\alpha = 0.05$)

c) Construct a 95% confidence interval for the difference between the means, and explain how this relates to the result in part b)

d) Construct a bar graph in Excel showing the results and the results of this hypothesis test and add a proper caption (see lecture 10)

2) Problem 4.11 (4.17 in edition 7) from your book a-c. Assume though instead of two technicians making measurements on the same part (as the problem statement implies) the data represent the surface finish of parts made in January (column to the left) and surface finish of parts made in February (column to the right), not technician 1 and technician 2. You want to know if there is a difference in the surface finish of these parts made in January vs. February. First though, construct a box plot and normal probability plot using Minitab to check if equal variance and normality are ok assumptions for this problem. You may use Minitab to calculate the average and standard deviation of your data as well, but the rest should be calculated by hand. Finally, use Minitab to check your final answer by running the appropriate hypothesis test.

3) Consider the following computer program output:

Two-Sample T-Test and Cl

Sample	N	Mean	StDev	SE Mean
1	15	54.73	2.13	0.55
2	20	58.64	5.28	1.2

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Difference = mu (1) - mu (2)
Estimate for difference: -3.91
95% upper bound for difference: ?
T-test of difference = 0(vs <): T-value =
-3.00 P-value = ? DF = ?
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a) Fill in the missing values. Is this a one-sided or two sided test? Use upper and lower bounds to find the P-value.

b) What are your conclusions if $\alpha=0.05$? $\alpha=0.01$?

c) Suppose that the alternative hypothesis was $\mu_1 \neq \mu_2$, would your conclusions be different if $\alpha=0.05$

4) Do problem 4.15 in your book (4.25 in the 7th edition). You may use Minitab to calculate the needed means and standard deviations but show the formulas in your answer for how you would obtain these (with some values subbed in) and the rest should be calculated by hand. Note that the inspectors are measuring the same part with the micrometer caliper, and the vernier caliper.