FUNDAMENTALS OF ENGINEERING STATISTICAL ANALYSIS
ISE/DSA 5013
Assignment 7

Show your work for calculation problems. You will receive no credit if you only provide the answer. *As with all homework this semester, spend time to be neat and organized. Any disorganized submissions are subject to a zero grade.*

Problem 1
A manufacturer uses two machines to drill holes in pieces of sheet metal used in engine construction. The workers who attach the sheet metal to the engine become inspectors in that they reject sheets so poorly drilled that they cannot be attached. The production manager is interested in knowing whether one machine produces more defective drillings than the other machine. As an experiment, employees mark the sheets so that the manager can determine which machine was used to drill the holes. A random sample of 191 sheets of metal drilled by machine 1 is taken, and 38 of the sheets are defective. A random sample of 202 sheets of metal drilled by machine 2 is taken, and 21 are defective. Use α = 0.05 to determine whether the proportion of sheets drilled with defective holes is significantly larger for machine 1.
Use the p-value approach.

Problem 2
Samples of eastern white pine lumber were collected, and a particular loading was applied to each. For each piece of lumber, the modulus of elasticity (in MPa) was found one minute after the loading was applied, and it was again found after four weeks.
 a. Using the data found in the Assignment 7 spreadsheet, what can you say about the claim that the modulus of elasticity decreases by over 2500 MPa at four weeks relative to one minute after loading? Use the p-value approach and draw conclusions with 90% confidence.
 b. Produce a 99% confidence interval for the true mean difference in the modulus of elasticity.

Problem 3
You're a human factors engineer examining the reaction time of pilots to two different instrument panel layouts (A, B). You asked eight pilots to undergo a simulated disruption scenario, and you recorded their reaction time (in seconds) to resolve the scenario using layout A. You asked the same of 11 pilots for layout B. Sample statistics are below. First compare variances then compare mean performance with the appropriate t test. Use the critical value approach considering 0.05 significance.

Layout	n	$\bar{y}$	s
A	8	14.7	0.8
B	11	16.4	2.1

Problem 4

There are two primary means to drill holes in rock: dry drilling and wet drilling. With dry drilling, compressed air is used to flush the cuttings out of the drill bit. With wet drilling, a liquid is used. The time required (in minutes) to drill a hole of a particular depth was acquired and found in the Assignment 7 spreadsheet. Assume similar variances for the two drilling methods. Is mean drilling time for the wet drilling method significantly shorter with 95% confidence? Use the p-value approach.

Problem 5

A company is marketing an additive for gasoline to improve car mileage per gallon of gasoline consumed. Ten cars were selected, and the highway miles per gallon (mpg) for each car without and with the additive were measured. Determine whether there is enough statistical evidence that the mpg is improved upon using the additive with 95% confidence and the p-value approach.

Car	mpg without additive	mpg with additive
1	25.5	25.0
2	19.0	20.1
3	18.2	19.2
4	17.5	18.2
5	24.0	24.0
6	21.0	21.5
7	27.5	27.4
8	18.5	20.0
9	19.4	20.1
10	26.0	26.2

Problem 6

An independent consumer group tested radial tires from two major brands (1, 2) to determine whether there were any differences in the expected tread life. The data (in thousands of miles) are provided in the Assignment 7 spreadsheet. Is mean performance different for the two brands?

a. First test the variances of the tread lives of the two brands to determine which assumption about equality of variances to use. Use 90% confidence and the critical value approach.

b. Based on the result of part a, answer the question about the mean performance of the two brands using the p-value approach and 99% confidence.

c. Is the proportion of tires that last at least 55,000 miles larger for Brand 2 tires? Use 99% confidence and the critical value approach.