AUA Spring 2024

CS 108 Statistics

Homework 06

Due date: 10 April, 2024, 11:59PM

- No late homework will be accepted.

Problem 1 (25 points)

A company wants to compare the productivity levels of two departments: Department A and Department B. They collect data on the number of tasks completed in a day by 16 employees from each department. The data is shown in the table below:

Departament_A	Departament_B
110	82
100	105
101	97
95	105
105	104
104	102
101	102
96	91
98	102
97	103
99	107
95	101
102	107
100	99
98	104
94	98

Assume the productivity levels of employees in both departments follow a normal distribution.

a. Define the Null and Alternative hypotheses. (3 points)

b. Define the Rejection Region for the Null hypothesis, if $\alpha = 0.01$ (5 points)

c. Perform a test to determine if there is sufficient evidence to indicate that the variances of productivity levels in the two departments are the same. Show the solution using both P-values and Test Statistic. (7 points)

d. Determine if the average productivity level of Department A is significantly different from the average productivity level of Department B.(8 points)

Solution

Problem 2 (20 points)

A car manufacturer wants to determine if there is a difference in the average fuel efficiency among three models of cars: Model A, Model B, and Model C. They test five cars of each model and record their fuel efficiency in miles per gallon (MPG). The data are as follows:

Model_A	Model_B	Model_C
28.6	28.1	25.5
29.9	30.6	26.1
27.2	31.8	28.7
27.8	30.1	27.1
27.7	29.4	26.7

Assume the variances of fuel efficiency don't differ significantly across the car models and follow a normal distribution.

a. Use a significance level of 5% and determine if there is a difference in average fuel efficiency among the car models.(15 points)

b. Do you think there is a need for the Tukey-Kramer procedure? Explain Assume the variances of battery life don't differ significantly across the phone types and follow a normal distribution.(5 points)

Solution

Problem 3 (15 points)

A survey is conducted to determine the favorite ice cream flavors among a group of 200 people. The results are as follows:

Chocolate: 60 people

Vanilla: 66 people

Strawberry: 40 people

Mint: 34 people

Is there evidence to suggest that the ice cream flavor preferences are equally distributed among the population? Use a significance level of 0.05.

Solution

Problem 4 (20 points)

A company wants to determine if there is a relationship between the type of smartphone operating system (iOS, Android, Windows) and the preferred social media platform among its customers. They survey 680 customers and record their preferences. The results are summarized in the contingency table below:

Social Media	IOS	Android	Windows	Total
Facebook	120	100	80	300
Instagram	70	110	60	240
Twitter	50	60	30	140

Test whether the preference for social media platform is independent of the type of smartphone operating system. Use a significance level of $\alpha = 0.05$. Explain your conclusion.

Solution

Problem 5 (20 points)

The expected percentage of the number of children per family in Armenia is distributed as in below table (see a column **Percent**). A random sample of 1,000 families is drown from Yerevan and the distribution is presented in the last column of the table.

Number of children	Percent	Frequency
0	23	257
1	14	497
2	44	191
3	16	50
4+	3	5

At the 1% significance level, does it appear that the distribution "number of children" of family in Yerevan is different from the distribution for Armenia family population as a whole?

Solution