Introduction to Statistical Methods

(S1-25_AIMLCLZC418) – Assignment 2

AIML Section - 6

Each question carries 05 Marks (5 x 2 = 10 Marks)
Duration: 25th January 2026 – 08th February 2026
1) Submissions are individual
2) Solve these on paper, scan, and upload
3) Plagiarism results in zero marks
4) Write your name, BITS ID and Section on each page
5) AI generated graphs/diagrams result in zero marks

Problem-1

Quality Control in Tobacco Processing

A laboratory is testing the nicotine content of two different tobacco blends, Sample A and Sample B. To maintain product consistency, the lab manager needs to determine whether there is a statistically significant difference between the average nicotine levels of the two samples or if the observed differences are due to chance.

Data (Nicotine in mg)

Sample A ($n_1 = 5$): 24, 27, 26, 21, 25

Sample B ($n_2 = 6$): 27, 30, 28, 31, 22, 36

Answer the following:

a) State the appropriate null and alternative hypotheses.

b) Calculate the sample means for both Sample A and Sample B. Based solely on these averages, which sample appears to have a higher nicotine content?

c) Calculate the variance, standard deviation for both samples. Why is it necessary to calculate the variance before performing a t-test to compare means?

d) At $\alpha = 0.05$, should you reject or fail to reject the Null Hypothesis? State whether the two samples come from populations with the same mean.

e) Construct side-by-side box plots for Sample A and Sample B and comment on their spread and median values and specify which sample shows greater dispersion?

Problem-2

Efficiency of Different Study Methods

A university educational researcher wants to determine whether different study methods significantly affect student test scores. She randomly assigns 15 students to three groups, each using a different study technique for one week before a common examination.

Group A (Textbook Only): 35, 38, 32, 34, 36

Group B (Video Lectures): 40, 42, 38, 45, 40

Group C (Interactive Flashcards): 42, 48, 44, 46, 45

Answer the following:

a) Formulate Null and Alternative Hypotheses

b) Determine the Degrees of Freedom (df) for:

i) Between-groups (df_between)

ii) Within-groups (df_within)

c) Calculate the Mean Square Between (MSB) and Mean Square Within (MSW) and find the F-calculated value

d) What does your conclusion imply about the effectiveness of the three study methods?

i) Does it prove that one method is “best”?

ii) Or does it only indicate that at least one method differs?

e) Suppose the researcher repeats the study with 60 students per group instead of 5. How would this affect the reliability of the F-test?

**********Happy Learning**********