

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Fourth Semester)

Branch – INFORMATION TECHNOLOGY

STATISTICS FOR INFORMATION TECHNOLOGY

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 In systematic sampling, what does "n" represent?
 - (i)The size of the population
 - (ii)The number of sampling units to be selected
 - (iii)The interval size for selecting sampling units
 - (iv)The standard deviation of the population
- 2 What is the purpose of a test of significance in statistics?
 - (i)To summarize the data
 - (ii)To determine the population mean
 - (iii)To assess whether the observed difference between groups is due to chance
 - (iv)To calculate the standard deviation
- 3 What is the F-test used for?
 - (i)Comparing means of two independent groups
 - (ii)Comparing variances of two independent groups
 - (iii)Comparing proportions of two independent groups
 - (iv)Comparing means of more than two independent groups
- 4 In one-way ANOVA, if the null hypothesis is rejected, what can be concluded about the means of the groups?
 - (i)At least one group mean is different from the others
 - (ii)All group means are equal
 - (iii)No conclusion can be drawn about the group means
 - (iv)The means of two specific groups are different
- 5 When should the Mann-Whitney U test be used?
 - (i)To compare means of two independent groups with normal distributions
 - (ii)To compare medians of two independent groups with normal distributions
 - (iii)To compare means of two independent groups regardless of distribution
 - (iv)To compare variances of two independent groups regardless of distribution

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SECTION - B (15 Marks)Answer **ALL** Questions**ALL** Questions Carry **EQUAL** Marks

(5 x 3 = 15)

- 6 a State and prove sample mean $\bar{y}$ is an unbiased estimate of $\bar{Y}$.
OR
- b Prove that in stratified random sampling $V(\bar{y}_{st}) = \frac{1}{N^2} \sum_{i=1}^k N_i (N_i - n_i) \frac{S_i^2}{n_i}$.
- 7 a Discuss the role of the null hypothesis in hypothesis testing.
OR
- b Describe the procedure for difference of proportions in large samples.
- 8 a Describe the assumptions underlying the Student's t-test.
OR
- b A company claims that the mean delivery time for their online orders is 3 days. To test this claim, a random sample of 20 recent orders was selected, and the delivery times (in days) were recorded as follows:
3, 2, 4, 3, 3, 3, 2, 3, 4, 3, 4, 3, 3, 2, 3, 3, 3, 4, 2, 3
Perform a one-sample t-test at a significance level of 0.05 to determine whether there is evidence to support the company's claim. [At $\alpha = 0.05$ (two-tailed test) and $df = 19$, the critical t-value is 2.093]
- 9 a Explain the concept of one-way ANOVA.
OR
- b Describe the applications of the chi-square test.
- 10 a Explain the concept of a run test in statistical analysis.
OR
- b A student claims that they have improved their score in a math test after attending extra tutoring sessions. The student took two tests, before and after the tutoring sessions. The scores (out of 100) are as follows:
Before tutoring: 65, 70, 60, 68, 72
After tutoring: 75, 78, 70, 80, 82
Using the sign test at a significance level of 0.05, determine if there is a significant improvement in the student's scores after attending the tutoring sessions.

SECTION - C (30 Marks)Answer **ALL** questions**ALL** questions carry **EQUAL** Marks

(5 x 6 = 30)

- 11 a Prove that under SRSWOR $v(\bar{y}) = (1-f) \frac{s^2}{n}$.
OR
- b Describe the sampling and non-sampling errors.
- 12 a A random sample of 500 apples was taken from a large consignment and 60 were found to be bad. Obtain the 98% confidence limits for the percentage number of bad apples in the consignment.
OR
- b The mean yield of wheat from a district A was 210 pounds with S.D. 10 pounds per acre from a sample of 100 plots. In another district the mean yield was 220 pounds with S.D. 12 pounds from a sample of 150 plots. Assuming that the S.D. 12 pounds from a sample of 150 plots. Assuming that the S.D of yield of in the entire state was 11 pounds, test whether there is any significant difference between the mean yield of crops in the two districts.

Cont...

- 13 a To assess whether there's a significant difference in the average test scores between two groups of students, Group A and Group B, a random sample of 25 students from each group was selected, and their test scores were recorded as follows:

Group A: 75, 82, 68, 90, 88, 72, 79, 85, 91, 78, 83, 76, 84, 81, 87, 80,
77, 73, 89, 86, 74, 79, 84, 82, 75

Group B: 78, 85, 69, 92, 87, 75, 80, 86, 90, 79, 84, 77, 85, 82, 88, 81, 78,
76, 89, 83, 79, 85, 90, 88, 79

Perform a test of significance at a significance level of 0.05 to determine if there is a significant difference in the average test scores between the two groups. [At $\alpha = 0.05$ (two-tailed test) and $df = 48$, The critical t-value is 2.013]

OR

- b A company produces two types of batteries, A and B. The company wants to determine if there is a significant difference in the lifespans of the batteries produced by two different manufacturing processes. A random sample of 10 batteries of type A and 12 batteries of type B was selected, and their lifespans (in hours) were recorded as follows:

Type A: 200, 210, 220, 190, 215, 225, 205, 195, 200, 190

Type B: 220, 225, 235, 230, 215, 240, 225, 230, 235, 245, 220, 225

Perform an F-test at a significance level of 0.05 to determine if there is a significant difference in the lifespans between the two types of batteries.

[Given $\alpha = 0.05$ and $df_A = 9$, $df_B = 11$, the critical F-value = 3.49]

- 14 a To investigate whether there's a significant difference in the average scores among three different study groups (Group A, Group B, and Group C), 15 students are randomly assigned to each group, and their test scores after completing a study program are recorded as follows:

Group A: 75, 80, 85, 78, 82, 79, 83, 77, 81, 76, 84, 79, 80, 82, 76

Group B: 78, 82, 85, 80, 83, 79, 81, 77, 79, 75, 84, 78, 80, 82, 77

Group C: 80, 84, 87, 82, 85, 81, 83, 79, 82, 78, 86, 80, 81, 83, 77

Perform a one-way ANOVA to determine if there is a significant difference in the average test scores among the three study groups at a significance level of 0.05. [Given $\alpha = 0.05$ and $df_B = 2$, $df_W = 42$, the critical F-value is approximately $F(0.05, 2, 42) = 3.29$]

OR

- b On the basis of information given below about the treatment of 200 patients suffering from a disease, state whether the new treatment is comparatively superior to the conventional treatment.

	Favorable	Not Favorable	Total
New	60	30	90
Conventional	40	70	110

[Tabulated $\chi^2_{0.05} = 3.841$ for 1 d.f.]

- 15 a Two groups of students, Group A and Group B, were taught using different teaching methods. The exam scores (out of 100) for each group are as follows:

Method A: 78, 82, 85, 79, 83, 80

Method B: 75, 78, 83, 85, 79, 81

Using the Mann-Whitney U test at a significance level of 0.05, determine if there is a significant difference in the exam scores between the two teaching methods.

OR

- b Three groups of students (Groups A, B, and C) were assessed on their performance in a math test. The scores of five students in each group are as follows:

Group A: 72, 78, 80, 85, 88

Group B: 75, 80, 82, 86, 90

Group C: 70, 75, 78, 82, 85

Using the Kruskal-Wallis test at a significance level of 0.05, determine if there is a significant difference in the test scores among the three groups.

[Value of χ^2 at 5% level of significance for 2 degrees of freedom is 5.99]

Z-Z-Z END