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MST–004

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

June, 2026

MST-004 : STATISTICAL INFERENCE

Time : 3 Hours *Maximum Marks : 50*

Note : *(i) Question No. **1** is compulsory.*

*(ii) Attempt any **four** questions from the remaining question nos. 2 to 7.*

(iii) Use of scientific (non-programmable) calculator is allowed.

(iv) Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.

(v) Symbols have their usual meanings.

1. State whether the following statements are True *or* False. Give reasons in support of your answers : 5×2=10

(a) The Mann-Whitney U-test is used to test the goodness of fit of the continuous data.

(b) If sample size of a survey is increased by 100%, then the standard error will decrease by 50%.

(c) If X_1, X_2 and X_3 is a random sample of size 3 taken from a population with mean μ and variance σ^2, then the estimator $T = \frac{X_1 + 3X_2 + 4X_2}{8}$ is an unbiased estimator of μ.

(d) The 99% confidence interval for population mean when population variance is known will be : $P\left(\bar{X} - \frac{\sigma}{\sqrt{n}} \leq \mu \leq \bar{X} + \frac{\sigma}{\sqrt{n}}\right) = 0.99$.

(e) If p-value and level of significance for testing $H_0 : P = 0.4$ against $H_1 : P > 0.4$, are 0.06 and 0.05, respectively, then the H_0 will be rejected.

2. (a) Describe degrees of freedom. Explain with an example. 2

(b) The pdf of a random variable T is

$$f(t) = \frac{3}{8\left(1 + \frac{t^2}{4}\right)^{5/2}}; -\infty < t < \infty .$$

Obtain degrees of freedom of the distribution. Also find mean and variance of the given distribution. 4

(c) Write any *two* applications of the F-distribution. 2

(d) Obtain tabulated value of a Chi-square variate for which area on the left tail is 0.05 and degrees of freedom is 10. 2

3. A cricket coach developed reverse swing bowling technique. To determine how well this method works, the coach selected two teams, say, T_1 and T_2 of 12 players in each team. Each player of team T_1 was asked to bowl 60 balls using the old technique while

each player of team T_2, by reverse swing technique. The numbers of successful attempts for each player of teams T_1 and T_2 are given in the following table :

Team T_1	Team T_2
40	45
30	60
55	50
35	60
40	35
40	50
30	55
40	60
50	50
45	50
40	40
35	45

Examine whether the average successful attempts by the reverse swing technique is better than the old technique at 5% level of

significance, if it is assumed that the data follow normal distribution. 10

4. (a) A random sample of 50 households was selected in a survey. A question was asked "Do you or any member of your family have a 5G mobile phone ?" Out of 50 respondents 28 said, "Yes" and 22 said "No".

   (i) Determine the sample proportion of 5G mobile phone users.

   (ii) If the population proportion of 5G mobile phones users is 0.40, find the standard error of the sampling distribution of proportion of 5G mobile phone users.

   (iii) What is the probability that more than 50% mobile phone users have 5G mobile phones ? 5

   (b) The course coordinator of MST-004 course wants to test the hypothesis that

the variance of the marks of the learners in the course MST-004 in final examination in Delhi region is less than the Pune region. The coordinator collects the data from both regions which are given as follows :

	Delhi	Pune
Sample size	20	15
Sample S.D.	4.3	4.6

If the marks of the learners follow normal distribution, is there enough evidence to show that variance of marks of the learners in Delhi region is less than the Pune region at 1% level of significance ? 5

5. The sales manager of a garment company wants to determine whether sales of the company's brand of jeans depends on the age group. He has appointed a marketing researcher for this purpose. The researcher

conducted a survey on three brands of the company's jeans on 570 consumers of three age categories. The observed data are given as follows :

Brand / Age Group	Brand I	Brand II	Brand III
15-25	65	75	85
25-40	60	40	65
40-60	55	65	60

Test whether brand preference is independent of the age group at 5% level of significance. 10

6. The demand of a commodity follows Gamma distribution with pdf given as follows :

$$f(x) = \frac{\alpha^5}{\lfloor 5} e^{-\alpha x} x^4; \; x \geq 0$$

(i) Find maximum likelihood estimator of α.

(ii) Determine the sufficient statistic for parameter α. 10

7. (a) A travel agency call centre wants to know the average number of calls received per day. A random sample of 21 days is selected and sampled average number of calls received was found to be 166.2 with a standard deviation of 22.8 calls. Assume that calls received daily are normally distributed. Calculate a 95% confidence interval for the mean number of daily calls received by the call centre. 4

(b) A sequence of Heads (H) and Tails (T) after tossing of a coin 16 times is given as follows :

H T T T H T H T H H T H T T H H

(i) Count the number of runs.

(ii) Test whether the Heads and Tails occur in random order at 5% level of significance. 6

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