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MST–004

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

June, 2025

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 of 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) If a random sample X_1, X_2, ..., X_n is taken from exponential distribution with parameter θ, then estimator :

$$T = \frac{3X_1 + 2X_2 + X_3}{6}$$

is an unbiased estimator for $\frac{1}{\theta}$.

(b) For testing null hypothesis $H_0 : \theta = \theta_0$ against $H_1 : \theta > \theta_0$ at 5% level of significance, if we get the *p*-value as 0.02, then we reject the null hypothesis.

(c) If we draw all possible random samples of size 2 from a binomial population B(5, 0.1), then sampling distribution of mean will be normal N(5, 0.1).

(d) If T_1 and T_2 are two unbiased estimators of a parameter θ such that :

$$\text{Var}(T_1) = \frac{1}{2n} \text{ and } \text{Var}(T_2) = \frac{1}{n}$$

then T_2 is more efficient than T_1.

(e) The Kolmogorov-Smirnov goodness of fit test is designed for categorical data.

2. (a) The blood cholesterol levels of a group of workers have mean 202 mg/dL and S.D. 14 mg/dL. If all possible samples of 36 workers are randomly selected from this group and sample mean is calculated for each sample, then find : 7

(i) Mean and S.D. of the sampling distribution of mean.

(ii) The probability that the sample mean of their blood cholesterol level will lie between 198 mg/dL and 206 mg/dL.

(b) Define *t*-distribution. Also write its applications. 3

3. (a) In a city, 36 out of a random sample of 500 men were found alcohol drinkers. After the heavy increase in the tax on intoxicants, another sample of 100 men

from the same city was taken and 6 men were found alcohol drinkers. Do you feel that the observed proportion of alcohol drinkers decreases significantly at 1% level of significant ? 5

(b) An industry produces particular type of items. To estimate the variance of the weight of the items, an analyst of the industry takes a random sample of 10 items. He measures their weights (in kg) which are given as follows :

75, 70, 72, 74, 70, 75, 73, 74, 70, 69

Obtain point estimate as well as 95% confidence interval for the variance of the weight of the items, assuming that the weight of the items follows normal distribution. 5

4. (a) A new computer software package is developed to reduce the project completion time. To evaluate the benefit of the new software package, time taken by new software package is compared

with the current software and the following data is recorded :

Time taken by Current Software (in minutes)	Time taken by New Software (in minutes)
300	274
280	220
344	308
385	356
372	360
360	350
288	300
321	320
376	350
290	300
301	260
283	250

Test whether the average project completion time of new software is less than current software at 5% level of significance. 7

(b) Explain the paired *t*-test, with an example. 3

5. A newspaper publisher was trying to pinpoint his market's characteristics, whether newspaper readership in the community is related to reader's educational achievement. For this a survey was conducted, levels of education and reading habits of individuals were noted. The results are shown as follows :

Reading Habits	Level of Education			
	Professional/Post Graduates	Graduates	High School	Did not complete High School
Never	100	170	110	210
Sometimes	120	230	80	50
Week ends	350	380	160	70
Daily	280	190	60	130

Do these data provide the sufficient evidence that newspaper reading habit in the community differ according to the reader's level of education at 5% level of significance ?

10

6. A company arranged a special training programme for one segment of its employees. The company wants to measure the change in the attitude of its employees after the training. For this purpose, it has used a well-designed questionnaire which consists of 10 questions on a 1 to 5 rating scale (1 is strongly disagree and 5 is strongly agree). The company selected a random sample of 10 employees. The scores obtained by these employees are given as follows :

Employee	Scores Before Training	Scores After Training
1	25	32
2	26	30
3	28	32
4	22	34
5	20	32
6	30	28
7	22	25
8	20	30
9	21	25
10	24	20

To examine whether there is a significant change in the attitude of employees after the training programme, give the answer of the following : 5×2=10

(i) Are both scores paired ?

(ii) Formulate null and alternative hypotheses.

(iii) Whether the assumptions of parametric test are fulfilled or not ?

(iv) If assumptions of parametric test are not fulfilled, then which non-parametric test is applied under the assumption that the differences of scores before and after the training programme is symmetrical about its median ?

(v) Test the hypotheses constructed in (ii), at 5% level of significance and conclude the result.

7. (a) If the sample values are 3, 5, 2, 6 and 0, then obtain maximum likelihood estimate for parameter θ for the following distribution : 7

$$f(x) = \theta e^{-\theta x}; \quad x, \theta > 0$$

(b) Write the merits and demerits of method of moments. 3

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