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**MST-004**

**POST GRADUATE DIPLOMA IN  
APPLIED STATISTICS (PGDAST)**

**Term-End Examination**

**June, 2023**

**MST-004 : STATISTICAL INFERENCE**

*Time : 3 Hours*

*Maximum Marks : 50*

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***Note :** Question No. 1 is compulsory. Attempt any **four** questions from the remaining Question Nos. 2 to 7. Use of scientific (non-programmable) calculator is allowed. Use of Formulae and Statistical Tables Booklet for PGDAST is allowed. Symbols have their usual meanings.*

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1. State whether the following statements are True or False. Give reasons in support of your answers : 2×5=10
  - (a) If sample size of a survey has decreased by 5%, then the standard error will also decrease by 50%.

**P. T. O.**

- (b) If probability density function of a  $\chi^2$  distribution is :

$$f(\chi^2) = \frac{1}{4} e^{-\frac{\chi^2}{2}} \chi^2; 0 < \chi^2 < \infty$$

then the degrees of freedom of the distribution will be 2.

- (c) Consider a hypothesis  $H_0 : P = P_0 = \frac{1}{2}$  against  $H_1 : P = P_1 = \frac{1}{4}$  on the basis of tossing a coin once, where  $P$  is the probability of getting head in a single toss. If we reject  $H_0$  when a head appears, then the size of the test is 0.5.
- (d) If a random sample of marks is 36, 22, 30, 45 and 29, then the sum of the positive ranks will be 7 for applying Wilcoxon signed-rank test.
- (e) The number of possible samples of size 2 with replacement from a population of size 5 will be 25.

2. The age (in years) of five workers of a manufacturing unit are as follows :

28, 24, 30, 26, 32

- (a) How many samples of size 2 are possible without replacement ? Write them.
- (b) Compute the mean of the samples obtained in (a) and set up the sampling distribution of the sample mean.
- (c) Compute the expected value of the sample mean.
- (d) How many samples of the same size are possible with replacement ? Calculate expected value of the sample mean and compare it with the expected value for the case of without replacement.  $2+2+2+4$
3. (a) The following data give the sales of 7 models of mobiles at four different stores. The sales of each mobile (in number of mobiles sold) from each store are given below :

Store A	Store B	Store C	Store D
58	74	35	78
55	57	51	85
38	65	41	62
63	48	52	75
41	83	54	87
50	61	53	57
43	68	57	66

Test whether there is a significant difference in the sales of the four stores by using a suitable test at 1% level of significance. 8

(b) Explain 'run' in non-parametric tests with an example. 2

4. (a) An experiment was conducted to compare the defective items produced by two different machines A and B. The data on number of defective items produced by both machines were observed and are given in the following table :

A	B
26	19
37	22
40	24
35	27
30	24
30	18
40	20
26	19
30	25
35	
45	

Assuming that the parent populations are normal, test that the variance of the

defective items produced by machine A is greater than machine B at 1% level of significance. 8

(b) Write a short note on the 'Central Limit Theorem'. 2

5. (a) A sample of 200 persons is chosen at random from a colony of a given city. 60% of them were tested corona positive. If large number of persons were tested for corona, then compute 95% confidence interval for the proportion of corona positive persons. 3

(b) The number of correct answers out of total 10 questions before and after attending the counselling sessions were recorded for 10 candidates in the following table :

Candidate Number	Correct Answers (before)	Correct Answers (after)
1	5	7
2	6	7
3	4	6
4	7	9

5	7	8
6	6	9
7	8	9
8	4	6
9	6	6
10	5	7

Calculate 95% confidence interval for the average change in the correct answers after counselling sessions. 5

- (c) Write various properties of good estimator. Explain anyone. 2
6. (a) The average weight of all persons living in a small town is 60 kg and standard deviation of weights is 25 kg. If a sample of 36 persons is selected at random, find the probability that persons having their average weights are :
- (i) more than 70 kg,
  - (ii) less than 50 kg,
  - (iii) between 50 kg and 65 kg. 6
- (b) Describe the properties and applications of *t*-test. 4

7. (a) Explain the method of maximum likelihood and its properties. 5
- (b) If  $X_1, X_2, \dots, X_n$  is a random sample taken from Poisson distribution ( $\lambda$ ), then show that sample mean ( $\bar{X}$ ) is a consistent estimator of  $\lambda$ . 5