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**MST-004**

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

**Term-End Examination**

**December, 2021**

**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 questions. 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 probability density function of a  $\chi^2$ -

distribution is  $f(\chi^2) = \frac{1}{4} \cdot \chi^2 \cdot e^{-\chi^2/2}$ ;

$0 < \chi^2 < \infty$ , then the degrees of freedom of the distribution will be 4.

(b) For applying Wilcoxon signed-rank test, the sum of the positive ranks will be 2 if a random sample of IQ level of 3 students is 30, 42 and 26.

(c) The parametric test is used when the form of population is unknown.

(d) An estimator ( $t$ ) is said to be an unbiased estimator of parameter  $\theta$ , if  $\text{var}(t) \rightarrow 0$  for  $n \rightarrow \infty$ .

(e) If the probability of type I error is 0.5, then level of significance will be 0.05.

2. (a) The number of times four people go for grocery shopping in a month is given as follows :

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1, 3, 5 and 7.

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- (i) List all possible samples of size 2 with replacement and compute their means.
- (ii) Compute the mean and standard error of the sampling distribution of the sample mean.

- (b) A random sample of 500 bikers who used the helmet of a particular brand was selected and 65 bikers found the helmet uncomfortable.

Construct 95% confidence interval for the proportion of bikers who are uncomfortable with the helmet. 4

3. (a) A shoe manufacturer claims that athletes can increase their vertical jump heights using the manufacturer's training shoes.

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The vertical jump heights of eight randomly selected athletes measured before and after using the training shoes are as follows :

Athlete	Vertical Jump Height	
	Before	After
1	24	26
2	22	25
3	25	25
4	28	29
5	35	33
6	32	34
7	30	35
8	27	30

At  $\alpha = 0.10$ , is there enough evidence to support the manufacturer's claim ? Assume that the vertical jump heights are normally distributed. 6

- (b) Differentiate between parametric and non-parametric tests. Also write two tests of each kind of tests. 4

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4. It is given that the yearly growth in the sales of a departmental store (in lakhs) follows geometric distribution with parameter  $\theta$ . If 11.1, 11.3, 11.8, 12.2, 12.5, 12.7, 13.3, 13.7, 13.8 and 14.6 are the sales of 10 stores, then show that  $\bar{X}$  is a consistent estimator of  $\frac{1}{\theta}$ . Also compute the consistent estimate of  $e^{\frac{1}{\theta}}$ . 10
5. A survey of 320 families with 5 children each, revealed the following distribution :

No. of Boys	No. of Girls	No. of Families
5	0	14
4	1	56
3	2	110
2	3	88
1	4	40
0	5	12

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- Is this result consistent with the hypothesis that male and female births are equally probable at 5% level of significance? 10
6. (a) What are the properties of maximum likelihood estimator? 3
- (b) A test was conducted on a random sample of 12 individual storage batteries containing the modified design. The following data show the amount of time (in minutes) the battery system to last under normal conditions :
- 89 85 91 95 95 97 81 89 94 86 87 83
- Test whether the modified design has no effect on the variability of the storage life at 10% level of significance. It is given that the standard average storage time is 88 minutes per battery with standard deviation of 6 minutes. 7
7. (a) A study analysed the sleep habits of college students. The study found that the mean sleep time was 6.8 hours with a standard

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deviation of 1.4 hours. Random samples of 100 sleep times are drawn from this population and the mean of each sample is determined. Find the mean and standard deviation of the sampling distribution of sample means.

Also draw a graph of the sampling distribution. 4

- (b) Let  $x_1, x_2, \dots, x_n$  be a random sample of size  $n$  taken from the following p.d.f. :

$$f(x, \theta) = \begin{cases} \frac{1}{2}; & \theta \leq x \leq \theta + 2 \\ 0; & \text{elsewhere} \end{cases}$$

Determine the consistent estimator of  $(\theta+1)$ . 6