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MST-004

Post Graduate Diploma in Applied Statistics (PGDAST)

Term-End Examination

December, 2020

MST-004 : STATISTICAL INFERENCE

Time : 3 Hours *Maximum Marks : 50*

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.*

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

   (a) The variance of t-distribution with 8 degrees of freedom will be 0.8.

(b) The moment estimators are always unbiased estimators.

(c) For testing $H_0 : \theta = 1$ against $H_1 : \theta = 2$, the pdf of the variable is given by

$$f(x, \theta) = \begin{cases} \frac{1}{\theta}; & 0 \le x \le \theta \\ 0; & \text{otherwise} \end{cases}.$$

If the critical region is $X \ge 0.4$, the power of the test will be 0.8.

(d) If a sequence of defective (D) and non-defective (N) 15 items is DDNNNNDNNDDNNNN, then the number of runs in this sequence will be 6.

(e) The number of all possible samples of size 3 with replacement from a population of size 5 will be 10.

2. A battery manufactured by company A has mean lifetime of 2400 hours with standard deviation 200 hours, while battery manufactured by company B has mean lifetime of 2200 hours with standard deviation of 100 hours. If random samples of 125 batteries of each company are tested, determine :

(i) The mean and standard error of the sampling distribution of the difference between mean lifetimes of the batteries.

(ii) The probability that the batteries of company A will have a mean lifetime at least 160 hours more than that of company B. 10

3. (a) Differentiate between estimator and estimate. Write the properties of a good estimator. 3

(b) The following table contains the data related to smoking habit among the participants of two cities :

	Smokers	**Non-Smokers**
City A	800	200
City B	800	400

Construct 99% confidence limits for the difference in proportions of the smokers of the two cities A and B. 7

4. A plant has installed two machines producing polythene bags. The company researcher has taken a random sample of bags produced in 10 days from machine I and 13 days from

machine II, respectively. The following data give the number of units of an item produced on a sampled day by two machines :

Machine I	**Machine II**
18	16
19	17
19	17
18	17
17	16
19	18
18	16
19	16
18	17
19	17
	16
	16
	17

Determine whether the variances of both populations are equal or not at $\alpha = 0.05$ level of significance. 10

5. A research team of a firm has randomly collected data relating to the income and age of 726 employees who have quit their Jobs and recorded in the following table :

	Income Category		
Age Group	I	II	III
Young	50	69	89
Middle aged	67	98	102
Old	78	70	103

Determine whether income depends on age group of employees at 5% level of significance. 10

6. (a) Let $X_1, X_2, \ldots\ldots X_n$ be a random sample from $N(\theta, 9); -\infty < \theta < \infty$. Find the MLE of θ. 5

(b) Differentiate between parametric and non-parameter tests. 5

7. (a) Write the properties and applications of *t*-distribution. 3

(b) A tyres manufacturer claims that the average life of the tyres is 40,000 km. For

testing the claim, a random sample of 8 tyres was selected. The results obtained are presented in the following table :

Tyre	Life (in km)
1	35000
2	38000
3	42000
4	41000
5	39000
6	41500
7	43000
8	38500

Test the claim at 5% level of significance.

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