



Date: 26-04-2025

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A – K1 (CO1)

Answer ALL the questions

(5 x 1 = 5)

1 Define the following

- a) Type I and Type II errors.
- b) Unbiased Test.
- c) Maximal invariant function.
- d) Likelihood Ratio Test.
- e) Length of a run.

SECTION A – K2 (CO1)

Answer ALL the questions

(5 x 1 = 5)

2 Fill in the blanks

- a) Population value is called _____.
- b) If the Critical region is evenly distributed then the test is referred as _____.
- c) Let $X=a+bZ$, $a \in \mathbb{R}$ and $b \in (0, \infty)$, then 'a' is called _____ parameter.
- d) The likelihood ratio is bounded between _____.
- e) The degrees of freedom for the chi square test statistics when testing for independence in a contingency table with 4 rows and 4 columns would be _____.

SECTION B – K3 (CO2)

Answer any THREE of the following

(3 x 10 = 30)

- 3 Define MLR property and show that Poisson distribution possess MLR.
- 4 Show that an UMP level α test is unbiased.
- 5 Let $M(\tilde{x}) = (x_1 - x_n, x_2 - x_n, \dots, x_{n-1} - x_n)$ and G be a group of location changes. Show that $M(\tilde{x})$ is maximal invariant.
- 6 In SPRT, under standard notations prove that $A \leq \frac{1-\beta}{\alpha}$ and $B \geq \frac{\beta}{1-\alpha}$.
- 7 List the merits and demerits of non-parametric methods.

SECTION C – K4 (CO3)**Answer any TWO of the following****(2 x 12.5 = 25)**

8 Let $X \sim B(2, \theta)$. Let the critical region be $C = \{1, 2\}$. Write the test function for testing $H: \theta = 1/2$ vs $K: \theta = 3/4$. Determine Type I error, Type II error and power of the test.

9 Let $X_1, X_2, \dots, X_n$ be a random sample from $N(\theta, 1)$. Obtain UMPU level α test for testing $H_0: \theta = \theta_0$ vs $H_1: \theta \neq \theta_0$. Discuss the case $\theta_0 = 0$ and $\alpha = 0.05$.

10 Find the UMPI test for testing $H: X_1, X_2 \sim N(\mu, 1)$ vs $K: X_1, X_2 \sim \text{Cauchy}(\mu, 1)$.

11 Test whether there is dependency in choosing a type of insurance product on age group based on the data given below:

	Life Insurance	Home Insurance	Health Insurance
Age ≥ 45	362	498	672
Age < 45	456	54	265

SECTION D – K5 (CO4)**Answer any ONE of the following****(1 x 15 = 15)**

12 Let $X \sim B(1, \theta)$. Find UMPT, if it exists, using linear programming method for testing $H: \theta = 0.2$ vs $K: \theta = 0.1, 0.3$ at $\alpha = 0.05$.

13 Discuss the procedure for H-test and one-sample Kolmogorov- Smirnov test.

SECTION E – K6 (CO5)**Answer any ONE of the following****(1 x 20 = 20)**

14 State and prove Neyman-Pearson lemma.

15 Obtain LRT for testing equality of two population variances based on normal distribution.

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