

M. SC. (APPLIED STATISTICS)

(MSCAST)

Term-End Examination

December, 2025

**MST-021 : CLASSICAL AND BAYESIAN
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 6.*

(iii) *Use of Scientific calculator (non-programmable) is allowed.*

(iv) *Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answer :

$$5 \times 2 = 10$$

- (a) If the population does not follow, the normal distribution and sample size is

small, then we use t -test for testing the hypothesis about average of a population.

- (b) In Bayesian approach, we treat the population parameter as a variable.
- (c) The ratio of the likelihood under null hypothesis and under the entire parametric space is called probability ratio.
- (d) For testing goodness of fit when the data are in categorical form, we use K-S test.
- (e) The Cramer-Rao bound on the variance of an estimator T of parameter θ is :

$$\text{Var}(T) \geq \frac{(\theta')^2}{nE\left[\frac{\partial^2}{\partial\theta^2}\log f(x)\right]}$$

2. A food processing company packages 10 gm honey in small jars. Previous experience suggest that the volume of a randomly

selected jar of the company's honey is normally distributed with a known variance of 2 gm. Derive likelihood ratio test for testing :

10

$$H_0 : \mu = 10 \text{ against } H_1 : \mu \neq 10$$

at a α level of significance.

$$\text{Given } [P[-\infty < Z < 1.64] = 0.95].$$

3. The following table presents the analysis of 300 persons according to hair colour and eye colour :

Hair Colour	Eye Colour		
	Brown	Grey	Black
Fair	30	10	40
Brown	40	20	40
Black	50	30	40

Test whether there is an association between hair colour and eye colour at 5% level of significance. (Given $\chi^2_{(4),0.05} = 9.49$).

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4. If the number of weekly accidents occurring on a mile stretch of a particular road follows a Poisson distribution with parameter λ , then : 6+4
- (i) Find the Cramer-Rao lower bound for the variance.
 - (ii) Also, find the UMVUE of λ .
5. (i) Generate 10 random numbers from the following LCG :
- $$x_i = (1573 x_{i-1} + 19) \mod 1000 \quad \text{with} \quad x_0 = 159$$
- (ii) Convert the generated random numbers in part (i) in $U(0, 1)$.
 - (iii) If the inter-arrival times of the patients arriving in a clinic has an exponential distribution with arrival rate $\alpha = 0.2$ per minute, then simulate the times of 10 patients arriving in the clinic using the random numbers obtained in part (ii). 4+2+4
6. Differentiate between the following : 5+5
- (i) Classical and Bayesian approaches of statistical inference
 - (ii) Parametric and Non-parametric tests.

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