No. of Printed Pages : 6 **MST–021**

M. SC. (APPLIED STATISTICS)

(MSCAST)

Term-End Examination

June, 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.

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

(a) If $\tilde{\mu}_1$ and $\tilde{\mu}_2$ represent the median of two independent populations, then for testing the hypothesis :

$$H_0 : \tilde{\mu}_1 \geq \tilde{\mu}_2 \text{ against } H_1 : \tilde{\mu}_1 < \tilde{\mu}_2,$$

we use Wilcoxon matched-pair signed-rank test.

(b) In Bayesian approach, we assume the parameter as a constant.

(c) The Rao-Blackwell theorem enables us to obtain minimum variance unbiased estimator through complete statistic.

(d) A test which is at least as powerful as any other test of the same size is called most powerful test.

(e) For testing the hypothesis whether two attributes are independent or not, we use K-S test.

2. The magnitude of the earthquakes recorded in a region, modelled as an exponential distribution with parameter θ whose p.d.f. is given by :

$$f(x) = \theta e^{-\theta x} \quad ; \quad x > 0, \theta > 0$$

If a seismologist wants to test the hypothesis :

$$H_0 : \theta = \theta_0 \text{ against } H_1 : \theta = \theta_1, (\theta_1 < \theta_0),$$

then derive the test. 10

3. 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 as follows :

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 Kruskal-Wallis test at 1% level of significance (Given : $\chi^2_{(3),0.01} = 11.34$) . 10

4. If the reduced weight (in kg) after a diet plan follows an exponential distribution with parameter θ whose p.d.f. is given as :

$$f(x) = \theta e^{-\theta x}; \quad x \geq 0, \theta > 0,$$

then : 7+3

(i) Find the Cramer-Rao lower bound for the variance.

(ii) Also find UMVUE of $\frac{1}{\theta}$.

5. The number of customer arrivals at a restaurant, follows Poisson distribution, whose p.m.f. is given as follows :

$$P[X = x] = \frac{e^{-\lambda}\lambda^x}{x!}; \; x = 0, 1, 2, \ldots\ldots\ldots, \lambda > 0$$

It is assumed that the arrival rate (λ) of the customers is a random variable and has gamma prior whose p.d.f. is given as follows :

$$f(\lambda) = \frac{b^a}{\Gamma a} e^{-b\lambda} \lambda^{a-1} \; ; \quad a, b > 0$$

If $X_1, X_2, \ldots\ldots\ldots\ldots, X_n$ represent the number of customer arrivals, then show that gamma is a conjugate distribution for the Poisson distribution. 10

6. (a) The following data give the number of road accidents that occurred during the various days of a week :

Day	No. of Accidents
Mon.	14
Tue.	15
Wed.	8
Thu.	20
Fri.	11
Sat.	9
Sun.	14

Test whether the accidents are uniformly distributed over the week at 5% level of significance. (Given : $\chi^2_{(6),0.05} = 12.59)$. 6

(b) Describe OC and ASN function. 4

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