UC-5722

M.A. / M.Sc. (Sem. IV) Examination, June-2023

MATHEMATICS

PAPER- MATH 4 O(iii)

MATHEMATICAL STATISTICS-II

Time Allowed : **Three Hours**

Maximum Marks : **70**

Min. Pass Marks : **28**

Note : *Non-Programmable Scientific Calculator is allowed in this paper.*

This question paper will be divided into three sections as under :

Section-A ***Max. Marks-10***

*This section contains 01 compulsory question comprising **10** short answer type questions (maximum **20** words answer) taking two questions from each unit. Each question shall be of one marks.*

Section-B ***Max. Marks-25***

*This section contains **10** questions, **02** questions from each unit (answer about in **250** words). Students are instructed to attempt five questions by selecting one question from each unit. Each question shall be of five marks.*

Section-C ***Max. Marks-35***

*This section contains five long answer type questions comparising one compulsory question (question no. **07**) of **15** marks and four questions of **10** marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in **500** words) and any two more questions (answer about in **400** words) out of remaining four questions.*

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SECTION-A

1 (i) Define 't' distribution.

(ii) Define the Standard error.

(iii) What is the method of estimation?

(iv) Define the method of moments in estimation.

(v) Explain the consistency.

(vi) Write a note on confidence interval.

(vii) Define the multiple correlation.

(viii) Explain the regression and write the two lines of regression y on x and x on y.

(ix) Explain the contingency table.

(x) Define the non-parametric test.

SECTION-B

UNIT-I

2 Explain the relation between F and Chi-square distribution

OR

Cor the t-distribution with n degree of freedom, establish the recurrence relation.

$$\mu_{2r} = \frac{n(2r-1)}{(n-2r)}\mu_{2r-2} \quad n > 2r$$

UNIT - II

3 Explain the method of least square in estimation as linear function of y.

OR

For the distribution with density function

$$f(x,\theta) = \frac{e^{-\theta}\theta^x}{\lfloor x(1-e^{-\theta})}; \; x = 1, 2, 3, \ldots.$$

obtain the estimate of θ by method of moments.

UNIT - III

4 Show that for a sample of size n drawn from a normal population with mean μ and variance σ^2 i.e. $N(\mu, \sigma^2)$, the statistics $\hat{\mu} = \frac{1}{n+1}\sum_{i=1}^{n} x_i$ is the most efficient for estimating μ though it is biased.

OR

Given the probability density function

$$f(n:\theta) = [\pi(1+(x-\theta)^2]^{-1}, \; -w < \theta < w, \; -w < x < w$$

Show that the Cramer–Rao lower bound of variance of an unbiased estimator of θ is $\frac{2}{n}$, where n is the size of random sample from this distribution.

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UNIT - IV

5 Obtain the equation of two lines of regression for the following data. Also obtain the estimate of x for $y = 70$.

x :	65	66	67	67	68	69	70	72
y :	67	68	65	68	72	72	69	71

OR

In a trivariate distribution

$\sigma_1 = 2 = \sigma_2 = \sigma_3$, $r_{12} = 0.7$, $r_{23} = r_{31} = 0.5$

Find (i) $r_{23.1}$ (ii) $R_{1.23}$ (iii) $b_{12.3}$, $b_{13.2}$

UNIT - V

6 Two sample polls of votes for two condidates A and B for a public office are taken, one from among resident of rural area and other from among the urban area. The results are given below. Examine whether the nature of the area is related to voting perference in this election.

Votes for / Area	A	B	Total
Rural	620	380	1000
Urban	550	450	1000
Total	1170	830	2000

OR

Write a short note on Median Test

SECTION-C

7 Derive the Probability density function (P.D.F.) and Moments generating function (M.G.F.) of Chi-square distribution.

8 Find the maximum likelihood estimator (M.L.E.) of the parameter α and λ (λ being large), of the distribution

$$f(x;\alpha,\lambda) = \frac{1}{\lceil\lambda}\left(\frac{\lambda}{\alpha}\right)^{\lambda} e^{-\lambda x/\alpha} x^{\lambda-1},\ \lambda > 0,\ 0 \le x < \infty$$

You may use that for large value of λ

$$\psi(\lambda) = \frac{\lambda}{\partial\lambda}\log\lceil\lambda = \log\lambda - \frac{1}{2\lambda} \text{ and}$$

$$\psi'(\lambda) = \frac{1}{\lambda} + \frac{1}{2\lambda^2}$$

9 If T_1 and T_2 be two unbiased estimators of $y(\theta)$ with variance σ_1^2, σ_2^2 and corelation ρ, what is the best unbiased linear combination of T_1 and T_2, and what is the variance of such combination.

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10 Show that the correlation coefficient between the residuals $X_{1.23}$ and $X_{2.13}$ is equal and opposite to that between $X_{1.3}$ and $X_{2.3}$.

11 Explain the Test of Independence of Attributes - Contingency tables.

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