

# RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2025

SECOND YEAR (BATCH 2023-27)

Date : 13/05/2025

STATISTICS

Time : 11 am – 1 pm

Paper : 4STAMIC1

Full Marks : 50

[Use a separate Answer Book for each Group]

## Group-A

Answer **any five** questions :

[5×5]

1. What do you mean by multiple correlation coefficients? How do you measure the association between ordinal variables?

2. Suppose three variables  $x_1, x_2, x_3$  satisfy the relation  $a_1x_1 + a_2x_2 + a_3x_3 = k$ , then prove that

$$r_{12} = \frac{a_3^2 s_3^2 - a_1^2 s_1^2 - a_2^2 s_2^2}{2a_1 a_2 s_1 s_2}.$$

3. Prove that the regression equation of  $x_2$  on  $x_1$  and  $x_3$  is

$$x_2 - \bar{x}_2 = \left( \frac{r_{12} - r_{23}r_{31}}{r_{31}^2} \right) \left( \frac{s_2}{s_1} \right) (x_1 - \bar{x}_1) + \left( \frac{r_{23} - r_{12}r_{13}}{r_{13}^2} \right) \left( \frac{s_2}{s_3} \right) (x_3 - \bar{x}_3).$$

4. Multiple correlation coefficients can be expressed in terms of total and partial correlation coefficients as  $R_{1.23} = \sqrt{1 - (1 - r_{12}^2)(1 - r_{13.2}^2)}$ .

5. Taking three variables only, derive partial correlation coefficient formula.

6. Discuss standard error of estimate for multiple regressions. How do you create and interpret a contingency table?

## Group-B

Answer **any five** questions :

[5×5]

7. Consider the p.d.f of the exponential random variable  $X$  as :

$$f(x) = \begin{cases} \theta e^{-\theta x} & ; x \geq 0, \theta > 0 \\ = 0 & ; \text{otherwise} \end{cases}$$

After computing its 'mean', find  $P[X \leq \text{mean}]$ .

8. Let  $X_1 \sim b(n_1, p)$  and  $X_2 \sim b(n_2, p)$ . Let  $X_1$  and  $X_2$  be independent. Find the conditional distribution of  $X_1$  given a value of the random variable  $(X_1 + X_2)$ .

9. A continuous random variable  $X \sim N(\mu, \sigma^2)$ . Derive the expression of the points of inflection of the curve.

10. Derive Poisson distribution from binomial distribution.

11. Provide the statement of

a) 'Weak law of large numbers' (WLLN)

b) If  $X$  is the standard normal variable and  $P(0 \leq X \leq k) = \alpha$ , find the value of  $P(|X| \geq k)$ . (2+3)

12. Suppose a computer program has an error in it. To detect the error, the programmer conducts a series of independent tests. Let the probability that a random test can detect the error be 0.25. Find the expected number of tests required to detect the error for the first time.