2022
B.A./B.Sc.
Sixth Semester
CORE-14
STATISTICS
Course Code: STC 6.21
(Multivariate Analysis & Nonparametric Methods)

Total Mark: 70   *Pass Mark: 28*
Time: 3 hours

Answer <u>five</u> questions, taking <u>one</u> from each unit.

UNIT–I

1. (a) Define bivariate normal distribution. Write down the assumptions of bivariate normal distribution.   1+4=5

    (b) Show that for the bivariate normal distribution $f(x, y)$ is a probability density function.   4

    (c) Obtain the moment generating function of bivariate normal distribution.
                                                                        5

2. (a) Write down the properties of bivariate normal distribution.   5

    (b) Obtain the conditional distribution of X for fixed Y of the bivariate normal distribution.   5

    (c) Show that if X_1 and X_2 are independent normal variates with correlation coefficient ρ between them, then the correlation coefficient between X_1^2 and X_2^2 is given by ρ^2.   4

UNIT–II

3. (a) Give the Rao's definition of multivariate normal distribution. If the density of a p-dimensional random vector X is given as

$|A|^{\frac{1}{2}} (2\pi)^{-\frac{p}{2}} e^{-\frac{1}{2}(X-\mu)^T A(X-\mu)}$, then show that $E(X) = \mu$ and covariance

matrix is A^{-1} which is generally denoted by Σ. 2+6=8

(b) Obtain the moment generating function of multivariate normal distribution.

6

4. (a) If $X \sim N_P(\mu, \Sigma)$, then determine the value of the constant k of multivariate normal distribution. 7

(b) If $X \sim N(\mu, \Sigma)$ and $Y \sim N(\mu, \Sigma)$, then show that X and Y have the same distribution. 4

(c) Let x have a multivariate normal distribution with covariance matrix

$$\Sigma = \begin{bmatrix} 1 & \rho & \rho^2 \\ \rho & 1 & 0 \\ \rho^2 & 0 & 1 \end{bmatrix}, \text{ Show that the conditional distribution of}$$

(X_1, X_2) given $X_3 = x_3$ is also multivariate normal with mean

$$\mu = \begin{bmatrix} \mu_1 + \rho^2(x_3 - \mu_3) \\ \mu_2 \end{bmatrix} \text{ and covariance matrix } \begin{bmatrix} 1-\rho^4 & \rho \\ \rho & 1 \end{bmatrix}. \qquad 3$$

UNIT–III

5. (a) Define σ-scores and standard scores. 4

(b) Write notes on scaling of rankings and scaling of ratings in terms of normal probability curve. 6

(c) What do you understand by reliability of test scores? Write down the assumptions of reliability of test scores. 4

6. (a) Write notes on normalised scores and T-scores. Define percentile scores. 6+3=9

(b) What is index of reliability? Describe one of the methods of determining test reliability. 2+3=5

UNIT–IV

7. (a) What is index numbers? Write down the characteristics of index numbers. $2+4=6$

(b) Distinguish between fixed based and chain based index numbers. 4

(c) Show that Fisher's index number formula satisfies both the time reversal test and the factor reversal test. 4

8. (a) Explain different types of index numbers. 4

(b) Discuss the problems involved in the construction of index numbers. 5

(c) Show that Marshall-Edgeworth's index numbers lies between Laspeyre's and Paasche's index number formula. 5

UNIT–V

9. (a) What is meant by cost of living index numbers? Discuss the uses of cost of living index numbers. $2+5=7$

(b) Write a notes on the following: $3\frac{1}{2}×2=7$
   (i) Wholesale price index numbers
   (ii) Index number of agricultural production

10. (a) Discuss the problems involved in the construction of cost of living index number. 7

(b) What do you mean by deflating the index numbers? 3

(c) Explain briefly about index numbers of industrial production. 4

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