2024

B.A./B.Sc.

Sixth Semester

CORE – 14

STATISTICS

Course Code: STC 6.21

(Multivariate Analysis & Index Numbers)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. (a) Show that $f(x, y)\,dxdy$ is a probability density function. 3
   (b) Obtain the m.g.f. of a bivariate normal distribution. 8
   (c) Write down the properties of bivariate normal distribution. 3

2. (a) Obtain the conditional distribution of X for fixed Y of the bivariate normal distribution. 4
   (b) If X and Y are bivariate normally distributed, then the regression of Y on X is linear. 4
   (c) Determine the parameters of the bivariate normal distribution given by $f(x, y) = C.e^{-\frac{1}{24}[(x-5)^2+4(y-3)^2-2(x-5)(y-3)]}$. Also, find the value of the constant C. 6

UNIT–II

3. (a) Derive the estimation of mean, variance and covariance matrix. 6
   (b) Find the value of constant k of the multi-variate normal distribution. 6
   (c) Let X be a random n-vector with mean vector μ and covariance matrix Σ. Further, let B be an $m \times n$ matrix, b be a constant m-vector and $Y = BX + b$, then $E(Y) = B\mu + b$ and $\text{Cov}(Y) = B\Sigma B'$. 2

4. (a) Define multivariate normal distribution. Derive the independence of variate and marginal distribution. 2+6=8

(b) If the density of a p-dimensional random vector X is $|A|^{\frac{1}{2}} (2\pi)^{-\frac{p}{2}} e^{-\frac{1}{2}(x-\mu)'A(X-\mu)}$. It can be shown that $E(X) = \mu$ and covariance matrix is A^{-1} which is generally denoted by Σ. 6

UNIT–III

5. (a) Define Z-scores. What are the mean and standard deviation of Z-scores? Show the relation between Z-scores and standard scores. Write two disadvantages of Z-scores. 2+2+2+2=8
   (b) What do you understand by reliability of test scores? Describe the Kuder- Richardson formula for estimating reliability. 2+4=6

6. (a) Illustrate the calculation of T-scores for a given frequency distribution. 3
   (b) Define percentile score with its advantages and disadvantages. 3+2=5
   (c) Define intelligent quotient with Herril's classification of an individual. 4+2=6

UNIT–IV

7. (a) Discuss the problems involved in the construction of an index number. 7
   (b) Why is Laspeyre's formula said to have an upward bias and the Paasche's formula have a downward bias? 7

8. (a) What is time reversal test? Explain the performance of different formulae in case of time reversal test. 2+5=7
   (b) Distinguish between fixed-base and chain base methods for the construction of index numbers. Also, mention the steps used in construction of chain indices. 4+3=7

UNIT–V

9. (a) What is family budget survey? Write down its uses. 6
   (b) Explain the process of computing cost of living index number. 4
   (c) Write a note on the index of agricultural production. 4

10. (a) What is meant by base shifting? Explain in detail the process of base shifting. 5

(b) Give the limitations of an index number. 6

(c) Mention the different heads under which the data for index of industrial production is collected. 3
