M 16672

Reg. No. : A8PSST1003

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STATISTICS
Paper – 3.2 : Multivariate Analysis

Time: 3 Hours Max. Marks: 70

Instructions: *1) Answer any* ***5*** *questions without omitting any Unit.*
2) ***All*** *questions carry* ***equal*** *marks.*

UNIT – I

I. a) Define a p-variate normal distribution. Show that the marginal and conditional distributions of subsets of variables of a p-variate normal distribution are also normal.

b) Define any multivariate non-normal distribution and state its properties. Describe singular multivariate normal distribution.

II. a) Obtain the characteristic function of a p-variate normal distribution. Hence show that a linear function of a p-variate normal vector is again a normal vector.

b) Show that X is p-variate normal if and only if every linear combination of its components is normal.

UNIT – II

III. a) Let $(x_1, x_2, ...x_n)$ be a random sample of n vector observations taken from a p-variate normal population $N(\mu, \Sigma)$. Obtain the maximum likelihood estimation of μ and Σ. Examine whethere two estimators are independently distributed.

b) Describe how you construct confidence region for the mean vector of a multinormal distribution when its dispersion matrix is known.

IV. a) Write down the distribution of rectangular coordinates and derive the distribution of Wishart matrix.

b) Obtain the characteristics function of a Wishart distribution. State and prove additive property of Wishart distribution.

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UNIT – III

V. a) Explain and derive the likelihood ratio criterion for testing the independence of sets of variates.

b) Explain how will you test $H: \mu = \mu_1$, and $\Sigma = \Sigma_1$ using a random sample from $N_p(\mu, \Sigma)$, where μ_1 and Σ_1 are given.

VI. a) Derive the likelihood ratio criterion λ to test the hypothesis that the mean vector and covariance matrix of a p-variate normal distribution are respectively equal to a given vector and a given matrix. Give the asymptotic distribution of $-2 \log \lambda$.

b) What do you mean by spherical normal distribution ? Explain how to test the hypothesis $\Sigma = \sigma^2 I$ using a random sample from $N_p(\mu, \Sigma)$.

UNIT – IV

VII. a) Derive the distribution of the sample partial correlation coefficient in the null case.

b) Obtain the distribution of the sample multiple correlation coefficient.

VIII. a) Define Mahalanobis D^2 Statistic. Derive its distribution. Point out the relationship between D^2 and T^2.

b) Obtain the confidence region for $\mu^{(1)} - \mu^{(2)}$ in a two sample problem using D^2 statistic.

UNIT – V

IX. a) Describe briefly the discrimination problem. Derive the Bayes procedure of classification into one of the two populations whose probability distributions are known.

b) Define principal components. Explain the procedure to construct principal components. State and derive their properties.

X. a) Discuss the problem of estimating canonical correlations and variates in normal populations. Explain how would you determine, statistically, the numbers of non-zero and zero population canonical correlations.

b) What is factor analysis ? Distinguish between principal component analysis and factor analysis. Discuss the problems associated with estimation of factor scores.
