



K24P 3651

Reg. No. :

Name :

IV Semester M.Sc. Degree (C.B.S.S.-Regular) Examination, April 2024
(2022 Admission)

STATISTICS WITH DATA ANALYTICS

Core Course

MST4C12 : Multivariate Analysis

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all eight** questions. **Each** question carries 2 marks.

1. Define characteristic function of a random vector. What are its properties ?
2. What is Mahalanobis D^2 statistic ?
3. What is MANOVA ?
4. Define canonical correlation.
5. Describe sphericity test.
6. What is factor score ?
7. Distinguish between singular and non-singular normal distributions.
8. Describe classification problem.

(8×2=16)

PART – B

Answer **any four** questions. **Each** question carries 4 marks.

9. Find the marginal distribution of Wishart distribution.
10. How data reduction can be attained using principal components ?
11. Derive the MLE of the mean vector of $N_p(\mu, \Sigma)$.
12. Define and describe the use of Fisher's discriminant function.

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13. Find out the relation between Hotelling T^2 and Mahalanobis D^2 .
14. Show that any principal submatrix of a Wishart matrix is again a Wishart matrix. (4×4=16)

PART – C

Answer **any four** questions. **Each** question carries **12** marks.

15. a) State and establish the reproductive property of Wishart distribution $W_p(n, \Sigma)$.
 b) Let $Y^{(1)}, Y^{(2)}, \dots, Y^{(n)}$ are independent random vectors with each $Y^{(i)}, i = 1, 2, \dots, n$ are $N_p(0, I)$ then find the distribution of $W = \sum_{i=1}^n Y^{(i)} Y^{(i)\top}$.
16. a) If \bar{y} is the mean of a sample of N drawn from $N_p(\mu, \Sigma)$ and Σ is known, then obtain a critical region of size α for testing the hypothesis $\mu = \mu_0$.
 b) Derive the distribution of one sampling Hotelling T^2 .
17. a) Explain the role of factor analysis of multivariate data.
 b) Discuss the problem of estimating canonical correlations and variates in normal populations.
18. a) Define Hotelling's T^2 statistic. Express it as a function of the likelihood ratio criterion.
 b) Show that Mahalanobis D^2 is the square of the distance between two vectors.
19. a) Derive the classification rule for classifying the objects into one of the two multivariate normal population when $\Sigma_1 = \Sigma_2 = \Sigma$.
 b) Show that Baye's procedure is admissible.
20. a) Find the distribution of any principal submatrix of a Wishart matrix.
 b) What is generalized variance ? What is the distribution of sample generalized variance ? (4×12=48)