19P452 (Pages: 2) Name: ………………….…...

Reg. No……………………..

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2021

(CBCSS-PG)

CC19P MST4 C14 - MULTIVARIATE ANALYSIS

(Statistics - Core Course)

(2019 Admission - Regular)

Time: Three Hours Maximum:30 Weightage

PART A

Answer any ***four*** questions. Each question carries 2 weightage.

1. Define the singular multivariate normal distribution.
2. Show that $X \sim N_p(\mu, \Sigma)$ if and only if $T'X \sim N_1(T'\mu, T'\Sigma T)$ where T is any real vector.
3. Distinguish between partial and multiple correlation.
4. Describe sphericity test.
5. Define Wishart distribution.
6. Define canonical variates and canonical correlation.
7. Explain the classification problem with a suitable example.

(4 × 2 = 8 Weightage)

PART B

Answer any ***four*** questions. Each question carries 3 weightage.

8. Derive the null distribution of the sample correlation coefficient.
9. Show that $\bar{X}$ and S are independently distributed when sampling from a multivariate normal population.
10. Let $X = \begin{pmatrix} X^{(1)} \\ X^{(2)} \end{pmatrix}$ be a p-variate multivariate Normal random vector. Obtain the necessary and sufficient condition for the independence of $X^{(1)}$ and $X^{(2)}$.
11. Let X $\sim N_p(0, \Sigma)$, then write the necessary and sufficient condition for the independence of the quadratic forms $X'AX$ and $X'BX$ where A and B are real symmetric matrices.
12. Derive likelihood ratio test for testing $H_0 : \mu_1 = \mu_2 (= \mu_0)$ in $N_p(\mu_1, \Sigma)$ and $N_p(\mu_2, \Sigma)$ distributions, where Σ is unknown.
13. Formulate the classification problem as a special case of a statistical decision problem.
14. Distinguish between principal components and factor analysis.

(4 × 3 = 12 Weightage)

PART C

Answer any ***two*** questions. Each question carries 5 weightage.

15. Obtain the MLE of μ and $\sum$ when sampling from Multivariate Normal population with parameters μ and $\sum$.
16. State and prove the Cochran's theorem for the independence of quadratic forms and mention its applications.
17. Derive the distribution of Hotelling's T^2 statistic and explain its properties.
18. Evaluate the principal components in $X' = (x_1, x_2, x_3)$ with the covariance matrix $A = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 2 \\ 1 & 2 & 4 \end{pmatrix}$.

(2 × 5 = 10 Weightage)

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