1M4A23228 (Pages : 2) Reg. No:.........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Statistics Degree Examination, April 2023

MST4C14 – Multivariate Analysis

(2019 Admission onwards)

Time: 3 hours Max. Weightage : 30

PART A

Answer Any four questions. Weightage 2 for each question

1. Define a non-singular multivariate normal distribution. If $X \to N_p(\mu, \Sigma)$, find the marginal distribution of any sub-vector of X?
2. If $X \sim N_p(\mu, \Sigma)$ then derive the distribution of $(X-\mu)'\Sigma^{-1}(X-\mu)$.
3. Distinguish between simple, partial and multiple correlation.
4. What is generalized variance? Mention its distribution?
5. Show that Hotellings T^2 is invariant under non-singular transformation.
6. Describe the test for the mean vector of a multivariate normal distribution when its dispersion matrix is known.
7. Write short note on classification problem.

(4x2=8 Weightage)

PART B

Answer Any four questions. Weightage 3 for each question

8. Find means, variances and correlation coefficient, when X follows bivariate normal with density function $f(x) = \frac{1}{2.4\,\pi} \exp \frac{1}{0.72} \left(\frac{x^2}{4} - 1.6\frac{xy}{2} + y^2\right)$.
9. If $X \sim N_p(0, I)$, show that the characteristic function of X'AX is $|I - 2itA|^{-1/2}$.
10. Obtain the MLE's of μ and Σ in $N_p(\mu, \Sigma)$. Show that they are independent.
11. Define Wishart distribution. If A follows Wishart distribution $W(m, \Sigma)$, then find the distribution of CAC'.
12. Explain the sphericity test.
13. Derive the test for independence of sub vectors of a multivariate normal random vector.
14. What are principal components? Obtain their relations with eigen values and eigen vectors of dispersion matrices.

(4x3=12 Weightage)

PART C

Answer Any 2 questions. Weightage 5 for each question

15. Let $X = \begin{pmatrix} X^{(1)} \\ X^{(2)} \end{pmatrix}$ *follows* $N_p(\mu, \Sigma)$, where $X^{(1)}$ is of order of $qx1$.

 (a) Derive a necessary and sufficient condition for the independence of the sub vectors $X^{(1)}$ and $X^{(2)}$.

 (b) Obtain the conditional distribution of $X^{(1)}$ given $X^{(2)} = x^{(2)}$.

16. (a) Find the characteristic function of Wishart distribution.

 (b) What do you mean by canonical correlation analysis? What are their uses?

17. (a) Define Hotellings T^2 distribution and obtain its density function.

 (b) Explain any two uses of Hotellings T^2 in the construction of confidence regions.

18. (a) Describe the procedure of classification into one of two known multivariate normal populations with the same known dispersion matrix.

 (b) Describe orthogonal factor model. What are factor loadings?

(2x5=10 Weightage)

1M4A23229 (Pages : 2) Reg. No:.........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester M.Sc Statistics Degree Examination, April 2023

MST4E01 – Operations Research – I

(2019 Admission onwards)

Time: 3 hours Max. Weightage : 30

Part A (Short answer questions)

Answer any four questions. Weightage two for each question.

1. Define basic solution of a system of linear equations. When it will become degenerate? Illustrate it with the help of an example.
2. Define dual of a linear programming. State and prove weak duality theorem.
3. Define a transportation problem. Show that a balanced transportation problem always will have a feasible solution.
4. Explain the concept of loop in a transportation problem. How it is related to a basic feasible solution of a transportation problem?
5. Differentiate between sensitivity analysis and parametric programming problem.
6. Give any two application of 0-1 programming.
7. Define pure and mixed strategies associated with a game. Why we need to introduce mixed strategies?

Part B (Short essay type questions)

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

8. Define a convex set and extreme point of a convex set. Show that optimum feasible solution of a linear programming problem if it exists will always be at one of the extreme points.
9. Explain the step by step algorithm associated with solving a linear programming problem.
10. Define an assignment problem. Explain the steps involved in solving an assignment problem.

11. Sole the transportation problem

	D_1	D_2	D_3	D_4	
O_1	16	10	15	22	300
O_2	19	30	24	8	175
O_3	30	25	18	35	225
	100	200	150	150	

12. Describe the steps involved in obtaining the optimal sequencing of 3-job n-mechine problem.
13. Discuss graphical method of solving an mx2 game.
14. Explain how an mxn game can be transformed in to a linear programming problem.

Part C (long essay questions)

Answer any two questions .Each question carry 5 weight.

15. Solve the LPP by dual simplex method

    Max $Z= 2x_1+5x_2+4x_3$

    Subject to

    $5x_1+3x_2+x_3 \geq 10$

    $3x_1+4x_2+2x_3 \geq 12$; x_1, x_2, x_3 nonnegative.

16. A .Discuss Vogal's method of finding an initial basic solution to a transportation problem.

    B .Explain iterative steps involved in solving a transportation problem.

17. Define an integer programming problem .Differentiate between pure and mixed integer programming problems. Discuss Gomery's cutting method of solving an integer programming problem.
18. Solve the game

	B_1	B_2	B_3	B_4
A_1	10	14	17	8
A_2	18	32	16	20
A_3	-2	9	22	28