ALUPE UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR

ACADEMICS, RESEARCH AND STUDENTS AFFAIRS

UNIVERSITY EXAMINATIONS

2024/2025 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER REGULAR MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN APPLIED STATISTICS

COURSE CODE: STA 429

COURSE TITLE: APPLIED MULTIVARIATE ANALYSIS

DATE: 22nd April 2025 **TIME:** 08:00 – 11:00

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES **PLEASE TURN OVER**

STA 429

REGULAR – MAIN EXAM

STA 429: APPLIED MULTIVARIATE ANALYSIS

STREAM: BSC (Applied Statistics With Computing) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. Answer ALL questions from section A and ANY THREE Questions in section B.

ii. All questions in section B carry Equal Marks.

iii. Do not write on the question paper.

SECTION A (31 marks): Answer ALL questions

QUESTION ONE (16MKS)

a) Define the following terms as used in multivariate analysis, giving relevant example where possible. (5 Marks)

i) Multivariate data

ii) Null matrix

iii) Diagonal matrix

iv) Identity matrix

v) Trace of a matrix

b) Find the eigen values and corresponding eigen vectors of the matrix A (5 Marks)

$$A = \begin{bmatrix} 1 & 2 \\ 2 & -2 \end{bmatrix}$$

c) Find the mean vector and covariance matrix for the two random variable X_1 and X_2 when their joint pdf $f(X_1, X_2)$ is given in the following table (6 marks)

X_2 \ X_1	0	1	$f_{1(x_1)}$
-1	0.24	0.06	0.30
0	0.16	0.14	0.30
1	0.40	0.00	0.40
$f_2(x_2)$	0.80	0.20	

QUESTION TWO (15 Marks)

a) Given the data matrix, obtain the sample mean, the sample variance covariance matrix and sample correlation matrix of the matrix below (5 marks)

$$X = \begin{bmatrix} 42 & 4 \\ 52 & 5 \\ 48 & 4 \\ 58 & 3 \end{bmatrix}$$

b) List 5 assumptions of discriminant analysis (5 marks)

c) If $S = \begin{bmatrix} 14808 & 14213 \\ 14213 & 15538 \end{bmatrix}$ obtain generalized sample variance (5 Marks)

SECTION B (39 MARKS, CHOOSE ANY THREE QUESTIONS)

QUESTION THREE (13 MARKS)

a) If variance covariance matrix $\epsilon = \begin{bmatrix} 4 & 1 & 2 \\ 1 & 9 & -3 \\ 2 & -3 & 25 \end{bmatrix}$ obtain $V^{1/2}$ and e (3 marks)

b) Discuss 5 objectives of multivariate analysis. (10 marks)

QUESTION FOUR (13 Marks)

a) X_1 and X_2 have a bivariate normal distribution with mean $\mu = \begin{bmatrix} 2.9 \\ 0.16 \end{bmatrix}$, $\epsilon =$

$\begin{bmatrix} 0.16 & 0.16 \\ 0.16 & 0.25 \end{bmatrix}$

Calculate;

i. $P(2.1 < X_2 < 3.3)$ (2 marks)

ii. $P(2.1 < X_2 < 3.3 | X_1 = 3.2)$ (4 marks)

b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 1 & 0 \\ 1 & 2 \end{bmatrix}$ (7 marks)

QUESTION FIVE (13 Marks)

a) Discus 3 assumptions of factor analysis (3 marks)

b) Discuss 6 steps applied in exploratory Factor Analysis. (6 marks)

c) Clearly elaborate 4 methods for finding number of factors to be extracted in factor analysis (4 marks)

QUESTION SIX (13 Marks)

a) Explain the following terms as used in factor analysis (4 marks)

i. Factor loading

ii. Factor rotation

b) List the 9 steps running discriminant analysis in SPSS (9 marks)

QUESTION SEVEN (13 Marks)

a) Discuss 5 advantages and 4 disadvantages of factor analysis (9 marks)

b) Outline 4 different types of factor analysis (4 marks)