



MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2022/ 2023 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER

**SCHOOL OF BUSINESS AND ECONOMICS.
DEGREE IN ECONOMICS AND STATISTICS.**

COURSE CODE: ECS 4108

COURSE TITLE: ADVANCED STATISTICS.

DATE: 14TH DECEMBER, 2022

TIME: 1430-1630

INSTRUCTIONS TO CANDIDATES

Answer Question ONE and any other TWO questions

This paper consists of FOUR printed pages. Please turn over.

Question One

- a. State any two properties of orthogonal matrix. Hence show that;

$$A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \text{ is orthogonal} \quad \textbf{(3 marks)}$$

- b. Give two properties of canonical correlation **(2 marks)**

c. Let $A = \begin{pmatrix} 3 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{pmatrix}$, find;

- i. The eigenvalues of A **(6 marks)**

- ii. $\text{Tr}(A)$ **(2 marks)**

- iii. Determinant of A **(2 marks)**

- d. Inertial weight in tons and fuel economy in (mi/gal) were measured for a sample of seven diesel trucks and results presented as below;

Weight	8	24.5	27	14.5	28.5	12.75	21.25
Mileage	7.69	4.97	4.56	6.49	4.34	6.24	4.45

- i. Compute the least square line for predicting mileage from height **(5 marks)**

- ii. If two trucks differ in weight by 5 tons, how much would you predict their mileages to differ? **(2 marks)**

- iii. Is the slope coefficient significant, at 5% significance level? **(4 marks)**

- e. In discriminant analysis, group represent either a population or a sample. Explain two main objectives to be considered in separation of groups **(4 marks)**

Question Two

- a. Your village members believe that economic growth is affected by agricultural output and trade. To investigate this believe you conducted a survey in your village among 10 village members. Suppose the summary was given by;

$$(X^T X)^{-1} = \begin{bmatrix} 1.3812 & -2.0963 & 0.6654 \\ -2.0963 & 3.8543 & -1.3312 \\ 0.6654 & -1.3312 & 0.4841 \end{bmatrix}, y^T y = 172.273 \text{ and } X^T y = \begin{bmatrix} 35.350 \\ 63.445 \\ 128.950 \end{bmatrix}$$

- i. From the summary statistics, is trade useful for studying the economic growth, at 99% confidence level? **(3 marks)**

- ii. At 5% level of significance, comment on the adequacy of the model used to investigate this believe **(5 marks)**
 - iii. One of the senior villager is 95% confident that agricultural output and trade have no significant difference in terms of economic contribution. Can this be true? **(5 marks)**
 - iv. At 99% level of confidence, construct the confidence interval for agricultural output **(4 marks)**
- b. Give three assumptions for fitting the model in (a) above **(3 marks)**

Question Three

- a. Differentiate between type I and type II error **(2 marks)**
- b. Samples of steel produced at two different rolling temperatures are compared, where y_1 is the yield point and y_2 is the ultimate strength as shown in the table.

Temperature 1		Temperature 2	
y1	y2	y1	y2
33	60	35	57
36	61	36	59
35	64	38	59
38	63	39	61
40	65	41	63
		43	65
		41	59

Calculate;

- i. The pooled covariance matrix (S_{pl}) **(8 marks)**
- ii. The discriminant function **(5 marks)**
- iii. The values of projected points **(5 marks)**

Question Four

- a. Three variables are measured at 10 different locations and the data is recorded as shown.

Location No.	y1	y2	y3
1	35	3.5	2.80
2	35	4.9	2.70
3	40	30.0	4.38
4	10	2.8	3.21
5	6	2.7	2.73
6	20	2.8	2.81
7	35	4.6	2.88
8	35	10.9	2.90
9	35	8.0	3.28
10	30	1.6	3.20

Given the covariance matrix $S = \begin{pmatrix} 140.54 & 49.68 & 1.94 \\ 49.68 & 72.25 & 3.68 \\ 1.94 & 3.68 & 0.25 \end{pmatrix}$, find

- Correlation matrix, R **(4 marks)**
- Given that $z = 3y_1 - 2y_2 + 4y_3$, find mean and variance of z **(4 marks)**
- Another linear combination $w = y_1 + 3y_2 - y_3$. Find the sample correlation between z and w **(5 marks)**
- Given the following three linear functions. Calculate correlation matrix R_z **(7 marks)**
 $z_1 = y_1 + y_2 + y_3$
 $z_2 = 2y_1 - 3y_2 + 2y_3$
 $z_3 = -y_1 - 2y_2 - 3y_3$

///END///