



MAASAI MARA UNIVERSITY
REGULAR UNIVERSITY EXAMINATIONS
2023/2024
SCHOOL OF BUSINESS AND ECONOMICS
BACHELOR'S OF SCIENCE IN ECONOMICS
AND STATISTICS
THIRD YEAR FIRST SEMESTER

COURSE CODE: ECS 3103-1

COURSE TITLE: ECONOMETRICS I

DATE:

TIME:

INSTRUCTIONS:

Attempt Question one and any other Two Questions

Show your workings as marks will be awarded for correct working.

Question One

- The Gauss Markov theorem states that the OLS estimators are the most efficient unbiased estimators. Explain what this means. **(2 marks)**
- State the implications that will result when a linear regression model is estimated and used in inferential analysis when it violates the following assumptions.
 - Normality. **(2 marks)**
 - Homoscedasticity. **(2 marks)**
 - No serial correlation. **(2 marks)**
 - No Multicollinearity. **(2 marks)**
- In a simple linear regression model $Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$ where $\varepsilon_i \sim N(0, \sigma^2)$ the OLS estimators for β_1 is given as $\hat{\beta}_1 = \sum_{i=1}^n C_i Y_i$ where $C_i = \frac{(X_i - \bar{X})}{\sum_{i=1}^n (X_i - \bar{X})^2}$. Show that the estimator is unbiased and hence determine the sample distribution of the estimator. **(6 marks)**
- The growth of Micro Finance Institutions is believed to be affected by various types of innovations (institutional, product, process and market). To assess this theorem a study was conducted among 151 Micro Finance Institutions. The survey asked the respondents to rate in a scale of 1 to 5 the level of implementation of the innovations in their institutions together with the level of growth of their institutions. The statistic related to the survey were as illustrated below.

$$(X'X)^{-1} = \begin{bmatrix} 0.1760 & -0.0150 & -0.0149 & -0.0122 & -0.0138 \\ -0.0150 & 0.0048 & 0.0001 & 0.0004 & -0.0001 \\ -0.0149 & 0.0001 & 0.0046 & -0.0005 & 0.0005 \\ -0.0122 & 0.0004 & -0.0005 & 0.0041 & 0.0000 \\ -0.0138 & -0.0001 & 0.0005 & 0.0000 & 0.0042 \end{bmatrix}$$

$$X'Y = \begin{bmatrix} 365 \\ 1082 \\ 1240 \\ 1169 \\ 1132 \end{bmatrix}, Y'Y = 1083$$

Use the data to fit the following linear regression model. **(4 marks)**

$$Growth = \beta_0 + \beta_1 Institution + \beta_2 process + \beta_3 product + \beta_4 market + \varepsilon$$

Question Two

The data below shows the cost of a sample of bedsitter houses in Narok town and the location of the houses with reference to Maasai Mara University. Use it to answer the questions below.

Location	Rent In Thousands of Shillings
Far from Campus	5.1
Near Campus	7.1
Far from Campus	5.2
Far from Campus	5.0
Far from Campus	4.7
Near Campus	6.9
Far from Campus	5.0
Far from Campus	4.9
Near Campus	7.0
Far from Campus	5.1
Near Campus	6.7
Near Campus	7.1
Far from Campus	5.0
Far from Campus	4.8
Near Campus	7.0
Far from Campus	5.2

- a. Use the data to fit the following linear regression model to the data and interpret the results. **(4 marks)**
$$\text{Rent in Thousands} = \beta_0 + \beta_1 \text{Near Campus} + \varepsilon$$
- b. At 1% significance level test the assumption that location of the bedsitter near the campus affects its price. **(4 marks)**
- c. Using appropriate the confidence intervals at 95% confidence level make conclusion about the following assumptions.
- The average price of house located away from campus is Kshs 4000. **(3 marks)**
 - Location of bedsitter near the university increases the rental cost by Kshs 1500 on average. **(3 marks)**
- d. If it cost a student 100 shillings on transport per days to travel to campus from bedsitters which are located far away from campus and the student has to travel 3 times a week to campus. Would you advice the student to live in bedsitters near or away from campus? Justify your reasoning. **(1 mark)**

Question Three

The time required for a merchandiser to stock a grocery store shelf with a soft drink product as well as the number of cases of product stocked is shown in the table below;

No.	Time (y)	Cases stocked (x)
1	10.25	25
2	3.01	6
3	3.07	8
4	6.92	17
5	0.34	2
6	5.15	13
7	9.40	23
8	12.01	30
9	12.06	28
10	6.32	14

- Fit a simple linear regression model time required for a merchandiser to stock a grocery store shelf based on the number of cases of product stocked. **(4 marks)**
- Assess the assumption that there is a linear relationship between time and cases stocked at 95% confidence level. **(5 marks)**
- Assess the assumption that there is no serial correlation in the model. **(6 marks)**

Question Four

A multiple linear regression model can be written in matrix form as $Y = X\beta + \varepsilon$ where Y is an $n \times 1$ matrix, β is a $k \times 1$ matrix, X is a $n \times k$ matrix and ε is a $n \times 1$ matrix such that

$$E(\varepsilon) = 0 \text{ and } \text{var}(\varepsilon) = \sigma^2.$$

- Derive the OLS estimator for the parameter β . **(4 marks)**
- Show that the estimator in (a) above is unbiased. **(3 marks)**
- Show that the estimator in (a) above has minimum variance. **(8 marks)**