

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF
SCIENCE IN PROCUREMENT AND LOGISTICS MANAGEMENT. MASTER
OF ENTREPRENEURSHIP AND ENTERPRISE MANAGEMENT AND
MASTER OF BUSINESS MANAGEMENT**

MSOM 821: QUANTITATIVE METHODS**STREAMS: MSC. PLM, MBA (Y1S1)****TIME: 3 HOURS****DAY/DATE: WEDNESDAY 23/04/2025****2.30 P.M. – 4.30 P.M.****INSTRUCTIONS**

- Answer question ONE (compulsory) and any other THREE questions.

QUESTION ONE (40 marks)

- a. Quantitative techniques are widely used in business decision-making, yet they come with limitations. Discuss four such limitations. (6 marks)
- b. A software development firm generates revenue at the rate $R = 20 + 16x - x^2$ thousand Kenya shillings in its x years of operation, while its average cost of operation is $c = 2t - \frac{65}{x} - 20$ thousand Kenya shillings
- (i) When is the revenue of the firm greatest and what is its value? (3 marks)
- (ii) When is the profit of the firm optimum? (5 marks)
- c. The following data give the experience of machine operators and their performance ratings as given by the number of good parts turned out per 100 pieces :

Operator	1	2	3	4	5	6	7	8
Experience (in years) X	15	11	17	5	4	9	6	11
Performance Ratings Y	85	86	88	70	77	79	74	82

Required:

- (i) Fit the regression equation of performance ratings on experience [6 marks]
- (ii) Estimate the expected performance rating of an operator with 7 years of experience [2 marks]
- (iii) Test the significance of correlation coefficient at 5% level (6 marks)

d. The following table shows data on the number of sick leave days taken by managerial and non-manual employees of a particular organization.

No. of Days	Employee Category		
	Managerial	Non-managerial	Total
0-10	25	30	45
11-20	20	18	12
21 or more	45	48	57
Total	100	50	150

Perform appropriate hypothesis test to assess whether there is evidence to suggest that employee category is associated with number of sick leave days taken at 5% level of significance. (6 marks)

Highlight four important characteristics of chi-square test (6 marks)

QUESTION TWO

- (a) Distinguish the following concepts as used in quantitative statistics
 - (i) Parametric and distribution free tests (2 marks)
 - (ii) A null and alternative hypothesis (2 marks)
- (b) A man invested Ksh. 30,000 into three different investments. The rates of interest is 2%, 3% and 4% per annum resp. The total annual income is Kshs. 1000. If the income from the first and second investments is Kshs. 50 more than the income from third, find the amount of each investment, by using matrix algebra (6 marks)
- (c) A company manufactures two products, X and Y, using two machines. Each unit of product X requires 2 hours on Machine 1 and 1 hour on Machine 2. Each unit of product Y requires 1 hour on Machine 1 and 2 hours on Machine 2. The company aims to maximize the contribution margin, with constraints that machine availability is 16 hours for Machine 1 and 14 hours for Machine 2. Formulate the problem as a linear

programming model and determine the optimal production levels using graphical methods. (10 marks)

QUESTION THREE

a) The average revenue function for a product is $AR(X) = -X^2 + 20X + 1000$. The total cost function $TC(x) = 10X^2 - 200X$ where X is the number of units sold.

Required:

(i) How many units must be sold to maximise profit? (6 marks)

(ii) What is the maximum possible profit (4 marks)

b) A manager in charge of operations wants to determine whether there is difference in the mean monthly number of customers served in the company's three branches. Several cashiers from each branch are randomly selected and each provides their data on the number of customers served (in thousands) for the previous month. The results are as shown in the table below.

	Cashiers	
A	B	C
12	14	14
15	14	17
17	21	20
12	15	15
	19	

- i. Set up an analysis of variance table for the above information.
- ii. At 5% level of significance, can the analyst conclude that there is a significant difference in the mean monthly customers served by the three cashiers?

(10 marks)

QUESTION FOUR

a) Describe the hypothesis testing procedure (6 marks)

b. The ICT department conducted a seminar to reduce the number of errors made by the administrative staff when entering data in an ERP system. The table below shows the number of errors recorded before and after training:

Staff	1	2	3	4	5	6	7
Errors (before)	14	11	13	7	6	5	8

Errors (After)	10	9	7	4	2	1	7
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At 5% level of significance, test whether the seminar significantly reduced the number of errors. (6 marks)

b) The average cost function of a product is given by

$$AC(x) = x^3 - \frac{615x^2}{2} + 15750x + 1800 \text{ where } x \text{ is the number of units produced. Determine}$$

- i. The total cost of producing 10 units (4 marks)
- ii. The level of output at which Average cost is minimized (4 marks)

QUESTION FIVE

- (a) Outline the significance of regression analysis (4 marks)
- (b) In order to determine the effects of Contract Processing Time (TIME) and Contract Cost Management (COST) on Operational Efficiency (OE) the following model was estimated. The variables were observed by statements measured on a five point likert scale.

$$\widehat{OE} = 4.26 + 2.157COST - 0.447TIME$$

$$P\text{-value} \quad (0.104) \quad (.007) \quad (.000)$$

$$n = 526, R^2 = .516$$

Where p-values appear in parentheses below the estimated coefficients.

Required:

- i. Interpret the model intercept term and other predictor variable coefficients (6 marks)
 - ii. Interpret R-square of the model (2 marks)
 - iii. Identify the significant predictors of the dependent variable at 5% level of significance (2 marks)
- (c) A housing agent claims that the average speed of vehicles plying through an estate is greater than 35Km/h speed limit. A random sample of 100 vehicles has an average speed of 36.5 Km/hour with a variance of 16Km/h. Use 5% level of significance to test the claim of the housing agent. (6 marks)