CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF BUSINESS ADMINISTRATION/MASTERS OF SCIENCE IN PROCUREMENT AND LOGISTICS MANAGEMENT

MSOM 821: QUANTITATIVE METHODS

STREAMS: ODEL **TIME:3 HOURS**

DAY/DATE: THURSDAY 13/04/2023 **2.30 P.M. –5.30 P.M.**

INSTRUCTIONS

Answer question ONE and any other THREE questions

QUESTION ONE (40 marks)

a) Explain the meaning and different types of quantitative techniques (8 marks)

b) Highlight issues that limit the application of quantitative methods in managerial decision making (4 marks)

c) Distinguish between a null and alternative hypothesis (4 marks)

d) The demand function faced by a firm is $4p + Q - 16 = 0$. The total cost function of a commodity produced by the firm is given as $TC = 4 + 2Q - \frac{3Q^2}{10} + \frac{Q^2}{20}$ where Q is the quantity produced in units. Find:-

   i. The expression for Total Revenue and Profit functions (4 marks)

   ii. The output at which the profit for the firm is maximum. (6 marks)

e) The Director of quality assurance wants to determine if class attendance is able to predict a students 'final grade. The Director selects 10 students from a class and obtains the following data.

Student	A	B	C	D	E	F	G	H	I	J
Final Aggregate Points	81	90	86	76	51	75	44	81	94	93
Classes missed	1	0	2	3	6	4	7	2	0	1

Required:

i. Fit the regression equation for the data using least squares method (4 marks)

ii. Interprete your intercept and the coeffient of the independent variable X (4 marks)

iii. Compute and interprete the correlation coefficient for the data (6 marks)

QUESTION TWO

a) Explain the following concepts as used in quantitative methods

i. A sampling design (2 marks)

ii. Slack variable (2 marks)

iii. Feasible region (2 marks)

b) A company manufactures two types of products, A and B. Each product uses two processes, I and II. The processing time per unit of product A on process I is 6 hours and process II is 5 hours. The processing time per unit of product B on process I is 12 hours and process II is 4 hours. The maximum number of hours available per week on process I and II are 75 and 55 hours respectively. The profit per unit of selling A and B are Rs. 12 and Rs.10 respectively.

i. Formulate a linear programing model so that the profit is maximized.

ii. Solve the problem graphically and determine the optimum values of product A and B.

(8 marks)

c) A lighting company has decided to build a test sample of 1, 000 light bulbs that are assumed to be a random sample before it begin it begins full scale production. The sample results showed the mean of 704 hours and a standard deviation of 150 hours.

Required:

Determine at 5% level of significance whether the mean life of the new light bulbs exceeds the old bulb average of 700 hours. (6 marks)

QUESTION THREE

a) Chi-square statistic is considered a non-parametric test. What is your understanding of a non-parametric test? Specify any two conditions that must be satisfied for chi-square test to applied in analysis (6 marks)

b) Suppose a building contractor has accepted orders for five Victoria styles houses, seven colonial style houses and twelve traditional style houses. These orders can be represented by the row matrix $Q = [5 \quad 7 \quad 12]$

Furthermore, suppose the input elements that go into each type of house are steel, wood, glass, paint and labour. The entries in the matrix R below gives the number of units of each cost element going into each type of house:

	Steel	Wood	Glass	Paint	Labour
Victoria	5	20	16	7	17
Colonial	7	18	12	9	21
Traditional	6	25	8	5	31

Hence R= $\begin{bmatrix} 5 & 20 & 16 & 7 & 17 \\ 7 & 18 & 12 & 9 & 21 \\ 6 & 25 & 8 & 5 & 31 \end{bmatrix}$

Suppose that steel costs Ksh. 1500/unit, wood costs Ksh 800/unit, glass, paint and labour cost Ksh. 500, Ksh. 100, and Ksh. 1000 per unit respectively.

i. Compute the product matrix, QR, the amount of each raw material needed for the contract.

ii. Hence use matrix algebra to compute the cost of each type of house. (6 marks)

c) Five Nairobi County new drivers were given a test to determine their knowledge of the city streets. The results were not considered to be satisfactory. The five drivers were recommended for a two-day workshop training on the various streets in Nairobi. The following table represents the scores obtained by the drivers before and after the workshop training.

Driver	Score before Training	Score after training
1	8	10
2	9	12
3	12	15
4	15	19
5	12	15

Required: AT 0.05 level of significance, use paired T-test to determine whether the drivers have improved their knowledge of Nairobi city streets. (8 marks)

QUESTION FOUR

a) The procedure of testing hypothesis requires a researcher to adopt several steps. Outline chronologically the main steps. (8 marks)

b) A retailer of motorized bicycles has examined cost data and has determined the average cost function which expresses the annual cost of purchasing, owning, and maintaining inventory as a function of size (number of units) of each order it places for the bicycles.

The average cost function is: $AC(x) = x^3 - \frac{615x^2}{2} + 15750x + 18000$ where x the number of cycles equals ordered each time the retailer replenishes the supply. Determine the order size, which minimizes average inventory cost. (6 marks)

c) To test the claim that the mean credit card debt for individuals id greater than Ksh. 5, 000, you do some research and find that a random sample of 6 cardholders has a mean credit card balance of Ksh. 5,434 with a standard deviation of Ksh. 625. Assume that the hypothesis for your statistical experiment are:

$H_O: \mu = 5000$

$H_a: \mu > 5000$

At 5% significance level, explain why you cannot reject the Null. Assume the population is normally distributed. (6 marks)

QUESTION FIVE

a) Explain the following concepts as used in hypothesis testing

i. Level of significance (2 marks)

ii. A population parameter (2 marks)

iii. A statistic (2 marks)

b) The total revenue function for a product is $TR = 4x$. A monopolist finds that the total cost is sh. 252 when 20 units are sold. The marginal cost function for the products is estimated as $MC = 0.01x$ where x represents the number of units sold.

Required:

i. Derive the total cost function (3 marks)

ii. How many units must be sold to maximise profit? (3 marks)

c) A random sample of 735 employees in a certain institution is classified by two characteristics namely housing (do they own or rent a house) and highest level of education (Phd, Masters or undergraduate) as shown in the table below.

	Highest Level of Education			
Housing	Phd	Masters	Undergraduate	TOTAL
Own	40	60	150	250
Rent	80	140	265	485
TOTAL	120	200	415	735

Required:

Test the hypothesis at 5% level of significance that the two variables are not related. (10 marks)
