

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 scope of quantitative techniques (6 marks)
- b) Psychometric test scores are often used by HR personnel to check if a candidate has the right skillset for a role. The data relates to scores of a sample of 10 randomly selected candidates in a psychometric test for accountancy internship.

114, 115, 123, 120, 110, 130, 119, 118, 116, 115

- i. For this sample, calculate the mean and standard deviation (4 marks)
- ii. The HR manager claims that the average score for all candidates taking this test is 115. Carry out a hypothesis test at 5% level of significance to check whether or not this seems to be the case. (4 marks)

- c) Solve for X, Y and Z in the matrix equation

$$\begin{bmatrix} 5 & -2 & 3 \\ 2 & 3 & -5 \\ 4 & -5 & 6 \end{bmatrix} \begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{bmatrix} 16 \\ 2 \\ 7 \end{bmatrix} \quad (8 \text{ marks})$$

- d) The following table shows data on age (X) and blood pressure (Y) of 8 persons:

Person	X	Y
1	52	62
2	63	53
3	45	51
4	36	25
5	72	79
6	65	43
7	46	60
8	25	33

- i. Use the table to compute and interpret the correlation coefficient for the data (6 marks)
- ii. Test the significance of correlation coefficient at 5% level (4 marks)
- iii. Fit a simple linear regression model for the data (4 marks)
- iv. Interpret your intercept and coefficient of X in (iii) above (4 marks)

### QUESTION TWO

- a) Discuss important assumptions of the Linear programming model. (6 marks)
- b) Explain the following concepts as used in hypothesis testing
  - i. Significance level (2 marks)
  - ii. Type I error (2 marks)
  - iii. Alternative hypothesis (2 marks)
- c) A door manufacturer makes and sells two types of doors: glass doors and wooded doors. Each glass door requires 10 hours of production time and one hour of assembly time. Each wooden door requires 5 hours of production time and 4 hours of assembly time. Currently there is a maximum of 2000 hours per week available in the production department and 480 hours per week in the assembly department. Given the current demand, the manufacturer should make and sell at least 40 glass and 15 wooden doors. Each glass generates £100 profit. The manufacturer aims to maximize weekly profit
  - i. Formulate a system of linear programme model required to solve the above problem (6 marks)
  - ii. Compute the minimum profit (2 marks)

### QUESTION THREE

- a) Distinguish between a sample and population in statistics (4 marks)

- b) The total revenue function 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 product 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 maximize profit? (3 marks)
- iii) What is the selling price at this level of production (2 marks)
- c) A shoe manufacturer claims that athletes can increase their vertical jump heights using the manufacturer's new strength shoes. The vertical jump heights of eight randomly selected athletes are measured. After the athletes have used the strength shoes for 8 months, their vertical jump heights are measured again. The vertical jump heights (in inches) for each athlete are shown in the table below.

Athlete	1	2	3	4	5	6	7	8
Vertical jump height (before using shoes)	24	22	25	28	35	32	30	27
Vertical jump height (after using shoes)	26	25	25	29	33	34	35	30

At 1% level significance, use paired t-test to state whether there is enough evidence to support the manufacturer's claim? Assume the vertical jump heights are normally distributed. (8 marks)

#### QUESTION FOUR

- a) Describe the process of testing hypothesis (6 marks)
- b) The national Institute of Diabetes, Digestive and Kidney Diseases reports that the average cost of bariatric (weight loss) surgery is about Sh. 22,500. You think this information is incorrect. You randomly select 30 bariatric surgery patients and find that the average cost for their surgeries is SH. 21,545 with a standard deviation of SH. 3,015. Is there enough evidence to support your claim? Use Z-test critical values to make conclusion at  $\alpha = 0.05$ . (6 marks)
- c) The average cost function of a product is given by  $AC(x) = x^3 - \frac{615x^2}{2} + 15750x + 1800$  where  $x$  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 library hours (Lib) and course work load (cwL) on university cumulative average points (ucAP), the following model has been estimated. Library exposure (Lib) was measured by average number of hours a student spent in the library in an academic year while cwL was measured by a student's total number of units enrolled for in the an academic year.

$$uc\widehat{AP} = 48.26 + 10.157Lib - 3.447cwL$$

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

$$n = 526, R^2 = .316$$

Where p-values 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) You are investigating the relationship between the ages of staff and what aspect of career development they consider to be the most important. You randomly collect the data shown in the contingency table below.

Age of staff (year)	Career Development Aspect		
	Learning new skills	Pay increase	Career growth
18-26	31	22	21
27-36	27	31	33
42-61	19	14	8

At 1% error rate, is there enough evidence to conclude that age is related to career development choice? (6 marks)

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