



*(University of Choice)*

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN EXAMINATION**

**UNIVERSITY EXAMINATIONS  
2023/2024 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE IN ECONOMICS**

**COURSE CODE: ECO 303**

**COURSE TITLE: INTRODUCTION QUANTITATIVE  
METHODS**

**DATE: MONDAY -11-12-2023**

**TIME: 3:00-5:00**

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**INSTRUCTIONS TO CANDIDATES**

**ATTEMPT QUESTION ONE AND ANY OTHER TWO**

**TIME: 2 Hours**

**MMUST observes ZERO tolerance to examination cheating**

*This Paper Consists of 4 Printed Pages. Please Turn Over.*

### QUESTION ONE (COMPULSARY)

- a) Distinguish between the following terms as;
- Event and experiment (4 marks)
  - Feasible and optimal solutions (4 marks)
- b) A newspaper vendor purchases magazines which can be ordered only in batches of 10. Each magazine costs Ksh.2.50 and sells at Ksh.4.00 each. Unsold magazines have no resale value. The probability distribution obtained from analysis of past sales data is given below;

|             |     |      |      |      |      |
|-------------|-----|------|------|------|------|
| Magazines   | 10  | 20   | 30   | 40   | 50   |
| Probability | 0.2 | 0.35 | 0.25 | 0.15 | 0.05 |

How many magazines should the vendor purchase to minimize cost?

(16 marks)

- c) Discuss the properties of a binomial probability distribution (6 marks)

### QUESTION TWO

- a) A workshop owner plans to produce 2 products i.e. chairs and tables from the available resources which consists of 400 board feet of mahogany timber and 450 man hours of labour, he knows that to make a chair, he requires 5 board feet and 10 man hours and yields a profit of kshs. 45, while each table uses 20 board feet and 15 man hours and a profit of ksh. 80.

**Required;**

- Formulate the above as a linear programming equation (3 marks)
  - Determine how many chairs and tables the company can make keeping within its resources constraints in order to maximize profits (Solve the problem using Simplex method) (10 marks)
- b) Examine the properties of a normal distribution (7 marks)

### QUESTION THREE

- a) Highlight the steps followed in decision theory. (5 Marks)
- b) Given the table below of the options a company has in making a decision of building a given plant. Write down the decisions that the company would make under the following criterions.
- Maximax
  - Realism assuming the coefficient of realism is 0.8
  - Minimax regret

| Actions     | States of Nature  |                     |
|-------------|-------------------|---------------------|
|             | Favourable Market | Unfavourable market |
| Large plant | \$200,000         | -\$180,000          |
| Small plant | \$100,000         | -\$20,000           |
| No plant    | \$0               | \$0                 |

(15 Marks)

#### QUESTION FOUR

A company owns two mills A and B, which have different production capabilities for high, medium and low grade flour. This company has entered into a contract to supply flour to a firm every week with 12, 8, and 24 quantities of high, medium and low grade respectively. It costs the company Kshs. 1,000 and Kshs. 800 per week to run mill A and B respectively. On a week, mill A produces 6, 2, and 4 quantities of high, medium and low grade flour respectively. Mill B produces 2, 2, and 12 quantities of high, medium and low grade respectively.

- Formulate the above statement into a linear programming problem. (4 marks)
- Using the Dual-Simplex method, calculate how many days per week each mill should be operated in order to minimize cost? (12 marks)
- Identify the binding and non-binding constraints (4 marks)

#### QUESTION FIVE

- State the fundamental assumptions of linear programming (5 Marks)
- Discuss the steps followed when turning a problem into a standard form in the simplex algorithm of linear programming. (8 Marks)
- Consider the following example.

$$\text{Maximize } Z = X_1 + 2X_2 + 3X_3 \quad (a)$$

Subject to:

$$X_1 + X_2 - X_3 = 1 \quad (b)$$

$$-2X_1 + X_2 + 2X_3 \geq -5 \quad (c)$$

$$X_1 - X_2 \leq 4 \quad (d)$$

$$x_2 + x_3 \leq 5$$

(e)

$$x_1 \geq 0$$

(f)

$$x_2 \geq 0$$

(g)

Write in standard form.

(7 Marks)