



MUEO

# MOI UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR  
(ACADEMICS, RESEARCH, EXTENSION & STUDENT AFFAIRS)

## UNIVERSITY EXAMINATIONS

### 2022/2023 ACADEMIC YEAR

#### FIRST YEAR EXAMINATION

#### FOR THE DEGREE OF

#### BACHELOR

#### OF

#### BUSINESS MANAGEMENT

**COURSE CODE:** BBM 113/HRD 101

**COURSE TITLE:** QUANTITATIVE SKILLS I

**DATE:** FRIDAY 11<sup>TH</sup> AUGUST, 2023

**TIME:** 9.00 A.M. – 12.00 NOON.

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### INSTRUCTION TO CANDIDATES

- SEE INSIDE.

THIS PAPER CONSISTS OF (4) PRINTED PAGES

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**BBM 113: BUSINESS MATHEMATICS I / ECF 114: MATHEMATICAL ECONOMICS I / HRD 101: QUANTITATIVE SKILLS I.****INSTRUCTION.**

Answer **QUESTION ONE** and any other **THREE** questions.

**QUESTION ONE (25 MARKS).**

- a) Citing relevant example if necessary, explain the following concepts as used in set theory.
- i) Infinite set. (2marks)
  - ii) Null set (2marks)
  - iii) Union of set (2marks)
  - iv) Disjoint set. (2marks)
  - v) Complement of a set. (2marks)
- b) Given the universal set  $U = (a, b, c, 1, 4, 6, 7, d, 8, 9)$ , set  $A = (a, 1, 4, d)$ , set  $B = (b, 6, 7)$  and set  $C = (c, 8, 9)$ ; determine;
- i)  $A^1 \cup B^1$  (2marks)
  - ii)  $B^1 \cap C^1$  (2marks)
  - iii)  $(A \cap C^1) \cup B^1$  (2marks)
- c) A restaurant sells beverages as follows;
- 2 cups of tea, 3 glasses of red wine, and a bottle of soda for kshs. 490  
3 cups of tea, 4 glasses of red wine and 2 bottles of soda for kshs. 700  
A cup of tea, 2 glasses of red wine and a bottle of soda for kshs. 330.
- i) Formulate the above information into a simultaneous equation. (3marks)
  - ii) Using Cramer's rule, determine the price of a cup of tea, a glass of red wine and a bottle of soda. (6marks)

**QUESTION TWO (15 MARKS).**

A scrap metal dealer has received an order from a customer for at least 2,000 kilograms of scrap metal. The customer requires that at least 1,000 kilograms of the shipment of metal must be of a high quality metal called Alpha, that can be melted down and used to produce metal tubing. Further, the customer will not accept delivery of the order if it contains more than 175 kilograms of metal that he deems unfit for commercial use i.e. metal that contains an excessive amount of impurities and cannot be melted down and refined profitably.

The dealer can purchase scrap metal from the different suppliers in unlimited quantities from the following percentages (by weight) of Alpha and Unfit scrap metal.

	Supplier A	Supplier B
Alpha	25%	75%
Unfit scrap metal	5%	10%

The cost per kilogram of metal purchased from supplier A and supplier B are \$1 and \$4 respectively.

- Formulate a linear programming model in a standard manner. (5marks)
- Using graphical method, determine the optimal solution. (10marks)

### QUESTION THREE (15 MARKS).

- The general form of a quadratic equation is given as;

$ax^2 + bx + c = 0$ , where  $a \neq 0$ , and  $a$ ,  $b$  and  $c$  are constants. Using this given form of quadratic

equation, show that  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

and hence solve  $15x^2 + 16x = 15$ .

(9marks)

- A local university football team has added a national power to next year's schedule. The other team has agreed to play the game for a guaranteed fee of \$100,000 plus 25% of the gate receipts. Assuming the ticket price is \$12,
  - Determine the number of tickets which must be sold to recover the \$100,000 guarantee. (2marks)
  - If the college officials hope to net a profit of \$240,000 from the game, how many tickets must be sold. (2marks)
  - If a sell out of 50,000 fans is assured, what ticket price would allow the university to earn the desired profit of \$240,000. (2marks)

### QUESTION FOUR (15 MARKS).

- Records at Moi university show the following about the enrollment of 100 first – year students in Mathematics, fine arts and Economics;
  - 38 students take mathematics.
  - 42 students take fine arts.
  - 20 students take economics.
  - 4 students take economics and fine arts.
  - 15 students take mathematics and economics.
  - 9 students take mathematics and fine arts.
  - 12 students take mathematics and economics but not fine arts.

Draw a venn diagram representing this information and label all the areas. Use the diagram to answer the followings;

- i) How many students take none of these three courses. (3marks).
- ii) How many students take mathematics or economics. (3marks)
- iii) How many students take exactly one of these three courses. (3marks)

- b) The demand and supply functions of a two – commodity market model are given below;

$$Q_{d1} = 18 - 3P_1 + P_2 ; \quad Q_{d2} = 12 + P_1 - 2P_2$$

$$Q_{s1} = -2 + 4P_1 \quad ; \quad Q_{s2} = -2 + 3P_2$$

Determine the equilibrium values of prices and quantities for the two commodities.

(6marks)

### QUESTION FIVE (15 MARKS).

A small iron works manufactures two types of gate. The requirements for each stage of production, along with the limitations on the available man – hours are given in the following table;

Gate type	Stages of production			Selling price (£)	Unit profit (£)
	Welding	Finishing	Sales		
Security	4.5	1.0	1.0	7200	180
Ornamental	2.0	2.0	1.0	665	315
Maximum hours	900	400	250		

- a) Write down the expressions for;
  - i) The constraints. (3marks)
  - ii) Total revenue. (1mark)
  - iii) Profit. (1mark)
- b) Using graphical technique, determine the number of each type of gate which should be produced and sold to maximise;
  - i) Profit. (4marks)
  - ii) Total revenue. (4marks)
- c) Calculate the number of man – hours which are not used when;
  - i) Profit is maximized. (1mark)
  - ii) Total revenue is maximised. (1mark)

**QUESTION SIX (15 MARKS).**

- a) A management accountant is studying the relationship between the number of units of output in a year and the total cost incurred for a given product. From the records of the firm the following data was extracted.

Output(Q)	Total costs(C)
0	120
1	124
3	120
5	140

- i) Determine the firm's fixed cost. (1mark)
- ii) Given the cubic equation as  $C = a + b_1Q + b_2Q^2 + b_3Q^3$ , fit the above data in this 3<sup>rd</sup> degree polynomial and estimate the total cost if the level of output equals 11 units. (7marks).
- b) Given that a certain commodity has a linear demand and supply functions going through the following points;
- i) When  $P = \text{ksh.7500}$ ,  $Q = 1000$ units and when  $P = \text{ksh.4625}$ ,  $Q = 750$ units.
- ii) When  $P = \text{ksh.2525}$ ,  $Q = 100$ units and when  $P = \text{ksh.1525}$ ,  $Q = 2000$ units.

Assuming that these are normal commodities, determine the linear functions that go through the given points (i) and (ii) above and explain which is the demand function and supply function. (7marks)

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