



Strathmore
UNIVERSITY

STRATHMORE UNIVERSITY BUSINESS SCHOOL
Bachelor of Science in supply Chain and Operations Management

END OF SEMESTER EXAMINATION
MAT 1105: BUSINESS MATHEMATICS

Date: 7th November 2022

Time: 2 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.
3. Do not write on the question paper.

QUESTION ONE (30 MARKS)

- (a) A manufacturing company produces and sells seats. The cost function is given by:

$$C(x) = 3x + 110\sqrt{x} + 3000$$

where x is the number of tables. The seats are sold for \$ 300 each.

Find

- (i) The total cost of producing 19 seats. [2 Marks]
 - (ii) The total profit from producing and selling the 19 seats. [2 Marks]
- (b) The 2×2 matrices **A**, **B** and **C** are given below in terms of the scalar constants a, b and c .

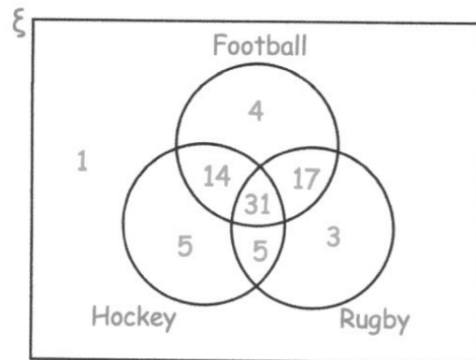
$$\mathbf{A} = \begin{pmatrix} a & 2 \\ 3 & 7 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 2 & 4 \\ b & 2 \end{pmatrix} \quad \text{and} \quad \mathbf{C} = \begin{pmatrix} -1 & c \\ 3 & 2 \end{pmatrix}$$

Given that $2\mathbf{A} - 3\mathbf{B} = 4\mathbf{C}$, find the values of a, b and c . [4 Marks]

- (c) Solve the following inequalities

(i) $x - 1 < 2x + 2 < 3x + 1$ (ii) $-2 < |2x + 1| < 7$ [6 Marks]

- (d) Joypasers Bus company sold 1000 tickets in the year 2019. Adult tickets cost \$8.50 while children's cost \$4.50, and a total of \$7300 was collected. How many tickets of each kind were sold by the company? [3 Marks]
- (e) Jennifer, a marketing executive asked 80 customers which sports they enjoy from Football, Hockey and Rugby. The results were shown in a Venn diagram as follows.



- (i) How many customers enjoy football and hockey but not rugby? [1 Marks]
- (ii) How many customers enjoy football or rugby? [1 Marks]
- (iii) Work out which sport is enjoyed by the most number of customers. [2 Marks]
- (f) Suppose that Ksh. 25,000 is invested at an annual rate of 5.5% compounded semi-annually, determine the amount paid after 12 years. [3 Marks]
- (g) A portfolio management expert is considering 30 stocks for investment. Only 10 stocks will be selected for inclusion in a portfolio. How many different combinations of stocks can be considered? [2 Marks]
- (h) The first term of an arithmetic progression is 17 and the common difference is 6.
- (i) Find the tenth term of the progression [2 Marks]
- (ii) Determine the sum of the first ten terms of the progress. [2 Marks]

QUESTION TWO (20 MARKS)

- (a) A sequence $x_1, x_2, x_3, x_4, \dots$ is given by the recurrence formula

$$x_{n+1} = 5(x_n + 1) - 2n^2, \quad x_1 = \frac{4}{5}.$$

Calculate the value of x_2, x_3, x_4 and x_5 . [4 Marks]

- (b) An advertising agency finds that, of its 400 clients, 230 use Television, 200 use Radio and 210 use Magazines. Also, 110 use Television and Magazines, 105 use Television and Radio, 125 use Radio and Magazines, 50 use all the three.
- (i) Draw **Venn diagram** to represent these data. [4 Marks]

Using the Venn diagram in (i), find

- (ii) how many do not use Radio? [2 Marks]
- (iii) how many use Television or Magazine? [2 Marks]
- (iv) how many use Radio and Magazine but not Television? [2 Marks]

(c) The cost for framing a picture is

- 2 pence per cm^2 of glass.
- 5 pence per cm of wooden frame.

A rectangular picture is such that its length is 4 cm greater than its width, x cm.

If a maximum of £10 is available for framing, determine the range of the possible values of x . [Note: There are 100 pence (p) in 1 pound (£)]. [6 Marks]

QUESTION THREE (20 MARKS)

- (a) Shima invested a certain sum of money in an account that pays 5% compounded quarterly. The account will amount to Kshs. 10,000 in 27 months' time. calculate the original principal that was invested. [5 Marks]
- (b) If $A = \begin{pmatrix} 1 & 2 \\ -3 & 0 \end{pmatrix}$ find $A^2 + 3A + 5I$ where I is unit matrix of order 2. [5 Marks]
- (c) A marketing survey of 1200 commuters found that 800 listen to the news, 700 listen to music, and 450 listen to both. Let N be the set of commuters in the sample who listen to news and M be the set of commuters in the sample who listen to music. Fill out a two-set Venn diagram [4 Marks]
- (d) A shop in Madaraka estate sells stationaries as follows: 3 pencils and 4 rulers cost Kshs. 260 while 2 rulers and 5 pencils costs Kshs. 200. Determine the total cost of two pencil and three rulers in the shop. [6 Marks]

QUESTION FOUR (20 MARKS)

- (a) A company that produces flags makes two flags for Nova Scotia-the traditional blue flag and the green flag for Cape Breton. To produce each flag, two types of material, nylon and cotton, are used. The company has 480 units of nylon in stock and 250 units of cotton. The traditional blue flag requires 6 units of nylon and 2 units of cotton. The Cape Breton flag requires 5 units of nylon and 7 units of cotton. Each Cape Breton flag that is made realizes a profit of \$18 for the company, whereas each blue flag realizes a profit of \$16.
 - (i) Identify the constraints [2 Marks]
 - (ii) Write inequalities for the constraints in this optimization problem. [6 Marks]
 - (iii) Write an equation to identify the profit, P . [2 Marks]

- (b) The resale value, R of a piece of industrial equipment has been found to behave according to the function $R(t) = 750,000e^{-0.08t}$ where t is the time in years from the date of purchase and R is the resale value in Kshs. Required:
- (i) What is the original value of the piece of equipment? [2 Marks]
 - (ii) What is the expected resale value after **five** years? [2 Marks]
 - (iii) How long does it take for the resale value of the asset to reach 25% of its original value? [6 Marks]

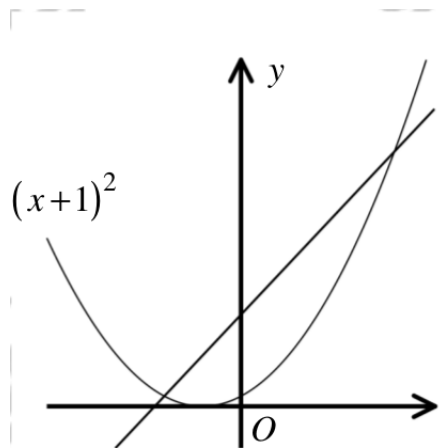
QUESTION FIVE (20 MARKS)

(a) Solve each of the following inequalities

(i) $6 - 4(4 - x) > 4$ [2 Marks]

(ii) $(2x + 3)(4x - 5) > (2x + 5)(2x - 1)$ [4 Marks]

(b) The figure below shows the graphs of $y = (x + 1)^2$ and $y = 4x + 9$.



- (i) Find the coordinates of the points of intersection between the two graphs. [4 Marks]
 - (ii) Determine the x-intercept and y-intercept of the linear function $y = 4x + 9$. [2 Marks]
 - (iii) Hence solve the inequality $(x + 1)^2 \geq 4x + 9$, fully justifying the answer. [2 Marks]
- (c) A finite set $S = \{28, 2\sqrt{2}, \frac{2}{3}, -27, 33, \sqrt{\pi}, -6\}$. Using the set notation $\{\dots\}$, write the sets of
- (i) integers numbers in G [2 Marks]
 - (ii) irrational numbers in G [2 Marks]
 - (iii) natural numbers in G [2 Marks]

END OF PAPER