QUALIFICATION : BACHELOR OF ECONOMICS (07BECO)	
QUALIFICATION CODE: **07BECO**	LEVEL: **5**
COURSE: **MATHEMATICS FOR ECONOMICS 1B**	COURSE CODE: **MFE512S**
DATE: **NOVEMBER 2023**	SESSION: **1**
DURATION: **3 HOURS**	MARKS: **100**

FIRST OPPORTUNITY: QUESTION PAPER

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MODERATOR: Ms. Kornelia David

INSTRUCTIONS:

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS:

1. Non-Programmable Calculator

This paper consists of 5 pages including this front page

Question 1 (Multiple choice questions, choose the correct letter, each equation 2 marks) [20 Marks]

1.1 What is a matrix?
   A) A mathematical operation
   B) A type of polynomial equation
   C) A rectangular array of numbers, symbols, or expressions
   D) A solution to a linear equation

1.2 How is the size of a matrix denoted?
   A) By its rank
   B) By its dimension
   C) By its order
   D) By its degree

1.3 In a matrix, the entries are arranged in:
   A) Rows and columns
   B) Circles and squares
   C) Lines and curves
   D) Diagonals and cross-sections

1.4 What is the main diagonal of a matrix?
   A) The row at the bottom of the matrix
   B) The column on the right side of the matrix
   C) The row and column where the indices are the same
   D) The row and column with the largest entries

1.5 What is an identity matrix?
   A) A matrix with all entries equal to 1
   B) A matrix with all entries equal to 0
   C) A matrix with ones on the main diagonal and zeros elsewhere
   D) A matrix with ones on the anti-diagonal and zeros elsewhere

1.6 If two matrices have the same dimensions, how do you add them?
   A) Multiply corresponding entries
   B) Take the average of corresponding entries
   C) Divide corresponding entries
   D) Add corresponding entries

1.7 What is the result of multiplying a matrix by a scalar?
   A) The matrix's size changes
   B) The matrix becomes the scalar
   C) Each entry of the matrix is multiplied by the scalar
   D) The matrix becomes the identity matrix

1.8 A matrix with only one row is called a:
   A) Row matrix
   B) Column matrix
   C) Square matrix
   D) Scalar matrix

1.9 A matrix with only one column is called a:
   A) Row matrix
   B) Column matrix
   C) Square matrix
   D) Diagonal matrix

1.10   What does the transpose of a matrix involve?
   A) Flipping the matrix along its main diagonal
   B) Adding the matrix to its negative
   C) Reversing the order of rows and columns
   D) Subtracting the matrix from its inverse

Question 2 (True/False question, each question 2 marks) [10 Marks]

2.1 A 2x3 matrix has three rows and two columns.

2.2 There are twelve entries in a 3x4 matrix.

2.3 A matrix of any order can have a diagonal

2.4 A 9x9 matrix is an example of a square matrix

2.5 The symbol aij represents an arbitrary entry of the matrix(aij).

Question 3 [3 Marks]

Given the following matrix,$B = \begin{bmatrix} 1/2 & J & K \\ 8 & 2 & M \\ V & 0 & D \end{bmatrix}$ write down the values/letters at b_{21}, b_{13}, and b_{33}.

Question 4 [5 Marks]

Consider the systems of linear equations:

$3x + 5y = 11$

$8x - 3y = 13$, solve it using Cramer's rule.

Question 5 [7 Marks]

Use the Jacobian to test for the functional dependence in the following system of equations

$Y_1 = 6x_1 + 4x_2$

$Y_2 = 7x_1 + 9x_2$

Question 6 [4 Marks]

If A=$\begin{bmatrix} x - y & x \\ x & x + y \end{bmatrix}$, show that determinant (A) $= -y^2$.

Question 7 [5 Marks]

For which values of 'p' if $\det(T) = 0$? If T=$\begin{bmatrix} p & -p \\ 2p & 3 \end{bmatrix}$.

Question 8 [12 Marks]

Given:

A=$\begin{bmatrix} 1 & 2 & 0 \\ 9 & 2 & 1 \\ 4 & 0 & 1 \end{bmatrix}$, B=$\begin{bmatrix} 10 & -1 & 6 \\ -2 & 4 & 5 \\ 7 & 8 & 9 \end{bmatrix}$, find $2A + 3B$.

Question 9 [7 Marks]

A firm makes two types of sleeping bags namely cool and Executive. Each cool requires 2 hours for cutting, 5 hours for sewing and 1 hour for waterproofing. Each executive requires 1 hour for cutting, 5 hours for sewing and 3 hours for waterproofing. The firm has at most 14 hours for cutting, at most 40 hours for sewing and at most 18 hours for waterproofing per day. The firm makes a profit of N\$ 50 per cool and N\$ 30 per executive. Model this word problem into a linear programming problem.

Question 10 [4 Marks]

Given the minimization model below, change it from primal to dual.

Minimize $\quad C = 40x + 60y$

Subject to: $\qquad\qquad\qquad\qquad\qquad 2a + 6b + 3c \leq 40$

$$5a + b + 2c \leq 60$$

$$a; b; c \geq 0.$$

Question 11 [17 Marks]

Given the system of equations, find the unknown variables using matrix inversion method.

$4x + y - 5z = 18$

$-2x + 3y + z = 12$

$3x - y + 4z = 5$

Question 12 [6 Marks]

Draw the straight lines that represent each of the following inequalities and indicate the feasible region.

$n < 4$
$6m + 3n \geq 18$
$m + n \leq 6$
$3m + 6n > 18$

End of 1st opportunity Exam!