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QUALIFICATION : **BACHELOR OF ECONOMICS (07BECO)**	
QUALIFICATION CODE: **07BECO**	LEVEL: **5**
COURSE: **MATHEMATICS FOR ECONOMICS 1B**	COURSE CODE: **MFE512S**
DATE: **JANUARY 2024**	SESSION: **2**
DURATION: **3 HOURS**	MARKS: **100**

SECOND OPPORTUNITY: QUESTION PAPER

EXAMINER: Mrs. Hilma Yvonne Nkalle; Mr. Tobias Kaenandunge; Mr. Ilenikemanya Ndadi

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, 2 marks each) [20 Marks]

1.1 Which of the following matrices is most likely to have an inverse?

A) A square matrix with determinant equal to 0.
B) A square matrix with all zero entries.
C) A square matrix with determinant not equal to 0.
D) A non-square matrix with all nonzero entries.

1.2 Given the matrix equation AX=B, where A is a square matrix and X,B are column matrices, how can the solution for X be obtained?

A) By dividing B by A.

B) By finding the inverse of A and multiplying it with B

C) By finding the determinant of A and dividing it into B.

D) By subtracting B from A.

1.3 If a square matrix A has an inverse, which of the following statements is true.

A) The determinant of A is 1.

B) The determinant of A is 0.

C) The product of A and its inverse is the identity matrix.

D) The transpose of A is its inverse.

1.4 Supposed you have a system of linear equations represented by the matrix equation AX=B, where A is a square matrix. Which of the following is the correct expression to solve for X?

A) X=AB

B) $X=A^{-1}B$

C) X=BA

D) $X=B^{-1}A$

1.5 If a matrix A is given and it has an inverse, which of the following is a correct way to find the inverse?

A) Compute the transpose of A.

B) Divide each entry of A by its determinant.

C) Swap rows and columns of A.

D) Use Gaussian elimination to row-reduce A to the identity matrix.

1.6 For a 2x2 matrix A with a nonzero determinant, what is the formula to calculate its inverse?

A) $A^{-1} = 1/det(A) \times adj(A)$

B) $A^{-1} = 1/trace(A) \times adj(A)$

C) $A^{-1} = 1/det(A) \times A$

D) $A^{-1} = A/ det\ (A)$

1.7 If a square matrix A is invertible, which of the equations is true?

A)$A \times A^{-1} = I$, where I is the identity matrix.

B) $A + A^{-1} = I$

C) $A \times A^{-1} = 0$

D) $A - A^{-1} = I$

1.8 What is the minimum requirement for a matrix to have an inverse?

A) It must be a square matrix.

B) It must have all positive entries.

C) It must be a non-square matrix.

D) It must have a determinant of 1.

1.9 A square matrix A is a singular (non-invertible), which of the following is true?

A) The matrix A is diagonal.

B) The matrix has no solution.

C) The matrix A has an infinite number of solution.

D) The determinant of matrix A is zero.

1.10 When solving for the inverse of a matrix A, why is it important to check whether the determinant of A is nonzero?

A) If the determinant is nonzero, the inverse does not exist.

B) If the determinant is zero, the inverse does not exist.

C) The determinant affects the size of the inverse matrix.

D) The determinant determines the number of the rows.

Question 2 (true/false questions, 2 marks each) [10 marks]

2.1 A 4x3 matrix has three rows and four columns.

2.2 Every diagonal matrix is an upper triangular matrix.

2.3 A zero matrix is a lower triangular matrix provided it is a square matrix.

2.4 A square matrix is a matrix whose entries are square numbers.

2.5 In a matrix, the entry a_{23} and the entry a_{32} represent the same.

Question 3 [2 Marks]

Give an example of a 3x3 lower triangular matrix.

Question 4 [12 Marks]

A company produces three types of products A, B and C. The total annual sales of these products for the years 1985 and 1986 on the four regions is given below.

For the year 1985:

Products	Khomas region	Omusati region	Oshana region	Ohangwena region
A	15000	8000	6000	12000
B	5000	24000	7000	8000
C	8000	4000	31000	6000

For the year 1986:

Products	Khomas region	Omusati region	Oshana region	Ohangwena region
A	17000	10000	5000	7000
B	5000	22000	11000	4000
C	13000	6000	39000	5000

Find the total sales of the three products for two years.

Question 5 [13 Marks]

Find the inverse of the following matrix, $A=\begin{bmatrix}1 & 2 & 3\\ 4 & 2 & 6\\ 7 & 8 & 9\end{bmatrix}$.

Question 6 [10 Marks]

Use Gaussian elimination method to find the solution (s) of the following system of linear equations.

$4y + 8z = 12$

$x - y + 3z = -1$

$3x - 2y + 5z = 6$

Question 7 [16 Marks]

Given the system of linear equations

$\text{Max P} = 6x + 8y$

Subject to: $30x + 20\,y \leq 300$

$5x + 10y \leq 110$

$X; y \geq 0$, find the unknown variables.

Hint: Introduce slack variables; Formulate the initial simplex tableau; Derive the optimum tableau; Interpret the final tableau.

Question 8 [7; 5; 5 Marks]

(a) Given A = $\begin{bmatrix} 2 & -1 & 9 \\ 6 & 4 & 3 \end{bmatrix}$, B = $\begin{bmatrix} 6 & 0 & 2 \\ 1 & 2 & 4 \end{bmatrix}$ find A+B.

(b) BC = $\begin{bmatrix} 4 & 4 \\ -9 & 10 \end{bmatrix}$, Find $(BC)^2$.

(c) Given the following matrices, A=$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, B=$\begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix}$ find AB.

End of 2nd opportunity Exam!