

Linear Algebra (MT1004)

Sessional-I Exam

Date: Sep. 23rd 2024

Course Instructor(s)

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Total Time (Hrs): 1

Total Marks: 30

Total Questions: 3

Roll No

Section

Student Signature

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Attempt all the questions.

CLO #1: Interpreting and finding the solutions of linear equations in detail.

Q1:

[5+5+5+3]

- a) Given are matrices A and b , write the augmented matrix for the linear system that corresponds to the matrix equation $Ax = b$, then solve the system by Gaussian elimination method.

$$A = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 1 & 5 \\ -2 & -4 & -3 \end{bmatrix}, \quad b = \begin{bmatrix} -2 \\ 2 \\ 9 \end{bmatrix}$$

- b) Determine conditions on a , b , and c if any, in order to guarantee that the system is consistent.

$$x - 2y + 5z = a$$

$$4x - 5y + 8z = b$$

$$-3x + 3y - 3z = c$$

- c) Find the inverse of the given matrix by inversion algorithm.

$$\begin{bmatrix} 2 & -1 & 4 \\ 1 & 3 & 5 \\ 3 & 7 & 7 \end{bmatrix}$$

- d) Find all the values of the unknown constants for which A is symmetric.

$$A = \begin{bmatrix} 2 & a - 2b & b + c \\ 3 & 5 & a + c \\ 0 & -2 & 7 \end{bmatrix}$$

CLO #2: Understanding the core concepts of Euclidean vector spaces and matrix transformations.

Q2:

[4+2]

- a) Find the domain, codomain and standard matrix for the transformation and use it to compute $T(x)$. Check your result by substituting directly in the formula for T .

$$T(x, y, z) = (x, y - z, y); \quad x = (-1, 1, 3)$$

- b) Given is $x = (-3, -1, 2)$, Use matrix multiplication to find the reflection of x about xy -plane.

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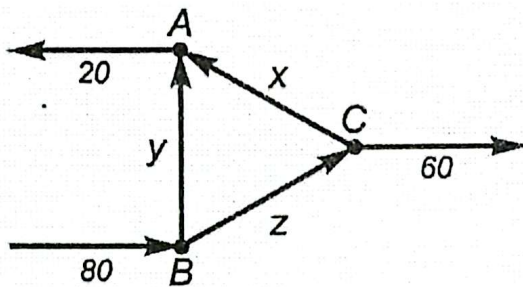
CLO #3: Applying the basic linear algebra concepts in computer science.

Q3:

[6]

The figure below shows the flow rates of hydrocarbons into and out of a network pipes at an oil refinery.

- a) Set up a linear system of equations whose solution provides the unknown flow rates.
- b) Solve the system for the unknown flow rates.
- c) Find the flow rates and direction of flow if $z = 30$



GOOD LUCK