Linear Algebra assignment 1

Task Requirements Document

Task Requirements

Definition of Matrix

1. Given the matrices:

$$A = \begin{bmatrix} 3 & 10 & 5 \\ -2 & 6 & -11 \end{bmatrix}$$

$$B = \begin{bmatrix} 4 & -9 \\ 7 & 2 \\ -5 & 8 \end{bmatrix}$$

$$C = \begin{bmatrix} 2 & -3 & 6 \\ -3 & 0 & -5 \\ 6 & -5 & 4 \end{bmatrix}$$

$$D = \begin{bmatrix} 1 & 0 & 10 & -7 \end{bmatrix}$$

$$E = \begin{bmatrix} -2 \\ 4 \\ 8 \\ 7 \end{bmatrix}$$

$$F = \begin{bmatrix} 5 & 12 \\ 12 & 5 \end{bmatrix}$$

a. What is the dimension of each matrix?

b. Which matrices are square?

c. Which matrices are symmetric?

d. Which matrix has the entry at row 2 and column 3 equal to -11?

e. Which matrices have the entry at row 1 and column 3 equal to 10?

f. Which are column matrices?

g. Which are row matrices?

h. Find A^T , C^T , E^T .

i. Find -3 * B

j. Find the determinant of C

2. Given the matrices:

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & -5 & 0 \\ 0 & 0 & 7 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 3 & 5 \\ 0 & 4 & -6 \\ 0 & 0 & 9 \end{bmatrix}$$

$$C = \begin{bmatrix} 8 & 0 & 0 \\ -4 & 2 & 0 \\ 7 & -1 & 3 \end{bmatrix} \quad D = \begin{bmatrix} 6 & 1 & -4 \\ 0 & 3 & 2 \\ 0 & 0 & 5 \end{bmatrix}$$

$$E = \begin{bmatrix} 2 & 0 & 0 \\ -5 & 7 & 0 \\ 3 & -4 & 1 \end{bmatrix} \quad F = \begin{bmatrix} 5 & -2 & 1 \\ 0 & 8 & -3 \\ 4 & -7 & 6 \end{bmatrix}$$

a. Which of the above matrices are diagonal?

b. Which of the above matrices are lower triangular?

c. Which of the above matrices are upper triangular?

d. Find B+E

e. Find D-E

f. Find the inverse of A and C, if they exist.

g. Find the determinant of A, C, and F.

Gaussian Elimination to Solve Systems

3. Write the augmented matrix of the system below in reduced row echelon form and find the solution to the given system.
4.

$$\begin{aligned} 2x_1 + 3x_2 - x_3 + 4x_4 &= 5 \\ x_1 - 2x_2 + 3x_3 - x_4 &= 7 \\ 3x_1 + x_2 - 2x_3 + x_4 &= -4 \\ x_1 + 4x_2 - x_3 + 2x_4 &= 3 \end{aligned}$$

Matrix Transpose and Inverse

5. Matrices A, B are given by:

$$A = \begin{bmatrix} 2 & -3 & 4 \\ 1 & 0 & -1 \\ 0 & 5 & 6 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 0 \\ 7 & -1 & 2 \end{bmatrix}$$

show that: $(A + B)^T = = B^T + A^T$ and $(AB)^T = = B^T A^T$

6. Find the inverse of Matrix A, using Row operations and proof that ($(cA)^{-1} = \frac{1}{c}A^{-1}, c \neq 0$)

Given that A=

$$A = \begin{bmatrix} 4 & 2 & 1 \\ 3 & 5 & 2 \\ 2 & 3 & 3 \end{bmatrix}$$

Task Programming Language and Technologies

Evaluation Criteria

80% overall solution structure

5% details of all steps

15% Apply methods of linear algebra

Deadline

17/10/2024 at 11:59 pm

Notes