

Linear Algebra

Quiz# 3, Fall 2024

September 24, 2024

06

Name: Zumaia Abdul Aziz

Roll Number: BSS E23058

Maximum Time Allowed: 20 minutes

Maximum Marks: 10

1. Compute the LU factorization of the following matrix:

[4]

$$A(E_{21}) = U$$

$$E_{21} = \begin{bmatrix} 1 & 0 \\ -4 & 1 \end{bmatrix}$$

$$A = \begin{bmatrix} 4 & 3 \\ 16 & 5 \end{bmatrix}$$

$$R_2 \leftarrow R_2 + (-4)R_1$$

$$16 + (-4)(4) = 16 - 16 = 0$$

$$5 + (-4)(3) = 5 - 12 = -7$$

$$A(E_{21}) = U$$

$$\begin{bmatrix} 4 & 3 \\ 16 & 5 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -4 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 3 \\ 0 & -7 \end{bmatrix}$$

$$L = [E_{21}^{-1}]$$

$$L = \begin{bmatrix} 1 & 0 \\ 4 & 1 \end{bmatrix}$$

$$A = LU$$

$$= \begin{bmatrix} 1 & 0 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} 4 & 3 \\ 0 & -7 \end{bmatrix} = \begin{bmatrix} 4 & 3 \\ 16 & 5 \end{bmatrix}$$

2. Find the complete solution $x = x_p + x_n$ on $[A \ b]$:

[6]

$$\begin{bmatrix} 1 & 2 & 1 & 0 \\ 2 & 4 & 4 & 8 \\ 4 & 8 & 6 & 8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \\ 10 \end{bmatrix}$$

$$[A \ b] = \left[\begin{array}{cccc|c} 1 & 2 & 1 & 0 & 4 \\ 2 & 4 & 4 & 8 & 2 \\ 4 & 8 & 6 & 8 & 10 \end{array} \right]$$

$$R_2 \leftarrow R_2 + (-2)(R_1)$$

$$R_2 \leftarrow R_2 + (-1/2)(R_3)$$

$$2 + (-1/2)(4) = 2 - 2 = 0$$

$$10 + (-1/2)(10) = 10 - 5 = 5$$