

Key

Birzeit University
Mathematics Department
Math234-Section (1)
Quiz#3

Instructor: Dr. Ala Talahmeh
Time: 10 minutes
Name:.....

First Semester 2022/2023
Date: 14/12/2022
Number:.....

Exercise [10 marks]. Let $A = \begin{pmatrix} 2 & 4 & 1 \\ 4 & 3 & 4 \\ 1 & 4 & 2 \end{pmatrix}$.

(a) Find elementary matrices E_1, E_2, E_3 so that $E_3 E_2 E_1 A = U$, where U is an upper triangular matrix.

X(b) Use part (a) to find an LU-factorization of the matrix A .

(a) $A = \begin{bmatrix} 2 & 4 & 1 \\ 4 & 3 & 4 \\ 1 & 4 & 2 \end{bmatrix} \xrightarrow[\substack{-2R_1+R_2 \\ -\frac{1}{2}R_1+R_3}]{4 \text{ pts}} \begin{bmatrix} 2 & 4 & 1 \\ 0 & -5 & 2 \\ 0 & 2 & \frac{3}{2} \end{bmatrix}$

$\xrightarrow[\substack{\frac{2}{5}R_2+R_3}]{2 \text{ pts}} \begin{bmatrix} 2 & 4 & 1 \\ 0 & -5 & 2 \\ 0 & 0 & \frac{23}{10} \end{bmatrix}$

$U = \begin{bmatrix} 2 & 4 & 1 \\ 0 & -5 & 2 \\ 0 & 0 & \frac{23}{10} \end{bmatrix}, L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ \frac{1}{2} & -\frac{2}{5} & 1 \end{bmatrix}$

2 pts

2 pts

Good Luck

Key

Birzeit University
Mathematics Department
Math234-Section (5)
Quiz#3

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Time: 10 minutes
Name:.....

First Semester 2022/2023
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Number:.....

Exercise [10 marks]. Find X in the matrix equation:

$$X \begin{pmatrix} 1 & -2 & 1 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \end{pmatrix}.$$

(2 pts)
$$X = \begin{pmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \end{pmatrix} \begin{pmatrix} 1 & -2 & 1 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{pmatrix}^{-1}$$

$$\left[\begin{array}{ccc|ccc} 1 & -2 & 1 & 1 & 0 & 0 \\ 0 & 1 & 3 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{array} \right]$$

(2 pts)
$$\xrightarrow{2R_2+R_1} \left[\begin{array}{ccc|ccc} 1 & 0 & 7 & 1 & 2 & 0 \\ 0 & 1 & 3 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{array} \right]$$

(4 pts)
$$\begin{array}{l} -7R_3+R_1 \\ -3R_3+R_2 \end{array} \rightarrow \left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & 2 & -7 \\ 0 & 1 & 0 & 0 & 1 & -3 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{array} \right]$$

(2 pts)
$$\therefore X = \begin{pmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 & -7 \\ 0 & 1 & -3 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 4 & -13 \\ 0 & 1 & -1 \end{pmatrix}.$$

Good Luck