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20710-214	TUTTOETS 3 / TUT TEST 3	2023
Voorl's en Van / Init's and Surname: MEMO		
Studentenommer/ Student number:		

$$A = \begin{bmatrix} 2 & -3 & 3 \\ 8 & -15 & 13 \\ 4 & 12 & 2 \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} 3 \\ 17 \\ -20 \end{bmatrix}$$

Doen die LU-onbinding van die matriks A hierbo. Los dan op $Ax = b$ met voorwaartse en terugwaartse substitusie. Skryf die antwoorde in die spasies hieronder (c is die antwoord van die voorwaartse substitusie, $Lc = b$).

Do LU-decomposition of the matrix A above. Then solve $Ax = b$ with forward and backward substitution. Write your answers in the spaces below (c is the answer from the forward substitution, $Lc = b$).

$$A = \begin{bmatrix} 2 & -3 & 3 \\ 8 & -15 & 13 \\ 4 & 12 & 2 \end{bmatrix}$$

$$L = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 2 & -6 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 2 & -3 & 3 \\ 0 & -3 & 1 \\ 0 & 18 & -4 \end{bmatrix}$$

$$U = \begin{bmatrix} 2 & -3 & 3 \\ 0 & -3 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$

$$Lc = b \quad \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 2 & -6 & 1 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 17 \\ -20 \end{bmatrix}$$

$$\begin{aligned} c_1 &= 3 \\ 4(3) + c_2 &= 17, \quad c_2 = 5 \\ 2(3) - 6(5) + c_3 &= -20, \quad c_3 = 4 \end{aligned}$$

$$Ux = c \quad \begin{bmatrix} 2 & -3 & 3 \\ 0 & -3 & 1 \\ 0 & 0 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \\ 4 \end{bmatrix}$$

$$\begin{aligned} 2z &= 4, \quad z = 2 \\ -3y + 2 &= 5, \quad y = -1 \end{aligned}$$

$$L = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 2 & -6 & 1 \end{bmatrix}$$

$$U = \begin{bmatrix} 2 & -3 & 3 \\ 0 & -3 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$

$$c = \begin{bmatrix} 3 \\ 5 \\ 4 \end{bmatrix}$$

$$x = \begin{bmatrix} 3 \\ -1 \\ 2 \end{bmatrix}$$

$$\begin{aligned} 2x - 3(-1) + 3(2) &= 3 \\ 2x + 3 + 6 &= 3 \\ 2x + 9 &= 3 \\ 2x &= 3 - 9 \\ 2x &= -6 \\ x &= -3 \end{aligned}$$