

20710-214	TUTTOETS 5 / TUT TEST 5	2023
Voorl's en Van / Init's and Surname:	MEMO	
Studentenommer / Student number:		

$$A = \begin{bmatrix} 1 & 2 & 5 & 2 \\ 2 & 4 & 9 & 7 \\ -3 & -6 & -19 & 6 \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} 6 \\ 14 \\ -10 \end{bmatrix}$$

$\frac{16}{10}$

Doen reghoekige LU-onbinding van die matriks A hierbo. Los dan op  $Ax = b$ . Skryf die antwoorde in die spasies hieronder.

Do rectangular LU-decomposition of the matrix A above. Then solve  $Ax = b$ . Write your answers in the spaces below.

LU

$$A = \begin{bmatrix} 1 & 2 & 5 & 2 \\ 2 & 4 & 9 & 7 \\ -3 & -6 & -19 & 6 \end{bmatrix}$$

$$\begin{array}{cccc} 1 & 2 & 5 & 2 \\ 0 & 0 & -1 & 3 \\ 0 & 0 & -4 & 12 \end{array}$$

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

$$U = \begin{bmatrix} 1 & 2 & 5 & 2 \\ 0 & 0 & -1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$Lc = b \quad \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ -3 & 4 & 1 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 14 \\ -10 \end{bmatrix}$$

$$c_1 = 6$$

$$12 + c_2 = 14, \quad c_2 = 2$$

$$-18 + 8 + c_3 = -10, \quad c_3 = 0$$

$$c = \begin{bmatrix} 6 \\ 2 \\ 0 \end{bmatrix}$$

Relabel  $x_2$  as  $\lambda$ ,  $x_4$  as  $\mu$ .

$$\begin{bmatrix} 1 & 2 & 5 & 2 \\ 0 & 0 & -1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ \lambda \\ x_3 \\ \mu \end{bmatrix} = \begin{bmatrix} 6 \\ 2 \\ 0 \end{bmatrix}$$

$$-x_3 + 3\mu = 2$$

$$x_3 = -2 + 3\mu$$

$$x_1 + 2\lambda + 5(-2 + 3\mu) + 2\mu = 6$$

$$x_1 = 6 + 10 - 2\lambda - 17\mu$$

$$x = \begin{bmatrix} 16 - 2\lambda - 17\mu \\ \lambda \\ -2 + 3\mu \\ \mu \end{bmatrix}$$

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

$$U = \begin{bmatrix} 1 & 2 & 5 & 2 \\ 0 & 0 & -1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$c = \begin{bmatrix} 6 \\ 2 \\ 0 \end{bmatrix}$$

$$x = \begin{bmatrix} 16 \\ 0 \\ -2 \\ 0 \end{bmatrix} + \lambda \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \end{bmatrix} + \mu \begin{bmatrix} -17 \\ 0 \\ 3 \\ 1 \end{bmatrix}$$