University of Technology Sydney
Department of Mathematical and Physical Sciences

37233 Linear Algebra
Tutorial Assignment 2

Question 1.

Use Doolittle's method to find an **LU** decomposition of the matrix

$$\mathbf{A} = \begin{pmatrix} 2 & 0 & -1 & 0 \\ -4 & 3 & 2 & 2 \\ 6 & 0 & -2 & 4 \\ 0 & -3 & 2 & 4 \end{pmatrix}.$$

Question 2.

Use the **LU** decomposition of the matrix **A** found in Question 1 to solve the system of equations

$$\begin{aligned} 2x_1 \quad\quad - \; x_3 \quad\quad &= -6, \\ -4x_1 + 3x_2 + 2x_3 + 2x_4 &= \;\; 2, \\ 6x_1 \quad\quad - 2x_3 + 4x_4 &= -34, \\ -3x_2 + 2x_3 + 4x_4 &= -12. \end{aligned}$$

.

Question 3.

Let

$$\mathbf{A} = \begin{pmatrix} 4 & 4 & -2 \\ 4 & 5 & 1 \\ -2 & 1 & 19 \end{pmatrix} \qquad \text{and} \qquad \mathbf{b} = \begin{pmatrix} 2 \\ 8 \\ 26 \end{pmatrix}.$$

(a) Use Cholesky's method to find an LU decomposition of A.

(b) Use the decomposition obtained in part (a) to solve the system $A\mathbf{x} = \mathbf{b}$.

.../Over

Question 4.

Let

$$\mathbf{A} = \begin{pmatrix} 2 & -2 & 0 \\ 2 & 1 & -3 \\ -1 & 4 & -5 \end{pmatrix} \qquad \text{and} \qquad \mathbf{b} = \begin{pmatrix} 2 \\ 14 \\ 15 \end{pmatrix}.$$

(a) Use Crout's method to find an **LU** decomposition of **A**.

(b) Use the decomposition obtained in part (a) to solve the system $A\mathbf{x} = \mathbf{b}$.

Question 5.

Can you guarantee that the matrices in the Questions 1, 3,and 4 have a **LU** factorisation **without** attempting to construct a factorisation?