CE 601 NUMERICAL METHODS

TUTORIAL – 2

Marks – 40 **Date: 09-August-2012**

The responses to the tutorial questions are to be submitted by 13-August-2012 (Monday). Each question carries 10 marks

1. Solve the following linear systems $A\vec{x} = \vec{b}$, where $\vec{x} = \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{Bmatrix}$; using Doolittle's algorithm.

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ -1 & 1 & 2 & 3 \\ 1 & -1 & 1 & 2 \\ -1 & 1 & -1 & 5 \end{bmatrix}; \quad \vec{b}_a = \begin{Bmatrix} 10 \\ 5 \\ 3 \\ 4 \end{Bmatrix}; \quad \vec{b}_b = \begin{Bmatrix} -4 \\ -5 \\ -3 \\ -4 \end{Bmatrix}; \quad \vec{b}_c = \begin{Bmatrix} -2 \\ -3 \\ 1 \\ -8 \end{Bmatrix};$$

2. Illustrate Crout's algorithm for LU decomposition and solve the system $A\vec{x} = \vec{b}$, where the coefficient matrix is $A = \begin{bmatrix} 2 & 7 & 5 \\ 6 & 20 & 10 \\ 4 & 3 & 0 \end{bmatrix}$, and $\vec{b} = \begin{Bmatrix} 14 \\ 36 \\ 7 \end{Bmatrix}$

3. Solve using Thomas algorithm the following tri-diagonal system.

$$\begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & -1 & 2 & -1 \\ 0 & 0 & 0 & -1 & 2 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{Bmatrix} = \begin{Bmatrix} 100 \\ 150 \\ 175 \\ 150 \\ 100 \end{Bmatrix},$$

4. Verify whether the following coefficient matrix is well-conditioned or ill-conditioned. $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ -1 & 1 & 2 & 3 \\ 1 & -1 & 1 & 2 \\ -1 & 1 & -1 & 5 \end{bmatrix}$. You may use Gauss-Jordan elimination for finding the inverse.