Tools for numerical analysis - HW 3

1.6.2020

1 Home Work

- (1) Given $Ax = b$, where $A = \begin{pmatrix} -5 & 8 & 0 \\ 2 & 0 & 2 \\ -5 & 1 & 1 \end{pmatrix}$ find matrices L, U such that $A = LU$. In addition, $b = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$; Find x. Show your calculation.

- (2) Write the LU decomposition algorithm in Matlab (You may not use the "LU" command).

- (3) Given $Ax = b$, where $A = \begin{pmatrix} 3 & -1 & 0 \\ -1 & 3 & -1 \\ 0 & -1 & 3 \end{pmatrix}$ find Cholesky's decomposition for A. Explain how you know that such decomposition is exists. In addition, $b = \begin{pmatrix} 5 \\ 0 \\ 0 \end{pmatrix}$; Find x. Show your calculation.

- (4) Is it possible to perform Cholesky's decomposition method on the following matrix: $A = \begin{pmatrix} 1 & 4 & 5 \\ 4 & 20 & 32 \\ -5 & 32 & -100 \end{pmatrix}$

- (5) perform Gauss elimination on $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{pmatrix}$. Show your calculation.

- (6) Perform both Jacobi and Gauss-Seidel methods on the following system $Ax = b$ such that: $A = \begin{pmatrix} 4 & 1 & 0 \\ 2 & 5 & -1 \\ 0 & -7 & 8 \end{pmatrix}$ and $b = \begin{pmatrix} 0.9 \\ 0.5 \\ 0.1 \end{pmatrix}$ where $x_0 = [1, 1, 1]$.

- (7) write a program in Matlab that gets matrix A, a vector b, and a precision ϵ and returns how many steps Jacobi and Gauss-Seidel methods need to converge to the result. Use L_∞ norm.