Question 1: LU decomposition and roundoff
Solve the Linear system $Ax = y$ using LU decomposition

$$A = \begin{pmatrix} 0.005 & 1 \\ 1 & 1 \end{pmatrix} \text{ and } y = \begin{pmatrix} 0.5 \\ 1 \end{pmatrix}$$

a) exactly

b) by rounding all the values of $L$ and $U$ to 2 decimal places after comma

c) by first swapping the rows of $A$ and $y$ and rounding them as in b)

Explain the difference between the solution obtained in b) and the exact value obtained from a). Compute the solution with the MATLAB command `lu`

Question 2: LU Decomposition
Determine the LU decomposition of the matrix

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

and thus solve the linear equation system $Ax = b$ for $b = (1, 2, 3)^T$. Verify your results with MATLAB command `lu`

Question 3: Iterative schemes
a) Can you briefly explain the difference between Direct and Iterative methods for solution of the linear system $Ax = b$.

b) For an iterative scheme given by $x^{k+1} = T x^k + c$, where $T$ is the iteration matrix, $x^k$ is the solution at $k$ iteration and $c$ is a column vector
   i) What is the sufficient condition for convergence of the iterative scheme ?
   ii) What is the sufficient and necessary condition for convergence of the iterative scheme ?
   iii) See if matrix $A$ in Problem 2) is diagonally dominant and also compute the spectral radius of the same.

Question 4: Gaussian elimination in computer
Write a MATLAB/python code for solving the linear system $Ax = b$ using Gaussian elimination with partial pivoting. Test your code for linear system in Problem 2.