Homework #3

Problem 1: Numerical Solution of System of Linear Algebraic Equations

Use your MATLAB implementation of the Gauss algorithm to solve:

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 3 & 1 \\ 4 & 1 & 5 & 5 \\ 5 & 3 & 1 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} 11 \\ 11 \\ 13 \\ 4 \end{pmatrix}$$

Problem 2: Jacobi Method

You are given the following system of linear equations:

$$\begin{pmatrix} 8 & 0 & 1 \\ 2 & 9 & 0 \\ 0 & 2 & 7 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

a) Using the Jacobi method, what are P and Q?
b) Perform the first three iterations for the Jacobi method. Use $x_0 = (1\ 1\ 1)^T$ as the starting point

Feel free to use MATLAB for this problem or perform the solution by hand/calculator. However, show your work for the three steps.

Problem 3: Solution of a Nonlinear Equation

You are given the following nonlinear equation:

$$x + \ln(x) = 0$$

for a), b), and c) below perform iterations until the change from one iteration to the next has an absolute value of less than 0.01.

a) Use $x_0 = 1$, and the method of successive substitutions to solve this problem. Show the results for each iteration.
b) Use $x_1 = 0.01$ and $x_2 = 1$and the linear interpolation method to solve this problem. Show the results for each iteration.
c) Use $x_0 = 1$, and the Newton-Raphson method to solve this problem. Show the results for each iteration.
d) List the number of iterations required to meet the desired accuracy for each of the three methods. Which one requires the most and which one the fewest iterations?

Use MATLAB for this problem is encouraged, but not required.