Alexandria University
Faculty of Engineering
Computer and Communications
Engineering

7th Semester

Numerical Analysis

Project 2

Objective:

The aim of this assignment is to compare and analyze the behavior of numerical methods studied in class: Gaussian-elimination, LU decomposition, Gaussian-Jordan and Gauss-Seidel.

Description:

You are required to implement a program for solving systems of linear equations, which takes as an input the equations, the technique to use and its required parameters.

Specification:

- The program must contain the following features:

1- An interactive GUI that enables the user to enter a set of linear equations.

2- Reading from files must be available as well (all the inputs are available in the same file).

3- A way to choose a method to solve the given equation (Preferably a drop down list or buttons), also a way to choose to use all the methods and provide text boxes to enter the parameters for each method.

4- A way to enter the precision and the max number of iterations otherwise default values are used, Default Max Iterations = 50, Default Epsilon = 0.00001;

5- The answer for the chosen method indicating the number of iterations (if exists), execution time, all iterations' approximate root and precision.

6- You need to output the above results in a file preferably in a tabular format.

7- In the case of using an **_iterative method_**, you need to plot the following curve for every variable separately: -

    i.   Curve between the number of iterations and the obtained root value at this iteration for all the methods in the same graph.

- The final report should contain:

1- Flowchart or pseudo-code for each method and the general algorithm.

2- Analysis for the behavior of different examples using the analysis template, and your conclusion about the behavior of each method (at least two examples).

3- Problematic functions and the reason for their misbehaviour and your suggestions (if exists).

4- Sample runs and snapshots from your GUI.

Assumptions:

Reading from files will follow the following template:
1st line: number of equations
2nd line: Method Name (e.g. 'Gaussian-elimination)
3rd line --> nth line: equations
last line: Space separated initial points (e.g. 1.1 2)

A sample file in this case will be:

```
3
Gaussian-elimination
3*a + 2*b + c - 6
2*a + 3*b - 7
2*c - 4
```

Or in case of iterative methods, it will be:

```
3
Gaussian-jordan
3*a + 2*b + c - 6
2*a + 3*b - 7
2*c - 4
1  1.1  2
```