



## **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: -
- 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: 1<sup>st</sup> line: number of equations

2<sup>nd</sup> line: Method Name (e.g. 'Gaussian-elimination')

3<sup>rd</sup> line --> n<sup>th</sup> 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**

$$3*a + 2*b + c - 6$$

$$2*a + 3*b - 7$$

$$2*c - 4$$

$$1 \quad 1.1 \quad 2$$