Alexandria University
Faculty of Engineering
Computer and Systems Engineering Department

Numerical Computing

Assigned: December 22, 2023
Due: January 1, 2024

Project – Phase 2

1- Objective

The aim of this project is to compare and analyze the behavior of the different numerical methods used for calculating the roots of equations:

1. Bisection
2. False-Position
3. Fixed point
4. Original Newton-Raphson
5. Modified Newton-Raphson
6. Secant Method.

2- Description

You are required to implement a root finder program which takes as an input the equation, the technique to use and its required parameters (e.g., interval for the bisection method).

3- Specification

You're required to build upon the GUI application of phase 1, to include the following:

1. Accepts a free-text input for a non-linear equation:
    a. The equations containing different function: {poly, exp, cos, sin}.
    b. The variable used is "x"
2. You have to plot of the function first to get the initial guess(es).
3. Choose any of the previously mentioned methods to solve the given equation via a drop-down list.
4. Parameters, if it applicable for the chosen solving method.
5. A way to enter the precision (number of significant figures), EPS and the max number of iterations otherwise default values are used; Default #SFs = System Default, Default Epsilon = 0.00001, and Default Max Iterations = 50.
6. A Solve button to display the output if exists, the run time must be displayed.

4- Bonus

You can implement *Single step mode* simulation showing each step of the algorithm.

5- Deliverables

You must deliver the following:

1. A fully commented and clean code. You may use any programming language.
2. A well-formatted report that contains the following:
   a. Flowchart or pseudo-code for each method.
   b. Sample runs for each method; they must include different cases (normal and tricky cases).
   c. Comparison between the different methods (time complexity, convergence and approximate errors).
   d. Data structure used and how helpful was your choice.

6- Notes

Please note the following:

1. You should continue working in the team formed in phase 1.
2. Code plagiarism detection will be applied and if a violation is detected, the cheating policy will be applied.