In the name of God

Sharif University of Technology

Department of Electrical Engineering

EE 25745-1 Numerical Computation, Group 1 Fall 1397-98

Computer Exercise 2

- Reports should include answers to the questions, diagrams, charts and explanation of your methods.
- MATLAB codes should be attached to your reports. Codes are also considered to be well-written with appropriate comments.
- It is suggested to use MATLAB Live Script for preparing your reports more conveniently.
- Reports should be uploaded to courseware.
- Naming Format: HW2_StudentNumber

1. Write a MATLAB code that finds negative zero of the following function in the interval $[-1,0]$ accuracy of $\epsilon = 10^{-4}$, using 5 different methods. For Newton and Fixed-point methods use $x_0 = 0$. For Secant, Bisection and Regula Falsi methods use $x_0 = -1$ and $x_1 = 0$. Find N such that $|x_n - x_{n-1}| < \epsilon$ for $n > N$ and plot $|x_n - x_{n-1}|$ and $f(x_n)$ at each stage of each method.

$$f(x) = \sin(x)\, e^x + 25x + 1$$

2. Use Newton's method to compute the zero of $f(x) = x^3 - 3x^2 2^{-x} + 3x4^{-x} - 8^{-x}$ in $[0,1]$ and explain why convergence is not quadratic.

3. The vertical distance y that a parachutist falls before opening the parachute is given by equation

$$y = \frac{\ln\left(\cosh\left(t\sqrt{gk}\right)\right)}{k}$$

Where t is elapsed time in seconds, $g = 9.8065\ m/s^2$ is the acceleration due to gravity, and $k = 0.00341\ m^{-1}$ is a constant related to air resistance. Use a zero finder to determine the elapsed time required to fall a distance of $1\ Km$.

4. Write a MATLAB program to compute the solution of the following 5×5 system of equation using Gauss-Jordan, Jacobi and Gauss Seidel methods. Exploit the MATLAB direct solution ($x = inv(A) * b;$) as a basis, to calculate the error of each method. For Jacobi and Gauss-Seidel methods, plot the error values with respect to the number of iterations.

$$Ax = b, where\ a_{ij} = \left(\frac{1}{3}\right)^{|i-j|}, b_i = \left(\frac{1}{7}\right)^{i}, i, j = 1, 2, 3, 4, 5$$