Assignment #. 1 – Spring 2024

Numerical Computing

Program: BSCS
Sections: 4A, 4B, 4C, 4D, 4E, 4F
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Submission Date: 2nd working day after Eid-ul-Fitr

Part-1

Q1 Built a code of Newton Rapson Method to find the solution of algebraic and transcendental equations. Also, apply it to find the all roots of at least one algebraic or transcendental equation.

Q2 Consider the ODE

$$\frac{dN}{dr} = \frac{-2N}{r} + \frac{2}{3r} - \frac{4Br}{3}, N(0.1) = 0.1$$

Where $0 \leq r \leq 5$ and B is a constant.
   i.   Solve the given ODE exactly.
   ii. Apply the Euler method and RK method of order 4 to solve the given ODE.
   iii. Built a code for the Euler's method and RK method of order 4 to solve the given ODE.
   iv. Plot the solution.
   v.   Extract data solution.
   vi. Interpolate the solution set.

Q3 Built a code of RK method of order 4 to solve system of 1st order ODE's.

Q4 Solve the following 2nd order ODE by RK method of order 4.

$$y'' + 12y' + 36y = 0, \quad y(1) = 0, \quad y'(1) = 1$$

Part-2

Q1 Consider the data given in a file bps.date
   i. Interpolate the given data by using cubic spline method.
   ii. Plot the graph of given data.

Q2 Built a code to find explicit expressions for x, y, and z from the following system of equations

$$1 - \frac{2M}{r} + \frac{3Mq^2}{r^3} - x^2r^2 = 0$$

$$\left(1 - \frac{2M}{r} + \frac{3Mq^2}{r^3}\right)^{-1} - \frac{y^2}{(x+zr)^2} = 0$$

$$\frac{d}{dr}\left[\left(1 - \frac{2M}{r} + \frac{3Mq^2}{r^3}\right)^{-1} - \frac{y^2}{(x+zr)^2}\right] = 0$$

Q3 The following table gives the population of a town during the last six censuses. Estimate the increase in the population during the period from 1976 to 1978:

Year:	1941	1951	1961	1971	1981	1991
Population: (in thousands)	12	15	20	27	39	52

Also, built a code for Newton's Backward Interpolation formula to solve the above problem for any year in the table.

Best of Luck