NUST School of Electrical Engineering and Computer Science
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Assignment 3

Math-351: Numerical Methods (3+0)

BEE-6AB

16-01-2017

Instructions

1. Plagiarism is not tolerable a single bit.
2. Use Matlab to solve the assignment.
3. Submit through LMS

Course Learning Outcomes (CLOs)

1. Explain the consequences of finite precision and estimate the amount of error inherent in different Numerical methods.
2. Derive algorithms for different Numerical techniques.
3. Apply different computational techniques to solve Mathematical problems arising in engineering and sciences.
4. Establish the limitations, advantages, and disadvantages of Numerical methods.

CLOs	CLO4	CLO4	CLO3	CLO3
Total Marks	**Q#1**	**Q# 2**	**Q# 3**	**Q#4**
40 Marks	10 Marks	10 Marks	10 Marks	10 Marks

Question 1: [marks 10]

The fourth-degree polynomial

$$f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$$

has two real zeros, one in $[-1, 0]$ and the other in $[0, 1]$. Attempt to approximate these zeros to within 10^{-6} using the

a. Method of False Position

b. Secant method

c. Newton's method

Use the endpoints of each interval as the initial approximations in (a) and (b) and the midpoints as the initial approximation in (c).

Question 2: [marks 10]

Apply, compare and discuss the limitations, advantages and disadvantages of simpson 1/3 and 3/8 rule for the following integral. Take n=12.

$$\int_{.75}^{1.75} (\sin^2 x - 2x \sin x + 1)\, dx,$$

Question 3: [marks 10]

Use Newton's method to find a solution to the following nonlinear systems in the given domain. Iterate until $\|\mathbf{x}^{(k)} - \mathbf{x}^{(k-1)}\|_\infty < 10^{-6}$.

$$\begin{aligned} 6x_1 - 2\cos(x_2 x_3) - 1 &= 0, \\ 9x_2 + \sqrt{x_1^2 + \sin x_3 + 1.06} + 0.9 &= 0, \\ 60x_3 + 3e^{-x_1 x_2} + 10\pi - 3 &= 0. \end{aligned}$$

Question 4: [marks 10]

Use the Runge-Kutta for Systems Algorithm to approximate the solutions of the following higher-order differential equations, and compare the results to the actual solutions.

$t^3 y''' - t^2 y'' + 3ty' - 4y = 5t^3 \ln t + 9t^3, \quad 1 \le t \le 2, \quad y(1) = 0, \quad y'(1) = 1, \quad y''(1) = 3,$ with $h = 0.1$; actual solution $y(t) = -t^2 + t\cos(\ln t) + t\sin(\ln t) + t^3 \ln t$.