0006

National University of Computer and Emerging Sciences

Lahore Campus

Numerical Computing (CS2008) — **Sessional-II Exam**

Date: Nov 04; 2024 — **Total Time (Hrs):** 1

Course Instructor(s) — **Total Marks:** 50

Dr. Mubashir Qayyum — **Total Questions:** 03

Dr. Sidra Afzal

Dr. Tauseef Saeed

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Mr. Usman Javed

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Attempt all questions on the answer book. Programmable calculators are not allowed. Don't write anything on a question paper except your name and roll number.

Q1a. Find **minimum number of iterations** N needed to achieve an accuracy of 1×10^{-7} for the following nonlinear equation using the ***Bisection Method***. **CLO2 Points (5)**

$$3\,\mathrm{Sin}(x) - \frac{x^2}{2} - x - \ln(x) = 0 \text{ in } [1,3].$$

Note: Find N without solving $f(x) = 0$ for x.

Q1b. Evaluate root of nonlinear equation within given interval mentioned in **Q1a** using **mixed methods**. Firstly, apply ***Bisection Method*** to given equation for initial two iterations. After that continue with ***Regular False Method*** in iteration three and four. **CLO2 Points (10)**
Note: (i) Throughout computation take 4 four digits after decimal place. (ii) Consider x is in radian.

Q1c. Derive general algorithm (formula) to compute $\sqrt[n]{M}$ (where n and M are positive integers greater than 1) based on ***Newton Raphson Method***, and apply obtained general formula to compute $\sqrt[2]{7}$ till three decimal places by choosing a suitable initial guess. **CLO2 Points (10)**
Note: Throughout computation take 4 four decimal places.

Q2. Solve the following linear system using ***Doolittle Method*** (*i.e.* $l_{ii} = 1$) **CLO2 Points (15)**

$$\begin{bmatrix} 4 & 11 & -1 \\ 6 & 3 & 12 \\ 8 & -3 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 33 \\ 35 \\ 20 \end{bmatrix}$$

Q3. For a linear system in **Q2**, evaluate approximate root by performing first iteration using ***Gauss Jacobi Method*** and then second iteration by ***Gauss Seidal Method***. Use [0,0,1] as initial guess for first iteration.
Hint: Check the sufficient condition of convergence. **CLO2 Points (10)**