National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Numerical Computing	Course Code:	CS2008
	Degree Program:	BS (CS)	Semester:	Fall 2021
	Exam Duration:	60 Minutes	Total Marks:	65
	Paper Date:	December 3, 2021	Weight	15%
	Section:	ALL	Page(s):	1
	Exam Type:	Mid Term-II		

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Instruction/Notes: 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.

Points (10)

Q1. (A)

For what values h and N composite Trapezoidal approximation of the following integral is correct to 10^{-4}.

$$\int_{1.5}^{3.5} e^{x}\,dx$$

Points (10)

(B)

Use composite Simpson rule with $h = 1$ *and* 0.5 to approximate $\int_{-1}^{1} xe^{3x}\,dx$ having exact solution 4.485580235538532. Then use Romberg Integration based on Simpson rule to find $O(h^6)$ approximation. Compare your results with exact solution and make conclusion.

Note: Throughout the problem values should be taken at least 6 decimals places.

Points (5)

Q2. (A)

Find the minimum number of iterations N, needed to achieve an accuracy of 10^{-3} by using the bisection method.

$$f(x) = e^{x} - 1 - x - \frac{x^2}{2} \text{ in } [-1, 1]$$

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

Points (10)

(B)

Show that order of convergence of Newton - Raphson method is 2.

Points (10)

(C)

Show that Newton sequence of iterations for the function $f(x) = x^3 - 2x + 2$ with $x_0 = 0$ will oscillate between 0 and 1. Furthermore, find the real root of $f(x) = 0$ up to 5 decimal places using Newton's method by choosing suitable x_0.

Points (10)

Q3. (A)

Solve the following linear system using Crout's Method.

$$\begin{bmatrix} 3 & 1 & -1 \\ -1 & 2 & 8 \\ 1 & -5 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 8 \\ -8 \\ -4 \end{bmatrix}$$

(B) For the system given in **Q3 (A)**, find approximate solution by performing first iteration using Gauss Jacobi method and then second iteration by Gauss Seidal method. Use [1,1,1] as initial guess for this problem.

Points (10)