CSE330 Assignment-2 [Spring-2024]
[CO4]

Instructions for submission: [Handwritten submission]

- **Write your Name, Student_ID, Section No. in the cover page of the assignment.**
- **Mark the answers properly for each corresponding question.**

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1. Consider the following table of data points/nodal points:

Time t (sec)	Velocity (ms^-1) v(t)
2	**10**
4	**20**
6	**25**

a. [4+1 marks] Find an interpolating polynomial of velocity that goes through the above data points by using **Vandermonde Matrix method**. Also compute an approximate value of acceleration at Time, **t = 7 sec**.
b. [4 marks] Find an interpolating polynomial of velocity that goes through the above data points by using **Lagrange method**.
c. [2 marks] If a **new data point** is added in the above scenario, which method should you use in finding a new interpolating polynomial? Also what will be the degree of that new polynomial?

2. Read the following and answer accordingly:

a. (4 marks) Consider the nodes **[−π/2, 0, π/2]**. Find an interpolating polynomial of appropriate degree by using **Newton's divided-difference method** for **f(x) = x sin(x)** .
b. (1 mark) Use the interpolating polynomial to find an approximate value at node = π/4.
c. (4 marks) Add a new node **π** to the above nodes, and find the interpolating polynomial of appropriate degree.

3. [5 marks] Derive the interpolating polynomial for the function **f(x) = x ln x** at the nodes **(x0 = 1, x1 = 3)** using the **Lagrange method**. Keep up to 4 significant figures.

4. [5 marks] The function f(x) = $e^{3x} - e^{-3x}$ has been interpolated at the nodes at **(-1, 0, 1)** using Vandermonde matrix method. Evaluate the upper bound of the interpolation error for the interval **[-1.5, 1.5]** using **Cauchy's theorem**. Keep up to 4 significant figures.