CSE 330: Summer 2024
Assignment-2
Total Marks: 30

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

Time (sec) t	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) [1 mark] If a **new data point** is added in the above scenario, which method you should 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) (2 marks) Use the interpolating polynomial to find an approximate value at **π/4**, and compute the percentage relative error at **π/4**.
(c) (4 marks) Add a new node **π** to the above nodes, and find the interpolating polynomial of appropriate degree.

3. An interpolating polynomial, $\mathbf{p_1(x) = 1.648(x - 1)}$ is derived for the function **f(x) = x ln x** at the nodes $\mathbf{(x_0 = 1, x_1 = 3)}$ using the Lagrange method. Answer the following keeping up to 4 significant figures.
a) (1 mark) Explain what you need to do to obtain a **degree 3** interpolating polynomial for the same function f(x) and for the same nodal points $\mathbf{(x_0 = 1, x_1 = 3)}$.
b) (4 marks) Calculate the bases of the **degree 3** polynomial.

4. [5 marks] The function $\mathbf{f(x) = e^{3x} - e^{-3x}}$ 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.