CSE 330 (Summer 2024)
Assignment 2
Total Marks: 40

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

Time (sec) t	Velocity (m/s) v(t)
10	22
12	28
15	40

(a) [3+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=23 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? Explain your answers.

2. Read the following and answer accordingly:
(a) [4 marks] Consider the nodes **[−π/4, 0, π/4]**. Find an interpolating polynomial of appropriate degree by using **Newton's Divided-Difference** method for **f(x) = xcos(x)** .
(b) [2 marks] Use the interpolating polynomial to find an approximate value at **π/6**, and compute the percentage relative error at **π/6**.
(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 **(-2, 0, 2)** using Lagrange method. Evaluate the upper bound of the interpolation error for the interval **[-3, 3]** using Cauchy's theorem. Keep up to 7 significant figures.

5. Consider the following **Runge Function** $\mathbf{f(x) = 1/(1+25x^2)}$, given interval **[-5/2, 5/2] and n = 2.** Answer the following using the given data,
(a) [5 marks] Calculate the corresponding **equal angled points**.
(b) [5 marks] Calculate the **Chebyshev Nodes** up to 5 significant figures.