Math330

Assignment #4

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(Q1) Let $f(x) = \cos(\frac{\pi x}{2})$.

(a) Using the nodes: -1, 0, find Lagrange's polynomial.

(b) Find Newton's polynomial based on the nodes: -1, 0, 1, 2. Then estimate $f(0.5)$.

(c) Estimate $\cos(\frac{\pi}{8})$ using Lagrange's polynomial based on the nodes: -1, 0, 1.

(d) Find $f[2, 3, 4]$, then calculate its cost.

(e) Using the nodes: 0, 1, 2, find $L_{2,1}(1.5)$.

(Q2) Given the data

x	0	1	2
y	b	-1	12

Using the interpolating polynomial for these data, if the coefficient of x^2 is 4, find b.

(Q3) Let $f(x) = e^{-x/3}$; $0.2 \leq x \leq 0.8$. Using equally space nodes, find upper bounds for $E_1(x), E_2(x)$, and $E_3(x)$.

(Q4) Let $f(x) = x - \frac{1}{(x+2)^2}$ with the nodes 0, 1, 3 respectively. Find the upper bound of $E_2(2)$ when estimating $f(x)$ by Newton's polynomial $P_2(x)$.

(Q5) Given the nodes $x_{-3} = x_0 - 3h$, $x_{-1} = x_0 - h$, and $x_1 = x_0 + h$, find the uniform upper bound for $E_2(x)$ of interpolating the data in the interval $[x_{-3}, x_1]$ assuming that $|f^{(3)}(x)| < 0.5$ on this interval.

(Q6) Consider the data points: $(1, 2), (2, 9), (3, 28)$

(a) Estimate $f(1.5)$ using Lagrange interpolating polynomial $P_2(x)$

(b) Find the cost of the above estimation.

(c) Estimate $f(1.5)$ using Newton interpolating polynomial $P_2(x)$

(d) Find the cost of the above estimation.

(e) Find an upper bound for the error at $x = 1.5$ in the above estimation, given that $f(x) = x^3 + 1$
