Math330

Assignment #4

2nd semester 2018/2019 Mahmoud Ghannam

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

(Q4) Consider the function $f(x) = x^2 - \frac{2}{x}$ with the points $(1, -1), (2, 3), (5, 24.6)$.
Find an upper bound for the interpolation error $E_2(x)$ for all $x \in [1, 5]$

(Q5) Consider the function $f(x) = x^3 - 2\cos x$ with the data points $(1.1, 0.4238), (1.2, 1.003), (1.4, 2.404)$

(a) Estimate $f(1.25)$ using Newton's interpolating polynomial $P_2(x)$

(b) Find an upper bound for the error at $x = 1.25$ in the above estimation.

(c) Find $L_{2,1}(1.25)$

(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 $f(x) = x^3 + 1$
