BRAC University (Department of Computer Science and Engineering)

CSE 330 (Numerical Methods) for FALL 2022 Semester

Quiz 2

Full Marks: 10

Student ID:
Section:

Duration: 20 minutes

Name:

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1. [CO2] An experiment is conducted to monitor the velocity change with respect to time. The table of results is given below:

Time(seconds)	Velocity(ms^-1)
1	10
2	15
3	20

a) Using **Lagrange basis**, construct a polynomial that goes through the above nodes. [5 marks]

b) Using **Newton's divided difference** method, construct a polynomial that goes through the above nodes. [4 marks]

c) Use the polynomial to find the approximate velocity at Time=6 seconds. [1 mark]

(2) $l_0 = \frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)} = \frac{(x-2)(x-3)}{2}$ | $l_1 = \frac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)} = -(x-1)(x-3)$

$l_2 = \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)} = \frac{(x-1)(x-2)}{2}$

$\therefore P_2(x) = f(x_0)l_0(x) + f(x_1)l_1(x) + f(x_2)l_2(x)$

$= 10\frac{(x-2)(x-3)}{2} + 15(-(x-1)(x-3)) + 20\frac{(x-1)(x-2)}{2}$

$= 5x^2 - 25x + 30 - 15x^2 + 60x - 45 + 10x^2 - 30x + 20$

$= 5x + 5$

(b)

$x_0 = 1 \qquad f[x_0] = 10$

$$f[x_0, x_1] = 5$$

$x_1 = 2 \qquad f[x_1] = 15 \qquad f[x_0, x_1, x_2] = 0$

$$f[x_1, x_2] = 5$$

$x_2 = 3 \qquad f[x_2] = 20$

$$\therefore P_2(x) = f[x_0] + f[x_0, x_1](x - x_0) + f[x_0, x_1, x_2](x - x_0)(x - x_1)$$

$$= 10 + 5(x-1) + 0(x-1)(x-2)$$

$$= 10 + 5x - 5 = 5x + 5$$

(c) Applying value on $P_2(x) \Rightarrow$

$$P_2(x=6) = (5 \times 6) + 5 = 35$$