

BRAC University (Department of Computer Science and Engineering)
CSE 330 (Numerical Methods) for Spring 2024 Semester
Quiz 2 [CO1]

Student ID:

Name:

Section: 08

Full Marks: 10

Duration: 15 minutes

1) Consider the following nodes:

Time (Sec)	Displacement (m)
10	35
20	45

- a) State the number of nodes and no. of degree (n) for the above nodes. [1]
b) Using **Vandermonde Matrix** method, construct a polynomial that goes through the above nodes. You can use the following formulae for the function. [3]
c) Find the value of displacement if x(time)=17 sec using the above polynomial. [1]
d) If a new node (30,60) is added to the above nodes, then find a new polynomial of appropriate degree by using **Newton's Divided Difference** method. [5]

(a) no. of nodes = 2
 $n = 1$

(b)
$$\begin{pmatrix} 1 & 10 \\ 1 & 20 \end{pmatrix} \begin{pmatrix} x_0 \\ x_1 \end{pmatrix} = \begin{pmatrix} 35 \\ 45 \end{pmatrix}$$
$$\begin{pmatrix} x_0 \\ x_1 \end{pmatrix} = \begin{pmatrix} 1 & 10 \\ 1 & 20 \end{pmatrix}^{-1} \begin{pmatrix} 35 \\ 45 \end{pmatrix} \quad \text{--- (1)}$$
$$\begin{pmatrix} x_0 \\ x_1 \end{pmatrix} = \begin{pmatrix} 2 & -1 \\ -\frac{1}{10} & \frac{1}{10} \end{pmatrix} \begin{pmatrix} 35 \\ 45 \end{pmatrix} = \begin{bmatrix} 25 \\ 1 \end{bmatrix}$$

--- (2)

$$y = a_0 + a_1 x^1$$

$$f(x) = \boxed{y = 25 + 1x} \quad \text{--- (1)}$$

(c)

$$\begin{aligned} f(17) &= 25 + 1(17) \\ &= 25 + 1(17) \\ &= 42 \end{aligned}$$

(d)

	<u>Layer 1</u>		
$x_0 = 10$	$f[x_0] = 35$		
		<u>Layer 2</u>	
$x_1 = 20$	$f[x_1] = 45$	$f[x_1, x_0] = \frac{45-35}{20-10} = 1$	
			<u>Layer 3</u>
$x_2 = 30$	$f[x_2] = 60$	$f[x_2, x_1] = \frac{60-45}{30-20} = 1.5$	$f[x_0, x_1, x_2] = \frac{1.5-1}{30-10} = \frac{0.5}{20}$

$$\begin{aligned} f(x) &= a_0 + a_1(x-x_0) + a_2(x-x_0)(x-x_1) \\ &= 35 + 1(x-10) + \frac{0.5}{20}(x-10)(x-20) \end{aligned}$$

① 1.5 mark each \rightarrow 1 layer correct each
 ② 0.5 mark \rightarrow $f(x)$ correct.