BLG 202E

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Q1) Student ID = 150190024

Q1a) Reverse Student ID = 420091051 ↓ invalid

Q1b) (4,2), (0,0), (9,1), (5,1)

Newton's Basis:

x	0	4	5	9
f(x)	0	2	1	1

$\phi_0 = 1$

$\phi_1 = (x-0)$

$\phi_2 = (x-0)(x-4)$

$\phi_3 = (x-0)(x-4)(x-5)$

Last function is here

$v(x) = c_0 \cdot \phi_0 + c_1 \cdot \phi_1 + c_2 \phi_2 + c_3 \phi_3$

$= 0.1 + \frac{1}{2}(x) + -0.3(x)(x-4) + 0.0555(x)(x-4)(x-5)$

	ϕ_0	ϕ_1	ϕ_2	~~ϕ_3~~			
x_0	1	0	0	0	c_0	=	0
x_1	1	4	0	0	c_1		2
x_2	1	5	5	0	c_2		1
x_3	1	9	45	180	c_3		1

$c_0 = 0 \quad c_1 = \frac{1}{2} \quad c_2 = -0.3 \quad c_3 = \frac{1}{18}$

~~c_0~~ $+ 5c_1 + 5c_2 = 1$

$5c_2 = -\frac{3}{2}$

$0 + \frac{9}{2} - \frac{45.3}{10} + 180c_3 = 1$

$c_3 \approx \frac{1}{18}$

$v(x)$

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Q1 b) Continue ...

Newton Divided Difference:

x_i	$f[x_i]$	$f[x_{i-1}, x_i]$	$f[x_{i-2}, x_i]$	....
0	0			
4	2	$\frac{2-0}{4-0} = \frac{1}{2}$		
5	1	$\frac{1-2}{5-4} = -1$	$\frac{-1-\frac{1}{2}}{5-0} = \frac{-3}{10}$	
9	1	$\frac{1-1}{9-5} = 0$	$\frac{0-(-1)}{9-4} = \frac{1}{5}$	$\frac{\left(\frac{1}{5} - \frac{-3}{10}\right)}{9-0} = \frac{1}{18}$

$c_0 = 0 \quad c_1 = \frac{1}{2} \quad c_2 = \frac{-3}{10} \quad c_3 = \frac{1}{18}$

$$v(x) = 0 + \frac{1}{2}(x-0) - \frac{3}{10}(x-0)(x-4) + \frac{1}{18}(x-0)(x-4)(x-5)$$

Q1 c) The equations are same. The questions says us predict $x=10$ with interpolation. But we can not do that. Because our range is between $[0, 9]$. Predicting $x=10$ will be extrapolation.

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(Q2) 150190024 → 42009 1051

Q2a) image size = 42009 × 1051 pixels

Each pixel will be 8 bits. (1 byte)

$$42009 \cdot 1051 \cdot (\text{pixel}) \cdot \left(1 \frac{\text{byte}}{\text{pixel}}\right) = 44151459 \text{ byte}$$

$$\approx 44 \text{ megabyte}$$

Q2b)

$$42009 \cdot 10 + 10 + 10 \cdot 1051 = 430610 \text{ byte}$$

$$\approx 430 \text{ kilobyte}$$

Q2c) $42009 \cdot 100 + 100 + 100 \cdot 1051 = 4306100$ byte

≈ 4.3 megabyte

For Q2a → the image size formula is

= (length) × (wide) × (size of each pixel)

For Q2b and Q2c → for mxn matrix, the size formula is

$$\left(\underset{\text{row number}}{m}\right) \times \text{rank} + \text{rank} + \text{rank} \times \left(\underset{\text{column number}}{n}\right) = \text{total truncated size}$$