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Topic: 4.2 –Lagrange’s Interpolation

② Using Lagrange's interpolation formula, fit polynomial to the following data

x	0	1	3	4
y	-12	0	6	12

Given : $x_0 = 0, x_1 = 1, x_2 = 3, x_3 = 4$
 $y_0 = -12, y_1 = 0, y_2 = 6, y_3 = 12$

By Lagrange's interpolation formula

$$y = f(x) = \frac{(x-x_1)(x-x_2)(x-x_3)}{(x_0-x_1)(x_0-x_2)(x_0-x_3)} y_0$$
$$+ \frac{(x-x_0)(x-x_2)(x-x_3)}{(x_1-x_0)(x_1-x_2)(x_1-x_3)} y_1 + \frac{(x-x_0)(x-x_1)(x-x_3)}{(x_2-x_0)(x_2-x_1)(x_2-x_3)} y_2$$
$$+ \frac{(x-x_0)(x-x_1)(x-x_2)}{(x_3-x_0)(x_3-x_1)(x_3-x_2)} y_3$$
$$= \frac{(x-1)(x-3)(x-4)}{(-1)(-3)(-4)} (-12) + \frac{(x-0)(x-1)(x-4)}{(3)(2)(-1)} (6)$$
$$+ \frac{(x-0)(x-1)(x-3)}{(4)(3)(1)} (12)$$
$$= (x^3 - 8x^2 + 19x - 12) - (x^3 - 5x^2 + 4x) + x^3 - 4x^2 + 32x$$
$$f(x) = x^3 - 7x^2 + 18x - 12$$

③ Using Lagrange's formula of interpolation, find $y(9.5)$ given the data

x	7	8	9	10
y	3	1	1	9



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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Given : $x_0 = 7, x_1 = 8, x_2 = 9, x_3 = 10$
 $y_0 = 3, y_1 = 1, y_2 = 1, y_3 = 9$

By Lagrange's interpolation formula

$$f(x) = \frac{(x-8)(x-9)(x-10)}{(7-8)(7-9)(7-10)} (3) + \frac{(x-7)(x-9)(x-10)}{(8-7)(8-9)(8-10)} (1)$$
$$+ \frac{(x-7)(x-8)(x-10)}{(9-7)(9-8)(9-10)} (1) + \frac{(x-7)(x-8)(x-9)}{(10-7)(10-8)(10-9)} (9)$$
$$= \frac{(1.5)(0.5)(-0.5)}{-2} + \frac{(2.5)(0.5)(-0.5)}{2}$$
$$+ \frac{(2.5)(1.5)(-0.5)}{-2} + 3 \frac{(2.5)(1.5)(0.5)}{2}$$

$y(9.5) = 0.375 + 0.1875 - 0.3125 + 0.9375 + 2$
 $= 3.625$