CS 3010 Num. Methods

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# Assignment 4

(3,1), (1, 0.12), (0, -0.3), (4, 2), (7, 2.5)

| x | y |
|---|---|
| 3 | 1 |
| 1 | 0.12 |
| 0 | -0.3 |
| 4 | 2 |
| 7 | 2.5 |

## Exercise 1

$$P(x) = 1\,\frac{(x-1)(x-0)(x-4)(x-7)}{(3-1)(3-0)(3-4)(3-7)} + 0.12\,\frac{(x-3)(x-0)(x-4)(x-7)}{(1-3)(1-0)(1-4)(1-7)}$$

$$+ -0.3\,\frac{(x-3)(x-1)(x-4)(x-7)}{(0-3)(0-1)(0-4)(0-7)} + 2\,\frac{(x-3)(x-1)(x-0)(x-7)}{(4-3)(4-1)(4-0)(4-7)}$$

$$+ 2.5\,\frac{(x-3)(x-1)(x-0)(x-4)}{(7-3)(7-1)(7-0)(7-4)}$$

$$P(2) = 1\,\frac{(x^2-x)(x^2-11x+28)}{24} + 0.12\,\frac{(x^2-3x)(x^2-11x+28)}{-36}$$

$$+ -0.3\,\frac{(x^2-4x+3)(x^2-11x+28)}{84} + 2\,\frac{(x^2-4x+3)(x^2-7x)}{-36}$$

$$+ 2.5\,\frac{(x^2-4x+3)(x^2-4x)}{504}$$

$$P(2) = \frac{x^4-11x^3+28x^2-x^3+11x^2+28x}{24} + 0.12\,\frac{x^4-11x^3+28x^2-3x^3+33x^2-}{-36}$$

$$+(0.3)\,\frac{x^4-11x^3+28x^2-4x^3+44x^2-112x+3x^2-33x+84}{84}$$

$$+2\,\frac{x^4-7x^3-4x^3+28x^2+3x^2-21x}{-36}$$

$$+2.5\,\frac{x^4-4x^3-4x^2+46x^2+3x^2-12x}{504}$$

$$P(x) = \frac{x^4 - 12x^3 + 39x^2 + 28x}{24} + 0.12\,\frac{x^4 - 14x^3 + 61x^2 - 84x}{-36}$$

$$+(-0.3)\,\frac{x^4 - 15x^3 + 75x^2 - 145x + 84}{84} + 2\,\frac{x^4 - 11x^3 + 31x^2 - 21x}{-36}$$

$$+ 2.5\,\frac{x^4 - 4x^3 + 15x^2 - 12x}{504}$$

$$P(2) = -0.0158333x^4 + 0.171667x^3 - 0.474167x^2$$

$$+ 0.738333x - 0.3$$

$$P(2) = 0.4$$

Exercise 2

| | $b_0$ | $b_1$ | $b_2$ | $b_3$ | $b_4$ |
|---|---|---|---|---|---|
| 3 | 1 | $\frac{0.12-1}{1-3} = 0.44$ | $\frac{0.42-0.44}{0-3} = 0.006667$ | 0.044997 | $\frac{-0.018332833 - 0.044997}{7-3} = -0.01583$ |
| 1 | 0.12 | $\frac{-0.3-0.12}{0-1} = 0.42$ | $\frac{0.575-0.42}{4-1} = 0.05167$ | $\frac{0.051667 - 0.006667}{4-3}$ | |
| 0 | −0.3 | $\frac{2+0.3}{4-0} = 0.575$ | $\frac{0.166667-0.575}{7-0} = -0.05833$ | $\frac{-0.05833 - 0.05167}{7-1}$ | |
| 4 | 2 | $\frac{2.5-2}{7-4} = 0.166667$ | | | |
| 7 | 2.5 | | | | |

−0.018332833

$$f(x) = b_0 + b_1(x - x_0) + b_2(x - x_0)(x - x_1) + b_3(x - x_0)(x - x_1)(x - x_2) +$$
$$b_4(x - x_0)(x - x_1)(x - x_2)(x - x_3)$$

$$= 1 + 0.44(x - 3) + 0.006667(x - 3)(x - 1) + 0.044997(x - 3) + (-0.0158$$
$$(x - 3)(x - 1)(x - 0)(x - 4)$$

$$f(1) = 0.44$$