

Multiple-Choice Test

Chapter 05.04

Lagrange Method of Interpolation

1. A unique polynomial of degree _____ passes through $n + 1$ data points.
(A) $n + 1$
(B) n
(C) n or less
(D) $n + 1$ or less
2. Given the two points $[a, f(a)]$, $[b, f(b)]$, the linear Lagrange polynomial $f_1(x)$ that passes through these two points is given by
(A) $f_1(x) = \frac{x-b}{a-b}f(a) + \frac{x-a}{a-b}f(b)$
(B) $f_1(x) = \frac{x}{b-a}f(a) + \frac{x}{b-a}f(b)$
(C) $f_1(x) = f(a) + \frac{f(b)-f(a)}{b-a}(b-a)$
(D) $f_1(x) = \frac{x-b}{a-b}f(a) + \frac{x-a}{b-a}f(b)$
3. The Lagrange polynomial that passes through the 3 data points is given by

x	15	18	22
y	24	37	25

$$f_2(x) = L_0(x)(24) + L_1(x)(37) + L_2(x)(25)$$

The value of $L_1(x)$ at $x = 16$ is most nearly

- (A) -0.071430
- (B) 0.50000
- (C) 0.57143
- (D) 4.3333

4. The following data of the velocity of a body is given as a function of time.

Time (s)	10	15	18	22	24
Velocity (m/s)	22	24	37	25	123

A quadratic Lagrange interpolant is found using three data points, $t = 15, 18$ and 22 . From this information, at what of the times given in seconds is the velocity of the body 26 m/s during the time interval of $t = 15$ to $t = 22$ seconds.

- (A) 20.173
 (B) 21.858
 (C) 21.667
 (D) 22.020
5. The path that a robot is following on a x, y plane is found by interpolating four data points as

x	2	4.5	5.5	7
y	7.5	7.5	6	5

$$y(x) = 0.15238x^3 - 2.2571x^2 + 9.6048x - 3.9000$$

The length of the path from $x = 2$ to $x = 7$ is

- (A) $\sqrt{(7.5-7.5)^2 + (4.5-2)^2} + \sqrt{(6-7.5)^2 + (5.5-4.5)^2} + \sqrt{(5-6)^2 + (7-5.5)^2}$
 (B) $\int_2^7 \sqrt{1 + (0.15238x^3 - 2.2571x^2 + 9.6048x - 3.9000)^2} dx$
 (C) $\int_2^7 \sqrt{1 + (0.45714x^2 - 4.5142x + 9.6048)^2} dx$
 (D) $\int_2^7 (0.15238x^3 - 2.2571x^2 + 9.6048x - 3.9000) dx$
6. The following data of the velocity of a body is given as a function of time.

Time (s)	0	15	18	22	24
Velocity (m/s)	22	24	37	25	123

If you were going to use quadratic interpolation to find the value of the velocity at $t = 14.9$ seconds, what three data points of time would you choose for interpolation?

- (A) 0, 15, 18
 (B) 15, 18, 22
 (C) 0, 15, 22
 (D) 0, 18, 24

For a complete solution, refer to the links at the end of the book.