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.