BITI1223 CALCULUS AND NUMERICAL METHODS

Started on	Wednesday, 8 May 2019, 11:16 AM
State	Finished
Completed on	Wednesday, 8 May 2019, 12:26 PM
Time taken	1 hour 9 mins

Question **1**

Complete

Marked out of 1.00

Given the Taylor Polynomial of fifth order of one function is

$$P_5(x) = 2 - 2(x-a) + \sqrt{5}\,(x-a)^2 - \frac{\pi}{2}(x-a)^3 + (x-a)^4 + 13(x-a)^5$$

Identify what is the value of $f^{(1)}(a)$?

Select one:

- a. -1
- b. 1
- c. -2
- d. 2

Question **2**

Complete

Marked out of 1.00

The data set {(10,22),(15,24),(18,37),(22,25),(24,123)} is the set of velocity v, in meter/second, of a body is given as a function of time t, in seconds. A quadratic Lagrange interpolating polynomial is found using three data points at t=15, 18, and 22. From this information, at what of times given is the velocity of the body 26 meter/second during the time interval [15,22].

Select one:

- a. 22.020
- b. 21.667
- c. 20.173
- d. 21.858

Question **3**

Complete

Marked out of 1.00

The Lagrange polynomial that interpolates the set of data points {(15,24), (18,37), (22,25)} is given by $P_2(x)=24L_0(x)+37L_1(x)+25L_2(x)$. The value of $L_1(x)$ at x=16 is

Select one:

- a. 0.5000
- b. 4.3333
- c. -0.0714
- d. 0.5714

Question **4**

Complete

Marked out of 1.00

Which of the following fall under Open methods:

Select one:

- a. Bisection
- b. Newton-Raphson
- c. Incremental searches
- d. False position

Question **5**

Complete

Marked out of 1.00

Given n + 1 data pairs, a unique polynomial of degree _____ passes through the n + 1 data points.

Select one:

- a. n + 1
- b. n
- c. n or more
- d. n or less

Question **6**

Complete

Marked out of 1.00

How many terms available in Taylor Polynomial of degree 2 for $f(x) = e^x$ centered at x = 0.

Select one:

- a. Three terms
- b. Two terms
- c. Four terms
- d. One term

Question **7**

Complete

Marked out of 1.00

Which of the following is the right formula for Newton-Raphson method?

Select one:

- a. $$x_{i+1} = x_i - \frac{f(x_{i-1})}{f'(x_{i-1})}$$
- b. $$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$
- c. $$x_{i+1} = x_i + \frac{f(x_i)}{f'(x_i)}$$
- d. $$x_{i+1} = x_i - \frac{f(x_{i-1})}{f'(x_i)}$$

Question **8**

Complete

Marked out of 1.00

The data set {(10,22),(15,24),(18,37),(22,25),(24,123)} is the set of velocity v, in meter/second, of a body is given as a function of time t, in seconds. If you were going to use quadratic Lagrange interpolating polynomial to find the velocity at t=14.9 seconds, what three data points of time would you choose for the interpolation?

Select one:

- a. 15, 18, 22
- b. 10, 15, 18
- c. 10, 18, 24
- d. 10, 15, 22

Question **9**

Complete

Marked out of 1.00

What is the stopping criteria for Newton-Raphson?

Select one:

- a. Stop the iteration when $|x_i - x_{i-1}| < \varepsilon$
- b. Stop the iteration when $|x_i - x_{i-2}| < \varepsilon$
- c. Stop the iteration when $|x_i| < \varepsilon$
- d. Stop the iteration when $|x_i - \varepsilon| < \varepsilon$

Question **10**

Complete

Marked out of 1.00

For

Select one:

a.

$$x_m = \frac{3(x_a - x_b)}{2}$$

b.

$$x_m = \frac{x_a - x_b}{2}$$

c.

$$x_m = \frac{x_a + x_b}{2}$$

d.

$$x_m = \frac{3(x_a + x_b)}{2}$$

Question **11**

Complete

Marked out of 1.00

What is root of equation?

Select one:

a. The value of f(x) when x = 0.

b. The value of f(x) for any given x.

c. The square root of f(x).

d. A solution to an equation of the form f(x) = 0.

Question **12**
Complete
Marked out of 1.00

Use the Newton-Raphson method to estimate the root of $f(x) = 0.9x^2 + 1.7x - 5$ employing an initial guess of $x_0 = 1$ accurate to within $\varepsilon = 0.1$.

Select one:

- a. 1.5947
- b. 0.0016
- c. 1.5963
- d. 0.0894

Question **13**
Complete
Marked out of 1.00

Identify the Taylor Polynomial of degree 3 for $f(x)$ centered at $x = a$.

Select one:

- a. $f(a) + f'(a)(x-a) + f''(a)(x-a)^2 + f'''(a)(x-a)^3$
- b. $f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3 + \frac{f''''(a)}{4!}(x-a)^4$
- c. $f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3$
- d. $f(a) + f'(a)(x-a) + f''(a)(x-a)^2 + f'''(a)(x-a)^3 + f''''(a)(x-a)^4$

Question **14**
Complete
Marked out of 1.00

Find the third term in Taylor Polynomial when a = -1 for the function $f(x) = \frac{1}{x^2}$.

Select one:

- a. $6(x+1)^2$
- b. $3(1-x)^2$
- c. $6(x-1)^2$
- d. $3(1+x)^2$

Question **15**

Complete

Marked out of 1.00

The curve that passes through the following data set {(18, …),(22,25), (24,123)} is given by $y=8.125x^2-324.75x+3237$. The corresponding polynomial using Newton interpolation is given by $P_2(x)=b_0+b_1(x-18)+b_2(x-18)(x-22)$. Then, the value of b_2 is

Select one:

- a. 24.0000
- b. 8.1250
- c. 1.0000
- d. 0.2500

Question **16**

Complete

Marked out of 1.00

Let $f(x) = x^n$ for some non-negative integer. Let $x_0, x_1, \ldots, x_m$ be $m+1$ distinct numbers. For $m = n$, $f[x_1, x_2, \ldots, x_m] =$

Select one:

- a. 0
- b. 3
- c. 1
- d. 2

Question **17**

Complete

Marked out of 1.00

Given the data set {(15,24),(18,37),(22,25)}. The Newton interpolating polynomial for the data is $P_2(x)=b_0+b_1(x-15)+b_2(x-15)(x-18)$. The value of b_1 is

Select one:

- a. -1.0480
- b. 0.1433
- c. 24.0000
- d. 4.3333

Question **18**
Complete
Marked out of 1.00

Using Bisection method, find the root of

$$f(x) = x^6 - x - 1$$

Accurate to within $\varepsilon = 0.3$. Given that $x_a = 1$ and $x_b = 2$.

Select one:

- a. 1.25
- b. 8.8906
- c. 1.5647
- d. 1.5

Question **19**
Complete
Marked out of 1.00

The formula to calculate the relative error is given by

$$Relative\ Error = \left|\frac{Error}{True\ Value}\right|$$

Select one:

- a. False
- b. True

Question **20**
Complete
Marked out of 1.00

For the given set of data $\{(0.1,0.2),(0.2,0.24),(0.3,0.30)\}$, $P_2(0.15)$ is

Select one:

- a. 0.0500
- b. 0.1000
- c. 0.2000
- d. 0.2175

Question **21**

Complete

Marked out of 1.00

Let $x_0=0.85$, $x_1=0.87$, $x_2=0.89$ and $f(x)=e^x$. Using the value of $f(x_0)$, $f(x_1)$ and $f(x_2)$, the error of the approximation of $f'(\frac{x_0+x_1}{2})$ is

Select one:

- a. 0.000049
- b. 0.000029
- c. 0.000019
- d. 0.000039

Question **22**

Complete

Marked out of 1.00

Given two points (a, b) and (c, d), the linear Lagrange interpolating polynomial is given by _____.

Select one:

- a. $\frac{x-c}{a-c}b+\frac{x-a}{c-a}d$
- b. $b+\frac{d-b}{c-a}(c-a)$
- c. $\frac{x-c}{a-c}b+\frac{x-a}{a-c}d$
- d. $\frac{x}{c-a}b+\frac{x}{c-a}d$

Question **23**
Complete
Marked out of 1.00

Which of following fall under bracketing method:

Select one:

- a. Secant
- b. Newton-Raphson
- c. Bisection
- d. Fixed point iteration

Question **24**
Complete
Marked out of 1.00

For Bisection method, fill in the blank for the following:

Given a function f(x) continuous on an interval [a,b] and $f(a) * f(b) < 0$

Do

m = (a+b)/2

if f(a) * f(m) < 0 then (_____)

Select one:

- a. b = m
- b. a = f(b)
- c. a = m
- d. b = f(a)

Question **25**
Complete
Marked out of 1.00

Use **three digit chopping arithmetic** to perform the calculation of 133 - 0.499 and find the relative error if the exact value is given by 132.501.

Select one:

- a. 133 and relative error is 3.76×10^{-3}
- b. 132 and relative error is 3.77×10^{-3}
- c. 132 and relative error is 3.78×10^{-3}
- d. 133 and relative error is 3.77×10^{-3}

Question **26**

Complete

Marked out of 1.00

Find the Taylor Polynomial of degree 1 for f(x) = e^x centered at x = 0.

Select one:

- a. 1 + x
- b. 1 - x
- c. e^x - x
- d. e^x + x

Question **27**

Complete

Marked out of 1.00

Given the Taylor Polynomial of fifth order of one function is

$$P_5(x) = 2 - 2(x-a) + \sqrt{5}\,(x-a)^2 - \frac{\pi}{2}(x-a)^3 + (x-a)^4 + 13(x-a)^5$$

Identify what is the value of $f^{(3)}(a)$?

Select one:

- a. $\sqrt{5}$
- b. 1
- c. $-\pi/2$
- d. -3π

Question **28**

Complete

Marked out of 1.00

The formula to calculate the error is given by

$$Error = Approximate\ Value - True\ Value$$

Select one:

- a. False
- b. True

Question **29**

Complete

Marked out of 1.00

Use **three digit rounding arithmetic** to perform the calculation of 133 - 0.499 and find the relative error if the exact value is given by 132.501.

Select one:

- a. 133 and relative error is 3.77×10^{-3}
- b. 132 and relative error is 3.77×10^{-3}
- c. 133 and relative error is 3.76×10^{-3}
- d. 132 and relative error is 3.78×10^{-3}

Question **30**

Complete

Marked out of 1.00

Use the Newton-Raphson method to estimate the root of $f(x) = e^{-x} - x$ employing an initial guess of $x_0 = 0$ accurate to within $\varepsilon = 0.1$.

Select one:

- a. 0.566311
- b. 0.066311
- c. 0.5
- d. 0.567143