Jahangirnagar University

Institute of Information Technology

2nd Year 1st Semester B.Sc. (Honors) Final Examination-2020

Course No. # ICT -2105
Course Title# Numerical Analysis

Examination Roll No. #	19 23 40
Registration No. #	20193650283
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Total no of written pages in the script # 6

Exam Date: 29, Aug **, 2021**

Instructions:

1. Examinee must write his/her exam roll no. and page no. at the top of every page of the script.
2. Do not write your name or any identification mark anywhere of the script.
3. Total time for exam is 45 minutes. You will get 15 additional minutes for submission.
4. Delay in submission is not acceptable.
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8. After completing the exam, you must write the total number of pages used for the exam in the top sheet.

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Answer to the question no - 1

a. Given that

$f(x) = x^5 + x^4 - 3$

$x_1 = 1.5$

Using bisection method on [1, 2]

$f(x_1) = f(1.5) = (1.5)^5 + (1.5)^4 - 3$

$= 9.6562$

Now root between 1 and 1.5

$x_2 = \frac{1+1.5}{2}$

$= 1.25$

$f(x_2) = f(1.25) = (1.25)^5 + (1.25)^4 - 3$

$= 2.4932$ Ans.

Here $f(1) = -1 < 0$ and $f(1.25) = 2.4932 > 0$

Now root 1 and 1.25

$x_3 = \frac{1+1.25}{2}$

$= 1.125$ Ans.

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b. Newton's backward difference table is

x	Y	∇y	$\nabla^2 y$	$\nabla^3 y$	$\nabla^4 y$
1891	46				
		20			
1901	66		-5		
		15		2	
1911	81		-3		-3
		12		-1	
1921	93		-4		
		8			
1931	101				

here

$$h = x_1 - x_0$$
$$= 1901 - 1891$$
$$= 10$$

$$r = \frac{x - x_n}{h}$$
$$= \frac{1925 - 1931}{10}$$
$$= -0.6$$

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Newton backword difference interpolation formula

$$y_{(x)} = y_n + r \nabla y_n + \frac{r(r+1)}{\lfloor 2} \cdot \nabla^2 y_n + \frac{r(r+1)(r+2)}{\lfloor 3} \nabla^3 y_n$$

$$+ \frac{r(r+1)(r+2)(r+3)}{\lfloor 4} \cdot \nabla^4 y_n$$

$$\therefore y(1925) = 101 + (-0.6) \times 8 + \frac{-0.6(-0.6+1)}{2} \times -4$$

$$+ \frac{-0.6(-0.6+1)(-0.6+2)}{6} \times -1$$

$$+ \frac{-0.6(-0.6+1)(-0.6+2)(-0.6+3)}{24} \times -3$$

$$\therefore y(1925) = 101 - 4.8 + 0.48 + 0.056 + 0.1008$$

$$\therefore y(1925) = 96.837$$

Ans.

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Answer to the question no-2

a. Given tant

$a = x = 7.47$

$b = x = 7.52$

let $h = 0.01$

Trapezoidal rule

$$\int_a^b f(x)\,dx = \frac{h}{2}\left[(y_0 + y_n) + 2(y_1 + y_2 + \cdots + y_{n-1})\right]$$

$$\Rightarrow \int_{7.47}^{7.52} f(x)\,dx = \frac{0.01}{2}\left[(1.93 + 2.06) + 2(1.95 + 1.98 + 2.01 + 2.03)\right]$$

$$= 0.005\,(19.93)$$

$$= 0.09965 \quad \text{Ans.}$$

$n = 5$, Simpson's 3/8 rules are not applicable.

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b. Limitation of Taylor Series method.

1. Successive terms get very complex.

2. Truncation error tends to grow rapidly away from expansion point.

3. Always not as efficient as curve fitting or direct approximation.

c. Roundoff error happen during Arithmetic operation of floating-Point Numbers.

When working with floating-Point arithmetic it is helpful to consider the quantity known as the machine accuracy or the floating Point accuracy of your partical computer.

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This is the Smallest number that when added to 1.0 Produces a floating Point result that is different from 1.0.

Round off error are cumulative. Depending on the algorithm you are using a Calculation involving n arithmeic Operation might have a total round off error between SQRT time the + machine accuracy and n time the machine accuracy.

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