Victoria University
of Bangladesh
Department of CSE
Program: B.Sc in CSIT
Sem:- Fall 2022
Course title:- Numerical
Methods
Course code:- MAT 415

Name:- Nusrat Jahan Tanshu
ID:- 252020001111
Batch:- 20

Mid Assesment

(1)

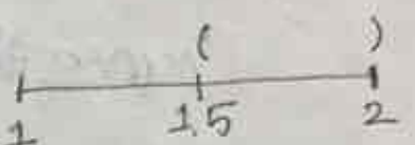
Ans to the 8 no-(3)

1) Finding the root of the equation $x^4 - x - 10 = 0$, using bisection method :-

$f(x) = x^4 - x - 10$

$f(0) = -10$

$f(1) = 1 - 1 - 10 = -10$



$f(2) = 16 - 2 - 10 = 4$

$f(1) < 0, f(2) = 4 > 0.$

$\exists$ a root in between $[1, 2]$

$x_1 = \frac{1+2}{2} = \frac{3}{2} = 1.5$ [according to bisectional method]

$f(x_1) = f(1.5) = (1.5)^4 - 1.5 - 10$

$= -6.4375 < 0$

$x_2 = 1.5 + 2/2 = 3.5/2 = 1.75$

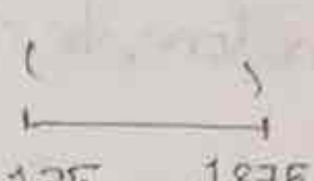
$f(1.75) = (1.75)^4 - 1.75 - 10$

$= -2.37109 = -2.37$

$x_3 = 1.75 + 2/2 = 3.75/2 = 1.875$

$f(1.875) = (1.875)^4 - 1.875 - 10$

$= .484 > 0$



$x_4 = (1.75 + 1.875)/2 = 3.625/2 = 1.80$

$f(1.80) = (1.8)^4 - 1.8 - 10 = -1.3024 < 0$

$x_5 = (1.8 + 1.875)/2 = 3.675/2 = 1.8375$

$f(1.8375) = (1.84)^4 - 1.84 - 10$

$= -0.3777 < 0$

$x_6 = (1.84 + 1.875)/2 = 3.715/2$

$= 1.86$

$f(1.86) = (1.86)^4 - 1.86 - 10$

$= .1088 > 0$

$x_7 = (1.84 + 1.86)/2 = 3.70/2$

$= 1.85$

$f(1.85) = (1.85)^4 - 1.85 - 10$

$= -0.136 < 0$

$x_8 = (1.85 + 1.86)/2 = 371/2 = 1.855$

≈ 1.86

Therefore, the root is 1.86.

(4)

Ans to the Q no (1)

(1) Let

$$x = \frac{8}{9}$$

$$x' = 0.8889$$

How,

(a) Absolute Error $= E_A = |x - x'|$

$$= \left|\frac{8}{9} - 0.8889\right|$$

$$= \left|\frac{8 - 0.8889}{9}\right|$$

$$= 0.000011$$

(b) Relative Error $= E_R = \frac{E_A}{|x|}$

$$= \frac{\left|\frac{8}{9} - 0.8889\right|}{\frac{8}{9}}$$

$$= |1 - 1.0000125|$$

$$= 0.0000125$$

(c) Percentage Error = $E_R \times 100$

$= 0.0000125 \times 100$

$= 0.00125$

(Ans)

Ans to the Q:no-(4)

(i) Let

$f(x) = x^3 - 4x - 9$

As, $f(2) = (2)^3 - 4\times2 - 9 = -9$

$f(3) = (3)^3 - 4\times3 - 9 = 6$

Here,

$a = 2, b = 3$

$\therefore f(a) \cdot f(b) = -9 \times 6 = -54 < 0$

At least one root of the equation lies between

[2, 3]

a	b	f(a)	f(b)	$c = \frac{a \cdot f(b) - b \cdot f(a)}{f(b) - f(a)}$	f(c)
2	3	-9	6	2.6	-1.824
2.6	3	-1.824	6	2.693	-0.242
2.693	3	-0.242	6	2.704	-0.045
2.704	3	-0.045	6	2.706	-0.948

From here it is evident that up to two decimal places the required root of the given equation is 2.70.

Ans to the 8 no (b)

(i) Let,

$$f(x) = x^3 - 4x - 9 = 0$$

$$\Rightarrow x^3 - 4x - 9 = 0$$

$$\Rightarrow x^3 = 9 + 4x$$

$$\Rightarrow x = \sqrt[3]{4x+9}$$

$$\Rightarrow x = g(x)$$

where, $g(x) = \sqrt[3]{4x+9}$

Let, $x_0 = 1$

$x_1 = g(x_0) = g(1) = (4*1+9)^{1/3} = 2.3513$

$x_2 = g(x_1) = g(2.3513) = (4 \times 2.3513 + 9)^{1/3} = 2.6403$

$x_3 = g(x_2) = g(2.6403) = (4 \times 2.6403 + 9)^{1/3} = 2.6944$

$x_4 = g(x_3) = g(2.6944) = (4 \times 2.6944 + 9)^{1/3} = 2.7043$

$x_5 = g(x_4) = g(2.7043) = (4 \times 2.7043 + 9)^{1/3} = 2.7061$

$x_6 = g(x_5) = g(2.7061) = (4 \times 2.7061 + 9)^{1/3} = 2.7064$

Due to repetation of x_5 and x_6, we stop our work. Thus the required root is 2.706 correct to three decimal places.

Again,

Let $x_0 = 2$

$x_1 = g(x_0) = g(2) = (4 \times 2 + 9)^{1/3} = 2.571$

$x_2 = g(x_1) = g(2.571) = (4 \times 2.571 + 9)^{1/3} = 2.682$

$x_3 = g(x_2) = g(2.682) = (4 \times 2.682 + 9)^{1/3} = 2.702$

$x_4 = g(x_3) = g(2.702) = (4 \times 2.702 + 9)^{1/3} = 2.706$

$x_5 = g(x_4) = g(2.706) = (4 \times 2.706 + 9)^{1/3} = 2.706$

Due to repetation of x_4 and x_5, we stop our work. Thus the required root is 2.706 correct to three decimal places.

Ans to the Q no - (6)

i) Converting the binary to decimal :-

$(0111.0111)_2 = 0\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0 + 0\times2^{-1} + 1\times2^{-2} + 1\times2^{-3} + 1\times2^{-4}$

$= 0+4+2+1+0+1/4+1/8+1/16$

$= 4+2+1+0.25+0.125+0.0625$

$= (7.4375)_{10}$

ii) Converting the hexadecimal number to decimal number :-

$(F2C.A)_{16} = F\times16^2 + 2\times16^1 + C\times16^0 + A\times16^{-1}$

$= 15\times256 + 2\times16 + 12\times1 + 10 + 1/16$

$= 3840 + 32 + 12 + 0.625$

$= (3884.625)_{10}$

(Ans)

(10)