NUMERICAL ANALYSIS

ASSIGNMENT#02

SUBMITTED TO:

SIR NOMAN

SUBMITTED BY:

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SHYMA ABDULHAMEED SHAH

Question#01:

(i) Compute the two solutions:

$x = g(x)$

$x = 1 + x - x^2/4$

Rearranging the above equation to find the fixed point

[2019-CS-226]

$x^2 = 4$

$x = \pm 2$

Hence the fixed points are $+2, -2$.

(ii) Write the property that fixed-point iteration process will converge to a unique fixed point.

To converge the iteration method we consider an interval $[a, b]$ in which the root lies. The iteration method converge if $|g'(x)| <$ whenever $x \in [a,b]$.

(iii) What will happen when $g'(x) = 1$

If $g'(x) = 1$ then the given iteration method cannot converge in general. Because the error term may vanish or may not vanish increasing the number of iterations.

(iv) From the table discuss converging/diverging behaviour of iterations for both cases.

For Case 1:

$g'(x) = 1 - x/2$

when $-3 \leq x \leq -1$ $3/2 < |g'(x)| < 5/2$ and so $|g'(x)| > 1$ and so the method is not convergent.

2019-CS-326

For Case 2:

when $1 < x < 2$ $|g'(x)|$ varies between $[0, 1/2]$ and so $|g'(x)| < 1$ and hence the iteration converges to 2.

Question #02:

(i) Compute Specific heat Capacity Cp at T=1300.

T(°F)	800	1000	1200	1400	1600
H(Btu/Lb)	1305	1460	1585	1705	1825

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=> Solving the given data by Newton's Forward Diffrence formula:

T	H	ΔH	$\Delta^2 H$	$\Delta^3 H$	$\Delta^4 H$
800 T_0	H_0 1305				
		ΔH_0: 1460-1305 = 155			
1000 T_1	H_1 1460		$\Delta^2 H_0$: 125-155 = -30		
		ΔH_1: 1585-1460 = 125		$\Delta^3 H_0$: -5-(-30) = 25	
1200 T_2	H_2 1585		$\Delta^2 H_1$: 120-125 = -5		$\Delta^4 H_0$: 5-(25) = 20
		ΔH_2: 1705-1585 = 120		$\Delta^3 H_1$: 0-(-5) = 5	
1400 T_3	H_3 1705		$\Delta^2 H_2$: 120-120 = 0		
		ΔH_3: 1825-1705 = 120			
1600 T_4	H_4 1825				

Formula By Newton's Forward Difference:

$$F(T) = H_0 + \frac{1}{h}(T-T_0)\Delta H_0 + \frac{1}{2!h^2}(T-T_0)(T-T_1)\Delta^2 H_0 +$$

$$+ \frac{1}{3!h^3}(T-T_0)(T-T_1)(T-T_2)\Delta^3 H_0 + \frac{1}{4!h^4}(T-T_0)(T-T_1)(T-T_2)(T-T_3)\Delta^4 H_0$$

where $h = x_1 - x_0 = x_2 - x_1 = \cdots = x_n - x_{n-1}$

$h = 1000 - 800$

$$\boxed{h = 200}$$

Putting Values in the formula:

$$F(\overset{1300}{T}) = 1305 + \frac{1}{200}(1300-800)(155) + \frac{1}{80000}(1300-800)(1300-1000)(-30)$$

$$+ \frac{1}{48000000}(1300-800)(1300-1000)(1300-1200)(25)$$

Page#03

$$+ \frac{1}{3.84\times10^{10}}(1300-800)(1300-100)(1300-1200)(1300-1400)(-20)$$

$$\Rightarrow 1305 + \frac{1}{2\cancel{00}}(775\cancel{00}) + \frac{1}{8\cancel{0000}}(-45\cancel{00000}) + \frac{1}{48\cancel{000000}}(375\cancel{000000})$$

$$+ \frac{1}{3.84 \times \cancel{10^{10}}}(3 \times \cancel{10^{10}})$$

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$$\Rightarrow 387.5 - 56.25 + 7.8125 + 0.78125$$

$$\boxed{F(T) = 1644.84375}$$

Thus the Specific heat Capacity Cp at $T=1300$ is 1644.84375