9/10 Rahman

CSE 330 Numerical Methods

SUMMER 2022

Quiz 2

ANSWER ALL THE QUESTIONS

Time: 20mins

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CO3

1. Consider the following function, $f(x) = x^2 - 9x + 8$ in the interval [-5,5].

   a. Check that it is a valid range [2]
   b. Show 2 iterations using Newton Raphson method and find the error in each step.Use x0 = -5. [3]

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2. Consider the function $f(x) = e^{2x} + 3x^2$ and step size = 0.01

   a. Find the first derivate using Central difference at x=3 [1.5]
   b. Find the first derivate using Forward difference at x=3 [1.5]
   c. Find the actual value of derivative [1]
   d. Hence find the truncation error for Central difference method only. [1]

$f(x) = x^2 - 9x + 8$ $\qquad [-5, 5]$

validity $= f(-5) \times f(5)$

$= 78 \times -12$

$= -936$; < 0

$\therefore$ The eqn is valid

(b) $x_0 = -5$

$f(x) = x^2 - 9x + 8$

$\Rightarrow f'(x) = 2x - 9$

$$\cancel{x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}}$$

$$\cancel{\Rightarrow x_{-5+1} = x_{-5} - \frac{f(x_{-5})}{f'(x_{-5})}}$$

$$x_{0+1} = x_0 - \frac{f(x_0)}{f'(x_0)}$$

$$= -5 - \frac{f(-5)}{f'(-5)}$$

1

$$= -0.8947$$

Error $= |-5 + 0.8947|$

$= 4.1053$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

$$= -0.8947 - \frac{f(-0.8947)}{f'(-0.8947)}$$

$$= -3.4380$$

Error $= |-0.8947 + 3.4380|$

$= 2.5433$

1) (a) $f(x) = e^{2x} + 3x^2$ $h = 0.01$

(a) $f'(x) = \frac{f(x+h) - f(x-h)}{2h}$

$\Rightarrow f'(3) = \frac{f(3+0.01) - f(3-0.01)}{2 \times 0.01}$

$= 824.944$

(b) $f'(x) = \frac{f(x+h) - f(x)}{h}$

$\Rightarrow f'(3) = \frac{f(3+0.01) - f(3)}{0.01}$

$= 833.0102$

(c) $f(x) = e^{2x} + 3x^2$

$\Rightarrow f'(x) = 2e^{2x} + 6x$

$\Rightarrow f'(3) = 2e^{2(3)} + 6(3)$

~~$= 824.3$~~

$= 0.8249 \times 10^3$

(d) Error $= |0.8249 \times 10^3 - 824.944|$

$= 0.0714$

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