Scomp Task 7

2602067874 - Hansel Aditia H.
260206719 - Ignatius Kennard

x	1	1.2	1.4	1.6	1.8
y	0.8415	1.1184	1.3796	1.5993	1.7529

a). First Central Difference

$$f'(x) : \frac{-1 \cdot f(x-h) + 1 \cdot f(x+h)}{2h}$$

$$: \frac{-1 \cdot f(1.4-0.2) + 1 \cdot f(1.4+0.2)}{2(0.2)}$$

$$: \frac{-1 \cdot f(1.2) + 1 \cdot f(1.6)}{0.4}$$

$$: \frac{-1 \cdot (1.1184) + 1 \cdot (1.5993)}{0.4}$$

$$: 1.2023$$

$$f''(x) : \frac{1 \cdot f(x-h) - 2 \cdot f(x) + 1 \cdot f(x+h)}{h^2}$$

$$: \frac{1 \cdot f(1.4-0.2) - 2 \cdot f(1.4) + 1 \cdot f(1.4+0.2)}{(0.2)^2}$$

$$: \frac{f(1.2) - 2f(1.4) + f(1.6)}{0.04}$$

$$: \frac{1.1184 - 2(1.3796) + 1.5993}{0.04}$$

$$: -1.0375$$

b). First Forward Difference

$$f'(x) : \frac{-1 \cdot f(x) + 1 \cdot f(x+h)}{h}$$

$$: \frac{-1 \cdot f(1.4) + 1 \cdot f(1.4+0.2)}{0.2}$$

$$: \frac{-f(1.4) + f(1.6)}{0.2}$$

$$: \frac{-1.3796 + 1.7993 \; 1.5993}{0.2}$$

$$: 1.0985$$

$$f''(x) : \frac{1 \cdot f(x) - 2 \cdot f(x+h) + 1 \cdot f(x+2h)}{h^2}$$

$$: \frac{1 \cdot f(1.4) - 2 \cdot f(1.4+0.2) + 1 \cdot f(1.4 + 2(0.2))}{h^2}$$

$$: \frac{f(1.4) - 2 \cdot f(1.6) + f(1.4 + 0.4)}{h^2}$$

$$: \frac{f(1.4) - 2 \cdot f(1.6) + f(1.8)}{0.4}$$

$$: \frac{1.3796 - 2(1.5993) + 1.7529}{0.4}$$

$$: -1.6525$$

c). $f'(x) : \dfrac{-1 \cdot f(x-h) + 1 \cdot f(x)}{h}$

$\qquad : \dfrac{-1 \cdot f(1.4 - 0.2) + 1 \cdot f(1.4)}{0.2}$

$\qquad : \dfrac{-1 \cdot f(1.2) + 1 \cdot f(1.4)}{0.2}$

$\qquad : \dfrac{-1.1184 + 1.3796}{0.2}$

$\qquad : 1.3060$

$f''(x) : \dfrac{1 \cdot f(x-2h) - 2 \cdot f(x-h) + 1 \cdot f(x)}{h^2}$

$\qquad : \dfrac{1 \cdot f(1.4 - 2(0.2)) - 2 \cdot f(1.4 - 0.2) + 1 \cdot f(1.4)}{0.2^2}$

$\qquad : \dfrac{f(1.0) - 2f(1.2) + f(1.4)}{0.04}$

$\qquad : \dfrac{0.8415 - 2 \cdot (1.1184) + 1.3796}{0.04}$

$\qquad : -0.3925$

d). Second Backward Difference !

$f'(x) : \dfrac{-3 \cdot f(x) + 4 \cdot f(x+h) - 1 \cdot f(x+2h)}{2h}$

$\qquad : \dfrac{-3 \cdot f(1.4) + 4 \cdot f(1.4 + 0.2) - 1 \cdot f(1.4 + 2(0.2))}{2(0.2)}$

$\qquad : \dfrac{-3 \cdot f(1.4) + 4 \cdot f(1.6) - f(1.8)}{0.4}$

$\qquad : \dfrac{-3 \cdot (1.3796) + 4 \cdot (1.7993) - 1.7529}{0.4}$

$\qquad : 1.2638$

$f''(x) : \dfrac{-1 \cdot f(x-3h) + 4 \cdot f(x-2h) - 5f(x-h)}{}$ ~~(crossed out)~~

$f''(x) : \dfrac{2 \cdot f(x) - 5 \cdot f(x+h) + 4 \cdot f(x+2h) - 1 \cdot f(x+3h)}{h^2}$

$\qquad : \dfrac{2 \cdot f(1.4) - 5 \cdot f(1.4 + 0.2) + 4 \cdot f(1.4 + 2(0.2)) - f(1.4 + 0.6)}{0.2^2}$

$\qquad : \dfrac{2 \cdot f(1.4) - 5 \cdot f(1.6) + 4 \cdot f(1.8) - 1 \cdot f(2)}{0.04}$

$\qquad \therefore$ unable to solve since $f(2)$ is not declared.

e). Second Backward Difference

$f'(x) : \dfrac{1 \cdot f(x-2h) - 4 \cdot f(x-h) + 3 \cdot f(x)}{2h}$

$\qquad : \dfrac{1 \cdot f(1.4 - 2(0.2)) - 4 \cdot f(1.4 - 0.2) + 3 \cdot f(1.4)}{2h}$

$\qquad : \dfrac{f(1) - 4 \cdot f(1.2) + 3 \cdot f(1.4)}{2(0.2)}$

$\qquad : \dfrac{0.8415 - 4(1.1184) + 3(1.3796)}{0.4}$

$\qquad : 1.2668$

$f''(x) : \dfrac{-1 \cdot f(x-3h) + 4 \cdot f(x-2h) - 5f(x-h) + 2 \cdot f(x)}{h^2}$

$\qquad : \dfrac{-1 \cdot f(1.4 - 0.6) + 4 \cdot f(1.4 - 0.4) - 5 \cdot f(1.4 - 0.2) + 2 f(1.4)}{0.2^2}$

$\qquad : \dfrac{-1 \cdot f(0.8) + 4 \cdot f(1) - 5 \cdot f(1.2) + 2 \cdot f(1.4)}{0.04}$

$\qquad \therefore$ unable to solve since $f(0.8)$ is not declared

8). $x : 1.4$

   $h : 0.4$

$f'(x) : \dfrac{-1 \cdot f(x-h) + 1 \cdot f(x+h)}{2h}$

$\quad : \dfrac{-1 \cdot f(1.4 - 0.4) + 1 \cdot f(1.4 + 0.4)}{2(0.4)}$

$\quad : \dfrac{- f(1) + f(1.8)}{0.8}$

$\quad : \dfrac{- 0.8415 + \dfrac{1.7529}{\cancel{1.7429}}}{0.8}$

$\quad : 1.1393$

$f''(x) : \dfrac{1 \cdot f(x-h) - 2 \cdot f(x) + 1 \cdot f(x+h)}{h^2}$

$\quad : \dfrac{1 \cdot f(1.4 - 0.4) - 2 \cdot f(1.4) + 1 \cdot f(1.4 + 0.4)}{(0.4)^2}$

$\quad : \dfrac{f(1) - 2 \cdot f(1.4) + f(1.8)}{0.16}$

$\quad : \dfrac{0.8415 - 2 \cdot (1.3796) + 1.7529}{0.16}$

$\quad : -1.0300$

9). $h = 0.2$

   $h_2 = 0.4$

$f'(x) :$

$6 : \dfrac{(0.2 \div 0.4)^2 \cdot g(0.4) - g(0.2)}{(0.2 \div 0.4)^2 - 1}$

$\quad : \dfrac{(0.5)^2 \cdot g(0.4) - g(0.2)}{(0.5)^2 - 1}$

$\quad : \dfrac{0.25 \cdot (1.1393) 1 - 2023}{0.25 - 1}$

$\quad : 1.2233$

$f''(x) :$

$6 : \dfrac{(0.2 \div 0.4)^2 \cdot g(0.4) - g(0.2)}{(0.2 \div 0.4)^2 - 1}$

$\quad : \dfrac{(0.5)^2 \cdot g(0.4) - g(0.2)}{(0.5)^2 - 1}$

$\quad : \dfrac{0.25 \cdot (-1.0300) - (-1.0375)}{0.25 - 1}$

$\quad : -1.0400$