

n^{th} order Assignment - 7

$$f_n(x) = b_0 + b_1(x-x_0) + \dots + b_n(x-x_0)(x-x_1) \dots (x-x_{n-1})$$

'n+1' data points

$$b_0 = f(x_0)$$

$$b_1 = f[x_1, x_0] \checkmark$$

$$\vdots$$
$$\rightarrow b_n = f[x_n, x_{n-1}, \dots, x_1, x_0]$$

$$f[x_1, x_0] = \frac{f(x_1) - f(x_0)}{x_1 - x_0} \quad \text{1st divided difference}$$

$$b_2 = f[x_i, x_j, x_k] = \frac{f[x_i, x_j] - f[x_j, x_k]}{x_i - x_k}$$

In general for evaluating ' b_n '

$$b_n = f[x_n, x_{n-1}, \dots, x_1, x_0]$$

$$= \frac{f[x_n, x_{n-1}, \dots, x_1] - f[x_{n-1}, x_{n-2}, \dots, x_0]}{x_n - x_0}$$

\rightarrow

		$j=0$	$j=1$	$j=2$	$j=3$
	x_i	$f(x_i)$	1st	2nd	3rd
$i=0$	x_0	$f(x_0)$	$f[x_1, x_0]$	$f[x_2, x_1, x_0]$	$f[x_3, x_2, x_1, x_0]$
$i=1$	x_1	$f(x_1)$	$f[x_2, x_1]$	$f[x_3, x_2, x_1]$	
$i=2$	x_2	$f(x_2)$	$f[x_3, x_2]$		
$i=3$	x_3	$f(x_3)$			

- ① Read the x, n
- ② for $i=0$ to 3 in steps of 1 do
read x_i 's and $f(x_i)$'s end for.
- ③ Take a 2D array variable and store the $f(x_i)$ values in it.
table _{i, j} .
- ④ for $i=0$ to 3 in steps of 1 do
table _{$i, 0$} = $f(x_i)$ end for.

⑤ for $j=1$ to 3 in steps of 1 do
 for $i=0$ to $3-j$ in steps of 1 do

$$\text{table}_{i,j} = \frac{\text{table}_{i+1,j-1} - \text{table}_{i,j-1}}{x_{i+j} - x_i}$$

 end for
end for

rough:

$$\text{table}_{0,1} = \frac{\text{table}_{1,0} - \text{table}_{0,0}}{x_1 - x_0} = \frac{f(x_1) - f(x_0)}{x_1 - x_0} = f[x_1, x_0]$$

$$\begin{aligned} \rightarrow f_n(x) = & \downarrow f(x_0) + (x-x_0) \downarrow f[x_1, x_0] + \dots \\ & + f[x_n, \downarrow x_{n-1}, \dots, x_1, x_0] (x-x_0)(x-x_1) \\ & \dots (x-x_{n-1}) \end{aligned}$$

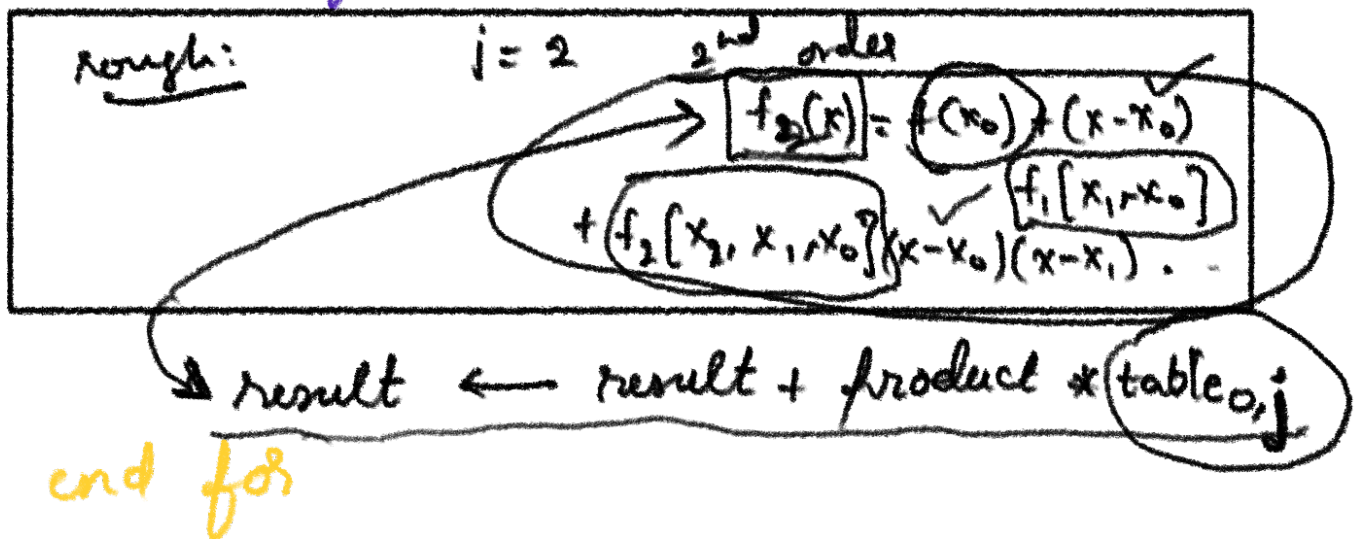
⑥ result $\leftarrow f(x_0)$ i.e. $\text{table}_{0,0}$

⑦ for $j=1$ to 3 in steps of 1 do
 product $\leftarrow 1$

for $i=0$ to $i < j$ in steps of 1 do

$$\text{product} = \text{product} * (x - x_i)$$

end for



⑧ Write 'result' i.e. $f(x)$ ✓

⑨ Stop