Assignment - 7

n^{th} order

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

'n+1' data points

$$b_0 = f(x_0)$$

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

$$\vdots$$

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

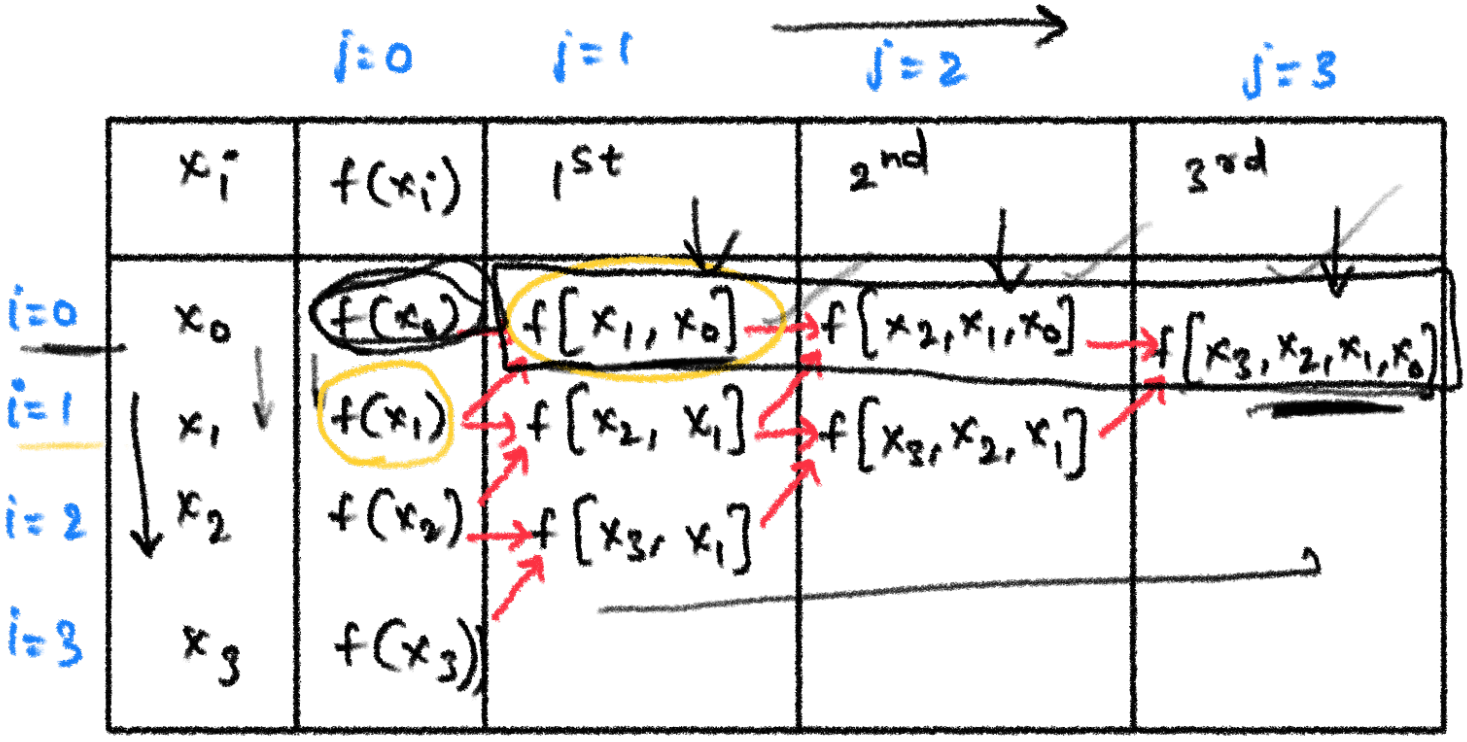
$$f[x_1, x_0] = \frac{f(x_1) - f(x_0)}{x_1 - x_0}$$ 1st divided difference

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

In general for evaluating 'b_n'

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

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



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
  {
    $\text{table}_{i,j} = \dfrac{\text{table}_{i+1,j-1} - \text{table}_{i,j-1}}{x_{i+j} - x_i}$ ✓
  }
  end for
end for

rough:

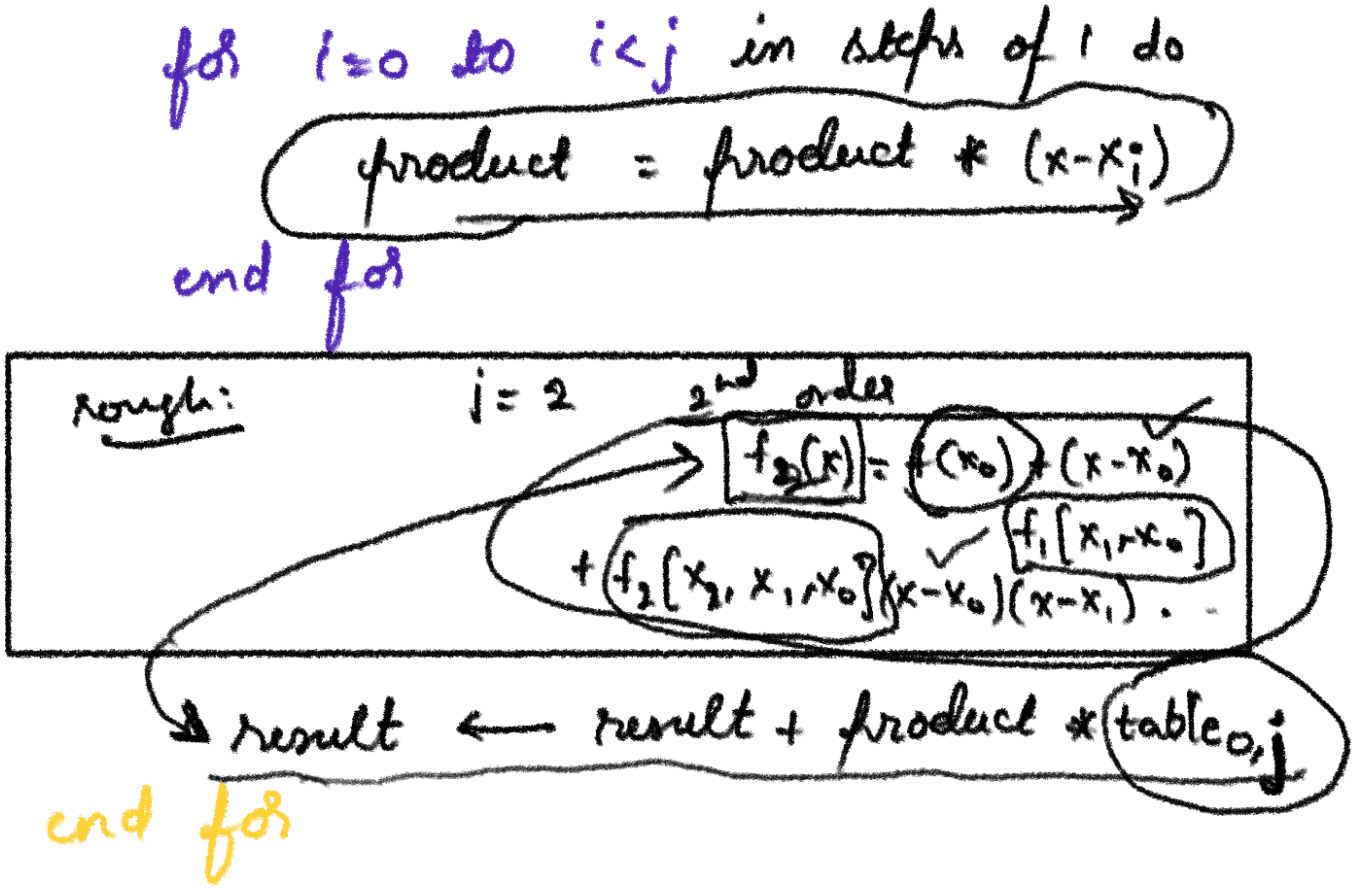
$$\text{table}_{0,1} = \frac{\text{table}_{1,0} - \text{table}_{0,0}}{x_1 - x_0} = f(x_1) - f(x_0) \,/\, x_1 - x_0 = f[x_1, x_0]$$

$$\rightarrow f_n(x) = f(x_0) + (x - x_0) f[x_1, x_0] + \ldots$$

$$+ f[x_n, x_{n-1}, \ldots x_1, x_0] (x - x_0)(x - x_1) \ldots (x - x_{n-1})$$

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

⑦ for $j := 1$ to 3 in steps of 1 do
  product ← 1



(8) Write 'result' i.e. f(x) ✓

(9) Stop