Numerical Analysis Questions & Answers

Question by Student 201529190

Dear professor, you said in computer, it can store $x^1, x^2, \ldots x^n$ *,while we calculate* x^n *. So it just take n-1 times work.Is it same when we calculate* $(x-x_1)(x-x_2)(x-x_3)\ldots(x-x_n)$*? It can also store* $(x-x_1),(x-x_1)(x-x_2),(x-x_1)(x-x_2)(x-x_3)\ldots\ldots$*? It take n-1 times work. When we want to find*

$$P_n(x_{new}) = C_0 + C_1(x_{new}-x_1) + C_2(x_{new}-x_1)(x_{new}-x_2) + \ldots$$
$$+C_n(x_{new}-x_1)(x_{new}-x_2)\ldots(x_{new}-x_n)$$

The work is : Work= n(times of subtraction)+$(n-1)$ *(times of multiplication when calculate* $(x-x_1)(x-x_2)(x-x_3)\ldots(x-x_n)$*)+n(times of terms multiply with* $C_{1,2,3,4\ldots n}$*)+n(times of addition totally). Work=4n-1*$\propto$ *n*

Yes you're on the right track. I may ask you this question in the next assignment. You should explain this better thus perhaps with a C program or a more detailed example. 1 point bonus.

Question by Student 201427129

proffesor I answer your question in lecture about needed works to calculate y if we know Cs let

$$p_n(x_1) = c_0$$

$$p_n(x_2) = c_0 + c_1(x_2 - x_1)$$

$$p_n(x_3) = c_0 + c_1(x_3 - x_1) + c_2(x_3 - x_1)(x_3 - x_2)$$

$$\cdots$$

$$\begin{aligned} p_n(x_n) = c_0 + c_1(x_N - x_1) + c_2(x_N - x_1)(x_N - x_2)\cdots \\ +c_N(x_N - x_1)(x_N - x_2)\cdots(x_N - x_n) \end{aligned}$$

$$p_n = y_{n+1}$$
$$y_1 = c_o$$

$$y_2 = c_0 + c_1(x_2 - x_1) = y_1 + c_1(x_2 - x_1)$$

$$c_1 = \frac{y_2 - y_1}{x_2 - x_1}$$

$$c_2 = \frac{y_3 - y_2}{x_3 - x_2}$$

$$c_3 = \frac{y_4 - y_3}{x_4 - x_3}$$

$$.$$

$$\vdots$$

$$c_N = \frac{y_{N+1} - y_N}{x_{N+1} - x_N}$$

so we have 'N+1' equations which have 2 sub, 1 division

but except c_0

$W = 3N + 3c_0$

so $W \propto N$

Hm, no, this is not what I had in mind.. What you are calculating here is the work needed for one of the terms, not the work needed to obtain *all* terms. 1 point for effort.

Question by Student 201327139

Professor. I'm the one who asked you how to solve Q.4 (b) after class, but I can't understand, so Let me ask you one more time, please.
On Q.4 (b) , secant method in system form, using Jacobian,

$$\begin{pmatrix} \frac{f_1(x_1)-f_1(x_0)}{x_1-x_0} & \frac{f_1(y_1)-f_1(y_0)}{y_1-y_0} \\ \frac{f_2(x_1)-f_2(x_0)}{x_1-x_0} & \frac{f_2(y_1)-f_2(y_0)}{y_1-y_0} \end{pmatrix} \begin{pmatrix} \Delta x_1 \\ \Delta y_1 \end{pmatrix} = \begin{pmatrix} -f_1(x_1, y_1) \\ -f_2(x_1, y_1) \end{pmatrix}.$$

but, I can't calculate $\frac{f_2(x_1)-f_2(x_0)}{x_1-x_0}$.

Because, $f_2(x) = 0.3 - \sqrt{x} + \arccos(\frac{0.5}{\sin^2 x})$, *and* $\arccos(\frac{0.5}{\sin^2(0.6)})$ *is NaN.*

How can I calculate this? or did I miss something? Thank you.

The problem comes from your arccos().. Hint: when using the secant method in A4Q4b, you shouldn't have to find derivatives analytically. Thus, there shouldn't be an arccos to compute because such doesn't appear in the original functions.

Question by Student 201627131

Professor, I try to solve 4(b) by secant method, but I can` t solve because In jacobian,

$$\frac{\delta f_1}{\delta x_1} = \frac{\delta f_1}{\delta x_2}$$

And,

$$\frac{\delta f_2}{\delta x_1} = \frac{\delta f_2}{\delta x_2}$$

But

$-f_1(x_1, x_2)$

and

$-f_2(x_1, x_2)$

are different. So, root is non-exist, I can` t solve this. Is there something wrong?

If you want me to help you, you need to explain better how you compute the jacobian of the secant method. Give me an example of how one term in the Jacobian matrix is computed below.

Question by Student 201627131

I calculate this process. jacobian is

$$\begin{bmatrix} \frac{\delta f_1}{\delta x_1} & \frac{\delta f_1}{\delta x_2} \\ \frac{\delta f_2}{\delta x_1} & \frac{\delta f_2}{\delta x_2} \end{bmatrix} \begin{bmatrix} \Delta x_1 \\ \Delta x_2 \end{bmatrix} = \begin{bmatrix} -f_1(x_1, x_2) \\ -f_2(x_1, x_2) \end{bmatrix}$$

and

$$\frac{\delta f_1}{\delta x_1} = \frac{\delta f_1}{\delta x_2} = \frac{sin^2(0.60001)cos(0.60001) - sin^2(0.6)cos(0.6)}{0.00001}$$

$$\frac{\delta f_2}{\delta x_1} = \frac{\delta f_2}{\delta x_2} = \frac{\sqrt{0.60001} - 0.60001 - \sqrt{0.6} + 0.6}{0.00001}$$

but,

$$-f_1(x_1, x_2) = 0.5 - sin^2(0.6)cos(0.6)$$

$$-f_2(x_1, x_2) = 0.3 - \sqrt{0.6} + 0.6$$

so, I can't do gaussian elimination because

$$\begin{bmatrix} \frac{\delta f_1}{\delta x_1} & \frac{\delta f_1}{\delta x_2} \\ 0 & 0 \end{bmatrix}$$

And, I think that root is non-exist

The problem here is the way you determine your derivatives numerically. Hint: $\delta f_1/\delta x_1 \neq \delta f_1/\delta x_2$. To evaluate those correctly, recall the definition of a partial derivative:

$$\frac{\partial f(x,y)}{\partial x} = \frac{f(x + \Delta x, y) - f(x,y)}{\Delta x} \quad \text{for } \Delta x \to 0$$

Question by Student 201529190

Dear Professor I wonder about A#5 for Q#3-2. I get Total=303+404+12+12+606+404=1741 but answer is=2751 . I am confused.

Indeed, the answer should be 1943 operations (simple algorithm) or 1741 operations (more complex algorithm). Either answer is fine. Good observation: 2 points bonus.