

Numerical Analysis Questions & Answers

Question by Student 201527105

professor, i have a question about Assignment 7-Q#4. To calculate the error, the actual value of integral should be known. According to the trapezoidal rule and the simpson rule, i obtained approximate values. But i don't know the actual value of given integral. How can i get it? / And i also wonder if the error always decreases as N increases. (Intuitively, i think it is true.)

You can find the exact value by using a very large N . So, just double N until the value of the integral doesn't change significantly anymore and use this as the exact value. 2 points bonus.

Question by Student 201427128

professor, I have question in operation counting about gaussian elimination with partial pivoting. for example, In the process of gaussian elim, if

$$m = \begin{bmatrix} 1 & 0 & 5 & 5 \\ 0 & 0 & 6 & 6 \\ 0 & 1 & 7 & 7 \end{bmatrix}$$

I have to do partial pivoting P_{23}

$$P_{23}m = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 5 & 5 \\ 0 & 0 & 6 & 6 \\ 0 & 1 & 7 & 7 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 5 & 5 \\ 0 & 1 & 7 & 7 \\ 0 & 0 & 6 & 6 \end{bmatrix}$$

*In this course, Operation counts of $P_{23} = 3 * (3 * 4) = 36?$, Is what I'm doing right? or Is there another way to calculate?*

No, there is no work done when doing the pivoting operation because there is no addition or multiplication. This was mentioned above for a similar question.

Question by Student 201427128

professor, I have question in A7#3. In this case, N is even($=50$). In simpson method, Interval I_i need 3 data point.

ex) I_1 mean interval between point (i_1, i_2, i_3)

so when I use simpson method in this problem, I_{49} (between i_{49}, i_{50}) is left. how can I solve it? Maybe I think the remaining Interval I_{49} can be solved by trapezoidal rule. Is it the right way?

That's for you to find out. Check if you obtain reasonable convergence rates using your approach when N is small (i.e. as you would expect for the Simpson rule) and if so, it means it's fine.

Question by Jaehyuk

Professor, I have a question about 4th order Runge Kutta method. I made a assumption that $f(\phi, t) = f(t)$. In this case,

$$k_1 = \Delta t \times f(t), k_2 = k_3 = \Delta t \times f\left(t + \frac{\Delta t}{2}\right), k_4 = \Delta t \times f(t + \Delta t)$$

. Substitute them to 4th order Runge Kutta,

$$\phi_{n+1} = \phi_n + \Delta t \times (f(t) + 4 \times f\left(t + \frac{\Delta t}{2}\right) + f(t + \Delta t))/6$$

, which is same as the Simpson's Rule. Am I on the right track to relate 4th order Runge Kutta to Simpson's Rule?

Hm, didn't I mention this in class..? It's a good observation, but not a question.

Question by Student 201427128

professor, I have question about A7#5(=Quiz 7). In Quiz, I got the polynomial coefficients. In Numerical Analysis Scores page, you comment "using Taylor series" but I don't understand what is mean. I need help.

I'll check again your quiz to be sure. The problem in your case is that you used the Simpson rule to get I_i : you shouldn't do this here hence why you got 2/3.

Question by Jaehyuk

Professor, I have a question about A8Q#4. According to the question, $dt (= 0.2)$ and $tmax (= 1.0)$ determine the steps to find q at t is 1.0. In this case, when step reaches 2, this indicates $t = 1.0$ and we can find q at $t = 1.0$. However, in case $dt = 0.4$ and $tmax = 1.0$, when step reaches 2 this indicates q at $t = 0.8$, and when step reaches 3 this indicates q at $t = 1.2$. Do I have to consider this as an error or is there another ways to reduce this error?

Good question. You should implement the algorithm so that dt is changed at the final step in order to yield $t=tmax$ after the iterative process. 2 points bonus.