Numerical Analysis Questions & Answers

Question by Student 201529190

Dear Professor, In Question #5 1,I think it should be added "$|\epsilon 0|Newton = |\epsilon 0|secant$ ". Although does not affect the question, it will be more rigorous, and this is what you mentioned in class.

It is not necessary to distinguish between the initial error of Newton and of secant because both should be set to the same value for a fair comparison. Also, you should typeset your question better in the future and use latex for all math expressions.

Question by Student 201529190

Dear Professor , for the work times of diagonal matrix. To turn the number to zero from bottom. At row(N) no work so work(N)=o. At row(N-1), we need turn x_{N-1,N} to 0. It use 4 works (2moct+2add).so work(N-1)=4

$$\begin{bmatrix} \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & x_{N-1,N-1} & x_{N-1,N} & x_{N-1,N+1} \\ \cdots & \cdots & x_{N,N} & x_{N,N+1} \end{bmatrix}$$

At row(N-2), we need turn x_{N-2,N-1} and x_{N-2,N} to 0. It use 8 works 2(2moct+2add).so work(N-1)=8*

$$\begin{bmatrix} \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ x_{N-2,N-2} & x_{N-2,N-1} & x_{N-2,N} & x_{N-2,N+1} \\ \cdots & x_{N-1,N-1} & 0 & x_{N-1,N+1} \\ \cdots & \cdots & x_{N,N} & x_{N,N+1} \end{bmatrix}$$

then

$$\begin{bmatrix} \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ x_{N-2,N-2} & 0 & 0 & x_{N-2,N+1} \\ \cdots & x_{N-1,N-1} & 0 & x_{N-1,N+1} \\ \cdots & \cdots & x_{N,N} & x_{N,N+1} \end{bmatrix}$$

so total work =\sum_{m=1} ^{N-1} 4\times (N-n) =2(N-1) ^{2}\propto N ^{2}. then C2 = 2.(THE LAST LINE CAN SHOW IN OTHER LaTeX EDITOR. I don,t know WHY it not show here..)*

There's some LaTeX problems in your question formulation: you need to make sure the math is surrounded by $ signs. Please post again below with correct typesetting.

Question by Student 201529190

Dear Professor , for the work times of diagonal matrix. To turn the number to zero from bottom. At row_N *no work so,* $work_{N=0} = o$. *At* row_{N-1}*,we need turn* $A_{N-1,N}$ *to 0. It use 4 works (2moct+2add).so,* $work_{N-1} = 4$

$$\begin{bmatrix} .. & .. & .. & .. & .. \\ .. & .. & .. & .. & .. \\ .. & .. & .. & .. & .. \\ .. & .. & A_{N-1,N-1} & A_{N-1,N} & X_{N-1} \\ .. & .. & .. & A_{N,N} & X_N \end{bmatrix}$$

At row_{N-2}*, we need turn* $A_{N-2,N-1}$ *and* $A_{N-2,N}$ *to 0. It use 8 works 2*(2moct+2add).so* $work_{N-2} = 8$

$$\begin{bmatrix} .. & .. & .. & .. & .. \\ .. & .. & .. & .. & .. \\ .. & A_{N-2,N-2} & A_{N-2,N-1} & A_{N-2,N} & X_{N-2} \\ .. & .. & A_{N-1,N-1} & 0 & X_{N-1} \\ .. & .. & .. & A_{N,N} & X_N \end{bmatrix}$$

then

$$\begin{bmatrix} .. & .. & .. & .. & .. \\ .. & .. & .. & .. & .. \\ .. & A_{N-2,N-2} & 0 & 0 & X_{N-2} \\ .. & .. & A_{N-1,N-1} & 0 & X_{N-1} \\ .. & .. & .. & A_{N,N} & X_N \end{bmatrix}$$

so $work_{N-3} = 12$, $work_{N-n} = 4n$ *total work* $= \sum_{m=1}^{N-1} 4 \times (N-n) = 2 * (N-1)^2 \propto N^2$. *then C2 = 2*

This is a very good explanation. There is only a small problem with it: you should have written B instead of X within the last column. 3 points bonus boost.

Question by Student 201700278

Dear Professor,
For Question 1 in Assignment 3, may I know is Gaussian decomposition means Gaussian elimination? I tried to search it online but the results are mostly showing either Gaussian Elimination or LU decomposition. I am confused which method should we use in that question?

Fixed. Good observation. 1 point bonus boost.

Question by Student 201427116

Professor, I have a question about what we studied at last class. Matrices that used in last class are below :

$$A = \begin{bmatrix} -2 & 2 & -1 \\ 6 & -6 & 7 \\ 3 & -8 & 4 \end{bmatrix} \; P_{12} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \; m_1 = \begin{bmatrix} 1 & 0 & 0 \\ \frac{1}{3} & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

$$P_{23} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

With only Gauss Elimination, we can't handle the "zero" pivot. We must use permutation matrix, as a result, the Upper triangular matrix transfomed from A is below:

$$P_{23} m_1 P_{12} A = U = \begin{pmatrix} 6 & -6 & 7 \\ 0 & -5 & \frac{1}{2} \\ 0 & 0 & \frac{4}{3} \end{pmatrix}$$

And the next step is to get the Lower triangular matirx, L. At first, I thought that L had to be $(P_{23} m_1 P_{12})^{-1}$. Because A can be expressed as $A = (P_{23} m_1 P_{12})^{-1}$ and we used these same method in $A = LU$ decomposition to get Lower triangular matrix. But you added more processes and concluded that $L = (P_{23} m_1 P_{23})^{-1}$.

I wonder why L must be $(P_{23} m_1 P_{23})^{-1}$, not $(P_{23} m_1 P_{12})^{-1}$.

Well, try it. Calculate $(P_{23} M_1 P_{12})^{-1}$ and see if that is lower triangular.. If not, you answered your question.

Question by Student 201427152

Dear Professor, in last class, When you explained "why put the minus (-) next to RHS", You wrote the 3rd row is

$L[0][0] * V[0] + L[0][1] * V[1] + L[0][2] * V[2] = B[2]$

So, you wrote

$L[0][2] * V[2] = B[2] - L[0][0] * V[0] + L[0][1] * V[1]$

But, I think it is not 3rd row. because it is $B[0]$ and 3rd row is

$L[2][0] * V[0] + L[2][1] * V[1] + L[2][2] * V[2] = B[2]$

Isn't there any wrong in your notation?

Is that when I wrote the code using the online C IDE? I may have made a mistake when explaining the logic on the blackboard. Of course, the third row should read

$$L[2][0] * V[0] + L[2][1] * V[1] + L[2][2] * V[2] = B[2]$$

Good observation. 1 point bonus.