Numerical Analysis Questions & Answers

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:

$$P_{23}m_1P_{12}A = U = \begin{pmatrix} 6 & -6 & 7 \\ 0 & -5 & \frac{1}{2} \\ 0 & 0 & \frac{4}{3} \end{pmatrix}$$

And the next step is to get the Lower triangular matirx, L. At first, I thought that L had to be $(P_{23}m_1P_{12})^{-1}$. *Because A can be expressed as* $A = (P_{23}m_1P_{12})^{-1}$ *and we used these same method in* $A = LU$ *decomposition to get Lower triangular matrix. But you added more processes and concluded that* $L = (P_{23}m_1P_{23})^{-1}$.

I wonder why L must be $(P_{23}m_1P_{23})^{-1}$, *not* $(P_{23}m_1P_{12})^{-1}$.

Well, try it. Calculate $(P_{23}M_1P_{12})^{-1}$ 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.

Question by Student 201627131

Professor, I wonder about partical pivoting. In partical pivoting, I learned to interchange rows to put largest possible magnitude number within column on pivot. But, I think if interchanging row to put smallest absolute number on pivot, calculation process is more easy because some numbers can be eliminated by pivot multiply integer. Is there a reason to use largest number on pivot?

I can't understand what you mean. Why would putting the smallest number on the pivot result in less computing effort?

Question by Student 201327139

Professor, In Q.2, I found A_n *, using Jacobian,*

$$A_n = \begin{pmatrix} 4x_n^3 & 1 \\ y_n & x_n + 1.5y_n^{(0.5)} \end{pmatrix},$$

and A[0][1]=1. I was writing C code for this matrix and trying to make A[1][0]=0 (define double A[2][2],x,y and x_n *=1.0,* y_n *=1.0),*

$$A_0 = \begin{pmatrix} 4 & 1 \\ 0 & 2.25 \end{pmatrix}.$$

But, when I defined double A[1][1],

A_n *matrix became* $A_n = \begin{pmatrix} 4 & 0 \\ 0 & 2.5 \end{pmatrix}$.

Why A[0][1]=0 and A[1][1]=0 when I define double A[1][1]?

I don't understand... Why are you defining "double A[1][1]"? You should rather define A only once as "double A[N][N]".