MA423 Lab-02

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Question 1

(a)

A - L*U =

$$\begin{bmatrix} 0 & 0 \\ 1.1102 * 10^{-16} & 1 \end{bmatrix}$$

(b)

Solving Ax = b using genp and A/b :
2 norm difference between the solutions is 1.
We conclude that genp does not work well in cases where there are values of low magnitude on the diagonal of the matrix.
It goes wrong at the step where division by 10^{-20} is executed.

Question 2

(b)

Computing norms of (A(p,:) - LU) for various choices of A:

For random matrix of size 2 , $\|(A(p,:) - LU)\|$ is : 0
For random matrix of size 3 , $\|(A(p,:) - LU)\|$ is : 2.5152*10^{-16}
For random matrix of size 4 , $\|(A(p,:) - LU)\|$ is : 2.2380*10^{-16}
For random matrix of size 5 , $\|(A(p,:) - LU)\|$ is : 4.996*10^{-16}
For random matrix of size 6 , $\|(A(p,:) - LU)\|$ is : 5.924910^{-16}
For random matrix of size 7 , $\|(A(p,:) - LU)\|$ is : 6.6669*10^{-16}
For random matrix of size 8 , $\|(A(p,:) - LU)\|$ is : 4.9571*10^{-16}
For random matrix of size 9 , $\|(A(p,:) - LU)\|$ is : 6.8645*10^{-16}
For random matrix of size 10, $\|(A(p,:) - LU)\|$ is : 7.8289*10^{-16}

(c)

Computing differences between [L,U] outputs of gepp and lu command for various choices of A:

For random matrix of size 2 :
Norm between L obtained using gepp and lu command is : 0
Norm between U obtained using gepp and lu command is : 2.7755*10^{-17}

For random matrix of size 3 :
Norm between L obtained using gepp and lu command is : 0

Norm between U obtained using gepp and lu command is : $1.1102*10^{-16}$

For random matrix of size 4 :
Norm between L obtained using gepp and lu command is : $2.7755*10^{-17}$
Norm between U obtained using gepp and lu command is : 0

For random matrix of size 5 :
Norm between L obtained using gepp and lu command is : $1.2053*10^{-16}$
Norm between U obtained using gepp and lu command is : $2.4825*10^{-16}$

For random matrix of size 6 :
Norm between L obtained using gepp and lu command is : $1.1102*10^{-16}$
Norm between U obtained using gepp and lu command is : $4.9650*10^{-16}$

For random matrix of size 7 :
Norm between L obtained using gepp and lu command is : $2.3649*10^{-16}$
Norm between U obtained using gepp and lu command is : $7.2846*10^{-16}$
For random matrix of size 8 :
Norm between L obtained using gepp and lu command is : $9.1355*10^{-16}$
Norm between U obtained using gepp and lu command is : $1.1947*10^{-15}$

For random matrix of size 9 :
Norm between L obtained using gepp and lu command is : $4.3551*10^{-16}$
Norm between U obtained using gepp and lu command is : $1.1865*10^{-15}$

For random matrix of size 10 :
Norm between L obtained using gepp and lu command is : $7.3123*10^{-16}$
Norm between U obtained using gepp and lu command is : $4.1116*10^{-15}$

Question 3

Computing norms of difference between actual solution and gepp solution to Ax = b for various choices of A,b:

For random matrix of size 2 , norm is : 0
For random matrix of size 3 , norm is : $4.1561*10^{-12}$
For random matrix of size 4 , norm is : $3.4399*10^{-15}$
For random matrix of size 5 , norm is : $1.5594*10^{-14}$
For random matrix of size 6 , norm is : $1.3689*10^{-14}$
For random matrix of size 7 , norm is : $5.2369*10^{-16}$
For random matrix of size 8 , norm is : $4.7332*10^{-16}$
For random matrix of size 9 , norm is : $1.5895*10^{-15}$
For random matrix of size 10, norm is : $1.6274*10^{-15}$

Question 4

Computing determinants using mydet and det for various choices of A:

For random matrix of size 2 :
Determinant using mydet is : 1.588404
Determinant using det is : 1.588404
Error between answers of mydet and det are : 0

For random matrix of size 3 :
Determinant using mydet is : -2.098142
Determinant using det is : -2.098142
Error between answers of mydet and det are : $4.440892*10^{-16}$

For random matrix of size 4 :
Determinant using mydet is : -6.335083
Determinant using det is : -6.335083
Error between answers of mydet and det are : $8.881784*10^{-16}$

For random matrix of size 5 :
Determinant using mydet is : -0.4237916
Determinant using det is : -0.4237916
Error between answers of mydet and det are : $5.551115*10^{-17}$

For random matrix of size 6 :
Determinant using mydet is : 1.409829
Determinant using det is : 1.409829
Error between answers of mydet and det are : $8.881784*10^{-16}$

For random matrix of size 7 :
Determinant using mydet is : 18.518191
Determinant using det is : 18.518191
Error between answers of mydet and det are : $1.776356*10^{-14}$

For random matrix of size 8 :
Determinant using mydet is : -11.677234
Determinant using det is : -11.677234
Error between answers of mydet and det are : $5.329071*10^{-15}$

For random matrix of size 9 :
Determinant using mydet is : -239.273003
Determinant using det is : -239.273003
Error between answers of mydet and det are : $8.526513*10^{-14}$

For random matrix of size 10 :
Determinant using mydet is : -219.235809
Determinant using det is : -219.235809
Error between answers of mydet and det are : $8.526512*10^{-14}$

Question 5

Computing the norm between cholesky factors using mychol and chol for various choices of positive definite matrices:

For random positive definite matrix of size 2 :
Norm of error between decomposition matrices of mychol and chol are : 0

For random positive definite matrix of size 3 :
Norm of error between decomposition matrices of mychol and chol are : $4.7184*10^{-16}$

For random positive definite matrix of size 4 :
Norm of error between decomposition matrices of mychol and chol are : $5.7220*10^{-17}$

For random positive definite matrix of size 5 :
Norm of error between decomposition matrices of mychol and chol are : $3.3808*10^{-16}$

For random positive definite matrix of size 6 :
Norm of error between decomposition matrices of mychol and chol are : $2.5469*10^{-16}$

For random positive definite matrix of size 7 :
Norm of error between decomposition matrices of mychol and chol are : $2.7350*10^{-14}$

For random positive definite matrix of size 8 :
Norm of error between decomposition matrices of mychol and chol are : $6.4600*10^{-16}$

For random positive definite matrix of size 9 :
Norm of error between decomposition matrices of mychol and chol are : $2.8365*10^{-13}$

For random positive definite matrix of size 10 :
Norm of error between decomposition matrices of mychol and chol are : $3.1944*10^{-14}$