Matrix Computations MA423 Lab 02

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Ques.**1**

```
Question 1 (a)


L =

   1.0e+20 *

    0.0000         0
    1.0000    0.0000


U =

   1.0e+20 *

    0.0000    0.0000
         0   -1.0000


A - L*U =
         0         0
    0.0000    1.0000

Question 1 (b)

GENP Solution
     0
     1

Actual solution for Ax = b
    -1
     1

2-norm difference between GENP and Actual =  1.000000
```

- GENP is **unstable** if some value in the matrix is close to zero. Things start to go wrong while computing the LU decomposition. Hence I can conclude that **A is not equal to LU.**

Ques.**2**

```
Question 2
Give input size of random matrix:
5
Matrix A
     6.076005758460840e-01    -1.483121022515899e+00    -2.899630408000279e-01    -6.568159289480825e-01    -5.407864164885258e-01
    -1.177982892679625e-01    -1.020264385682965e+00     1.261550718141148e+00    -1.481399071578780e+00    -3.086418152801131e-01
     6.991603336441667e-01    -4.469950107445275e-01     4.754248117072714e-01     1.554889959038940e-01    -1.096593301525472e+00
     2.696486417165979e-01     1.096585913276026e-01     1.174116751493715e+00     8.185513685210005e-01    -4.930098153164506e-01
     4.942870553794108e-01     1.128736452028283e+00     1.269470680436459e-01    -2.925881308343940e-01    -1.807393564150375e-01



A(p,:)-L*U
                         0                         0                         0                         0                         0
     5.551115123125783e-17                         0                         0    -5.551115123125783e-17                         0
    -1.387778780781446e-17                         0     2.220446049250313e-16                         0                         0
                         0                         0     5.551115123125783e-17    -1.110223024625157e-16     2.220446049250313e-16
                         0     1.387778780781446e-17                         0     3.330669073875470e-16     1.110223024625157e-16

norm(A(p,:)-L*U)=
     3.592397195092880e-16


L-L1
                         0                         0                         0                         0                         0
    -1.110223024625157e-16                         0                         0                         0                         0
                         0    -2.220446049250313e-16                         0                         0                         0
                         0    -2.220446049250313e-16                         0                         0                         0
                         0     5.551115123125783e-17                         0     2.220446049250313e-16                         0

norm(L-L1)=
     3.231785954951167e-16


U-U1
                         0                         0                         0                         0                         0
                         0    -2.220446049250313e-16     8.326672684688674e-17     5.551115123125783e-17    -1.110223024625157e-16
                         0                         0                         0                         0     2.775557561562891e-17
                         0                         0                         0                         0                         0
                         0                         0                         0                         0    -2.220446049250313e-16

norm(U-U1)=
     2.965521764667878e-16


                                p-p1
                                     0     0     0     0     0

                                norm(p-p1)=
                                     0
```

- As we can see norm(p-p1) = 0.

Ques.**3**

```
Matrix A:
    -1.318203529158936e-01    -2.383015045897330e-01     6.011020324682951e-01    -1.749879306387625e+00     1.837034230912490e-01
     5.953576738841018e-01     2.295968932203138e-01     9.230795123896227e-02     9.104825796471120e-01     2.907901348844536e-01
     1.046832784305232e+00     4.399979048226293e-01     1.729841391572364e+00     8.670825529473254e-01     1.129447170210512e-01
    -1.979586326118420e-01    -6.168659288892274e-01    -6.085574447383194e-01    -7.989283905803710e-02     4.399521888724399e-01
     3.276781639072007e-01     2.748367869116662e-01    -7.370597716978055e-01     8.984759893771418e-01     1.016624437003412e-01

Matrix B:
     2.787335227813435e+00
    -1.166665030194641e+00
    -1.854299082689694e+00
    -1.140681144669632e+00
    -1.093343456239604e+00
```

```
Ax = b Solution using geppsolve(A,b)
    -5.908611969356159e+00
     7.222407412226013e+00
     8.881834866584932e-01
    -1.208476327592536e+00
     5.884451311381897e+00

Ax = b Solution using A\b
    -5.908611969356163e+00
     7.222407412226014e+00
     8.881834866584941e-01
    -1.208476327592535e+00
     5.884451311381901e+00

Norm of difference =
     5.197930934883577e-15
```

Ques.**4**

```
>> mydet([1,3;5,6])

ans =

    -9
```

Ques.**5**

- The 5 input test cases are shown below:

```
Input the size of Positive Symmetric Matrix A:
3
Output for chol function

ans =

     1.153424832138172e+00     7.292147520802900e-01     6.883166789861760e-01
                         0     8.052795553128489e-01    -4.193674221496413e-01
                         0                         0     2.940399363533903e-02

Output for mychol function

ans =

     1.153424832138172e+00     7.292147520802900e-01     6.883166789861761e-01
                         0     8.052795553128489e-01    -4.193674221496414e-01
                         0                         0     2.940399363533578e-02

Input the size of Positive Symmetric Matrix A:
3
Output for chol function

ans =

     1.172253062457215e+00     6.589910870581184e-01     7.808681157043911e-01
                         0     3.377039656218109e-01     1.823534105794913e-01
                         0                         0     5.505457520070244e-01

Output for mychol function

ans =

     1.172253062457215e+00     6.589910870581184e-01     7.808681157043911e-01
                         0     3.377039656218110e-01     1.823534105794912e-01
                         0                         0     5.505457520070246e-01
```

Input the size of Positive Symmetric Matrix A:

4

Output for chol function

ans =

1.226415538364223e+00	1.450100397703951e+00	9.272360325671677e-01	7.979075492832146e-01
0	3.720718297222986e-01	-1.921430614743627e-01	-9.129486999962122e-02
0	0	4.479912302904974e-01	-3.112671393754742e-01
0	0	0	2.575737384539804e-01

Output for mychol function

ans =

1.226415538364223e+00	1.450100397703951e+00	9.272360325671676e-01	7.979075492832146e-01
0	3.720718297222987e-01	-1.921430614743621e-01	-9.129486999962108e-02
0	0	4.479912302904979e-01	-3.112671393754734e-01
0	0	0	2.575737384539814e-01

5

Output for chol function

ans =

1.070428876929745e+00	1.035683693978036e+00	5.840923473408289e-01	6.611019393514311e-01	1.513909131988654e+00
0	4.677227526589754e-01	-2.313883004871233e-01	-3.317537158085979e-01	5.356156870948224e-03
0	0	4.501049922202334e-01	6.272028873906086e-01	2.594672711007453e-01
0	0	0	3.843092990357188e-01	3.904048732486282e-02
0	0	0	0	3.052677162906726e-02

Output for mychol function

ans =

1.070428876929745e+00	1.035683693978036e+00	5.840923473408289e-01	6.611019393514311e-01	1.513909131988654e+00
0	4.677227526589754e-01	-2.313883004871232e-01	-3.317537158085979e-01	5.356156870948456e-03
0	0	4.501049922202334e-01	6.272028873906086e-01	2.594672711007453e-01
0	0	0	3.843092990357190e-01	3.904048732486287e-02
0	0	0	0	3.052677162906705e-02

```
4
Output for chol function

ans =

     1.161366806718001e+00     7.417983418692852e-01     3.879245279348211e-01     7.850708718740801e-01
                         0     9.930628238300678e-01     5.752879837809366e-01     2.370799086710843e-01
                         0                         0     4.523137000782647e-01    -1.875382912662122e-01
                         0                         0                         0     2.373493458286581e-01

Output for mychol function

ans =

     1.161366806718001e+00     7.417983418692853e-01     3.879245279348211e-01     7.850708718740801e-01
                         0     9.930628238300677e-01     5.752879837809367e-01     2.370799086710842e-01
                         0                         0     4.523137000782647e-01    -1.875382912662124e-01
                         0                         0                         0     2.373493458286581e-01
```

Test Case No	Norm Difference
1.00000000000000e+00	3.25812658067825e-15
2.00000000000000e+00	2.79598360629757e-16
3.00000000000000e+00	1.36395914469479e-15
4.00000000000000e+00	3.28310875310719e-16
5.00000000000000e+00	2.03919230244562e-16