Test for Gaussian elimination and solvers

```
%Define a random matrix and check that is non-singular with the
 condition
%number of A
A=zeros(20,20);
tol=100;
i=1;
%The following loop will redefine the matrix A until one of them has a
%condition number below tol.
while cond(A)>tol
A=rand(20); %Redefine A
i=i+1;      %Count how many tries
end
A
i
b=rand(20,1)
%We proceed with the Gaussian Elimination with Partial Pivoting.
[L,U,piv]=GEpiv(A)
%Then we obtain PA=A(piv,:), L and U, where PA=LU
A(piv,:)
L*U
%Observe that they are equal
%We are going to solve the following system: PAx=LUx=Pb, where
 Pb=b(piv).
%We start with the following: Lz=Pb, z=Ux.
z=Ltrisol(L,b(piv))
%Obtained z, we now calculate the solution x
x=Utrisol(U,z)
%Calculate the residue vector
r=b(piv)-A(piv,:)*x
%Calculate two norms of the residue vector
N1=norm(r,1)
N2=norm(r,2)

% About the row interchanges, the information is given by the vector
 piv.
```

```
A =

  Columns 1 through 7

    0.9814    0.9056    0.5927    0.9865    0.1768    0.6421    0.8229
    0.5417    0.8843    0.4492    0.7884    0.8413    0.0279    0.6141
    0.1358    0.3935    0.7878    0.9682    0.4997    0.4560    0.6187
    0.5290    0.5131    0.0530    0.1651    0.6768    0.9730    0.3930
    0.0228    0.2320    0.7071    0.1843    0.1789    0.4326    0.9516
    0.6541    0.0953    0.6603    0.8710    0.2637    0.5066    0.0978
    0.4974    0.0598    0.7553    0.3211    0.6997    0.3540    0.2361
    0.8456    0.9749    0.0997    0.8258    0.4169    0.7034    0.0183
    0.5978    0.6570    0.6203    0.4834    0.6857    0.3433    0.5898
```

```
    0.0812    0.5670    0.5470    0.9941    0.5198    0.7452    0.3096
    0.7135    0.2368    0.3159    0.1590    0.9311    0.9679    0.7895
    0.3585    0.9204    0.1471    0.6279    0.1411    0.2208    0.7363
    0.2767    0.7006    0.7986    0.3642    0.6537    0.0638    0.7674
    0.9097    0.3101    0.4180    0.4518    0.3021    0.1531    0.7612
    0.0663    0.4592    0.6174    0.8602    0.9471    0.1632    0.4434
    0.4087    0.5456    0.8045    0.9426    0.9932    0.6381    0.4301
    0.9471    0.8189    0.8817    0.6914    0.2992    0.7603    0.6049
    0.5313    0.7846    0.8723    0.4783    0.3917    0.7953    0.8727
    0.3295    0.7091    0.5363    0.4762    0.4322    0.6652    0.7783
    0.9239    0.1987    0.9394    0.0163    0.1262    0.2233    0.0534

Columns 8 through 14

    0.0226    0.5468    0.5330    0.8822    0.7296    0.6289    0.6860
    0.3498    0.0309    0.6701    0.6577    0.9630    0.7104    0.3656
    0.5538    0.0421    0.6035    0.3528    0.8209    0.7819    0.7047
    0.5525    0.6292    0.5441    0.1807    0.5439    0.0062    0.5190
    0.7511    0.9211    0.5359    0.8888    0.2686    0.9147    0.5099
    0.8829    0.5770    0.4814    0.3754    0.9512    0.8505    0.7561
    0.8836    0.5983    0.0159    0.4957    0.7239    0.2305    0.1555
    0.2053    0.2941    0.3235    0.8784    0.0506    0.7581    0.0087
    0.2390    0.4506    0.9691    0.8574    0.0521    0.9309    0.1028
    0.8378    0.7621    0.8568    0.2588    0.9822    0.2926    0.8241
    0.1844    0.1707    0.3100    0.1206    0.8424    0.7768    0.7449
    0.8533    0.6461    0.5774    0.1966    0.2384    0.9449    0.7628
    0.5814    0.3524    0.0111    0.1423    0.8119    0.9320    0.0621
    0.5607    0.3426    0.9944    0.6615    0.5759    0.5950    0.5142
    0.7038    0.4044    0.9665    0.4041    0.0045    0.7411    0.5604
    0.8903    0.0954    0.4969    0.7975    0.6367    0.1906    0.1202
    0.2436    0.2206    0.7631    0.1449    0.1722    0.0572    0.5438
    0.0015    0.6639    0.2467    0.2297    0.1146    0.8016    0.1176
    0.6214    0.9673    0.6206    0.1164    0.0499    0.0878    0.1558
    0.0742    0.1094    0.0799    0.7624    0.9962    0.0125    0.7979

Columns 15 through 20

    0.7114    0.4676    0.7022    0.2876    0.8059    0.0548
    0.7046    0.7998    0.8983    0.2867    0.8281    0.6627
    0.0448    0.6660    0.6649    0.6348    0.1104    0.4709
    0.0837    0.7143    0.6589    0.2303    0.6784    0.8793
    0.3276    0.8059    0.3371    0.8290    0.8410    0.9374
    0.0912    0.6201    0.9211    0.2238    0.2403    0.8490
    0.6737    0.7140    0.0317    0.7972    0.0488    0.4931
    0.4887    0.1084    0.7959    0.7723    0.9956    0.0514
    0.0573    0.3222    0.4188    0.7583    0.3279    0.5451
    0.5622    0.7808    0.0115    0.2690    0.8856    0.8571
    0.3239    0.9918    0.0679    0.0952    0.8658    0.7567
    0.3574    0.4093    0.5026    0.8761    0.8903    0.7449
    0.6902    0.2365    0.4171    0.1939    0.6647    0.4311
    0.9830    0.7149    0.4246    0.1056    0.5691    0.0797
    0.5958    0.6709    0.9735    0.7823    0.7248    0.5618
    0.3307    0.1980    0.7169    0.9423    0.2212    0.3106
    0.0132    0.8397    0.6079    0.7192    0.2949    0.8399
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```
    0.6696    0.1257    0.1860    0.5673    0.7246    0.4869
    0.1740    0.4291    0.6106    0.9607    0.7438    0.6246
    0.8157    0.5719    0.1590    0.6812    0.3689    0.6474


i =

    10


b =

    0.8118
    0.1336
    0.7644
    0.7205
    0.8484
    0.1252
    0.6245
    0.2960
    0.6733
    0.8644
    0.4441
    0.5453
    0.0388
    0.0070
    0.6693
    0.1621
    0.7675
    0.2533
    0.3828
    0.0642


L =

  Columns 1 through 7

    1.0000         0         0         0         0         0         0
    0.9415    1.0000         0         0         0         0         0
    0.2819   -0.6809    1.0000         0         0         0         0
    0.1384   -0.4102    0.9676    1.0000         0         0         0
    0.7271    0.6448   -0.4050   -0.1913    1.0000         0         0
    0.5414   -0.4501    0.8114   -0.0329   -0.1851    1.0000         0
    0.8617   -0.2975   -0.3339   -0.4864    0.3805   -0.1059    1.0000
    0.0233   -0.3226    0.9160    0.3663   -0.3163    0.8916   -0.6063
    0.0676   -0.6087    0.9083    0.7427    0.4416   -0.6952    0.3648
    0.5069    0.6105    0.2492    0.5244    0.5205   -0.4283    0.1129
    0.3653   -0.9017    0.3079   -0.4002   -0.1697    0.1480    0.0681
    0.0828   -0.7525    0.8807    0.7149    0.0363    0.4104    0.5373
    0.6665    0.7775   -0.0350    0.9269    0.2773   -0.5016    0.1290
    0.9270    0.8096   -0.4939    0.0120    0.4378   -0.8682   -0.4439
    0.9651    0.0843    0.3113   -0.0175   -0.0473    0.4560    0.1878
    0.4165   -0.2576    0.7360    0.7082    0.5321   -0.3178    0.5296
```

```
    0.6091   -0.1611    0.3598   -0.0737    0.3421   -0.2355    0.2129
    0.3358   -0.6194    0.6435   -0.0776   -0.0295    0.7131    0.0796
    0.5390   -0.0382   -0.2827   -0.5668    0.6584    0.5033    0.5094
    0.5520   -0.5879    0.3884   -0.0867    0.4674   -0.9350    0.3853

  Columns 8 through 14

         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
    1.0000         0         0         0         0         0         0
   -0.4063    1.0000         0         0         0         0         0
    0.3618    0.8254    1.0000         0         0         0         0
    0.9741   -0.5275   -0.4754    1.0000         0         0         0
    0.4758    0.5683    0.2797    0.5462    1.0000         0         0
    0.6347    0.6700    0.9124    0.6792    0.2316    1.0000         0
    0.4428   -0.0191   -0.5163    0.7256   -0.4019    0.0643    1.0000
    0.2337   -0.5202   -0.6535    0.8984   -0.3181   -0.6529    0.7411
    0.0181    0.2240    0.2224   -0.2305   -0.2290   -0.9415    0.3543
   -0.3117    0.4554   -0.5692   -0.0399   -0.0832    0.0534    0.6000
    0.6524    0.1653   -0.0576    0.6715    0.2416   -0.5769    0.4370
    0.6719   -0.0153   -0.1707    0.6279    0.5533   -0.5671    0.3138
   -0.6198    0.2135   -0.5332   -0.1805    0.0935   -0.2629    0.3024

  Columns 15 through 20

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
    1.0000         0         0         0         0         0
    0.4061    1.0000         0         0         0         0
    0.9783    0.6130    1.0000         0         0         0
    0.8489    0.4616   -0.1403    1.0000         0         0
    0.7366    0.5578   -0.3241    0.8678    1.0000         0
    0.2851   -0.1856    0.0862    0.4232    0.0818    1.0000

U =
```

Columns 1 through 7

0.9814	0.9056	0.5927	0.9865	0.1768	0.6421	0.8229
0	-0.6539	0.3813	-0.9124	-0.0403	-0.3813	-0.7213
0	0	0.8911	-0.5352	0.5764	-0.3768	0.0442
0	0	0	0.9753	-0.0990	0.5753	0.1661
0	0	0	0	1.0431	0.7044	0.7060
0	0	0	0	0	0.7312	0.2028
0	0	0	0	0	0	-1.0569
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Columns 8 through 14

0.0226	0.5468	0.5330	0.8822	0.7296	0.6289	0.6860
0.0529	-0.4054	-0.4220	-0.0681	0.3093	-0.5796	0.1521
0.6111	-0.0778	-0.4265	-0.1528	0.8168	0.3601	-0.0277
-0.0188	-0.1245	0.7694	0.3507	0.0565	0.1088	0.6990
0.3778	-0.0208	0.1690	-0.4716	0.4541	0.8600	0.2706
-0.4134	0.2406	0.1710	-0.2304	-0.7180	0.0709	-0.0897
0.2089	-0.3508	-0.0758	0.3725	-0.4345	-0.1028	-0.3189
0.8296	0.4608	0.3512	1.1399	0.1028	0.4899	0.2846
0	0.7755	0.7043	0.5567	-1.1398	-0.1559	0.1628
0	0	-1.0084	-0.8229	0.3408	-0.3354	-1.0253
0	0	0	-1.2789	-0.3046	-0.4513	0.3399
0	0	0	0	1.5763	-0.3998	0.4781
0	0	0	0	0	1.1027	-0.2429
0	0	0	0	0	0	-1.2959
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Columns 15 through 20

0.7114	0.4676	0.7022	0.2876	0.8059	0.0548
0.1459	0.1317	-0.5021	0.4104	-0.3898	0.5958
0.5890	0.1944	-0.1227	0.3922	0.1720	0.8213
-0.5636	0.4672	0.4805	0.3838	-0.3274	-0.0870
-0.1567	0.7351	-0.0766	-0.1463	0.5383	0.6487
-0.1754	-0.0744	-0.3190	0.2637	0.0621	0.1762

```
   -0.1174   -0.2507    0.2296    1.0478   -0.1148    0.1853
    0.0607    0.6351    0.4945    0.8088    0.7041    0.5683
    0.5349    0.1691    0.3043    0.5656    0.6535    0.2387
   -0.0710   -0.6524   -0.7919   -0.5868   -1.0276   -0.7432
    0.0189   -0.2024   -0.6556    0.2703   -0.6792    0.2649
    0.3147    0.3693   -0.4781   -1.4214    0.5769    0.1015
   -0.4006   -0.2983    0.9861   -0.8027    0.5930    0.2974
    0.4526   -0.5330   -0.4297   -0.9122   -0.1495   -0.8968
   -1.0805    0.4533    1.0421   -0.8538    0.3048    0.5538
         0   -0.8612    0.3588   -0.3855    0.2170    0.0697
         0         0   -1.6435    1.6403   -1.4722   -0.3119
         0         0         0    1.1954   -0.3915   -0.3192
         0         0         0         0   -0.8659   -0.1030
         0         0         0         0         0    0.7645

piv =

     1
    20
    13
     3
    11
    18
     8
     5
    15
     7
    12
    10
     6
    14
    17
    16
     9
    19
     4
     2


ans =

  Columns 1 through 7

    0.9814    0.9056    0.5927    0.9865    0.1768    0.6421    0.8229
    0.9239    0.1987    0.9394    0.0163    0.1262    0.2233    0.0534
    0.2767    0.7006    0.7986    0.3642    0.6537    0.0638    0.7674
    0.1358    0.3935    0.7878    0.9682    0.4997    0.4560    0.6187
    0.7135    0.2368    0.3159    0.1590    0.9311    0.9679    0.7895
    0.5313    0.7846    0.8723    0.4783    0.3917    0.7953    0.8727
    0.8456    0.9749    0.0997    0.8258    0.4169    0.7034    0.0183
    0.0228    0.2320    0.7071    0.1843    0.1789    0.4326    0.9516
    0.0663    0.4592    0.6174    0.8602    0.9471    0.1632    0.4434
    0.4974    0.0598    0.7553    0.3211    0.6997    0.3540    0.2361
```

```
    0.3585    0.9204    0.1471    0.6279    0.1411    0.2208    0.7363
    0.0812    0.5670    0.5470    0.9941    0.5198    0.7452    0.3096
    0.6541    0.0953    0.6603    0.8710    0.2637    0.5066    0.0978
    0.9097    0.3101    0.4180    0.4518    0.3021    0.1531    0.7612
    0.9471    0.8189    0.8817    0.6914    0.2992    0.7603    0.6049
    0.4087    0.5456    0.8045    0.9426    0.9932    0.6381    0.4301
    0.5978    0.6570    0.6203    0.4834    0.6857    0.3433    0.5898
    0.3295    0.7091    0.5363    0.4762    0.4322    0.6652    0.7783
    0.5290    0.5131    0.0530    0.1651    0.6768    0.9730    0.3930
    0.5417    0.8843    0.4492    0.7884    0.8413    0.0279    0.6141

Columns 8 through 14

    0.0226    0.5468    0.5330    0.8822    0.7296    0.6289    0.6860
    0.0742    0.1094    0.0799    0.7624    0.9962    0.0125    0.7979
    0.5814    0.3524    0.0111    0.1423    0.8119    0.9320    0.0621
    0.5538    0.0421    0.6035    0.3528    0.8209    0.7819    0.7047
    0.1844    0.1707    0.3100    0.1206    0.8424    0.7768    0.7449
    0.0015    0.6639    0.2467    0.2297    0.1146    0.8016    0.1176
    0.2053    0.2941    0.3235    0.8784    0.0506    0.7581    0.0087
    0.7511    0.9211    0.5359    0.8888    0.2686    0.9147    0.5099
    0.7038    0.4044    0.9665    0.4041    0.0045    0.7411    0.5604
    0.8836    0.5983    0.0159    0.4957    0.7239    0.2305    0.1555
    0.8533    0.6461    0.5774    0.1966    0.2384    0.9449    0.7628
    0.8378    0.7621    0.8568    0.2588    0.9822    0.2926    0.8241
    0.8829    0.5770    0.4814    0.3754    0.9512    0.8505    0.7561
    0.5607    0.3426    0.9944    0.6615    0.5759    0.5950    0.5142
    0.2436    0.2206    0.7631    0.1449    0.1722    0.0572    0.5438
    0.8903    0.0954    0.4969    0.7975    0.6367    0.1906    0.1202
    0.2390    0.4506    0.9691    0.8574    0.0521    0.9309    0.1028
    0.6214    0.9673    0.6206    0.1164    0.0499    0.0878    0.1558
    0.5525    0.6292    0.5441    0.1807    0.5439    0.0062    0.5190
    0.3498    0.0309    0.6701    0.6577    0.9630    0.7104    0.3656

Columns 15 through 20

    0.7114    0.4676    0.7022    0.2876    0.8059    0.0548
    0.8157    0.5719    0.1590    0.6812    0.3689    0.6474
    0.6902    0.2365    0.4171    0.1939    0.6647    0.4311
    0.0448    0.6660    0.6649    0.6348    0.1104    0.4709
    0.3239    0.9918    0.0679    0.0952    0.8658    0.7567
    0.6696    0.1257    0.1860    0.5673    0.7246    0.4869
    0.4887    0.1084    0.7959    0.7723    0.9956    0.0514
    0.3276    0.8059    0.3371    0.8290    0.8410    0.9374
    0.5958    0.6709    0.9735    0.7823    0.7248    0.5618
    0.6737    0.7140    0.0317    0.7972    0.0488    0.4931
    0.3574    0.4093    0.5026    0.8761    0.8903    0.7449
    0.5622    0.7808    0.0115    0.2690    0.8856    0.8571
    0.0912    0.6201    0.9211    0.2238    0.2403    0.8490
    0.9830    0.7149    0.4246    0.1056    0.5691    0.0797
    0.0132    0.8397    0.6079    0.7192    0.2949    0.8399
    0.3307    0.1980    0.7169    0.9423    0.2212    0.3106
    0.0573    0.3222    0.4188    0.7583    0.3279    0.5451
    0.1740    0.4291    0.6106    0.9607    0.7438    0.6246
```

```
    0.0837    0.7143    0.6589    0.2303    0.6784    0.8793
    0.7046    0.7998    0.8983    0.2867    0.8281    0.6627


ans =

  Columns 1 through 7

    0.9814    0.9056    0.5927    0.9865    0.1768    0.6421    0.8229
    0.9239    0.1987    0.9394    0.0163    0.1262    0.2233    0.0534
    0.2767    0.7006    0.7986    0.3642    0.6537    0.0638    0.7674
    0.1358    0.3935    0.7878    0.9682    0.4997    0.4560    0.6187
    0.7135    0.2368    0.3159    0.1590    0.9311    0.9679    0.7895
    0.5313    0.7846    0.8723    0.4783    0.3917    0.7953    0.8727
    0.8456    0.9749    0.0997    0.8258    0.4169    0.7034    0.0183
    0.0228    0.2320    0.7071    0.1843    0.1789    0.4326    0.9516
    0.0663    0.4592    0.6174    0.8602    0.9471    0.1632    0.4434
    0.4974    0.0598    0.7553    0.3211    0.6997    0.3540    0.2361
    0.3585    0.9204    0.1471    0.6279    0.1411    0.2208    0.7363
    0.0812    0.5670    0.5470    0.9941    0.5198    0.7452    0.3096
    0.6541    0.0953    0.6603    0.8710    0.2637    0.5066    0.0978
    0.9097    0.3101    0.4180    0.4518    0.3021    0.1531    0.7612
    0.9471    0.8189    0.8817    0.6914    0.2992    0.7603    0.6049
    0.4087    0.5456    0.8045    0.9426    0.9932    0.6381    0.4301
    0.5978    0.6570    0.6203    0.4834    0.6857    0.3433    0.5898
    0.3295    0.7091    0.5363    0.4762    0.4322    0.6652    0.7783
    0.5290    0.5131    0.0530    0.1651    0.6768    0.9730    0.3930
    0.5417    0.8843    0.4492    0.7884    0.8413    0.0279    0.6141

  Columns 8 through 14

    0.0226    0.5468    0.5330    0.8822    0.7296    0.6289    0.6860
    0.0742    0.1094    0.0799    0.7624    0.9962    0.0125    0.7979
    0.5814    0.3524    0.0111    0.1423    0.8119    0.9320    0.0621
    0.5538    0.0421    0.6035    0.3528    0.8209    0.7819    0.7047
    0.1844    0.1707    0.3100    0.1206    0.8424    0.7768    0.7449
    0.0015    0.6639    0.2467    0.2297    0.1146    0.8016    0.1176
    0.2053    0.2941    0.3235    0.8784    0.0506    0.7581    0.0087
    0.7511    0.9211    0.5359    0.8888    0.2686    0.9147    0.5099
    0.7038    0.4044    0.9665    0.4041    0.0045    0.7411    0.5604
    0.8836    0.5983    0.0159    0.4957    0.7239    0.2305    0.1555
    0.8533    0.6461    0.5774    0.1966    0.2384    0.9449    0.7628
    0.8378    0.7621    0.8568    0.2588    0.9822    0.2926    0.8241
    0.8829    0.5770    0.4814    0.3754    0.9512    0.8505    0.7561
    0.5607    0.3426    0.9944    0.6615    0.5759    0.5950    0.5142
    0.2436    0.2206    0.7631    0.1449    0.1722    0.0572    0.5438
    0.8903    0.0954    0.4969    0.7975    0.6367    0.1906    0.1202
    0.2390    0.4506    0.9691    0.8574    0.0521    0.9309    0.1028
    0.6214    0.9673    0.6206    0.1164    0.0499    0.0878    0.1558
    0.5525    0.6292    0.5441    0.1807    0.5439    0.0062    0.5190
    0.3498    0.0309    0.6701    0.6577    0.9630    0.7104    0.3656

  Columns 15 through 20
```

```
    0.7114    0.4676    0.7022    0.2876    0.8059    0.0548
    0.8157    0.5719    0.1590    0.6812    0.3689    0.6474
    0.6902    0.2365    0.4171    0.1939    0.6647    0.4311
    0.0448    0.6660    0.6649    0.6348    0.1104    0.4709
    0.3239    0.9918    0.0679    0.0952    0.8658    0.7567
    0.6696    0.1257    0.1860    0.5673    0.7246    0.4869
    0.4887    0.1084    0.7959    0.7723    0.9956    0.0514
    0.3276    0.8059    0.3371    0.8290    0.8410    0.9374
    0.5958    0.6709    0.9735    0.7823    0.7248    0.5618
    0.6737    0.7140    0.0317    0.7972    0.0488    0.4931
    0.3574    0.4093    0.5026    0.8761    0.8903    0.7449
    0.5622    0.7808    0.0115    0.2690    0.8856    0.8571
    0.0912    0.6201    0.9211    0.2238    0.2403    0.8490
    0.9830    0.7149    0.4246    0.1056    0.5691    0.0797
    0.0132    0.8397    0.6079    0.7192    0.2949    0.8399
    0.3307    0.1980    0.7169    0.9423    0.2212    0.3106
    0.0573    0.3222    0.4188    0.7583    0.3279    0.5451
    0.1740    0.4291    0.6106    0.9607    0.7438    0.6246
    0.0837    0.7143    0.6589    0.2303    0.6784    0.8793
    0.7046    0.7998    0.8983    0.2867    0.8281    0.6627

z =

    0.8118
   -0.7001
   -0.6667
    1.0100
    0.2285
    0.1152
   -0.4180
    0.5605
    0.4032
   -0.2811
   -0.1897
   -0.0089
   -1.0214
   -0.8916
    0.3616
   -1.3208
    1.2866
    0.1067
    0.8454
   -0.7118

x =

   -0.7462
    1.6940
    0.3712
   -0.4992
    0.4908
    0.2950
```

```
   -0.5118
    0.1277
    0.7798
   -0.4721
    0.6423
   -0.6425
    0.1724
    1.1452
   -0.4134
    1.3248
   -0.2728
   -0.4429
   -0.8657
   -0.9310


r =

   1.0e-14 *

         0
   -0.0111
    0.0555
         0
    0.0333
   -0.0389
    0.0722
   -0.0555
    0.1110
   -0.0777
   -0.0333
    0.0999
   -0.0666
   -0.0444
   -0.0111
    0.0111
    0.0777
    0.0222
    0.0444
    0.0555


N1 =

   9.2149e-15


N2 =

   2.4863e-15
```

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