

```
%PREPARATIONS
cd /media/anton/E6D8B24FD8B21E2D/Git/txcloud/Labs/CM/Larin_Anton_8383_CM_21_11/Solution
%cd D:\Git\TxCloud\Labs\CM\Larin_Anton_8383_CM_21_11\Solution

filename = "inp"
```

```
filename =
"inp"
```

```
%MATRIX BY HANDS
```

```
%2
%0.5308 0.9304 0.5688
%0.7792 0.1299 0.4694

n=2;
M=[1 2 3;
4 5 6];

file = fopen(filename, 'w');
fprintf(file, '%d\n', n);
for j = 1:size(M,1)
    for i = 1:size(M,2)
        fprintf(file, "%d ", M(j,i));
    end
    fprintf(file, "\n");
end
fclose(file);
A = M(:,1:1:end-1)
```

```
A = 2x2
    1     2
    4     5
```

```
b=M(:,end)
```

```
b = 2x1
     3
     6
```

```
%RANDOM
n=randi([2,10],1,1)
```

```
n = 3
```

```
M=rand(n,n+1)
```

```
M = 3x4
    0.6868    0.6256    0.9294    0.4359
    0.1835    0.7802    0.7757    0.4468
    0.3685    0.0811    0.4868    0.3063
```

```

file = fopen(filename, 'w');
fprintf(file, '%d\n', n);
for j = 1:size(M,1)
    for i = 1:size(M,2)
        fprintf(file, "%d ", M(j,i));
    end
    fprintf(file, "\n");
end
fclose(file);
A = M(:,1:1:end-1)

```

```

A = 3x3
    0.6868    0.6256    0.9294
    0.1835    0.7802    0.7757
    0.3685    0.0811    0.4868

```

```
b=M(:,end)
```

```

b = 3x1
    0.4359
    0.4468
    0.3063

```

```

%MATRIX FROM FILE
file = fopen(filename, 'r');
raw=fscanf(file, "%f");
n=raw(1)

```

```
n = 4
```

```

raw=raw(2:end);
M=vec2mat(raw,n+1);
A = M(1:1:n,1:1:end-1)

```

```

A = 4x4
    0.4039    0.9561    0.3532    0.1690
    0.0965    0.5752    0.8212    0.6491
    0.1320    0.0598    0.0154    0.7317
    0.9421    0.2348    0.0430    0.6477

```

```
b=M(1:1:n,end)
```

```

b = 4x1
    0.4509
    0.5470
    0.2963
    0.7447

```

```
%PROCESS
```

```
ethalonRoots = A\b
```

```
ethalonRoots = 4x1
```

```
0.5589
0.0639
0.3248
0.2921
```

```
%gauss
[~,out]=system("python3 main.py g 16 <"+filename)
```

```
out =
'0.5588918413482896
0.06391340808328069
0.3248066443802748
0.2921027777212042
'
```

```
%out="42"
pyRoots = str2num(out);
vpa(pyRoots,16)
```

```
ans =

$$\begin{pmatrix} 0.5588918413482896 \\ 0.06391340808328069 \\ 0.3248066443802748 \\ 0.2921027777212042 \end{pmatrix}$$

```

```
%iter roots
[~,out]=system("python3 main.py i 16 10 <"+filename)
```

```
out =
'0.5588918413482896
0.06391340808328069
0.3248066443802748
0.2921027777212042
'
```

```
%out="42"
pyRoots = str2num(out);
```

```
%cond res
```

```
ethalonRoots = A\b
```

```
ethalonRoots = 4x1
0.5589
0.0639
0.3248
0.2921
```

```
pr=8
```

```
pr = 8
```

```
res=[ ]
```

```
res =
```

```
[ ]
```

```
eps=[ ]
```

```
eps =
```

```
[ ]
```

```
while pr>0
    [~,out]=system("python3 main.py g "+pr+" "<"+filename);
    pyRoots = str2num(out);
    res=[res,pyRoots];
    eps=[eps,ethalonRoots-pyRoots]
    pr=pr-1;
end
```

```
eps = 4x1
```

```
10-15 x
    -0.1110
    -0.0694
         0
         0
```

```
eps = 4x2
```

```
10-7 x
    -0.0000    0.1727
    -0.0000   -0.0241
         0    -0.0168
         0   -0.2413
```

```
eps = 4x3
```

```
10-5 x
    -0.0000    0.0017    0.0930
    -0.0000   -0.0002   -0.1010
         0   -0.0002    0.1386
         0   -0.0024   -0.0932
```

```
eps = 4x4
```

```
10-5 x
    -0.0000    0.0017    0.0930    0.5533
    -0.0000   -0.0002   -0.1010    0.2333
         0   -0.0002    0.1386   -0.2622
         0   -0.0024   -0.0932   -0.5005
```

```
eps = 4x5
```

```
10-4 x
    -0.0000    0.0002    0.0093    0.0553   -0.4152
    -0.0000   -0.0000   -0.0101    0.0233    0.5301
         0   -0.0000    0.0139   -0.0262   -0.2898
         0   -0.0002   -0.0093   -0.0501    0.4391
```

```
eps = 4x6
```

```
    -0.0000    0.0000    0.0000    0.0000   -0.0000   -0.0007
    -0.0000   -0.0000   -0.0000    0.0000    0.0001    0.0005
         0   -0.0000    0.0000   -0.0000   -0.0000   -0.0011
         0   -0.0000   -0.0000   -0.0000    0.0000    0.0005
```

```
eps = 4x7
```

```
    -0.0000    0.0000    0.0000    0.0000   -0.0000   -0.0007    0.0090
    -0.0000   -0.0000   -0.0000    0.0000    0.0001    0.0005   -0.0074
         0   -0.0000    0.0000   -0.0000   -0.0000   -0.0011    0.0082
         0   -0.0000   -0.0000   -0.0000    0.0000    0.0005   -0.0064
```

```
eps = 4x8
```

```
    -0.0000    0.0000    0.0000    0.0000   -0.0000   -0.0007    0.0090    0.0351
```

-0.0000	-0.0000	-0.0000	0.0000	0.0001	0.0005	-0.0074	-0.0789
0	-0.0000	0.0000	-0.0000	-0.0000	-0.0011	0.0082	0.1224
0	-0.0000	-0.0000	-0.0000	0.0000	0.0005	-0.0064	-0.0412

```
res
```

```
res = 4x8
    0.5589    0.5589    0.5589    0.5589    0.5589    0.5596    0.5499    0.5238
    0.0639    0.0639    0.0639    0.0639    0.0639    0.0634    0.0713    0.1429
    0.3248    0.3248    0.3248    0.3248    0.3248    0.3259    0.3166    0.2024
    0.2921    0.2921    0.2921    0.2921    0.2921    0.2916    0.2985    0.3333
```

```
for i=1:size(eps,2)
    vpa(eps(:,i),10)
end
```

```
ans =

$$\begin{pmatrix} -1.110223025e-16 \\ -6.938893904e-17 \\ 0 \\ 0 \end{pmatrix}$$

```

```
ans =

$$\begin{pmatrix} 0.00000001727031218 \\ -0.000000002408720987 \\ -0.000000001683436002 \\ -0.000000002413223849 \end{pmatrix}$$

```

```
ans =

$$\begin{pmatrix} 0.0000009296873499 \\ -0.000001009719265 \\ 0.000001385862697 \\ -0.0000009316413521 \end{pmatrix}$$

```

```
ans =

$$\begin{pmatrix} 0.000005533279546 \\ 0.000002332828461 \\ -0.000002622349257 \\ -0.00000500549888 \end{pmatrix}$$

```

```
ans =

$$\begin{pmatrix} -0.00004151597111 \\ 0.00005301307994 \\ -0.00002898408227 \\ 0.00004390586892 \end{pmatrix}$$

```

```
ans =

$$\begin{pmatrix} -0.0007086415712 \\ 0.0005393094118 \\ -0.001135808995 \\ 0.0005165024019 \end{pmatrix}$$

```

```
ans =
```

$$\begin{pmatrix} 0.008990783363 \\ -0.00742568525 \\ 0.008206380225 \\ -0.006391073757 \end{pmatrix}$$

ans =

$$\begin{pmatrix} 0.03508231754 \\ -0.07894373477 \\ 0.122425692 \\ -0.04123055561 \end{pmatrix}$$

vpa(eps,16)

ans =

$$\begin{pmatrix} -0.0000000000000001110223024625157 & 0.0000000172703121803508 & 0.00000092968734988 \\ -6.938893903907228e-17 & -0.000000002408720986557533 & -0.0000010097192646 \\ 0 & -0.000000001683436001709282 & 0.00000138586269665 \\ 0 & -0.00000002413223848529711 & -0.00000093164135211 \end{pmatrix}$$

cond(A)

ans = 6.5014

eig(A)

ans = 4x1 complex  
 1.7761 + 0.0000i  
 0.0712 + 0.7954i  
 0.0712 - 0.7954i  
 -0.2762 + 0.0000i

ethalonRoots

ethalonRoots = 4x1  
 0.5589  
 0.0639  
 0.3248  
 0.2921

pyRoots

pyRoots = 4x1  
 0.5238  
 0.1429  
 0.2024  
 0.3333