

1.5 行の交換、逆行列、まるめの誤差

交換行列

```
P = [0,1;1,0]
```

```
P =  
      0      1  
      1      0
```

```
A = [0,2;3,4]
```

```
A =  
      0      2  
      3      4
```

```
P*A
```

```
ans =  
      3      4  
      0      2
```

P は交換行列

1.5.1

```
clear  
A = [1,4,2;-2,-8,3;0,1,1]
```

```
A =  
      1      4      2  
     -2     -8      3  
      0      1      1
```

```
b = [-2;32;1]
```

```
b =  
     -2  
     32  
      1
```

```
E21 = eye(3);  
E21(2,1) = 2
```

```
E21 =  
      1      0      0  
      2      1      0  
      0      0      1
```

```
U1 = E21 * A
```

```
U1 =  
      1      4      2
```

0	0	7
0	1	1

第2行と第3行を交換

```
P32 = [1,0,0;0,0,1;0,1,0];
U = P32 * U1
```

```
U =
     1     4     2
     0     1     1
     0     0     7
```

```
c1 = E21 * b
```

```
c1 =
    -2
    28
     1
```

```
c = P32*c1
```

```
c =
    -2
     1
    28
```

$$\begin{bmatrix} 1 & 4 & 2 \\ 0 & 1 & 1 \\ 0 & 0 & 7 \end{bmatrix} x = \begin{bmatrix} -2 \\ 1 \\ 28 \end{bmatrix}$$

```
% 要 Symbolic Math Toolbox
syms x y z;
eqn = U * [x;y;z] == c;
solx = solve(eqn, x,y,z);
Answer = [solx.x;solx.y;solx.z]
```

```
Answer =
```

$$\begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix}$$

1.5.2

```
clear
A = [1,1;3,3]
```

```
A =
     1     1
     3     3
```

```
E21 = [1,0;-3,1]
```

```
E21 =  
      1      0  
     -3      1
```

```
U = E21*A
```

```
U =  
      1      1  
      0      0
```

```
% 要 Symbolic Math Toolbox  
syms b1 b2  
b = [b1;b2]
```

```
b =  

$$\begin{pmatrix} b_1 \\ b_2 \end{pmatrix}$$

```

```
c = E21 * b
```

```
c =  

$$\begin{pmatrix} b_1 \\ b_2 - 3 b_1 \end{pmatrix}$$

```

よって $0 = b_2 - 3b_1$ なので $b_2 = 3b_1$

交換行列は $P_{kl} = P_{kl}^{-1}$ となる

P32 例

```
clear  
A = [1,2,3;2,4,2;0,1,1]
```

```
A =  
      1      2      3  
      2      4      2  
      0      1      1
```

```
E21 = eye(3);  
E21(2,1) = -2
```

```
E21 =  
      1      0      0  
     -2      1      0  
      0      0      1
```

```
U1 = E21 * A
```

```
U1 =
    1    2    3
    0    0   -4
    0    1    1
```

```
P23 = [1,0,0;0,0,1;0,1,0]
```

```
P23 =
    1    0    0
    0    0    1
    0    1    0
```

```
U = P23*U1
```

```
U =
    1    2    3
    0    1    1
    0    0   -4
```

```
PA = P23*A
```

```
PA =
    1    2    3
    0    1    1
    2    4    2
```

```
E31 = eye(3);
E31(3,1) = -2
```

```
E31 =
    1    0    0
    0    1    0
   -2    0    1
```

```
U = E31 * PA
```

```
U =
    1    2    3
    0    1    1
    0    0   -4
```

```
L = E31^-1
```

```
L =
    1    0    0
    0    1    0
    2    0    1
```

1.5.3

```
clear
A = [0,1;2,3]
```

```
A =
```

$$\begin{array}{cc} 0 & 1 \\ 2 & 3 \end{array}$$

$$P21 = [0,1;1,0]$$

$$P21 = \begin{array}{cc} 0 & 1 \\ 1 & 0 \end{array}$$

$$PA = P21 * A$$

$$PA = \begin{array}{cc} 2 & 3 \\ 0 & 1 \end{array}$$

$$L = [1,0;0,1]$$

$$L = \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array}$$

$$D = [2,0;0,1]$$

$$D = \begin{array}{cc} 2 & 0 \\ 0 & 1 \end{array}$$

$$U = [1,3/2;0,1]$$

$$U = \begin{array}{cc} 1 & 3/2 \\ 0 & 1 \end{array}$$

1.5.4

$$\begin{array}{l} \text{clear} \\ A = [1,1,1;1,1,2;1,2,5] \end{array}$$

$$A = \begin{array}{ccc} 1 & 1 & 1 \\ 1 & 1 & 2 \\ 1 & 2 & 5 \end{array}$$

$$E21 = [1,0,0;-1,1,0;0,0,1]$$

$$E21 = \begin{array}{ccc} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & 1 \end{array}$$

$$U1 = E21 * A$$

$$U1 = \begin{array}{ccc} 1 & 1 & 1 \\ 0 & 0 & 1 \end{array}$$

1	2	5
---	---	---

P32 = [1,0,0;0,0,1;0,1,0]

P32 =

1	0	0
0	0	1
0	1	0

U2 = P32 * U1

U2 =

1	1	1
1	2	5
0	0	1

U3 = E21 * U2

U3 =

1	1	1
0	1	4
0	0	1

=====

PA = P32 * A

PA =

1	1	1
1	2	5
1	1	2

PU1 = E21 * PA

PU1 =

1	1	1
0	1	4
1	1	2

E31 = eye(3);
E31(3,1) = -1

E31 =

1	0	0
0	1	0
-1	0	1

U = E31 * PU1

U =

1	1	1
0	1	4
0	0	1

1.5.5

その1

```
clear
A = [0,1,-1;1,-1,0;1,0,-1]
```

```
A =
     0     1    -1
     1    -1     0
     1     0    -1
```

```
b = [2;2;2]
```

```
b =
     2
     2
     2
```

```
P21 = [0,1,0;1,0,0;0,0,1]
```

```
P21 =
     0     1     0
     1     0     0
     0     0     1
```

```
PA = P21 * A
```

```
PA =
     1    -1     0
     0     1    -1
     1     0    -1
```

```
E31 = eye(3);
E31(3,1) = -1
```

```
E31 =
     1     0     0
     0     1     0
    -1     0     1
```

```
U = E31 * PA
```

```
U =
     1    -1     0
     0     1    -1
     0     1    -1
```

```
c = E31 * b
```

```
c =
     2
     2
     0
```

2行目と3行目が同じなのに**b**は異なるので特異&解なし

その2

```
clear
A = [0,1,-1;1,-1,0;1,0,-1]
```

```
A =
```

0	1	-1
1	-1	0
1	0	-1

```
b = [0;0;0]
```

```
b =
```

0
0
0

```
P21 = [0,1,0;1,0,0;0,0,1]
```

```
P21 =
```

0	1	0
1	0	0
0	0	1

```
PA = P21 * A
```

```
PA =
```

1	-1	0
0	1	-1
1	0	-1

```
E31 = eye(3);
E31(3,1) = -1
```

```
E31 =
```

1	0	0
0	1	0
-1	0	1

```
U = E31 * PA
```

```
U =
```

1	-1	0
0	1	-1
0	1	-1

```
c = E31 * b
```

```
c =
```

0
0
0

特異&解は $u = v = w$