

Augmented matrix A b

A0 =

2	-2	3	1
6	-7	14	5
4	-8	30	14

Proceed with elimination

A1=A0; A1(2,:)=A0(2,:)-3*A0(1,:),

A1 =

2	-2	3	1
0	-1	5	2
4	-8	30	14

A2=A1; A2(3,:)=A1(3,:)-2*A1(1,:),

A2 =

2	-2	3	1
0	-1	5	2
0	-4	24	12

A3=A2; A3(3,:)=A2(3,:)-4*A2(2,:),

A3 =

2	-2	3	1
0	-1	5	2
0	0	4	4

E21=elemat(3,2,1,-3)

E21 =

1	0	0
-3	1	0
0	0	1

E21: An elementary matrix. It differs from the identity matrix

I =

1	0	0
0	1	0
0	0	1

only at one position, namely position 2,1 (row 2, col 1).

The first elimination step can be expressed as a matrix-multiply:

B1=E21*A0

B1 =

2	-2	3	1
---	----	---	---

```

    0    -1    5    2
    4    -8   30   14
The same as our matrix A1 !

```

```
E31=elemat(3,3,1,-2)
```

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

```

```
E32=elemat(3,3,2,-4)
```

```
E32 =
    1    0    0
    0    1    0
    0   -4    1

```

```
B2=E31*B1
```

```
B2 =
    2   -2    3    1
    0   -1    5    2
    0   -4   24   12

```

```
B3=E32*B2
```

```
B3 =
    2   -2    3    1
    0   -1    5    2
    0    0    4    4

```

```
C=E32*E31*E21*A0
```

```
C =
    2   -2    3    1
    0   -1    5    2
    0    0    4    4

```

```
M=E32*E31*E21
```

```
M =
    1    0    0
   -3    1    0
   10   -4    1

```

```
Ei21=inv(E21)
```

Inverse of a matrix G: $G \cdot \text{inv}(G) = I$;

in our example the intuitive meaning is just that $\text{inv}(E21)$

is undoing whatever E21 has done, i.e.,

$\text{inv}(E21) \cdot E21 \cdot A0 = A0$, i.e., $\text{inv}(E21) \cdot E21 = I$.

```
Ei21 =
```

```

    1    0    0
    3    1    0

```

```

      0      0      1
E21*Ei21
ans =
      1      0      0
      0      1      0
      0      0      1
L=inv(E21)*inv(E31)*inv(E32)
L =
      1      0      0
      3      1      0
      2      4      1

```

The matrix L will get us from A3 back to the initial matrix A0 !
 Note that its entries are precisely the multipliers used in
 the elimination steps. See also the first chapter of the Lecture
 Notes for 309

```

A3
A3 =
      2      -2      3      1
      0      -1      5      2
      0      0      4      4
L*A3
ans =
      2      -2      3      1
      6      -7     14      5
      4      -8     30     14

```