

```
> A:=<2,4,-1,5,-2|-4,-5,3,-8,1|2,-5,3,-8,1|-6,0,7,-3,1>^+;
```

$$A := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 \\ -4 & -5 & 3 & -8 & 1 \\ 2 & -5 & 3 & -8 & 1 \\ -6 & 0 & 7 & -3 & 1 \end{bmatrix}$$

(1)

```
> # Copy-paste from Utah Maple Web HelpTools
> with(LinearAlgebra);
> combo:=(a,s,t,c)->RowOperation(a,[t,s],c);
> swap:=(a,s,t)->RowOperation(a,[t,s]);
> mult:=(a,t,c)->RowOperation(a,t,c);
```

combo := (a, s, t, c) → LinearAlgebra:-RowOperation(a, [t, s], c)

swap := (a, s, t) → LinearAlgebra:-RowOperation(a, [t, s])

mult := (a, t, c) → LinearAlgebra:-RowOperation(a, t, c)

(2)

```
> C:=<A|IdentityMatrix(4)>;
```

$$C := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 & 1 & 0 & 0 & 0 \\ -4 & -5 & 3 & -8 & 1 & 0 & 1 & 0 & 0 \\ 2 & -5 & 3 & -8 & 1 & 0 & 0 & 1 & 0 \\ -6 & 0 & 7 & -3 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(3)

```
> C1:=combo(C,1,2,2);
```

$$C1 := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 & 1 & 0 & 0 & 0 \\ 0 & 3 & 1 & 2 & -3 & 2 & 1 & 0 & 0 \\ 2 & -5 & 3 & -8 & 1 & 0 & 0 & 1 & 0 \\ -6 & 0 & 7 & -3 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(4)

```
> C2:=combo(C1,1,3,-1);
```

$$C2 := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 & 1 & 0 & 0 & 0 \\ 0 & 3 & 1 & 2 & -3 & 2 & 1 & 0 & 0 \\ 0 & -9 & 4 & -13 & 3 & -1 & 0 & 1 & 0 \\ -6 & 0 & 7 & -3 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(5)

```
> C3:=combo(C2,1,4,3);
```

$$C3 := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 & 1 & 0 & 0 & 0 \\ 0 & 3 & 1 & 2 & -3 & 2 & 1 & 0 & 0 \\ 0 & -9 & 4 & -13 & 3 & -1 & 0 & 1 & 0 \\ 0 & 12 & 4 & 12 & -5 & 3 & 0 & 0 & 1 \end{bmatrix}$$

(6)

```
> C4:=combo(C3,2,3,3);
```

(7)

$$C4 := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 & 1 & 0 & 0 & 0 \\ 0 & 3 & 1 & 2 & -3 & 2 & 1 & 0 & 0 \\ 0 & 0 & 7 & -7 & -6 & 5 & 3 & 1 & 0 \\ 0 & 12 & 4 & 12 & -5 & 3 & 0 & 0 & 1 \end{bmatrix} \quad (7)$$

> C5:=combo(C4,2,4,-4);

$$C5 := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 & 1 & 0 & 0 & 0 \\ 0 & 3 & 1 & 2 & -3 & 2 & 1 & 0 & 0 \\ 0 & 0 & 7 & -7 & -6 & 5 & 3 & 1 & 0 \\ 0 & 0 & 0 & 4 & 7 & -5 & -4 & 0 & 1 \end{bmatrix} \quad (8)$$

> U:=C5[1..4,1..5]

$$U := \begin{bmatrix} 2 & 4 & -1 & 5 & -2 \\ 0 & 3 & 1 & 2 & -3 \\ 0 & 0 & 7 & -7 & -6 \\ 0 & 0 & 0 & 4 & 7 \end{bmatrix} \quad (9)$$

> L1:=C5[1..4,6..9];

$$L1 := \begin{bmatrix} 1 & 0 & 0 & 0 \\ 2 & 1 & 0 & 0 \\ 5 & 3 & 1 & 0 \\ -5 & -4 & 0 & 1 \end{bmatrix} \quad (10)$$

> L:=1/L1;

$$L := \begin{bmatrix} 1 & 0 & 0 & 0 \\ -2 & 1 & 0 & 0 \\ 1 & -3 & 1 & 0 \\ -3 & 4 & 0 & 1 \end{bmatrix} \quad (11)$$

> (L.U)-A;

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \quad (12)$$

> LUdecomposition(A);U;

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 0 & 0 & 0 \\ -2 & 1 & 0 & 0 \\ 1 & -3 & 1 & 0 \\ -3 & 4 & 0 & 1 \end{bmatrix}, \begin{bmatrix} 2 & 4 & -1 & 5 & -2 \\ 0 & 3 & 1 & 2 & -3 \\ 0 & 0 & 7 & -7 & -6 \\ 0 & 0 & 0 & 4 & 7 \end{bmatrix}$$

$\left[\begin{array}{l} \\ \\ \\ \\ \end{array} \right] > 1/L;$

$$\begin{bmatrix} 2 & 4 & -1 & 5 & -2 \\ 0 & 3 & 1 & 2 & -3 \\ 0 & 0 & 7 & -7 & -6 \\ 0 & 0 & 0 & 4 & 7 \end{bmatrix}$$

(13)

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 2 & 1 & 0 & 0 \\ 5 & 3 & 1 & 0 \\ -5 & -4 & 0 & 1 \end{bmatrix}$$

(14)