```
j12 = {{0, -1, 0, 0}, {1, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
k13 = {{0, 0, 1, 0}, {0, 0, 0, 0}, {1, 0, 0, 0}, {0, 0, 0, 0}}
k14 = {{0, 0, 0, 1}, {0, 0, 0, 0}, {0, 0, 0, 0}, {1, 0, 0, 0}}
k24 = {{0, 0, 0, 0}, {0, 0, 0, 1}, {0, 0, 0, 0}, {0, 1, 0, 0}}
j34 = {{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 1}, {0, 0, -1, 0}}
k23 = {{0, 0, 0, 0}, {0, 0, 1, 0}, {0, 1, 0, 0}, {0, 0, 0, 0}}
```

Out[28]=

```
{{0, -1, 0, 0}, {1, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[29]=

```
{{0, 0, 1, 0}, {0, 0, 0, 0}, {1, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[30]=

```
{{0, 0, 0, 1}, {0, 0, 0, 0}, {0, 0, 0, 0}, {1, 0, 0, 0}}
```

Out[31]=

```
{{0, 0, 0, 0}, {0, 0, 0, 1}, {0, 0, 0, 0}, {0, 1, 0, 0}}
```

Out[32]=

```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 1}, {0, 0, -1, 0}}
```

Out[33]=

```
{{0, 0, 0, 0}, {0, 0, 1, 0}, {0, 1, 0, 0}, {0, 0, 0, 0}}
```

Out[35]=

```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```

```
Commutator[A_, B_] := A.B - B.A
```

In[74]:=

```
ans = Commutator[j12, k13]
MatrixForm[ans]
```

Out[74]=

```
{{0, 0, 0, 0}, {0, 0, 1, 0}, {0, 1, 0, 0}, {0, 0, 0, 0}}
```

Out[75]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[76]:=

```
ans = Commutator[j12, k14]
MatrixForm[ans]
```

Out[76]=

```
{{0, 0, 0, 0}, {0, 0, 0, 1}, {0, 0, 0, 0}, {0, 1, 0, 0}}
```

Out[77]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$$

In[78]:=
```
ans = Commutator[j12, k24]
MatrixForm[ans]
```

Out[78]=
```
{{0, 0, 0, -1}, {0, 0, 0, 0}, {0, 0, 0, 0}, {-1, 0, 0, 0}}
```

Out[79]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 \end{pmatrix}$$

In[80]:=
```
ans = Commutator[j12, j34]
MatrixForm[ans]
```

Out[80]=
```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[81]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[82]:=
```
ans = Commutator[j12, k23]
MatrixForm[ans]
```

Out[82]=
```
{{0, 0, -1, 0}, {0, 0, 0, 0}, {-1, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[83]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[90]:=
```
ans = Commutator[k13, k14]
MatrixForm[ans]
```

Out[90]=
```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 1}, {0, 0, -1, 0}}
```

Out[91]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{pmatrix}$$

In[93]:=
```
ans = Commutator[k13, k24]
MatrixForm[ans]
```

Out[93]=
```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[94]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[95]:=
```
ans = Commutator[k13, j34]
MatrixForm[ans]
```

Out[95]=
```
{{0, 0, 0, 1}, {0, 0, 0, 0}, {0, 0, 0, 0}, {1, 0, 0, 0}}
```

Out[96]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

In[97]:=
```
ans = Commutator[k13, k23]
MatrixForm[ans]
```

Out[97]=
```
{{0, 1, 0, 0}, {-1, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[98]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[99]:=
```
ans = Commutator[k14, k24]
MatrixForm[ans]
```

Out[99]=
```
{{0, 1, 0, 0}, {-1, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```

Out[100]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[101]:=
```
ans = Commutator[k14, j34]
MatrixForm[ans]
```
Out[101]=
```
{{0, 0, -1, 0}, {0, 0, 0, 0}, {-1, 0, 0, 0}, {0, 0, 0, 0}}
```
Out[102]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[103]:=
```
ans = Commutator[k14, k23]
MatrixForm[ans]
```
Out[103]=
```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, 0}}
```
Out[104]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[105]:=
```
ans = Commutator[k24, j34]
MatrixForm[ans]
```
Out[105]=
```
{{0, 0, 0, 0}, {0, 0, -1, 0}, {0, -1, 0, 0}, {0, 0, 0, 0}}
```
Out[106]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[107]:=
```
ans = Commutator[k24, k23]
MatrixForm[ans]
```
Out[107]=
```
{{0, 0, 0, 0}, {0, 0, 0, 0}, {0, 0, 0, -1}, {0, 0, 1, 0}}
```
Out[108]//MatrixForm=
$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

In[109]:=

```
ans = Commutator[j34, k23]
MatrixForm[ans]
```

Out[109]=

```
{{0, 0, 0, 0}, {0, 0, 0, -1}, {0, 0, 0, 0}, {0, -1, 0, 0}}
```

Out[110]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \end{pmatrix}$$