

```
> with(LinearAlgebra):
> a1:=Vector([1,1,0,0]);
> a2:=Vector([1,0,1,0]);
> a3:=Vector([0,0,1,1]);
```

$$a1 := \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$a2 := \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

$$a3 := \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \end{bmatrix}$$

(1)

```
> GramSchmidt([a1,a2,a3]);
```

$$\left[\begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \frac{1}{2} \\ -\frac{1}{2} \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -\frac{1}{3} \\ \frac{1}{3} \\ \frac{1}{3} \\ 1 \end{bmatrix} \right]$$

(2)

```
> GramSchmidt([a1,a2,a3], normalized);
```

$$\left[\begin{bmatrix} \frac{\sqrt{2}}{2} \\ \frac{\sqrt{2}}{2} \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \frac{\sqrt{6}}{6} \\ -\frac{\sqrt{6}}{6} \\ \frac{\sqrt{6}}{3} \\ 0 \end{bmatrix}, \begin{bmatrix} -\frac{\sqrt{3}}{6} \\ \frac{\sqrt{3}}{6} \\ \frac{\sqrt{3}}{6} \\ \frac{\sqrt{3}}{2} \end{bmatrix} \right]$$

(3)

```
> Q,R:=QRDecomposition(<a1|a2|a3>);
```

$$Q, R := \begin{bmatrix} \frac{\sqrt{2}}{2} & \frac{\sqrt{6}}{6} & -\frac{\sqrt{3}}{6} \\ \frac{\sqrt{2}}{2} & -\frac{\sqrt{6}}{6} & \frac{\sqrt{3}}{6} \\ 0 & \frac{\sqrt{6}}{3} & \frac{\sqrt{3}}{6} \\ 0 & 0 & \frac{\sqrt{3}}{2} \end{bmatrix}, \begin{bmatrix} \sqrt{2} & \frac{\sqrt{2}}{2} & 0 \\ 0 & \frac{\sqrt{6}}{2} & \frac{\sqrt{6}}{3} \\ 0 & 0 & \frac{2\sqrt{3}}{3} \end{bmatrix} \quad (4)$$

> R[1][2], R[2][2];

$$\frac{\sqrt{2}}{2}, \frac{\sqrt{6}}{2} \quad (5)$$

> R[1][2]*Column(Q,1)+R[2][2]*Column(Q,2);

$$\begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix} \quad (6)$$