Solutions for Assignment 6

Question 1

The columns of matrix A are linearly dependent because the number of columns are greater then the number of rows.

Question 2

```
A = {{1, 1, 0, 0}, {1, 0, 0, 1}, {0, 1, 1, 0}, {0, 0, 1, 1}}
```

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

```
A // MatrixForm
```

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

```
MatrixForm[RowReduce[A]]
```

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

There are free variables so the columns are linearly dependent.

Question 3

```
A = {{1, 1, 2, -2}, {2, 3, 1, 3},
   {1, -1, 0, 0}, {2, 2, 1, 2}}
```

```
{{1, 1, 2, -2}, {2, 3, 1, 3}, {1, -1, 0, 0}, {2, 2, 1, 2}}
```

```
MatrixForm[A]
```

$$\begin{pmatrix} 1 & 1 & 2 & -2 \\ 2 & 3 & 1 & 3 \\ 1 & -1 & 0 & 0 \\ 2 & 2 & 1 & 2 \end{pmatrix}$$

```
MatrixForm[RowReduce[A]]
```

$$\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & -2 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

If the columns of matrix A are v1, v2, v3, v4 then -v1-v2+2v3+v4=0

Question 4

The columns of this matrix are inevitably linearly dependent. There are more columns then rows.

Basis vectors must be linearly independent.

Question 5

```
u1 = {1, 2, 3, 4}
u2 = {1, 2, 3, 0}
u3 = {1, 2, 0, 0}
u4 = {1, 0, 0, 0}
```

```
0 * u1 - 2 u2 + u3 + 2 u4
```

```
{1, -2, -6, 0}
```

$$x = \begin{pmatrix} 1 \\ -2 \\ -6 \\ 0 \end{pmatrix}$$