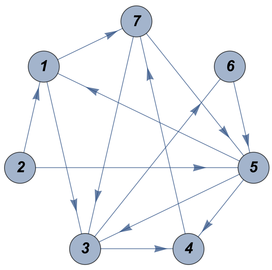
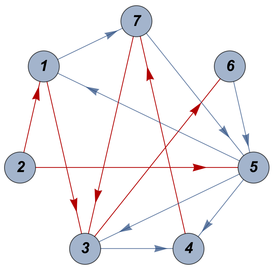
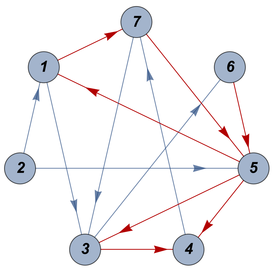
Out[-]=
$$\begin{pmatrix} x_{1\leftrightarrow 3} + x_{1\leftrightarrow 7} - x_{2\leftrightarrow 1} - x_{5\leftrightarrow 1} = 7 \\ x_{2\leftrightarrow 1} + x_{2\leftrightarrow 5} = 4 \\ -x_{1\leftrightarrow 3} + x_{3\leftrightarrow 4} + x_{3\leftrightarrow 6} - x_{5\leftrightarrow 3} - x_{7\leftrightarrow 3} = -1 \\ -x_{3\leftrightarrow 4} + x_{4\leftrightarrow 7} - x_{5\leftrightarrow 4} = -7 \\ -x_{2\leftrightarrow 5} + x_{5\leftrightarrow 1} + x_{5\leftrightarrow 3} + x_{5\leftrightarrow 4} - x_{6\leftrightarrow 5} - x_{7\leftrightarrow 5} = -2 \\ -x_{3\leftrightarrow 6} + x_{6\leftrightarrow 5} = -2 \\ -x_{1\leftrightarrow 7} - x_{4\leftrightarrow 7} + x_{7\leftrightarrow 3} + x_{7\leftrightarrow 5} = 1 \end{pmatrix} = \begin{pmatrix} 7 \\ 4 \\ -1 \\ -7 \\ -2 \\ -2 \\ 1 \end{pmatrix}$$

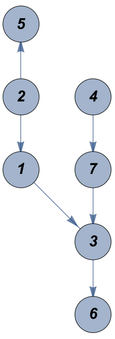
Out[-]= $\{2 \leftrightarrow 5,\ 2 \leftrightarrow 1,\ 1 \leftrightarrow 3,\ 7 \leftrightarrow 3,\ 4 \leftrightarrow 7,\ 3 \leftrightarrow 6\}$

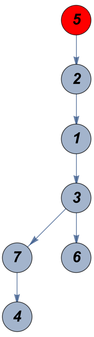
Out[-]= $\{1 \leftrightarrow 7,\ 3 \leftrightarrow 4,\ 5 \leftrightarrow 1,\ 5 \leftrightarrow 3,\ 5 \leftrightarrow 4,\ 6 \leftrightarrow 5,\ 7 \leftrightarrow 5\}$

Out[-]=


Out[-]=


Out[-]=


Out[-]=


Out[-]=


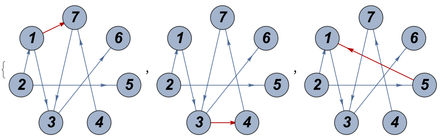
Out[-]=

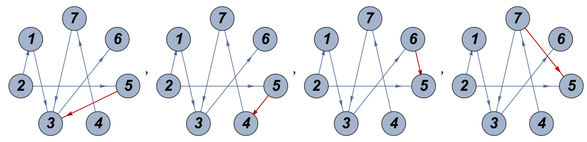
vertex	1	2	3	4	5	6	7
pred	2	5	1	7	0	3	3
dir	1	−1	1	−1	0	1	−1
depth	2	1	3	5	0	4	4
d	5	2	1	3	7	4	6

Out[-]= $\{x_{1\leftrightarrow 7} \to 0,\ x_{3\leftrightarrow 4} \to 0,\ x_{5\leftrightarrow 1} \to 0,\ x_{5\leftrightarrow 3} \to 0,\ x_{5\leftrightarrow 4} \to 0,\ x_{6\leftrightarrow 5} \to 0,\ x_{7\leftrightarrow 5} \to 0,\ x_{2\leftrightarrow 1} \to 2,\ x_{2\leftrightarrow 5} \to 2,\ x_{1\leftrightarrow 3} \to 9,\ x_{4\leftrightarrow 7} \to -7,\ x_{3\leftrightarrow 6} \to 2,\ x_{7\leftrightarrow 3} \to -6\}$

Out[-]= {True, True, True, True, True, True, True}

Spanning tree of the graph with cycles:

Out[-]=




Characteristic vectors:

Out[-]//TableForm=

	$x_{1\leftrightarrow 7}$	$x_{1\leftrightarrow 3}$	$x_{2\leftrightarrow 1}$	$x_{2\leftrightarrow 5}$	$x_{3\leftrightarrow 6}$	$x_{3\leftrightarrow 4}$	$x_{4\leftrightarrow 7}$	$x_{5\leftrightarrow 1}$	$x_{5\leftrightarrow 3}$	$x_{5\leftrightarrow 4}$	$x_{6\leftrightarrow 5}$	$x_{7\leftrightarrow 3}$	$x_{7\leftrightarrow 5}$
1 ↔ 7	1	−1	0	0	0	0	0	0	0	0	0	1	0
3 ↔ 4	0	0	0	0	0	1	1	0	0	0	0	1	0
5 ↔ 1	0	0	−1	1	0	0	0	1	0	0	0	0	0
5 ↔ 3	0	−1	−1	1	0	0	0	0	1	0	0	0	0
5 ↔ 4	0	−1	−1	1	0	0	1	0	0	1	0	1	0
6 ↔ 5	0	1	1	−1	1	0	0	0	0	0	1	0	0
7 ↔ 5	0	1	1	−1	0	0	0	0	0	0	0	−1	1

Out[-]= $\{x_{1\leftrightarrow 7},\ 9 - x_{1\leftrightarrow 7} - x_{5\leftrightarrow 3} - x_{5\leftrightarrow 4} + x_{6\leftrightarrow 5} + x_{7\leftrightarrow 5},\ 2 - x_{5\leftrightarrow 1} - x_{5\leftrightarrow 3} - x_{5\leftrightarrow 4} + x_{6\leftrightarrow 5} + x_{7\leftrightarrow 5},\ 2 + x_{5\leftrightarrow 1} + x_{5\leftrightarrow 3} + x_{5\leftrightarrow 4} - x_{6\leftrightarrow 5} - x_{7\leftrightarrow 5},\ 2 + x_{6\leftrightarrow 5},\ x_{3\leftrightarrow 4},\ -7 + x_{3\leftrightarrow 4} + x_{5\leftrightarrow 4},\ x_{5\leftrightarrow 1},\ x_{5\leftrightarrow 3},\ x_{5\leftrightarrow 4},\ x_{6\leftrightarrow 5},\ -6 + x_{1\leftrightarrow 7} + x_{3\leftrightarrow 4} + x_{5\leftrightarrow 4} - x_{7\leftrightarrow 5},\ x_{7\leftrightarrow 5}\}$

General solution of the balance system:

Out[-]=
$$\begin{pmatrix} x_{1\leftrightarrow 7} \\ x_{1\leftrightarrow 3} \\ x_{2\leftrightarrow 1} \\ x_{2\leftrightarrow 5} \\ x_{3\leftrightarrow 6} \\ x_{3\leftrightarrow 4} \\ x_{4\leftrightarrow 7} \\ x_{5\leftrightarrow 1} \\ x_{5\leftrightarrow 3} \\ x_{5\leftrightarrow 4} \\ x_{6\leftrightarrow 5} \\ x_{7\leftrightarrow 3} \\ x_{7\leftrightarrow 5} \end{pmatrix} = \begin{pmatrix} x_{1\leftrightarrow 7} \\ 9 - x_{1\leftrightarrow 7} - x_{5\leftrightarrow 3} - x_{5\leftrightarrow 4} + x_{6\leftrightarrow 5} + x_{7\leftrightarrow 5} \\ 2 - x_{5\leftrightarrow 1} - x_{5\leftrightarrow 3} - x_{5\leftrightarrow 4} + x_{6\leftrightarrow 5} + x_{7\leftrightarrow 5} \\ 2 + x_{5\leftrightarrow 1} + x_{5\leftrightarrow 3} + x_{5\leftrightarrow 4} - x_{6\leftrightarrow 5} - x_{7\leftrightarrow 5} \\ 2 + x_{6\leftrightarrow 5} \\ x_{3\leftrightarrow 4} \\ -7 + x_{3\leftrightarrow 4} + x_{5\leftrightarrow 4} \\ x_{5\leftrightarrow 1} \\ x_{5\leftrightarrow 3} \\ x_{5\leftrightarrow 4} \\ x_{6\leftrightarrow 5} \\ -6 + x_{1\leftrightarrow 7} + x_{3\leftrightarrow 4} + x_{5\leftrightarrow 4} - x_{7\leftrightarrow 5} \\ x_{7\leftrightarrow 5} \end{pmatrix}$$

Checking the solution:

Out[-]= {{True, True, True, True, True, True, True} == {7, 4, -1, -7, -2, -2, 1}}