Bit flipping decoding: example
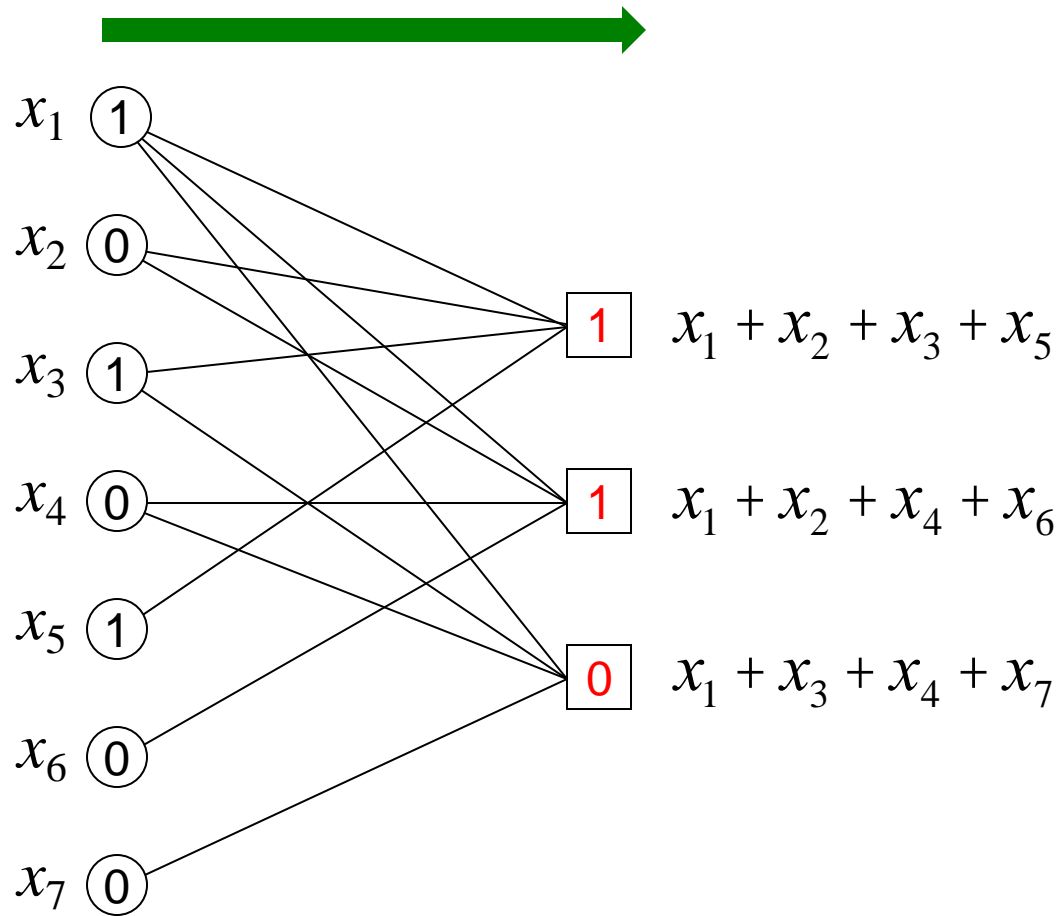
$$H = \begin{array}{c} \begin{matrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 & x_7 \end{matrix} \\ \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix} \end{array}$$
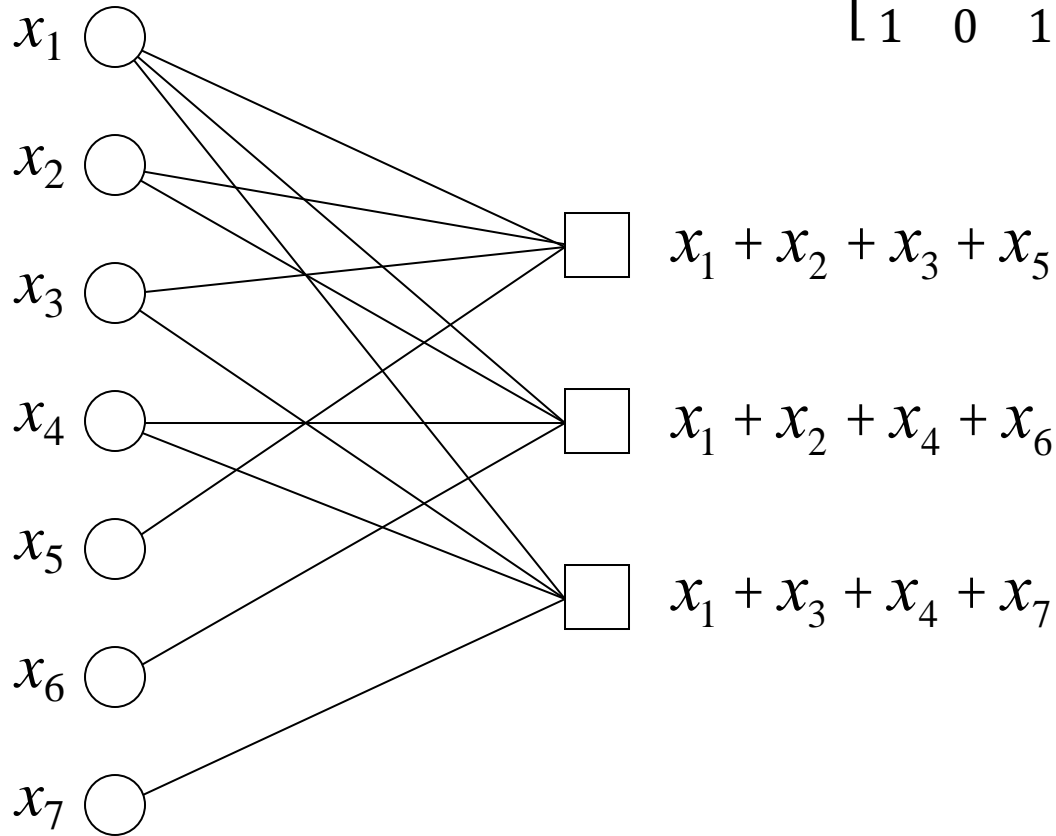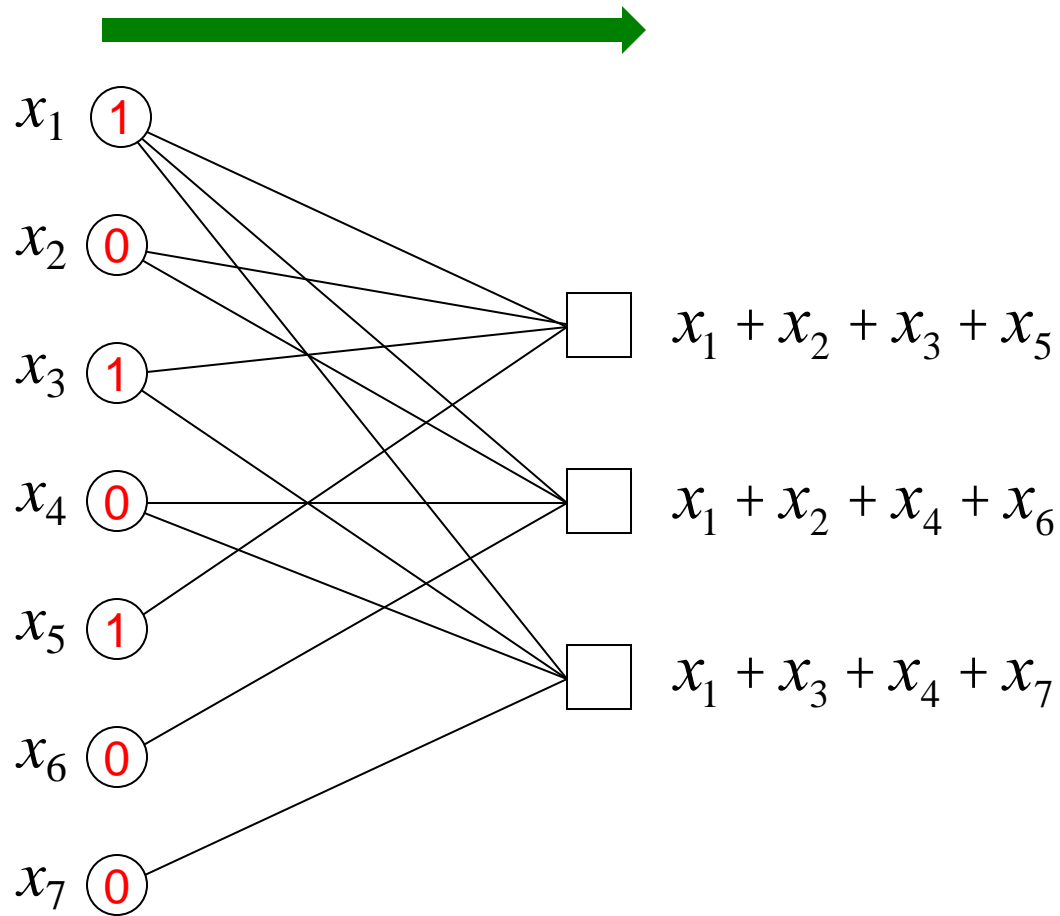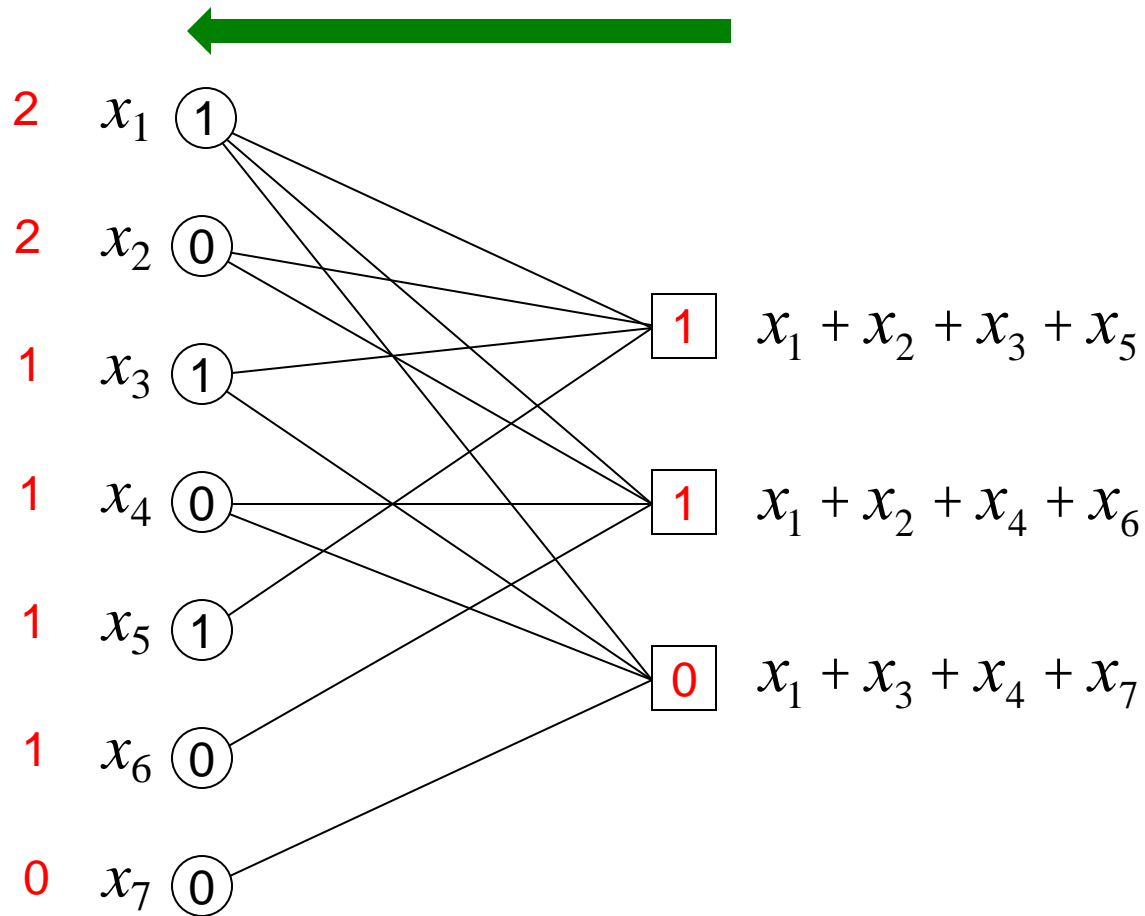
x_1

x_2

x_3

$x_1 + x_2 + x_3 + x_5$

x_4

$x_1 + x_2 + x_4 + x_6$

x_5

$x_1 + x_3 + x_4 + x_7$

x_6

x_7

Tanner graph

$x_1 + x_2 + x_3 + x_5$

$x_1 + x_2 + x_4 + x_6$

$x_1 + x_3 + x_4 + x_7$

Received word

x_1 (1)

x_2 (0)

x_3 (1)

x_4 (0)

x_5 (1)

x_6 (0)

x_7 (0)

1 $x_1 + x_2 + x_3 + x_5$

1 $x_1 + x_2 + x_4 + x_6$

0 $x_1 + x_3 + x_4 + x_7$

Compute checks

2	x_1 (1)	
2	x_2 (0)	
		1 $x_1 + x_2 + x_3 + x_5$
1	x_3 (1)	
1	x_4 (0)	1 $x_1 + x_2 + x_4 + x_6$
1	x_5 (1)	
		0 $x_1 + x_3 + x_4 + x_7$
1	x_6 (0)	
0	x_7 (0)	

Count number of unsatisfied checks for each code symbol

2 x_1 0

2 x_2 1

1 x_3 1

1 x_4 0

1 x_5 1

1 x_6 0

0 x_7 0

$x_1 + x_2 + x_3 + x_5$

$x_1 + x_2 + x_4 + x_6$

$x_1 + x_3 + x_4 + x_7$

Flip worst offenders

x_1 (0)

x_2 (1)

x_3 (1)

x_4 (0)

x_5 (1)

x_6 (0)

x_7 (0)

[1] $x_1 + x_2 + x_3 + x_5$

[1] $x_1 + x_2 + x_4 + x_6$

[1] $x_1 + x_3 + x_4 + x_7$

Recompute checks

3 $\quad x_1$ ⓪

2 $\quad x_2$ ①

2 $\quad x_3$ ①   ① $\quad x_1 + x_2 + x_3 + x_5$

2 $\quad x_4$ ⓪   ① $\quad x_1 + x_2 + x_4 + x_6$

1 $\quad x_5$ ①

   ① $\quad x_1 + x_3 + x_4 + x_7$

1 $\quad x_6$ ⓪

1 $\quad x_7$ ⓪

Count number of unsatisfied checks for each code symbol

3 x_1 ①

2 x_2 ①

2 x_3 ①

2 x_4 ⓪

1 x_5 ①

1 x_6 ⓪

1 x_7 ⓪

$x_1 + x_2 + x_3 + x_5$

$x_1 + x_2 + x_4 + x_6$

$x_1 + x_3 + x_4 + x_7$

Flip worst offenders

x_1 + x_2 + x_3 + x_5

x_1 + x_2 + x_4 + x_6

x_1 + x_3 + x_4 + x_7

Recompute checks

x_1 1
x_2 1
x_3 1
x_4 0
x_5 1
x_6 0
x_7 0

0 $x_1 + x_2 + x_3 + x_5$

0 $x_1 + x_2 + x_4 + x_6$

0 $x_1 + x_3 + x_4 + x_7$
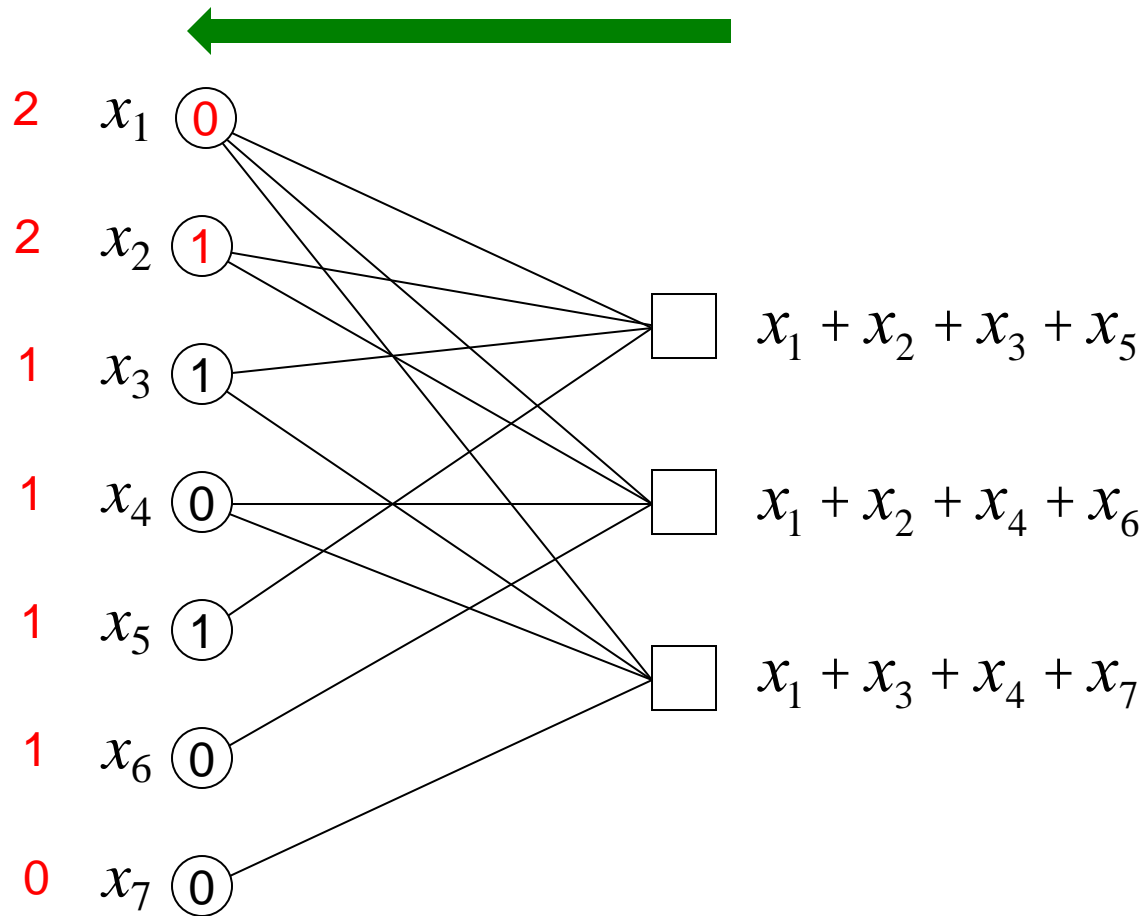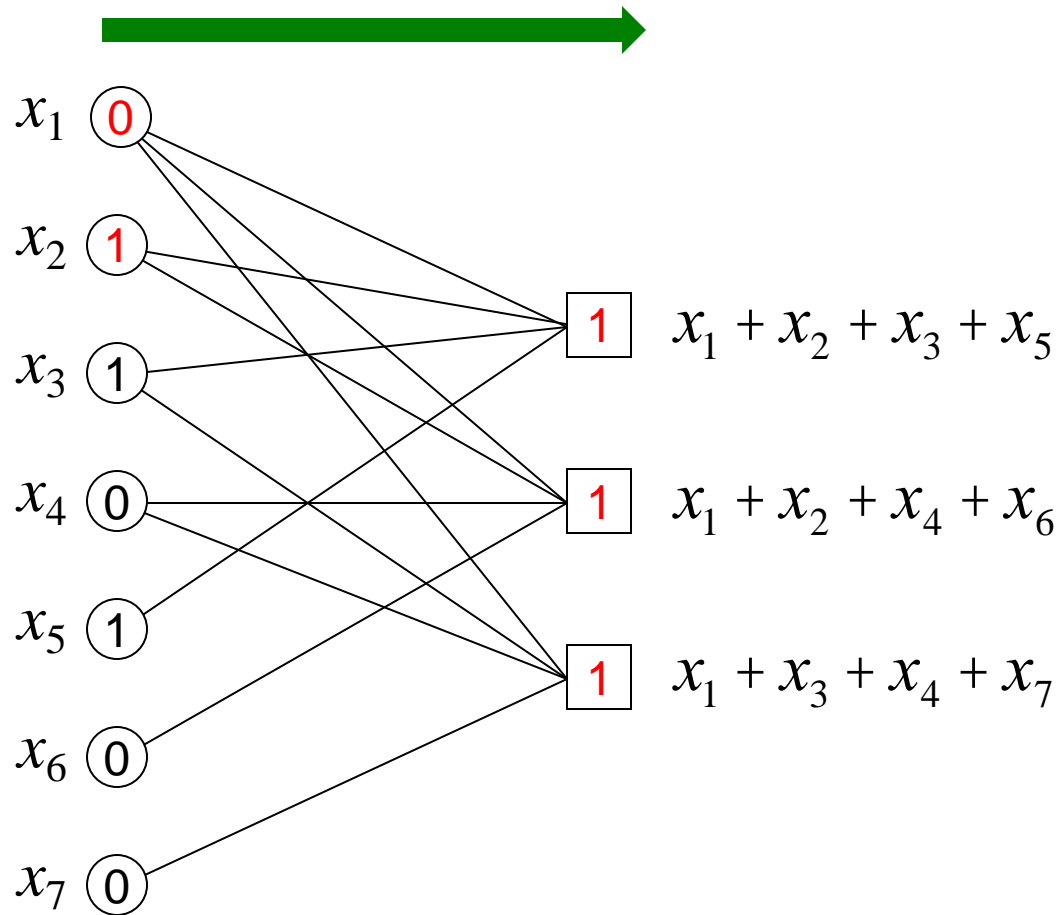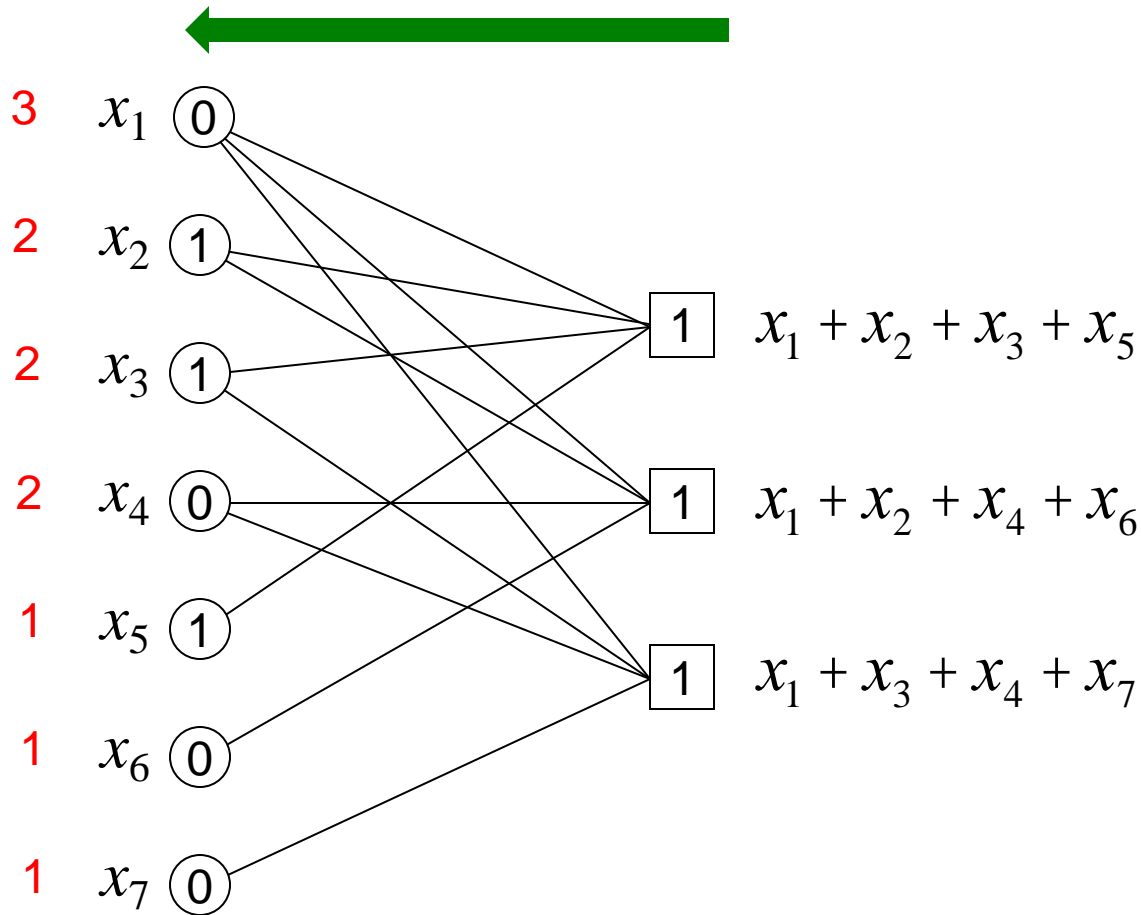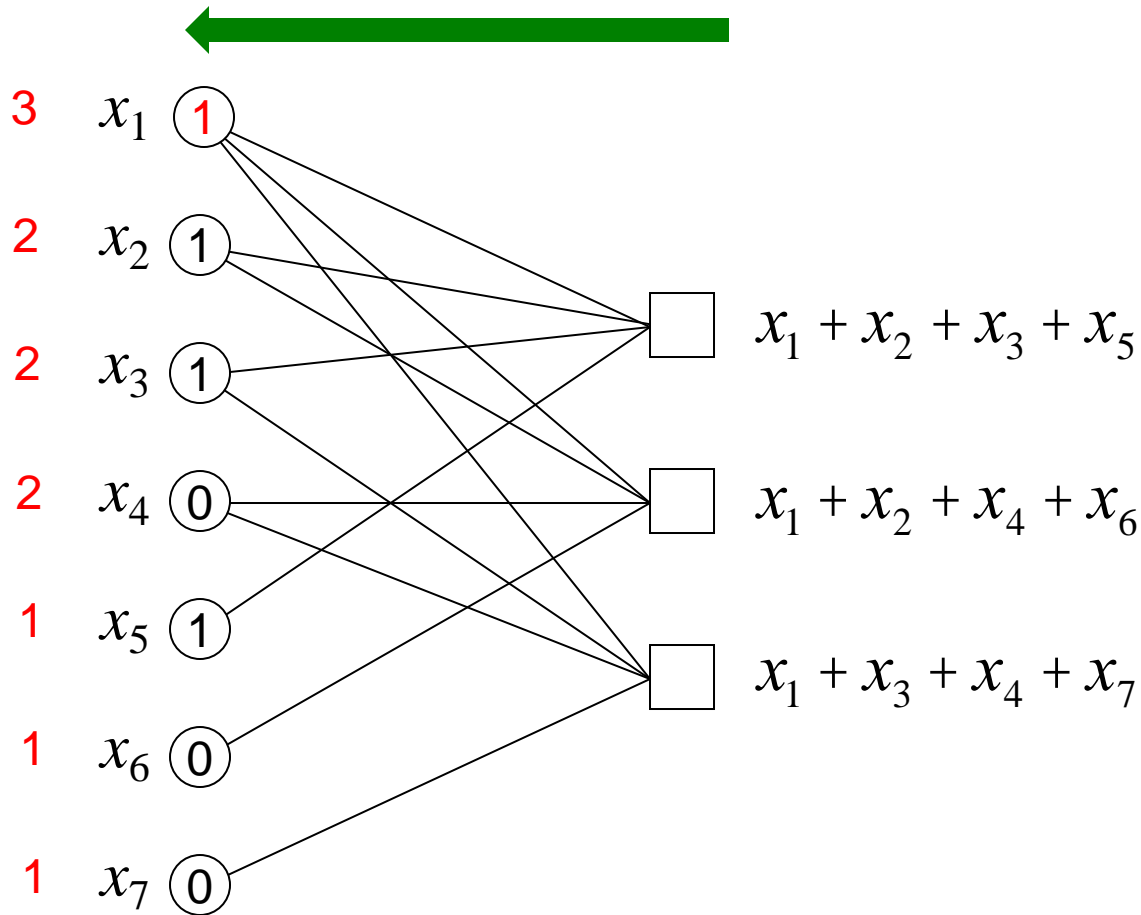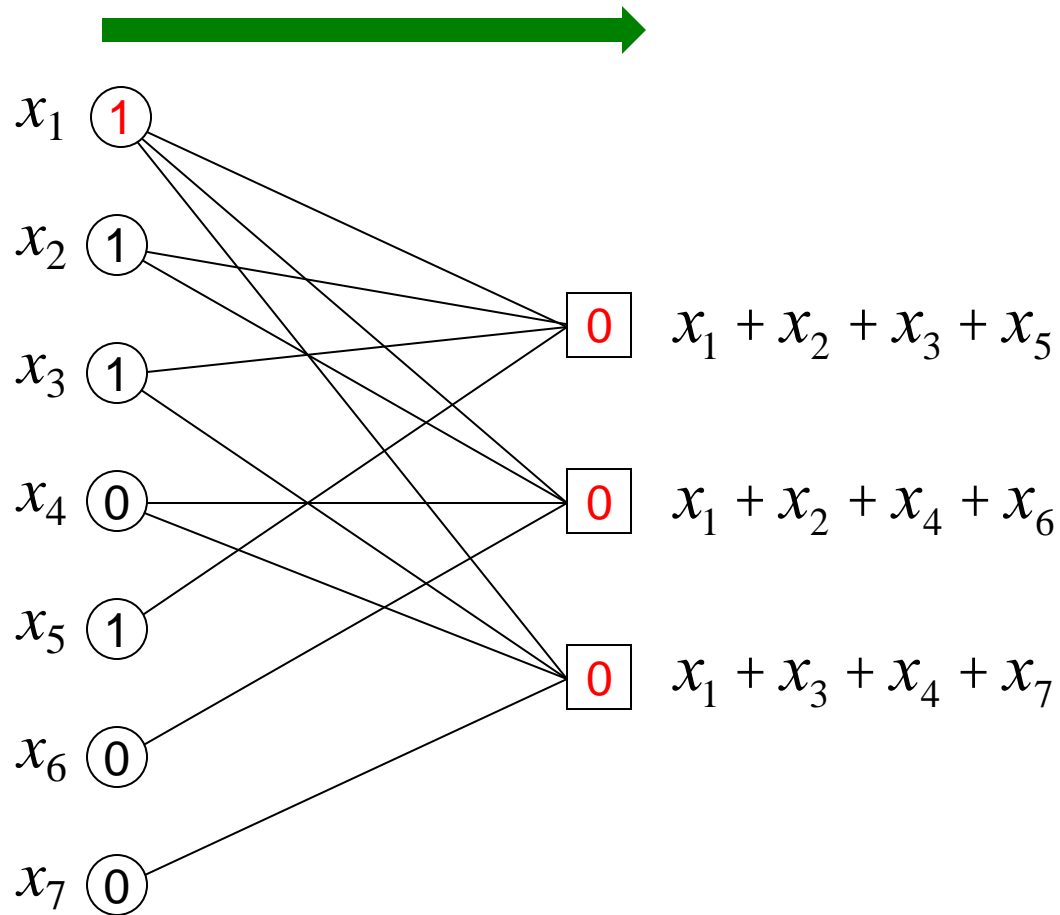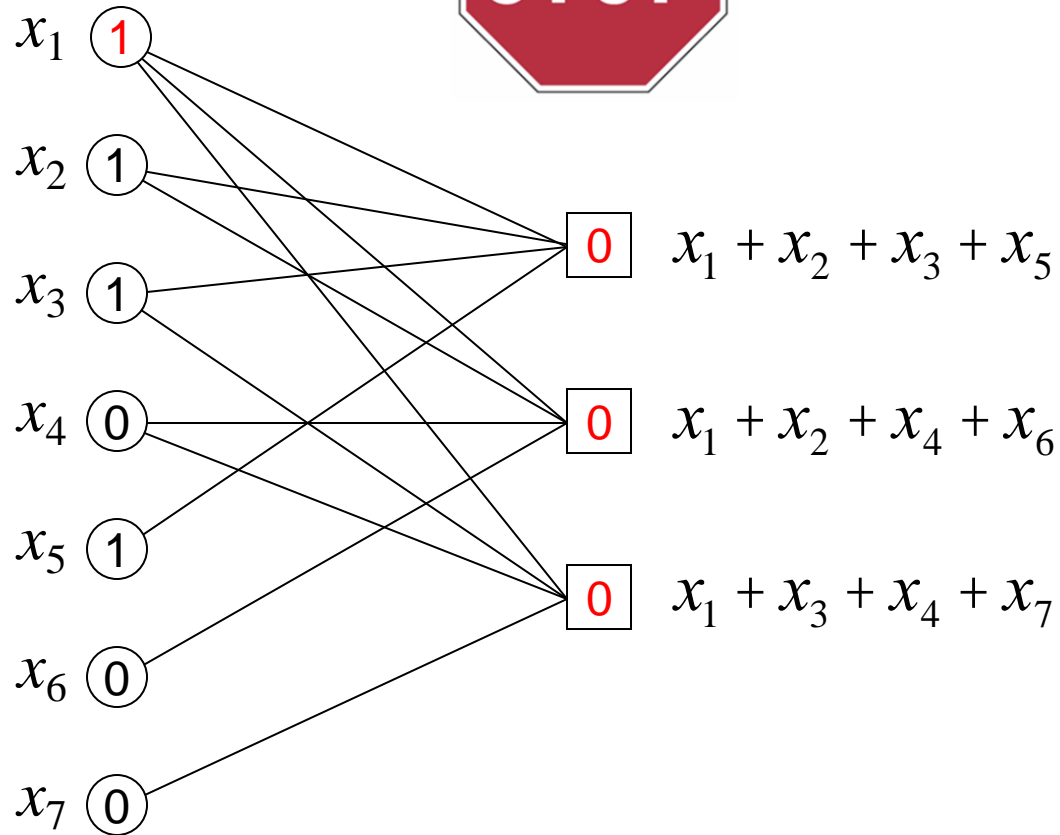
Stop when all checks satisfied