Karnaugh map

x_1	x_2	x_3	
0	1	0	$\Rightarrow \bar{x}_1 x_2$
0	1	1	

1 compliment this one

it changes so it is not needed

2 vars:

x_1	x_2	$f(x_1, x_2)$
0	0	m_0
0	1	m_1
1	0	m_2
1	1	m_3

x_2 \ x_1	0	1
0	m_0	m_2
1	m_1	m_3

x_1	x_2	f
0	0	1
0	1	1
1	0	0
1	1	1

$\Rightarrow f = x_2 + \bar{x}_1$

x_1	x_2	x_3
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

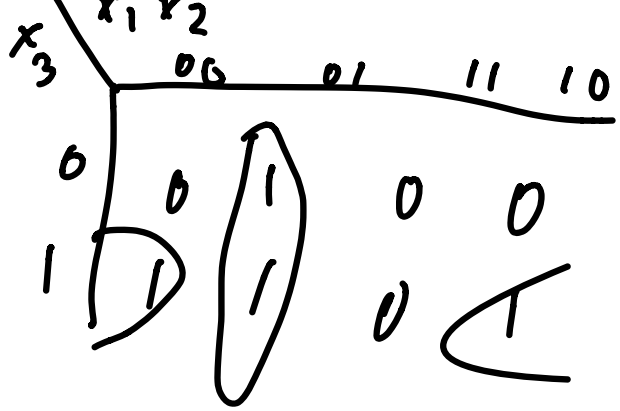
3 vars:

x_3 \ x_1x_2	00	01	11	10
0	m_0	m_2	m_7	m_4
1	m_1	m_3	m_6	m_5

Can combine $2, 4, 8 \ldots$ 2^x adj cells

Group rect area: 2^x

$1 \sim 2$
$2 \sim 1$
$2 \sim 3$



$f = !x_1x_2 + !x_2x_3$

1 · 4
4 − 1
...

4 vars:

x_3x_4 \ x_1x_2	00	01	11	10
00	m_0	m_4	m_{12}	m_8
01	m_1	m_5	m_{13}	m_9
11	m_3	m_7	m_{15}	m_{11}
10	m_2	m_6	m_{14}	m_{10}

x_1 (11, 10); x_4 (01, 11); x_3 (11); x_2 (01, 11)

5 vars:

x_3x_4 \ x_1x_2	00	01	11	10
00	m_0	m_8	m_{24}	m_{16}
01	m_2	m_{10}	m_{26}	m_{18}
11	m_6	m_{14}	m_{30}	m_{22}
10	m_4	m_{12}	m_{28}	m_{20}

x_3x_4 \ x_1x_2	00	01	11	10
00	m_1	m_9	m_{25}	m_{17}
01	m_3	m_{11}	m_{27}	m_{19}
11	m_7	m_{15}	m_{31}	m_{23}
10	m_5	m_{13}	m_{29}	m_{21}

10	m_4	m_{12}	m_{28}	m_{20}

$x_5 = 0$

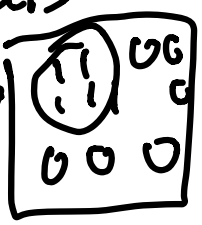
10	m_5	m_{13}	m_{29}	m_{21}

$x_5 = 1$

Literal - unique variable

Implicant - possible sets of 1s:

- minterms ($f_{02} \sum m(1, 2, 5) = 3$)
- all possible k-map sets
- f_{02} maps: 1×4



Prime Implicant - the largest rectangle in k-map:

- $!x_1$ (if k-map has x vars, all exp with x-1 or less are pure implicants)
- $x_2 x_3$

Cover - collection of all possible implicants that create a logically equivalent exp

- each 1 individually

$!x_1 x_2 + !x x_2 + x_2 x_3$ (2×4 groups)

$!x + x_2 x_3$ ($2 \times 2 + 2 \times 1$ groups)

- ...

Minimum cost circuit is the cover of a given function that consists of the prime implicants

Essential prime implicants - p.i. that includes a minterm not included in any other p.i.

Min SOP or POS:

find essential p.i.

chose one non essential p.i.

finish the cover

chose a different n.e. p.i.

finish the cover

compare the cost