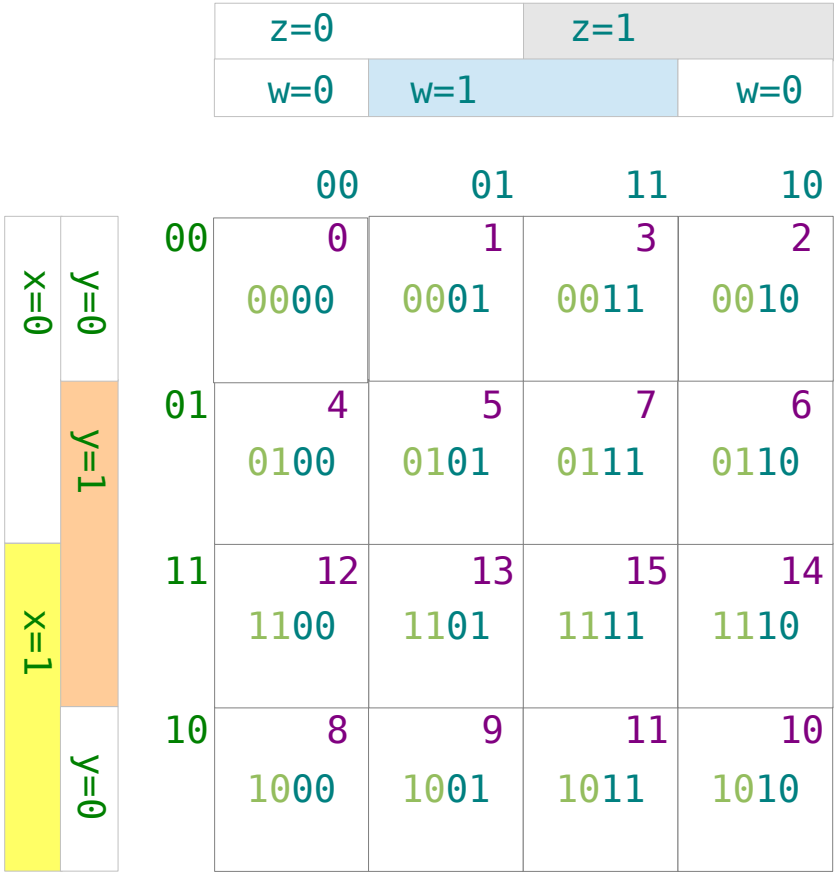
K-Map (2B)

Please send corrections (or suggestions) to youngwlim@hotmail.com.

This document was produced by using OpenOffice and Octave.

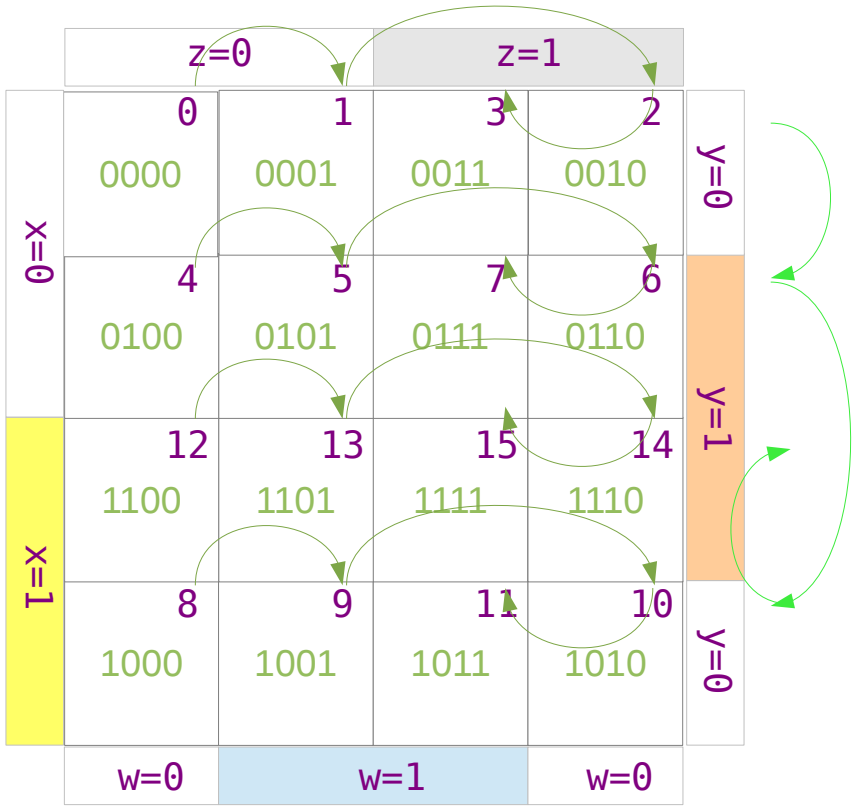
K-Map 4 variables (1)

index					minterms
0	0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}\,\bar{w}$
1	0	0	0	1	$\bar{x}\,\bar{y}\,\bar{z}\,w$
2	0	0	1	0	$\bar{x}\,\bar{y}\,z\,\bar{w}$
3	0	0	1	1	$\bar{x}\,\bar{y}\,z\,w$
4	0	1	0	0	$\bar{x}\,y\,\bar{z}\,\bar{w}$
5	0	1	0	1	$\bar{x}\,y\,\bar{z}\,w$
6	0	1	1	0	$\bar{x}\,y\,z\,\bar{w}$
7	0	1	1	1	$\bar{x}\,y\,z\,w$
8	1	0	0	0	$x\,\bar{y}\,\bar{z}\,\bar{w}$
9	1	0	0	1	$x\,\bar{y}\,\bar{z}\,w$
10	1	0	1	0	$x\,\bar{y}\,z\,\bar{w}$
11	1	0	1	1	$x\,\bar{y}\,z\,w$
12	1	1	0	0	$x\,y\,\bar{z}\,\bar{w}$
13	1	1	0	1	$x\,y\,\bar{z}\,w$
14	1	1	1	0	$x\,y\,z\,\bar{w}$
15	1	1	1	1	$x\,y\,z\,w$



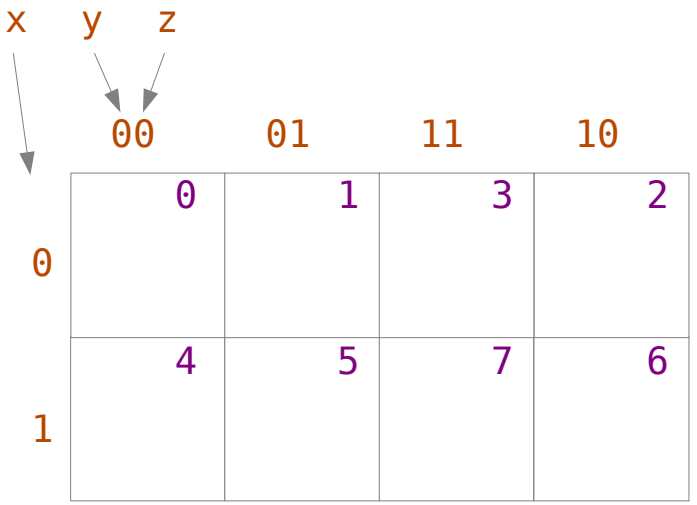
K-Map 4 variables (2)

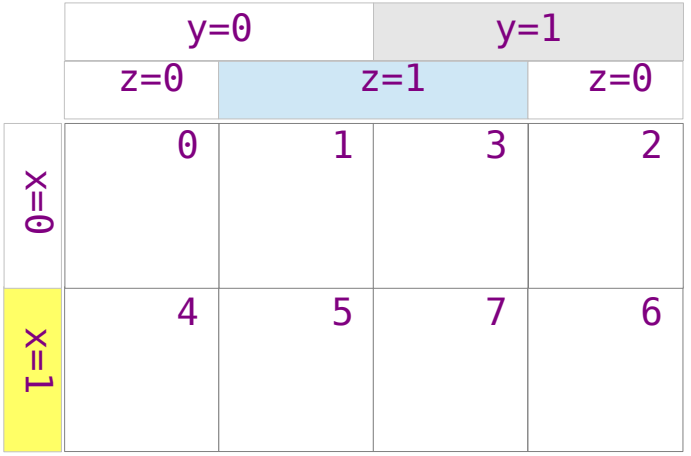
index					minterms
0	0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}\,\bar{w}$
1	0	0	0	1	$\bar{x}\,\bar{y}\,\bar{z}\,w$
2	0	0	1	0	$\bar{x}\,\bar{y}\,z\,\bar{w}$
3	0	0	1	1	$\bar{x}\,\bar{y}\,z\,w$
4	0	1	0	0	$\bar{x}\,y\,\bar{z}\,\bar{w}$
5	0	1	0	1	$\bar{x}\,y\,\bar{z}\,w$
6	0	1	1	0	$\bar{x}\,y\,z\,\bar{w}$
7	0	1	1	1	$\bar{x}\,y\,z\,w$
8	1	0	0	0	$x\,\bar{y}\,\bar{z}\,\bar{w}$
9	1	0	0	1	$x\,\bar{y}\,\bar{z}\,w$
10	1	0	1	0	$x\,\bar{y}\,z\,\bar{w}$
11	1	0	1	1	$x\,\bar{y}\,z\,w$
12	1	1	0	0	$x\,y\,\bar{z}\,\bar{w}$
13	1	1	0	1	$x\,y\,\bar{z}\,w$
14	1	1	1	0	$x\,y\,z\,\bar{w}$
15	1	1	1	1	$x\,y\,z\,w$



K-Map 3 variables (1)

index				minterms
0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}$
1	0	0	1	$\bar{x}\,\bar{y}\,z$
2	0	1	0	$\bar{x}\,y\,\bar{z}$
3	0	1	1	$\bar{x}\,y\,z$
4	1	0	0	$x\,\bar{y}\,\bar{z}$
5	1	0	1	$x\,\bar{y}\,z$
6	1	1	0	$x\,y\,\bar{z}$
7	1	1	1	$x\,y\,z$



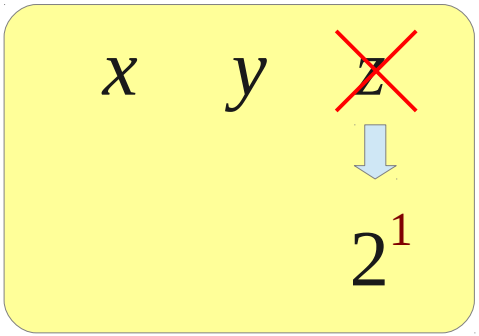


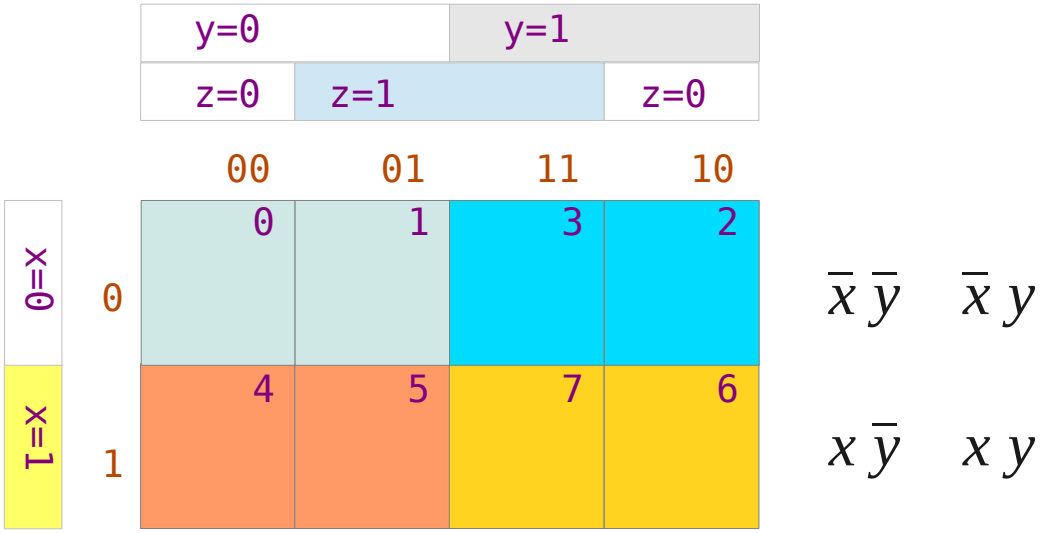
K-Map 3 variables (2)

index				minterms	
0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}$	$\bar{x}\,\bar{y}$
1	0	0	1	$\bar{x}\,\bar{y}\,z$	
2	0	1	0	$\bar{x}\,y\,\bar{z}$	$\bar{x}\,y$
3	0	1	1	$\bar{x}\,y\,z$	
4	1	0	0	$x\,\bar{y}\,\bar{z}$	$x\,\bar{y}$
5	1	0	1	$x\,\bar{y}\,z$	
6	1	1	0	$x\,y\,\bar{z}$	$x\,y$
7	1	1	1	$x\,y\,z$	

$$\bar{x}\,\bar{y}\,\bar{z} + \bar{x}\,\bar{y}\,z = \bar{x}\,\bar{y}(\bar{z}+z) = \bar{x}\,\bar{y}$$

a group of 2 minterms





$\bar{x}\,\bar{y}$ $\bar{x}\,y$

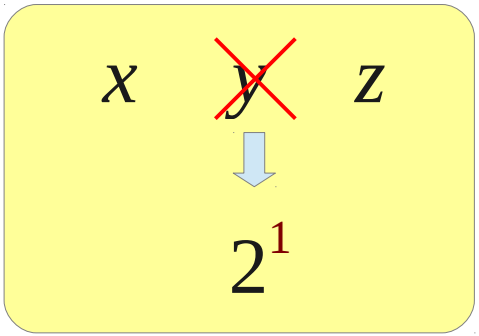
$x\,\bar{y}$ $x\,y$

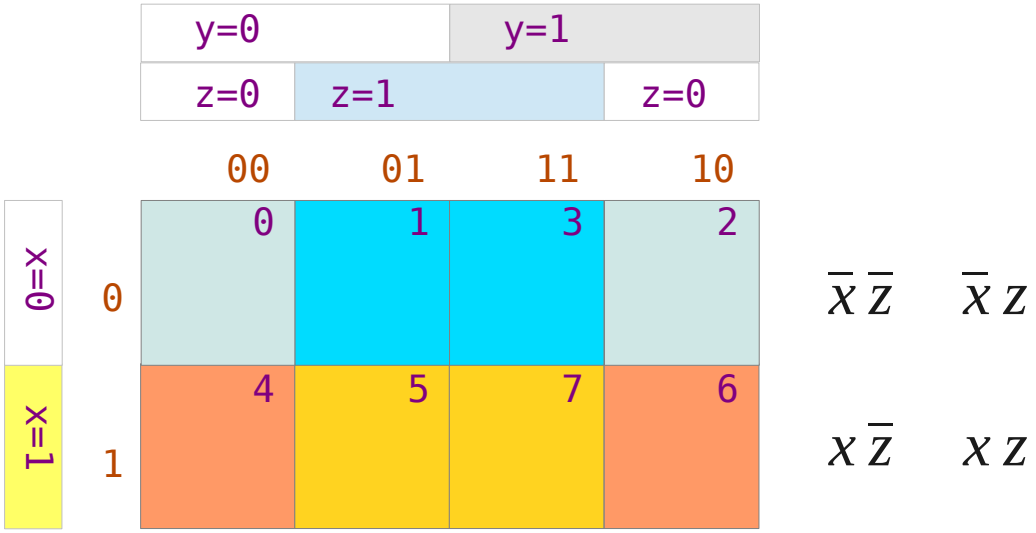
K-Map 3 variables (3)

index				minterms	
0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}$	$\bar{x}\,\bar{z}$
1	0	0	1	$\bar{x}\,\bar{y}\,z$	$\bar{x}\,z$
2	0	1	0	$\bar{x}\,y\,\bar{z}$	
3	0	1	1	$\bar{x}\,y\,z$	
4	1	0	0	$x\,\bar{y}\,\bar{z}$	$x\,\bar{z}$
5	1	0	1	$x\,\bar{y}\,z$	$x\,z$
6	1	1	0	$x\,y\,\bar{z}$	
7	1	1	1	$x\,y\,z$	

$$\bar{x}\,\bar{y}\,\bar{z} + \bar{x}\,y\,\bar{z} = \bar{x}\,\bar{z}(\bar{y}+y) = \bar{x}\,\bar{z}$$

a group of 2 minterms



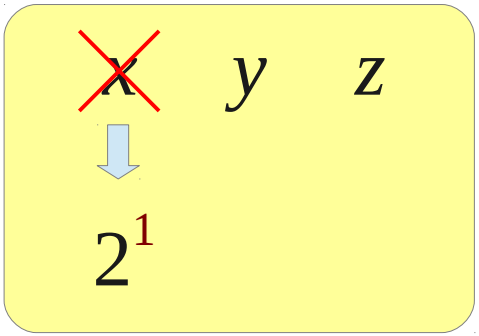


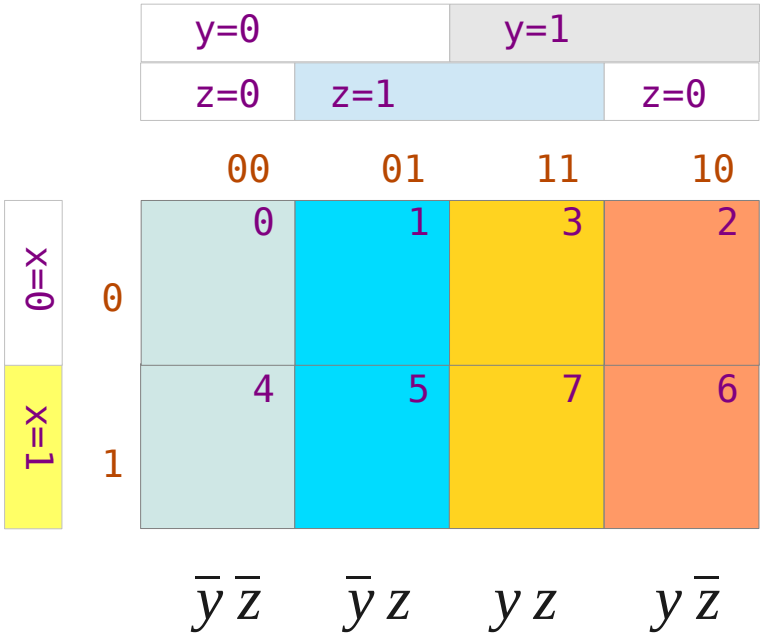
K-Map 3 variables (4)

index				minterms	
0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}$	$\bar{y}\,\bar{z}$
1	0	0	1	$\bar{x}\,\bar{y}\,z$	$\bar{y}\,z$
2	0	1	0	$\bar{x}\,y\,\bar{z}$	$y\,\bar{z}$
3	0	1	1	$\bar{x}\,y\,z$	$y\,z$
4	1	0	0	$x\,\bar{y}\,\bar{z}$	
5	1	0	1	$x\,\bar{y}\,z$	
6	1	1	0	$x\,y\,\bar{z}$	
7	1	1	1	$x\,y\,z$	

$$\bar{x}\,\bar{y}\,\bar{z} + x\,\bar{y}\,\bar{z} = \bar{y}\,\bar{z}(\bar{x}+x) = \bar{y}\,\bar{z}$$

a group of 2 minterms

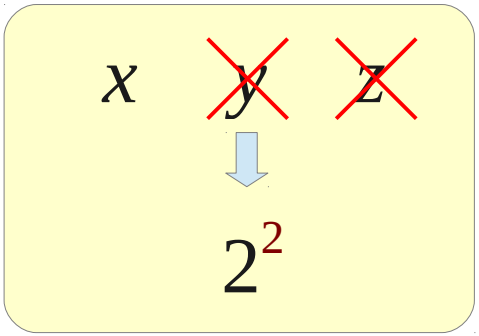


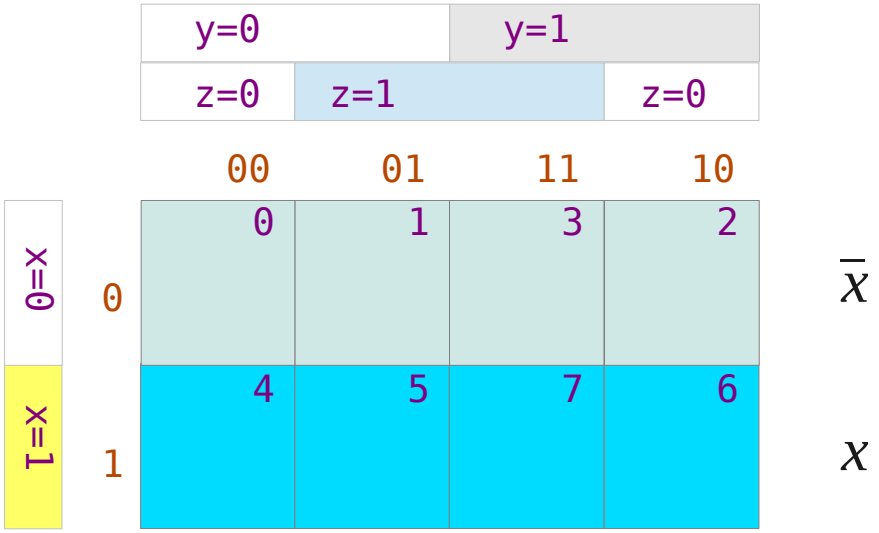


K-Map 3 variables (5)

index		minterms	
0	0 0 0	$\bar{x}\,\bar{y}\,\bar{z}$	$\bar{x}$
1	0 0 1	$\bar{x}\,\bar{y}\,z$	
2	0 1 0	$\bar{x}\,y\,\bar{z}$	
3	0 1 1	$\bar{x}\,y\,z$	
4	1 0 0	$x\,\bar{y}\,\bar{z}$	x
5	1 0 1	$x\,\bar{y}\,z$	
6	1 1 0	$x\,y\,\bar{z}$	
7	1 1 1	$x\,y\,z$	

a group of 4 minterms

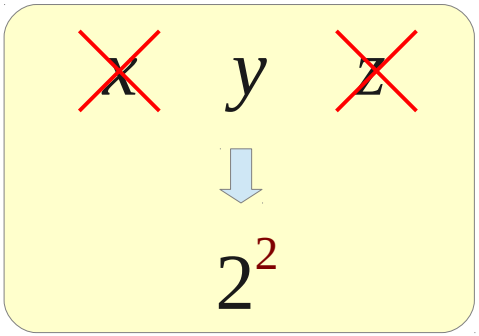


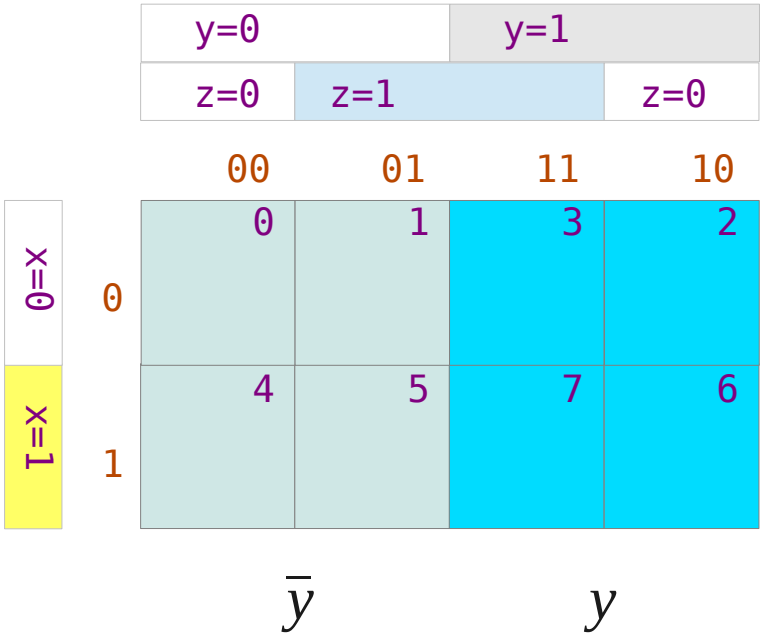


K-Map 3 variables (5)

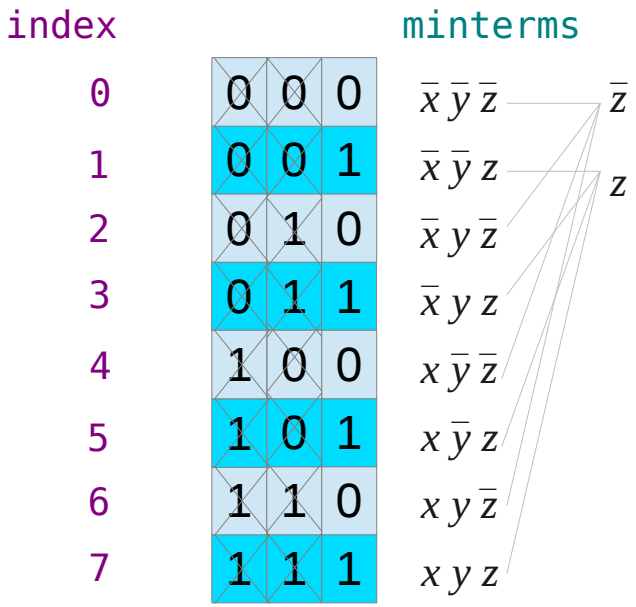
index				minterms	
0	0	0	0	$\bar{x}\,\bar{y}\,\bar{z}$	$\bar{y}$
1	0	0	1	$\bar{x}\,\bar{y}\,z$	
2	0	1	0	$\bar{x}\,y\,\bar{z}$	y
3	0	1	1	$\bar{x}\,y\,z$	
4	1	0	0	$x\,\bar{y}\,\bar{z}$	
5	1	0	1	$x\,\bar{y}\,z$	
6	1	1	0	$x\,y\,\bar{z}$	
7	1	1	1	$x\,y\,z$	

a group of 4 minterms

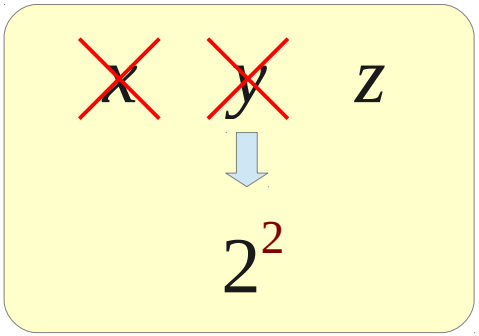


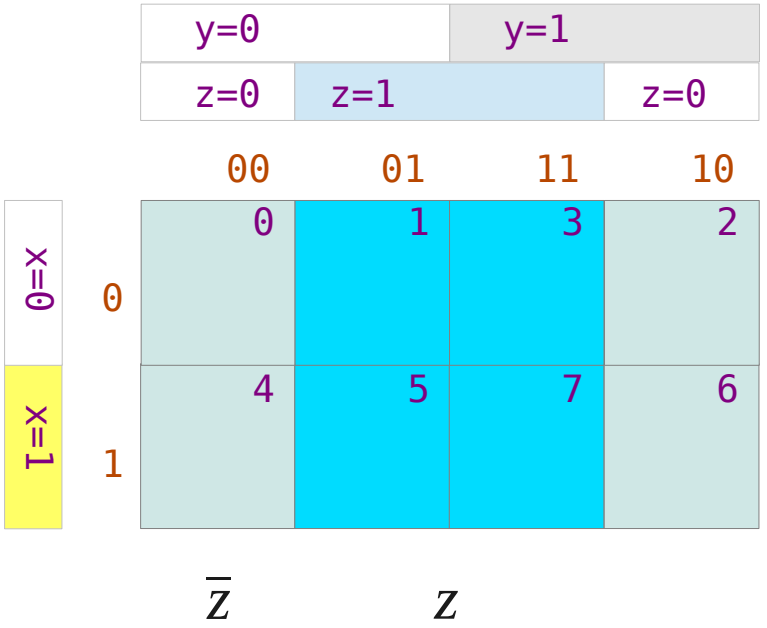


K-Map 3 variables (5)



a group of 4 minterms





Implicant

F takes the value 1, whenever P equals 1

implies

$$P \Rightarrow F$$

assuming *P* is a product term in a sum of products

$$f(x,y,z,w) = xy + yz + w$$

general, reduced

$(x=1,\ y=1)$ $\quad xy \Rightarrow f(x,y,z,w) = xy + yz + w$

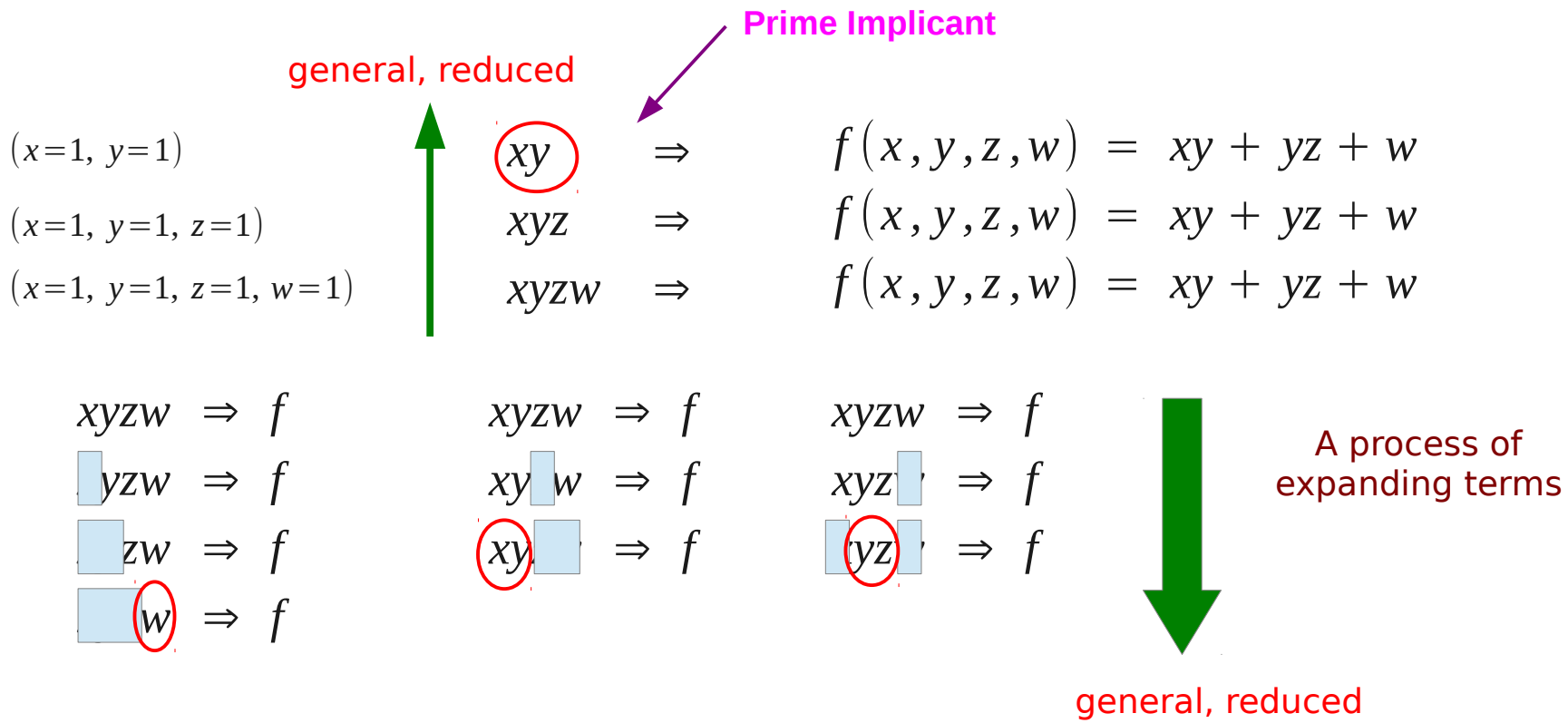
$(x=1,\ y=1,\ z=1)$ $\quad xyz \Rightarrow f(x,y,z,w) = xy + yz + w$

$(x=1,\ y=1,\ z=1,\ w=1)$ $\quad xyzw \Rightarrow f(x,y,z,w) = xy + yz + w$

Prime Implicant

Prime Implicant: An implicant that is minimal

The removal of any literal from P results in a non-implicant for F



Expanding Terms

$xyzw \Rightarrow f$

$\square yzw \Rightarrow f$

$\square\, zw \Rightarrow f$

$\square\, w \Rightarrow f$

$xyzw \Rightarrow f$

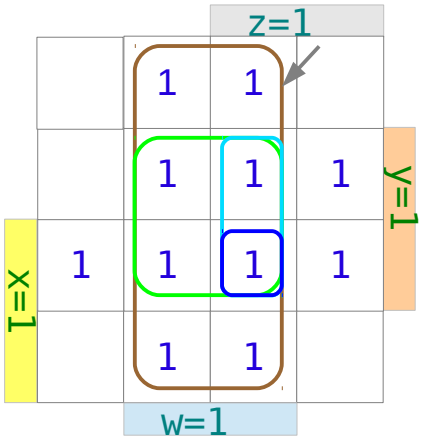
$xy\,\square\, w \Rightarrow f$

$xy\,\square\, \Rightarrow f$

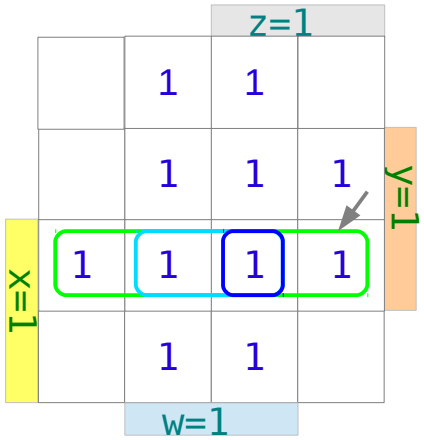
$xyzw \Rightarrow f$

$xyz\,\square\, \Rightarrow f$

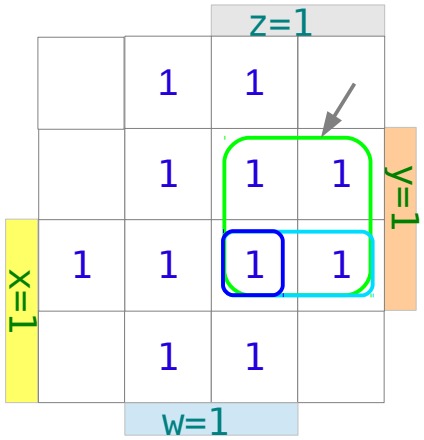
$\square yz\,\square\, \Rightarrow f$



Prime Implicant

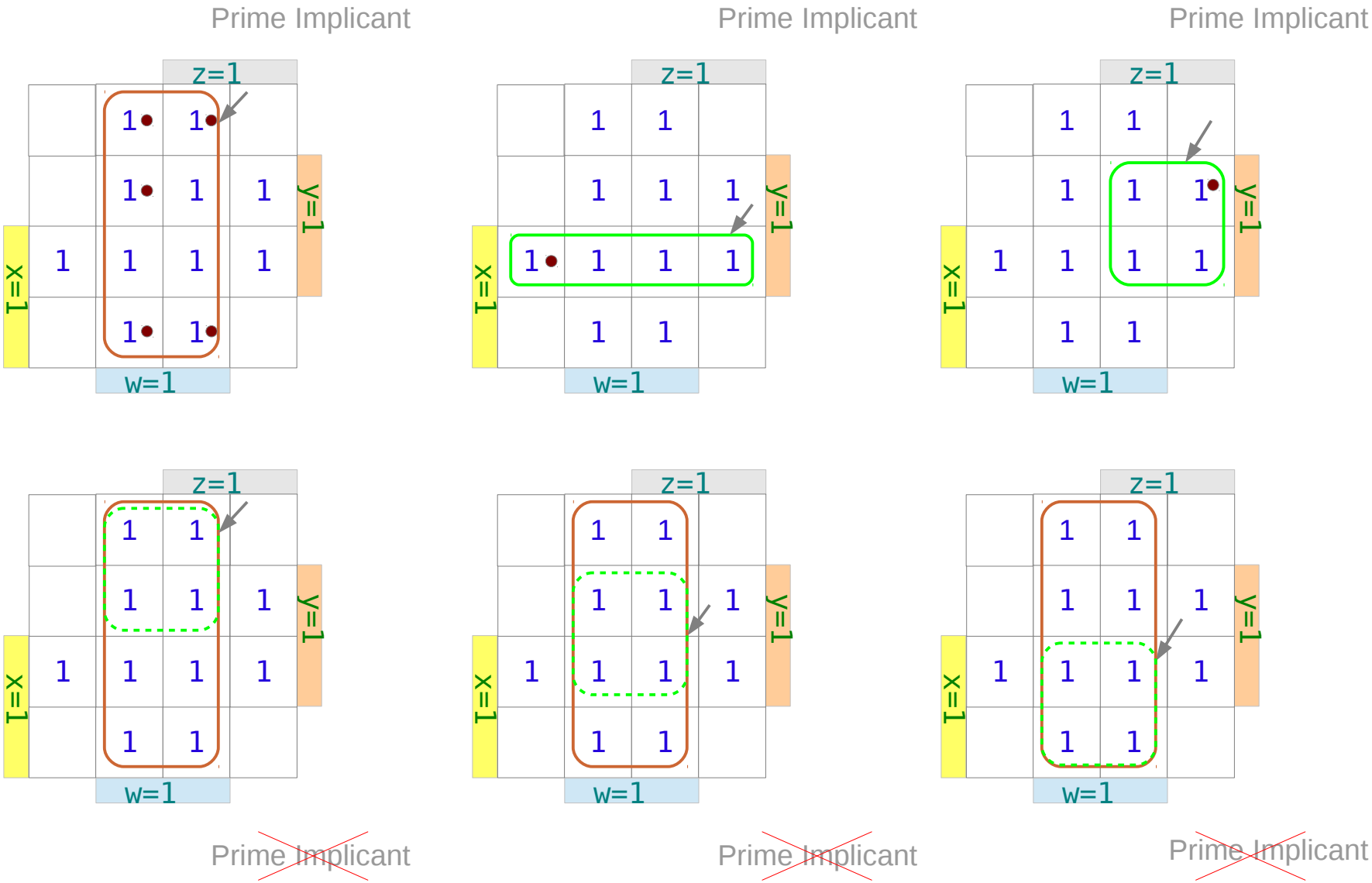


Prime Implicant



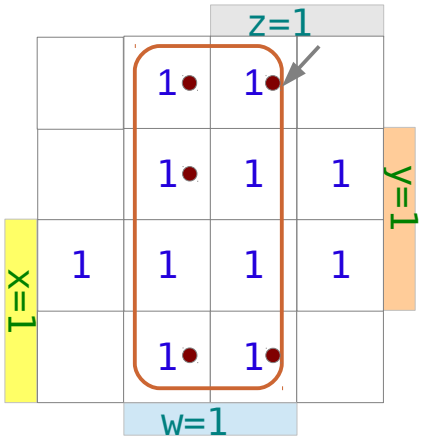
Prime Implicant

Prime Implicant Example

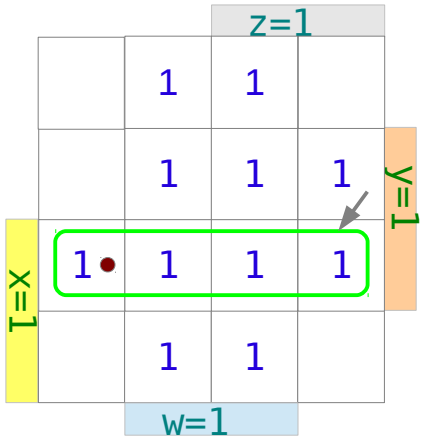


Essential Prime Implicant

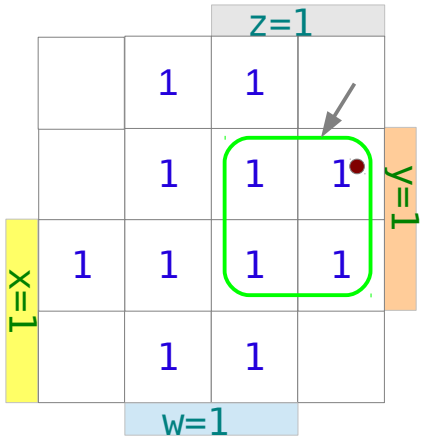
Essential Prime Implicant:
prime implicants
that cover an *output of the function*
that no combination of other implicants is able to cover



Essential Prime Implicant



Essential Prime Implicant



Essential Prime Implicant

Implicant

F takes the value 1, whenever P equals 1

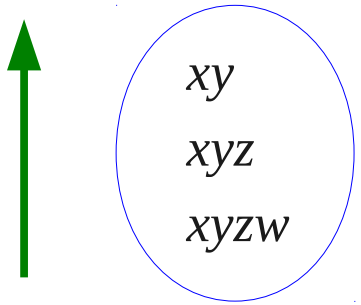
implies

$$P \Rightarrow F$$

assuming *P* is a product term in a sum of products

$$f(x,y,z,w) = xy + yz + w$$

General, Reduced



$$xy \Rightarrow f(x,y,z,w) = xy + yz + w$$
$$xyz \Rightarrow f(x,y,z,w) = xy + yz + w$$
$$xyzw \Rightarrow f(x,y,z,w) = xy + yz + w$$

implicants

2's Complement

Decimal to Binary (1)

Decimal to Binary (2)

Laplace Equation

Decimal

Laplace Equation

Laplace Equation

References

[1] http://en.wikipedia.org/
[2] http://planetmath.org/
[3] M.L. Boas, “Mathematical Methods in the Physical Sciences”