Four Variable K-map (SOP)

	$\bar y \bar z$	$\bar y z$	$y z$	$y \bar z$
$\bar w \bar x$	0000 0	0001 1	0011 3	0010 2
$\bar w x$	0100 4	0101 5	0111 7	0110 6
$w x$	1100 12	1101 13	1111 15	1110 14
$w \bar x$	1000 8	1001 9	1011 11	1010 10

Exercise ① (SOP example) SOP: sum of the products

Simplify the following expression using K-map.

$$f = \bar w x y z + \bar w x y \bar z + w x y z + w x y \bar z$$

Sol:

	$\bar y \bar z$	$\bar y z$	$y z$	$y \bar z$
$\bar w \bar x$	0	0	0	0
$\bar w x$	0	0	1	1
$w x$	0	0	1	1
$w \bar x$	0	0	0	0

→ Prime Implicant

The simplified version 'f'.

on wx axis the cells are '1' whether or not w is one and always when 'x' is 1 (w not needed)

on yz axis the cells are 1 whether or not z is one and always 'y' is '1' (z not needed)

$$f = xy.$$

Exercise ② (SOP example) :

Simplify expression $f = \Sigma m(4, 6, 12, 14)$

Sol:

	$\bar y \bar z$	$\bar y z$	$y z$	$y \bar z$
$\bar w \bar x$	0	0	0	0
$\bar w x$	1	0	0	1
$w x$	1	0	0	1
$w \bar x$	0	0	0	0

→ Prime Implicant

on wx-axis the cells are '1' whether or not w is one and x is alway 'one'

on yz-axis the cells are '1' whether or not y is one and always z is zero.

The simplified expression f.

$$f = x \bar z$$

Exercise: (POS → K map) (∵ POS k-map procedure same except we map 0's)

	$y+z$	$y+\bar{z}$	$\bar{y}+\bar{z}$	$\bar{y}+z$
$w+x$	0000 (0)	0001 (1)	0011 (3)	0010 (2)
$w+\bar{x}$	0100 (4)	0101 (5)	0111 (7)	0110 (6)
$\bar{w}+\bar{x}$	1100 (12)	1101 (13)	1111 (15)	1110 (14)
$\bar{w}+x$	1000 (8)	1001 (9)	1011 (11)	1010 (10)

We find prime implicants exactly same way — except that we look for variable the produces ~~zero~~ 0's.

ex: Simply the following expression.

$$f = (\bar{w}+\bar{x}+\bar{y}+\bar{z}).(\bar{w}+\bar{x}+\bar{y}+z).(\bar{w}+x+\bar{y}+\bar{z}).(\bar{w}+x+\bar{y}+z)$$

	$y+z$	$y+\bar{z}$	$\bar{y}+\bar{z}$	$\bar{y}+z$
$w+x$				
$w+\bar{x}$				
$\bar{w}+\bar{x}$			0	0
$\bar{w}+x$			0	0

→ prime implicat

The simplified expression

$$f=(\bar{w}+\bar{y})$$

In wx-axis the cells are ~~zero~~ '0' whether x is ~~zero~~ zero or one and w is always '0'. ∴ $\bar{w}$

In yz-axis the cells are ~~zero~~ '0' whether y is always zero and z is whether zero or one. ∴ $\bar{y}$

$$f = \bar{w}+\bar{y}$$