

Engaged Learning Practice #3

The K-Map

Practice #1: Finding Prime Implicants using K-Map

Find the prime implicants of the Boolean function

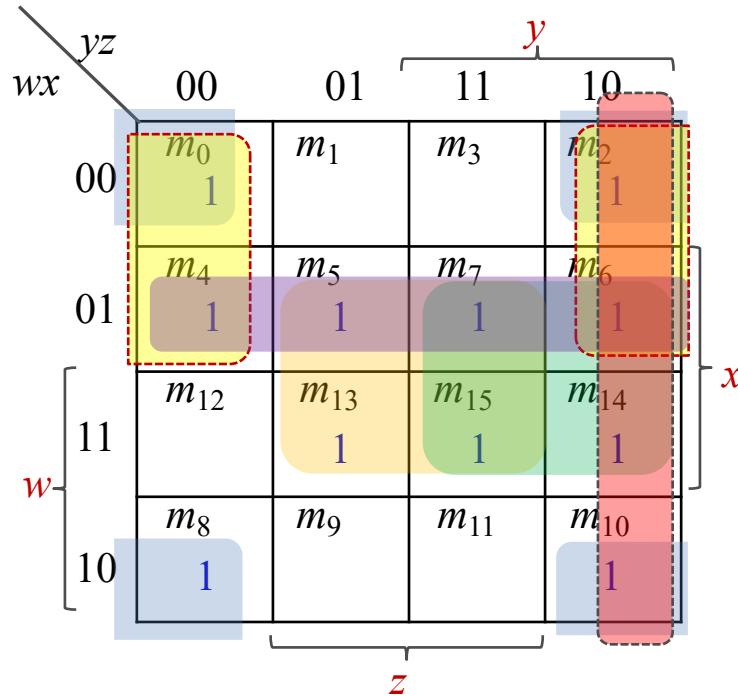
$$F(w, x, y, z) = \Sigma(0, 2, 4, 5, 6, 7, 8, 10, 13, 14, 15).$$

Solution to Practice #1

From the Boolean function given,

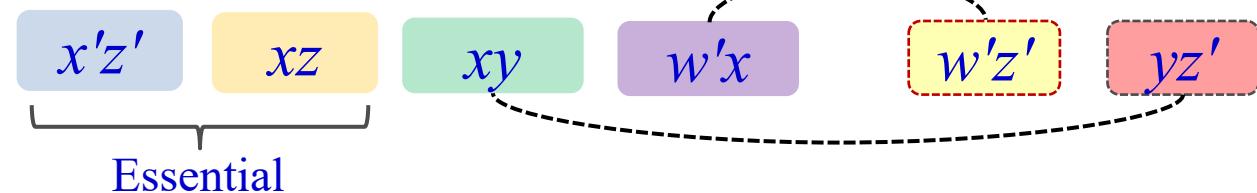
$$F(w, x, y, z) = \Sigma(0, 2, 4, 5, 6, 7, 8, 10, 13, 14, 15)$$

we draw the K-map as follow:



주항: 맵에서 인접한 네모 칸을 최대로 묶을 때 생기는 곱의 항을 의미

From the K-map, we can find the **prime implicants** of the Boolean function as follows:



The simplified expression is obtained from the logical sum of the two essential prime implicants and any two prime implicants that cover minterms m_4 , m_6 , and m_{14} .

$$\begin{aligned} F(w, x, y, z) &= x'z' + xz + xy + w'x \\ &= x'z' + xz + xy + w'z' \\ &= x'z' + xz + yz' + w'z' \\ &= x'z' + xz + yz' + w'x \end{aligned}$$

Practice #2: Simplification & Truth Table with K-Map

2-1. Simplify the Boolean function

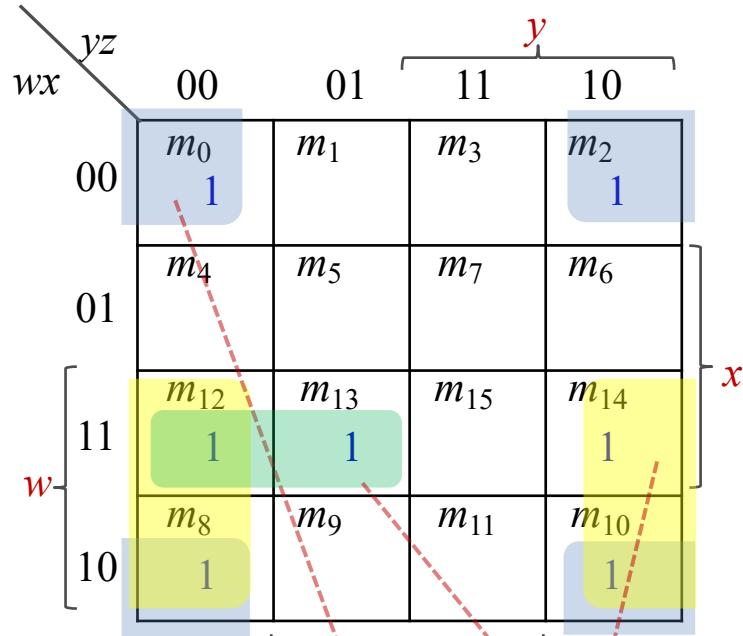
$$F(w, x, y, z) = \Sigma(0, 2, 8, 10, 12, 13, 14)$$

into (a) sum-of-products form and (b) product-of-sums form.

2-2. Derive the truth table of F .

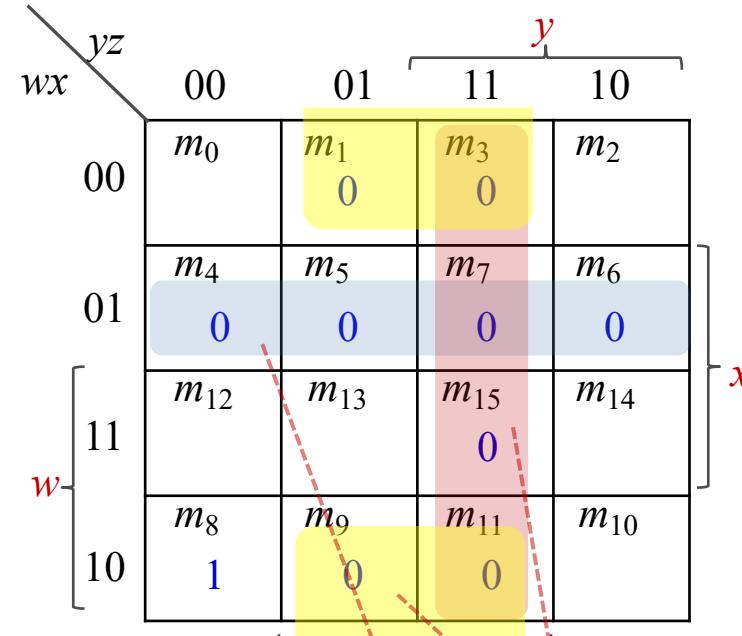
Solution to Practice #2

$$F(w, x, y, z) = \Sigma(0, 2, 8, 10, 12, 13, 14)$$



2-1(a) Sum-of-products form

$$F(w, x, y, z) = x'z' + wz' + wxy'$$



2-1(b) Product-of-sums form

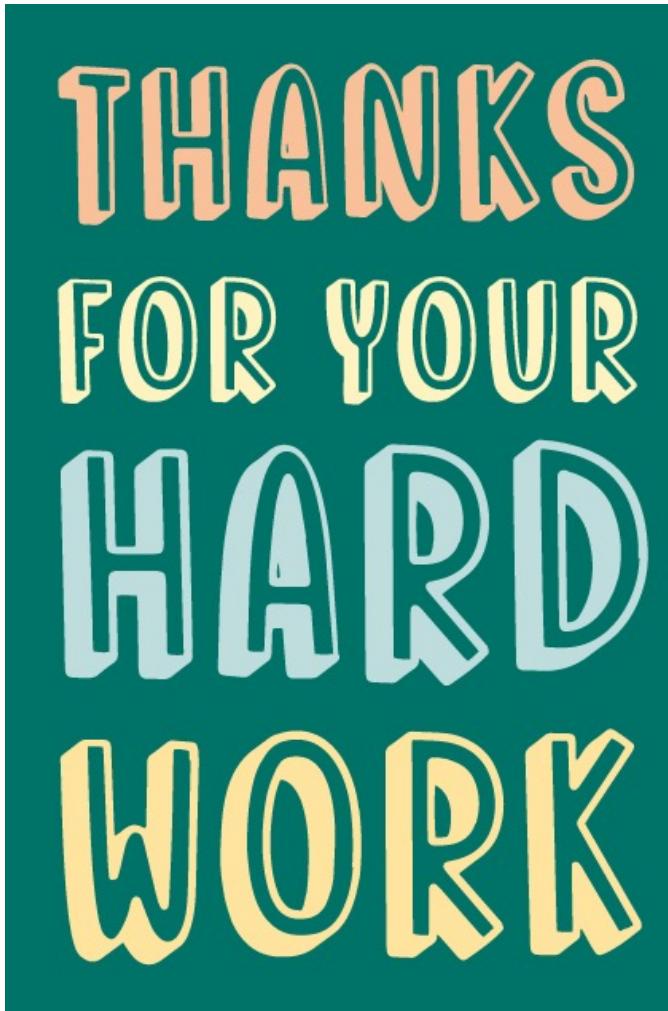
$$F'(w, x, y, z) = w'x + yz + x'z$$

The complement of F' is F , therefore

$$F(w, x, y, z) = (w + x')(y' + z')(x + z')$$

2-2. Truth table

wxyz	F
0000	1
0001	0
0010	1
0011	0
0100	0
0101	0
0110	0
0111	0
1000	1
1001	0
1010	1
1011	0
1100	1
1101	1
1110	1
1111	0



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