Row number	x_1	x_2	x_3	Minterm	Maxterm
0	0	0	0	$m_0 = \bar{x}_1\bar{x}_2\bar{x}_3$	$M_0 = x_1 + x_2 + x_3$
1	0	0	1	$m_1 = \bar{x}_1\bar{x}_2x_3$	$M_1 = x_1 + x_2 + \bar{x}_3$
2	0	1	0	$m_2 = \bar{x}_1x_2\bar{x}_3$	$M_2 = x_1 + \bar{x}_2 + x_3$
3	0	1	1	$m_3 = \bar{x}_1x_2x_3$	$M_3 = x_1 + \bar{x}_2 + \bar{x}_3$
4	1	0	0	$m_4 = x_1\bar{x}_2\bar{x}_3$	$M_4 = \bar{x}_1 + x_2 + x_3$
5	1	0	1	$m_5 = x_1\bar{x}_2x_3$	$M_5 = \bar{x}_1 + x_2 + \bar{x}_3$
6	1	1	0	$m_6 = x_1x_2\bar{x}_3$	$M_6 = \bar{x}_1 + \bar{x}_2 + x_3$
7	1	1	1	$m_7 = x_1x_2x_3$	$M_7 = \bar{x}_1 + \bar{x}_2 + \bar{x}_3$

$\boxed{m_0' = M_0}$

$(\bar{x}_1 \cdot \bar{x}_2 \bar{x}_3)' = (\bar{\bar{x}}_1) + (\bar{\bar{x}}_2) + (\bar{\bar{x}}_3)$

$= x_1 + x_2 + x_3 = M_0$

Example 1:

Express the Boolean function F = A + B'C as a sum of minterms. The function has three variables: A, B, and C.

The first term A is missing two variables; therefore,

A = A(B + B') = AB + AB' $\rightarrow$ $B + B' = 1$, $A \cdot 1 = A$

This function is still missing one variable,

so A = AB(C + C') + AB'(C + C') = ABC + ABC' + AB'C + AB'C'

The second term B'C is missing one variable;

Table 2.3
Truth Table for $F = A + B'C$

	A	B	C	F
0	0	0	0	0
1	0	0	1	1
2	0	1	0	0
3	0	1	1	0
4	1	0	0	1
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1

hence,

B'C = B'C(A + A') = AB'C + A'B'C

Combining all terms, we have

F = A + B'C = ABC + ABC'+ AB'C + AB'C' + A'B'C

F= m7 + m6 + m5 + m4 + m1

F(A, B, C) =sum of minterms (1, 4, 5, 6, 7) $= \Sigma m(1, 4, 5, 6, 7)$

Example 2:

Express the Boolean function $F = xy + x'z$ as a product of maxterms. First, convert the function into OR terms by using the distributive law:

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

$\rightarrow$ $a + b \cdot c = (a+b) \cdot (a+c)$

RHS :

$(a+b) \cdot (a+c) = \underbrace{a \cdot a}_{a} + a \cdot c + b \cdot a + b \cdot c$

$= a + a \cdot c + b \cdot a + b \cdot c$

$\rightarrow = a \cdot (1 + c) + b \cdot a + b \cdot c$

$= a \cdot 1 + b \cdot a + b \cdot c$

$= a(1 + b) + bc = a + b \cdot c$ //

The function has three variables: x, y, and z. Each OR term is missing one variable; therefore,

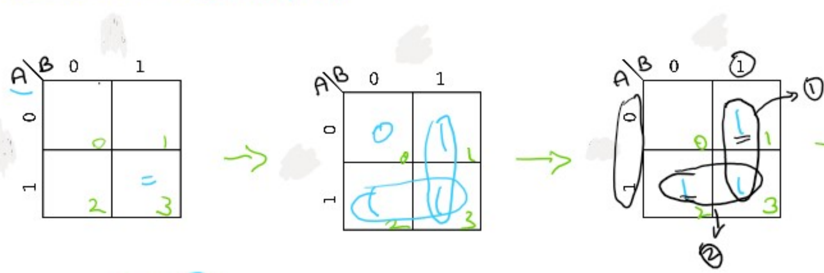
$$\begin{aligned} x' + y &= x' + y + zz' = (x' + y + z)(x' + y + z') \\ x + z &= x + z + yy' = (x + y + z)(x + y' + z) \\ y + z &= y + z + xx' = (x + y + z)(x' + y + z) \end{aligned}$$

Combining all the terms and removing those which appear more than once, we finally obtain

$$\begin{aligned} F &= (x + y + z)(x + y' + z)(x' + y + z)(x' + y + z') \\ &= M_0M_2M_4M_5 \end{aligned}$$

$x \backslash y$	0	1
0	m_0 $x'y'$	m_1 $x'y$
1	m_2 xy'	m_3 xy

Problem:
F = m1 + m2 + m3 = a'b + ab' + ab $\Sigma m(1, 2, 3)$



① $= m_1 + m_3 = A'B + AB$
$= B(A' + A) = B$

① $\rightarrow$ B

② $\rightarrow$ A

1 Final eqn = $\underline{A + B}$

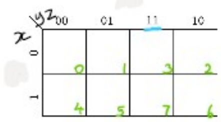
$x \backslash yz$	00	01	11	10
0	m_0 $x'y'z'$	m_1 $x'y'z$	m_3 $x'yz$	m_2 $x'yz'$
1	m_4 $xy'z'$	m_5 $xy'z$	m_7 xyz	m_6 xyz'

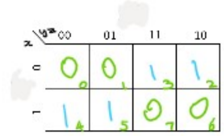
$A + A' = 1$

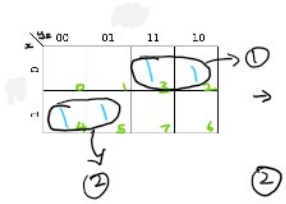
Problem:
F (a, b, c) = sum of minterms(2, 3, 4, 5)

yz 00 01 11 10 x\yz 00 01 11 10 yz 00 01 11 10

F (a, b, c) = sum of minterms(2, 3, 4, 5)







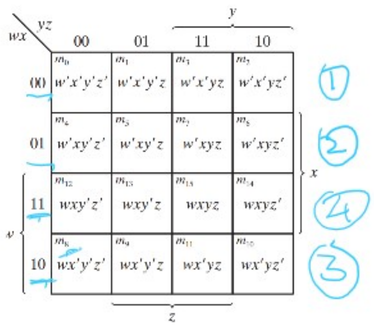
$① = x' \cdot y$

$= x' \cdot y \cdot z + x' \cdot y \cdot z'$

$= x' \cdot y (z + z') = x' \cdot y$

$② = x \cdot y'$

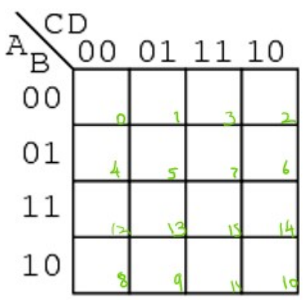
$\boxed{F = x' \cdot y + x \cdot y'}$

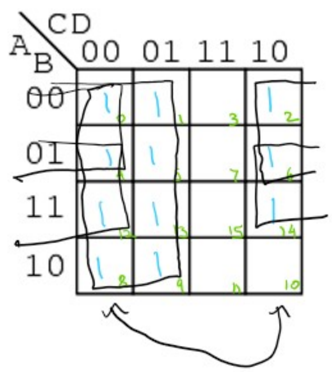


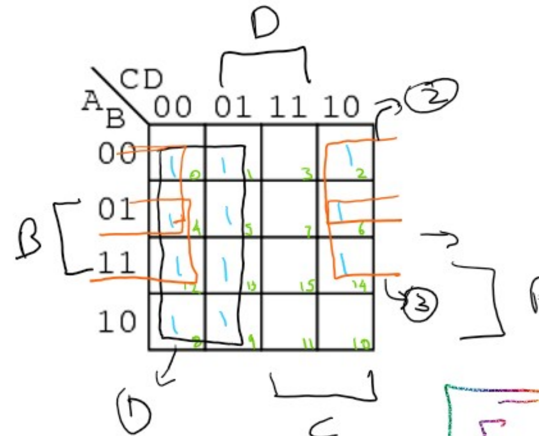
Problem:

F (a, b, c, d) = sum of minterms (0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)

1) check for octets







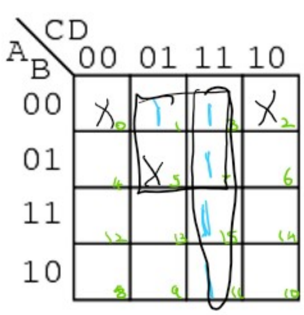
F=

Don't care:

Problem:

F (a, b, c, d) = (1, 3, 7, 11, 15)

d (a, b, c, d) = (0, 2, 5)



1 $\Rightarrow$ $\boxed{C'}$

2 $\Rightarrow$ $D' \cdot A' = A' \cdot D'$

3 $\Rightarrow$ $B \cdot D'$

$$\boxed{1 + 2 + 3 = C' + A' \cdot D' + B \cdot D'}$$