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K-Maps

Two Variable K-Map

$$F = \bar{x}y + x\bar{y} + xy$$

$$F = m_1 + m_2 + m_3$$

Simplify using K-map.

		y	
		0	1
x	0	m ₀	m ₁
	1	m ₂	m ₃

$x + y$

Three Variable K-Map

		yz			
		00	01	11	10
x	0	m ₀	m ₁	m ₃	m ₂
	1	m ₄	m ₅	m ₇	m ₆

Note: The characteristics of this sequence is that only one bit change in the value from one adjacent column to the next

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Eg 1.

$$F(x, y, z) = \sum(2, 3, 4, 5)$$

	yz			
x	00	01	11	10
0			1	1
1	1	1		

Red circles group the 1s in the top-right and bottom-left quadrants. Arrows point from these groups to the terms $\bar{x}y$ and $x\bar{y}$ respectively.

$$F(x, y, z) = \sum(2, 3, 4, 5) = \bar{x}y + x\bar{y}$$

Eg 2.

Simplify the Boolean Expression.

$$F(x, y, z) = \sum(3, 4, 6, 7)$$

	yz			
x	00	01	11	10
0			1	
1	1	1	1	1

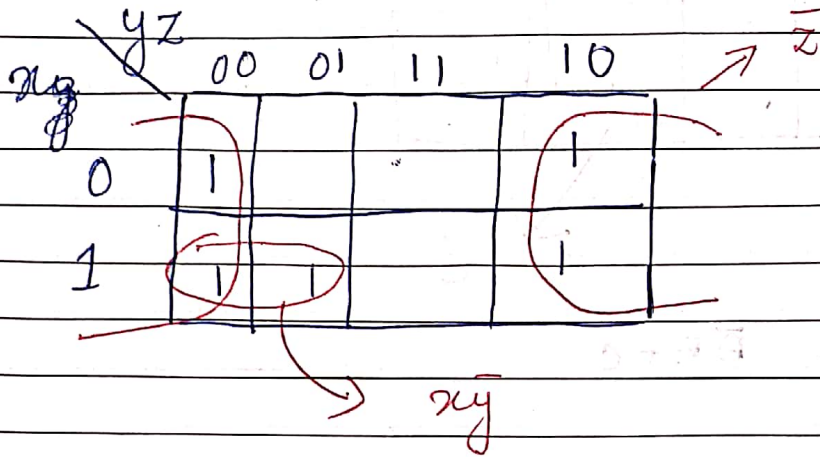
Red circles group the 1s in the top-right and bottom-left quadrants. Arrows point from these groups to the terms yz and $x\bar{z}$ respectively.

$$F = yz + x\bar{z}$$

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Eg: 3

$$F(x, y, z) = \sum(2, 4, 5, 6)$$



$$F = x\bar{y} + \bar{z}$$

Eg: 4

$$F = \bar{A}C + \bar{A}B + A\bar{B}C + BC$$

$$= \bar{A}C(B + \bar{B}) + \bar{A}B(C + \bar{C}) + A\bar{B}C +$$

$$BC(A + \bar{A})$$

$$= \bar{A}BC + \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}C +$$

$$ABC + \bar{A}BC$$

$$= \bar{A}BC + \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}C + ABC$$

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		BC			
A		00	01	11	10
0			1	1	1
1			1	1	

$\bar{A}B$ (points to the top row of 1s)
 c (points to the bottom row of 1s)

$$F = \bar{A}B + c$$

Eg: 5

$$S(x, y, z) = \sum (1, 2, 4, 7)$$

		yz			
x		00	01	10	11
0			1		1
1		1		1	

$\bar{x}\bar{y}z$ (points to the top-right 1)
 $\bar{x}y\bar{z}$ (points to the top-left 1)
 $x\bar{y}z$ (points to the bottom-left 1)
 xyz (points to the bottom-right 1)

$$F = \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}z + xyz$$