Boolean Algebra

Truth table (XOR)

	x	y	z
	0	0	0
$x'y$ ←	0	1	1
xy' ←	1	0	1
	1	1	0

} use for sum of products

Find z using sum of products.

- Use x, y when z = 1

if x = 0 → x'

if x = 1 → x

same for y

$z = x'y + xy'$ ✓

Find z using product of sums

- Use X, Y when z == ϕ

If X = 1 → X'
X = ϕ → X
same for Y

x	y	z
0	0	0 → (x+y)
0	1	1
1	0	1
1	1	0 → (x'+y')

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

x=0 y=0 = (0+0) (1+1) → z = 0
(0) (1)

x=0 y=1 (0+1) (1+0) → z = 1

x=1 y=0 (1+0) (0+1) → z = 1

x=1 y=1 (1+1) (0+0) → z = 0

Since $z = x'x + xy'$

and $z = (x+y)(x'+y')$

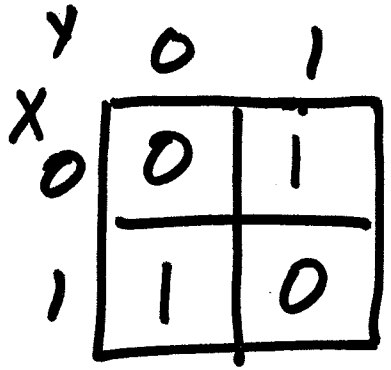
they should be equivalent.

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

$= xx' + xy' + yx' + yy'$

Karnaugh Maps

x	y	z
0	0	0
0	1	1
1	0	1
1	1	0



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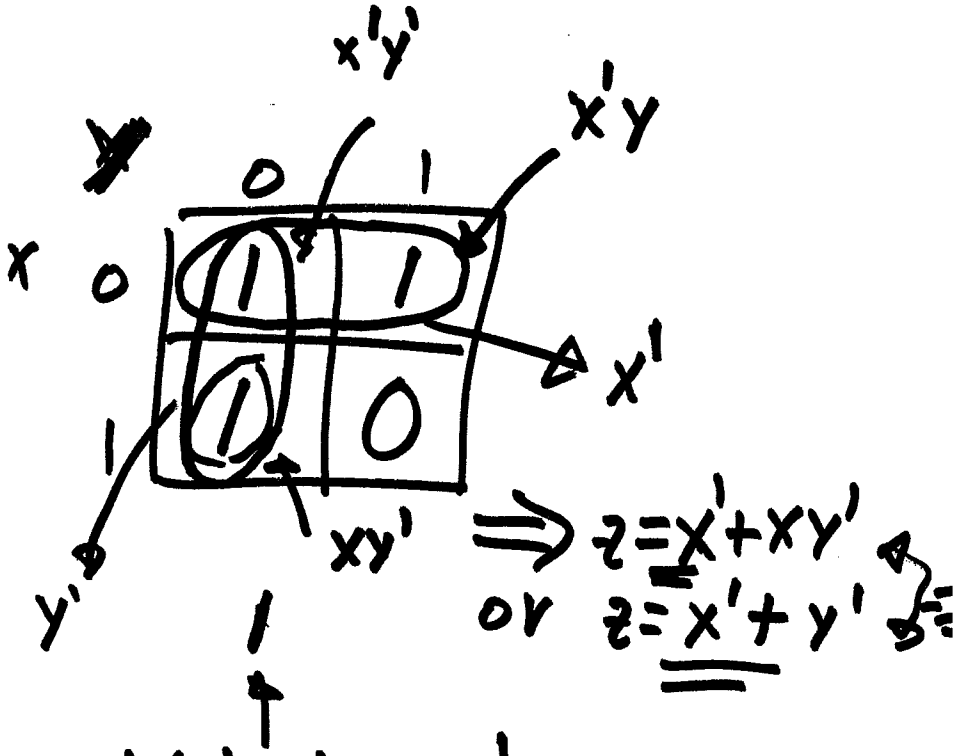
x	y	z	
0	0	1	→ x'y'
0	1	1	→ x'y
1	0	1	→ xy'
1	1	0	



Sum of products

$z = x'y' + x'y + xy' \Rightarrow z = x'(y' + y) + xy'$

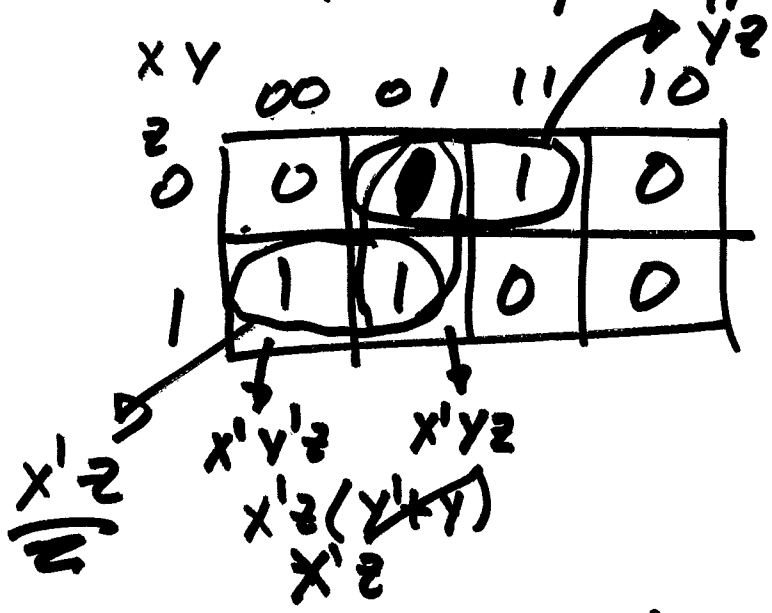
$z = x'(1) + xy' = \underline{x' + xy'}$

(5)

Truth Table

X	Y	Z	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

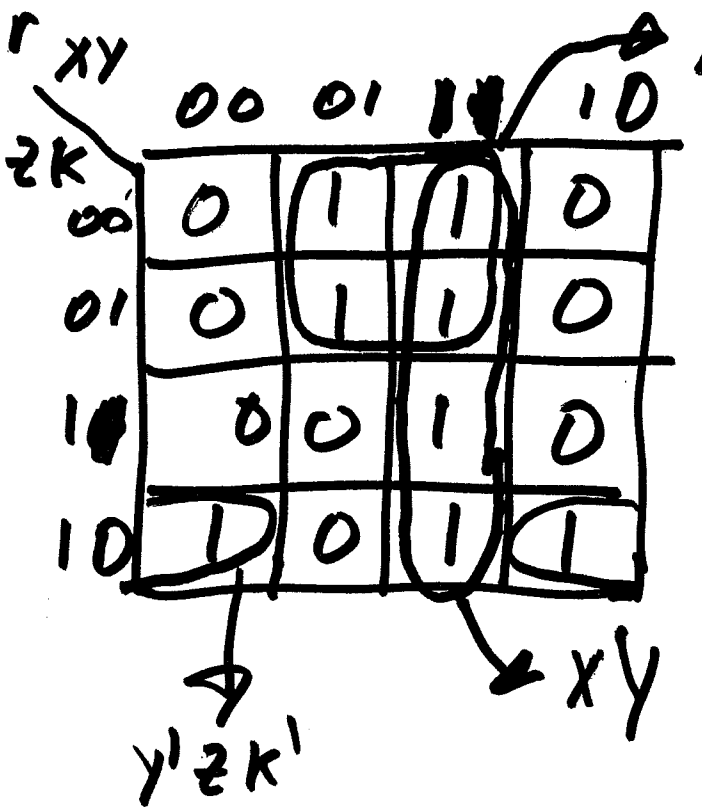
Karnaugh Map



$F = x'z + yz'$

Example Karnaugh Maps

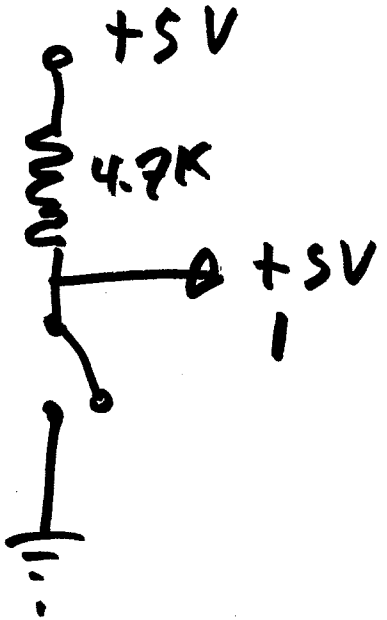
xy	zk	r
00	00	0
00	01	0
00	10	1
00	11	0
⋮		⋮
11	11	1

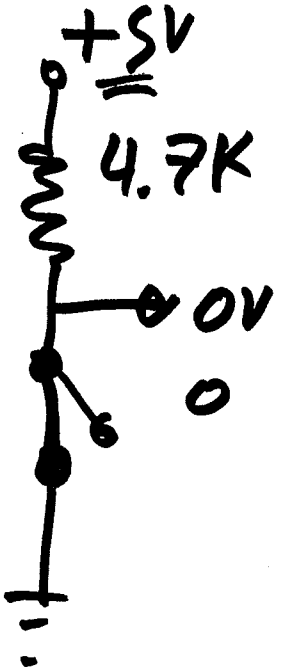


$r = yz' + xy + y'zk'$

pull up resistor

push button → 0





pull down resistor

push button → 1