Boolean Algebra.

True / False.
On / Off.
0 / 1.
High / Low.

AND $x \cdot y$ xy x AND y.
OR $x+y$ $x \vee y$ x OR y.
NOT NOT x $\neg x$ $\bar{x}$.

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

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

$0+1=1$

$0+0=0$

$1+$

$1+0=0$

$0+0=1$

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

3×2

2^3.

$3 \times 3 \times 3$.

$1x = x$
$1+x = 1$
$0+x = x$

$1x = x$
$0+x = x$
$xx = x$
$x+x = x$
$xx' = 0$
$x+x' = 1$

$0x = 0$
$1+x = 1$

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

$xy = yx$

$(xy)z = x(yz)$

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

$x(y+z) = xy+xz$

$x(x+y) = x$.

$x+xy = x$.

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

$= x + xy$.

$= x + (xy)$

$= (x+x)(x+y)$

$= x(x+y)$

$x' = x$.

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

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

$x+x$.

$F(x,y) = xy + xy$

$= xy$.

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

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

$= x'y + xz$

$F(x,y) = y + (xy)'$

$= y + x' + y'$

$= x' + 1 = 1$

$F(x,y) = (xy)'(x'+y)(y'+y)$

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

$(x'+y')(x'+y)$

$(x'+y')x' + (x'+y')y.$

$x'x + y'x' + x'y + y'y$

$x'(y'+y)$

x'

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

$= x'x + x'y$

$0 + x'y + (y+x)x + (y+x)y'$

$x + yy' + xy' + x'y$

$1 \qquad x + xy' + yy' + x'y.$

$x(1+y')$

$x + y(y'+x')$

$x+(yz)$

$= x+yt$

$x + x'y.$

$(x+x')(x+y)$

$(x+y)$

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

$(xy+x')(xy+z)$

$x'(y+1)$

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

$x'yxy + x'yz.$

$x'yz + yz$

$(x'+1)yz$

$x'yz.$

$xy + xz = x(y+z)$

$(x+y)(x+z)$

$= x + (yz)$

$(x'+y')(x'+y)$

$x' + y'y$

$= x' + 0 = x'$

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

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

$= x'x + x'y + x + yy'$

$= x'y + x$

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

$= x+y$

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

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

$= (xy+y)(xy+z) + xz$

$(x+y)(x+z) = x(x+1)$

$= x + yz$.

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

$= xyy + yz + x'z$

$= xy + yz + x'z$

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

$= xy + x'z + yz(x + x')$

$= xy + x'z + xyz + x'yz$

$= xy(1 + z) + x'z(1 + y)$

$= xy + x'z$.

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

$= y +$

$Q = A \oplus B \oplus C$

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

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

XOR → 奇数个1，输出才是1

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

A	B	C	$\bar{A}$	$A+B$	$\bar{A}+C$	
0	0	0	1	0	1	0
0	0	1	1	0	1	0
0	1	0	1	1	1	1
1	0	0	0	1	0	0
1	1	0	0	1	0	0
1	0	1	0	1	1	1
0	1	1	1	1	1	1
1	1	1	0	1	1	1

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

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

A	B	C		
0	0	0	1	
0	0	1	0	
0	1	0	1	
1	0	0	0	
1	1	0	0	
1	0	1	0	
0	1	1	0	
1	1	1	0	

$(1+1)(1\cdot 0)$

$(1+1)(1\cdot 0)$

$(1+0)(1\cdot 1)$

$(0+1)(0\cdot$

$0+0$

$(0+1)(0\cdot 0)$

$(1+0)(1\cdot 0)$

$0+0$

Sum of Product.

Product of Sum.

[Further Q]

$$Q = \overline{(A+B)(CD)} + A.$$

$$= \overline{(A+B)} + \overline{(CD)} + A.$$

$$= \overline{A}\,\overline{B} + (\overline{C}+\overline{D}) + A.$$

$$= \overline{A}\,\overline{B} + (\overline{C}\,\overline{D}) + A.$$

$$(A+D)(AD)$$

$$AAD + ADD$$

$$= AD + AD = AD$$

$$Q = (A+B) + (C+D) + \overline{(AB)(CD)}$$

$$= \quad \overline{AB} + \overline{CD}$$

$$\overline{A}+\overline{B} + \overline{C}+\overline{D} = 1$$

Identity Law: $A + 0 = A.$
$A + A = A.$

Zero and One's Law $A+1 = 1$
$A \cdot 0 = 0.$

Inverse Law $A+\overline{A} = 1$
$A \cdot \overline{A} = 0$

Commutative law $A+B = B+A.$

$AB = BA$.

Associative law: $A + B + C = A + (B + C)$

$(AB)C = A(BC)$

Distributive law: $A(B+C) = AB + AC$

$A + (BC) = (A+B)(A+C)$

De Morgan's Law: $\overline{AB} = \bar{A} + \bar{B}$

$\overline{A+B} = \bar{A}\bar{B}$

1. 组合逻辑电路.

时序逻辑电路.