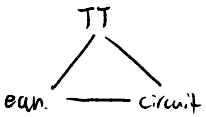
TRUTH TABLES

- one way to express a logic function



can convert btw. all 3.

- there will be 2^n combinations, where n is the # inputs

X_0	X_1	X_2	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

EQUATION FORM

$f = \bar{X}_2 \bar{X}_1 \bar{X}_0 + \bar{X}_2 X_1 X_0 + X_2 X_1 X_0$

rows with 1s: minterms

rows with 0s: maxterms

LOGICAL OPERATORS

- 3 basic logical operators: AND, OR, NOT
  - AND: denoted by $\cdot$ or " "

ex. $f = X_1 \cdot X_0 = X_1 X_0$

X_0	X_1	$f = X_1 X_0$
0	0	0
0	1	0
1	0	0
1	1	1

$\Rightarrow$

X_0	X_1	...	X_{n-2}	X_{n-1}	$f = X_{n-1} X_{n-2} \cdots X_1 X_0$
0	0	...	0	0	0
0	0	...	0	1	0
...	...	...	...	...	...
0	1	...	1	1	0
1	0	...	0	0	0
1	0	...	0	1	0
...	...	...	...	...	...
1	1	...	1	1	1

- OR: denoted by +

ex. $f = X_1 + X_0$

X_0	X_1	$f = X_1 X_0$
0	0	0
0	1	1
1	0	1
1	1	1

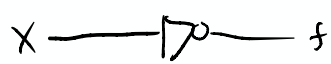
$\Rightarrow$

X_0	X_1	...	X_{n-2}	X_{n-1}	$f = X_{n-1} X_{n-2} \cdots X_1 X_0$
0	0	...	0	0	0
0	0	...	0	1	1
...	...	...	...	...	...
0	1	...	1	1	1
1	0	...	0	0	1
1	0	...	0	1	1
...	...	...	...	...	...
1	1	...	1	1	1

- NOT: denoted by !, ', $\neg$, $\overline{\ }$

ex. $f = !x = x' = \neg x = \overline{x}$

X	$f = !x$
0	1
1	0



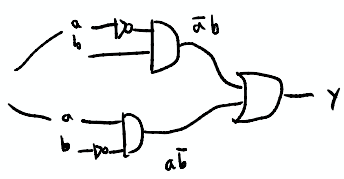
"o" inverts something is being inverted

"▷" buffer (amplifies signal aka relative repeater)

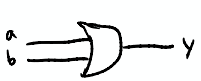
X	f
0	0
1	1

- XOR: denoted by $\oplus$

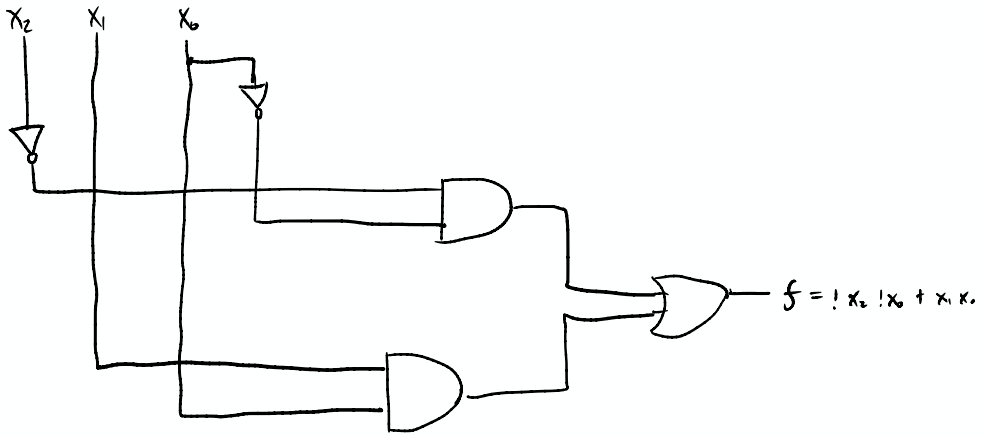
a	b	Y
0	0	0
0	1	1
1	0	1
1	1	0



$f = \bar{a}b + a\bar{b} = a \oplus b$

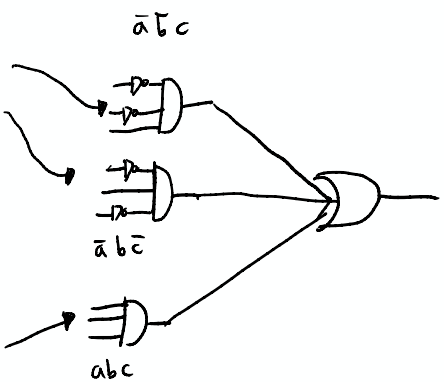


CIRCUIT DIAGRAMS



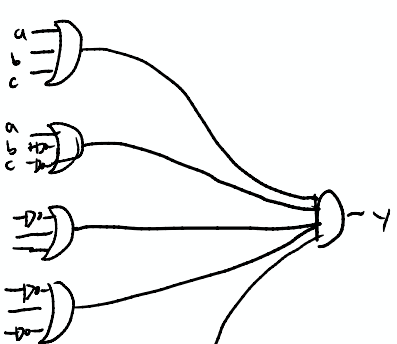
SUM OF PRODUCTS

a	b	c	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1



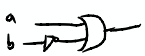
PRODUCT OF SUM

a	b	c	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

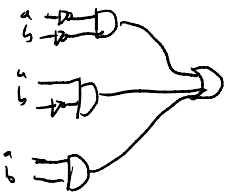


a	b	y	a
0	0	1	0
0	1	0	1
1	0	1	0
1	1	1	0

P.S



S.P



S.P'

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

LHS: $xy + \bar{x}z + yz \cdot 1$

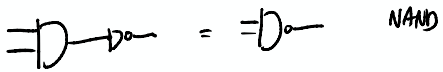
$= xy + \bar{x}z + yz(x + \bar{x})$

$= xy + \bar{x}z + xyz + \bar{x}yz$

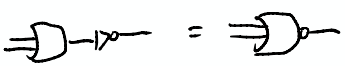
$= xy(1 + z) + \bar{x}z(1 + z)$

$= xy + \bar{x}z$

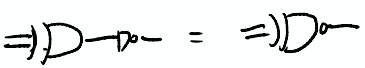
GATES



NAND

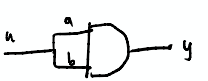


NOR



NXOR

UNARY FUNCTION



$Y = \text{NAND}(a, b) = \overline{ab}$

$\text{NAND}(a, a) = \overline{aa} = \bar{a}$