Lec-30

Digital Logic Gates:

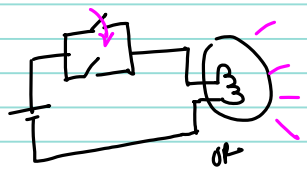
② OR gate

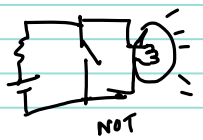
OR-operation.

$x + y$

F = $x + y$

x	y	F
0	0	0
0	1	1
1	0	1
1	1	1





③ NOT

x → $\bar{x}$ or x'

$F = \bar{x}$

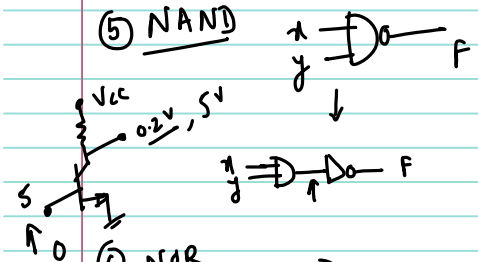
x	F
0	1
1	0

④ Buffer:

x → F

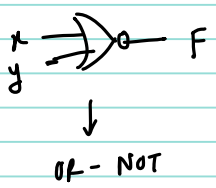
x	F
0	0
1	1

⑤ NAND



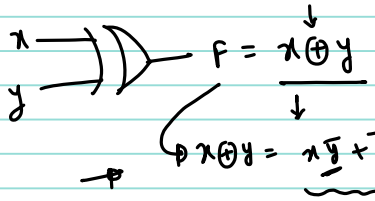
x	y	F
0	0	1
0	1	1
1	0	1
1	1	0

⑥ NOR



x	y	F
0	0	1
0	1	0
1	0	0
1	1	0

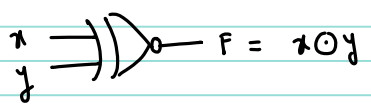
⑦ Exclusive OR (XOR)



literals

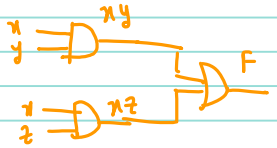
x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

⑧ Exclusive NOR (X-NOR)

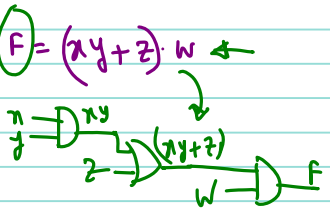


x	y	F
0	0	1
0	1	0
1	0	0
1	1	1

$F = xy + xz$



$F = (xy + z) \cdot w$



Boolean Algebra:

Postulates:

$x + 0 = x$

$x + \bar{x} = 1$

$x + x = x$

$x + 1 = 1$

$\bar{\bar{x}} = x$

$x + y = y + x$

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

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

$x + xy = x$

$x(1 + y) = x \cdot 1 = x$

$x \cdot 1 = x$

$x \cdot \bar{x} = 0$

$x \cdot x = x$

$x \cdot 0 = 0$

$xy = yx$

$x(yz) = (xy)z$

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

$x + xz + xy + zy$

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

$= x \cdot 1 + yz$

$= x + yz$

$x(x + y) = x$

De Morgan's Theorem

$$\overline{(x + y)} = \bar{x} \cdot \bar{y}$$

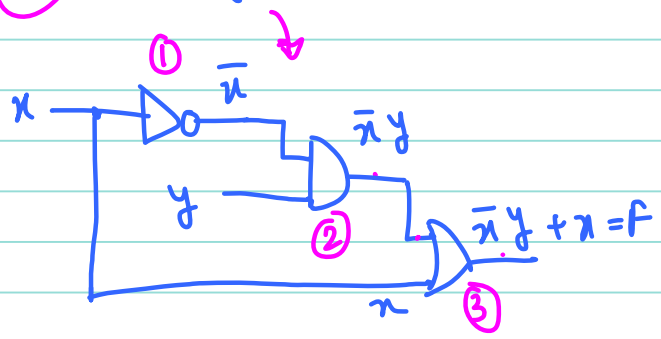
$$\overline{x \cdot y} = \bar{x} + \bar{y}$$

Operator Precedence

1. ( )
2. NOT
3. AND
4. OR

$F = \overline{(\quad) + (\cdot)(\quad)}$

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

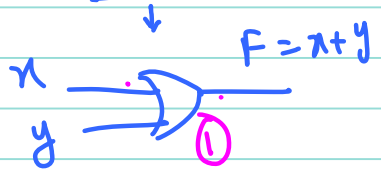


3 - gates

$= (x + \bar{x})(x + y)$

$= 1 \cdot (x + y)$

$= (x + y)$



1 gate

Less no. of gates → Less power dissipation. *

→ less delay. *

Example

$F = \underbrace{xy + \bar{x}z}_{\bar{x}yz + x\bar{y}z} + yz \cdot 1$ → $1 = x + \bar{x}$

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

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

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

$= xy \cdot 1 + \bar{x}z \cdot 1$

→ $f = xy + \bar{x}z$

→ $F = xy + \bar{x}z$

Truth table

i/p's x y z	o/p F
→ 0 0 0	0
→ 0 0 1	1
→ 0 1 0	0
→ 0 1 1	1
→ 1 0 0	0
→ 1 0 1	
1 1 0	
1 1 1	