# Rules

$A + 0 = A$

$A + 1 = 1$

$A \cdot 0 = 0$

$A \cdot 1 = 0$

$A + A = A$

$A + \bar{A} = 1$

$A \cdot A = 0$

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

$\bar{\bar{A}} = A$

$A + AB = A$

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

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

$A = 1$

$\bar{A} = 0$

9/8/24

## Basic Logic gate

Basic gates

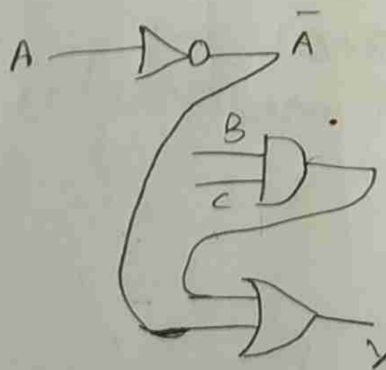
- Not $Y = \bar{A} \Rightarrow A = \bar{A}$ (In not gate contains only one input it may have two input its it have same value)
- And $Y = A \cdot B = AB$
- Possibilities

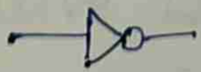
| | A B | Y | X |
|---|---|---|---|
| 0.0 | 0.0 | 0 | 0 |
| 1.0 | 0.1 | 0 | 1 |
| 0.1 | 1.0 | 0 | 1 |
| 1.1 | 1.1 | 1 | 1 |

- Or $X = A + B$

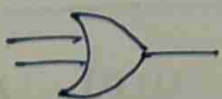
Questions:

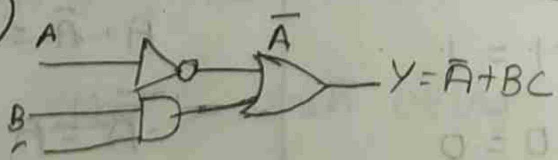
1) $Y = \bar{A} + BC$
2) $Y = B' + EF$
3) $Y = (A+D)'$
4) $Y = B' + A'$

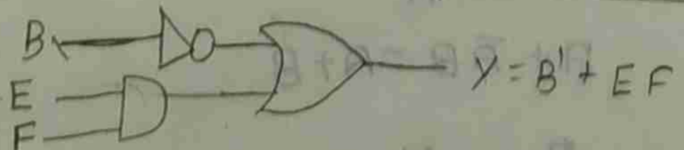



NOT 

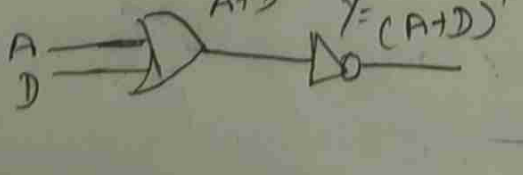
AND 

OR 

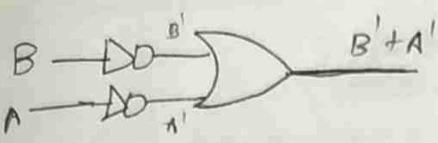
1) 


2) 


3) $Y = (A+D)'$



4) $y = B' + A'$

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$A + AB = A(1+B)$ $[\because A+1 = 1]$

$= A \cdot 1$ $[\because A \cdot 1 = A]$

$= A$

| A | B | AB | A + AB |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 |

$A = A + AB$

hence proved

$A + A'B = A + B$

$A + \bar{A}B = (A + AB) + \bar{A}B$ (Rule 10: $A = \boxed{A + AB}$)

$= (AA + AB) + \bar{A}B$ (Rule 7: $\boxed{A = AA}$)

$= AA + AB + A\bar{A} + \bar{A}B$ Rule 8: adding $A\bar{A} = 0$

$A\bar{A} = 0$ (add 0 will not affect)

$= (A + \bar{A})(A + B)$ Factoring $\longrightarrow$ according to demorgan

$= 1 \cdot (A+B)$

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

hence Proved

## Proving by truth table

| $A$ | $B$ | $\bar{A}$ | $\bar{A}B$ | $A+\bar{A}B$ | $A+B$ |
|---|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 |

equal

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

hence p

**Eg:**

To prove:

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

Soln:

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

$= A + AC + AB + BC$ Rule 7: $A \cdot A = A$

$= A(1+C) + AB + BC$ Rule 2: $1 + C = 1$

$= A \cdot 1 + AB + BC$

$= A + AB + BC$

$= A \cdot 1 + BC$

$= A + BC$

hence proved

Proof by truth table

| A | B | C | A+B | A+C | (A+B)·(A+C) | BC | A+BC |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

equal

$\boxed{\text{hence } (A+B)(A+C) = A+BC}$

hence proved