Portes logiques et algèbre de Boole

1. Simplification des fonctions

Objectif : Fabriquer un système

- ✓ à moindre coût
- ✓ rapide
- ✓ fiable
- ✓ Peu consommateur

a. Les théorèmes de Boole

Les théorèmes de Boole sont des règles utilisées pour la simplification des expressions logiques.

ALGEBRE DE BOOLE		
Commutativité	$a + b = b + a$	$a \cdot b = b \cdot a$
Associativité	$(a + b) + c = a + (b + c)$	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$
Distributivité	$a \cdot (b + c) = (a \cdot b) + (a \cdot c)$	$a + (b \cdot c) = (a + b) \cdot (a + c)$
Complémentation	$a + \overline{a} = 1$	$a \cdot \overline{a} = 0$
Eléments Neutres	$a + 0 = a$	$a \cdot 1 = a$
Eléments Absorbants	$a + 1 = 1$	$a \cdot 0 = 0$
Idempotence	$a + a = a$	$a \cdot a = a$

b. Théorème de De Morgan

Elle permettent de «casser» la barre des opérateurs NAND ET NOR .

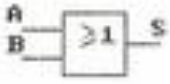
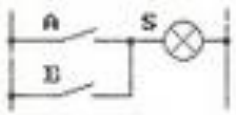
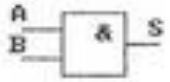
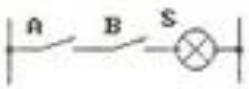
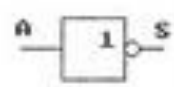
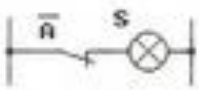
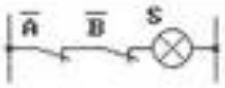
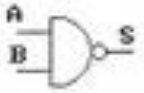
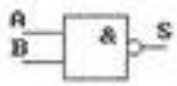
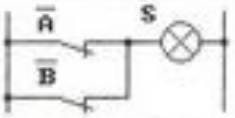
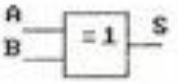
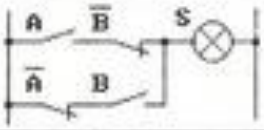
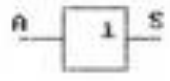
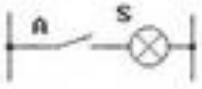
$$\overline{A + B} = \overline{A}.\overline{B}$$

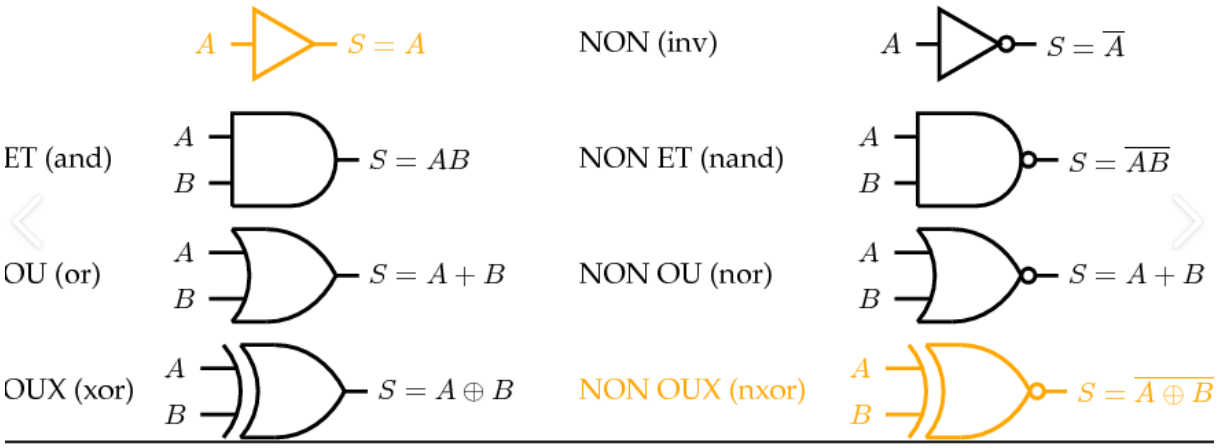
$$\overline{A.B} = \overline{A} + \overline{B}$$

2. Portes logiques

Une porte logique est un composant élémentaire d'un circuit numérique. Il existe sept portes logiques de base (AND, OR, XOR, NOT, NAND, NOR et XNOR).

La majorité des portes logiques disposent de deux entrées et d'une sortie. A tout moment, chaque borne (ou « broche ») affiche un des deux états binaires *bas* (0) ou *haut* (1), représentés par des niveaux de tension électrique distincts

Función	Ecuación lógica	Símbolos			Tabla de verdad
		Norma MIL	Norma IEC	Circuito físico con contactos	
OR	$S = A+B$				
AND	$S = A \cdot B$				
NOT	$S = \overline{A}$				
NOR (OR+NOT)	$S = \overline{A+B}$ $S = \overline{A} \cdot \overline{B}$				
NAND (AND+NOT)	$S = \overline{A \cdot B}$ $S = \overline{A}+\overline{B}$				
EXOR	$S = A \oplus B =$ $= A\overline{B} + \overline{A}B$				
EXCITADOR	$S = A$				


A
S = A
NON (inv)
A
S = Ā
ET (and)
A
B
S = AB
NON ET (nand)
A
B
S = AB
OU (or)
A
B
S = A + B
NON OU (nor)
A
B
S = A + B
OUX (xor)
A
B
S = A ⊕ B
NON OUX (nxor)
A
B
S = A ⊕ B