Boolean Algebra

Boolean algebra is used to analyse and simplify the digital (logic) circuits. It uses only the binary numbers i.e. 0 and 1.
It is also called as Binary Algebra or logical Algebra.

BOOLEAN POSTULATES AND LAWS

T1 : Commutative Law

(a)   A + B = B + A
(b)   A B = B A

T2 : Associate Law

(a)   (A + B) + C = A + (B + C)
(b)   (A B) C = A (B C)

T3 : Distributive Law

(a)   A (B + C) = A B + A C
(b)   A + (B C) = (A + B) (A + C)

T4 : Absorption Law

(a)   A(A+B)=A
(b)   A+(AB)=A

Multiplication

0*0 = 0
0*1 = 0
1*0 = 0
1*1 = 1

A*0 = 0
A*1 = A
A*A'=0
A*A=A

Addition

0+0 = 0
0+1 = 1
1+0 = 1
1+1 = 1

A+0=A
A+1=1
A+A'=1
A+A=A

DeMorgan's Theorems

break!
$\overline{AB}$
$\overline{A} + \overline{B}$
NAND to Negative-OR

break!
$\overline{A} + \overline{B}$
$\overline{AB}$
NOR to Negative-AND
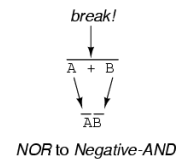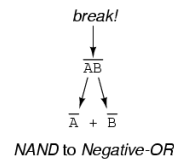
$$\overline{A*B} = \overline{A} + \overline{B} \qquad \overline{A+B} = \overline{A} * \overline{B}$$

1	2	3	4	5	6	7	8	9	10
A	B	A′	B′	A+B	A.B	(A+B)′	A′.B′	(A.B)′	A′+B′
0	0	1	1	0	0	1	1	1	1
0	1	1	0	1	0	0	0	1	1
1	0	0	1	1	0	0	0	1	1
1	1	0	0	1	1	0	0	0	0

Principle of Duality

Rule 1:- AND $\Rightarrow$ OR

OR $\Rightarrow$ AND

A*B $\Rightarrow$ A+B

A+B $\Rightarrow$ A*B

Rule 2:- 1 $\Rightarrow$ 0

0 $\Rightarrow$ 1

Example:-

(A+B) * (C+0) + D'

= (A*B) + (C*1) * D'
= AB + CD'