SNS COLLEGE OF ENGINEERING

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

23ITT201 -DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

II YEAR/ III SEMESTER

UNIT 1 – **MINIMIZATION TECHNIQUES AND LOGIC GATES**

TOPIC 1 - BOOLEAN POSTULATES AND LAWS - DEMORGAN'S THEOREM-PRINCIPLE OF DUALITY

BOOLEAN ALGEBRA AND THEOREMS

Boolean Algebra is an algebraic structure defined on a set of two elements, B = {0,1} together with two binary operators + and *

Postulates : The postulates are basic axioms of the algebraic structure and need no proof.

Closure: The set is closed with respect to the operator + and . Since the result of each operation is either 1 or 0.

IDENTITY LAW

- A.1 = A
- A Variable AND with 1 is always equal to the variable

- A+0 = A
- A variable OR with 0 is always equal to the variable.

ANNULMENT LAW

- A. O=O
  - A variable AND'ed with **O** is always equal to **O**
- A+1=1
  - A variable OR'ed with **1** is always equal to **1**

IDEMPOTENT LAW

- $A + A = A$
  - A variable OR'ed with itself is always equal to the variable
- $A . A = A$
  - A variable AND'ed with itself is always equal to the variable

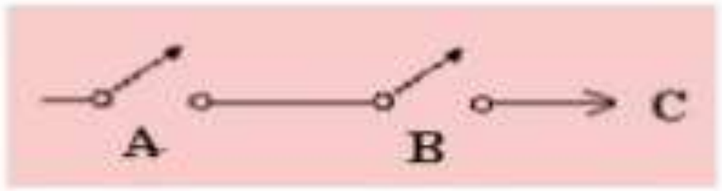
COMPLEMENT LAW

- $A \cdot \overline{A} = O$
  - A variable AND'ed with its complement is always equal to **O**
- $A + \overline{A} = 1$
  - A variable OR'ed with its complement is always equal to **1**

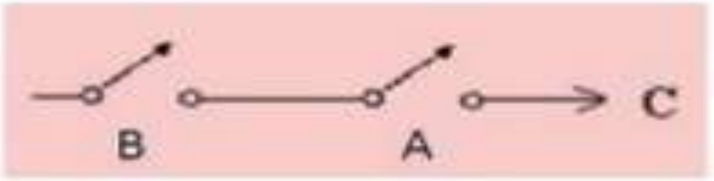
COMMUTATIVE LAW

- A . B = B . A
  - The order in which two variables are AND'ed makes no difference
- A + B = B + A
  - The order in which two variables are OR'ed makes no difference

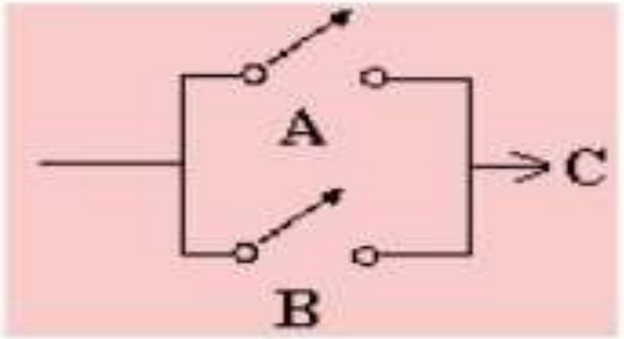
COMMUTATIVE LAW



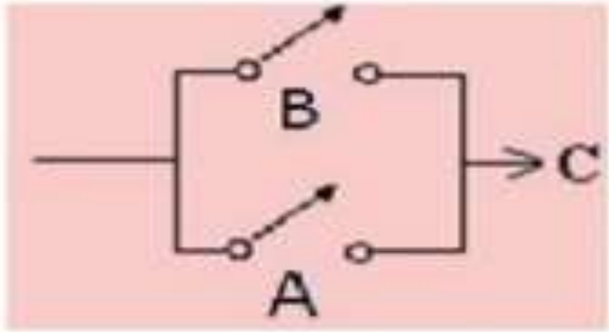
A • B



B • A



A + B



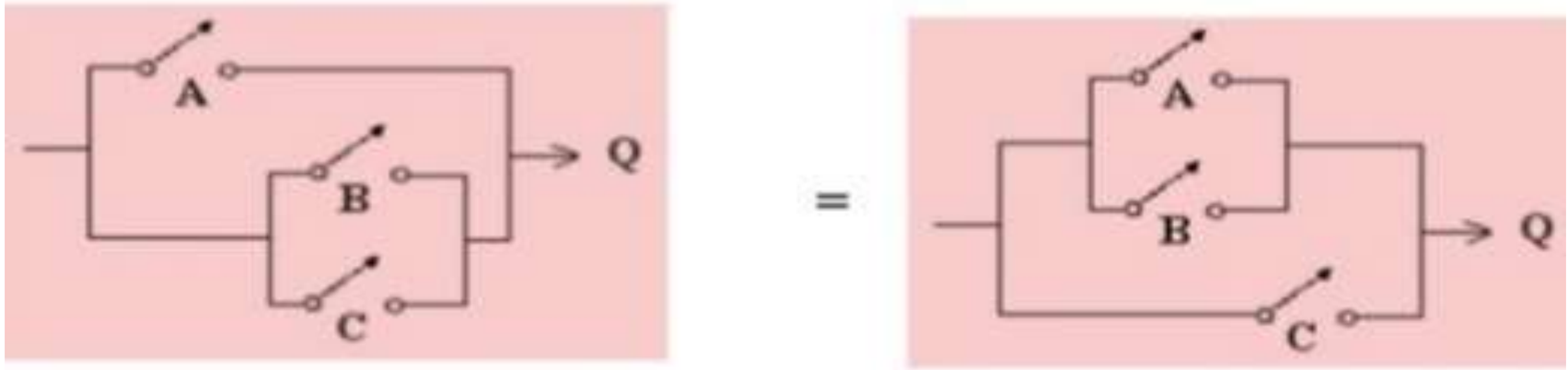
B + A

ASSOCIATIVE LAW

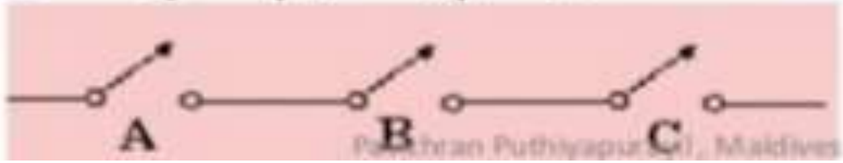
- Allows the removal of brackets from the expression
- $A + (B + C) = (A + B) + C = A + B + C$
  - OR Associate Law
- $A(B.C) = (A.B)C = A \,.\, B \,.\, C$
  - AND Associate Law

ASSOCIATIVE LAW

❖A+(B+C)=(A+B)+C



❖A • (B • C) = (A • B) • C

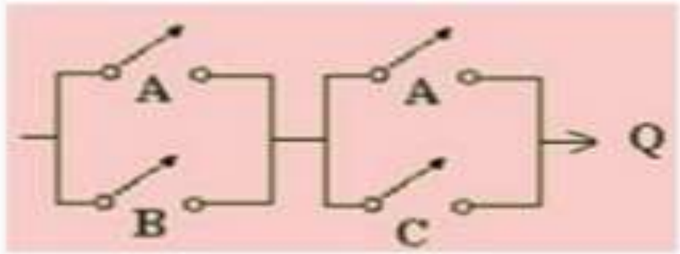


DISTRIBUTIVE LAW

- Permits the Multiplying or factors of the variable
- A(B + C) = A.B + A.C
  - OR Distributive Law
- A + (B.C) = (A + B).(A + C)
  - AND Distributive Law

DISTRIBUTIVE LAW

$$(A + B) \bullet (A + C)$$



A	B	C	Q
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

DOUBLE NEGATION LAW

- Inversion of a term twice with result in the same term
- $\overline{\overline{A}} = A$ $\overline{\overline{A}}$ double complement of a variable is always equal to the variable

DEMORGAN'S LAW

- Works Depending on the concept of Duality
- Helps in solving the algebraic problems in digital electronics
- $(A.B)' = A' + B'$.
  - The negation of a conjunction is the disjunction of the negations, which means that the complement of the product of two variables is equal to the sum of the compliments of individual variables.
- $(A + B)' = A'B'$.
  - The negation of disjunction is the conjunction of the negations, which means that compliment of the sum of two variables is equal to the product of the complement of each variable.

DUALITY LAW

- How to apply the duality principle?
  - 1's and 0's are interchanged.
  - AND or OR operators are interchanged.
  - Variables are left unchanged.
- Dual theorem is still true!

(T1)	$X + 0 = X$	(T1′)	$X \cdot 1 = X$	(Identities)
(T2)	$X + 1 = 1$	(T2′)	$X \cdot 0 = 0$	(Null elements)
(T3)	$X + X = X$	(T3′)	$X \cdot X = X$	(Idempotency)
(T4)	$(X')' = X$			(Involution)
(T5)	$X + X' = 1$	(T5′)	$X \cdot X' = 0$	(Complements)

THANK YOU