

#### SNS COLLEGE OF TECHNOLOGY



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 ELECTRONICS & COMMUNICATION ENGINEERING

19ECB202 – LINEAR AND DIGITAL CIRCUITS

II YEAR/ III SEMESTER

UNIT 3 – GATES AND MINIMIZATION TECHNIQUES

**TOPIC 3 - Boolean Function** 



#### **Boolean Functions**



- A **Boolean Function** is described by an algebraic expression called **Boolean** expression which consists of binary variables, the constants 0 and 1, and the **logic** operation symbols.
- **≻Eg.** F=xy' z+p. We defined the **Boolean function** F=xy' z+p in terms of four binary variables x, y, z, and p.



#### **Boolean Functions - Simplifications**



#### - MU( • MM - V)

## Consensus laws

1.

$$AB + \overline{AC} + BC = AB + \overline{AC}$$

#### Proof

$$AB + \overline{A}C + BC = AB + \overline{A}C + BC \cdot 1$$

$$= AB + \overline{A}C + BC(A + \overline{A}) \qquad (\because A + \overline{A} = 1)$$

$$= AB + \overline{A}C + ABC + \overline{A}BC$$

$$= AB(1 + C) + \overline{A}C(1 + B) \qquad (\because 1 + B = 1 = 1 + C)$$

$$= AB + \overline{A}C$$



# INSTITUTIONS

### **Proof**

#### **Boolean Functions - Simplifications**

$$(A+B)(\overline{A}+C)(B+C) = (A+B)(\overline{A}+C)$$

$$(A+B)(\overline{A}+C)(B+C) = (A+B)(\overline{A}+C)(B+C+0)$$

$$= (A+B)(\overline{A}+C)(B+C+A\overline{A})$$

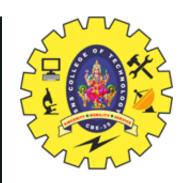
$$= (A+B)(\overline{A}+C)(B+C+A)(B+C+\overline{A})$$

$$[\because A+BC = (A+B)(A+C)]$$

$$= (A+B)(A+B+C)(\overline{A}+C)(\overline{A}+C+B)$$

$$= (A+B)(\overline{A}+C)$$

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



#### **Basic Theorems and Properties of Boolean** Algebra



Simplify 
$$Y = ABC + A\overline{B}C + AB\overline{C}$$
 to  $Y = A(B+C)$ .  
Solution:

# 3. Solution:

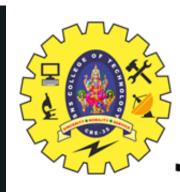
$$Y = ABC + A\overline{B}C + AB\overline{C}$$

$$= AC(B + \overline{B}) + AB\overline{C}$$

$$= AC \cdot 1 + AB\overline{C}$$

$$= A(C + B\overline{C})$$

$$= A(B + C)$$



#### Basic Theorems and Properties of Boolean Algebra



Simplify the given Boolean expression  $Y = \overline{ABC} + \overline{ABC} + AB\overline{C} + AB\overline{C}$ .

## 4. Solution:

$$Y = \overline{A}\overline{B}\overline{C} + \overline{A}B\overline{C} + A\overline{B}\overline{C} + AB\overline{C}$$

$$= \overline{A}\overline{C}(B + \overline{B}) + A\overline{C}(B + \overline{B})$$

$$= \overline{A}\overline{C} + A\overline{C}$$

$$= \overline{C}(\overline{A} + A)$$

$$= \overline{C} \cdot 1$$

$$= \overline{C}$$



**5.** 

#### **Description of the Laws of Boolean Algebra**



### Simplify the expression $Y = (AB + \overline{C})(\overline{A + B} + C)$ . Solution:

$$Y = \overline{(AB + \overline{C})(\overline{A} + \overline{B} + C)}$$

$$= \overline{(AB + \overline{C})(\overline{A} \cdot \overline{B} + C)}$$

$$= \overline{AB \cdot \overline{AB} + ABC + \overline{AB}\overline{C} + C\overline{C}}$$

$$= \overline{0 + ABC + \overline{AB}\overline{C} + 0}$$

$$= \overline{ABC + \overline{AB}\overline{C}}$$

$$= \overline{ABC} \cdot \overline{\overline{AB}\overline{C}}$$

$$= (\overline{A} + \overline{B} + \overline{C}) \cdot (\overline{A} + \overline{B} + \overline{C})$$

$$= (\overline{A} + \overline{B} + \overline{C}) \cdot (A + B + C)$$



#### **Description of the Laws of Boolean Algebra**



#### Prove the following Boolean expression

$$(A+B)(\overline{A}\overline{C}+C)\overline{(\overline{B}+AC)}=\overline{A}B.$$

#### 6. Solution:

$$(A + B)(\overline{A} \, \overline{C} + C)(\overline{B} + \overline{A} \, \overline{C}) = (A + B) + (\overline{A} \, \overline{C} + C)(\overline{B} \cdot \overline{A} \, \overline{C})$$

$$= (A + B)(\overline{A} \, \overline{C} + C)(B \cdot \overline{A} \, \overline{C})$$

$$= [A \overline{A} \, \overline{C} + AC + \overline{A} \, \overline{C} \, B + BC ][B(\overline{A} + \overline{C})]$$

$$= (AC + \overline{A} \, \overline{C} \, B + BC) \cdot (B\overline{A} + B\overline{C})$$

$$= AC \cdot B\overline{A} + AC \cdot B\overline{C} + \overline{A} \, \overline{C} \, B \cdot B\overline{A}$$

$$+ \overline{A} \, \overline{C} \, B \cdot B\overline{C} + BC \cdot B\overline{A} + BC \cdot B\overline{C}$$

$$= 0 + 0 + \overline{A} \, B\overline{C} + \overline{A} \, \overline{C} \, B + BC\overline{A} + 0$$

$$= \overline{A} \, B(\overline{C} + \overline{C} + C)$$

$$= \overline{A} \, B$$





#### **THANK YOU**