SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF CSE - IoT

COURSE NAME:19EC306 / DIGITAL CIRCUITS

II YEAR/III SEMESTER

UNIT:1- MINIMIZATION TECHNIQUES AND LOGIC GATES

TOPIC:BOOLEAN POSTULATES AND LAWS

Outline

- 1854: Logical algebra was published by **George Boole** → known today as "Boolean Algebra"
  - It's a convenient way and systematic way of expressing and analyzing the operation of logic circuits.
- 1938: **Claude Shannon** was the first to apply Boole's work to the analysis and design of logic circuits.

Boolean operations and expressions

- *Variable* – a symbol used to represent a logical quantity.
- *Complement* – the inverse of a variable and is indicated by a bar over the variable.
- *Literal* – a variable or the complement of a variable.

Basic Identities of Boolean Algebra

1. X + 0 = X
2. X + 1 = 1
3. X . 0 = 0
4. X . 1 = 1
5. X + X = X
6. X . X = X
7. X + X' = X
8. X . X' = 0

Basic Identities of Boolean Algebra

Laws of Commutativity

1. $X + Y = Y + X$
2. $XY = YX$

Laws of Associativity

1. $X + (Y+Z) = (X+Y) + Z$
2. $X(YZ) = (XY)Z$

Boolean function and truth table

Laws of Distributivity

1. $X(Y + Z) = XY + XZ$
2. $X + YZ = (X + Y)(X + Z)$

De Morgan's Theorem

1. $(X + Y)' = X'Y'$
2. $(XY)' = X' + Y'$

Law of Involution

1. $(X')' = X$

DeMorgan's Theorems

- The complement of two or more ANDed variables is equivalent to the OR of the complements of the individual variables.

NAND = Negative-OR

$$\overline{X \bullet Y} = \overline{X} + \overline{Y}$$

- The complement of two or more ORed variables is equivalent to the AND of the complements of the individual variables.

NOR = Negative-AND

$$\overline{X + Y} = \overline{X} \bullet \overline{Y}$$

Boolean function minimization using Boolean algebra

- Apply DeMorgan's theorems to the expressions:

$$\overline{X \bullet Y \bullet Z}$$

$$\overline{X + Y + Z}$$

$$\overline{\overline{X} + \overline{Y} + \overline{Z}}$$

$$\overline{\overline{W} \bullet \overline{X} \bullet \overline{Y} \bullet \overline{Z}}$$

Thank you