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

$$= AB(\because A\bar{A} = 0)$$

Consensus laws

1. $$AB + \bar{A}C + BC = AB + \bar{A}C$$

Proof

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

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

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

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

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

Boolean Functions - Simplifications

2.

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

Proof

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

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

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

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

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

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

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

Basic Theorems and Properties of Boolean Algebra

3. Simplify $Y = ABC + A\bar{B}C + AB\bar{C}$ to $Y = A(B+C)$.

Solution:

$$
\begin{aligned}
Y &= ABC + A\bar{B}C + AB\bar{C} \\
&= AC(B+\bar{B}) + AB\bar{C} \\
&= AC\cdot 1 + AB\bar{C} \\
&= A(C + B\bar{C}) \\
&= A(B+C)
\end{aligned}
$$

Basic Theorems and Properties of Boolean Algebra

Simplify the given Boolean expression $Y = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C} + AB\bar{C}$.

4. Solution:

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

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

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

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

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

$$= \bar{C}$$

Description of the Laws of Boolean Algebra

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

Solution:

$$
\begin{aligned}
Y &= \overline{(AB + \overline{C})(\overline{A + B} + C)} \\
&= \overline{(AB + \overline{C})(\overline{A} \cdot \overline{B} + C)} \\
&= \overline{AB \cdot \overline{A}\,\overline{B} + ABC + \overline{A}\,\overline{B}\,\overline{C} + C\overline{C}} \\
&= \overline{0 + ABC + \overline{A}\,\overline{B}\,\overline{C} + 0} \\
&= \overline{ABC + \overline{A}\,\overline{B}\,\overline{C}} \\
&= \overline{ABC} \cdot \overline{\overline{A}\,\overline{B}\,\overline{C}} \\
&= (\overline{A} + \overline{B} + \overline{C}) \cdot (\overline{\overline{A}} + \overline{\overline{B}} + \overline{\overline{C}}) \\
&= (\overline{A} + \overline{B} + \overline{C}) \cdot (A + B + C)
\end{aligned}
$$

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:

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

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

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

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

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

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

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

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

$$=\overline{A}B$$

THANK YOU