

Date :- 28/5/2020

Name :- Poojary sushant

Course :- Logic design

USN :- 4AL18EC400

Title :- Boolean eq. for digital ckt
Ckt - combinational ckt

Sem :- 6th sem 'B' sec

Boolean Algebra

"In 1854, George Boole developed an algebraic system now called Boolean algebra"

- Boolean algebra is a system mathematical logic
- "It is defined with set of element, a set of operators & a no of axioms or postulate"
- Set of element (0,1)
- Two binary operator - OR (+) & AND (.)
- Unary operator - NOT (u)

Boolean Algebra

$$A + A = A \quad 1 + 1 = 1$$
$$\cancel{A \cdot A = A} \quad 1 \cdot 1 = 1$$

Ordinary Algebra

$$A + A = 2A \quad 1 + 1 = 2$$
$$A \cdot A = A^2 \quad 1 \cdot 1 = 1$$

Binary number system

$$1 + 1 = (10) \quad 1 \cdot 1 = 1$$

Axioms (or) Postulates

$$\rightarrow A + 0 = A$$

$$\rightarrow A + 1 = 1$$

$$\rightarrow A + A = A$$

$$\rightarrow A + \bar{A} = 1$$

$$\rightarrow \bar{\bar{A}} = A$$

$$A \cdot 0 = 0$$

$$A \cdot 1 = A$$

$$A \cdot A = A$$

$$A \cdot \bar{A} = 0$$

⊗ Laws of Boolean Algebra

1) Commutative law

$$A + B = B + A$$

$$A \cdot B = B \cdot A$$

2) Associative law

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

$$A \cdot (B \cdot C) = (A \cdot B) \cdot C$$

3) Distributive law

$$A \cdot (B + C) = AB + AC$$

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

⊗ Theorems of Boolean algebra = $A + Bc$

1) Absorption Theorem

$$a) \quad X + XY = X$$

$$\rightarrow X(1 + Y)$$

$$\begin{aligned} &\rightarrow X \cdot 1 \\ &= X \end{aligned}$$

$$b) \quad A + \bar{A}B = A + B$$

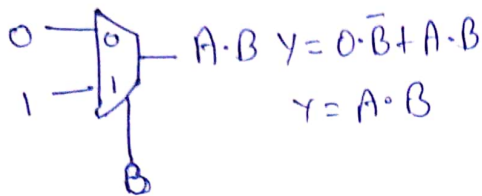
$$(A + \bar{A})(A + B)$$

$$1(A + B) = A + B$$

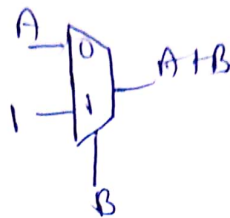
★ Mux to logic gates

1. Nand & Nor - universal gates

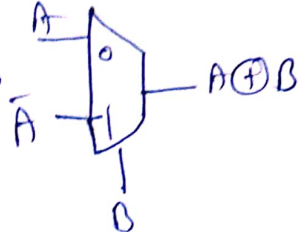
AND



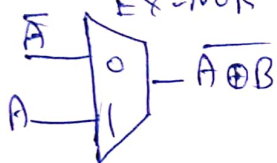
OR



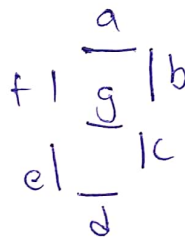
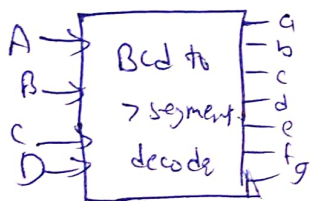
EX-OR



EX-NOR



★ 7 segment decoder



A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1

$$\begin{array}{ll}
 \rightarrow x + 0 = & x \cdot 0 = \\
 \rightarrow x + 1 = & x \cdot 1 = \\
 \rightarrow x + x = & x \cdot x = \\
 \rightarrow x + \bar{x} = & x \cdot \bar{x} = \\
 \rightarrow &
 \end{array}$$

All

Boolean algebra

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$$\begin{aligned}
 (1) \quad & xy + \bar{x}z + yz = xy + \bar{x}z + yz \cdot 1 \\
 & = xy + \bar{x}z + yz(x + \bar{x}) \\
 & = \underline{xy} + \underline{\bar{x}z} + \underline{xyz} + \underline{\bar{x}zy} \\
 & = xy(1+z) + \bar{x}z(1+y) \\
 (2) \quad & (x+y)(\bar{x}+z)(y+\bar{z})
 \end{aligned}$$

24:38



Digital Circuits Lecture-13: Boolean algebra (Part-2)

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Which is not the mode of failure of riveted joint.

- (A) Tensile failure of effective plate cross-section between rivets
- (B) Tensile failure of rivet at its minimum cross-section
- (C) Shearing of rivet cross-section