CSE260 Lab Report

Experiment Name : Applications of Boolean Algebra

Submitted by-

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Section 05

Date : 08 November 2020

1> Name of Experiment : Applications of Boolean Algebra

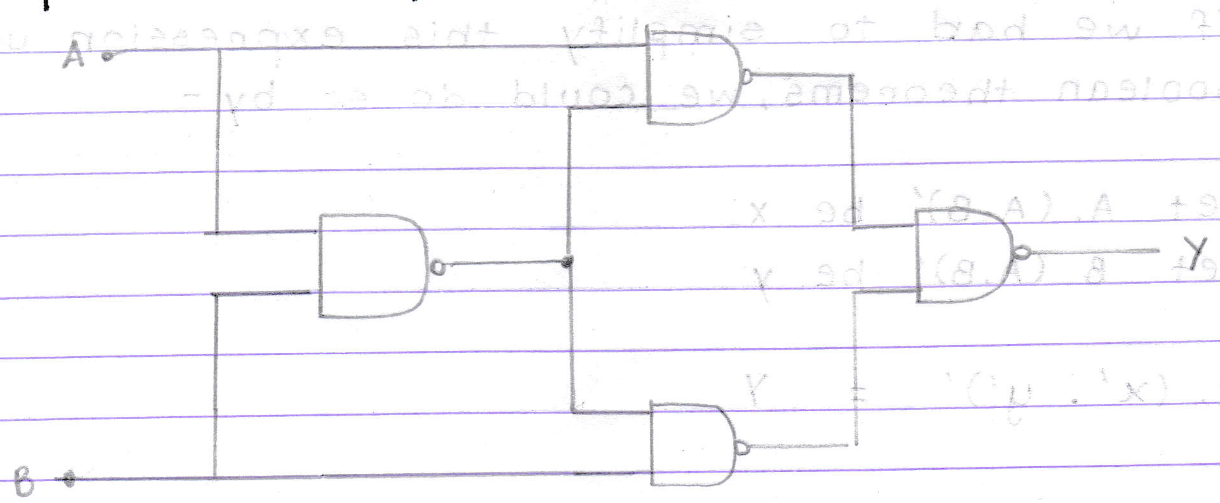
2> Objective

- to investigate the rules of Boolean algebra
- to gain experience working with practical circuits
- to simplify a complex function using Boolean algebra

3> Required components and equipments

- AT-700 Portable Analogue
- 7400 X1
- logic states
- NAND logic gate
- ground
- wires
- LED light

4 Experimental Setup



5) Truth Table

A	B	$(A.B)'$	$(A.(A.B))'$	$(B.(A.B))'$	$(A.(A.B)').(B.(A.B))$
0	0	1	1	1	0
0	1	1	1	0	1
1	0	1	0	1	1
1	1	0	1	1	0

In this experiment, we had constructed the given circuit and obtained results accordingly. The ~~logic~~ entire circuit was quite easy to construct and understand. After I constructed the circuit on Proteus, I had to write the truth table for the output. Even though, it seemed a little lengthy at first, however, after breaking down the truth table into several parts, it became more convenient to solve the truth table. The Boolean expression for the output was $(A.(A.B))'.(B.(A.B))'$ If we had to simplify this expression using Boolean theorems, we could do so by -

let $A.(A.B)'$ be x
let $B.(A.B)'$ be y

$\therefore (x'.y')' = Y$

$$\Rightarrow Y = (x' \cdot y')'$$
$$\Rightarrow Y = (x')' + (y')' \quad [\text{De Morgan's law}]$$
$$\Rightarrow Y = x + y \quad [(x')' = x \,,\, (y')' = y]$$
$$\Rightarrow Y = A \cdot (A \cdot B)' + B \cdot (A \cdot B)'$$
$$\Rightarrow Y = A \cdot (A' \cdot B') + B \cdot (A' \cdot B')$$
$$\Rightarrow Y = A \cdot A' + A \cdot B' + B \cdot A' + B \cdot B'$$
$$\Rightarrow Y = 0 + A \cdot B' + B \cdot A' + 0$$
$$\Rightarrow Y = A \cdot B' + B \cdot A'$$
$$\therefore Y = A \oplus B$$

After constructing the truth table and ~~obtaining~~ observing the results, we notice that the outputs are exactly identical to that of a XOR gate. The simplified Boolean expression also shows the final output in its simplest form, which is equivalent to a XOR gate. From this experiment, we can see how we can use multiple NAND gates to construct a circuit which gives the same output as a XOR gate. This is more advantangeous than using one single logic gate such as in terms of expense. This is why both NAND and NOR gates are called universal gates as they can be used to form any circuit.