Practical Submission Sheet

Term: 2020-1
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Course Code: PHY249
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Section: G2903
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Aim

Create a combinational logic system for a given truth table and create a boolean expression for the same.

Concepts Learnt

Learnt how circuit combinations can be used to create any desired logic system. Learnt making use of both NAND logic and AOI logic. Made use of deMorgan's theorem and wrote a boolean expression for the logic in context.

Key Observations & Insights

Both AOI and NAND combination logic circuits were created for two logic systems $A.\bar{B}.\bar{C} = 1$ and $\bar{A}.\bar{B}.C + A.\bar{B}.\bar{C} = 1$ and their corresponding truth tables were empirically verified.

Application Areas

Boolean logic is the most important in all of computer devices, these days now extending to emerging technologies such as internet of things.

Report

Firstly, a boolean expression for the logic summarized in Table 1 was written.

Input A	Input B	Input C	Output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Table 1: Truth table for the first logic system that was studied.

The key point to note in the truth table is that the output is "high" only for $A = 1, B = 0, C = 0$, and therefore a suitable boolean expression for this would be

$$A.\bar{B}.\bar{C} = 1$$

From deMorgan's law

$$\bar{B}.\bar{C} = \overline{B + C}$$

Therefore,

$$A.(\overline{B + C}) = 1$$

Since dot corresponds to an AND operation and + corresponds to an OR logic, our concerned logic system involves an AND gate with A and $\overline{B + C}$ as the inputs, where $\overline{B + C}$ itself is the output of a NOR gate over B and C.

The required logic system was constructed as shown in Figure 1.

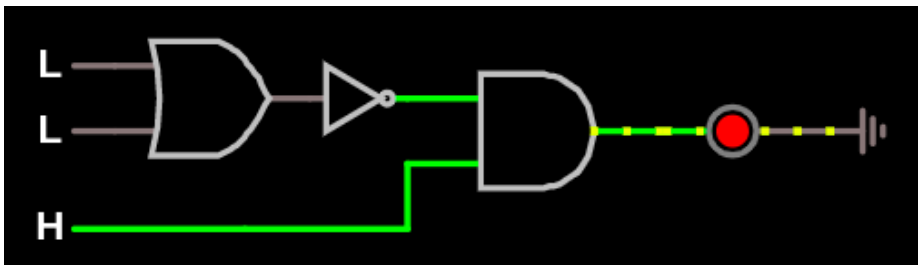

Figure 1: AOI logic combination for the first truth table.

The truth tables were correspondingly verified. A NAND combination was also created for the same logic as shown in Figure 2.

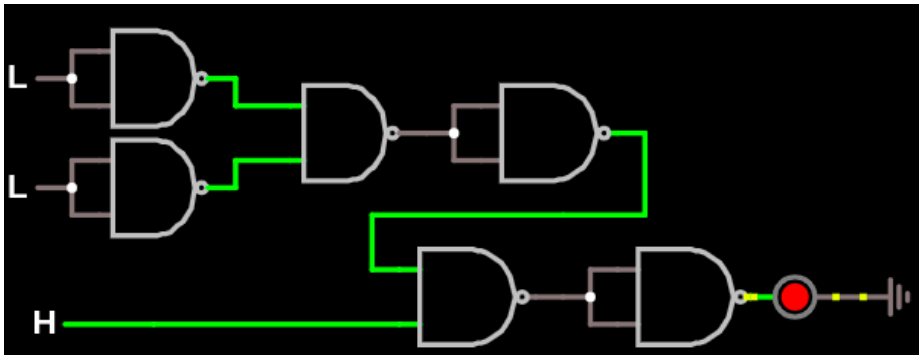

Figure 2: A NAND combination for the concerned logic system.

Another logic system was studied, for which the given truth table was the following

Input A	Input B	Input C	Output
0	0	0	0
0	0	1	1
0	1	0	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Table 2: Truth table for the second logic system.

The boolean expression for this logic system is

$$\bar{A}.\bar{B}.C + A.\bar{B}.\bar{C} = 1$$

An AOI logic combination equivalent to this boolean expression was created, as depicted in Figure 3. The truth table was also verified.

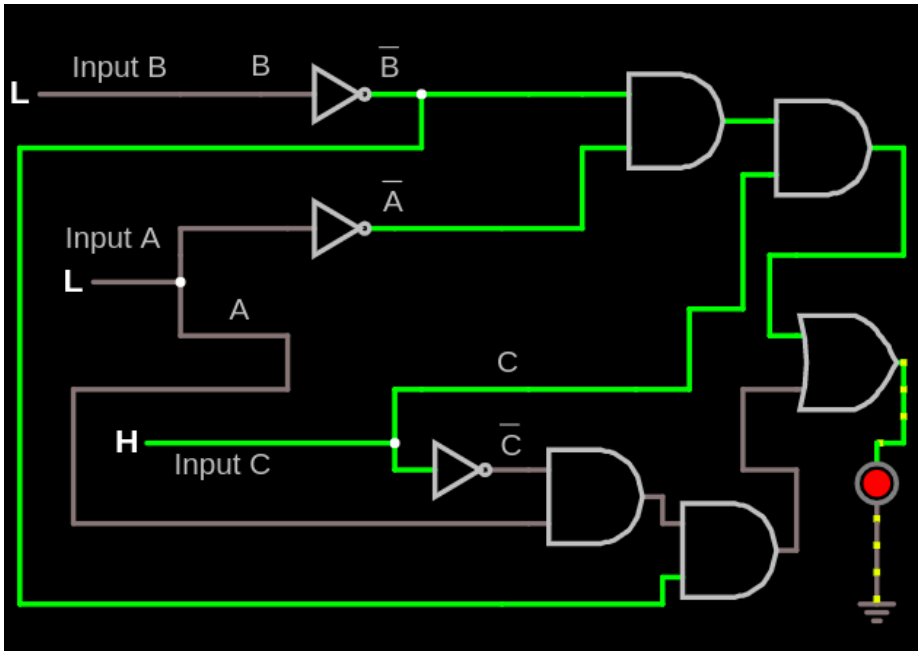

Figure 3: AOI logic for the logic $\bar{A}.\bar{B}.C + A.\bar{B}.\bar{C}$