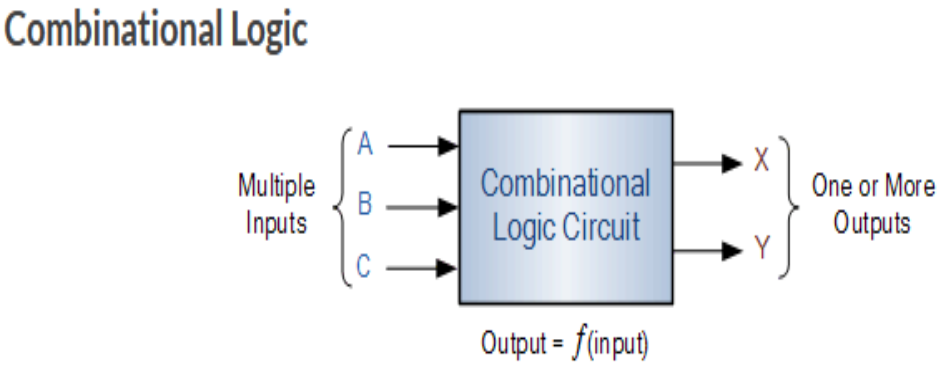
Lab no 03: Combinational Logic Circuit

The purpose of this Lab is to:

1) Introduce the combinational logic circuits.
2) Design, implement, and verify a simple combinational logic circuit using logic gates, switches, and LEDs.

Part1: Introduction to combinational logic circuits.

Combinational Logic Circuits are memoryless digital logic circuits whose output at any instant in time depends only on the combination of its inputs. Combinational Logic Circuits are made up of basic logic NAND, NOR, or NOT gates that are "combined" or connected together to produce more complicated switching circuits.



Part 2: Design and Implementation

Example:- Consider the case shown in Figure (a), where we have a truth table that indicates that the output x is to be 1 for two different cases: A = 0, B = 1, and A = 1, B = 0. How can this be implemented?

Step 1. Set up the truth table.

Given a Truth table to derive the Boolean expressions and build the logic circuit to realize it.

A	B	x
0	0	0
0	1	1
1	0	1
1	1	0

$\rightarrow \bar{A}\,B$

$\rightarrow A\,\bar{B}$

(a)

Figure 2.(a). Truth table using AND terms.

Step 2. Write the AND term for each case where the output is a 1

There are two cases. The AND terms are shown next to the truth table as shown in (Table a).

Step 3. Write the sum-of-products expression for the output.

$$X = \bar{A}\,B + A\,\bar{B}$$

Step 4. Implement the circuit for the final expression.

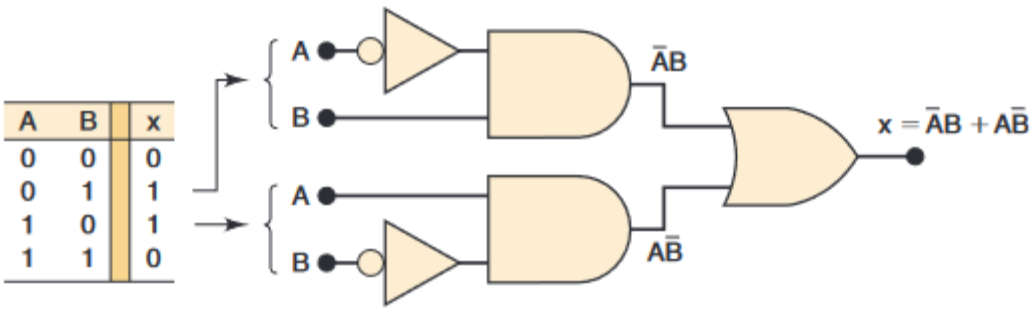


Figure 2.(b). Implementation using logic gates.

Step 5. Implement the circuit on the Green board.

1. Connect the switch (S1) to the input port of NOT gate (G15) using wire, red wire as shown in figure 3.
2. Connect the switch (S2) to the input port of NOT gate (G18) using wires, red wire as shown in figure 3.
3. Connect the output port of NOT gate (G15) and switch (S2) to the input ports of AND gate (G4) using wires, red and green wires as shown in figure 3.

4. Connect the output port of NOT gate (G18) and switch (S1) to the input ports of AND gate (G8) using wires, red and green wires as shown in figure 3.
5. Connect the output port of AND gate (G4) and the output port of AND gate (G8) to the input ports of OR gate (G7) using wires, orange wires as shown in figure 3.
6. Connect the output port of OR gate (G7) to LED (LP4) using wire, orange wire as shown in Figure 3.
7. Verify the Truth Table of Logical circuit by changing the switches (S1, S2) states between ON and OFF and observe the output on LED (LP4).

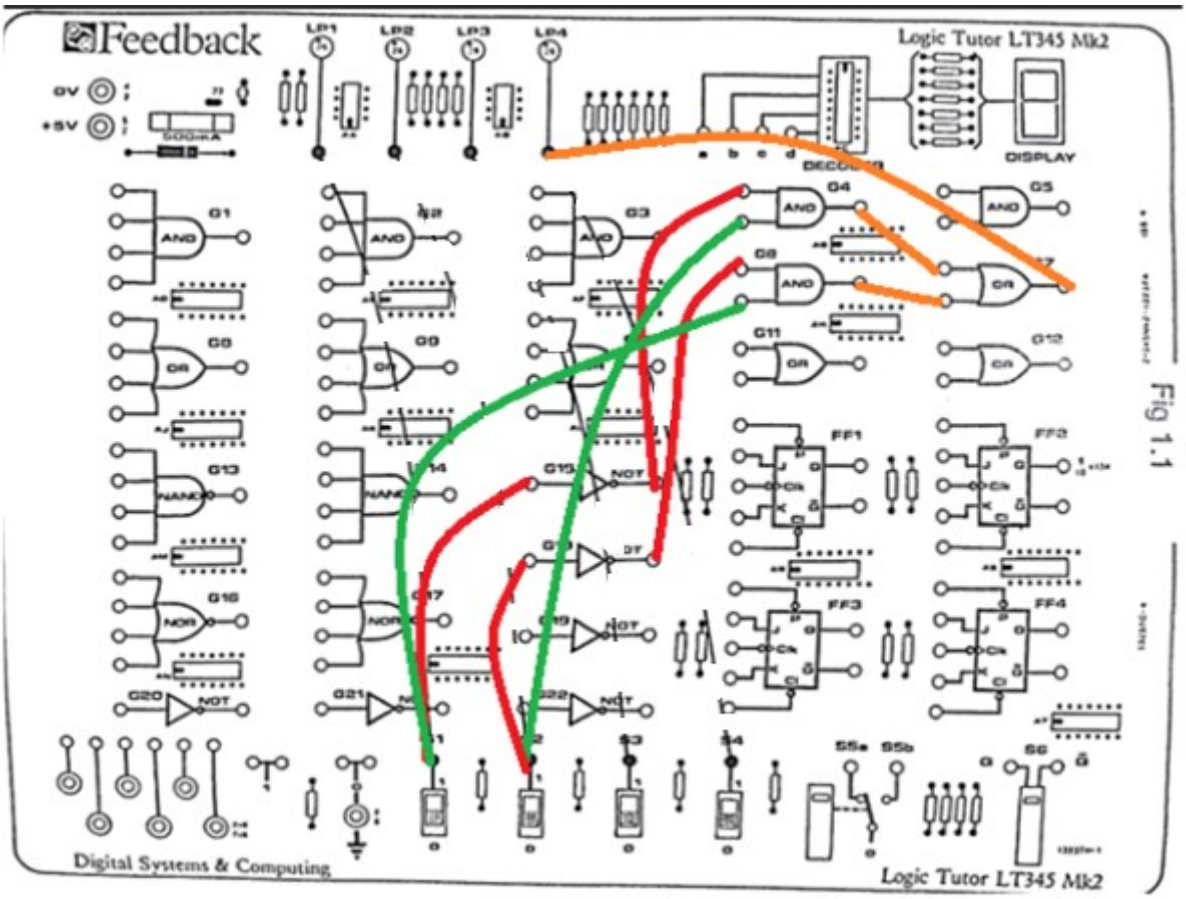


Figure 3. Connect Combinational logic expression on the Green Board