Lab Report

Lab Session-7

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AIM: Realize the boolean function using 8x1 mux.

COMPONENT: SN74LS151N, LED(x5), DC bench supply, wires

THEORY: A multiplexer is a combinational circuit that has maximum of 2^n data inputs, 'n' selection lines and single output line. One of these data inputs will be connected to the output based on the values of selection lines. For this experiment we use an 8x1 MUX. An 8x1 MUX has sixteen data inputs I_{15}, I_{14}, I_{13}, I_{12}, I_{11}, I_{10}, I_9, I_8, I_7, I_6, I_5, I_4, I_3, I_2, I_1 & I_0, three selection lines s_2, s_1 & s_0 and one output Y.

In this experiment we want implement a Boolean function using the 8x1 Multiplexer,

To implement an n-variable function, we assign n − 1 variables to the select inputs, one to each such input. The last variable and the constants 0 and 1 are assigned to the data inputs in such a way that, together with the select input variables, they will yield the required function. Such an implementation is usually possible when at least one variable is available in both it's complemented as well as its uncomplemented form.

In this experiment, we have to verify the functionality of ∑ (1,3,7,13,14,15)

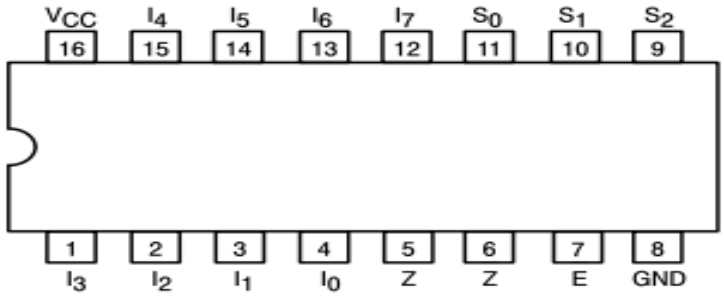
The Karnaugh map of the above SOP,

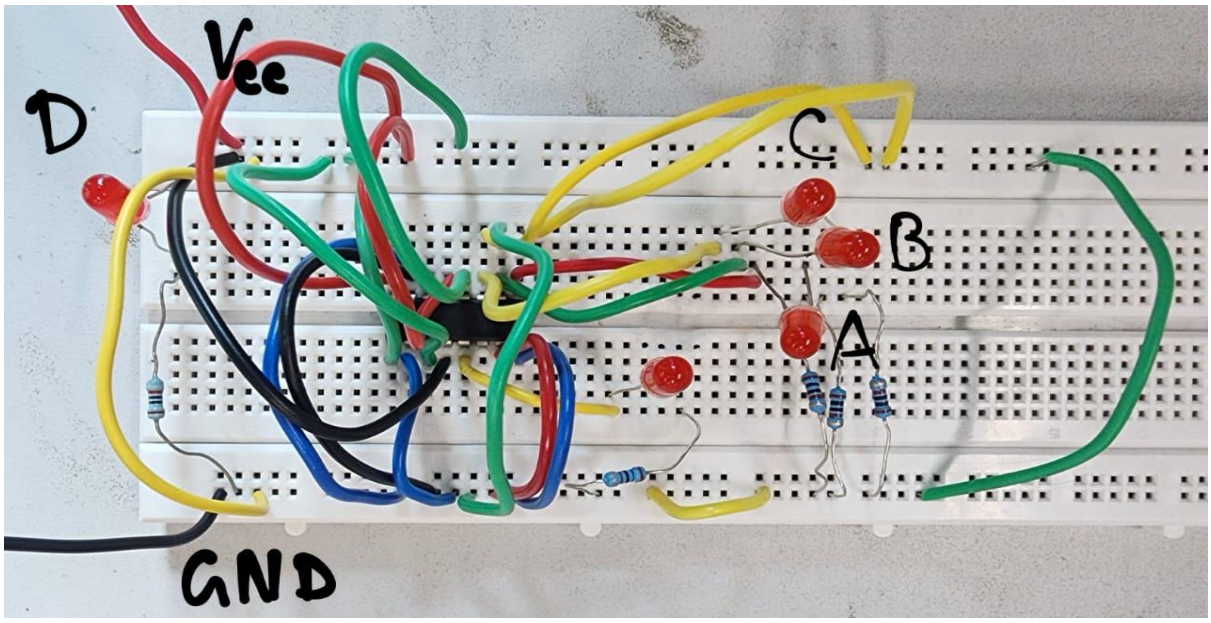
	$C'D'$	$C'D$	CD	CD'
A'B'	0	1	1	0
A'B	0	0	1	0
AB	0	1	1	1
AB'	0	0	0	0

Table 1: K-map of $\sum(1, 3, 7, 13, 14, 15)$

Solving the map, we get

$$Y = A'B'D + A'CD + ABD + ABC$$





PROCEDURE:

1. We firmly attach IC 54LS151 to the breadboard.
2. We select one of the side rails to be the D variable.
3. We set one of the side rails to be Vcc. We set the Vcc to be at 4.5V by connecting it to the DC bench power supply.
4. We connect the ground wire of the DC bench power supply to one of the side rails. Hence, we set one of the side rails of the breadboard as the ground.
5. We refer to the pin diagram of this IC, and by referring to the IC connection diagram, we set up the connections accordingly.
6. Pins 1,3,4,13 (I_0, I_1, I_3, I_6) of the IC are connected to the D side rail.
7. Pins 2,15,14(I_2, I_4, I_5) of the IC connected to the ground rail (zero voltage)
8. Pin 12 of the IC is connected to a Vcc of 4.5V.

9. Pins 11,10,9 of the IC are the selector pins, we connect to either ground(0v) or the Vcc rail (4.5V) to obtain the various outputs of the MUX.
10. The output of the MUX is obtained on pin number 5 on the IC.
11. Pin number 16 of the IC is connected to the Vcc rail of 4.5V.

In order to show the inputs and outputs (1/0), we use LED's.

12. From pins 11,10,9 (selector pins), we connect LED's, connected to a resistor of value 1k, which is then connected to the ground rail. (The resistors so that current passing through the LED is controlled, else the LED's may be damaged if excessive current passes through them.)
13. We also do the same to one end of the D variable side rail, and to pin number 16 of the IC to show the display the input D variable state (1/0) and output display, respectively.
14. We connect selector pins to the inputs (1/0) using wires.
15. We also set variable D to Vcc/GND using wires.
16. We make sure that all the connections are firm.
17. Finally, we power on the DC bench power supply to obtain the required output by checking the state of the LED.

We record the output and change the selector / D variables to find out other outputs.

RESULT:

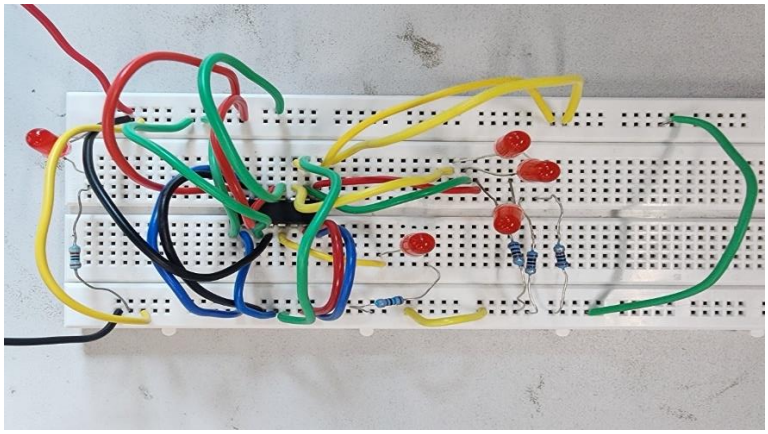
Note that the leftmost LED is a D variable, in the right-side LED's, the upper one is A variable, middle one is a B variable, lower one is a C variable.

The central LED represents the output of the Multiplexer

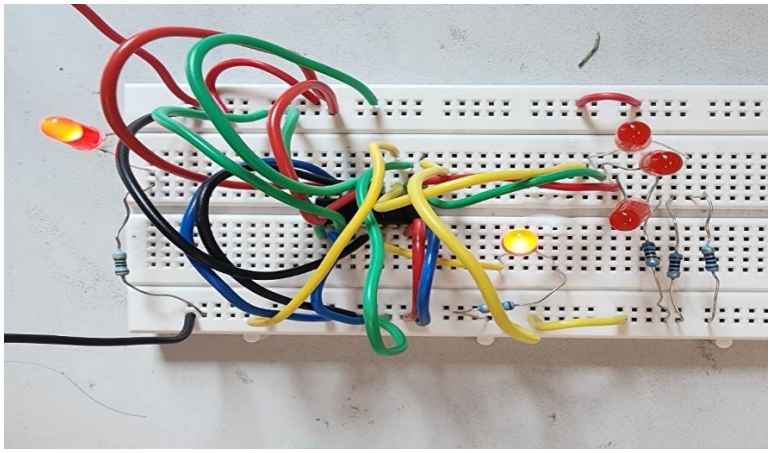
We want the output LED to glow whenever the input of ABCD is 1(0001),3(0011),7(0111),13(1101),14(1110),15(1111)

Displaying below the output for all 16 cases of input variables A,B,C,D and their corresponding outputs.

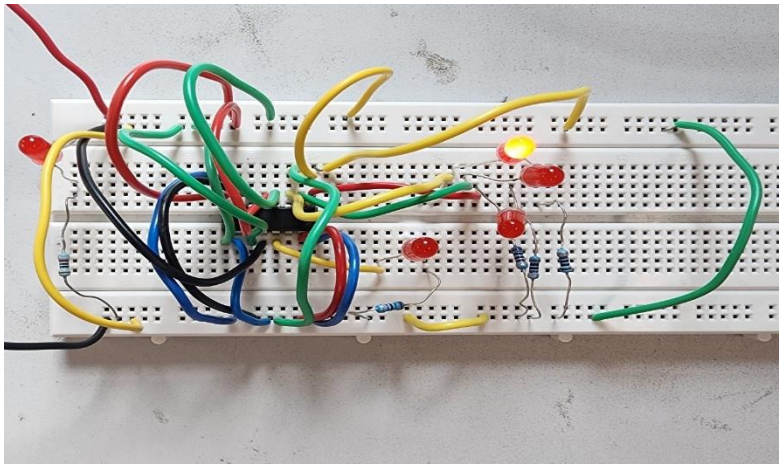
Case 1: 0000



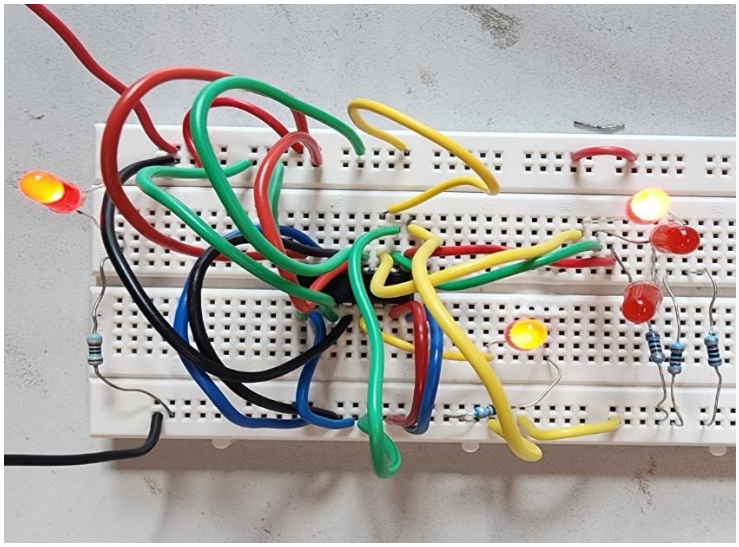
Case 2: 0001



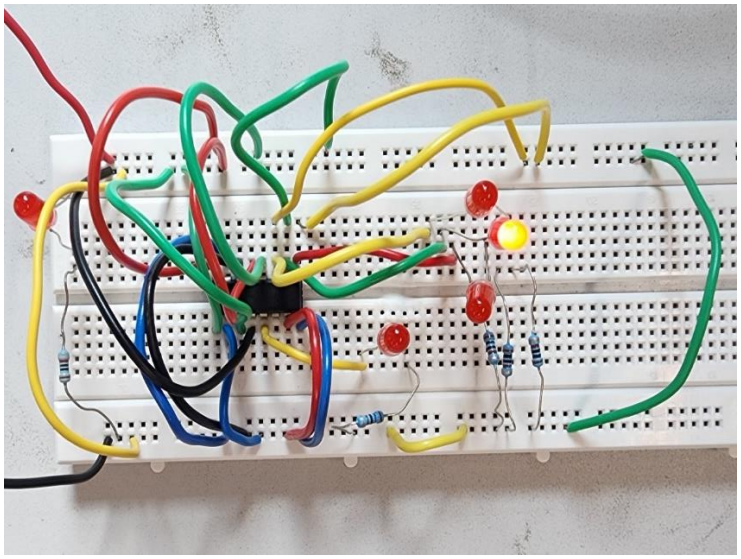
Case 3: 0010



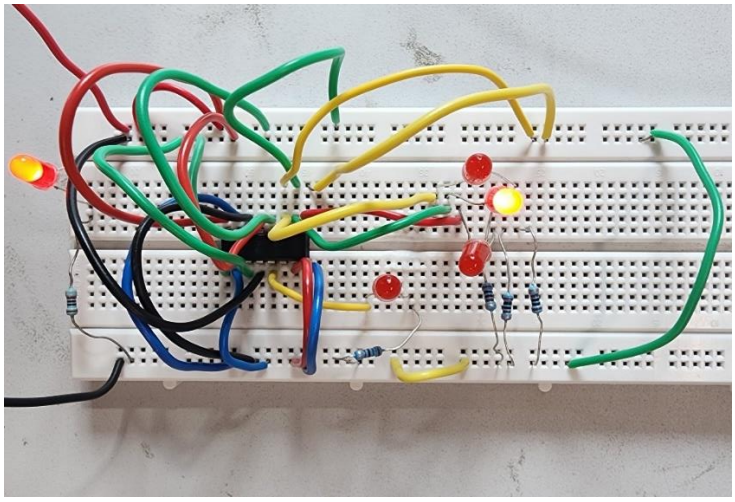
Case 4: 0011



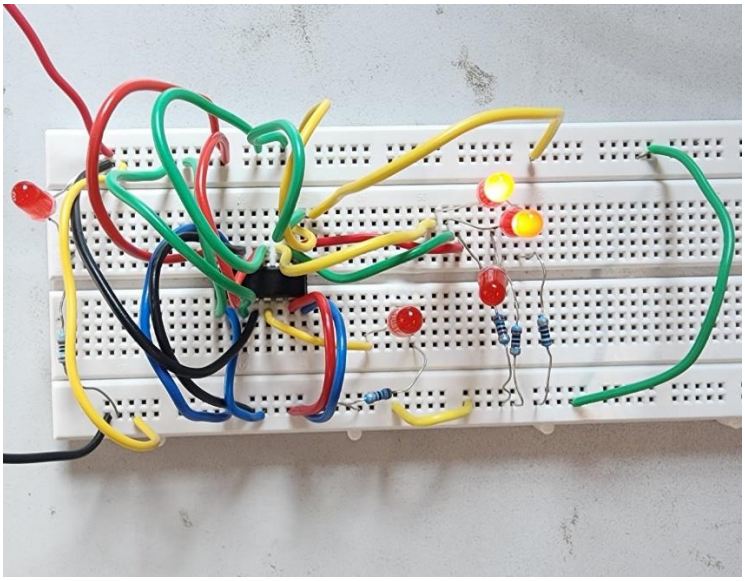
Case 5: 0100



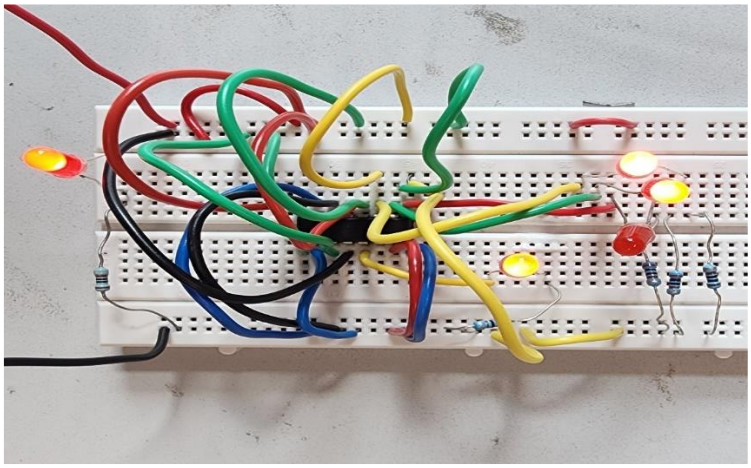
Case 6: 0101



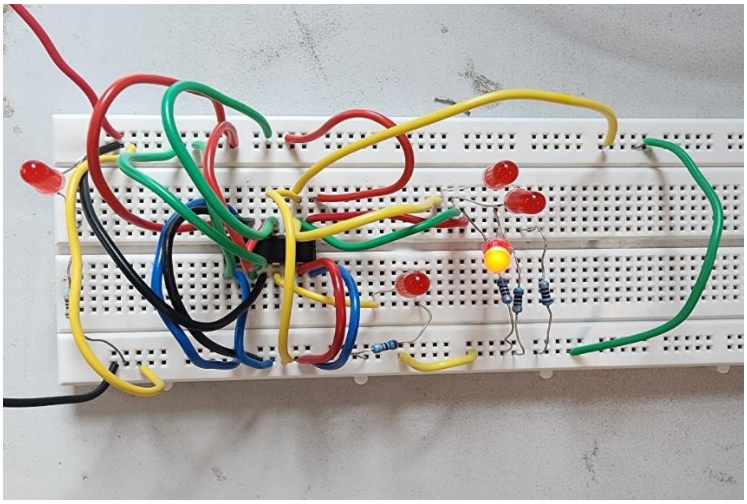
Case 7: 0110



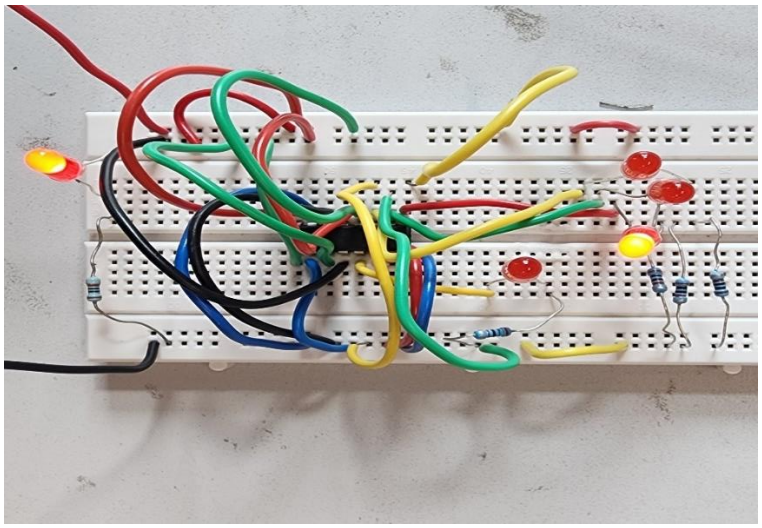
Case 8: 0111



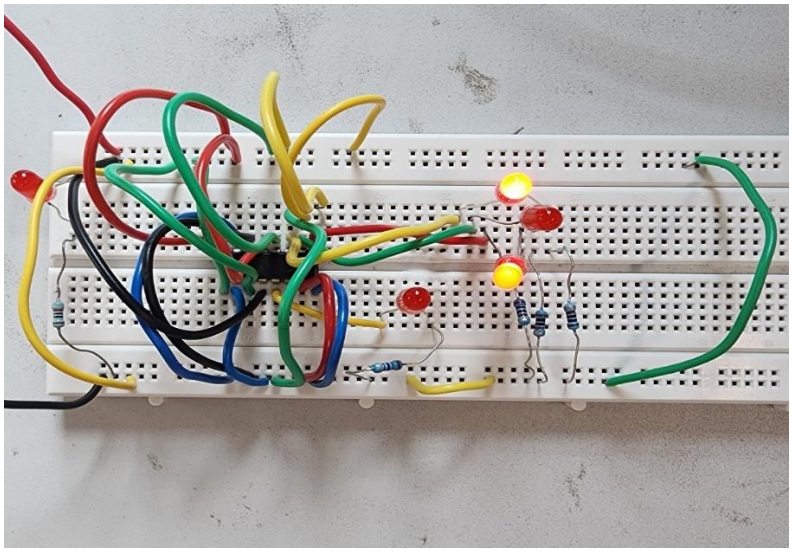
Case 9: 1000



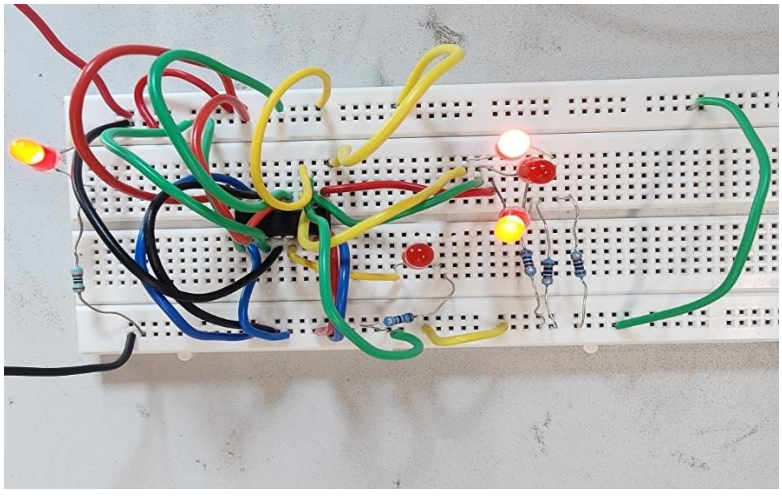
Case 10: 1001



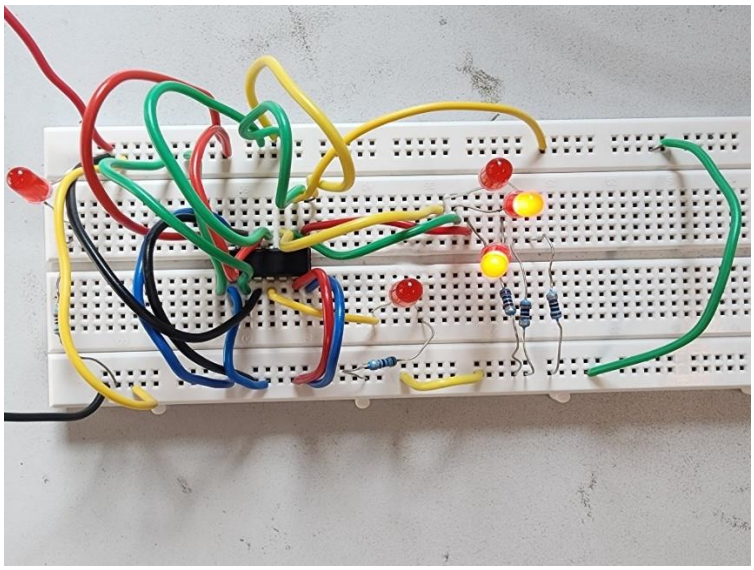
Case 11: 1010



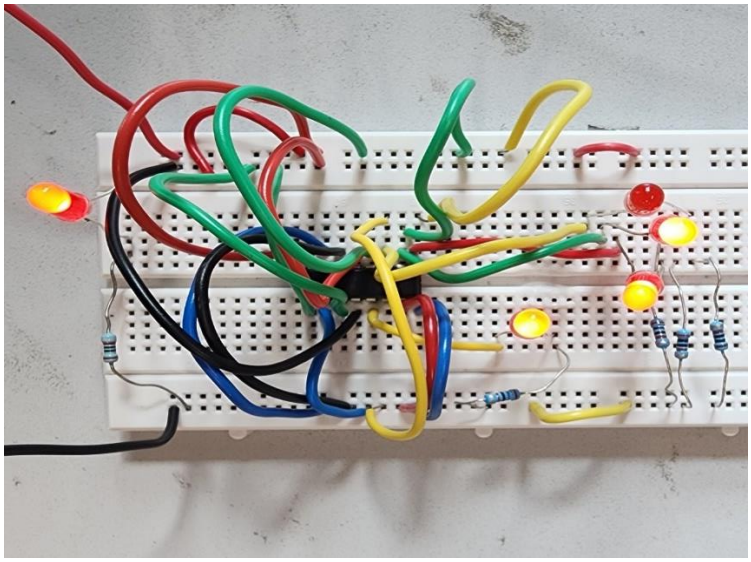
Case 12: 1011



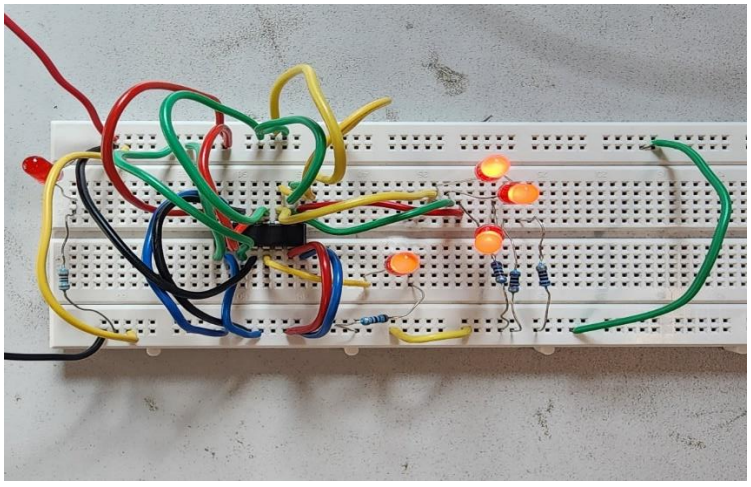
Case 13: 1100



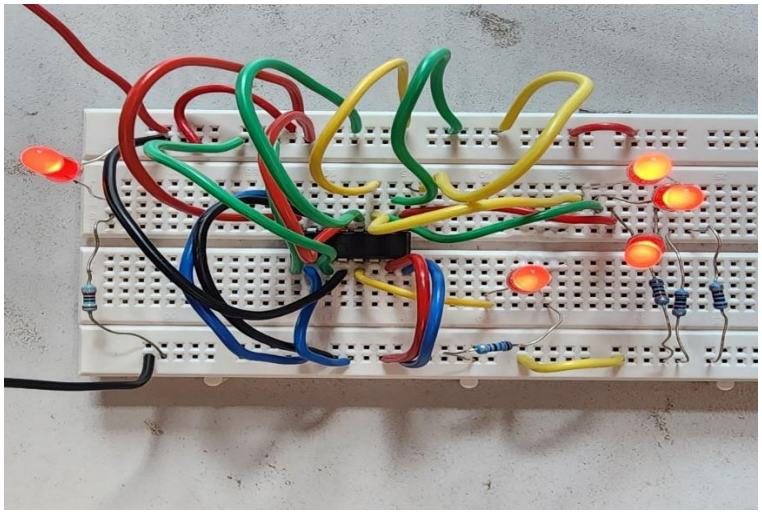
Case 14: 1101



Case 15: 1110



Case 16: 1111



READINGS

The above cases were tabulated in a truth table on latex.

cases	A	B	C	D	$\sum(A,B,C,D)$
1	0	0	0	0	0
2	0	0	0	1	1
3	0	0	1	0	0
4	0	0	1	1	1
5	0	1	0	0	0
6	0	1	0	1	0
7	0	1	1	0	0
8	0	1	1	1	1
9	1	0	0	0	0
10	1	0	0	1	0
11	1	0	1	0	0
12	1	0	1	1	0
13	1	1	0	0	0
14	1	1	0	1	1
15	1	1	1	0	1
16	1	1	1	1	1

Table 1: Truth table of $\sum(1,3,7,13,14,15)$

CONCLUSION

We see that the output LED glows when the minterms 1,3,7,13,14,15 are applied as the inputs and that for all other inputs, the output LED does not glow. So, we have implemented a Boolean function using a 8:1 multiplexer