

EEE102 LAB3

Combinational Logic Circuit

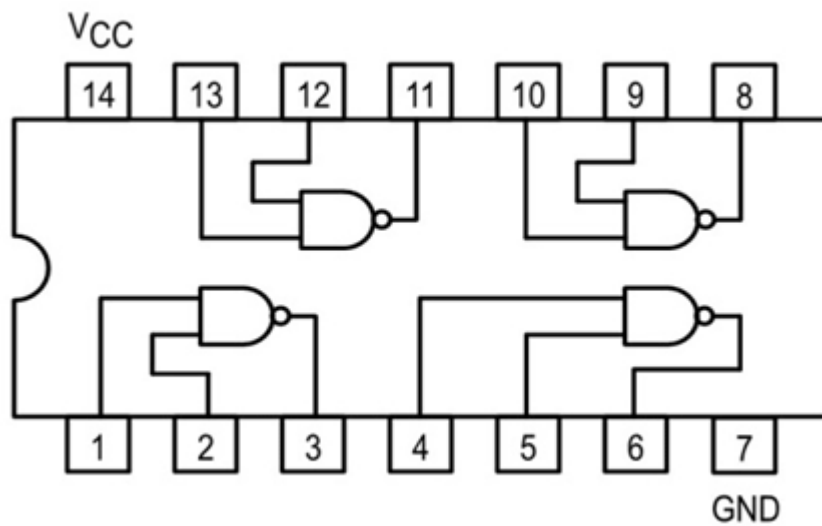
Purpose:

Aim of this experiment is to investigate how logic gates work and learn to implement a circuit which is done by logic gates on the breadboard and observe the signals of the circuit by using oscilloscope.

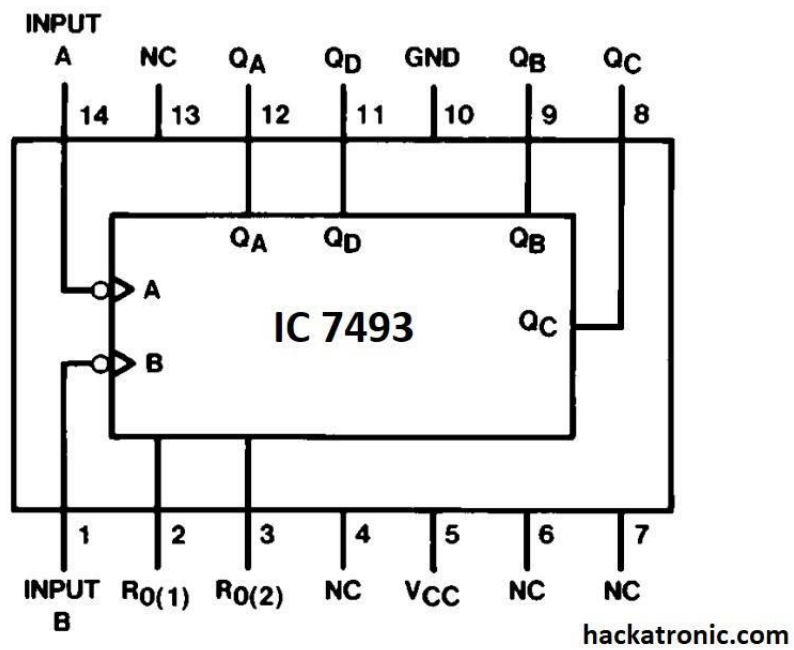
A) Methodology:

1) Pin Connection

In this experiment 2 to 1 multiplexer is done. Theoretically 2 to 1 multiplexer is done by using 4 NAND Gates. 2 inputs and a select signal assigned as "S" is used. First steps are implementation of 4 bit binary counter and 74 LC/SH 00. I1, I2 and S is connected to pins 14, 13, 12 respectively with jumper cables. S is connected to the 1st and 2nd pin of 74 LC/SH 00 in order to obtain inverse of S, a jumper cable with open end is connected to 3rd pin. I1 and inverse of S (jumper cable from 3rd pin) is connected to the 4th and 5th pins respectively and a jumper cable with one end open is connected to the 6th pin. I2 and S is connected to 13th and 14th pins with respectively and a jumper cable with an open end is connected to 11th pin. The open ends of the jumper cables are connected from 6th to 10th and 11th to 9th pin. A jumper cable with an open end is connected to the 8th pin. Now the inputs are complete. After completing pin connection for inputs and S, Vcc and GND pins are connected. For both 4 bit binary counter and 74 LC/SH 00, GND pins are connected to negative end of breadboard, Vcc pin for binary counter is connected with a jumper cable with one end open for connecting the other end of jumper cable to positive supply in the later step. Vcc pin of 74 LC/SH 00 is connected to the positive end of the breadboard. Now there is only one step left in pin connection. Since count mode of binary counter is used, 1st, 7th, 10th, and 9th, pins are connected to the positive end of the breadboard. The pin connection is fully complete.



Demonstration of 74 LC/SH 00



Demonstration of 4 bit binary counter

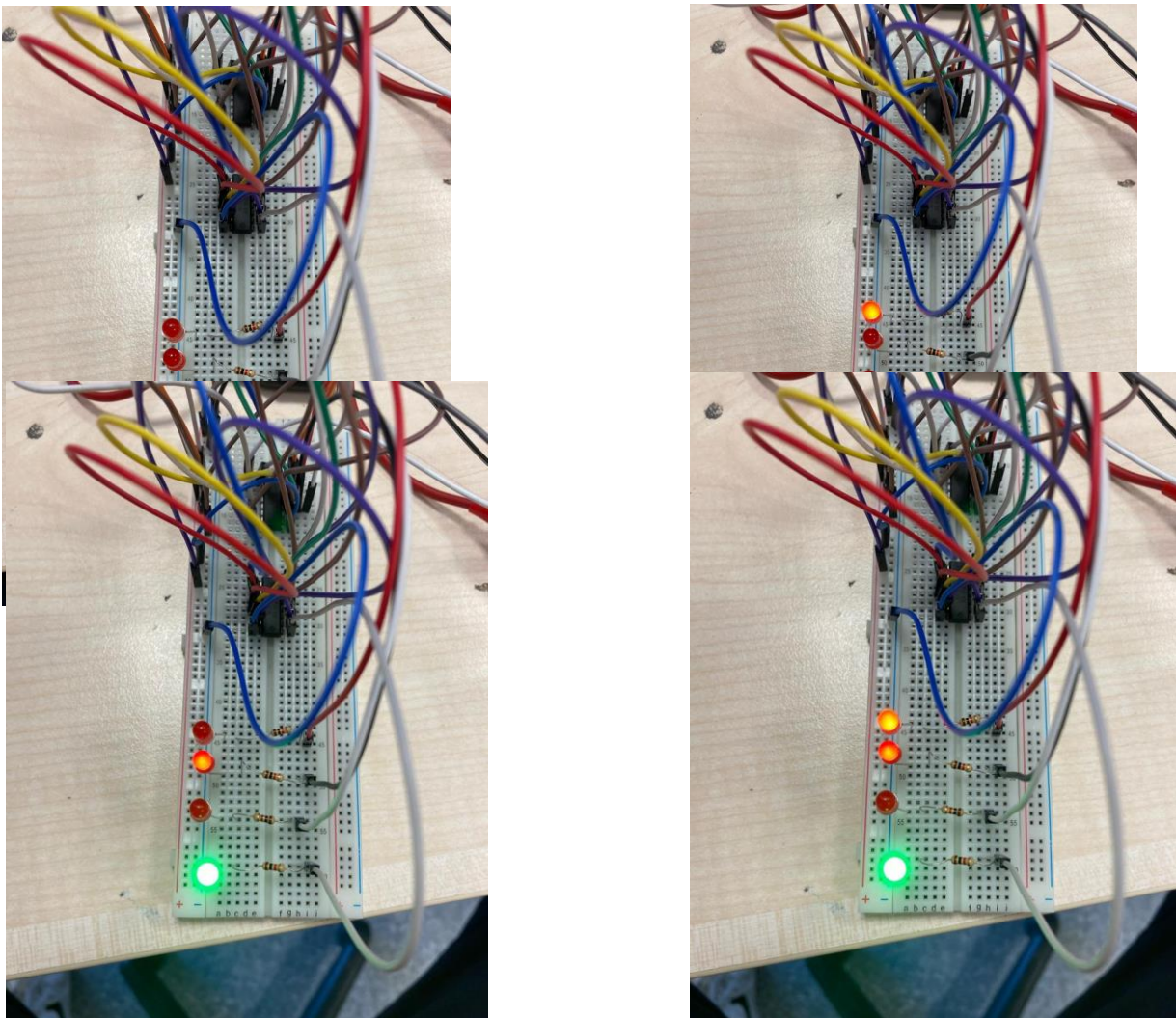
2)LED Circuit

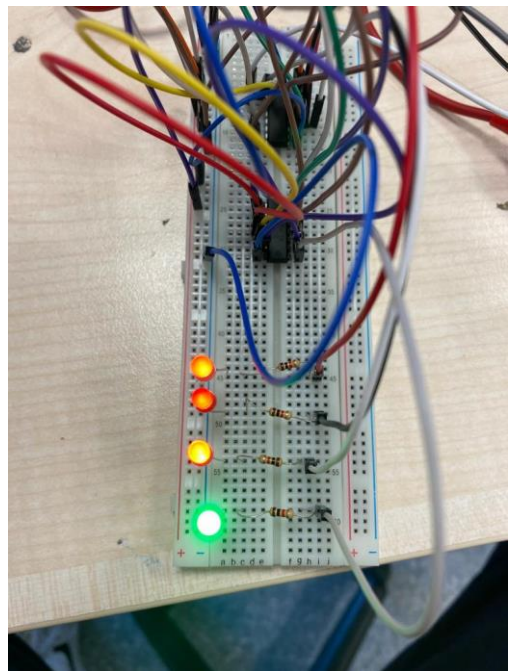
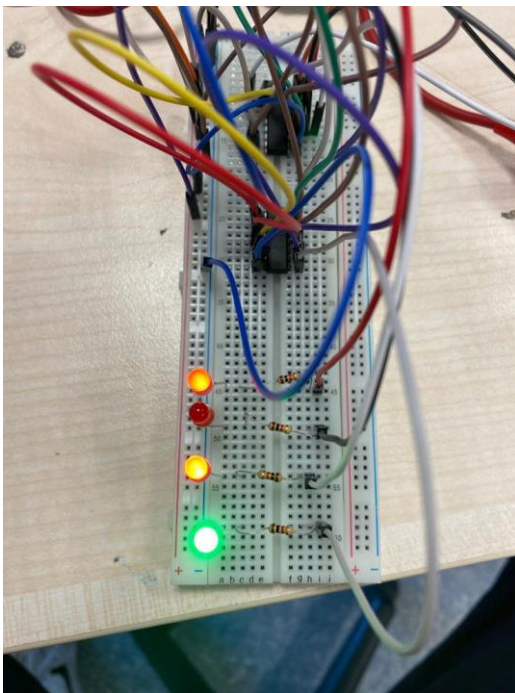
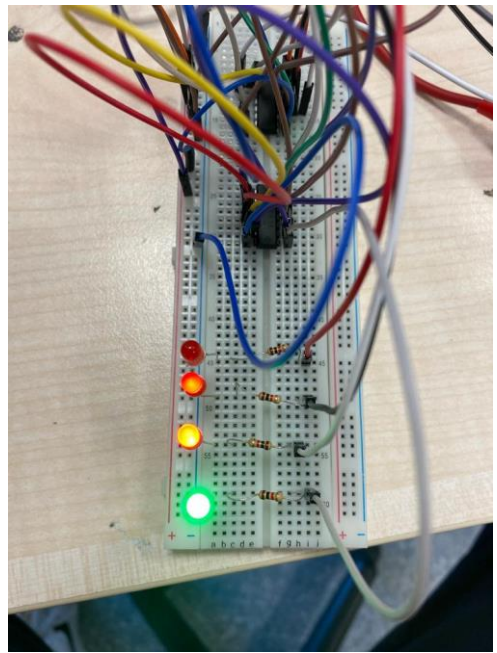
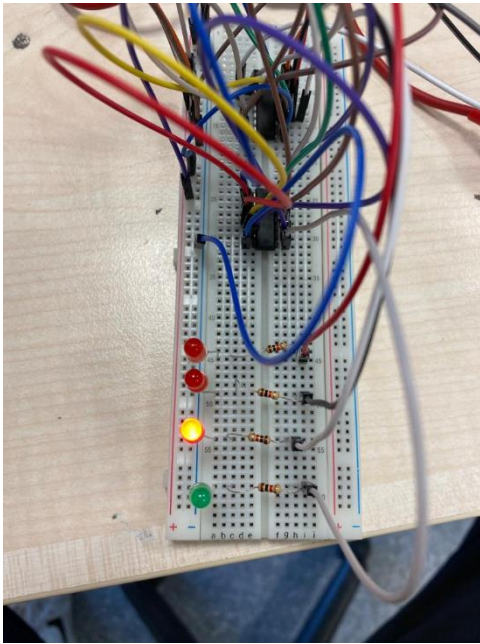
Moving to the LED circuit, three red LEDs and one green LED is selected. Red LEDs represent the inputs and S, green LED represent the output. Red LEDs represent I1, I2 and S respectively from top to bottom. Short legs of LEDs are implemented to the negative end of the breadboard. In addition, 4 resistors are used as shown in the figure. Open ended jumper cable from 8th pin of 74 LC/SH 00 is connected to the other end of the resistor which is at the same row with the green LED. 3 other jumper cables are used to provide connection between pins 14, 13 and 12 of binary counter and red LEDs. LED circuit is complete.

3)Connection with power supply

To black crocodile cables are grounded by using jumper cables. One red crocodile cable is connected to open ended jumper cable which was from Vcc pin of binary counter. Other red crocodile cable is connected to positive end of breadboard by using jumper cables. Now the LEDs are lit in a sync.

B)Images of LEDs



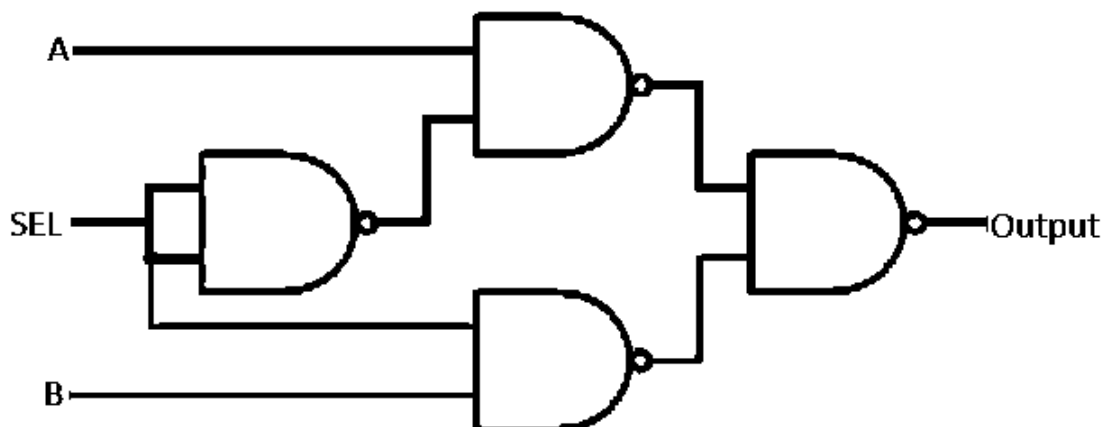


C) Truth table:

From the images truth table of the 2 to 1 multiplexer can be obtained.

I1	I2	S	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

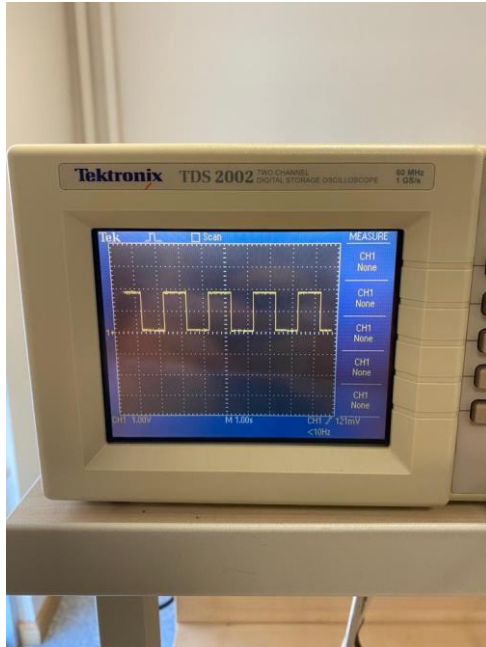
$$F = S'(I1) + S(I2)$$



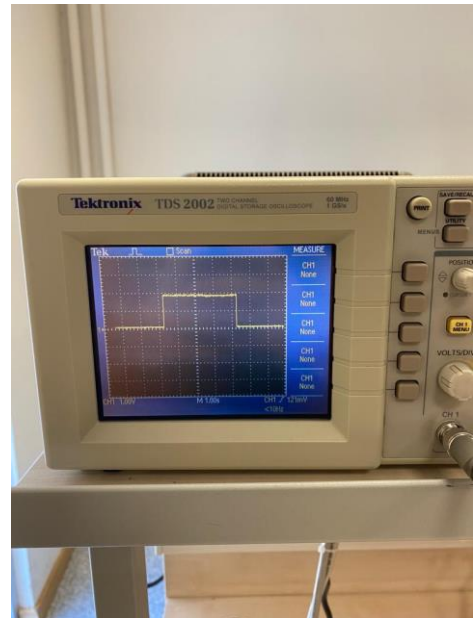
Demonstration of 2 to 1 multiplexer with NAND gates. However, in this experiment A is assigned as I1, B is assigned as I2, S is assigned as S and Output is assigned as F.

D) Observing Waveforms From Oscilloscope:

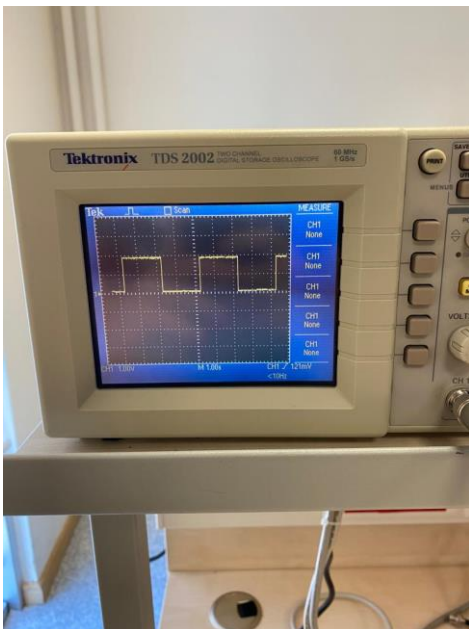
In figure D.1 signals from S are observed. In figure D.2 signals from I1 are observed. In figure D.3 signals from I2 are observed. In figure D.4 signals from F are observed.



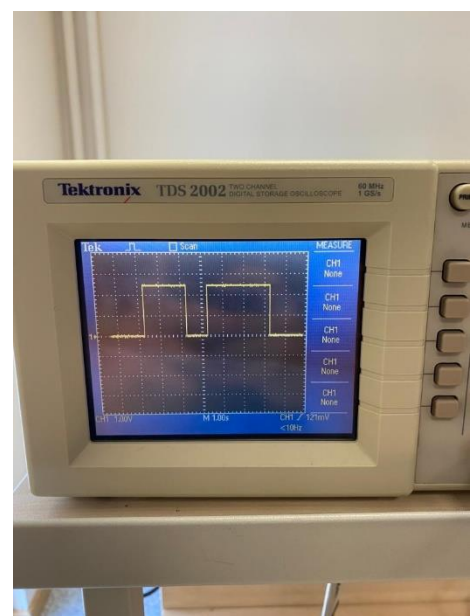
D.1



D.2



D.3



D.4

Conclusion:

This experiment was very successful in terms of understanding logic gate implementation on breadboard. 2 to 1 multiplexer done by 4 NAND gates is implemented on the breadboard and signals of inputs and output are observed from oscilloscope successfully. 8 different LED combination is obtained as we have 3 inputs. Displayed waveforms on oscilloscope is precise with the truth table.