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EEE- 102

24.10.2022

EE-102 Lab 3 Report

Purpose: The aim of this lab is to set up a combinational circuit design using a breadboard and to learn how to show this design on a waveform displayer using oscilloscope.

Design Specifications and Methodology: In this lab there is a simple design made out of 3 inputs. 2 of which is connected to an AND gate and their result with the third input is connected to an OR gate.

The function used the implement this design is,

$$F(X_1,X_2,X_3)= (X_1*X_2) + X_3$$

X_1	X_2	X_3	F
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	1	1

To implement this combinational circuit design into a breadboard a 74H163 counter should be used first. A 74H163 counter works as a type of clock signal that is capable of sending different signals to the outputs from a wave generator. For instance, if the 3 outputs of the counter are full and the counter is connected to a wave generator and a power supply it will start sending signals to the 3 outputs in different orders such as 0,0,0 ; 1,0,0 ; 1,0,1 etc. To begin with the 4-bit counter needs to be confirmed to be working through the use of an oscilloscope. After getting the clock to work in the breadboard the outputs of the counter will be used as inputs, as X_1 and X_2, to the AND gate while the output of AND gate and last signal, which is X_3, will be used as an input to the OR gate implemented. The final output will be connected to a green LED so that it is observable. Finally, to confirm that every input is working appropriately, each of the inputs will be connected to a red LED straight from the 4-bit counter.

Once the circuit is implemented and is confirmed to be working, to display the circuit design on the oscilloscope, a square wave must be sent to the oscilloscope and output of the design which is where

the green LED is must be connected an oscilloscope probe. The wave displayed should align with the truth table.

Results: The red LEDs are X_3 , X_2 , X_1 respectively. The green LED is the main output. The results of the 8 cases observed seems to align with the truth table.

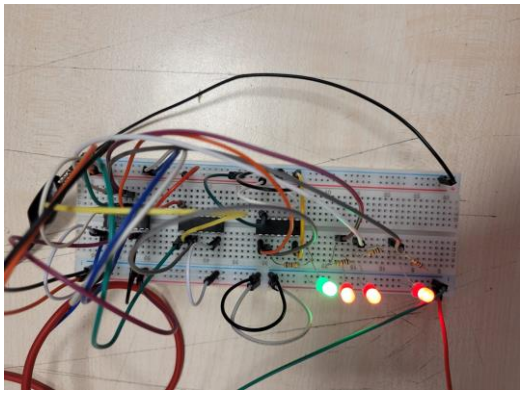

Figure 1: $F(X_1,X_2,X_3)= 1,1,1$

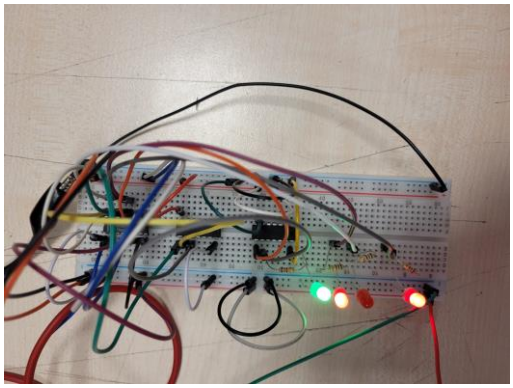

Figure 2: $F(X_1,X_2,X_3)= 1,0,1$

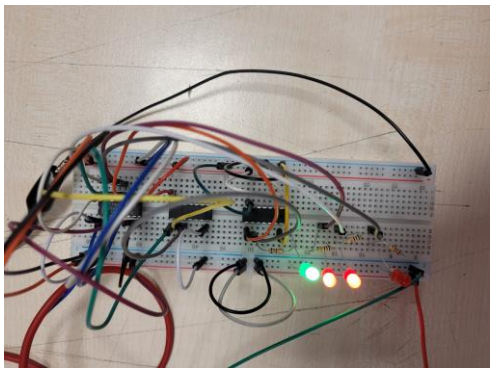

Figure 3: $F(X_1,X_2,X_3)= 0,1,1$

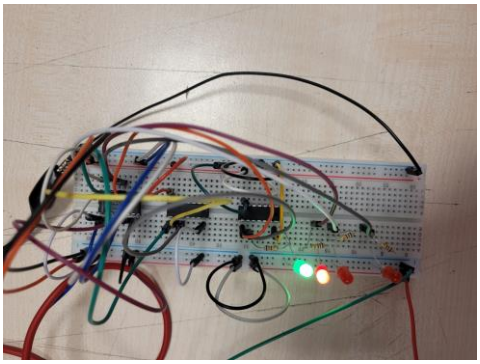

Figure 4: F(X_1,X_2,X_3)= 0,0,1

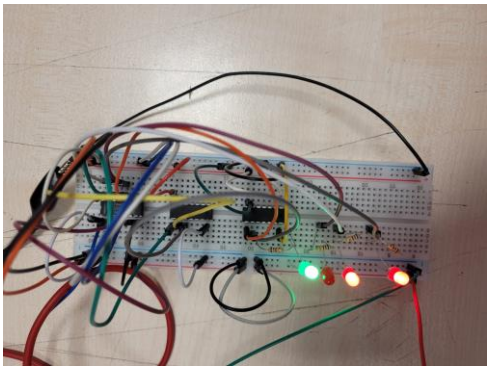

Figure 5: F(X_1,X_2,X_3)= 1,1,0

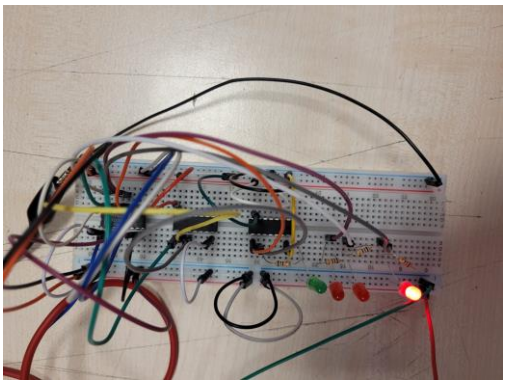

Figure 6: F(X_1,X_2,X_3)= 1,0,0

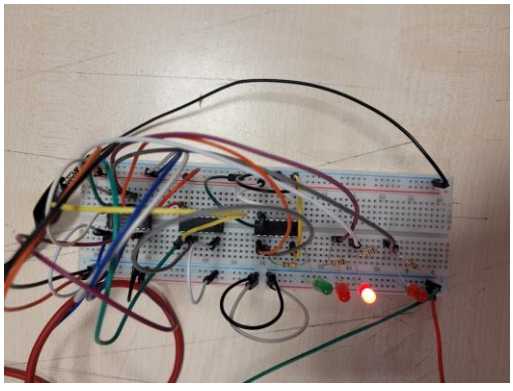

Figure 7: $F(X_1,X_2,X_3)= 0,1,0$

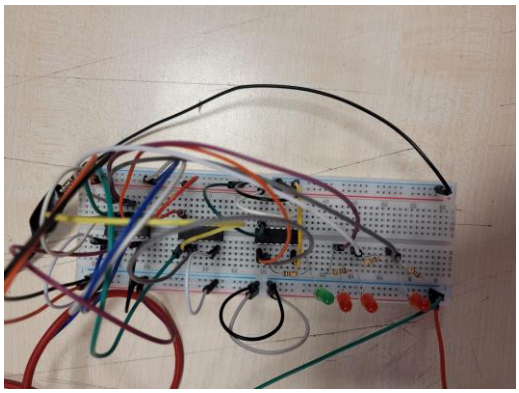

Figure 8: $F(X_1,X_2,X_3)= 0,0,0$

Finally, the result is also tested on oscilloscope which seems to match the occurrences of 1 which is 5 times in 8 different cases. The lines on the upper part are where f = 1 and the lines on the bottom are f = 0

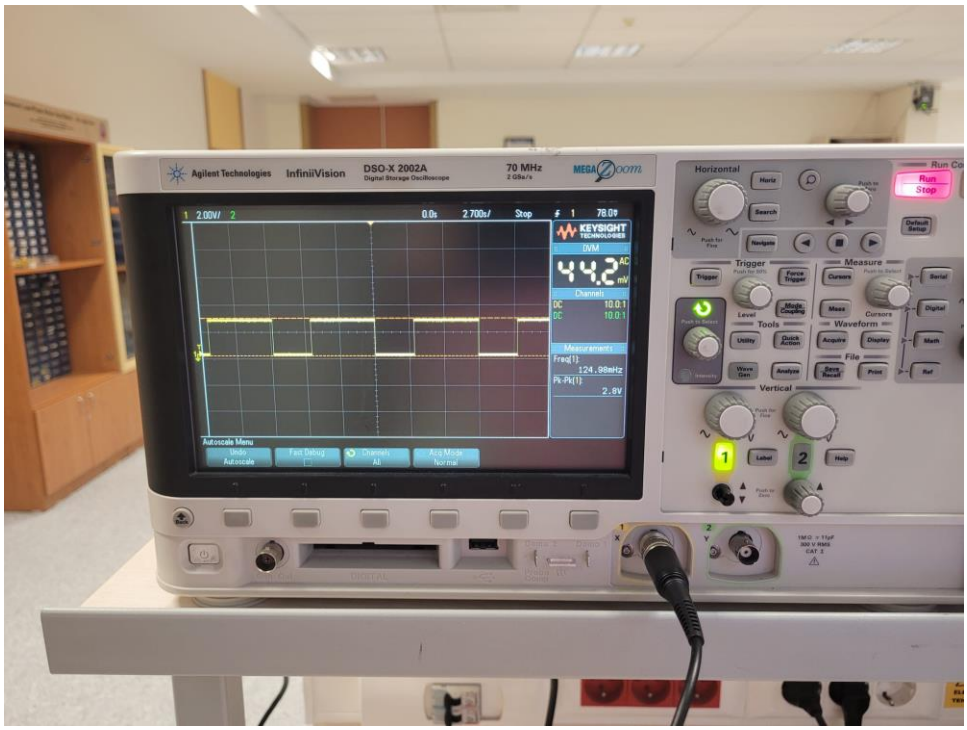

Figure 9: The circuit designs behavior

Conclusion: In this lab, I observed the behavior of a combinational circuit consisting of AND and OR gates. I also observed how a 4-bit binary counter behaves through the usage of a wave generator, power supply and LED lights. To further confirm the results, I also observed the combinational circuit design's behavior through an oscilloscope. In all of the cases the results matched the truth table which further conveys that the circuit design is working correctly. However, small errors might have occurred due to delays while signals are being transmitted.