INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY

HYDERABAD

Lab Report-5

Name: Satkar Juneja
Group No: 37
Teams Group No: 10
Course: Digital Systems and Microcontrollers Lab

Contents

1 Designing an ALU

1.1 Objective

To design an Arithmetic and Logic Unit (ALU) capable of performing listed below 8 Arithmetic/Logic functions on 1-bit operands.

$F_2F_1F_0$	ALU Function	Y_1	Y_0
000	0 (Zero)	-	0
001	A OR B	-	A+B
010	A AND B	-	A.B
011	A XOR B	-	A $\oplus$ B
100	A PLUS B	CARRY	Sum
101	A MINUS B	BORROW	Difference
110	A PLUS B PLUS C	CARRY	Sum
111	A MINUS B MINUS	BORROW	Difference

Table 1: ALU Function Table

Note: The first 4 functions are Logic functions generating 1-bit output Y_0, while the last four are Arithmetic functions generating 2-bit output Y_1Y_0.

1.2 Equipment Required

1. 2 8-input MUX(74LS151)
2. 1 Quad 2-Input MUX(74LS157)
3. 1 Quad 2-input XOR (74LS86)

1.3 Schematic

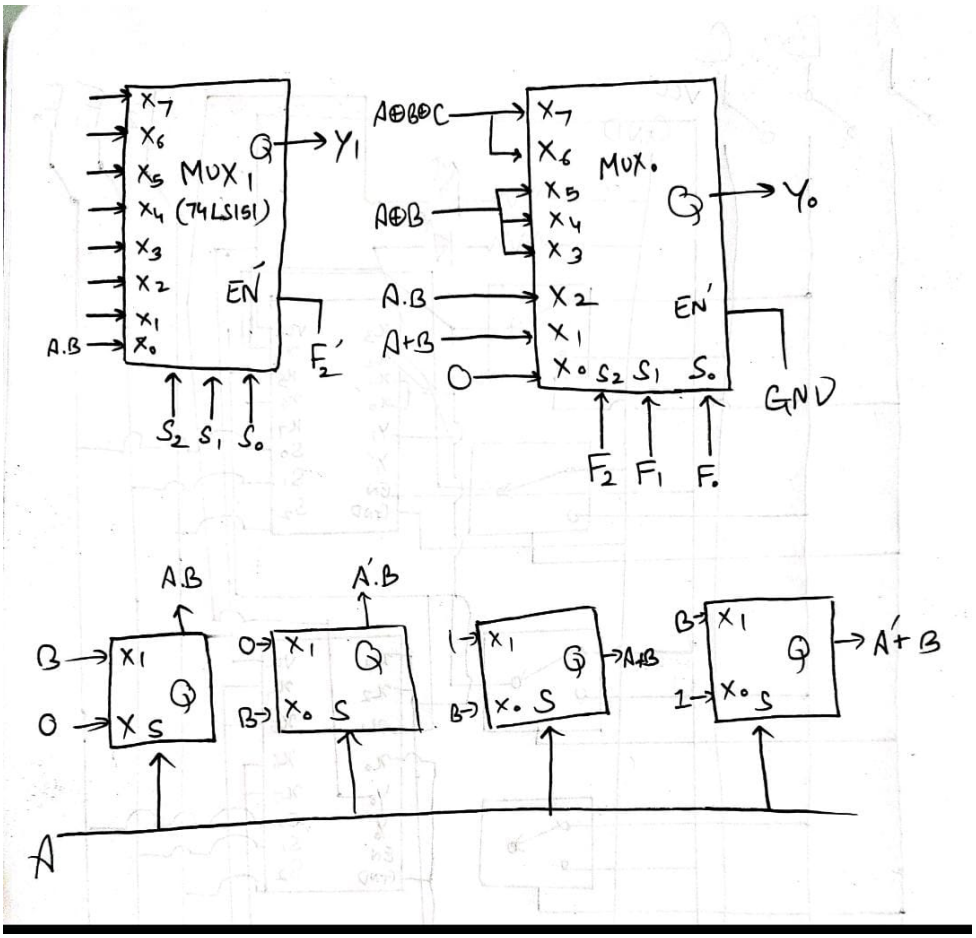

Figure 1: Input Connections for MUX_0 and MUX_1
Boolean functions implemented with a 2-Input MUX

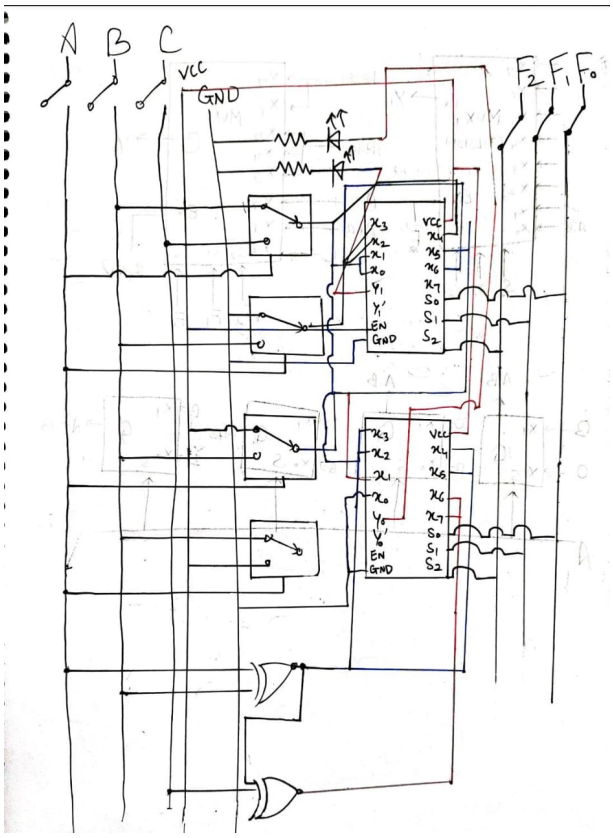

Figure 2: The ALU circuit

1.4 LAB Photo

1.5 Procedure

1. Place the IC's on the breadboard connect the Vcc and the Gnd.
2. Test the three given multiplexer chips one by one by connecting VCC and Gnd appropriately and applying EN'.
3. Asseble all the input switches for A,B,C,F_0, F_1, F_2
4. Conncet the select lines For MUX_0 and MUX_1 keeping in mind that the enabler of MUX_1 is F_2'
5. The select Lines for MUX_0 is F_0, F_1, F_2 respectively and for MUX_1 is $F_1, F_0, Carry$ respectively.
6. The Multiplexers only requires 6 distinct Boolean Functions- A·B, A+B, A'·B, A'+B, A⊕B, A⊕B⊕C
7. For A' we need not require a NOT Ic The XOR gate Ic will be used to produce A' and A⊕B, A⊕B⊕C
8. Except the XOR function all of these operations can be easily realized using a 2 input MUX.

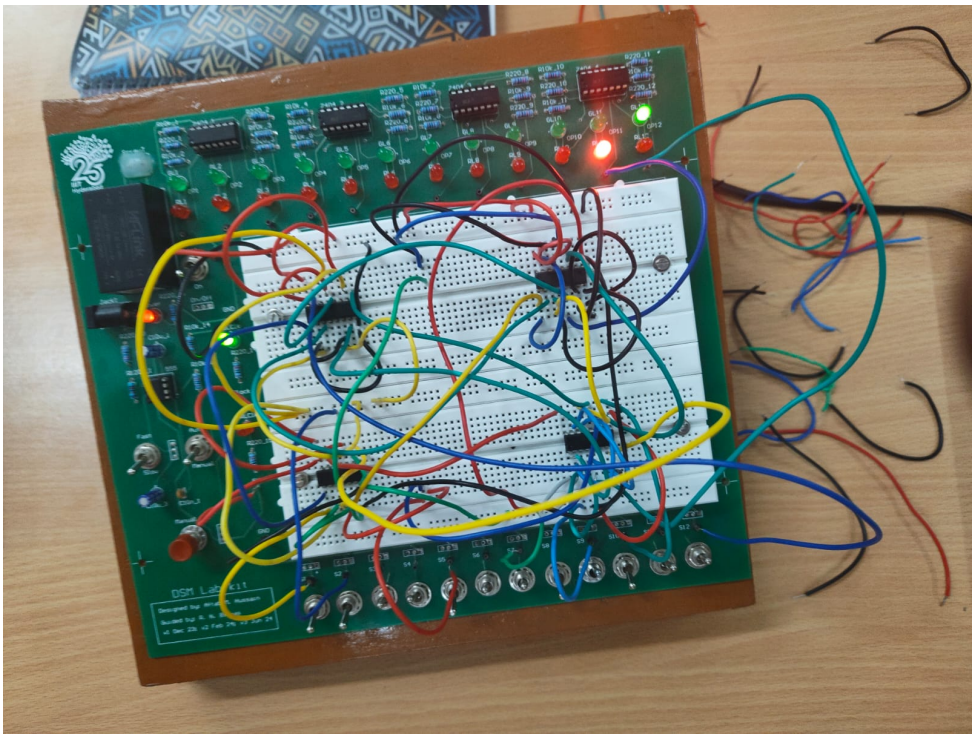

Figure 3: Lab Circuit

9. Assemble the circuit and verify the outputs for all combination of values of A and B

10. After completion of the Circuits required for Boolean Functions now Connect the outputs To The MUX by following The given Input connection table

1.6 TinkerCAD

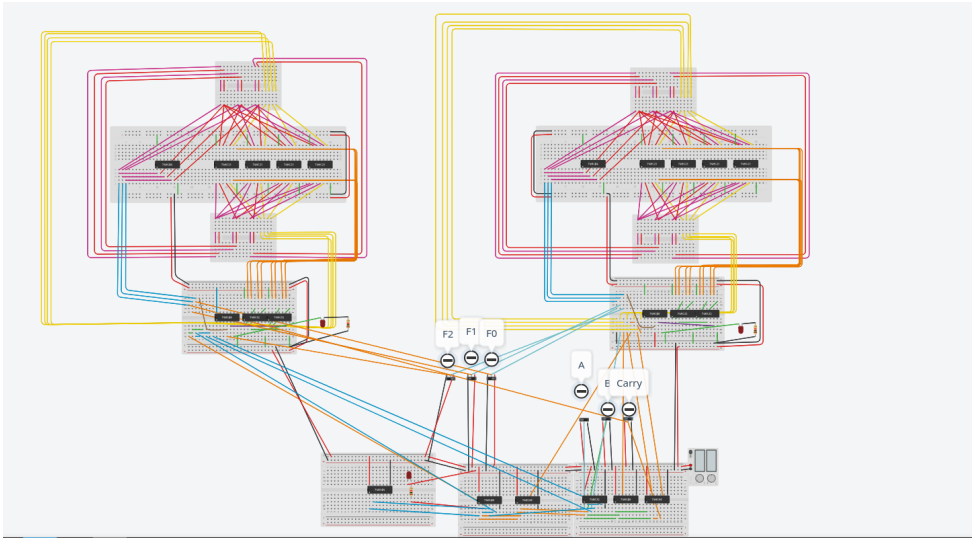

Figure 4: TinkerCAD

Here

1.7 Conclusion

We Designed 1-Bit Programmable ALU successfully performs all 8 functions.