**LAB REPORT :4**

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Aim: To design an Arithmetic and Logic Unit (ALU) capable of performing 8 Arithmetic/Logic functions on 1-bit operands,

Part A

Design a programmable ALU

Electronic Components Used : Arduino Uno R3, Breadboard , Inverter IC (74HC04), AND gate ICs (74HC11) and OR gate ICs (74HC32), XOR gates ICs(74hc86) , LED , wires

Reference Circuit :

Diagram

Description automatically generated

Diagram, schematic

Description automatically generated

Procedure :

1. The circuit simulation was first designed on Tinkercad software.
2. ALU consists of 2 MUX, so two 8:1 MUX were designed using ICs on separate breadboards.
3. Arduino was used to pass inputs(A,B,C) and select lines(f0,f1,f2) separately to each MUX designed. The input combinations were achieved by using different gates and setting them up on a different breadboard
4. The output of each MUX was observed with the blinking of the LED linked with the respective output line.
5. The observation were tabulated and compared with the corresponding theoretically estimated result

Conclusion :

Multiplexer is used to take multiple inputs and selectively output one of the inputs though its output channel. The select input channels is used for achieving this. The ALU uses combinations of such MUXs to achieve various arithmetic and logical operations. Using 8:1 MUX, the corresponding ALU could achieve 8 such operations as follows.

**A , B , C are the inputs**

|  |  |  |  |
| --- | --- | --- | --- |
| **F2F1F0** | **ALU FUNCTION** | **Y1** | **Y0** |
| 000 | 0 | - | 0 |
| 001 | A OR B | - | A+B |
| 010 | A AND B | - | A.B |
| 011 | A XOR B | - | A XOR 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 C | BORROW | DIFFERENCE |

Link of the TinkerCAD simulation :

https://www.tinkercad.com/things/865NKd2uj9z-lab4-aryan-gupta/editel?sharecode=mbjJvcKBPBHgbGnuSnuARktvB3YReeZ\_D7ZF-v5fglU