

Computer Architecture

Project Title

16 Bit ALU with Indirect Addressing Mode in Logisim

Working and Explanation of Project

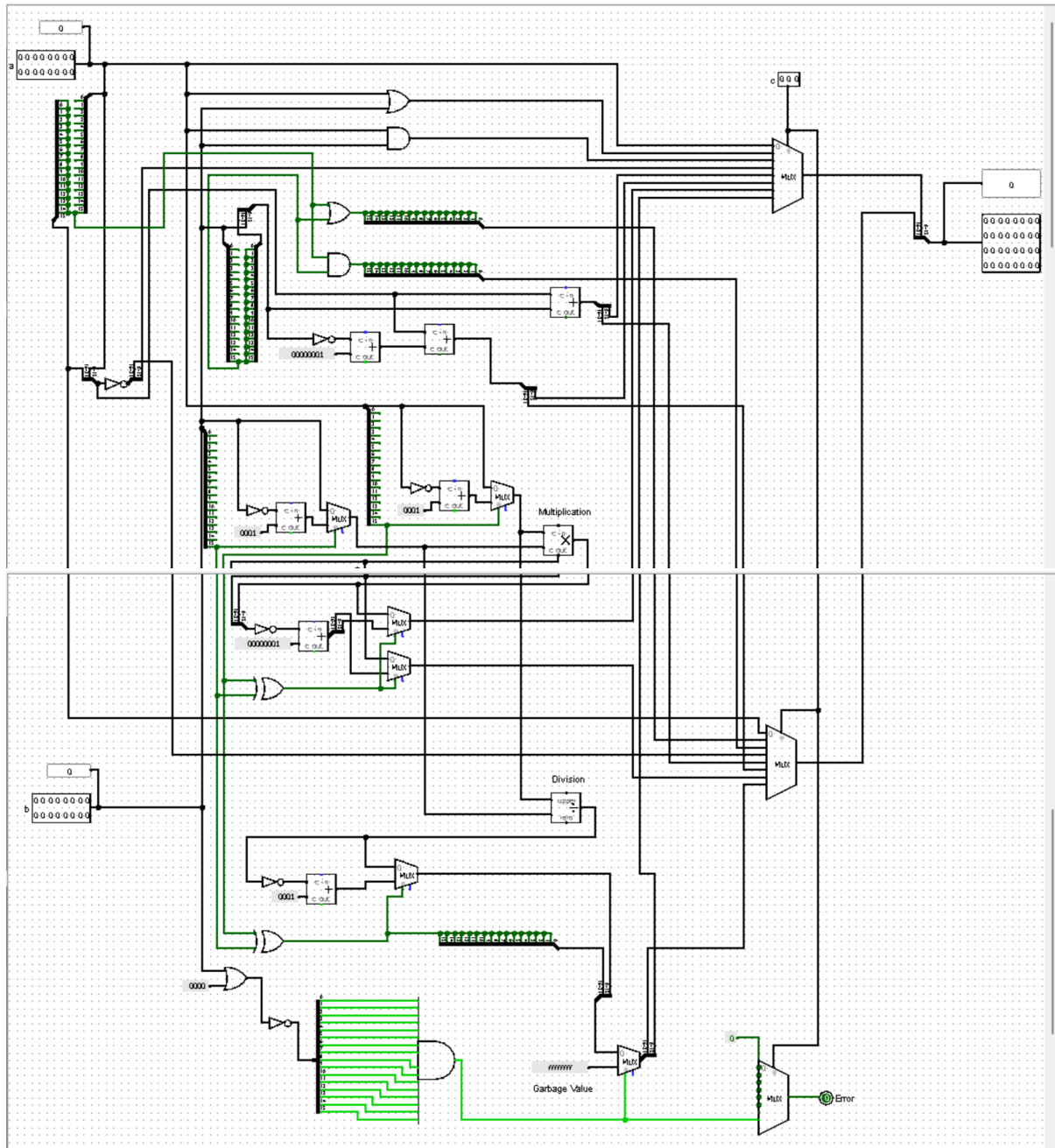
The project contains mainly three segments:

- Main Circuit
- ALU Circuit
- 7 Segment Display

ALU Circuit

The following are the functions which are implemented:

- Transfer
- OR, AND
- Complement
- Add
- Subtraction
- Multiplication
- Division



Methodology of the functions are as follows:

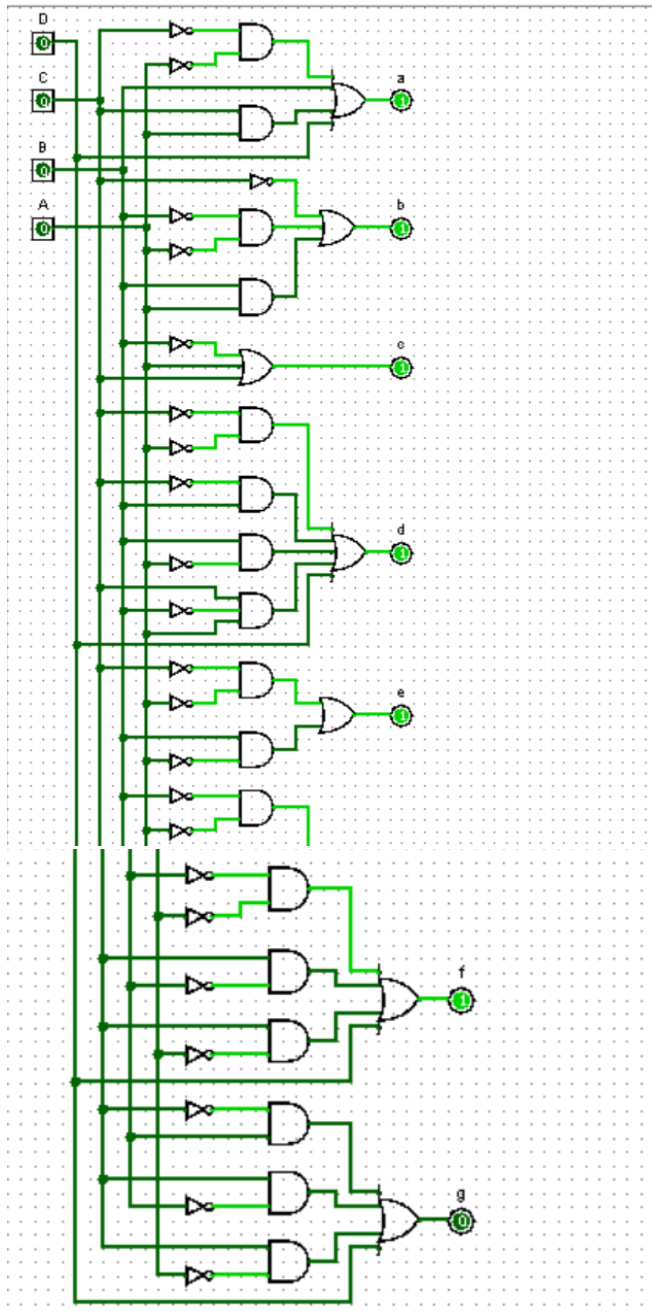
- In Transfer we have passed least 16 bits as A and the most 16 Bit as sign of A and then finally merge the answer.
- In OR, AND in a MUX, we have passed the OR of both the number and most 16 bit we have passed the sign bit. If A or B is negative then the most 16 bits would be 1.
- Complement and Add is used as per available parts
- Subtraction is done using 2's complement and of B and then add with A.
- Multiplication is done by taking 2's complement of both no. if they are negative and then multiplier is used. The final answer is provided to

Mux so as to consider the correct answer whether the answer is negative (2's complement of answer) or positive (as it is).

- Division is done similar to Multiplication by using divider. Here Error bit is kept to show that division by zero is not possible.

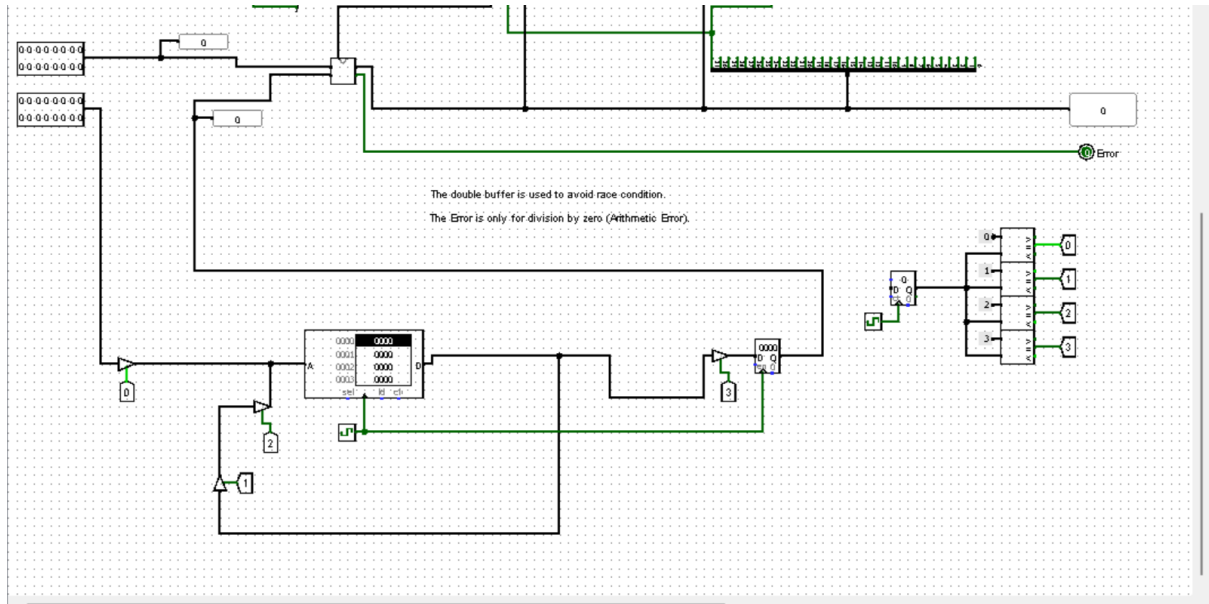
7 Segment Display

7 segment display is used to provide result in digits.



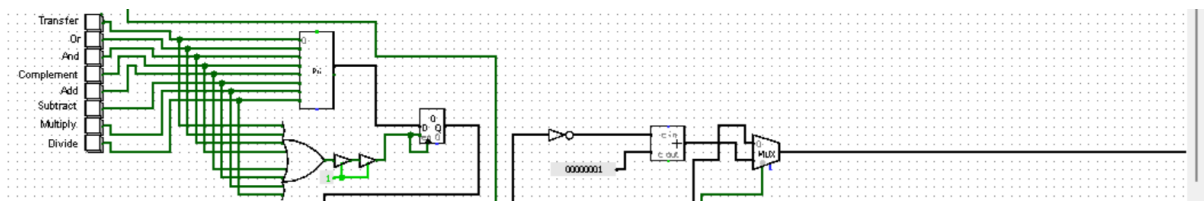
Main Circuit

Taking Input



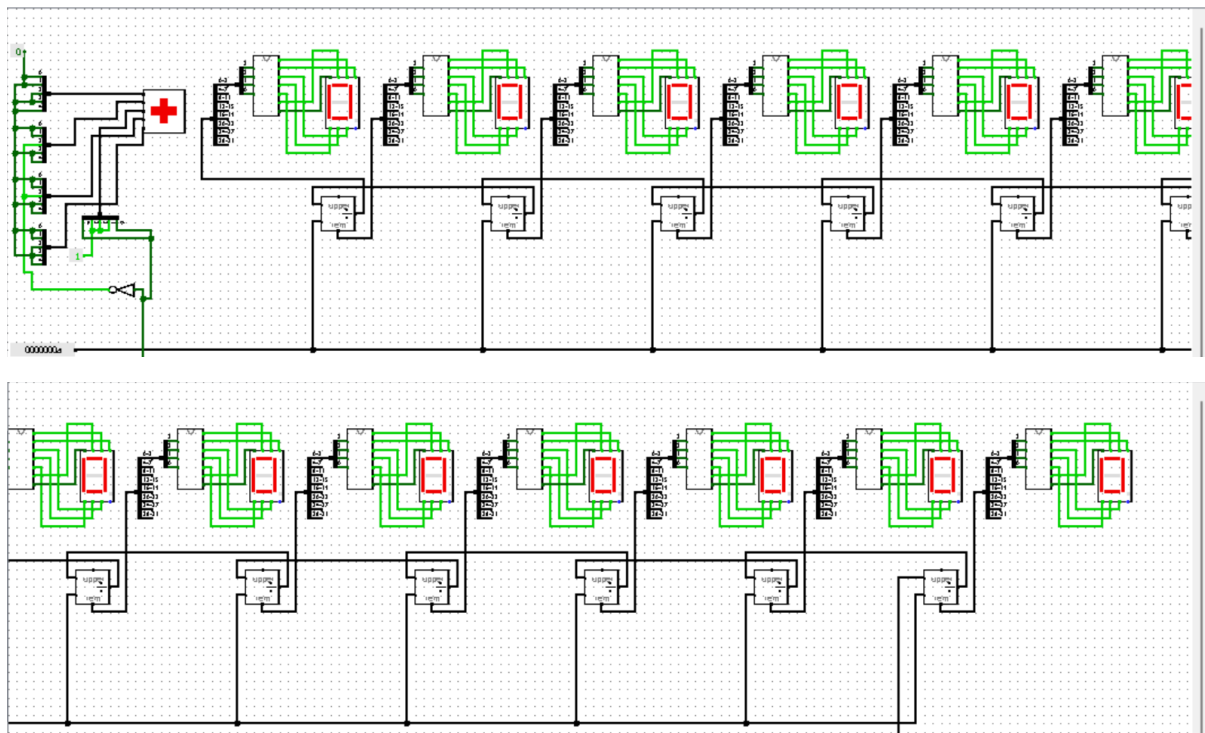
- Taking one input as one operand and another input as memory address (This address should be taken in such a manner that 2nd operand is present at effective address).
- Here the address which is provided will be used to take effective address from its location in memory. Again, the effective address will be used to fetch the operand from the memory.
- Here Buffers are used to keep data upto next cycle.

Selecting Operation



- Depending upon the user requirement, the corresponding operation should be selected by user and clicked.

Displaying Output



- Since the input is of 16-bit, maximum answer of any operation can be displayed with ten 7 Segment Display.
- Additionally, in order to represent the sign a component is kept additionally.
- Final answer with sign is displayed here. Magnitude and sign are displayed.
- Here the answer is displayed by using modulo operation. That is the no. is divided by 10 each time to display the remainder as last digit obtained.

Working

- At 0000 address, 0013 is placed. At 0013 the final operand 2345 is present. (Here all data is in hexadecimal).
- So, give one operand as input. Here that operand is 8 (1000).
- Another input is address which is 16 bits. Here it is 0 (0000).
- The operation which is selected is multiply.
- Final output is displayed with sign.

Screenshot

