

# Lab 2 Extra creits

ECE3056

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**Purpose:**

The purpose of this assignment is to add the MUL function into the exist multi-cycle LC3b simulator.

**Procedure:**

The following change were made in the original program:

**Unicode:**

One more state which represents the output gate signal for the multiplier is added at the end of the original ucode file. So now the ucode file is 36 bits instead of 35.

**Global Variable:**

GATE\_MUL: this represents the MUL gate signal, and it was put at the end of CS\_BITS before CONTROL\_STORE\_BITS.

mul\_count: the cycle count of the multiplier, which is up to 2. This variable is static.

MUL\_result: this variable represents the value after the multiplication is done and put on the bus

**eval\_bus\_drivers() function:**

In this function, a separate else if statement was created, which would load when the MUL\_gate is true. In the if statement, first the mul\_count was increased by one, then the mul\_count will be tested, if it is two, SR1 was loaded the value which was the IR[9:6], SR2 was loaded with the value which was the IR[2:0]. And the output  $SR1 * SR2$  was the output.

**drive\_bus() function:**

In this function, the BUS just simply load the output from the multiplier if the mul\_count is 2. If not, 0 is loaded to the BUS.

**Latech\_datapath\_values() function:**

In this function,

**Results:**

After the value was tested, the MUL got the results correctly. The cycle the hardware MUL takes is 2 cycles by itself. Which fits the requirements. Compare to the 90 cycles in the lab 1, it is a big improvements.

**Conclusion:**

In conclusion, the MUL was successfully implemented into the LC3b multi-cycle simulator.