3x3 Matrix Multiplier

ECE 2700 Final Project
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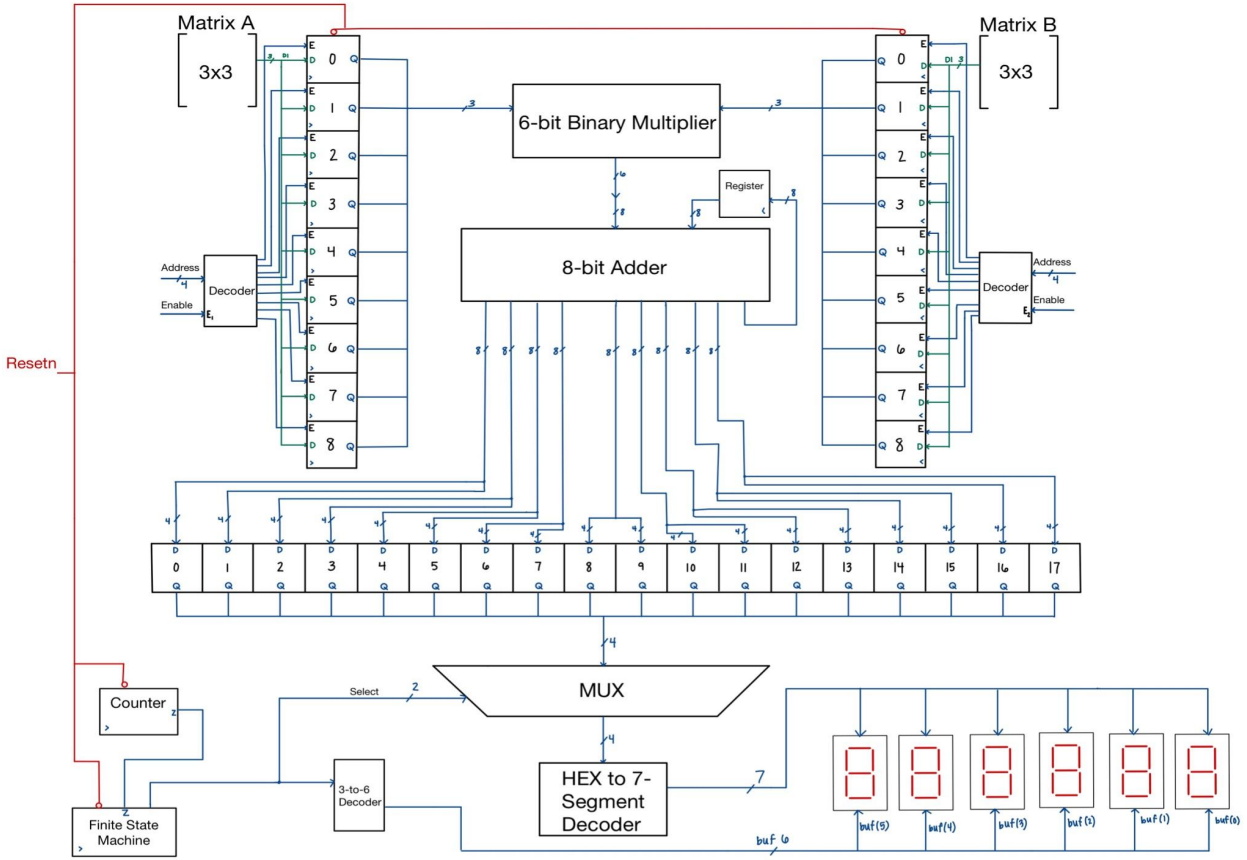
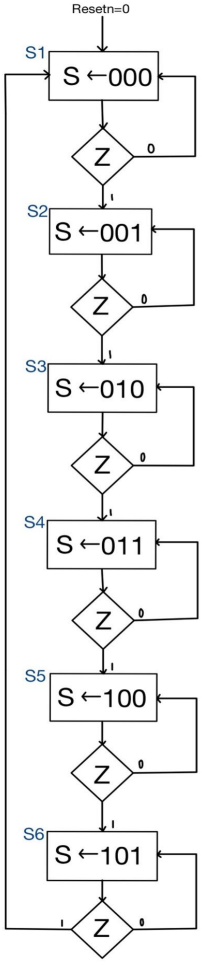
Kelly Koscielski
Stone Maguire
Jared Panizzoli

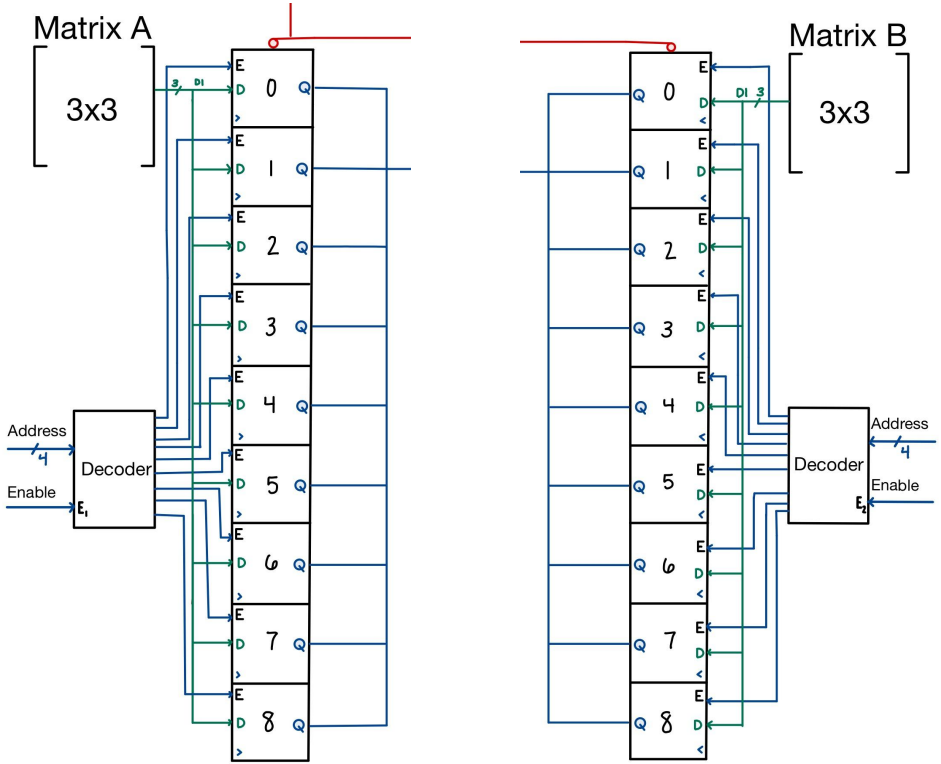
Block Diagram Overview





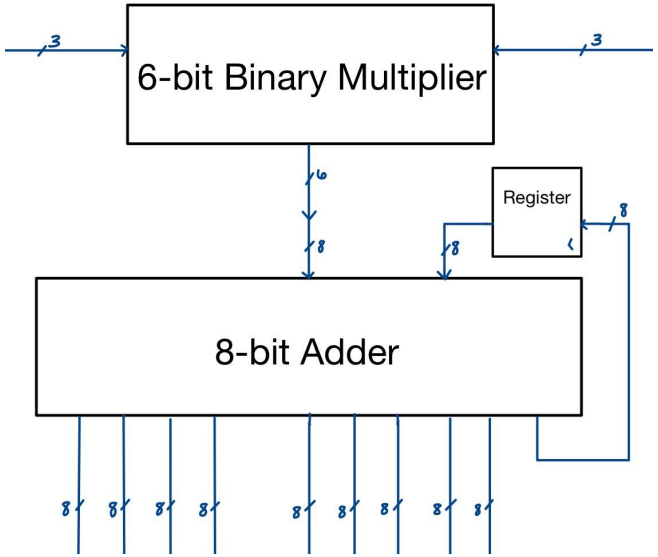
Matrix Inputs, Decoder, and Registers

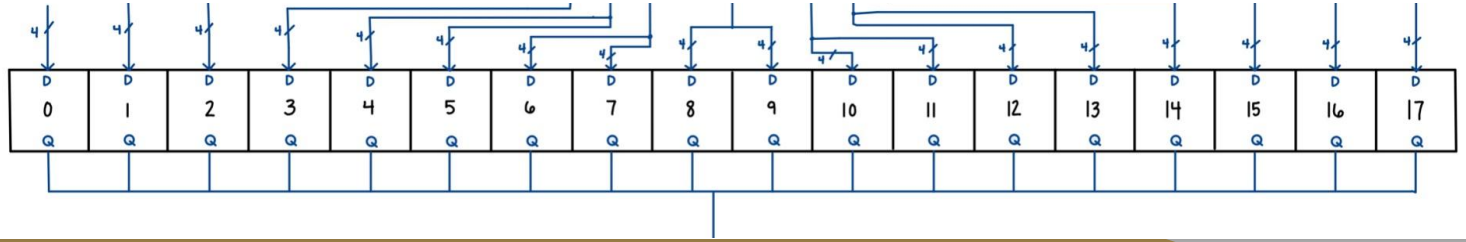
- There are two 3x3 matrices, Matrix A and Matrix B
- Each sector of the matrix is 3 bits, allowing for unsigned numbers ranging from 0 to 7 in binary
- Values will be chosen using three switches on the board
- Each value is stored in a register
- 2 decoders with separate enables are used to determine which registers to store the value in for each of the matrices
- This will be selected using 4 switches and the signal “address”
- These enables also control whether the seven segment display is on or off



6-Bit Binary Multiplier and 8-Bit Adder

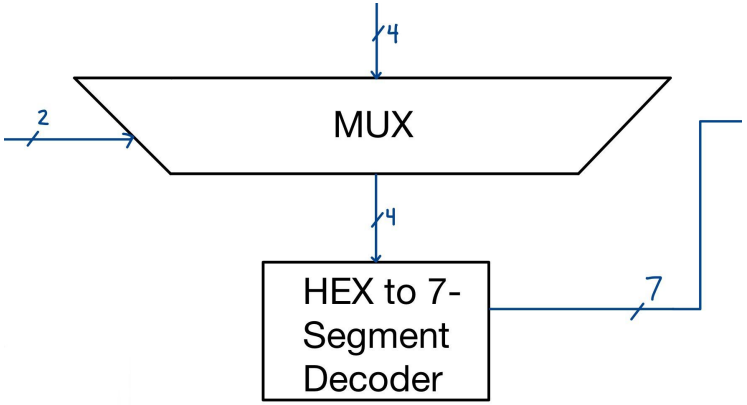
- Each sector from Matrix A will be multiplied with the corresponding sector from Matrix B and stored in a register
- The value from the register will be added together using the 8-Bit Adder to form the final matrix
- Each sector holds a 2 digit hex number and each register will hold one digit, totaling 18 registers

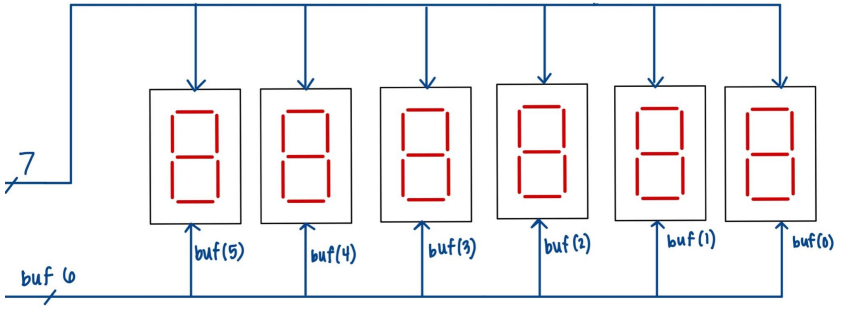




MUX, Seven Segment Decoder and Display

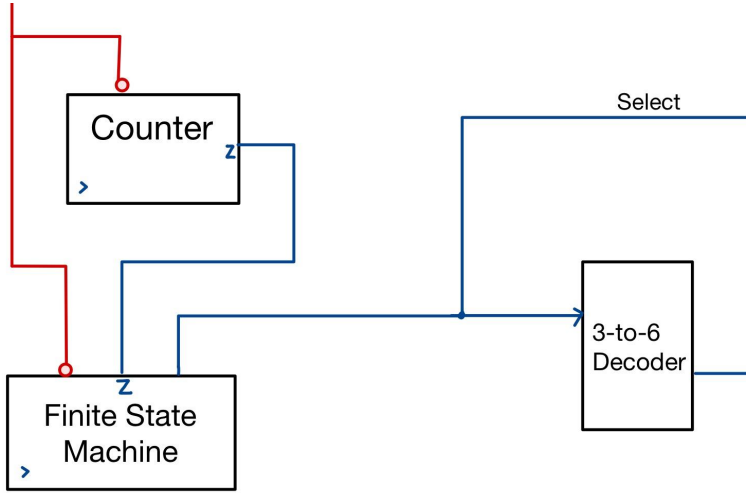
- The MUX is used to select which hex value from the registers holding the resulting matrix will be displayed on the seven segment display
- 2 switches will be used to make the row selection
- The seven segment decoder will take the signal from the MUX and display the Hex values on the display one row at a time.

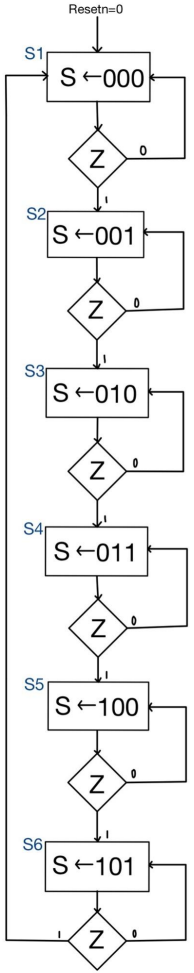




Finite State Machine, Counter, and 3-to-6 Decoder

- Every 1ms the output of the counter goes high
- The Finite State Machine switches states when counter is high
- Since the FSM switches states every 1ms, it looks like the displays are all lit up at the same time
- The 3-to-6 Decoder is used to select which display is lit up





Circuit Demo

Inputted Matrices:

$$\begin{bmatrix} 2 & 4 & 2 \\ 5 & 0 & 6 \\ 7 & 4 & 3 \end{bmatrix} X \begin{bmatrix} 7 & 3 & 1 \\ 4 & 6 & 0 \\ 3 & 5 & 2 \end{bmatrix}$$

Resulting Matrix Decimal:

$$\begin{bmatrix} 36 & 40 & 6 \\ 53 & 45 & 17 \\ 74 & 60 & 13 \end{bmatrix}$$

Resulting Matrix in Hex:

$$\begin{bmatrix} 24 & 28 & 06 \\ 35 & 2D & 11 \\ 4A & 3C & 0D \end{bmatrix}$$

Timing Diagram