ECE 2700: Final Project Matrix Multiplication

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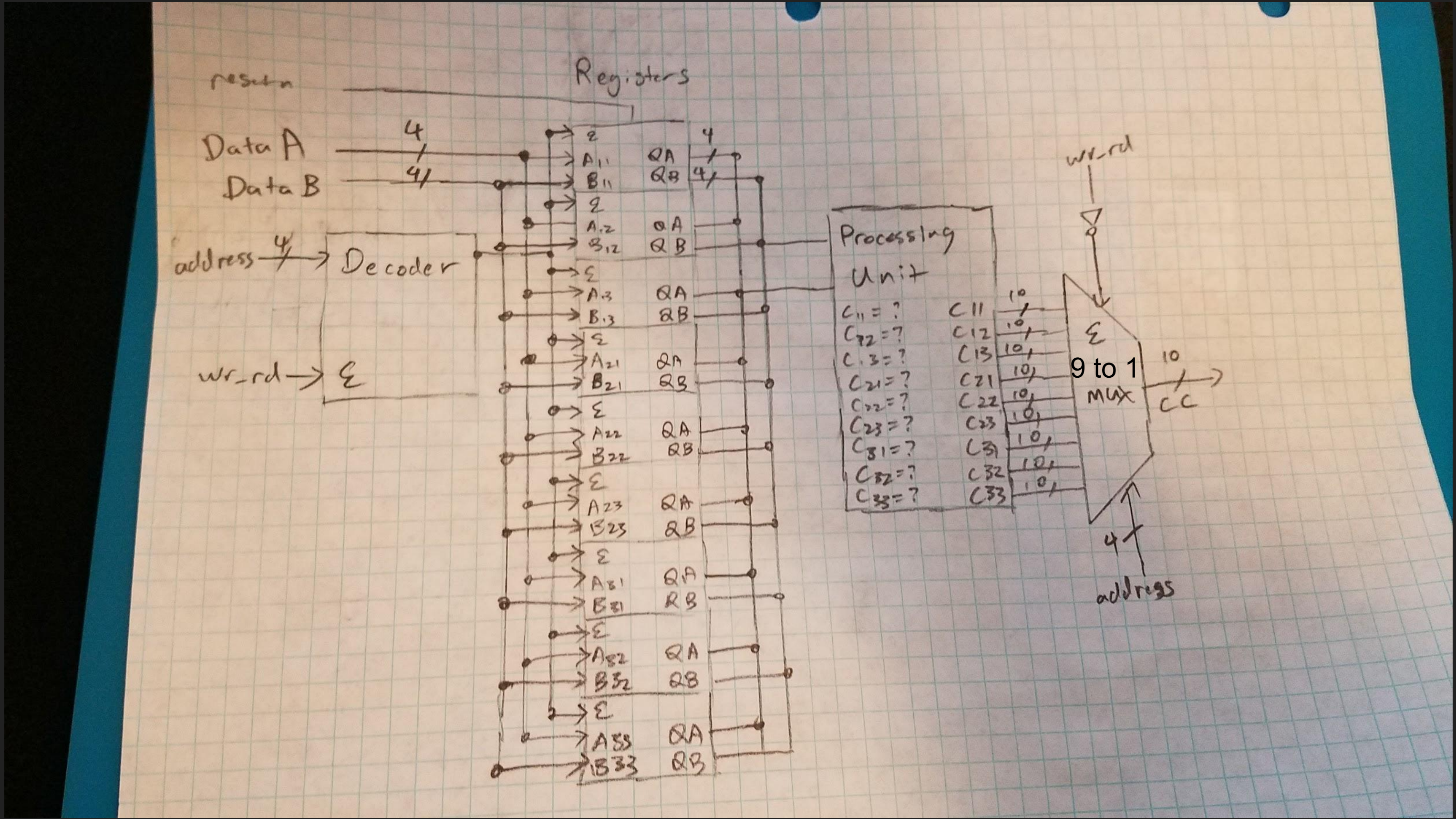
Matrix Multiplication Formula

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} * \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix}$$

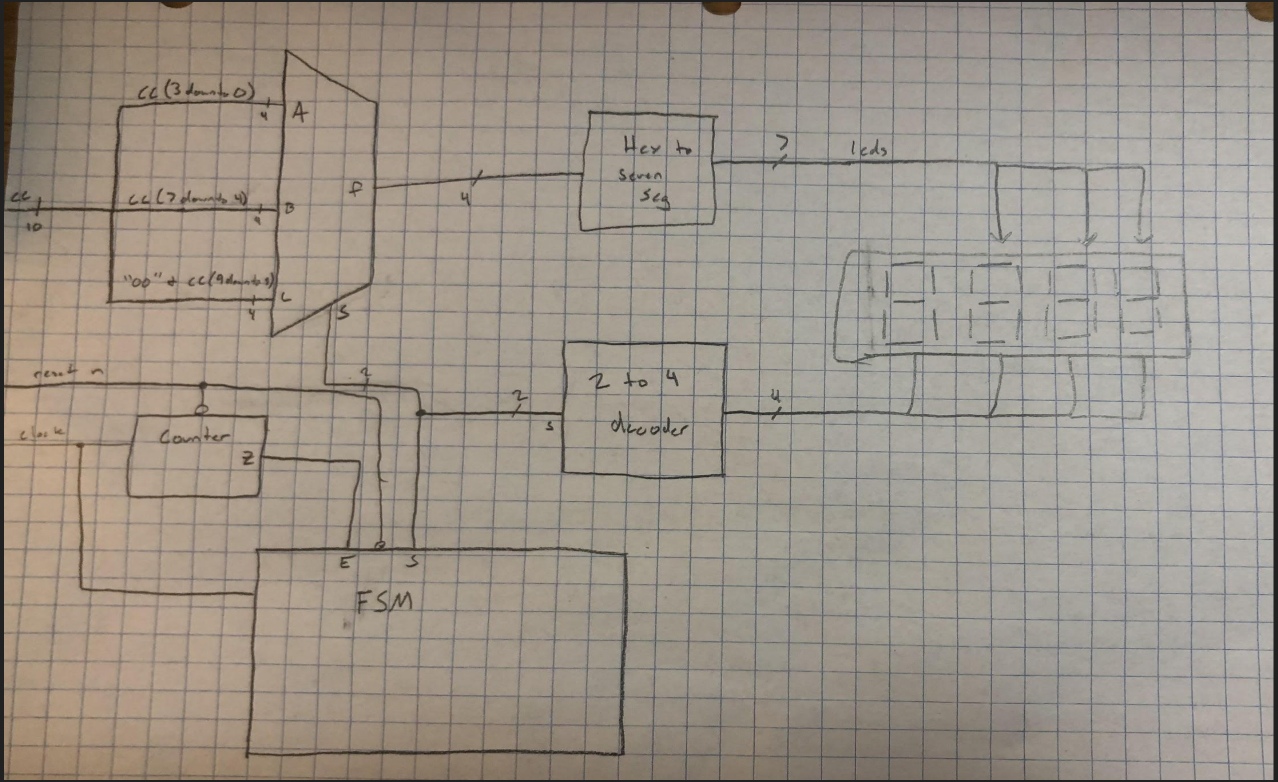
C11 = (A11*B11)+(A12*B21)+(A13*B31)
C12 = (A11*B12)+(A12*B22)+(A13*B32)
C13 = (A11*B13)+(A12*B23)+(A13*B33)
C21 = (A21*B11)+(A22*B21)+(A23*B31)
C22 = (A21*B12)+(A22*B22)+(A23*B32)
C23 = (A21*B13)+(A22*B23)+(A23*B33)
C31 = (A31*B11)+(A32*B21)+(A33*B31)
C32 = (A31*B12)+(A32*B22)+(A33*B32)
C33 = (A31*B13)+(A32*B23)+(A33*B33)

To turn a 3x3 matrix into a 2x2, set A13,A23,A31,A32,A33 = 0 and B13,B23,B31,B32,B33 = 0
So then C13,C23,C31,C32,C33 = 0

Block Diagram (pt. 1)

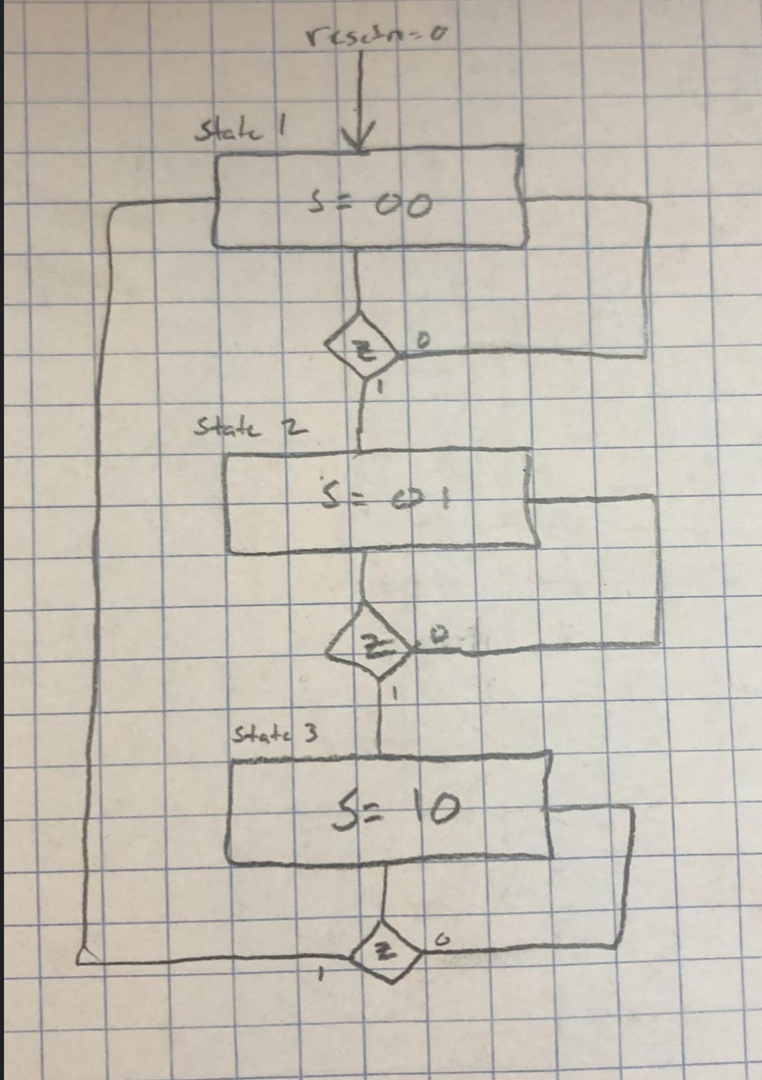


Block Diagram (pt. 2)



State Machine

The state machine cycles between 3 states.



Sample Calculations

Address Matrix

$$3\times3 \begin{bmatrix} 0 & 1 & 2 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix} \qquad 2\times2 \begin{bmatrix} 0 & 1 \\ 3 & 4 \end{bmatrix}$$

Matrix A Matrix B Matrix C

$$\begin{bmatrix} 15 & 15 & 15 \\ 15 & 15 & 15 \\ 15 & 15 & 15 \end{bmatrix} * \begin{bmatrix} 15 & 15 & 15 \\ 15 & 15 & 15 \\ 15 & 15 & 15 \end{bmatrix} = \begin{bmatrix} 675 & 675 & 675 \\ 675 & 675 & 675 \\ 675 & 675 & 675 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

$$\begin{bmatrix} 15 & 15 \\ 15 & 15 \end{bmatrix} * \begin{bmatrix} 15 & 15 \\ 15 & 15 \end{bmatrix} = \begin{bmatrix} 450 & 450 \\ 450 & 450 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} * \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$