Alenn Wright
Project 1
9/9/21

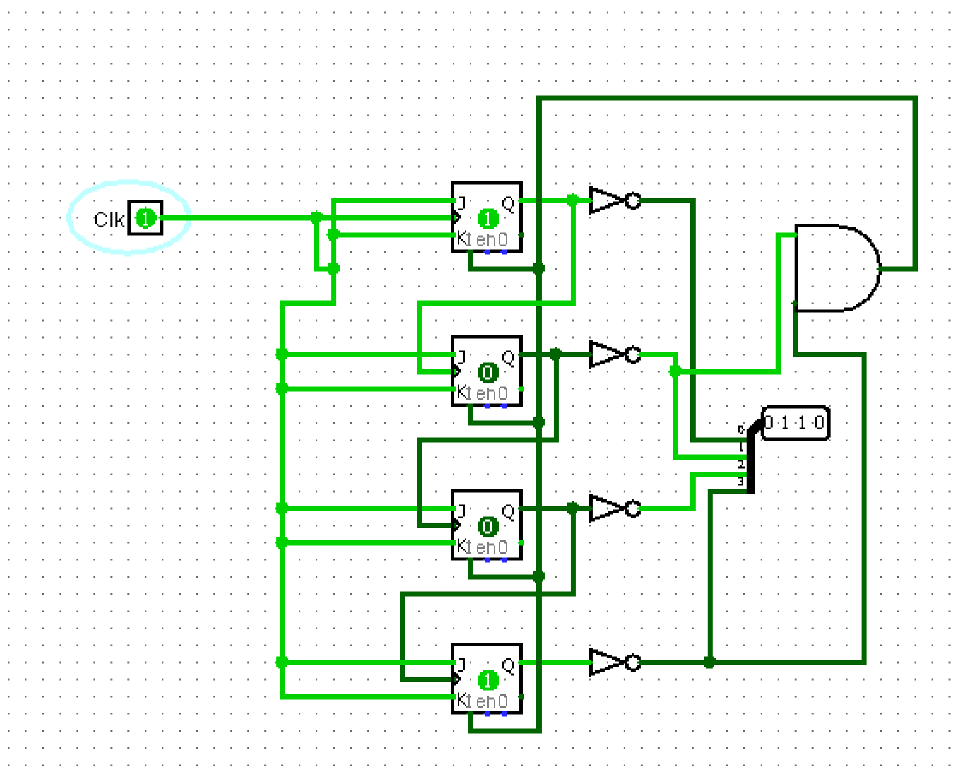
3 Bit Adder

Overview

In this project, we are tasked with making a modulo 10 counter paired with a 7 segment display. The mod 10 counter should be constructed using jk flip flops and take a pulse to count from 0 to 9. Then we have to make the logic to take the binary output of the counter to individually activate the segments corresponding to the decimal representation.

Mod 10 counter design

In the design of the JK flip flop counter, for the pulse input, I connected it to the jk flip flops jk inputs so that it is always in a toggle state everytime it gets an impulse. The output of each gate will act as the clock for the other jk flip flops. The output i have is inverted so I used Not gates to get the correct bit representation. I used a total of 4 flip flops to reach the bit required to reach 9 and when the counter reaches 9, the way I get it to loop back is I tied an and gate to the resets of the jk memory to start at 0 again.



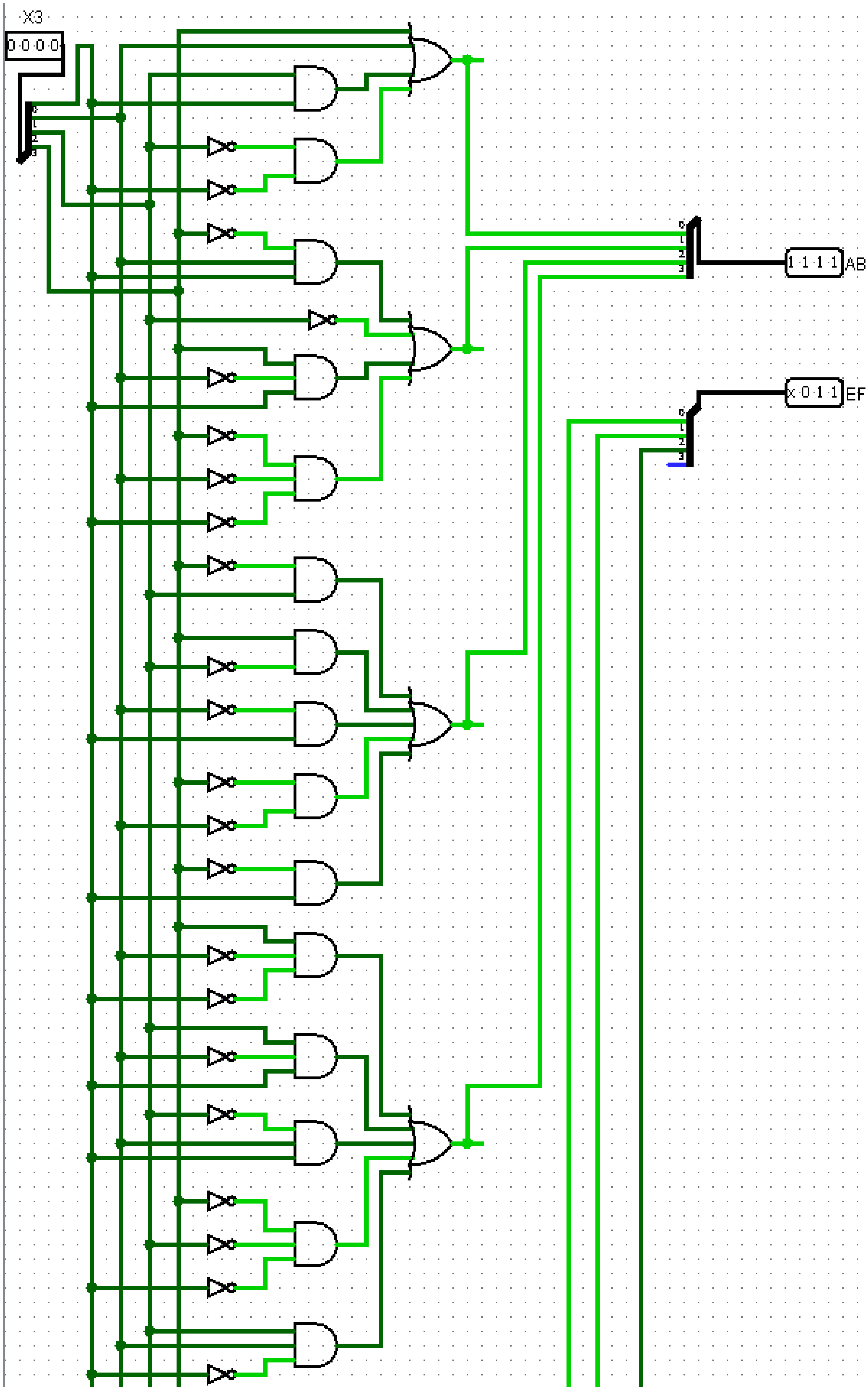
The 7 segment display Binary decoder

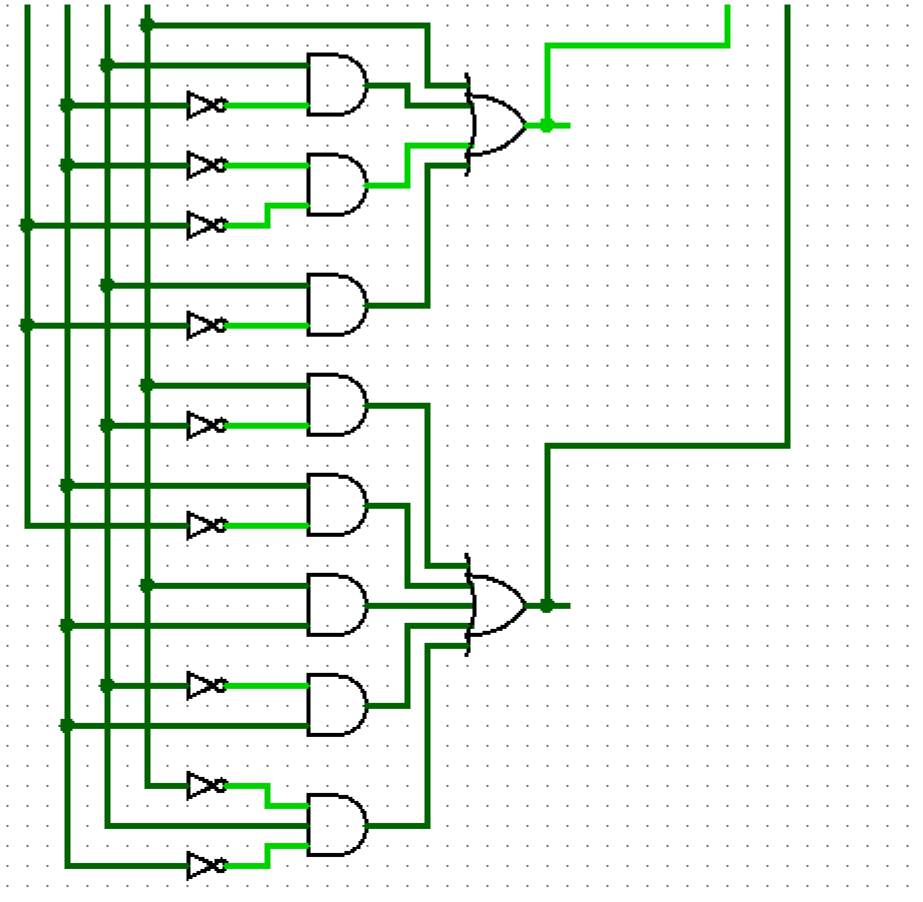
For the design of this chip, I made Kmaps for each segment respective to the 4 bit input and made the corresponding gate logic. I went above and beyond and designed it to be able to do 0-E, the full hexadecimal range to play with later.

The input output table:

A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1
1	0	1	0	1	1	1	0	1	1	1
1	0	1	1	0	0	1	1	1	1	1
1	1	0	0	1	0	0	1	1	1	0
1	1	0	1	0	1	1	1	1	0	1
1	1	1	0	1	0	0	1	1	1	1
1	1	1	1	1	0	0	0	1	1	1

After the Kmap(Because I did them by hand) Here is the final circuit that I derived

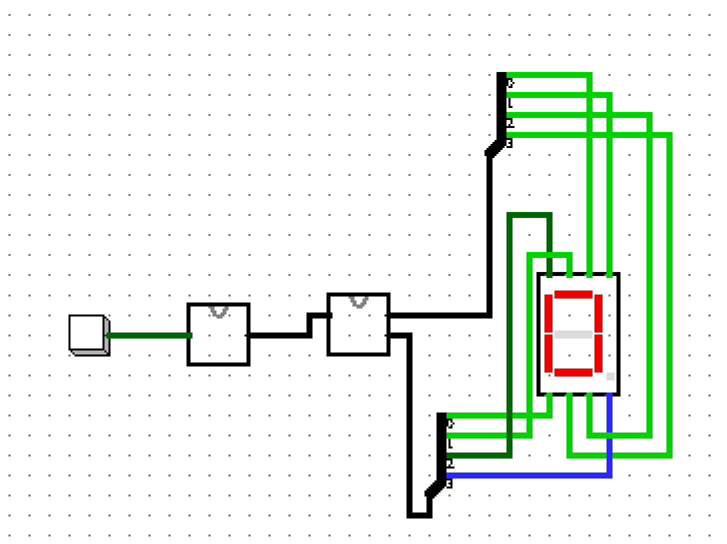

X3
0·0·0·0
1·1·1·1
ABC
x·0·1·1
EFC

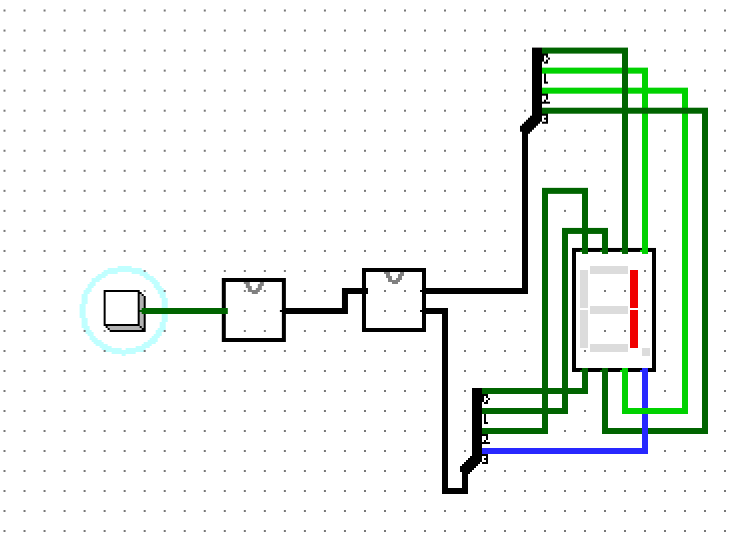


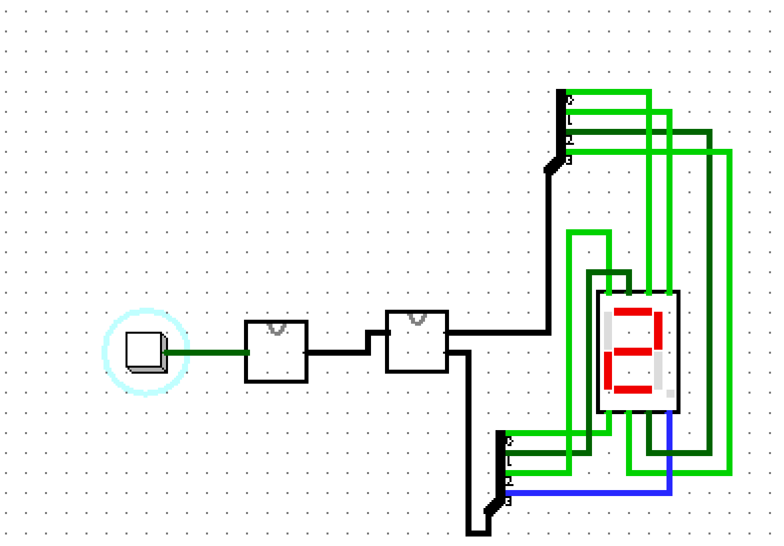
The Final result

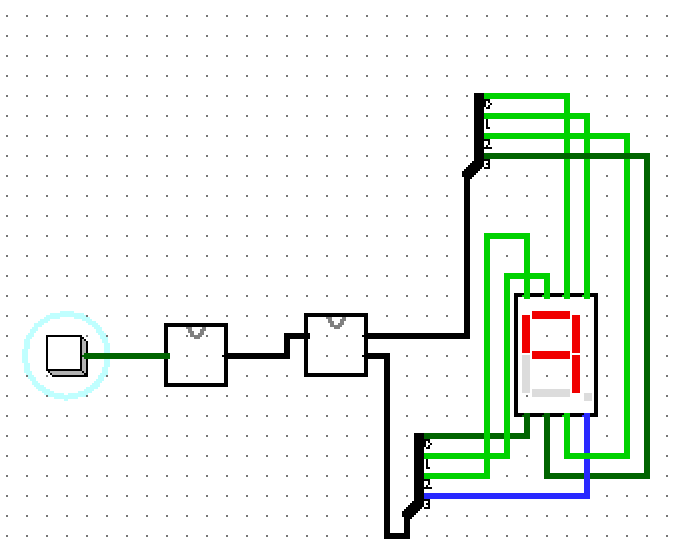
The final result is a counter that can be clicked to go from 0-9.

Here are some of the states:









Conclusion

This overall was a fun lab and gave me nostalgia from EE110. I love the refresher In K maps and logic design. I’ve learned that Logisim is a fun program to design with and wish I had this when I started my degree.