

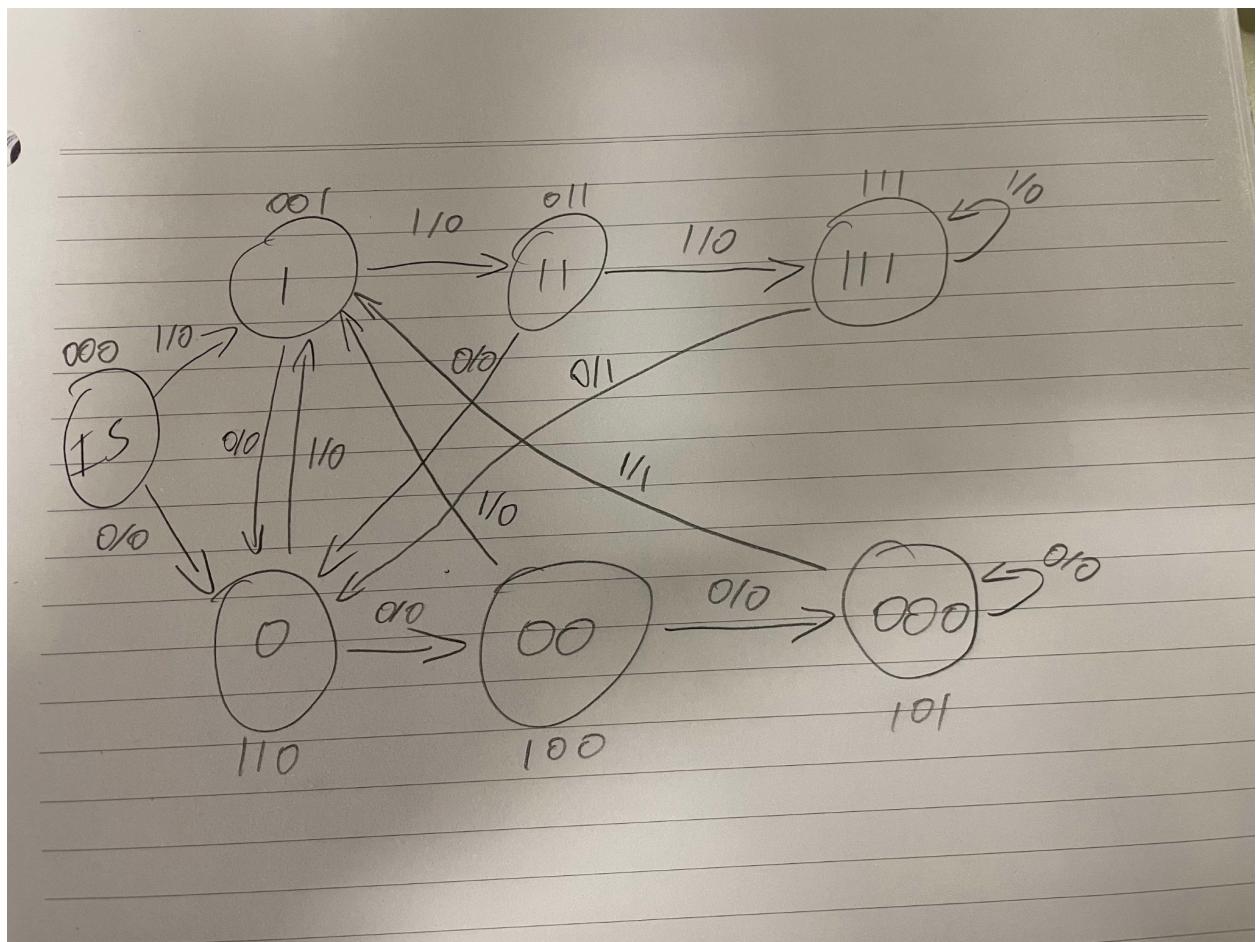
Theory

In this lab we created a circuit that would detect if a series of bits inputted into flip flops would have a next value of 1110 and 0001. Sequential logic is a topic which covers the processing of a sequence of data, including the primer sequence that needs to be detected to start an operation on a datastream. In sequential logic, there are flip flops usually so the detector sequence can look back and see if the wanted bits are detected. Sequential logic is usually dependent on the clock cycle which then uses past inputs to create an output. A combinational circuit however isn't dependent on time nor needs previous inputs to create an output. A combinational circuit uses what's given to create an output while a sequential circuit needs to look back to then form an output.

Deliverables

Q2 C	Q1 B	Q0 A	X	C Q2 ⁺	B Q1 ⁺	A Q0 ⁺	Y
0	0	0	0	1	1	0	0
0	0	0	1	0	0	1	0
0	0	1	0	1	1	0	0
0	0	1	1	0	1	1	0
0	1	0	0	X	X	X	X
0	1	0	1	X	X	X	X
0	1	1	0	1	1	0	0
0	1	1	1	1	1	1	0

1	0	0	0	1	0	1	0
1	0	0	1	0	0	1	0
1	0	1	0	1	0	1	0
1	0	1	1	0	0	1	1
1	1	0	0	1	0	0	0
1	1	0	1	0	0	1	0
1	1	1	0	1	1	0	1
1	1	1	1	1	1	1	0



AB/CX	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	0	0	0	1
10	0	0	1	0

$$Y = ABCX' + AB'CX$$

AB/CX	00	01	11	10
00	1	0	0	1
01	X	X	1	1
11	1	0	1	1
10	1	0	0	1

$$QC = BC + X'$$

AB/CX	00	01	11	10
00	1	0	1	1
01	X	X	1	1
11	0	0	1	1
10	0	0	0	0

$$QB = A'X' + A'C + BC$$

AB/CX	00	01	11	10
00	0	1	1	0
01	X	X	1	0
11	0	1	1	0
10	1	1	1	1

$$QA = X + AB'$$

Discussion

In this lab I learned more about sequential and combinational logic. I learned about how sequential circuits use previous inputs to create an output. I enjoyed putting together this detector but making the state diagram and table was kind of frustrating. Overall this lab was very enjoyable minus the hardware part as I had to debug for a while.

Questions

1. Using JK flip flops, design a counter that counts from DCBA=0001 sequentially to DCBA=1100 and then returns to 0001. Complete the table below

2.

Plot the state changes on the diagram below with a state diagram (0.4 pts).

We are asked to build this counter using D flip-flops. Use a K-map to find the logic expressions for D₂ (which defines how Q₂₊ is determined) (0.4 pts).

