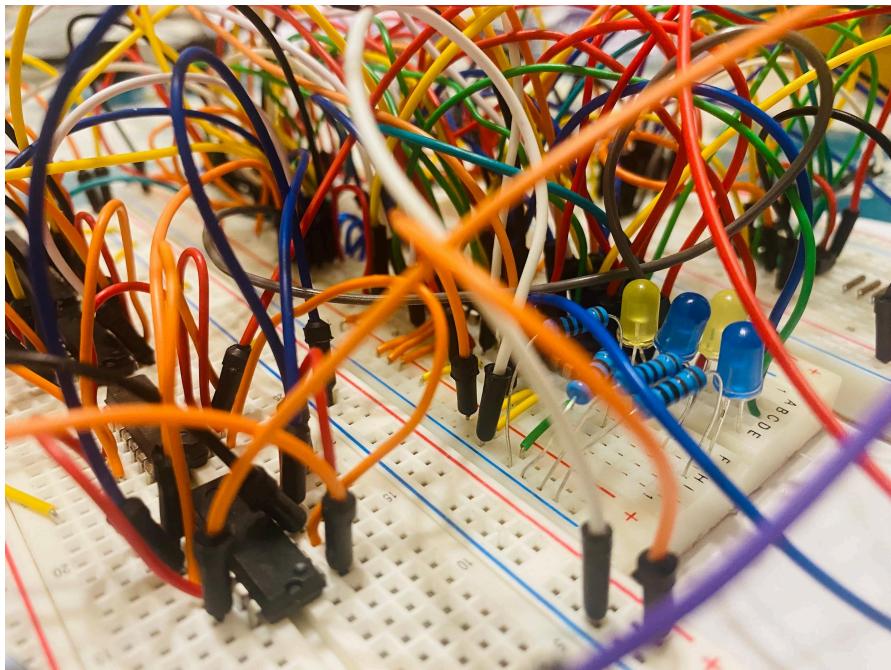




Computer Engineering Technology Department
CET 4705– Component and Subsystem Design I
Year & Semester: 2022 Fall
Instructor Name: Professor Luis Aponte

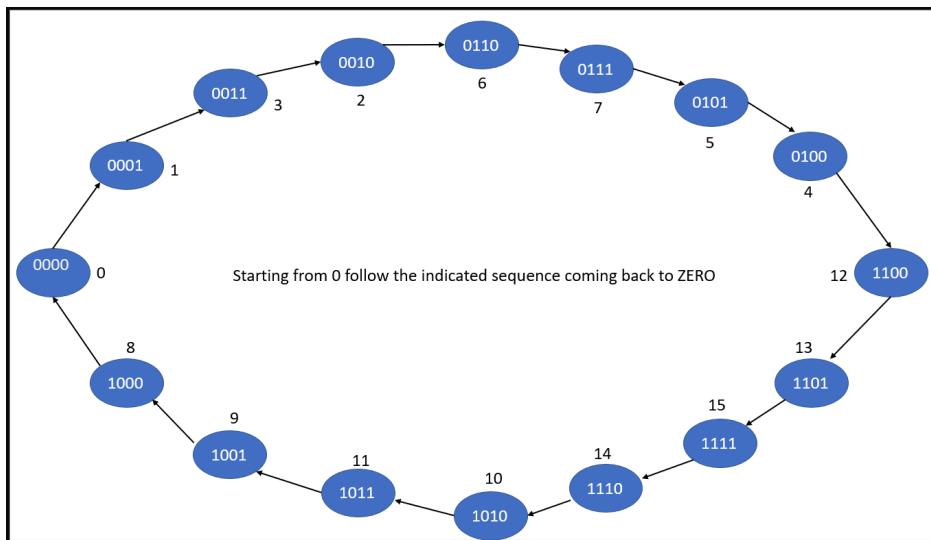


Sequential System Project

Date: 12/2/2022

Student Name: Touheda Khanom

STEP 1: STATE DIAGRAM



STEP 2: STATE TABLE

Present State	Next State
0 0 0 0	0 0 0 1
0 0 0 1	0 0 1 1
0 0 1 0	0 1 1 0
0 0 1 1	0 0 1 0
0 1 0 0	1 1 0 0
0 1 0 1	0 1 0 0
0 1 1 0	0 1 1 1
0 1 1 1	0 1 0 1
1 0 0 0	0 0 0 0
1 0 0 1	1 0 0 0
1 0 1 0	1 0 1 1
1 0 1 1	1 0 0 1
1 1 0 0	1 1 0 1
1 1 0 1	1 1 1 1
1 1 1 0	1 0 1 0
1 1 1 1	1 1 1 0

STEP 3: JK FLIP - FLOP | SIMPLER EXCITATION TABLE

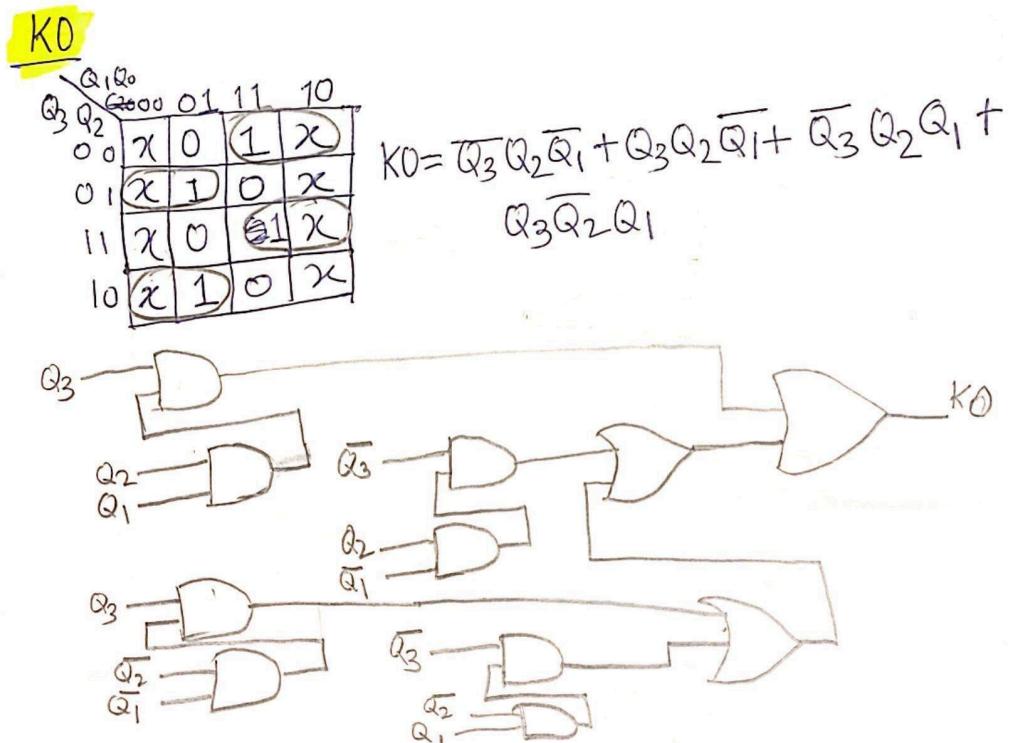
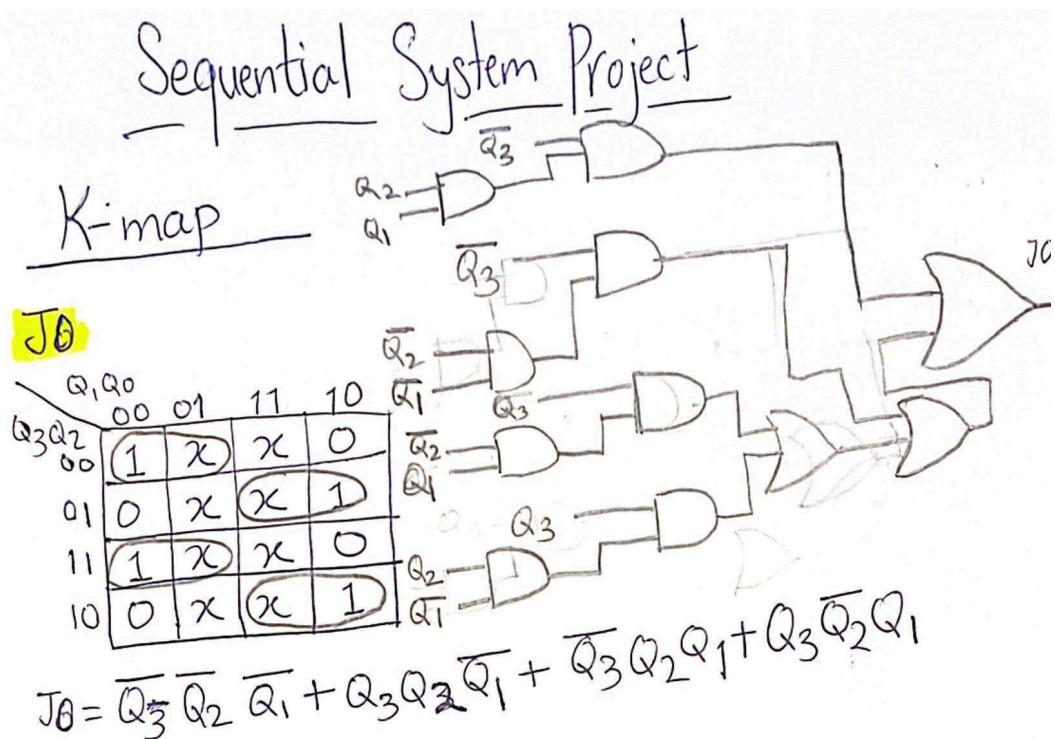
QN	QN+1	J	K
0	0	0	X

0	1	1	X
1	0	X	1
1	1	X	0

STEP 4: CIRCUIT TRANSITION TABLE

	OUTPUT STATE TRANSITION (Present state to next state)				Flip-Flop Inputs								
	Q3	Q2	Q1	Q0	J3	K3	J2	K2	J1	K1	J0	K0	
0	0 to 0	0 to 0	0 to 0	0 to 1	0	x	0	x	0	x	1	x	
1	0 to 0	0 to 0	0 to 1	1 to 1	0	x	0	x	1	x	x	0	
2	0 to 0	0 to 1	1 to 1	0 to 0	0	x	1	x	x	0	0	x	
3	0 to 0	0 to 0	1 to 1	1 to 0	0	x	0	x	x	0	x	1	
4	0 to 1	1 to 1	0 to 0	0 to 0	1	x	x	0	0	x	0	x	
5	0 to 0	1 to 1	0 to 0	1 to 0	0	x	x	0	0	x	x	1	
6	0 to 0	1 to 1	1 to 1	0 to 1	0	x	x	0	x	0	1	x	
7	0 to 0	1 to 1	1 to 0	1 to 1	0	x	x	0	x	1	x	0	
8	1 to 0	0 to 0	0 to 0	0 to 0	x	1	0	x	0	x	0	x	
9	1 to 1	0 to 0	0 to 0	1 to 0	x	0	0	x	0	x	x	1	
10	1 to 1	0 to 0	1 to 1	0 to 1	x	0	0	x	x	0	1	x	
11	1 to 1	0 to 0	1 to 0	1 to 1	x	0	0	x	x	1	x	0	
12	1 to 1	1 to 1	0 to 0	0 to 1	x	0	x	0	0	x	1	x	
13	1 to 1	1 to 1	0 to 1	1 to 1	x	0	x	0	1	x	x	0	
14	1 to 1	1 to 0	1 to 1	0 to 0	x	0	x	1	x	0	0	x	
15	1 to 1	1 to 1	1 to 1	1 to 0	x	0	x	0	x	0	x	1	

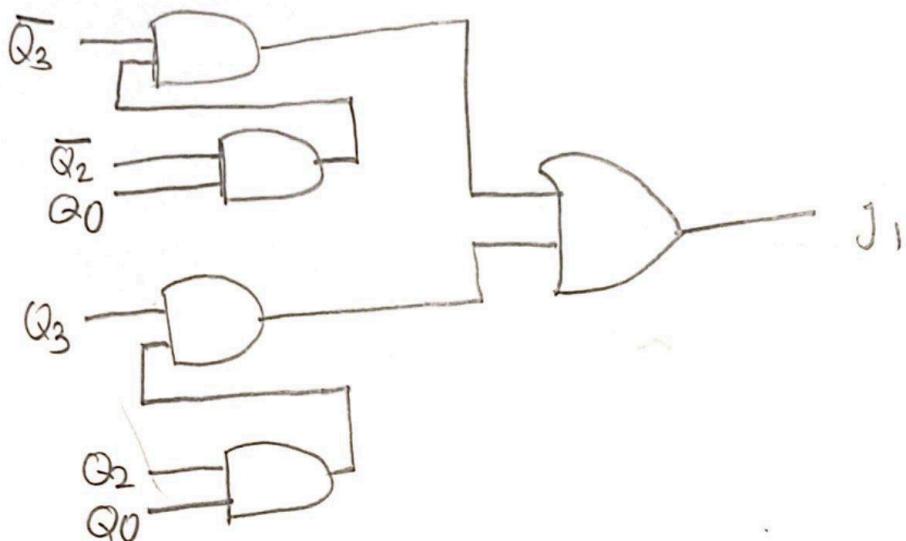
STEP 5: K-MAP, Boolean Expressions, & Combinational Circuits



J₁

		Q ₁ Q ₀	01	11	10
		Q ₃ Q ₂	00	01	11
Q ₃ Q ₂		00	1	X	X
		01	0	X	X
Q ₃ Q ₂		11	0	X	X
		10	0	X	X

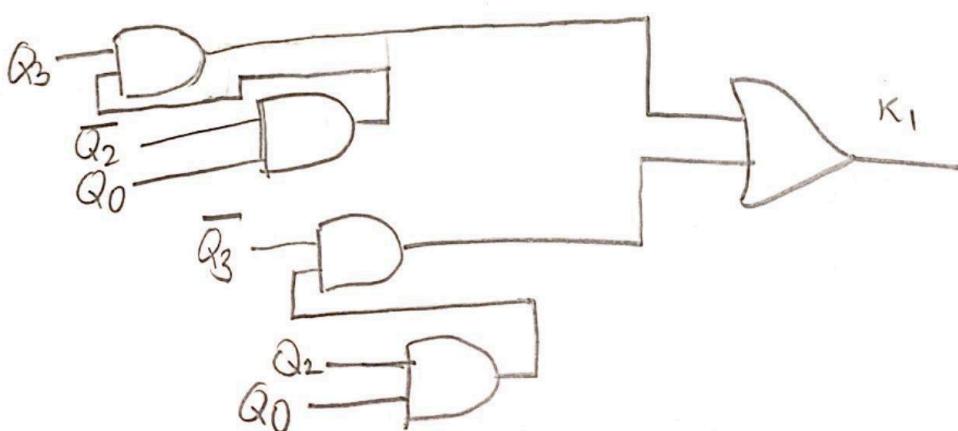
$$J_1 = \overline{Q}_3 \overline{Q}_2 Q_0 + Q_3 Q_2 Q_0$$



K₁

		Q ₁ Q ₀	01	11	10
		Q ₃ Q ₂	00	01	11
Q ₃ Q ₂		00	X	0	0
		01	X	1	0
Q ₃ Q ₂		11	X	0	0
		10	X	1	0

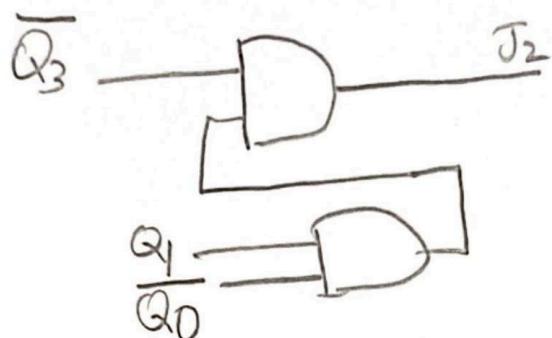
$$K_1 = \cancel{Q}_3 \cancel{Q}_2 Q_0 + \cancel{\overline{Q}}_3 \cancel{Q}_2 Q_0$$



J₂

		Q ₁ Q ₀	00	01	11	10
		Q ₃ Q ₂	00	01	11	10
Q ₁	00	0	0	0	(1)	
	01	x	x	x	x	
	11	x	x	x	x	
	10	0	0	0	0	

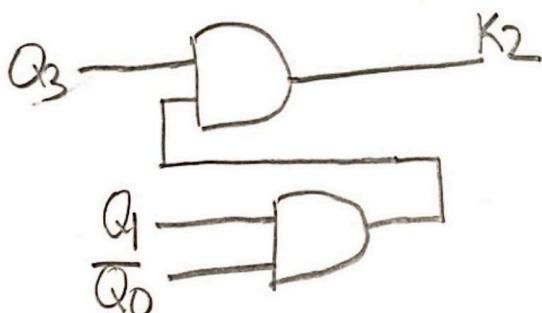
$$J_2 = \overline{Q}_3 Q_1 \overline{Q} 0$$



K₂

		Q ₁ Q ₀	00	01	11	10
		Q ₃ Q ₂	00	x	x	x
Q ₁	00	x	x	x	x	
	01	0	0	0	0	
	11	0	0	0	1	
	10	x	x	x	x	

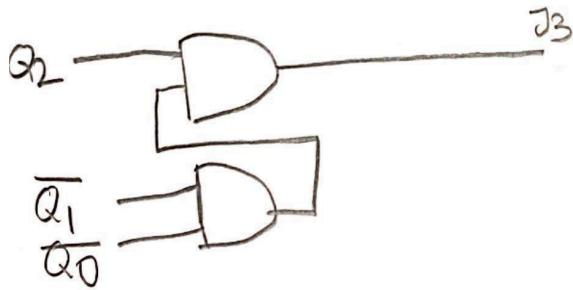
$$K_2 = Q_3 Q_1 \overline{Q} 0$$



J₃

		Q ₁ Q ₀	00	01	11	10
		Q ₃ Q ₂	00	0	0	0
		01	1	0	0	0
		11	X	X	X	X
		10	X	X	X	X

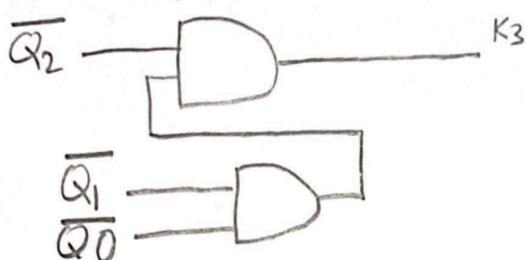
$$J_3 = Q_2 \bar{Q}_1 \bar{Q}_0$$



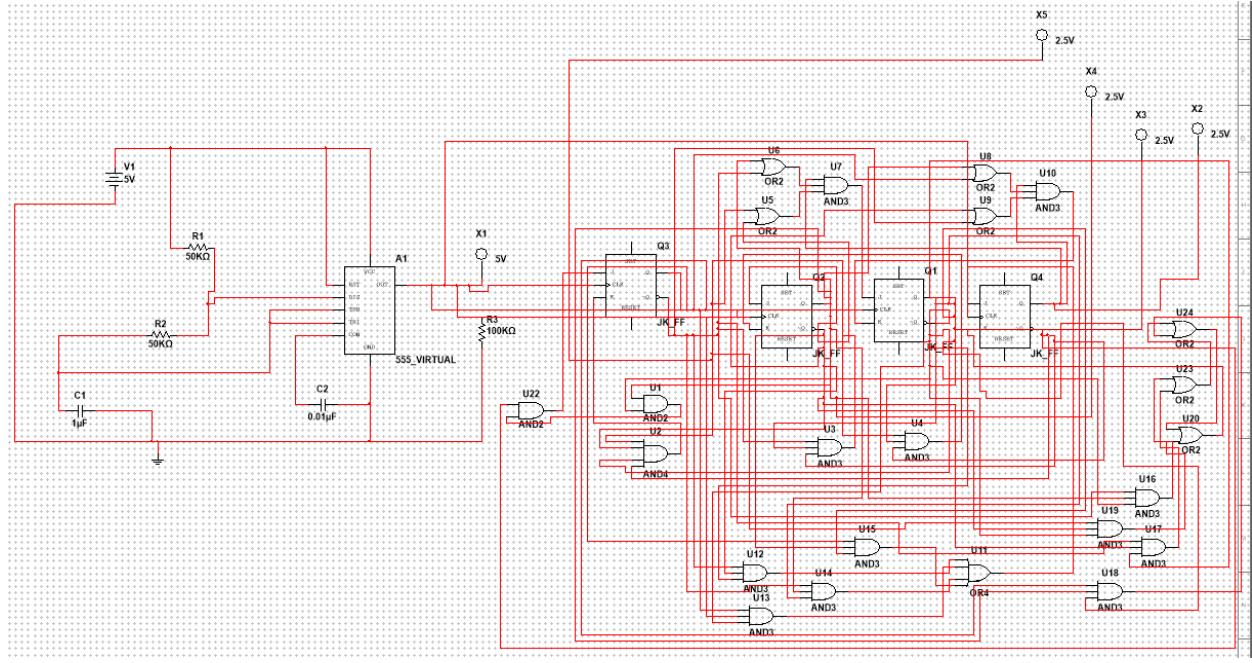
K₃

		Q ₁ Q ₀	00	01	11	10	
		Q ₃ Q ₂	00	X	X	X	X
		01	X	X	X	X	
		11	0	0	0	0	
		10	1	0	0	0	

$$K_3 = \bar{Q}_2 \bar{Q}_1 \bar{Q}_0$$



MULTISIM



Youtube Link For the Project

<https://youtu.be/TI3TwM5m37A>