

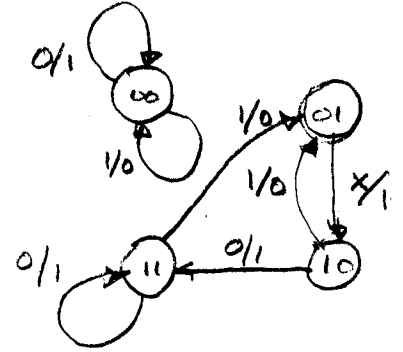
12.39 $S_1 = \bar{Q}_1 Q_2$ $R_1 = X Q_1$ $S_2 = Q_1 \bar{Q}_2$ $R_2 = \bar{Q}_1 Q_2$ $Y = \bar{X} + \bar{Q}_1 Q_2$

12.35	X, Q_1, Q_2	$\bar{X}, \bar{Q}_1, \bar{Q}_2$	$Q_1(t+1) = X\bar{Q}_1 + \bar{Q}_1 Q_2$	$Q_2(t+1) = XQ_1 + \bar{Q}_1 Q_2$	$Y = XQ_2 + \bar{Q}_1 Q_2$
	0 0 0	1 1 1	1+0=1	0	0+0=0
	0 0 1	1 1 0	1+0=1	0	0+1=1
	0 1 0	1 0 1	0+0=0	0	0+0=0
	0 1 1	1 0 0	0+1=1	0	0+0=0
	1 0 0	0 1 1	0+0=0	0	0+0=0
	1 0 1	0 1 0	0+0=0	0	1+1=1
	1 1 0	0 0 1	0+0=0	1	0+0=0
	1 1 1	0 0 0	0+1=1	0	1+0=1

X, Q_1, Q_2	S_1	R_1	S_2	R_2	$Q_1(t+1)$	$Q_2(t+1)$	Y
0 0 0	0	0	0	0	0	0	1
0 0 1	1	0	0	1	1	0	1
0 1 0	0	0	1	0	1	1	1
0 1 1	0	0	0	0	1	1	1
1 0 0	0	0	0	0	0	0	0
1 0 1	1	0	0	1	1	0	1
1 1 0	0	1	1	0	0	1	0
1 1 1	0	1	0	0	0	1	0

Since this is the same as Table 12.20, then the state diagram is given in Fig. 12.46.

12.39 state diagram:



12.44 using transition maps: (see Fig. 12.46)

FF₁: $Q_1 Q_2$

X	00	01	11	10
0	0	0	1	0
1	0	0	1	0

FF₂: $Q_1 Q_2$

X	00	01	11	10
0	0	0	0	0
1	0	0	0	0

J_1 : $Q_1 Q_2$

X	00	01	11	10
0	0	1	1	1
1	0	1	1	1

K_1 : $Q_1 Q_2$

X	00	01	11	10
0	1	1	1	1
1	1	1	1	1

J_2 : $Q_1 Q_2$

X	00	01	11	10
0	0	1	1	1
1	0	1	1	1

K_2 : $Q_1 Q_2$

X	00	01	11	10
0	1	1	1	1
1	1	1	1	1

$J_1 = \bar{X}$

$K_1 = \bar{Q}_2$

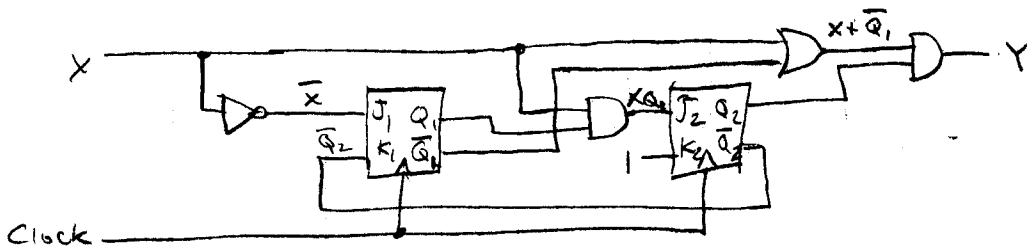
$J_2 = X Q_1$

$K_2 = 1$

Y : $Q_1 Q_2$

X	00	01	11	10
0	0	1	1	0
1	0	1	1	0

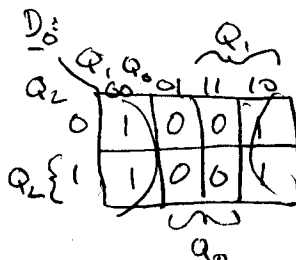
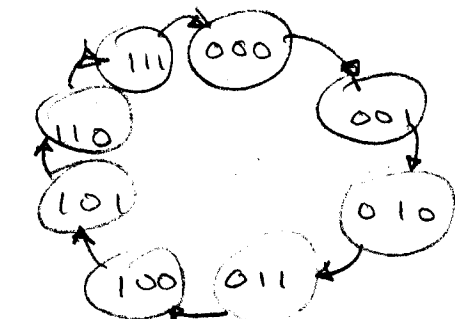
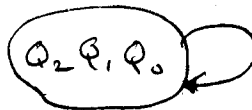
$Y = XQ_2 + \bar{Q}_1 Q_2 = (X + \bar{Q}_1) Q_2$



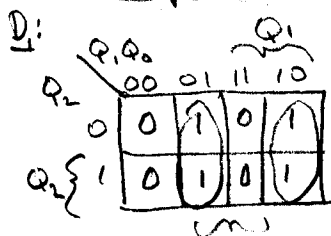
Assignment 6 extra problems:

(a) 3 bit synchronous counter with D FF's. Don't need to draw the transition map for D FF's since $D_i = Q_{i+1}$

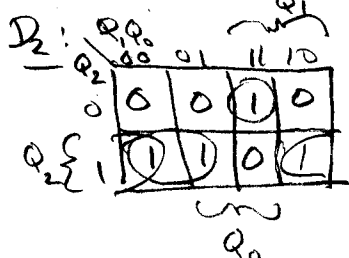
key!



$$D_0 = \bar{Q}_0$$



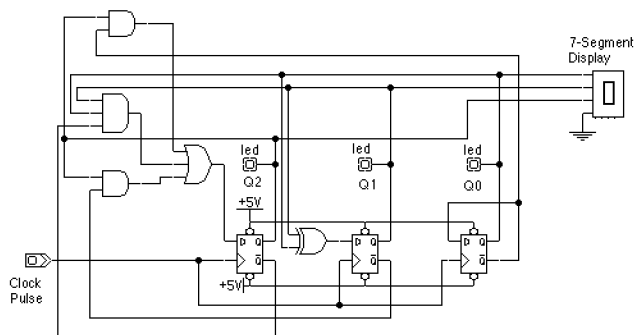
$$D_1 = Q_0 \bar{Q}_1 + \bar{Q}_0 Q_1 = Q_0 \oplus Q_1$$



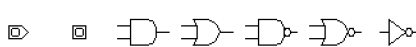
$$D_2 = \bar{Q}_1 Q_2 + \bar{Q}_0 Q_2 + Q_0 Q_1 \bar{Q}_2$$

Chipmunk "diglog" simulation of 3 bit binary counter made with D flip-flops

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Synchronous Sequential Design Handout Problem:
 Implement with T ff's instead of JK's:

Transition maps same as before. Use
 input eqns for T ff's: $T = \alpha, \beta$
 $D_T = X$

So the T ff k. maps become:

FF A:

	$Q_A Q_B$			
D	00	01	11	10
0	0	0	β	1
1	0	α	β	β

FF B:

	$Q_A Q_B$			
D	00	01	11	10
0	0	1	β	0
1	α	β	β	0

T_A :

	$Q_A Q_B$			
D	00	01	11	10
0			1	
1	1	1	1	

Q_B

T_B :

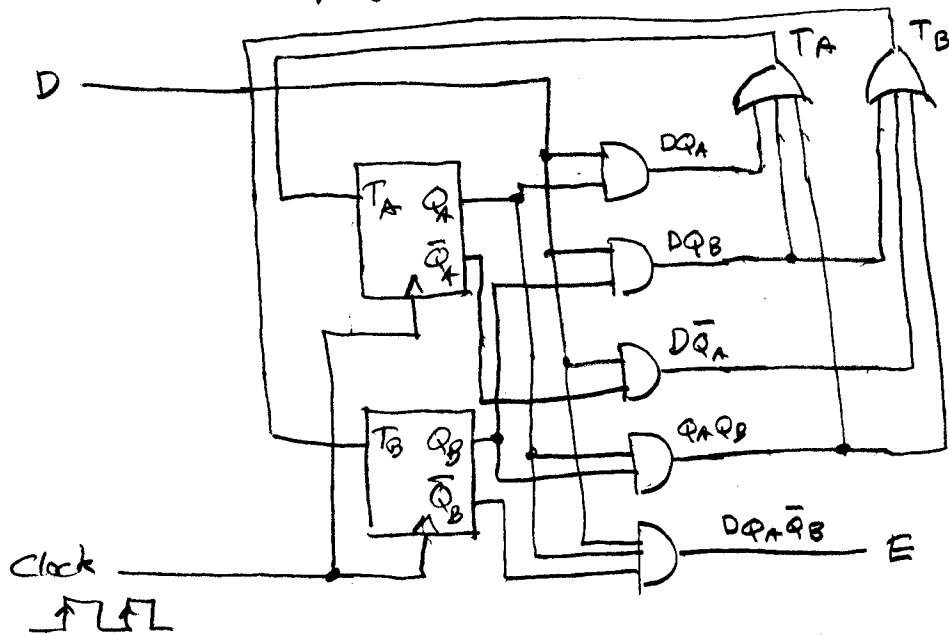
	$Q_A Q_B$			
D	00	01	11	10
0			1	
1	1	1	1	

Q_B

$$T_A = DQ_A + DQ_B + Q_A Q_B$$

$$T_B = D\bar{Q}_A + DQ_B + Q_A Q_B$$

($E = DQ_A \bar{Q}_B$ as before)



(c) Last problem (from handout)

Flip-flop A:
(transition map)

	$Q_A Q_B$			
D	00	01	11	10
0	0	0	0	0
1	0	1	1	1

J_A :

	$Q_A Q_B$			
D	00	01	11	10
0	0	0	X	X
1	0	1	X	X

$$J_A = D Q_B$$

K_A :

	$Q_A Q_B$			
D	00	01	11	10
0	X	X	1	1
1	X	X	0	0

$$K_A = \bar{D}$$

