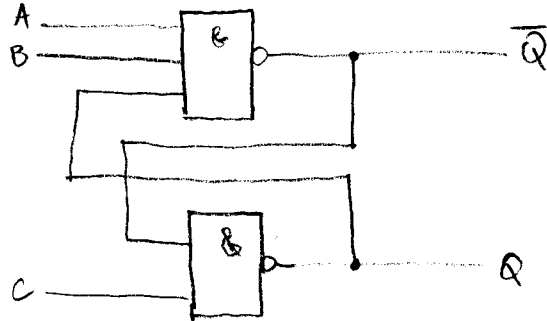


ECE 462 Spring 2005 Homework #8

(A)
Latch Behavior



A	B	C	Q	Q'
0	0	0	1	1
0	0	1	0	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	1
1	0	1	0	1
1	1	0	1	0
1	1	1	nc	nc

(B)

7.2b

		SR			
		00	01	11	10
q	0	0	0	0	1
	1	1	1	0	1

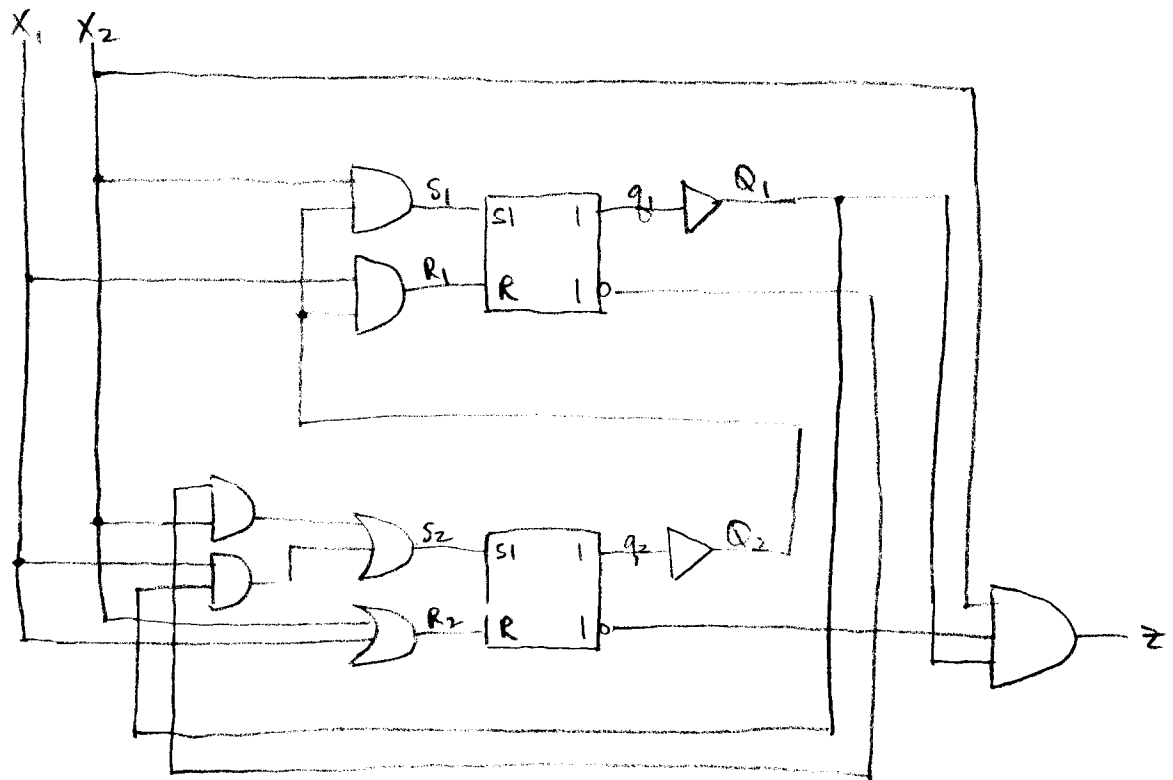
$$Q = SR' + qR'$$

7.2d

		DC			
		00	01	11	10
q	0	0	0	1	0
	1	1	0	1	1

$$Q = qC' + DC$$

(C)



$$S_1 = X_2 q_2$$

$$R_1 = X_1 q_2$$

$$S_2 = X_2 \bar{q}_1 + X_1 q_1$$

$$R_2 = X_1 + X_2$$

$$Z = \bar{q}_2 q_1 X_2$$

<u>X₁</u>	<u>X₂</u>	<u>q₁</u>	<u>q₂</u>	<u>S₁</u>	<u>R₁</u>	<u>Q₁</u>	<u>S₂</u>	<u>S₂</u>	<u>Q₂</u>
0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	1
0	0	1	1	0	0	1	0	0	1
0	0	1	0	0	0	1	0	0	0
0	1	0	0	0	0	0	1	1	1
0	1	0	1	1	0	1	1	1	1
0	1	1	1	1	0	1	0	1	0
0	1	1	0	0	0	1	0	1	0
1	1	0	0	0	0	0	1	1	1
1	1	0	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	0	0	0	1	1	1	1
1	0	0	0	0	0	0	0	1	0
1	0	0	1	0	1	0	0	1	0
1	0	1	1	0	1	0	1	1	1
1	0	1	0	0	0	1	1	1	1

Transition Table

x1x2

	00	01	11	10
00	(00)	01	01	(00)
01	(01)	11	11	00
11	(11)	10	(11)	01
10	(10)	(10)	11	11

Q1Q2

Races

		x1x2			
		00	01	11	10
q1q2	00	00	01	01	00
	01	01	11	11	00
	11	11	10	11	01
	10	10	10	11	11

Q1Q2

**By observing the transition table, you can see there are no races and no critical races either.

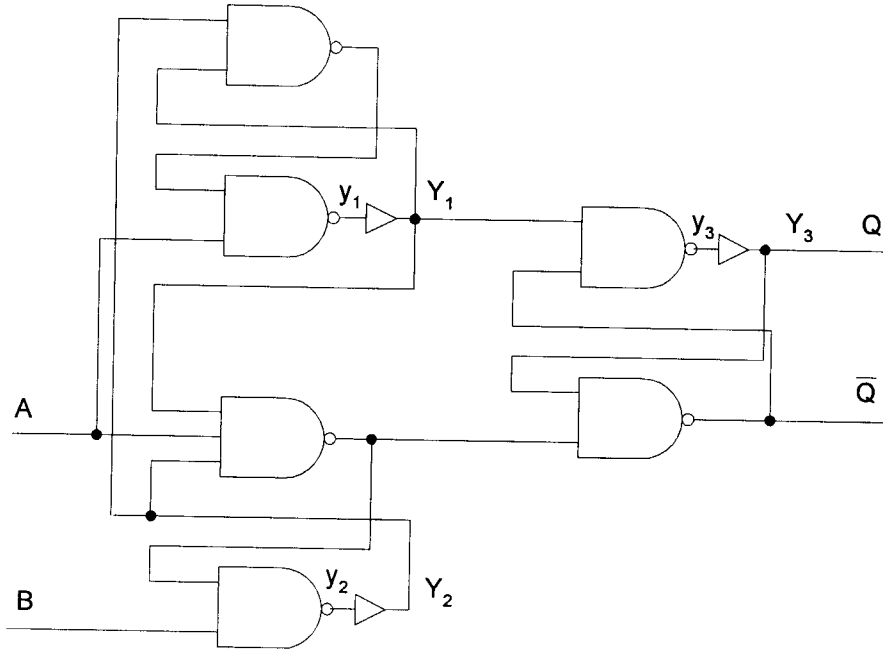
Flow Table

		x1x2			
		00	01	11	10
q1q2	00	00	10	11	00
	01	01	10	11	00
	11	11	10	11	00
	10	10	10	11	00

Q1Q2

E

a) Inserting the amplifiers given, you get the following (note that all loops are broken, so no additional amplifiers are needed).



b)

$$Y_1 = ((y_2 y_1)' A)' = y_1 y_2 + A'$$

$$Y_2 = ((y_1 A y_2)' B)' = A y_1 y_2 + B'$$

$$Y_3 = (y_1 (y_3 (y_1 A y_2)'))' = y_1' + y_3 (y_1 A y_2)' = y_1' + y_3 (y_1' + A' + y_2')$$

$$= y_1' + y_1' y_3 + A' y_3 + y_2' y_3 = y_1' + A' y_3 + y_2' y_3$$

c/d) Transition Table (potential races shown in gray)

Y ₁ Y ₂ Y ₃		AB			
		00	01	11	10
000	111	101	001	011	
001	111	101	001	011	
010	111	101	001	011	
011	111	101	001	011	
100	110	100	000	010	
101	111	101	001	011	
110	110	100	110	110	
111	111	101	110	110	

Output table: $Q' = (y_3(y_1Ay_2)')' = y_3' + y_1Ay_2$
 $Q = y_3$

		AB			
		00	01	11	10
$y_1y_2y_3$	000	01	01	01	01
	001	10	10	10	10
	010	01	01	01	01
	011	10	10	10	10
	100	01	01	01	01
	101	10	10	10	10
	110	01	01	01	01
	111	10	10	11	11

e) critical races shown by asterisks:

		AB			
		00	01	11	10
$y_1y_2y_3$	000	111*	101*	001	011
	001	111	101	001	011
	010	111*	101*	001	011
	011	111	101	001	011
	100	110	100	000	010*
	101	111	101	001	011*
	110	110	100	110	110
	111	111	101	110	110

f) Flow table:

		AB			
		00	01	11	10
$y_1y_2y_3$	000	-	-	001	011
	001	111	101	001	011
	010	-	-	001	011
	011	111	101	001	011
	100	110	100	001	-
	101	111	101	001	-
	110	110	100	110	110
	111	111	101	110	110