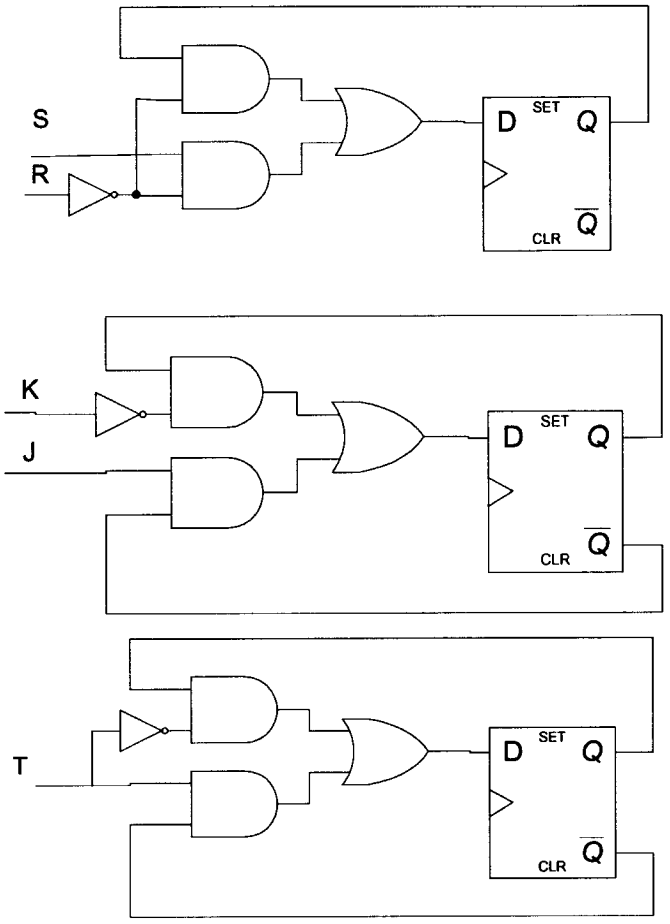
ECE 462 Homework #10 Solutions (Spring 2005)

A)



C B / 8.2b (2 pts)

Excitation equations:

Q_1^+ = D <CLOCK>↑ = ((X' + Q_1'')Q_2')'<CLOCK>↑ = (XQ_1' + Q_2)<CLOCK>↑

Q_2^+ = (J'K'Q_2 + JK' + JKQ_2') <CLOCK>↑

= (X'(Q1'X + Q_1X')'Q_2 + X(Q1' + Q_1X')' + X(Q1'X + Q_1X')Q_2'<CLOCK>↑

= (X'Q1'Q_2 + XQ_1 + XQ_2') <CLOCK>↑

J = X

K = $Q_1 \oplus X$ = Q1'X + Q_1X'

Z = (Q_1Q_2')' = Q1' + Q_2

Transition table:

<CLOCK>↑

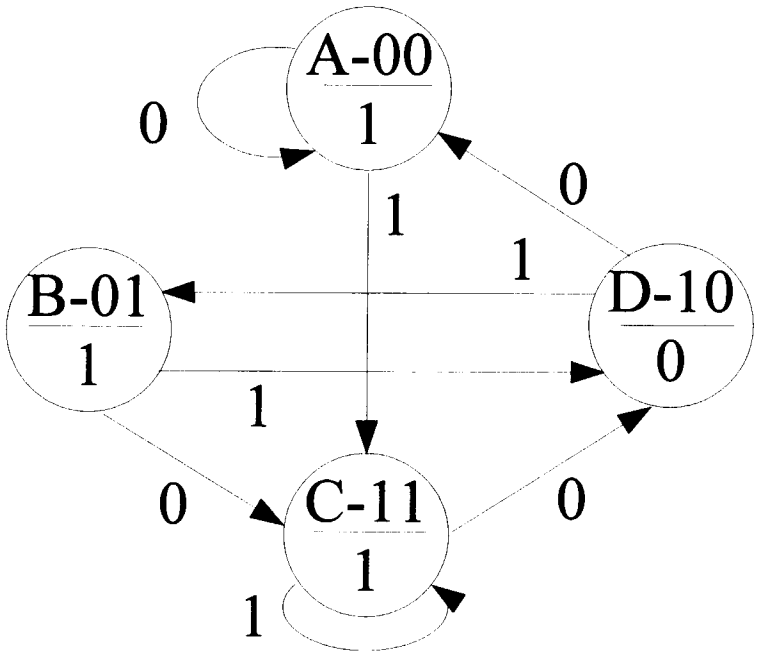
Q1	Q2	0		1		Z
0	0	0	0	1	1	1
0	1	1	1	1	0	1
1	0	1	0	1	1	1
1	1	0	0	0	1	0
		Q1+	Q2+			

State/Output table:

<CLOCK>↑

Q1	Q2	s	0	1	Z
0	0	A	A	C	1
0	1	B	C	D	1
1	0	C	D	C	1
1	1	D	A	B	0

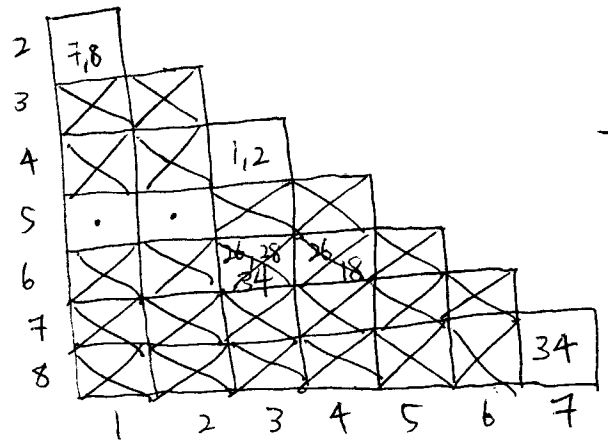
State/Output diagram:



D)

	00	01	11	10
1	1	–	7	4
2	2	3	8	–
3	6	–	2	3
4	6	6	1	–
5	–	A	–	4
6	2	6	8	4
7	8	4	B	–
8	7	3	5	2

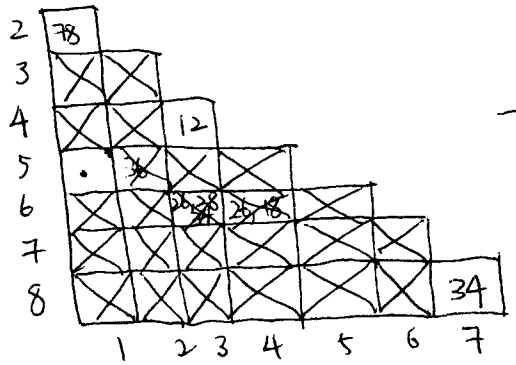
a) A = – B = –



[1,2,5] = A
[3,4] = B
[7,8] = C
[6] = D

	00	01	11	10	$z_1 z_2$
1	(A)	B	C	B	00
2	D	D	A	(B)	01
3	(C)	B	A	A	10
4	A	(D)	C	B	01

b) A = 6 B = –



[1,2] = A
[1,5] = B
[3,4] = C
[7,8] = D
[6] = E

	00	01	11	10	$z_1 z_2$
1	(A)	C	D	C	00
2	A	E	D	C	00
3	E	E	A	(C)	01
4	(D)	C	B	A	10
5	A	(E)	D	C	01

E

From description, come up with transition table (essentially each state is the amount of carry in the circuit. A is 0 B is 1 and C is 2):

	x = 0	x = 1
A	A,0	B,1
B	A,1	C,0
C	B,0	C,1

Next, choose a state assignment (there are many ways of doing this),
A=00
B=01
C=11
Transition table becomes.

y_1y_2	x = 0	x = 1
00	00,0	01,1
01	00,1	11,0
11	01,0	11,1

Break up into various K-maps (assuming D Flip-flops are used for simplicity):

Y_1

y_1y_2 \ x	0	1
00	0	0
01	0	1
11	0	1
10	x	x

Y_2

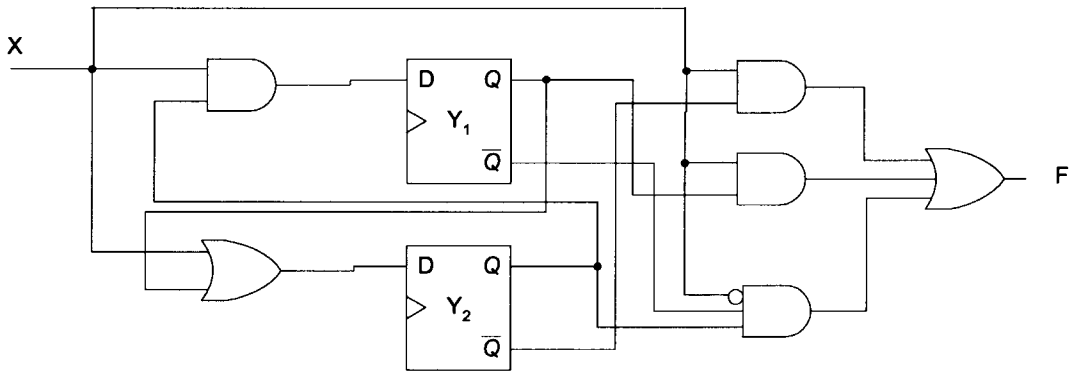
y_1y_2 \ x	0	1
00	0	1
01	0	1
11	1	1
10	x	x

F

y_1y_2 \ x	0	1
00	0	1
01	1	0
11	0	1
10	x	x

$Y_1 = xy_2$
$Y_2 = x+y_1$
$F = xy_2' + xy_1 + x'y_1'y_2$

Final circuit:



F

F= xy(y+z)

a) for b s-a-0 (same as y s-a-0)

$f_{y=0} = 0$
$f_{y=1} = x$
find solutions to: yx=1
Therefore tests are <x,y,z> = <1,1,d>

So testability is 2/8.

b) for h s-a-1
f = xyh with h=y+z

$f_{h=0} = 0$
$f_{h=1} = xy$

Find solution to h'xy=1 = y'z'xy'=1
No solutions exist

So testability is 0.

c) for h s-a-0
Find solutions to hxy = 1 = (y+z)xy = 1
Tests are <x,y,z> = <1,1,d>

so testability is 2/8.