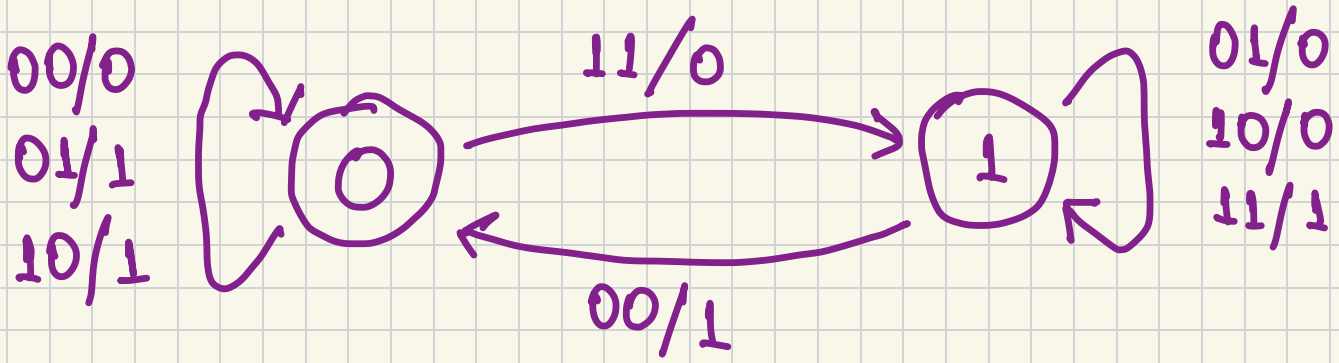
Quiz 4 (Solution)

1.

Present state	Inputs		Next state	Output
Q	x	y	Q	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1


00/0
01/1
10/1
0
11/0
00/1
1
01/0
10/0
11/1

2. We know, from the characteristic equation of JK flip-flops, that

$$A(t+1) = J_A A' + K_A' A$$

$$B(t+1) = J_B B' + K_B' B$$

Given that $J_A = x'$, $K_A = B'$, $J_B = A$, and $K_B = x$,

we obtain

$$A(t+1) = x'A' + BA$$

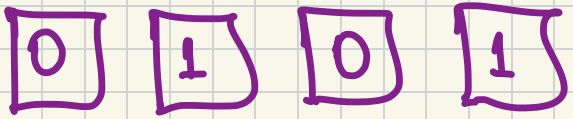
$$B(t+1) = AB' + x'B$$

Present state		Input	Next state	
A	B	x	A	B
0	0	0	1	0
0	0	1	0	0
0	1	0	1	1
0	1	1	0	0
1	0	0	0	1
1	0	1	0	1
1	1	0	1	1
1	1	1	1	0

1
00
1
01
0
0,1
0
10
1
11
0

3.

1011001



Serial input

After the first right shift : 1010

— second — : 0101

— third — : 0010

— fourth — : 1001

— fifth — : 1100

4.

Present State A	B	C	Input x	Next State A	B	C	Output y	J_A	K_A	J_B	K_B	J_C	K_C
0	0	0	0	0	1	1	0	0	x	1	x	1	x
0	0	0	1	1	0	0	1	1	x	0	x	0	x
0	0	1	0	0	0	1	0	0	x	0	x	x	0
0	0	1	1	1	0	0	1	1	x	0	x	x	1
0	1	0	0	0	1	0	0	0	x	x	0	0	x
0	1	0	1	0	0	0	1	0	x	x	1	0	x
0	1	1	0	0	0	1	0	0	x	x	1	x	0
0	1	1	1	0	1	0	1	0	x	x	0	x	1
1	0	0	0	0	1	0	0	x	1	1	x	0	x
1	0	0	1	0	1	1	0	x	1	1	x	1	x

unused states

x	x	x	x	x	x
x	x	x	x	x	x
.	.	.	.	.	.
x	x	x	x	x	x

J_A

AB \ Cx	00	01	11	10
00	0	1	1	0
01	0	0	0	0
11	X	X	X	X
10	X	X	X	X

$J_A = B'x$

K_A

1

J_B

AB \ Cx	00	01	11	10
00	1	0	0	0
01	X	X	X	X
11	X	X	X	X
10	1	1	X	X

$J_B = A + C'x'$

K_B

AB \ Cx	00	01	11	10
00	X	X	X	X
01	0	1	0	1
11	X	X	X	X
10	X	X	X	X

$K_B = C'x + Cx'$

$= C \oplus x$

J_C

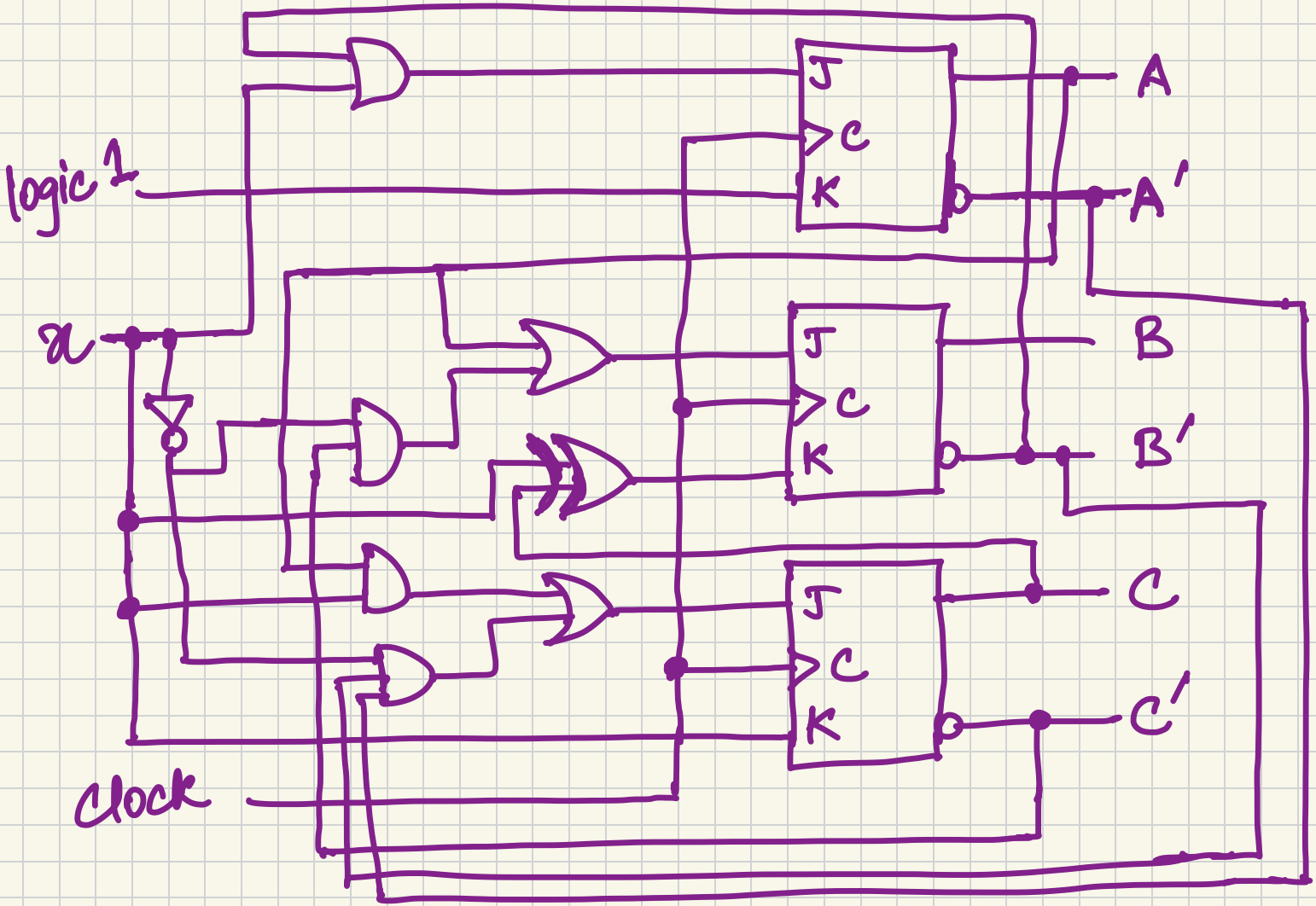
AB \ x	00	01	11	10
00	1	0	X	X
01	0	0	X	X
11	X	X	X	X
10	0	1	X	X

$J_C = Ax + A'B'x'$

K_C

AB \ x	00	01	11	10
00	X	X	1	0
01	X	X	1	0
11	X	X	X	X
10	X	X	X	X

$K_C = x$


logic 1
x
Clock
J
C
K
A
A'
B
B'
C
C'