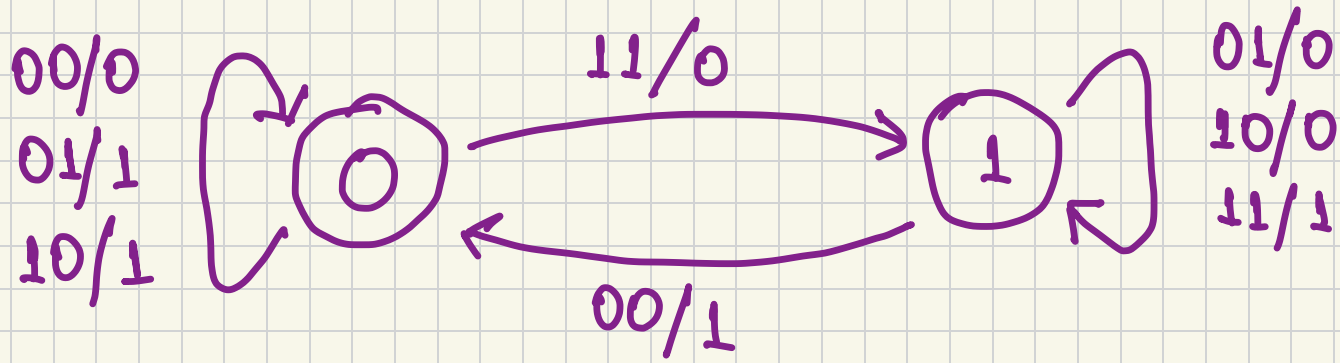


Quiz 4 (Solution)

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



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

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

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

Present state

A B

0 0

0 0

0 1

0 1

1 0

1 0

1 1

1 1

Input

x

0

1

0

1

0

1

0

1

Next state

A B

1 0

0 0

1 1

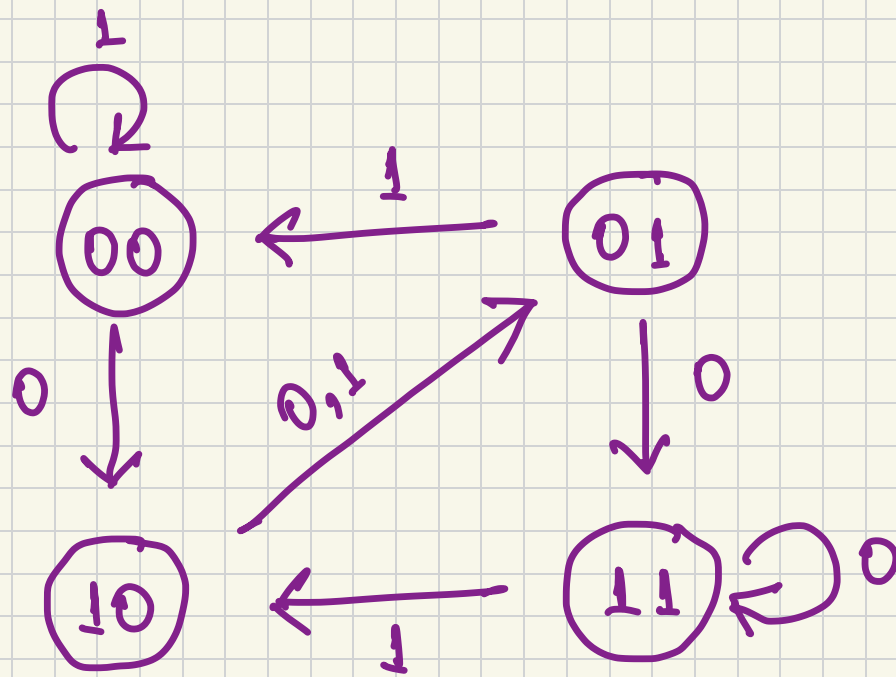
0 0

0 1

0 1

1 1

1 0



3.

1011001

Serial input

0 1 0 1

After the first right shift : 1010

— second — : 0101

— third — : 0010

— fourth ← : 1001

— fifth — : 1100

4.

Present State			Input	Next State			Output	Flip flop inputs					
A	B	C	u	A	B	C	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 K_A

Truth table for J_A and K_A based on inputs A and B .

AB	CN			
	00	01	11	10
00	0	1	1	0
01	0	0	0	0
11	X	X	X	X
10	X	X	X	X

1

$$J_A = B'CN$$

J_B CN

00 01 11 10

AB	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 CN

00 01 11 10

AB	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

CN

AB

	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

CN

AB

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

$$K_C = x$$

Truth table for the function $y = A'x$:

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

$$y = A'x$$

logic 1

a

clock

