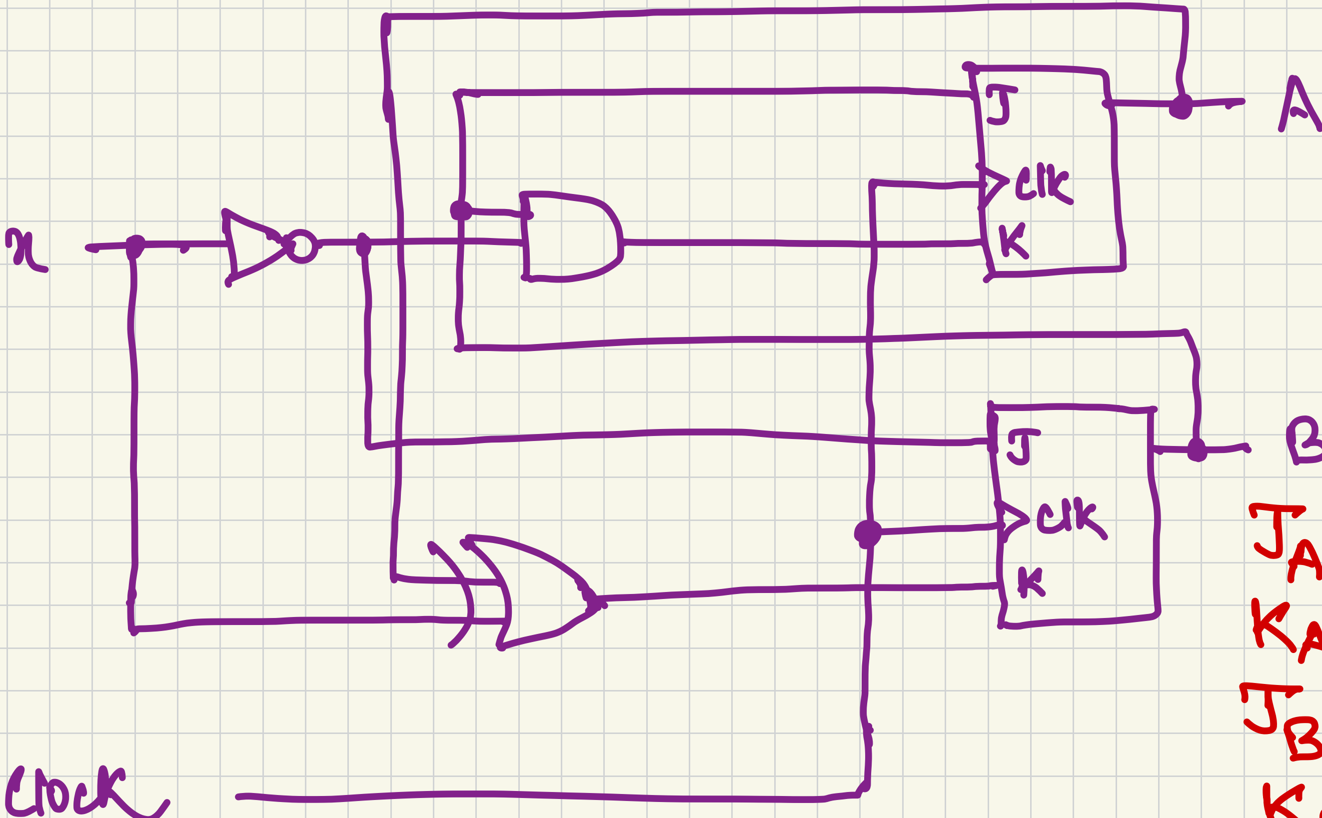
ACOL 215 JK Flip-flop (11th Nov.)



$J_A = B$

$K_A = x'B$

$J_B = x'$

$K_B = x \oplus A$

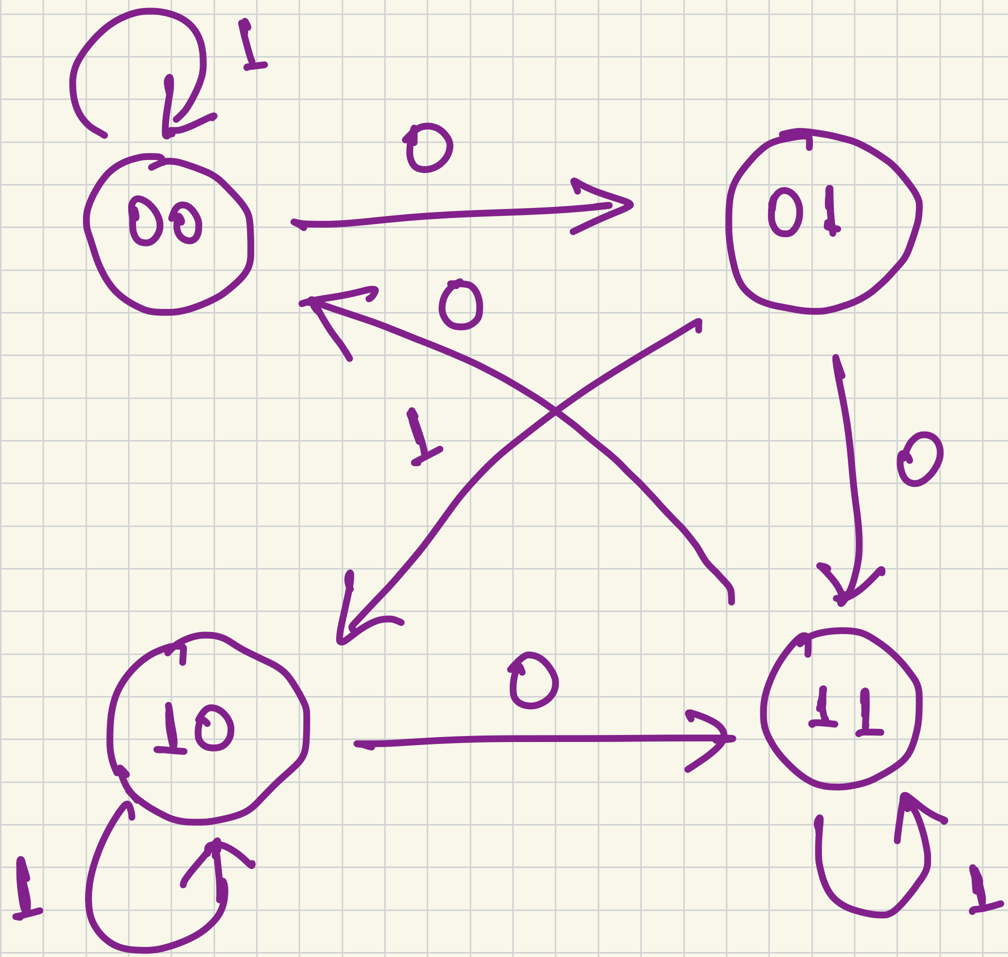
State Table

Present state A	Present state B	Input x	Next state A	Next state B	J_A	K_A	J_B	K_B
0	0	0	0	1	0	0	1	0
0	0	1	0	0	0	0	0	1
0	1	0	1	1	1	1	1	0
0	1	1	1	0	1	0	0	1
1	0	0	1	1	0	0	1	1
1	0	1	1	0	0	0	0	0
1	1	0	0	0	1	1	1	1
1	1	1	1	1	1	0	0	0

This could have been derived from the characteristic equations

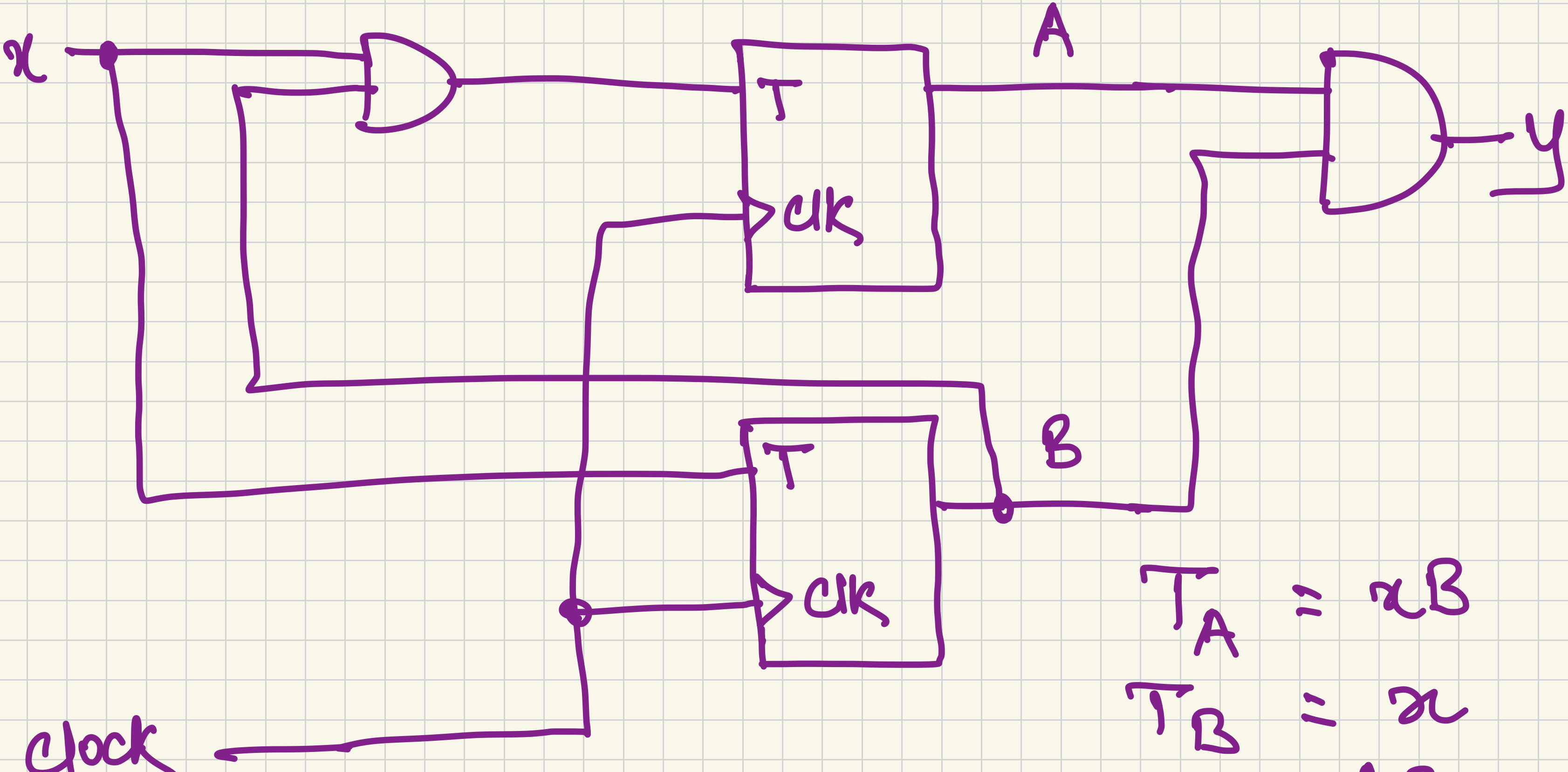
$$A(t+1) = J_A A' + K_A' A$$
$$= BA' + (x'B)'A$$
$$= BA' + (x+B')A$$
$$= \underline{BA' + xA + B'A}$$

Similarly for $B(t+1)$.



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

T flip-flop



$$T_A = xB$$

$$T_B = x$$

$$y = AB$$

$$A(t+1) = T_A A' + T_A' A$$

$$= xBA' + (xB)'A$$

$$= xBA' + (x' + B')A$$

$$= A'Bx + Ax' + AB'$$

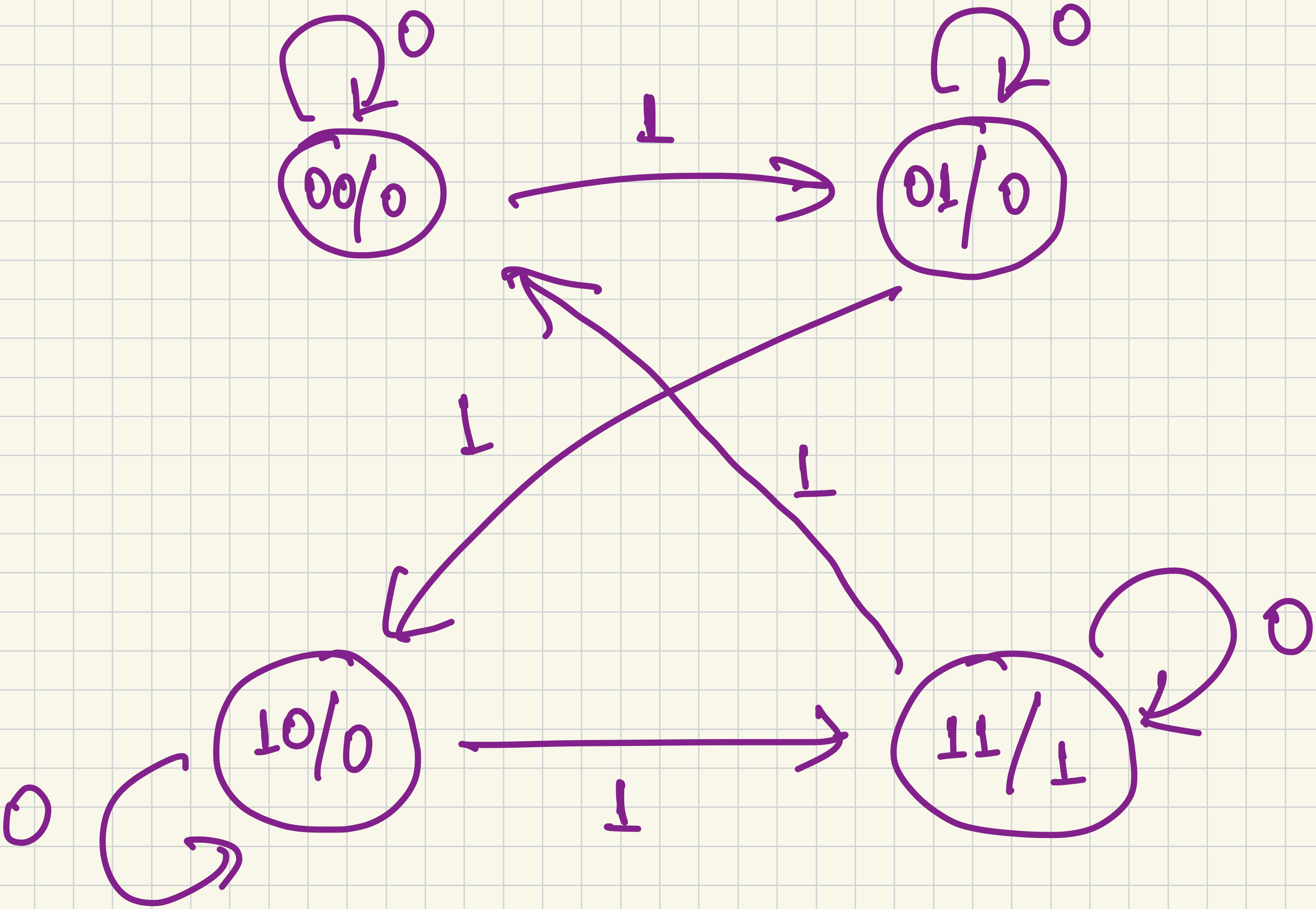
$$B(t+1) = T_B B' + T_B' B$$

$$= B'x + x'B$$

$$= (B \oplus x)$$

Flip-flop inputs		Present state		Input	Next state		Output
T_A	T_B	A	B	x	A	B	y
0	0	0	0	0	0	0	0
0	1	0	0	1	0	1	0
0	0	0	1	0	0	1	0
1	1	0	1	1	1	0	0
0	0	1	0	0	1	0	0
0	1	1	0	1	1	1	0
0	0	1	1	0	1	1	1
1	1	1	1	1	0	0	1

depends on the present state



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

Finite State Machines (FSMs)

→ Mealy and Moore models

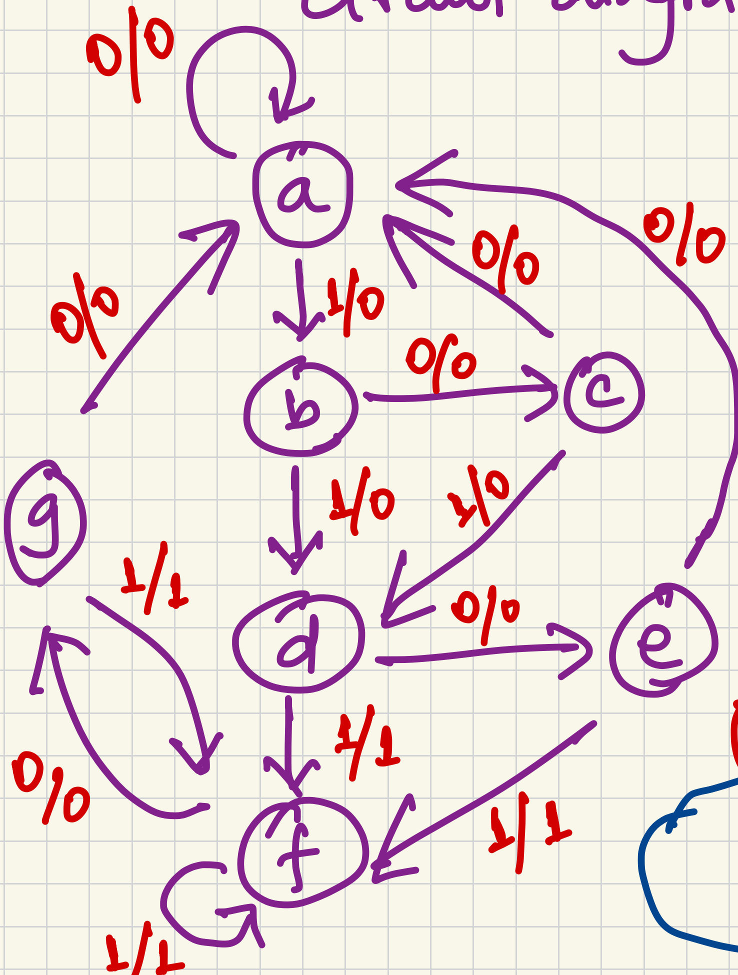
Mealy: Output is a function of both the present state and the input (Mealy machines / FSM)

Moore: output is a function of only the present state (Moore machines / FSM)

We have seen examples of both.

Circuit diagrams → Equations → State table → State diagram

Reduce it ←



Present	Next State $x=0$	Next State $x=1$	Output $x=0$	Output $x=1$
a	a	b	0	0
b	c	d	0	0
c	a	d	0	0
d	e	~~f~~ d	0	1
e	a	~~f~~ d	0	1
f	~~g~~ e	f	0	1
g	a	f	0	1

Present State		Next State $x=0$	Next State $x=1$	Output $x=0$	Output $x=1$
000	a	a	b	0	0
001	b	c	d	0	0
010	c	a	d	0	0
011	d	e	d	0	1
100	e	a	d	0	1

101
110
110

Don't care conditions

Gray code

000
001
011
010
110

Onehot encoding

00001
00010
00100
01000
10000