Homework #8

5.12 For the following state table

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

(a) Draw the corresponding state diagram.
(b)* Tabulate the reduced state table.

5.13 Starting from state a, and the input sequence 01010010111, determine the output sequence for
(a) The state table of the previous problem.
(b) The reduced state table from the previous problem. Show that the same output sequence is obtained for both.

Homework #8

5.15 List a state table for the T flip-flop using Q as the present and next state and T as inputs. Design the sequential circuit specified by the state table using D flip-flop and show that it is equivalent to Fig. 5.13(b).

5.17 Design a one-input, one-output serial 2's complementer. The circuit accepts a string of bits from the input and generates the 2's complement at the output. The circuit can be reset asynchronously to start and end the operation.

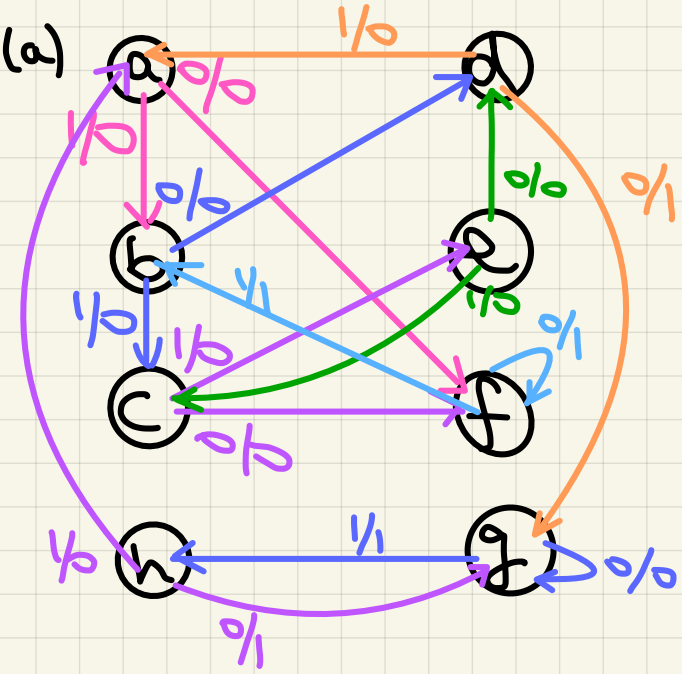
5.18* Design a sequential circuit with two JK flip-flops A and B and two inputs E and F. If $E = 0$, the circuit remains in the same state regardless of the value of F. When $E = 1$ and $F = 1$, the circuit goes through the state transitions from 00 to 01, to 10, to 11, back to 00, and repeats. When $E = 1$ and $F = 0$, the circuit goes through the state transitions from 00 to 11, to 10, to 01, back to 00, and repeats.

5.12 For the following state table

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

(a) Draw the corresponding state diagram.
(b)* Tabulate the reduced state table.

1.(a)



1.(b)

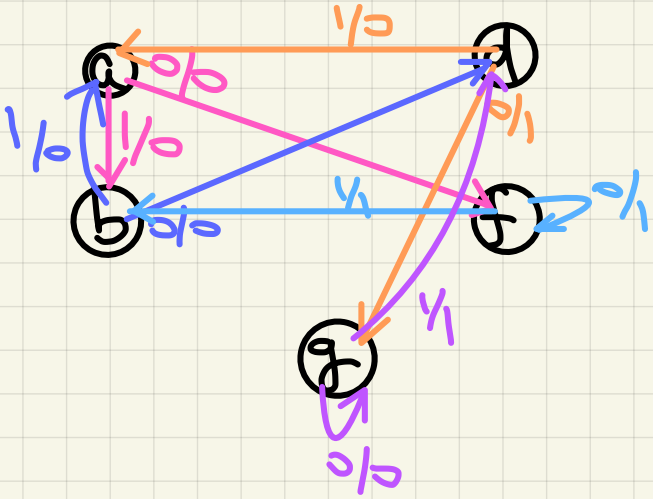
Present State	Next State $x=0$	Next State $x=1$	Output $x=0$	Output $x=1$
a	f	b	0	0
b	d	c → a	0	0
c	f	e → b	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h → d	0	1
h	g	a	1	0

$c \Rightarrow a$

$e \Rightarrow b$

$h \Rightarrow d$

present	next $x=0$	next $x=1$	output $x=0$	output $x=1$
a	f	b	0	0
b	d	a	0	0
d	g	a	1	0
f	f	b	1	1
g	g	d	0	1



5.13 Starting from state a, and the input sequence 01010010111, determine the output sequence for

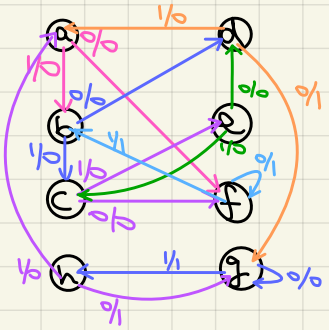
(a) The state table of the previous problem.

(b) The reduced state table from the previous problem. Show that the same output sequence is obtained for both.

2.(a) State: a f b d a f f b d a b

Input: 0 1 0 1 0 0 1 0 1 1 1

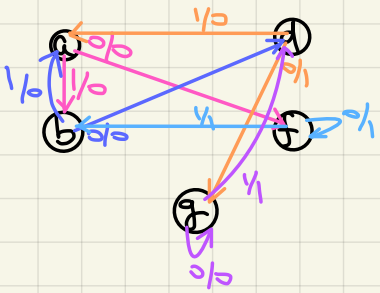
Output: 0 1 0 0 0 1 1 0 0 0 0



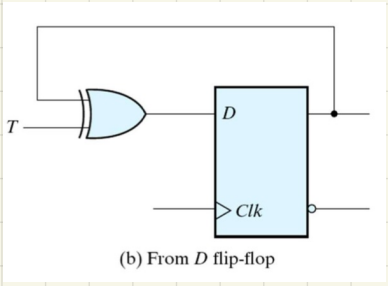
(b) State: a f b d a f f b d a b

Input: 0 1 0 1 0 0 1 0 1 1 1

Output: 0 1 0 0 0 1 1 0 0 0 0



5.15 List a state table for the T flip-flop using Q as the present and next state and T as inputs. Design the sequential circuit specified by the state table using D flip-flop and show that it is equivalent to Fig. 5.13(b).



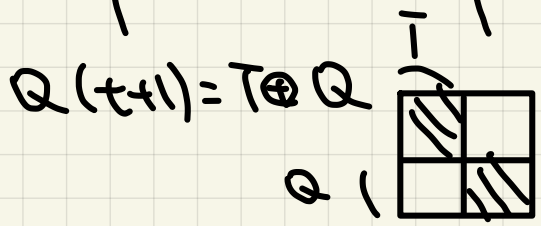
(b) From D flip-flop

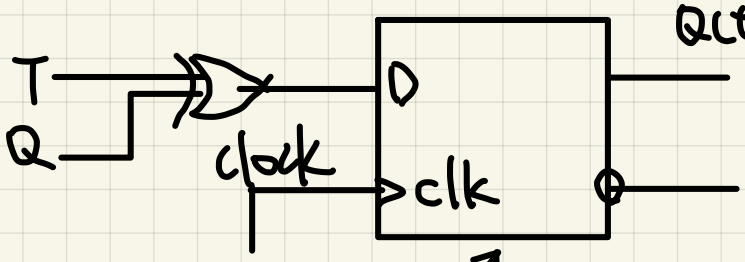
present state | inputs | next state

Q	T	Q(t+1)
0	0	0
0	1	1
1	0	1
1	1	0

no change — complement

$Q(t+1) = T \oplus Q$



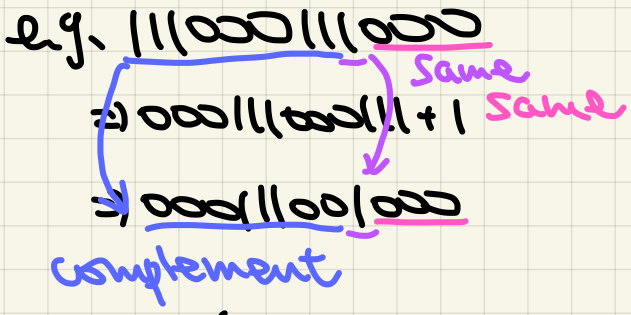


State table of ↗

present Q	input T	output Q(t+1)
0	0	0
0	1	1
1	0	1
1	1	0

equivalent

5.17 Design a one-input, one-output serial 2's complementer. The circuit accepts a string of bits from the input and generates the 2's complement at the output. The circuit can be reset asynchronously to start and end the operation.

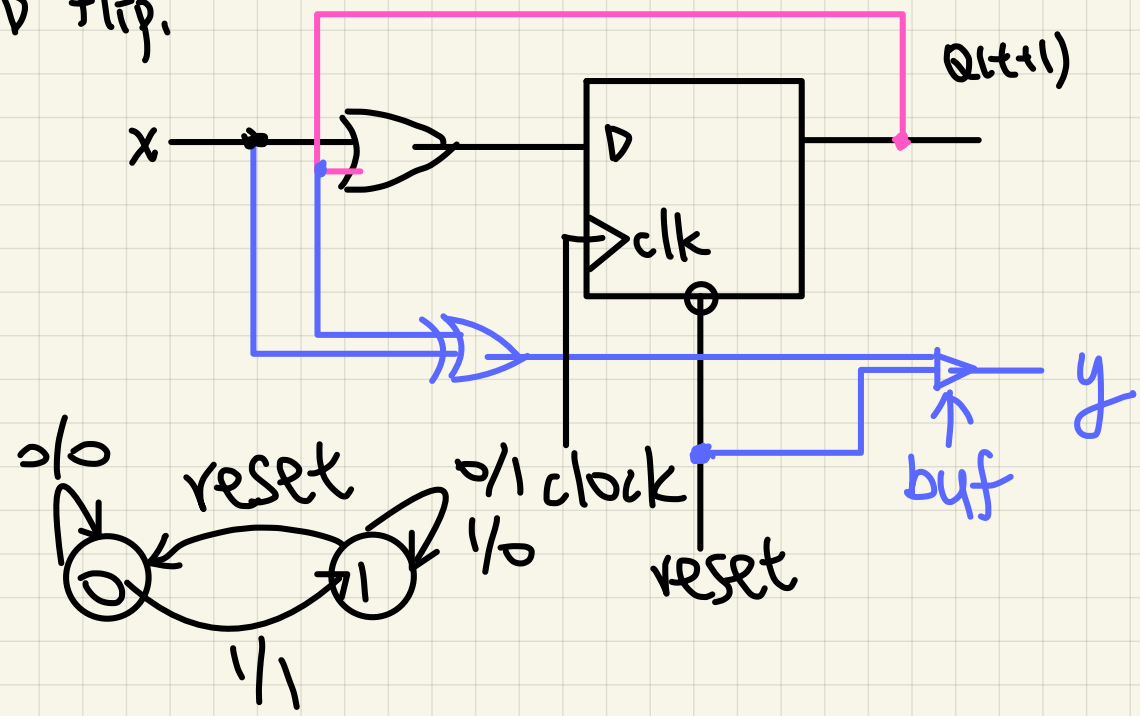


present inputs Q	x	next Q(t+1)	output y
0	0	0	0
0	1	1	1
1	0	1	1
1	1	1	0

$Q(t+1) = Q + X$

$y = Q \oplus X$

D flip.



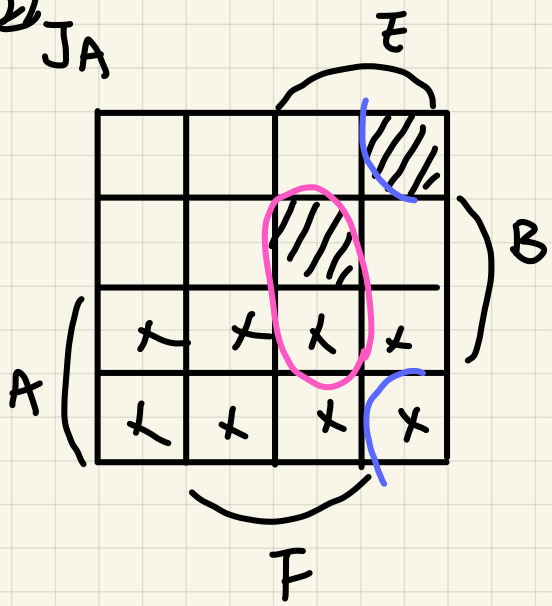
5.18* Design a sequential circuit with two *JK* flip-flops *A* and *B* and two inputs *E* and *F*. If $E = 0$, the circuit remains in the same state regardless of the value of *F*. When $E = 1$ and $F = 1$, the circuit goes through the state transitions from 00 to 01, to 10, to 11, back to 00, and repeats. When $E = 1$ and $F = 0$, the circuit goes through the state transitions from 00 to 11, to 10, to 01, back to 00, and repeats.

① present Input next

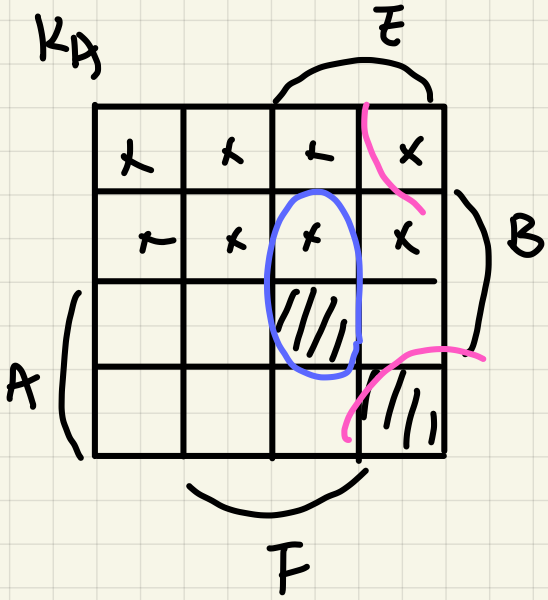
A	B	E	F	A	B	J_A	K_A	J_B	K_B
0	0	0	0	0	0	0	X	0	X
0	0	0	1	0	0	0	X	0	X
0	0	1	0	0	0	0	X	0	X
0	0	1	1	0	1	0	X	1	X
0	1	0	0	0	1	0	X	X	0
0	1	0	1	0	1	0	X	X	0
0	1	1	0	1	0	1	X	X	1
0	1	1	1	0	0	0	X	X	1
1	0	0	0	1	0	X	0	0	X
1	0	0	1	1	0	X	0	0	X
1	0	1	0	1	1	X	0	1	X
1	0	1	1	1	1	X	0	1	X
1	1	0	0	1	1	X	0	X	0
1	1	0	1	1	1	X	0	X	0
1	1	1	0	1	0	X	1	X	1
1	1	1	1	1	0	X	0	X	1

A	A(t+1)	J_A	K_A
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

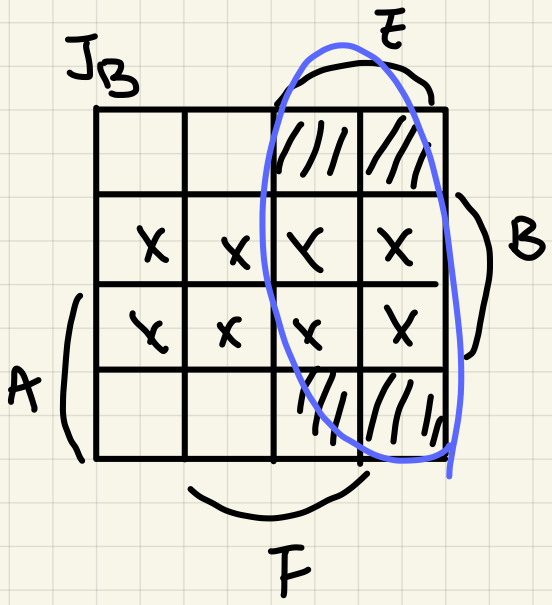
② J_A



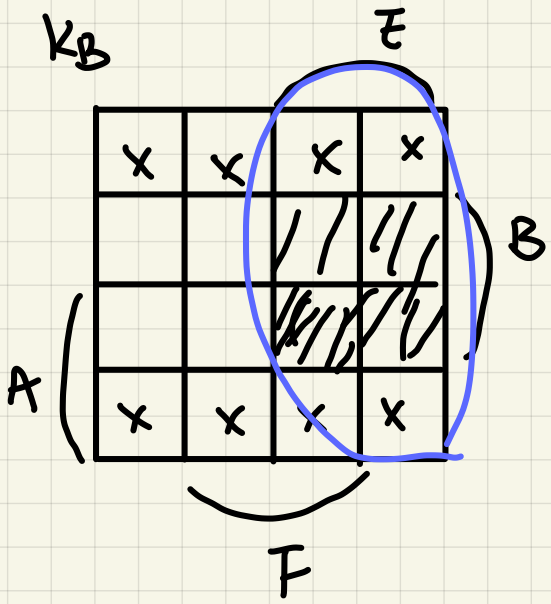
K_A



$J_A = B'EF' + BEF$ $K_A = BEF + B'EF'$



$J_B = E$



$K_B = E$

③ $J_A = BEF + B'EF'$

$K_A =$ "

$J_B = E$

$K_B = E$