5.3 For T – Flip-Flop,

$Q(t+1) \quad = TQ' + T'Q = T \oplus Q$

$Q'(t+1) \quad = [T \oplus Q]'$

$= T'Q' + TQ$

5.5 State table is also called as transition table.

The truth table describes a combinational circuit.

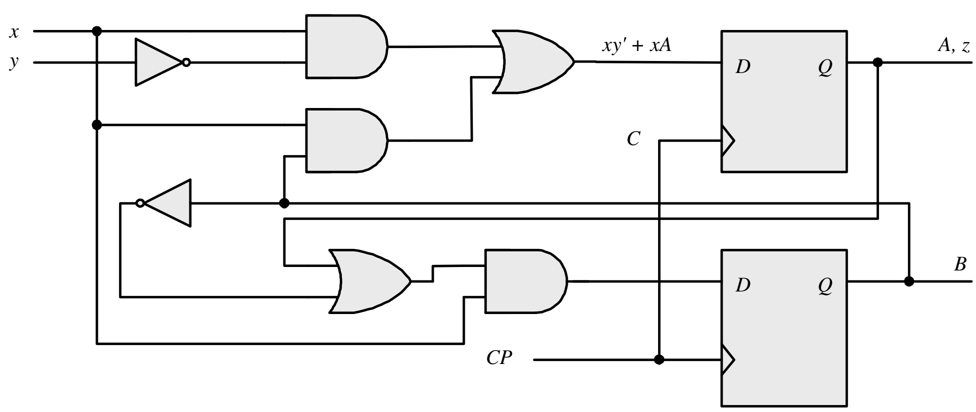
The state table describes a sequential circuit.

The characteristic table describes the operation of a flip-flop.

The excitation table gives the values of flip-flop inputs for a given state transition.

The four equations correspond to the algebraic expression of the four tables.

5.6 **(a)**



(b)

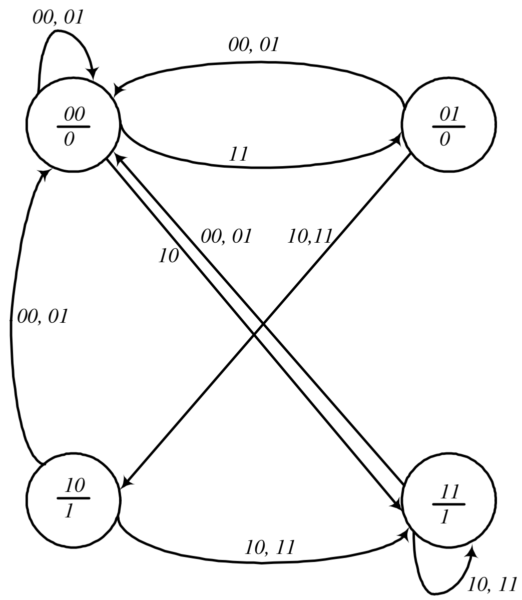
$A(t+1) = xy' + xB$

$B(t+1) = xA + xB'$

$z = A$

Present state		Inputs		Next state		Output
A	B	x	y	A	B	z
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	1	0	1	1	0
0	0	1	1	0	1	0
0	1	0	0	0	0	0
0	1	0	1	0	0	0
0	1	1	0	1	0	0
0	1	1	1	1	0	0
1	0	0	0	0	0	1
1	0	0	1	0	0	1
1	0	1	0	1	1	1
1	0	1	1	1	1	1
1	1	0	0	0	0	1
1	1	0	1	0	0	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

(c)



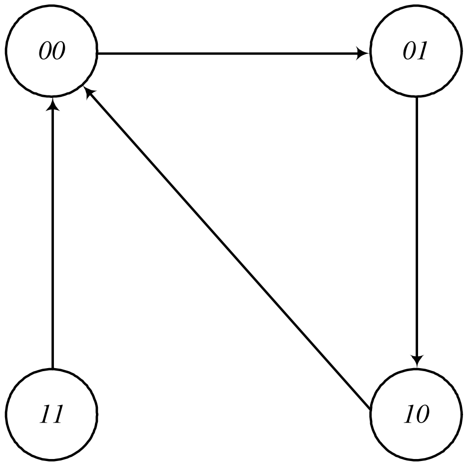
5.8 A counter with a repeated sequence of 00, 01, 10.

Present	*state*	*Next*	*state*	*FF Inputs*	
A	*B*	*A*	*B*	T_A	T_B
0	*0*	*0*	*0*	*0*	*1*
0	*1*	*1*	*0*	*1*	*1*
1	*0*	*0*	*0*	*1*	*0*
1	*1*	*0*	*0*	*1*	*1*

$$T_A = A + B$$
$$T_B = A' + B$$

Repeated sequence:

$\rightarrow 00 \longrightarrow 01 \longrightarrow 10 \rightarrow$



5.9 (a)

$A(t)$	$B(t)$ x	$A(t+1)$	$B(t+1)$	$A(t+1)$:
0	0	0	0	1
0	0	1	1	0
0	1	0	0	0
0	1	1	1	0
1	0	0	1	1
1	0	1	1	0
1	1	0	0	1
1	1	1	0	1

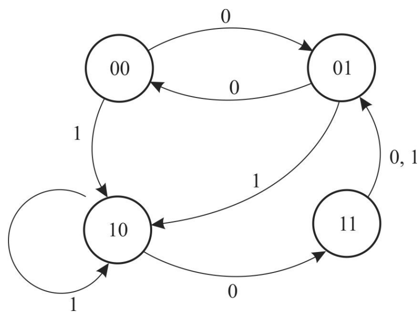
$A \backslash Bx$	00	01	11	10
0	0	1	1	0
1	1	1	0	0

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

$A \backslash Bx$	00	01	11	10
0	1	0	0	0
1	1	0	1	1

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

(b)



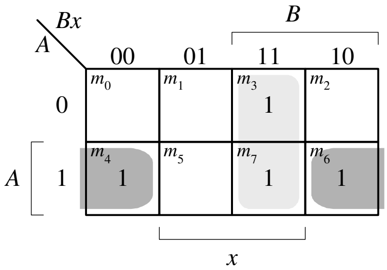
5.14

State	Assignment3
a	00001
b	00010
c	00100
d	01000
e	10000

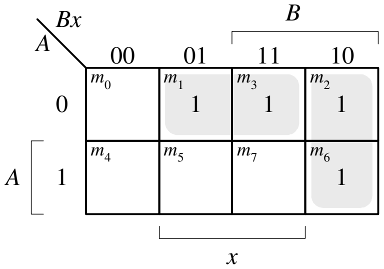
Present State		*Next State*		*Output*	
	A B C D E	$x = 0$	$x = 1$	$x = 0$	$x = 1$
a	0 0 0 0 1	00001	00010	0	0
b	0 0 0 1 0	00100	01000	0	0
c	0 0 1 0 0	00001	01000	0	0
d	0 1 0 0 0	10000	01000	0	1
e	1 0 0 0 0	00001	01000	0	1

5.16 **(a)**

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



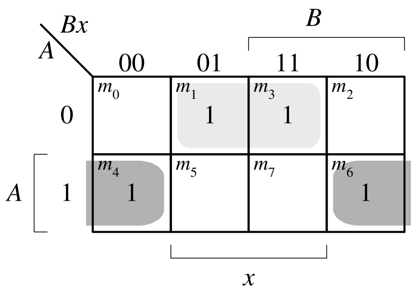
$D_A = Ax' + Bx$



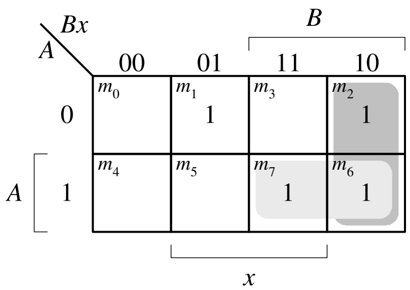
$D_B = A'x + Bx'$

(b)

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

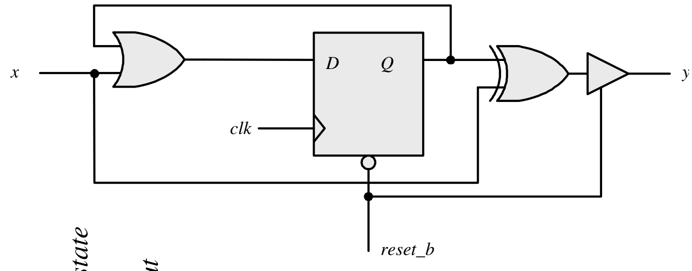


$D_A = A'x + Ax'$



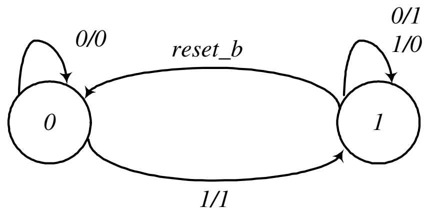
$D_B = AB + Bx'$

5.17 The output is 0 for all 0 inputs until the first 1 occurs, at which time the output is 1. Thereafter, the output is the complement of the input. The state diagram has two states. In state 0: output = input; in state 1: output = input'.



Present state	*Input*	*Next state*	*Output*
A	*x*	*A*	*y*
0	0	0	0
0	1	1	1
1	0	1	1
1	1	1	0

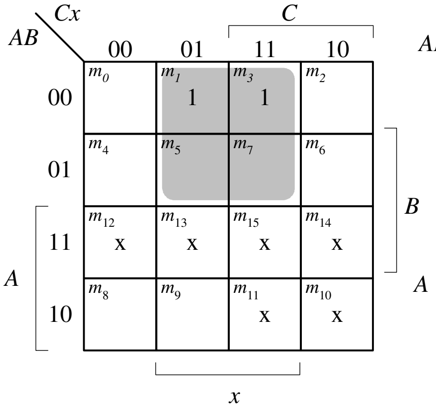
$D_A = A + x$
$y = Ax' + A'x$



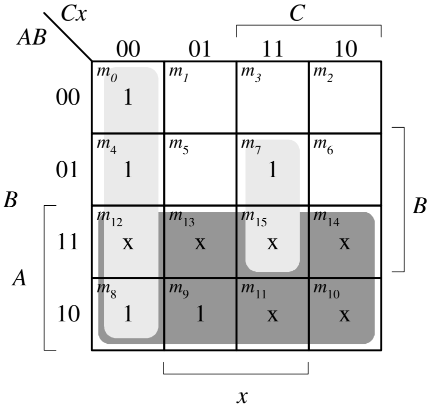
5.19 **(a)** Unused states (see Fig. P5.19): 101, 110, 111.

Present state ABC	*Input x*	*Next state ABC*	*Output y*
000	0	011	0
000	1	100	1
001	0	001	0
001	1	100	1
010	0	010	0
010	1	000	1
011	0	001	0
011	1	010	1
100	0	010	0
100	1	011	1

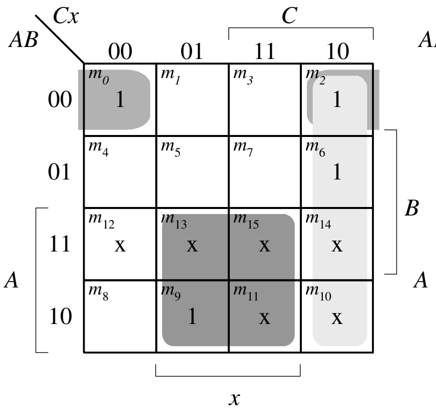
$d(A, B, C, x) = \Sigma\,(10, 11, 12, 13, 14, 15)$



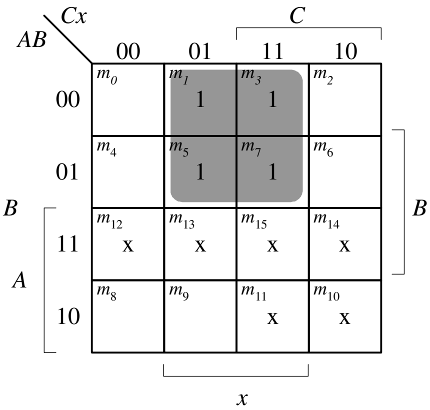
$D_A = A'B'x$



$D_B = A + C'x' + BCx$

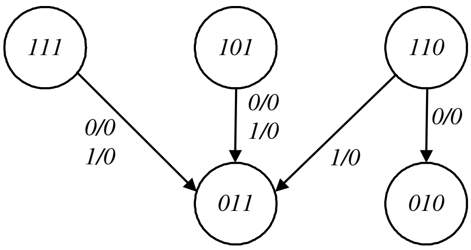


$D_C = Cx' + Ax + A'B'x'$



$y = A'x$

The machine is self-correcting, i.e., the unused states transition to known states.



(b) With JK flip=flops, the state table is the same as in (a).

Flip-flop inputs

J_A	K_A	J_B	K_B	J_C	K_C
0	x	1	x	1	x
1	x	0	x	0	x
0	x	0	x	x	0
1	x	0	x	x	1
0	x	x	0	0	x
0	x	x	1	0	x
0	x	x	1	x	0
0	x	x	0	x	1
x	1	1	x	0	x
x	1	1	x	1	x

$J_A = B'x$ $\quad K_A = 1$
$J_B = A + C'x'$ $\quad K_B = C'x + Cx'$
$J_C = Ax + A'B'x'$ $\quad K_C = x$
$y = A'x$

The machine is self-correcting because $K_A = 1$.