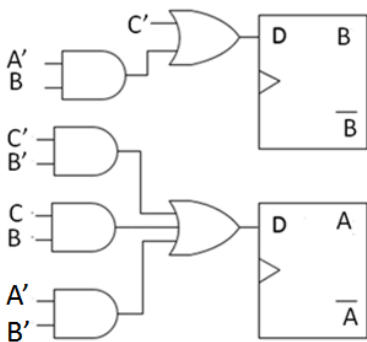
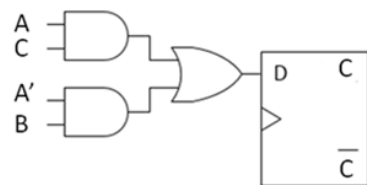
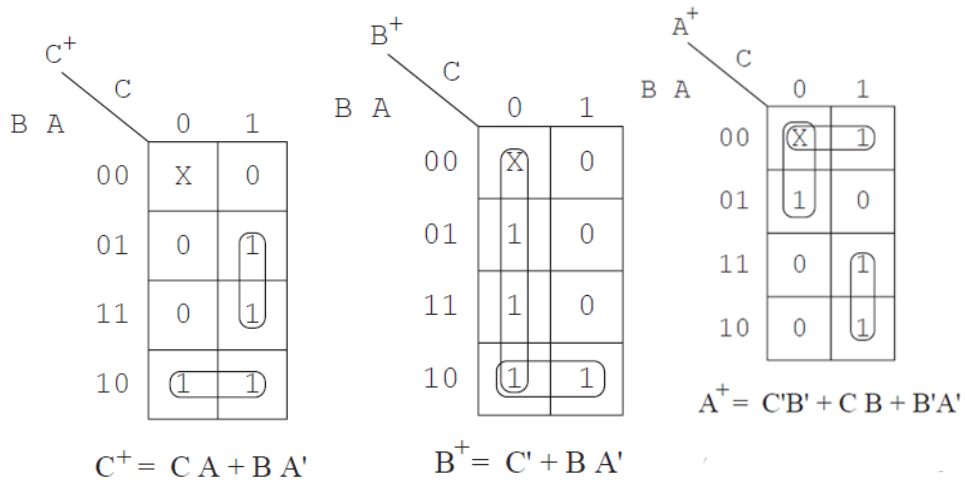


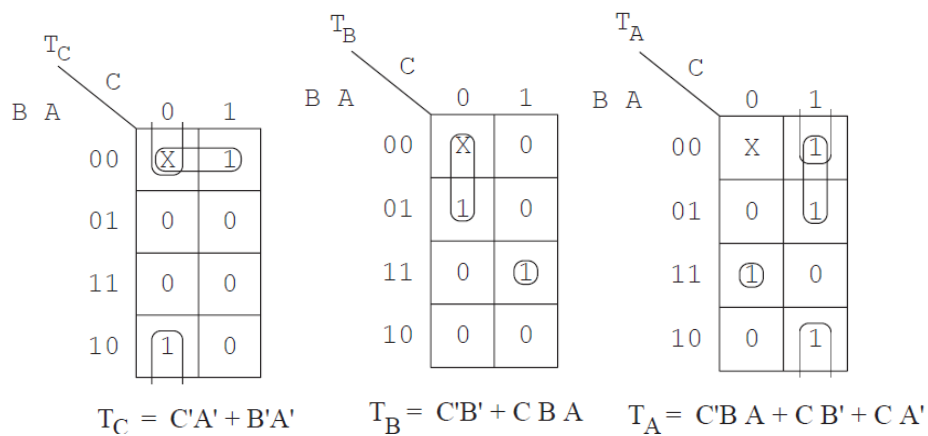
## 12.7

(a)



For D flip-flop: 000 goes to 011 because  $D_C D_B D_A = 011$

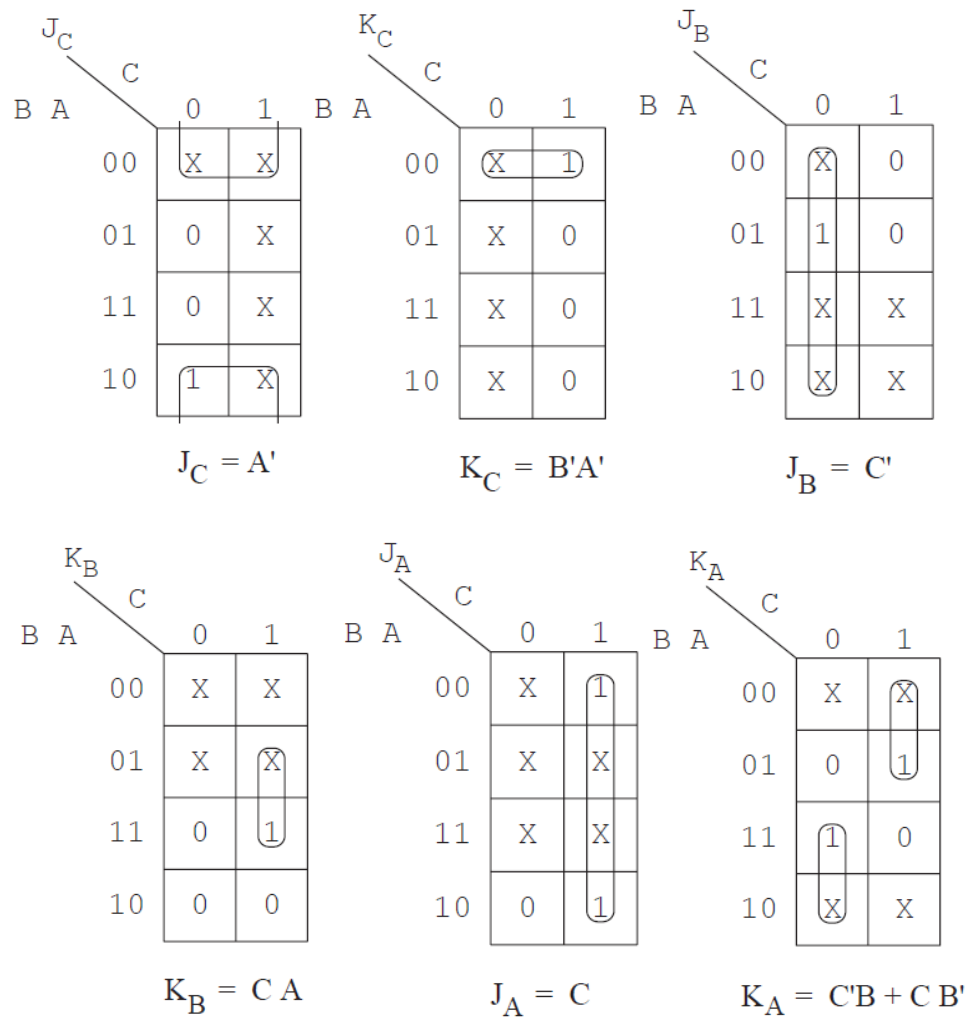
(b)



For T flip-flop: 000 goes to 110 because  $T_A T_B T_C = 110$

## 12.8

(a)



In state 000,

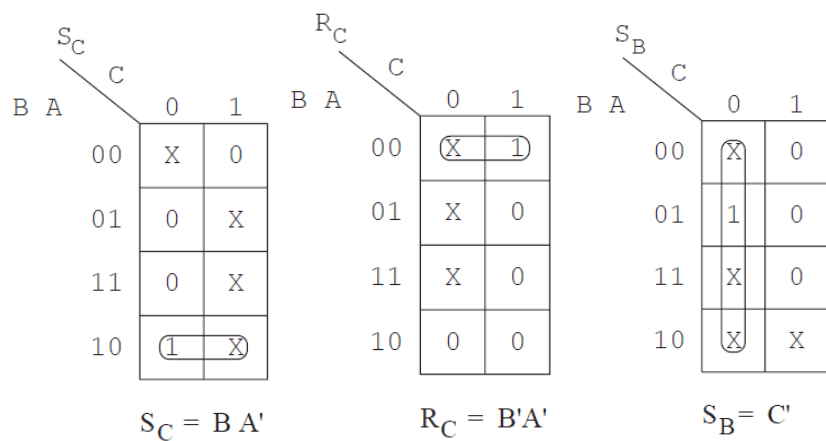
$$J_C = A' = 1, K_C = B'A' = 1, C^+ = C' = 1$$

$$J_B = C' = 1, K_B = CA = 0, B^+ = 1$$

$$J_A = C = 0, K_A = CB' + C'B = 0, A^+ = A = 0$$

So the next state is  $C^+B^+A^+ = 110$

(b)



$R_B$	$C$		
$B$	$A$	0	1
00		X	X
01		0	X
11		0	1
10		0	0
$R_B = CA$			

$S_A$	$C$		
$B$	$A$	0	1
00		X	1
01		X	0
11		0	X
10		0	1
$S_A = CA'$			

$R_A$	$C$		
$B$	$A$	0	1
00		X	0
01		0	1
11		1	0
10		X	0
$R_A = C'B + CBA$			

In state 000,

$$S_C = BA' = 0, R_C = B'A' = 1, C^+ = 0$$

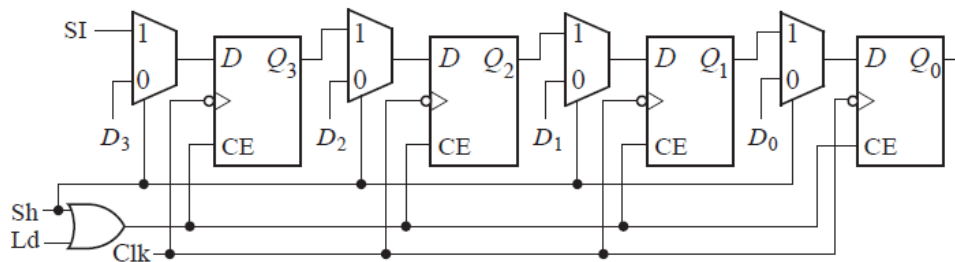
$$S_B = C' = 1, R_B = CA = 0, B^+ = 1$$

$$S_A = CA' = 0, R_A = C'B + CBA = 0, A^+ = A = 0$$

So the next state is  $C^+B^+A^+ = 010$

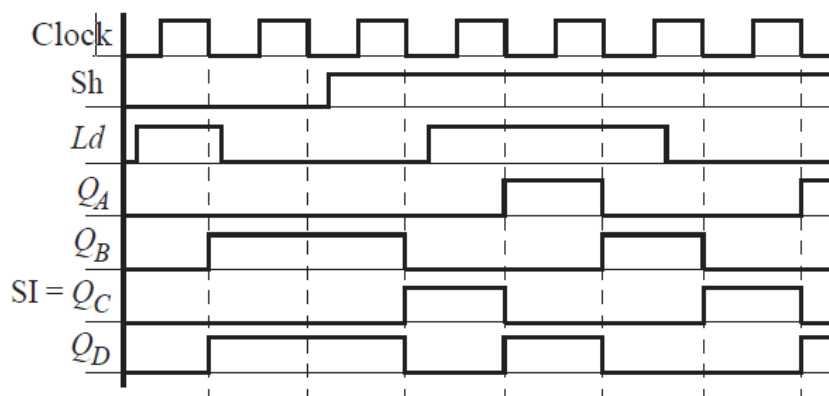
### 12.11

The flip-flops change state only when  $Ld$  or  $Sh = 1$ . So  $CE = Sh + Ld$ . Now only a 2-to-1 MUX is required to select the input to the D flip-flop.



### 12.13

Notice that  $Sh$  overrides  $Ld$  when  $Sh = Ld = 1$



## 12.35

(a)

Q	U V = 00	U V = 01	U V = 11	U V = 10
0	0	x	1	0
1	1	x	0	0

$$Q^+ = U'Q + VQ'$$

(b)

Q Q <sup>+</sup>	U V
00	x 0
01	1 1
10	1 x
11	0 0

(c)  $Q^+ = A + BQ$ .

Q	Q <sup>+</sup>			
	AB = 00	AB = 01	AB = 11	AB = 10
0	0	0	1	1
1	0	1	1	1

Q	U V			
	AB = 00	AB = 01	AB = 11	AB = 10
0	x0	x0	11	11
1	1x	00	00	00

$$U = A'B' + Q'$$

$$V = AQ'$$

## 12.36

(a)

Q	Q <sup>+</sup>			
	MF = 00	MF = 01	MF = 11	MF = 10
0	1	1	0	x
1	1	0	0	x

$$Q^+ = F' + Q'M'$$

(b)

Q Q <sup>+</sup>	MF
00	11
01	0x
10	x1
11	00

(c)  $Q^+ = CQ + DQ'$

Q	Q <sup>+</sup>			
	C D = 00	C D = 01	C D = 11	C D = 10
0	0	1	1	0
1	0	0	1	1

Q	MF			
	C D = 00	C D = 01	C D = 11	C D = 10
0	11	0x	0x	11
1	x1	x1	00	00

$$M = D'Q' \quad F = C' + Q'$$

## 12.38

Truth table:

ABCD	A <sup>+</sup> B <sup>+</sup> C <sup>+</sup> D <sup>+</sup>	J <sub>A</sub> K <sub>A</sub>	J <sub>B</sub> K <sub>B</sub>	J <sub>C</sub> K <sub>C</sub>	J <sub>D</sub> K <sub>D</sub>
0000	0011	0X0X	1X1X		
0001	0100	0X1X	0XX1		
0010	0101	0X1X	XX11		
0011	0110	0X1X	XX0X		
0100	0111	0XX0	1XX1		
0101	1000	1XX1	0XX1		
0110	1001	1XX1	XX11		
0111	1010	1XX1	XX0X		
1000	1011	X00X	1XX1		
1001	1100	X01X	0XX1		
1010	1101	X01X	XX11		
1011	1110	X01X	XX0X		
1100	1111	X0XX	01XX		
1101	XXXX	XXXX	XXXX		
1110	XXXX	XXXX	XXXX		
1111	XXXX	XXXX	XXXX		

Using Karnaugh maps:

$$J_A = A + BD + BC, K_A = 0; J_B = C + D, K_B = C + D;$$

$$J_C = D', K_C = D'; J_D = 1, K_D = 1$$