11.16 (a) $Q^+ = AB + QB$

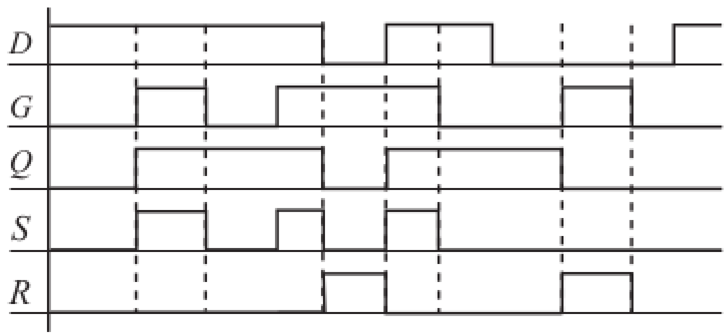
11.16 (b)

Present State Q	Next State Q^+ AB 00	01	11	10
0	**0**	**0**	1	**0**
1	0	**1**	**1**	0

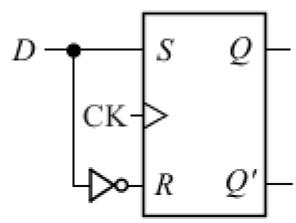
The stable states are in bold.

11.16 (c) AB = 01 is a hold input combination, AB = 00 and 10 are reset input combinations, and AB = 11 is a set input combination. This is reset dominant latch where S = A and R = B'. $P = Q' + B'$. In each stable state P = Q' even for the input combination AB = 10 (SR = 11) so P is usable as Q'. Allowing the input combination AB = 10 (SR = 11) would result in unreliable operation if both A and B could change at the same time, i.e., change to AB = 01 (SR = 00), because the latch could end up in either state 0 or 1 depending upon the delays in the circuit.

11.18

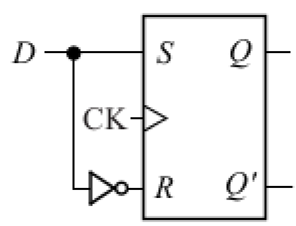


11.27 (a)



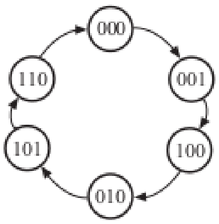
When $D = 0$, then $S = 0$, and $R = 1$, so $Q^+ = 0$.
When $D = 1$, then $S = 1$, and $R = 0$, so $Q^+ = 1$.

11.27 (a)

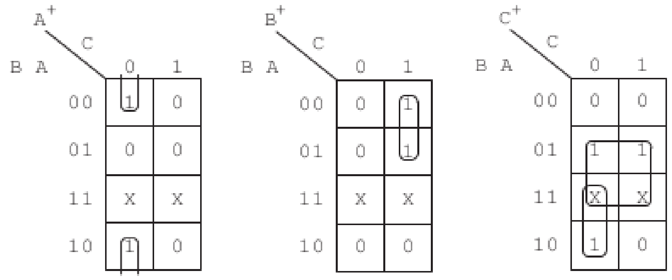


When $D = 0$, then $S = 0$, and $R = 1$, so $Q^+ = 0$.
When $D = 1$, then $S = 1$, and $R = 0$, so $Q^+ = 1$.

12.6 In the following state graph, the first flip-flop (C) takes on the required sequence 0, 0, 1, 0, 1, 1, (repeat).



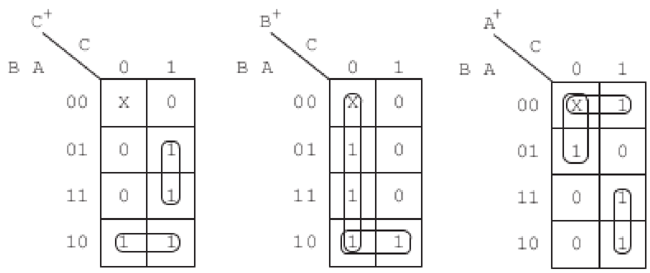
$C\ B\ A$	$C^+B^+A^+$
0 0 0	0 0 1
0 0 1	1 0 0
0 1 0	1 0 1
0 1 1	X X X
1 0 0	0 1 0
1 0 1	1 1 0
1 1 0	0 0 0
1 1 1	X X X



$A^+ = C'A'$ $B^+ = C\,B'$ $C^+ = A + C'B$

12.7 (a)

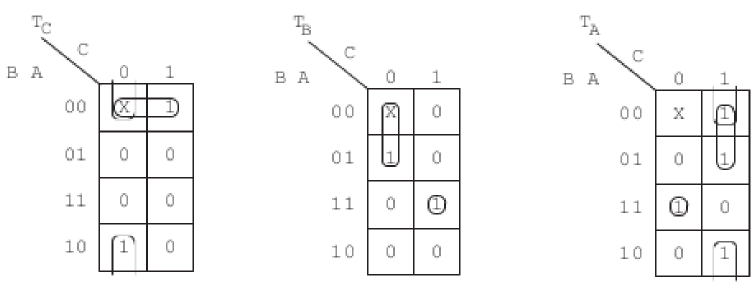
$C\,B\,A$	$C^+B^+A^+$
0 0 0	X X X
0 0 1	0 1 1
0 1 0	1 1 0
0 1 1	0 1 0
1 0 0	0 0 1
1 0 1	1 0 0
1 1 0	1 1 1
1 1 1	1 0 1



$C^+ = C\,A + B\,A'$ $B^+ = C' + B\,A'$ $A^+ = C'B' + C\,B + B'A'$

For D flip-flop: 000 goes to 011 because $D_C D_B D_A = 011$ $A^+ = C'B' + C\,B + C\,A'$

12.7 (b)

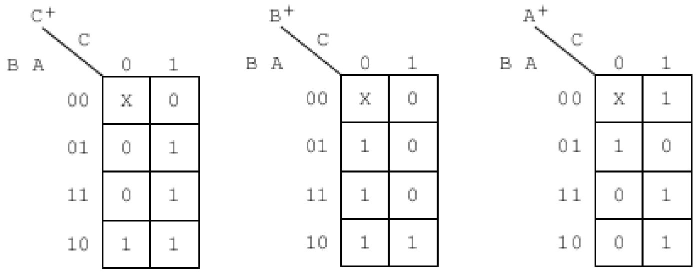


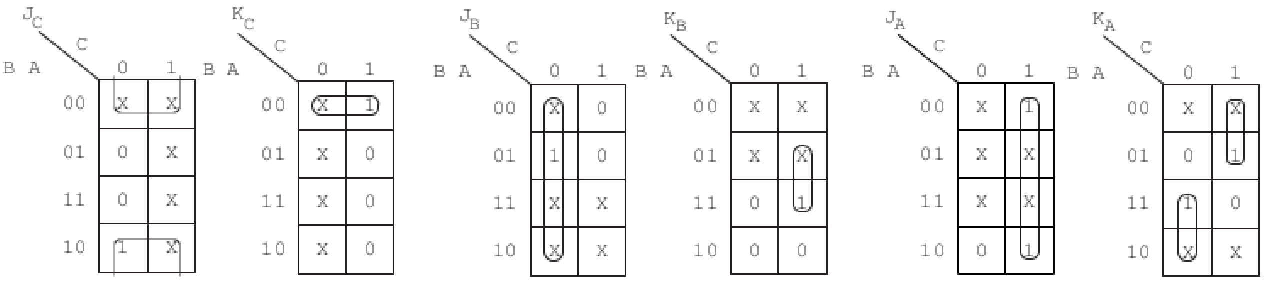
$T_C = C'A' + B'A'$ $T_B = C'B' + C\,B\,A$ $T_A = C'B\,A + C\,B' + C\,A'$

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

12.8 (a)

CBA	$C^+B^+A^+$
0 0 0	X X X
0 0 1	0 1 1
0 1 0	1 1 0
0 1 1	0 1 0
1 0 0	0 0 1
1 0 1	1 0 0
1 1 0	1 1 1
1 1 1	1 0 1

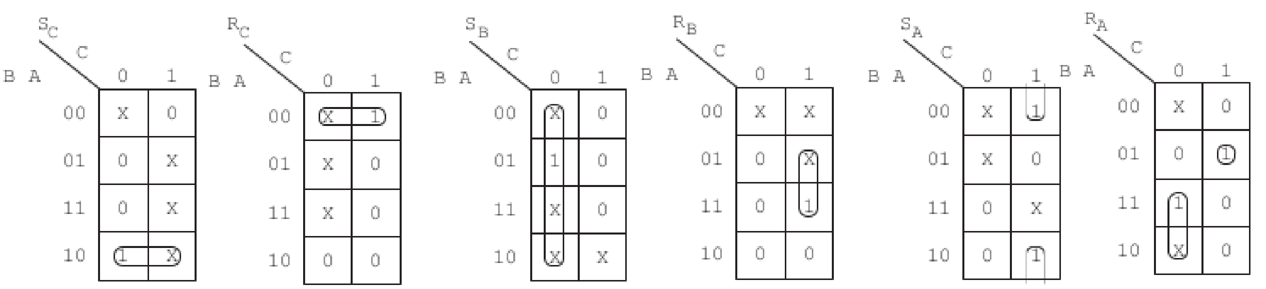




$J_C = A'$ $K_C = B'A'$ $J_B = C'$ $K_B = CA$ $J_A = C$ $K_A = C'B + CB'$

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 $C^+B^+A^+ = 110$

12.8 (b)



$S_C = BA'$ $R_C = B'A'$ $S_B = C'$ $R_B = CA$ $S_A = CA'$ $R_A = C'B + CB'A$

$S_C = C'A'$

In state 000,
$S_C = BA' = 0, R_C = B'A' = 1, C^+ = 0$
$S_B = C' = 1, R_B = CA = 0, B^+ = 1$
$S_A = CA' = 0, R_A = C'B + C'BA = 0, A^+ = A = 0$
So the next state is $C^+B^+A^+ = 010$

12.19

ABC	$A^+B^+C^+$
0 0 0	X X X
0 0 1	1 0 0
0 1 0	0 1 1
0 1 1	0 0 1
1 0 0	1 0 1
1 0 1	1 1 1
1 1 0	0 1 0
1 1 1	1 1 0

12.19 (a) $D_A = B' + AC$; $D_B = AC + BC'$; $D_C = A'B + AB'$

12.19 (b) $J_A = B'$, $K_A = BC'$; $J_B = AC$, $K_B = A'C$; $J_C = A' + B'$, $K_C = A'B' + AB$

12.19 (c) $T_A = A'B' + ABC'$; $T_B = A'BC + AB'C$; $T_C = A'B' + A'C' + B'C' + ABC$

12.19 (d) $S_A = B'$, $R_A = BC'$; $S_B = AC$, $R_B = A'C$; $S_C = A'B + AB'$, $R_C = A'B' + AB$

12.19 (e) State 000 goes to 100, because $D_AD_BD_C = 100$.