Homework 8 Solutions

Revision **0**

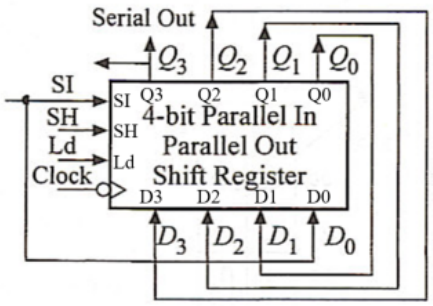
Problem 1

		Register															
	0					0	0	0	0	0	0	1	0	1	0	1	1
Shift	1						0	0	0	0	0	1	0	1	0	1	1
	2							0	0	0	0	0	1	0	1	0	1	1
	3								0	0	0	0	0	1	0	1	0	1	1
	4							0	0	0	0	0	0	1	0	1	0	1	1
	5						0	0	0	0	0	0	1	0	1	0	1	1	
	6				0	0	0	0	0	0	1	0	1	0	1	1			
	7			0	0	0	0	0	0	1	0	1	0	1	1				
	8		0	0	0	0	0	0	1	0	1	0	1	1					

Problem 2

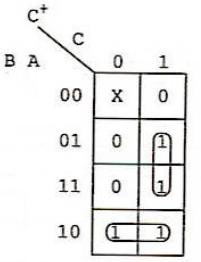
12.2

Serial input connected to D_0 for left shift.
$Sh = 0, L = 1$ causes a left shift.
$Sh = 1, L = 1$ or 0 causes a right shift

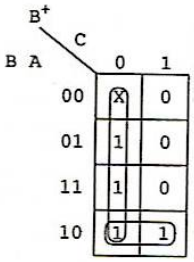


12.7a

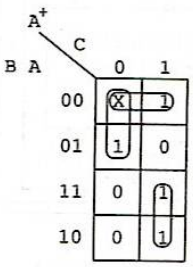
CBA	$C^+B^+A^+$
000	XXX
001	011
010	110
011	010
100	001
101	100
110	111
111	101



$C^+ = CA + BA'$



$B^+ = C' + BA'$

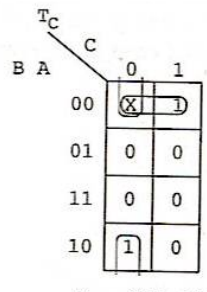


$A^+ = C'B' + CB + B'A'$

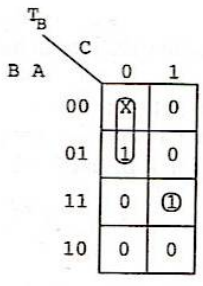
$A^+ = C'B' + CB + CA'$

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

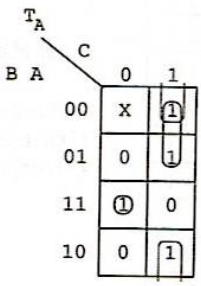
12.7b



$T_C = C'A' + B'A'$



$T_B = C'B' + CBA$

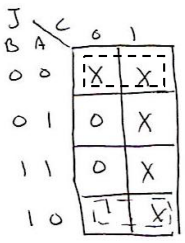


$T_A = C'BA + CB' + CA'$

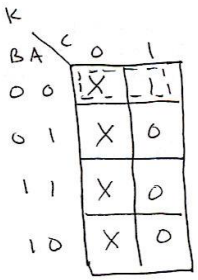
For T flip-flop: 000 goes to 110 because $T_A T_B T_C = 110$

12.7 using JK for Q2, T for Q1, and D for Q0

C	B	A	C^+	J	K
0	0	0	X	X	X
0	0	1	0	0	X
0	1	0	1	1	X
0	1	1	0	0	X
1	0	0	0	X	1
1	0	1	1	X	0
1	1	0	1	X	0
1	1	1	1	X	0



J=/A



$K = \bar{A}\bar{B}$

$T_B = \bar{C}\bar{B} + CBA$ (from (b))

$A^+ = \bar{C}\bar{B} + CB + \bar{B}\bar{A}$ (from (a))

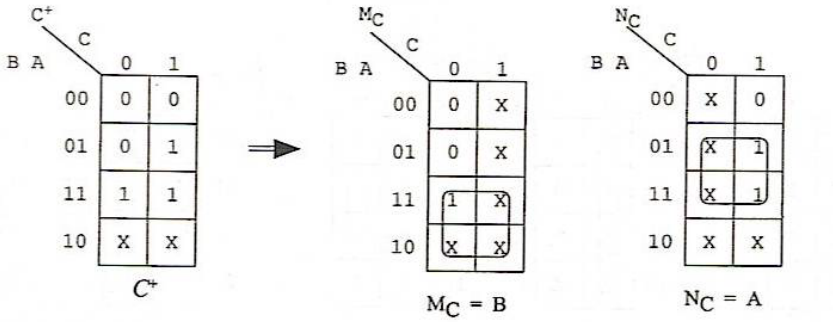
12.9

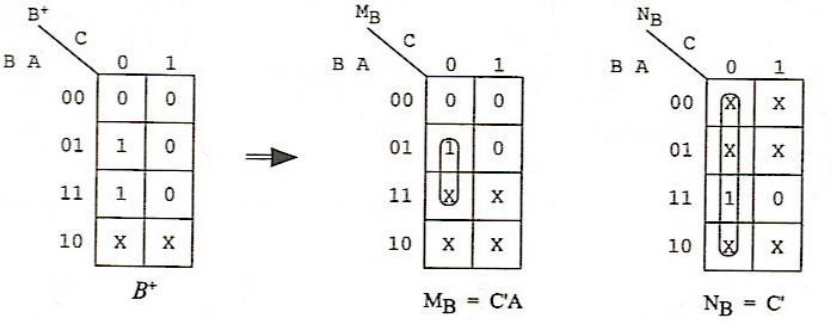
12.9 (a)

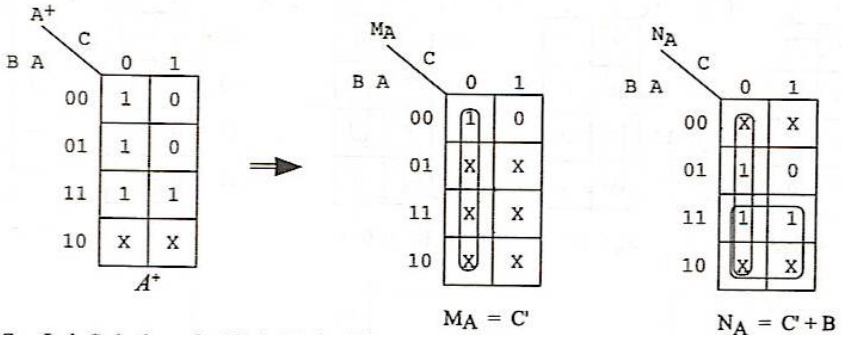
$Q\,Q^+$	$M\,N$	
0 0	0 0	0X
	0 1	
0 1	1 0	1X
	1 1	
1 0	1 0	X0
	0 0	
1 1	0 1	X1
	1 1	

12.9 (b)

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

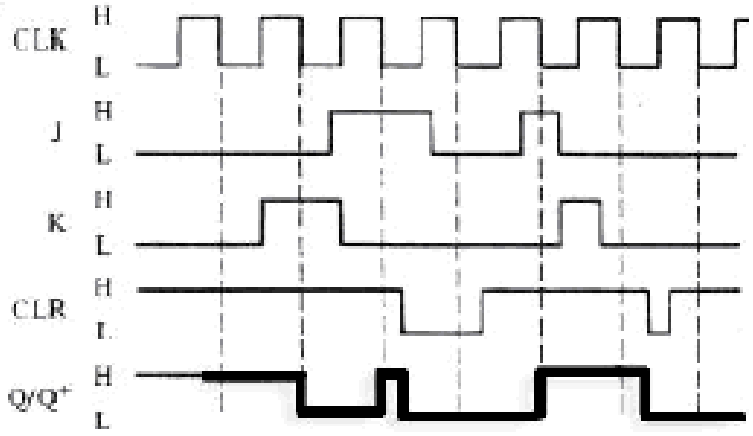






Problem 3

5.20

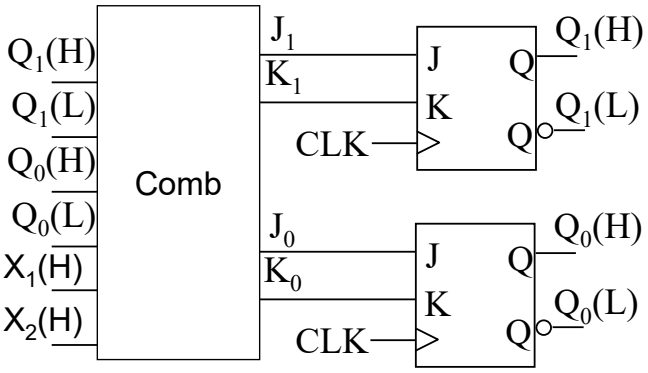


5.28

5.28 a) Truth Table:

X1	X2	Q1	Q0	Q1+	Q0+	J1	K1	J0	K0
0	0	0	0	0	1	0	X	1	X
0	0	0	1	1	0	1	X	X	1
0	0	1	0	1	1	X	0	1	X
0	0	1	1	0	0	X	1	X	1
0	1	0	0	1	1	1	X	1	X
0	1	0	1	0	0	0	X	X	1
0	1	1	0	0	1	X	1	1	X
0	1	1	1	1	0	X	0	X	1
1	0	0	0	1	0	1	X	0	X
1	0	0	1	0	0	0	X	X	1
1	0	1	0	1	1	X	0	1	X
1	0	1	1	0	1	X	1	X	0
1	1	0	0	0	1	0	X	1	X
1	1	0	1	1	1	1	X	X	0
1	1	1	0	0	0	X	1	0	X
1	1	1	1	1	0	X	0	X	1

5.28 b) Functional Block Diagram



5.28 b) Logic Equations (from the Truth Table and K-maps [not shown]):

J1= /Q0 /X2 X1 + /Q0 X2 /X1 + Q0 /X2 /X1 + Q0 X2 X1 = Q0 ⊕ X1 ⊕ X2

K1 = J1

J0 = /Q1 X2 + Q1 /X2 + /X1 = Q1 ⊕ X2 + /X1

K0 = /Q1 /X2 + Q1 X2 + /X1 = Q1 ⊗ X2 + /X1 = /(Q1 ⊕ X2) + /X1