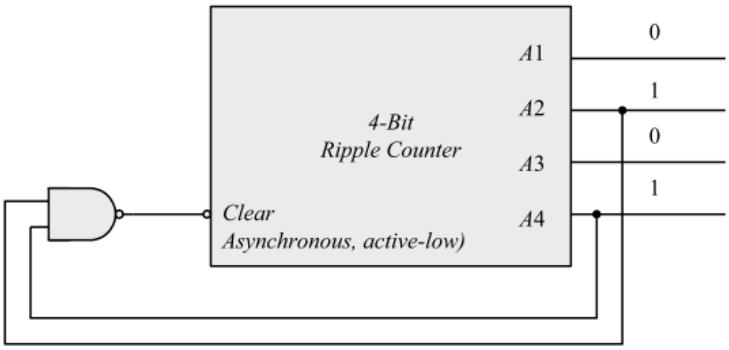
ITI1100C
Assignment #6
Solutions

6.11 **(a)** A count down counter.

(b) A count up counter.

6.13



6.19 **(b)** From the state table in Table 6.5: /a partir de la table 6.5

$D_{Q1} = Q'_1$
$D_{Q2} = \sum (1, 2, 5, 6)$
$D_{Q4} = \sum (3, 4, 5, 6)$
$D_{Q8} = \sum (7, 8)$
Don't care: d = $\sum$ (10, 11, 12, 13, 14, 15)

Simplifying with maps:
$D_{Q2} = Q_2Q'_1 + Q'_8Q'_2Q_1$
$D_{Q4} = Q_4Q'_1 + Q4Q'2 + Q'_4Q_2Q_1$
$D_{Q8} = Q_8Q'_1 + Q_4Q_2Q_1$

(a)

Present state	*Next state*	*Flip-flop inputs*			
$A_8\,A_4\,A_2\,A_1$	$A_8\,A_4\,A_2\,A_1$	$J_{A8}\,K_{A8}$	$J_{A4}\,K_{A4}$	$J_{A2}\,K_{A2}$	$J_{A1}\,K_{A1}$
0 0 0 0	0 0 0 1	0 x	0 x	0 x	1 x
0 0 0 1	0 0 1 0	0 x	0 x	1 x	x 1
0 0 1 0	0 0 1 1	0 x	0 x	x 0	1 x
0 0 1 1	0 1 0 0	0 x	1 x	x 1	x 1
0 1 0 0	0 1 0 1	0 x	x 0	0 x	1 x
0 1 0 1	0 1 1 0	0 x	x 0	1 x	x 1
0 1 1 0	0 1 1 1	0 x	x 0	x 0	1 x
0 1 1 1	1 0 0 0	1 x	x 1	x 1	x 1
1 0 0 0	1 0 0 1	x 0	0 x	0 x	1 x
1 0 0 1	0 0 0 0	x 1	0 x	0 x	x 1

$J_{A1} = 1$
$K_{A1} = 1$
$J_{A2} = A_1 A'_8$
$K_{A2} = A_1$
$J_{A4} = A_1 A_2$
$K_{A4} = A_1 A_2$
$J_{A8} = A_1 A_2 A_4$
$K_{A8} = A_1$

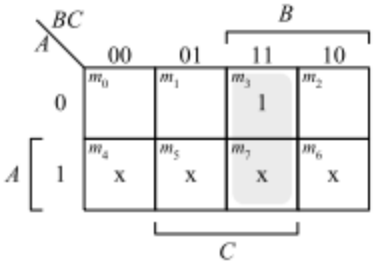
$d(A_8, A_4, A_2, A_1) = \Sigma\,(10, 11, 12, 13, 14, 15)$

	T – Flip Flop	**D – Flip Flop**	**J K – Flip Flop**
AND Gates#	5	7	4
OR Gates#	4	4	0
Total	9	11	4

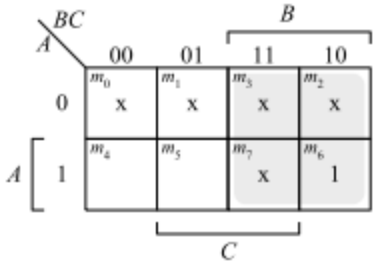
When compared between the above three designs, BCD counter that uses JK Flip Flop needs less number of combinational gates. so, it is most efficient.

6.27

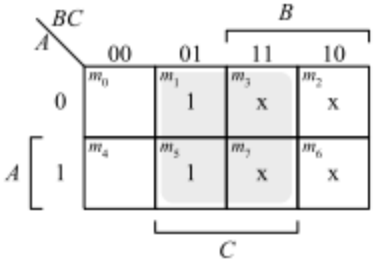
Present state ABC	Next state ABC	Flip-flop inputs J_A	K_A	J_B	K_B	J_C	K_C
000	001	0	x	0	x	1	x
001	010	0	x	1	x	x	1
010	011	0	x	x	0	1	x
011	100	1	x	x	1	x	1
100	101	x	0	0	x	1	x
101	110	x	0	1	x	x	1
110	000	x	1	x	1	0	x
111	xxx	x	x	x	x	x	x



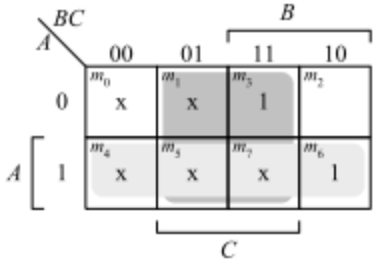
$J_A = BC$



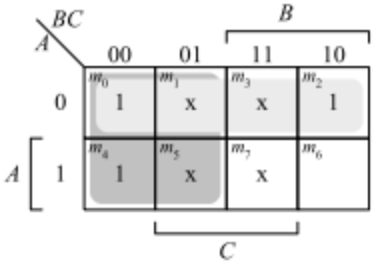
$K_A = B$



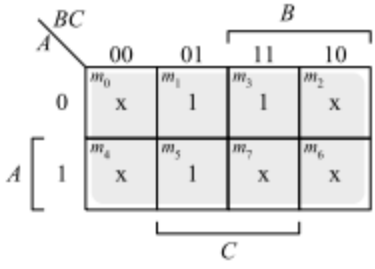
$J_B = C$



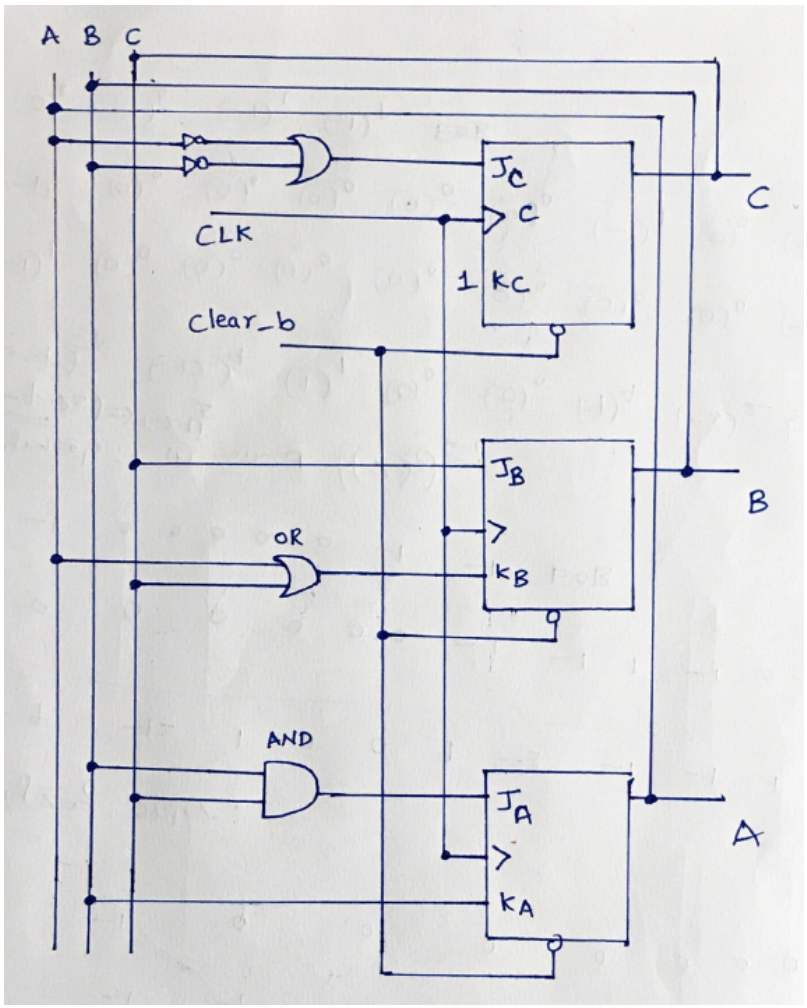
$K_B = A + C$



$J_C = A' + B'$



$K_C = 1$


A B C
CLK
Clear_b
OR
AND
J_C
C
1 K_C
J_B
K_B
J_A
K_A
C
B
A