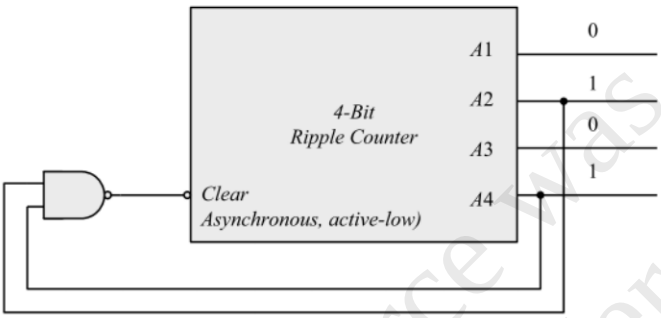
ITI1100A & IT1500
Assignment # 6
Solutions

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:

$D_{Q1} = Q'_1$
$D_{Q2} = \sum (1, 2, 5, 6)$
$D_{Q4} = \sum (3, 4, 5, 6)$
$D_{Q8} = \sum (7, 8)$
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)

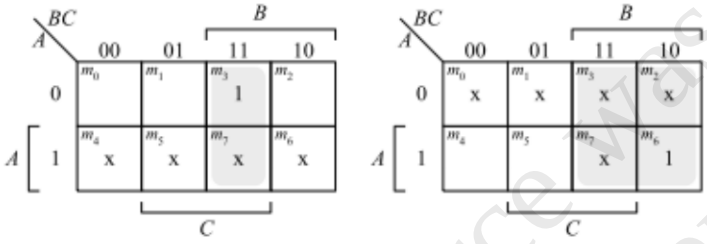
Present state	*Next state*	*Flip-flop inputs*							
$A_8\ A_4\ A_2\ A_1$	$A_8\ A_4\ A_2\ A_1$	J_{A8}	K_{A8}	J_{A4}	K_{A4}	J_{A2}	K_{A2}	J_{A1}	K_{A1}
0 0 0 0	0 0 0 1	0	x	0	x	0	x	1	x
0 0 0 1	0 0 1 0	0	x	0	x	1	x	x	1
0 0 1 0	0 0 1 1	0	x	0	x	x	0	1	x
0 0 1 1	0 1 0 0	0	x	1	x	x	1	x	1
0 1 0 0	0 1 0 1	0	x	x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

$J_{A1} = 1$
$K_{A1} = 1$
$J_{A2} = A_1A'_8$
$K_{A2} = A_1$
$J_{A4} = A_1A_2$
$K_{A4} = A_1A_2$
$J_{A8} = A_1A_2A_4$
$K_{A8} = A_1$

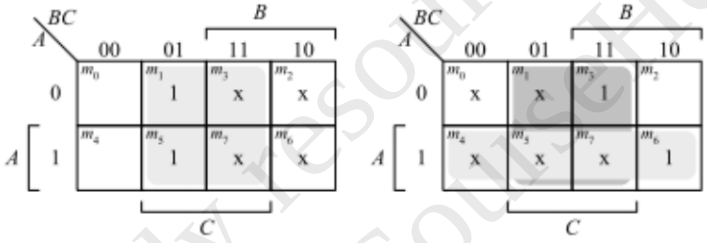
$d(A_8, A_4, A_2, A_1) = \Sigma\ (10, 11, 12, 13, 14, 15)$

6.27

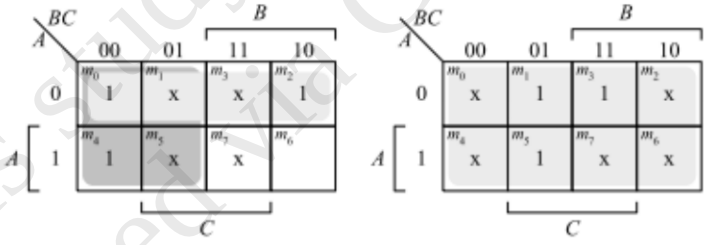
Present state *ABC*	*Next state* *ABC*	*Flip-flop inputs* J_A	K_A	J_B	K_B	J_C	K_C
000	001	0	x	0	x	1	x
001	010	0	x	1	x	x	1
010	011	0	x	x	0	1	x
011	100	1	x	x	1	x	1
100	100	x	0	0	0	1	x
101	110	x	0	1	x	x	1
110	000	x	1	x	1	0	x
111	xxx	x	x	x	x	x	x



$J_A = BC$ $K_A = B$



$J_B = C$ $K_B = A + C$



$J_C = A' + B'$ $K_C = 1$

Self-correcting