DATE

EXPT.NO.

PAGE NO.

Implement Synchronous Mod-7 Up/Down Counter. (Assignment-8)

This counter will be able to count both up and down direction with a mode select input to or control the count direction.

Range for Up counting - 0 to N-1 ⇒ 0 to 6

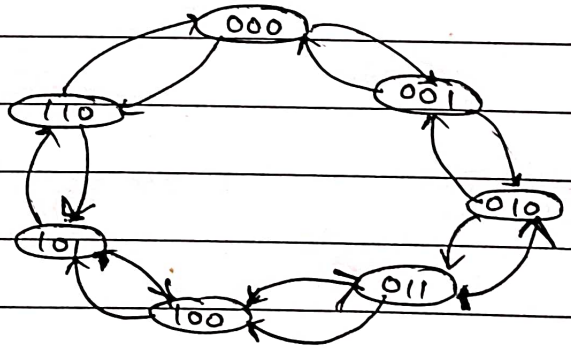
Range for down counting ⇒ 6 to 0

Number of states = 7

Number of Flip-flops = 3 (A, B, C)

$\{7 \leq 8 \Rightarrow 7 \leq 2^3\}$

Counting diagram



Now, we will draw or write State Table

mode M=0 ⇒ Up count

M=1 ⇒ down count

Omax®

Teacher's Signature .....

DATE

EXPT.NO.

PAGE NO.

STATE TABLE

i/Ps of T-flip-flops

up counting

M	Q_A	Q_B	Q_C	Q_{A+1}	Q_{B+1}	Q_{C+1}	T_A	T_B	T_C
0	0	0	0	0	0	1	0	0	1
0	0	0	1	0	1	0	0	1	1
0	0	1	0	0	1	1	0	0	1
0	0	1	1	1	0	0	1	1	1
0	1	0	0	1	0	1	0	0	1
0	1	0	1	1	1	0	0	1	1
0	1	1	0	0	0	0	1	1	0

Excitation Table for T ↗ using here↑

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

Down counting

M.	Q_A	Q_B	Q_C	Q_{A+1}	Q_{B+1}	Q_{C+1}	T_A	T_B	T_C
1.	1	1	0	1	0	1	0	1	1
1.	1	0	1	1	0	0	0	0	1
1.	1	0	0	0	1	1	1	1	1
1.	0	1	1	0	1	0	0	0	1
1..	0	1	0	0	0	1	0	1	1
1.	0	0	1	.0	0	0	0	0	1
1.	0	0	0	1	1	0	1	1	0

Omax®

Teacher's Signature .....

DATE

EXPT.NO.

PAGE NO.

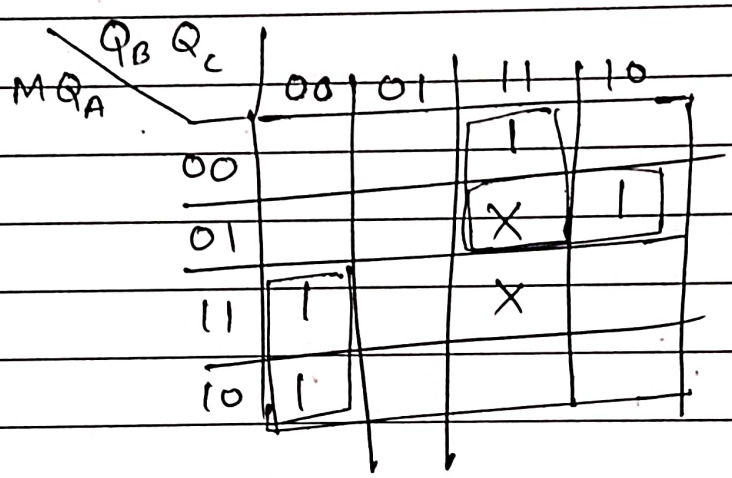
$T_A = \Sigma m(3,6,8,12) + d(7,15)$

$T_B = \Sigma m(1,3,5,6,8,10,12,14) + d(7,15)$

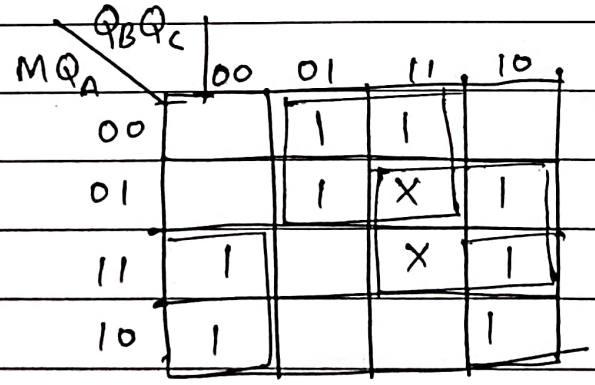
$T_C = \Sigma m(0,1,2,3,4,5,9,10,11,12,13,14) + d(7,15)$

K-Maps

<For T_A>



<For T_B>



Omax®

Teacher's Signature .....

DATE

EXPT.NO.

PAGE NO.

<For T_C>

MQ_A \ Q_BQ_C	00	01	11	10
00	1	1	1	1
01	1	1	X	
11	1	1	X	1
10		1	1	1

$$T_A = M\bar{Q}_B\bar{Q}_C + \bar{M}Q_BQ_C + \bar{M}Q_AQ_B$$

$$T_B = \bar{M}Q_C + M\bar{Q}_C + Q_AQ_B$$

$$T_C = \bar{M}\bar{Q}_B + Q_C + MQ_A + \bar{Q}_AQ_B$$

$$T_A = M\bar{Q}_B\bar{Q}_C + \bar{M}Q_B \cdot (\bar{Q}_A \text{ NAND } \bar{Q}_C)$$

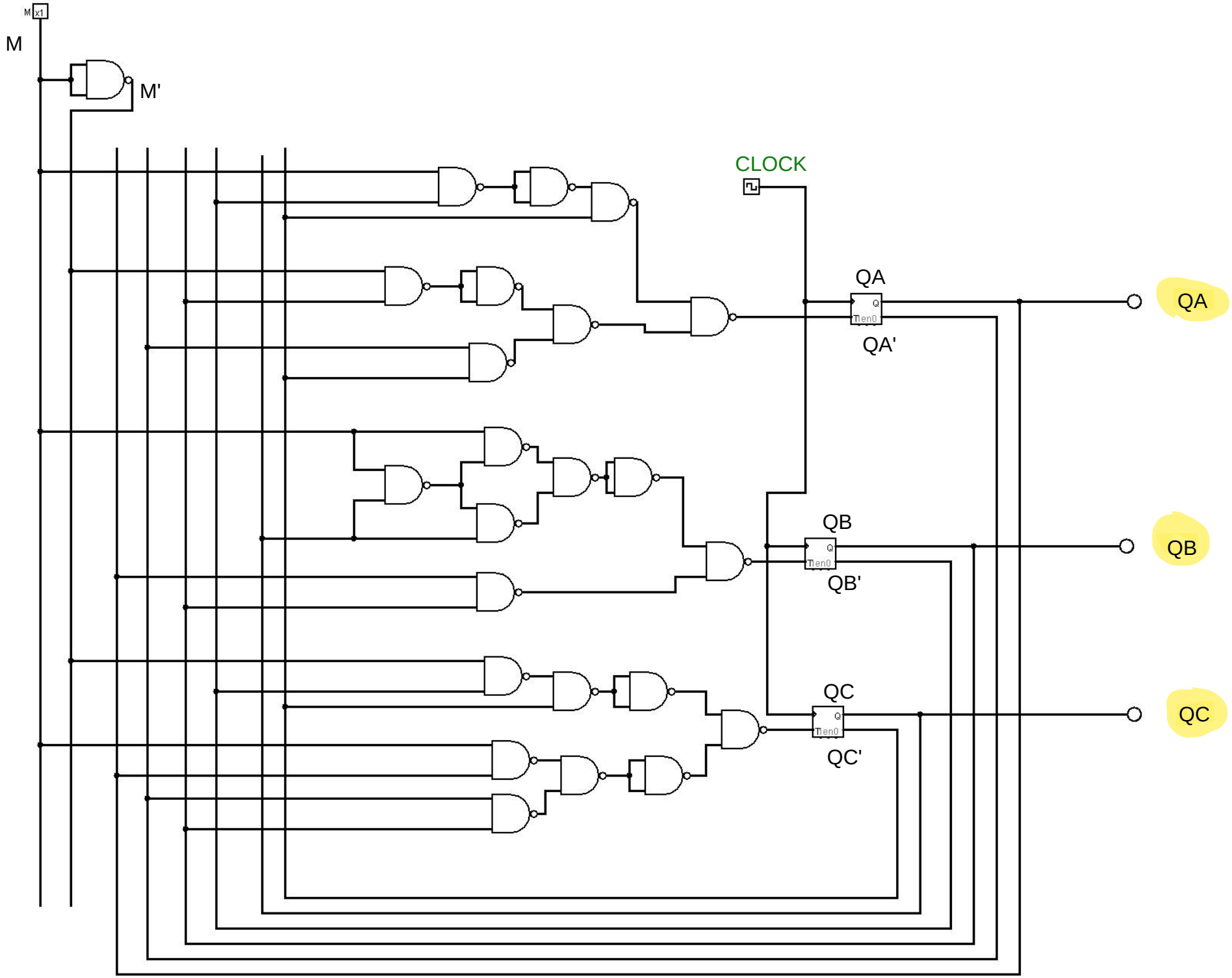
$$T_B = (M \odot Q_C) \text{ NAND } (Q_A \text{ NAND } Q_B)$$

$$T_C = \bar{M}\bar{Q}_B + Q_C + MQ_A + \bar{Q}_AQ_B$$

$$= (\bar{M} \text{ NAND } \bar{Q}_B) \text{ NAND } \bar{Q}_C + (M \text{ NAND } Q_A) \text{ NAND } (\bar{Q}_A \text{ NAND } Q_B)$$

Omax®

Teacher's Signature .....


M
M'
CLOCK
QA
QA'
QA
QB
QB'
QB
QC
QC'
QC