CS & IT ENGINEERING

DIGITAL LOGIC

Sequential Circuit

Lecture No. 9

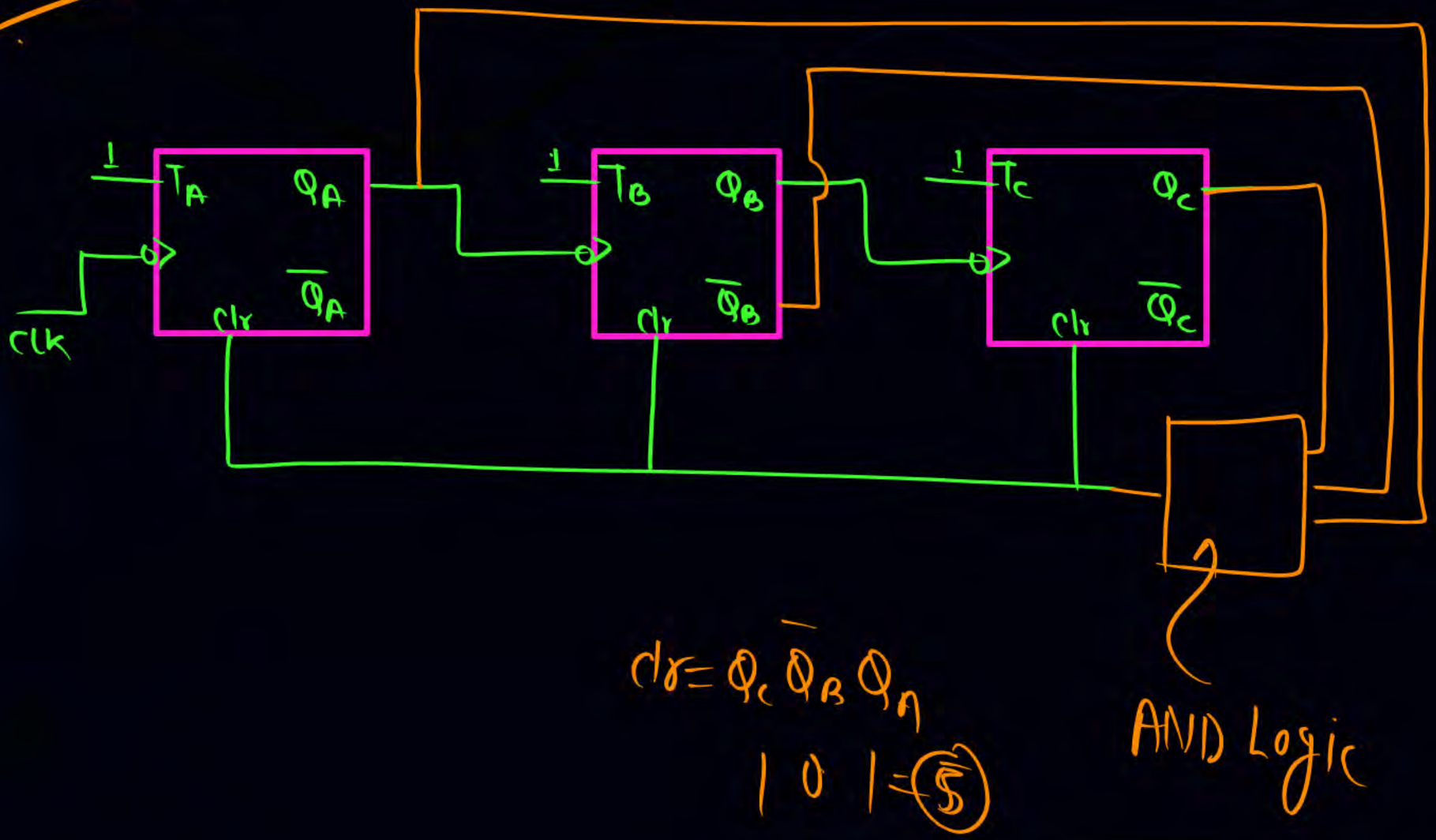
By- CHANDAN SIR

01 ASYNCHRONOUS COUNTER

02 PRACTICE

03 DISCUSSION

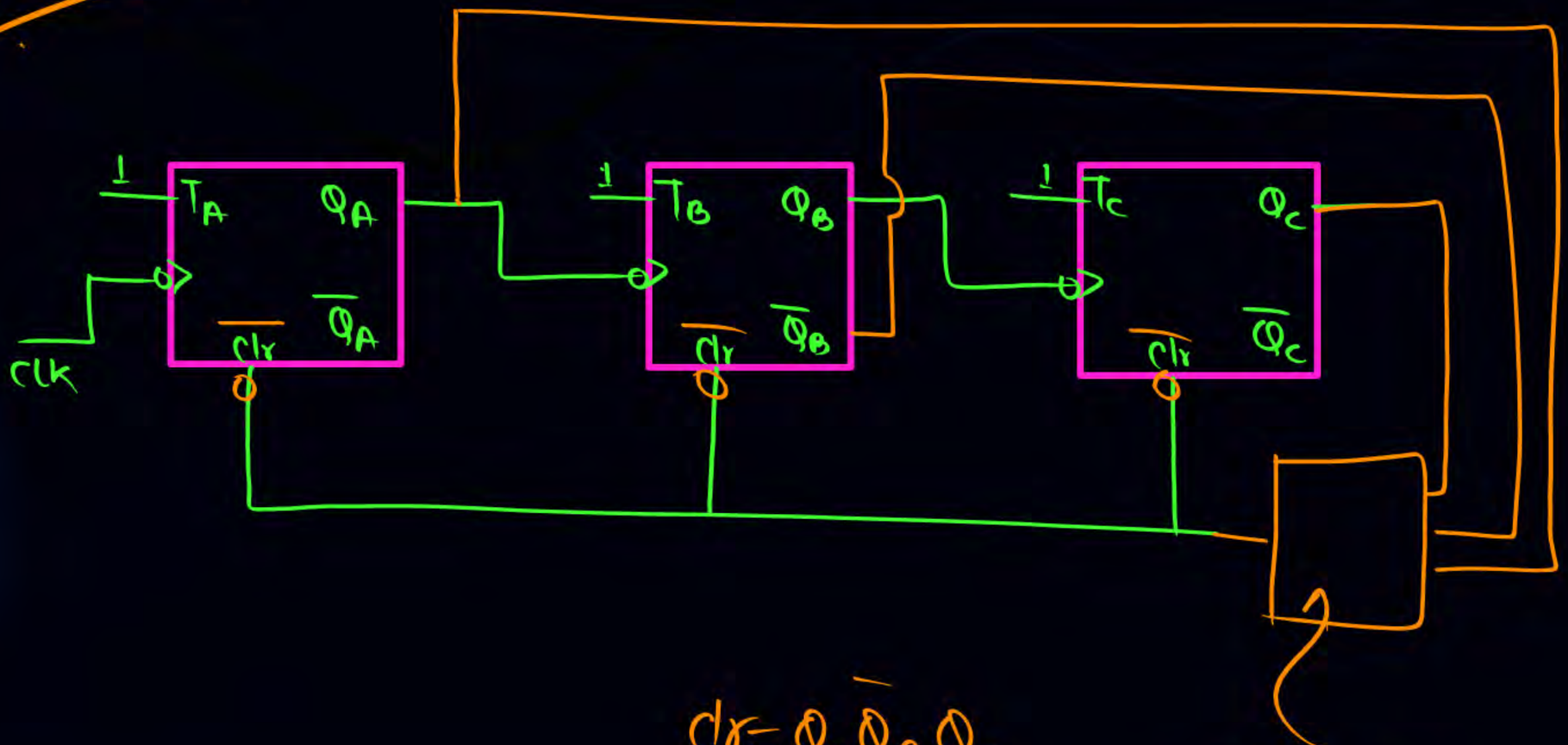
MOD-5 UP



$clr = Q_C \overline{Q_B} Q_A$

1 0 1 = (5)

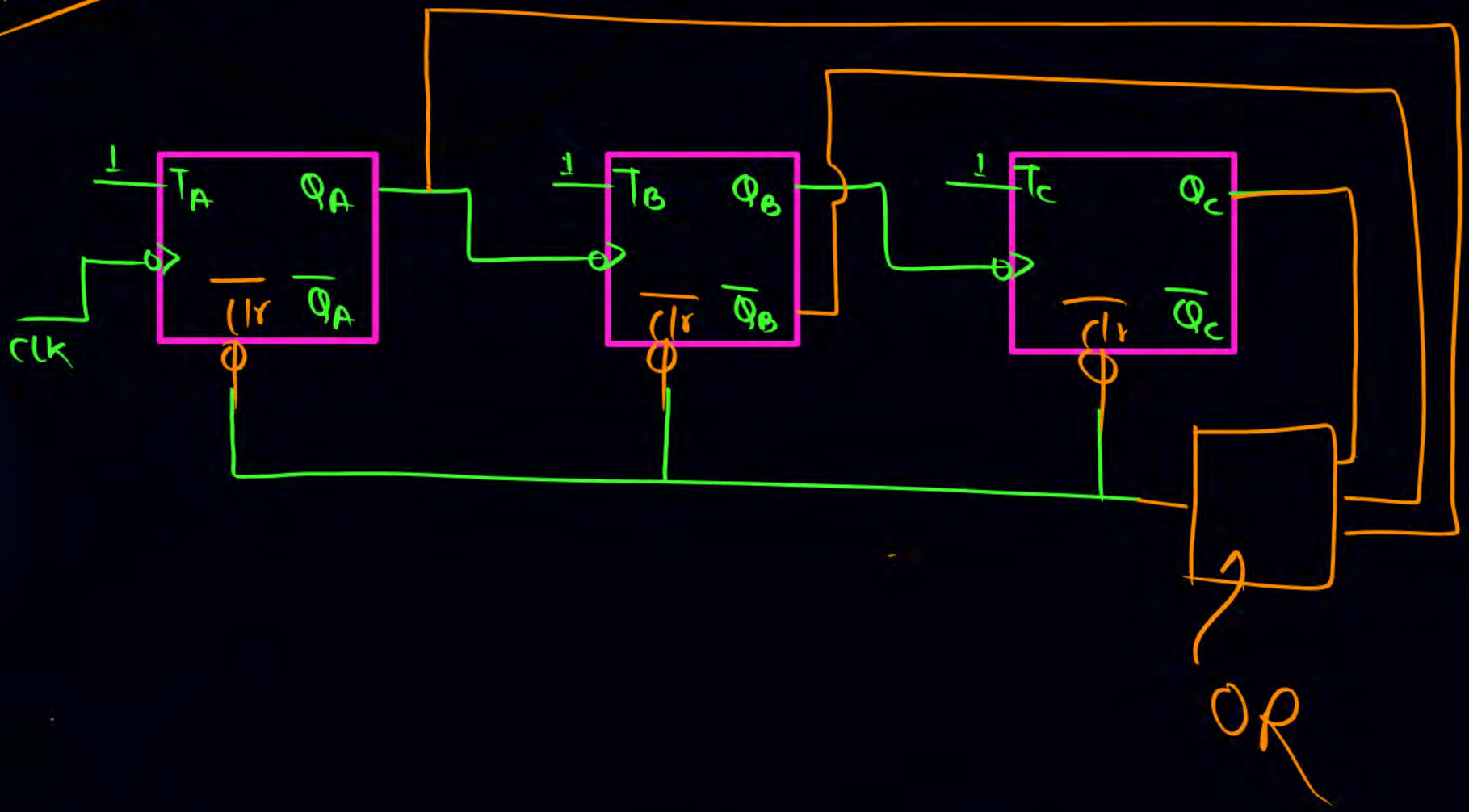
MOD-5 UP



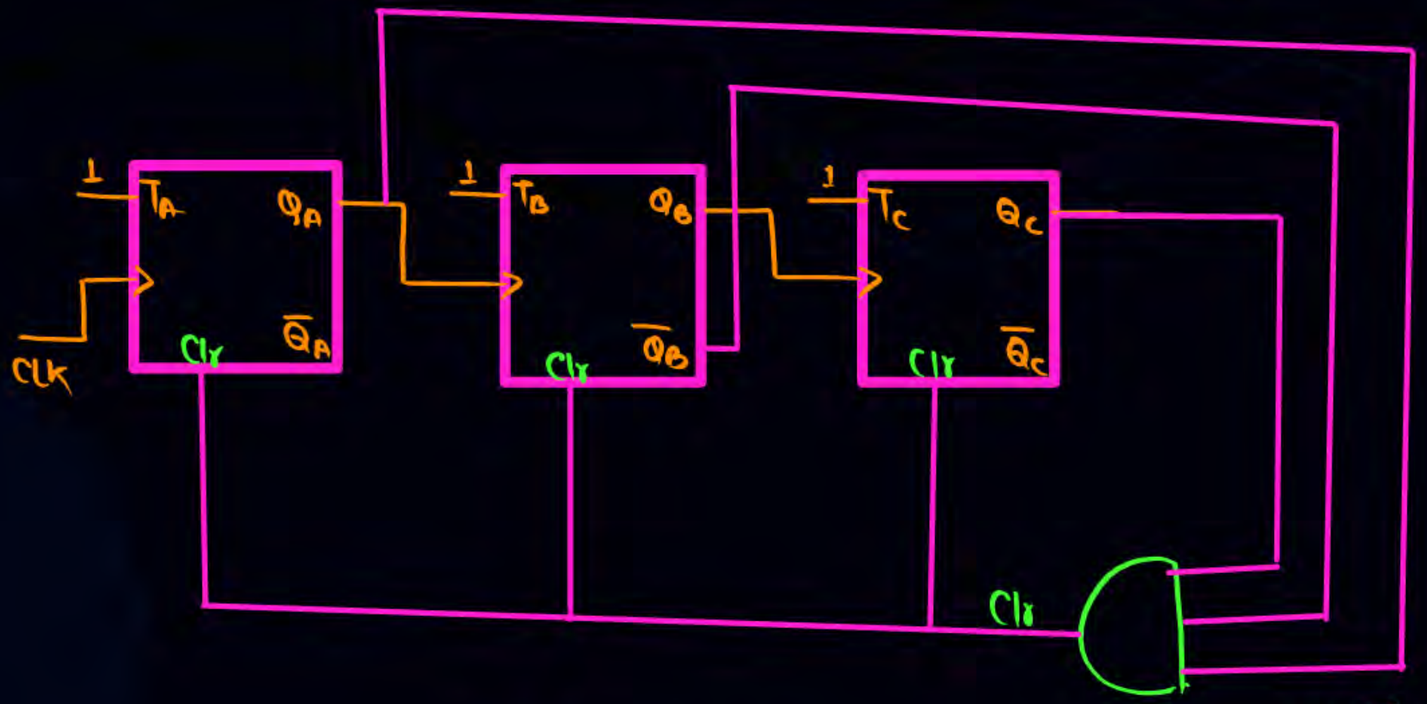
$clr = Q_C \overline{Q_B} Q_A$

1 0 1 = (5)

MOD-2 UP


1
T_A
Q_A
$\overline{Clr}$
$\overline{Q_A}$
CLK
1
T_B
Q_B
$\overline{Clr}$
$\overline{Q_B}$
1
T_C
Q_C
$\overline{Clr}$
$\overline{Q_C}$
OR

MOD-3 DOWN RIPPLE COUNTER



$111 \rightarrow 110 \rightarrow 000$

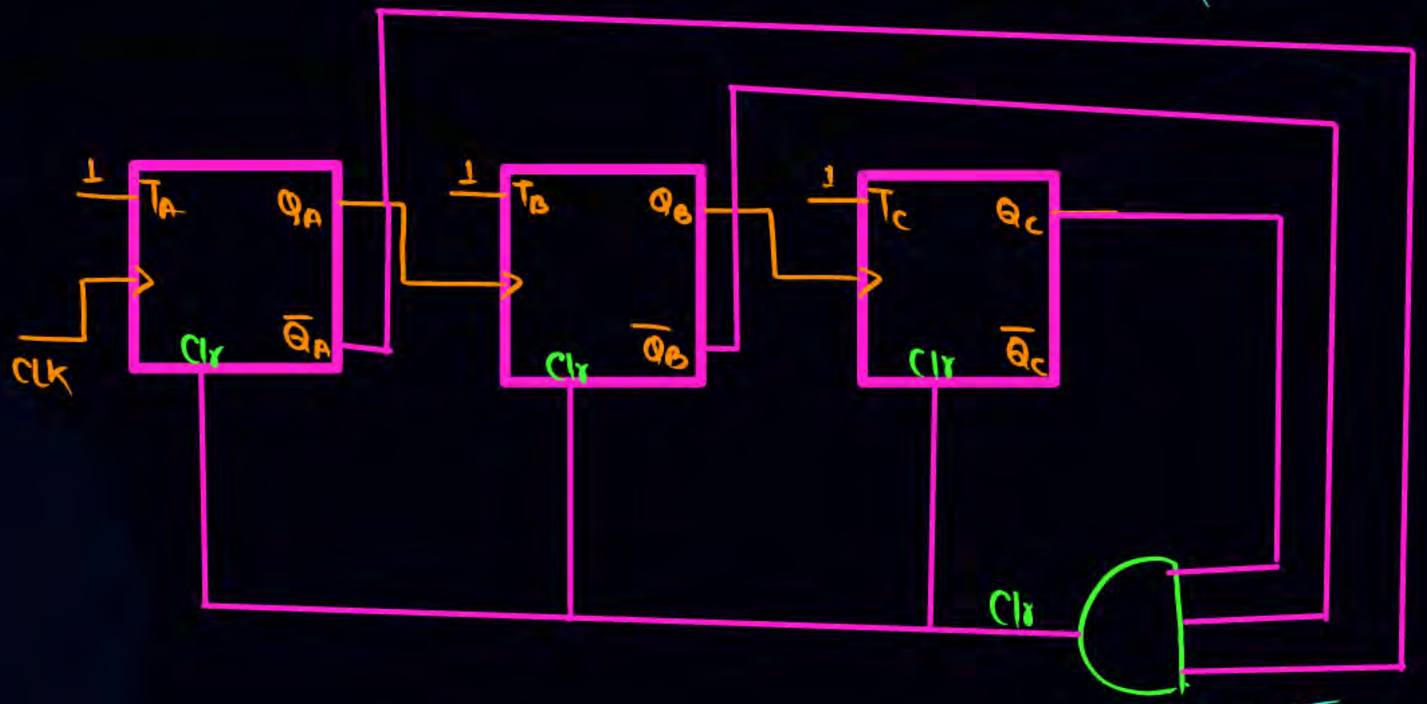
$Clr = Q_C \bar{Q}_B Q_A$

DOWN = FULL - UP

$\downarrow 3 = 8 - 5$

CLOCK	Q_C	Q_B	Q_A	$Clr = Q_C\bar{Q}_BQ_A$
0	0	0	0	0
1	1	1	1	0
2	1	1	0	0
3	~~1~~ 0	~~1~~ 0	~~0~~ 1	~~1~~ 0
4	1	1	1	0
5	1	1	0	0
6	~~1~~ 0	~~1~~ 0	~~0~~ 1	~~1~~ 0
7				
8				

MOD-4 DOWN RIPPLE COUNTER



$111 \rightarrow 110 \rightarrow 101 \rightarrow 000$

$Clr = Q_C \bar{Q}_B \bar{Q}_A$

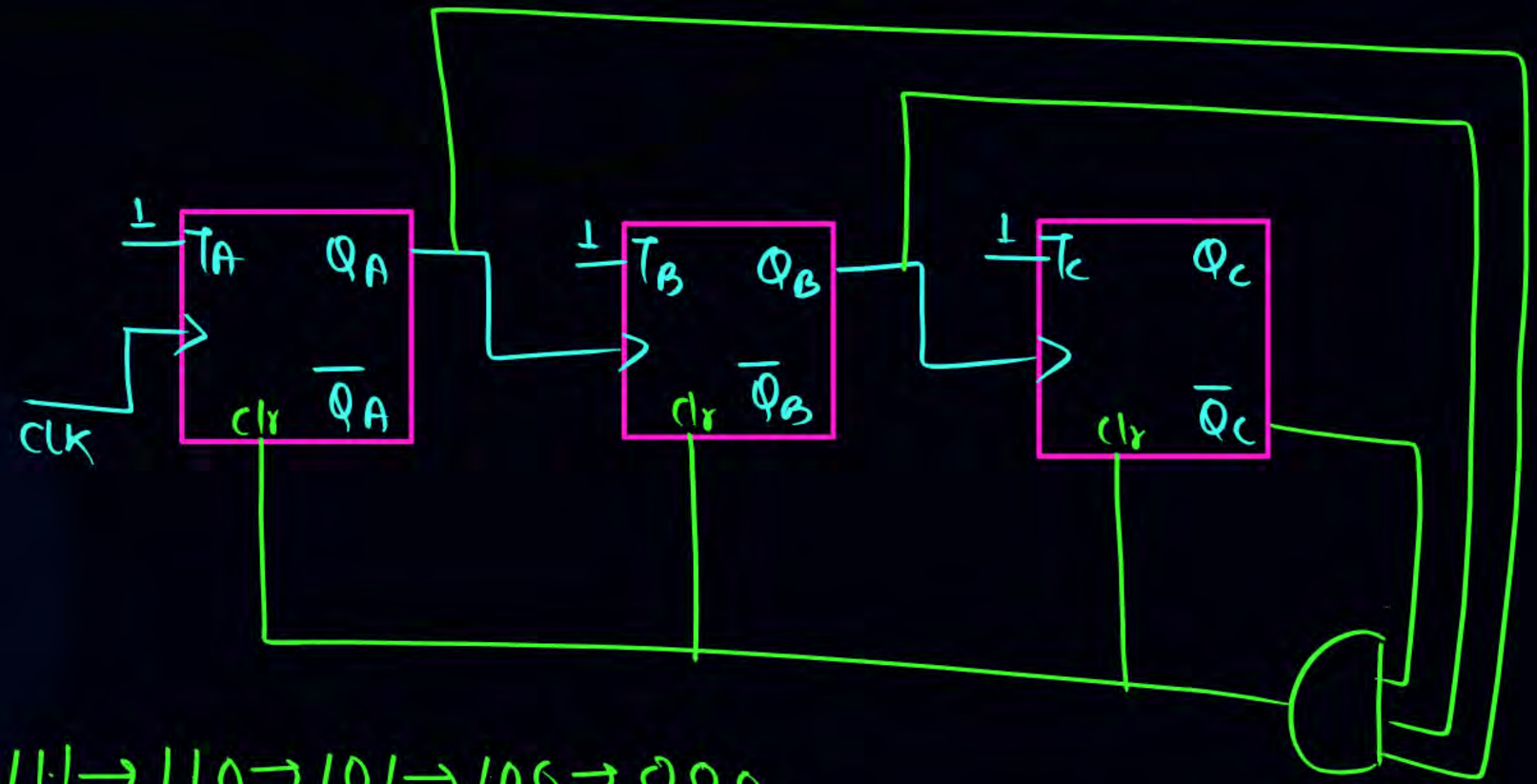
100

DOWN = FULL-UP

(4) = 8 − 4

CLOCK	Q_C	Q_B	Q_A	$Clr = Q_C \bar{Q}_B \bar{Q}_A$
0	0	0	0	0
1	1	1	1	0
2	1	1	0	0
3	1	0	1	0
4	1	0	0	1
5				
6				
7				

MOD-5 DOWN RIPPLE COUNTER



CLK	$Q_C Q_B Q_A$	Clr
0	0 0 0	0
1	1 1 1	0
2	1 1 0	0
3	1 0 1	0
4	1 0 0	0
5	0 0 0	1

111 → 110 → 101 → 100 → 000

DOWN = FULL − UP

(5) = 8 − 3

$Clr = \overline{Q_C} Q_B Q_A$

011 → 3

Q Design a MOD-13 Down Ripple counter?

FULL-UP = DOWN

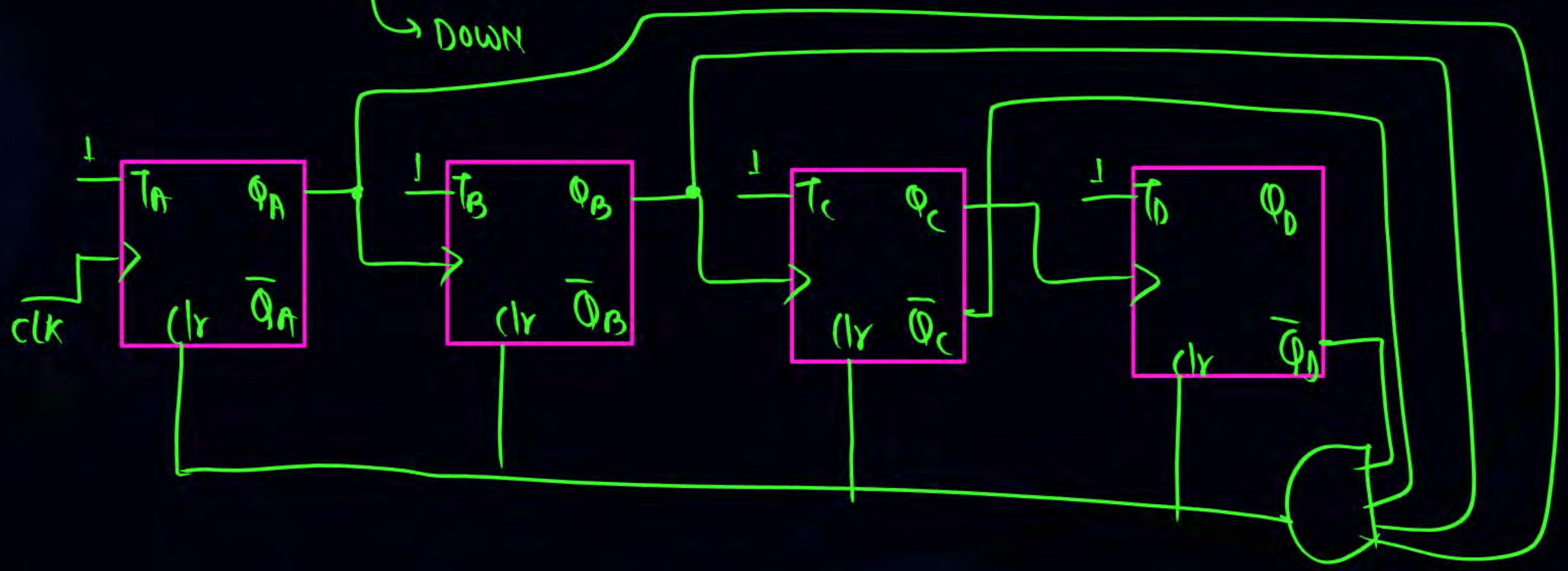
16 - UP = 13

16-13 = (03) UP

↳ DOWN

$\text{Clr} = \overline{Q_D}\,\overline{Q_C}\,Q_B\,Q_A$

0 0 1 1



Q Design a MOD-9 Down Ripple counter ?

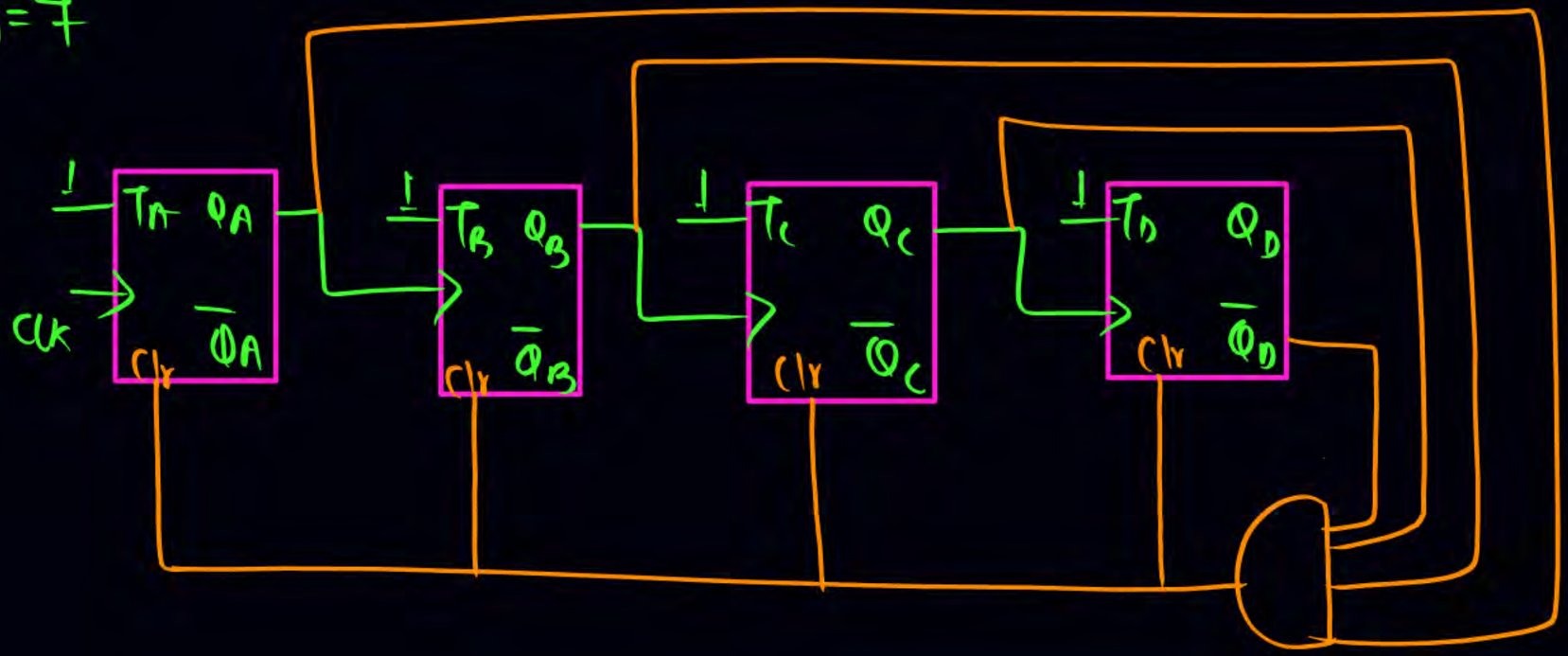
FULL - UP = DOWN

16 - UP = 9

UP = 16 - 9 = 7

$\overline{Clr} = \overline{Q_D}\, Q_C\, Q_B\, Q_A$

0 1 1 1

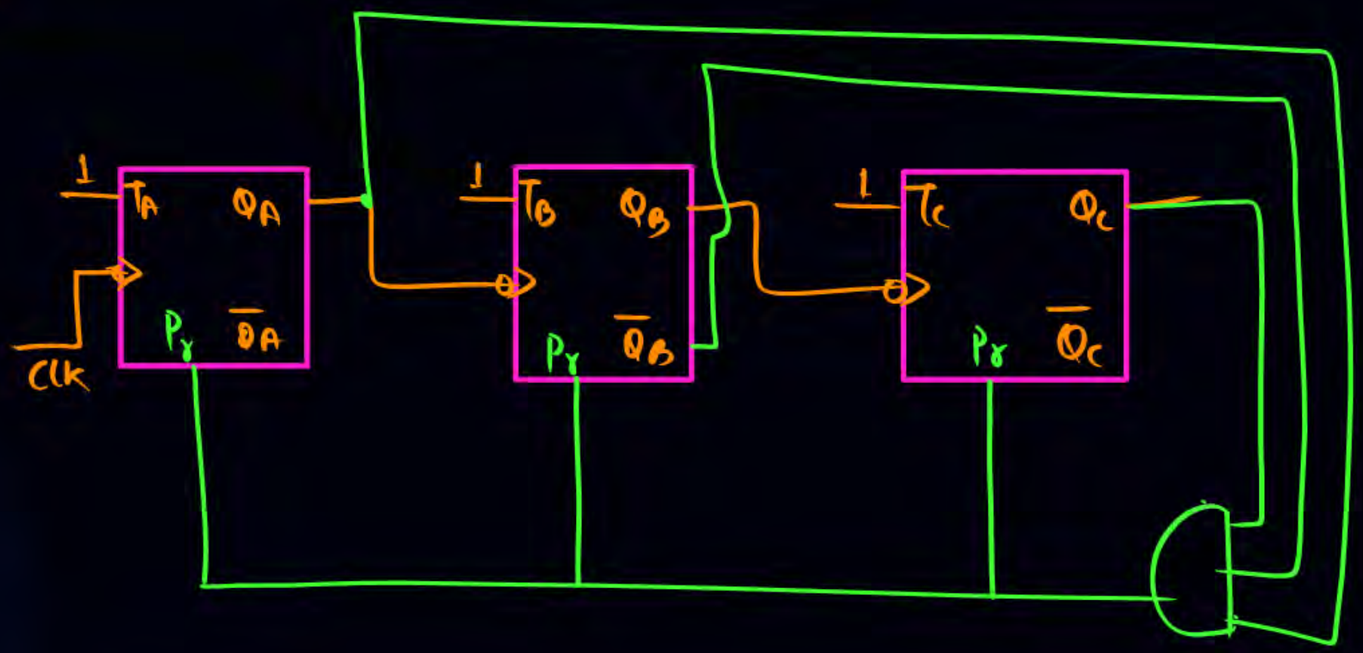


Q Design a MOD-19 Down Ripple counter ?

Q Design a MOD-23 Down Ripple counter ?

Q Design a MOD-11 Down Ripple counter.

Q.

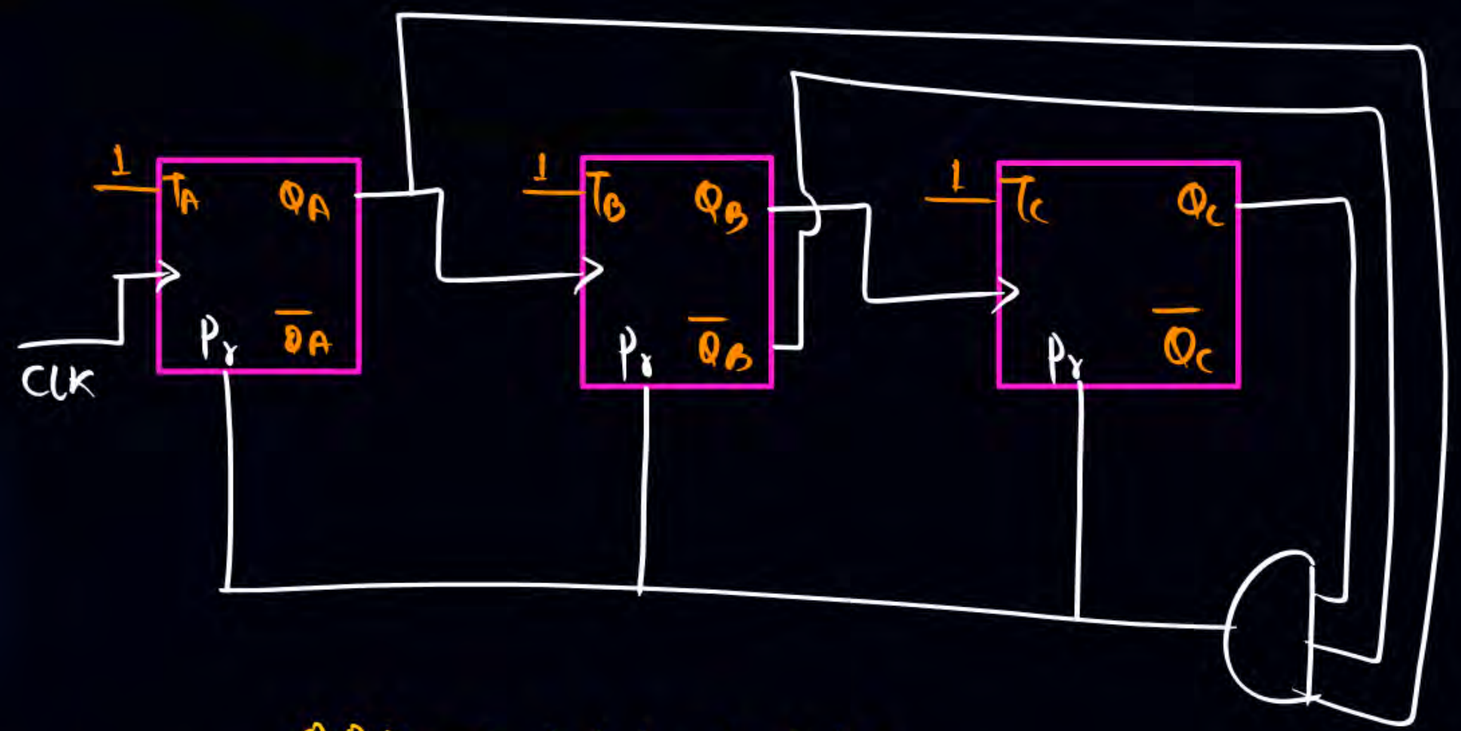


CLK	Q_C	Q_B	Q_A	$P_r = Q_C\overline{Q}_B Q_A$
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	0
4	1	0	0	0
5	1	0	1	1 → 0
6	0	0	0	0
7	0	0	1	0

$000 \rightarrow 001 \rightarrow 010 \rightarrow 011 \rightarrow 100 \rightarrow 101$

MOD-6

Q.

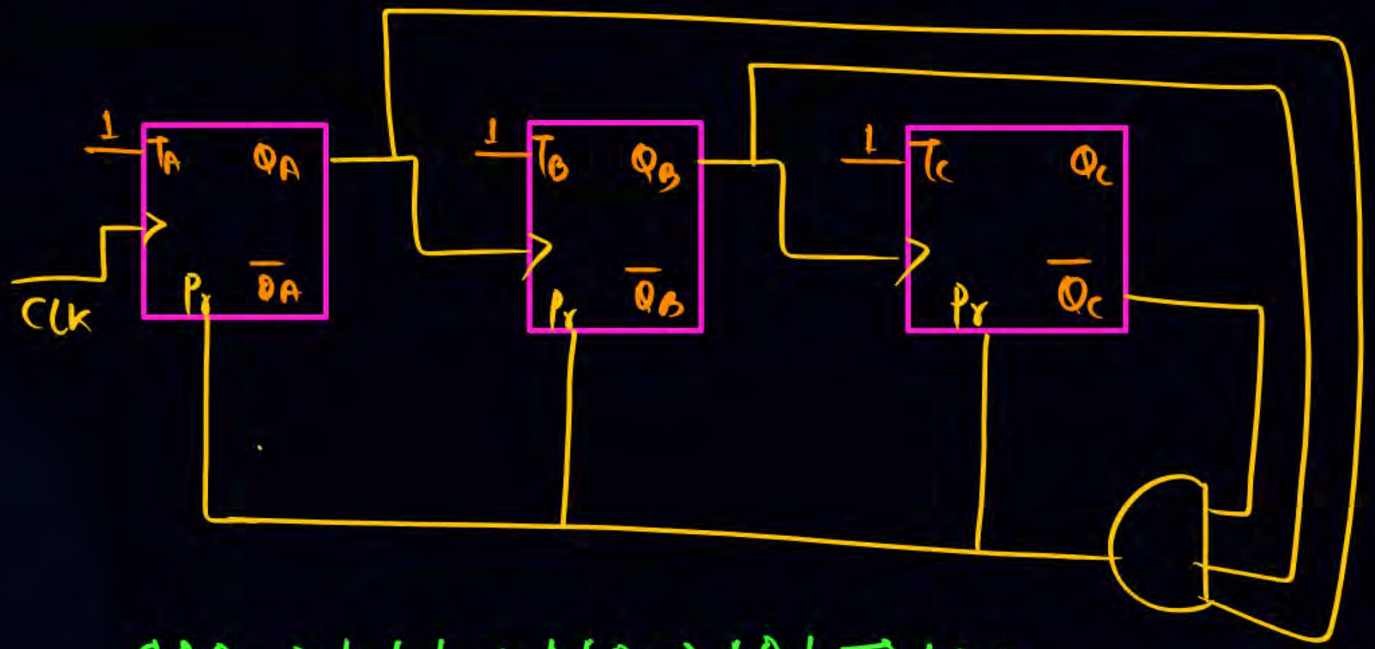


CLK	Q_C	Q_B	Q_A	$Pr=Q_C\overline{Q}_BQ_A$
0	0	0	0	0
1	1	1	1	0
2	1	1	0	0
3	1	0	1	1
4	1	1	0	0
5	1	0	1	1
6	1	1	0	0
7	1	0	1	1
	1	1	1	0

MOD-3

000 → 111 → 110

Q.



000 → 111 → 110 → 101 → 100

MOD = 4

$P_r = \overline{Q_C} Q_B Q_A$

CLK	Q_C	Q_B	Q_A	P_r
0	0	0	0	0
1	1	1	1	0
2	1	1	0	0
3	1	0	1	0
4	1	0	0	0
5	0	0	0	1
6	1	1	0	0
7	1	0	1	0

1 0 0 0

Thank you

GW

Soldiers !