CS & IT ENGINEERING

DIGITAL LOGIC

Sequential Circuit

Lecture No. 10

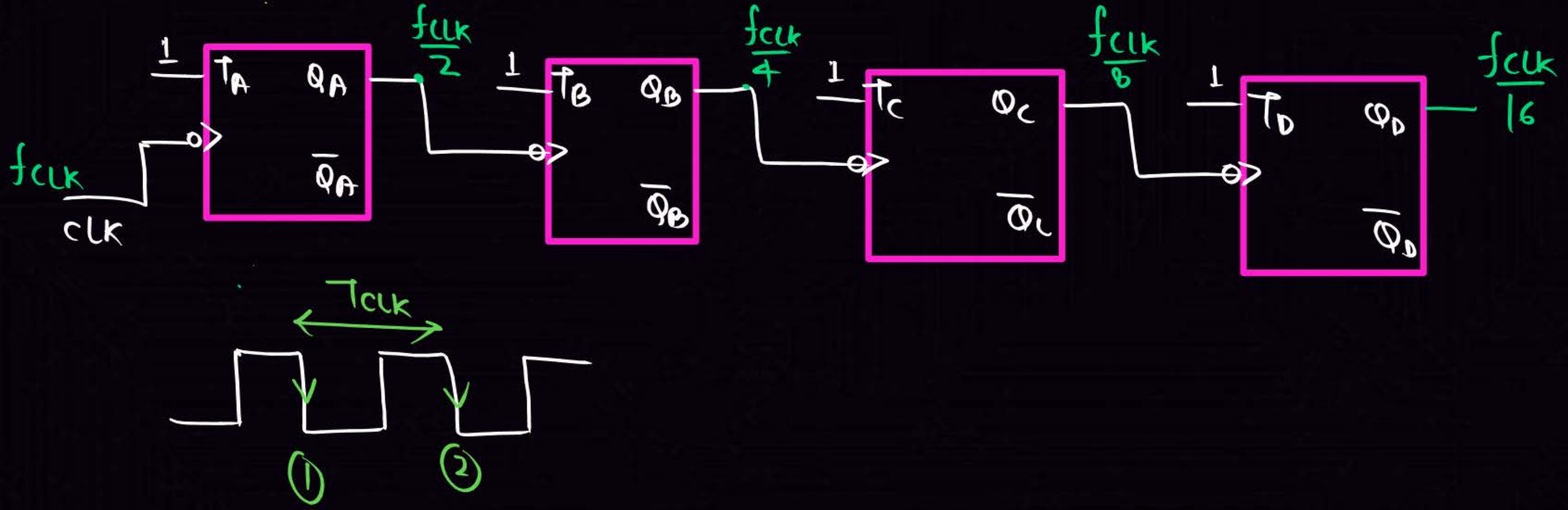
By- CHANDAN SIR

01 RING COUNTER

02 PRACTICE

03 DISCUSSION

Asynchronous [Ripple counter]



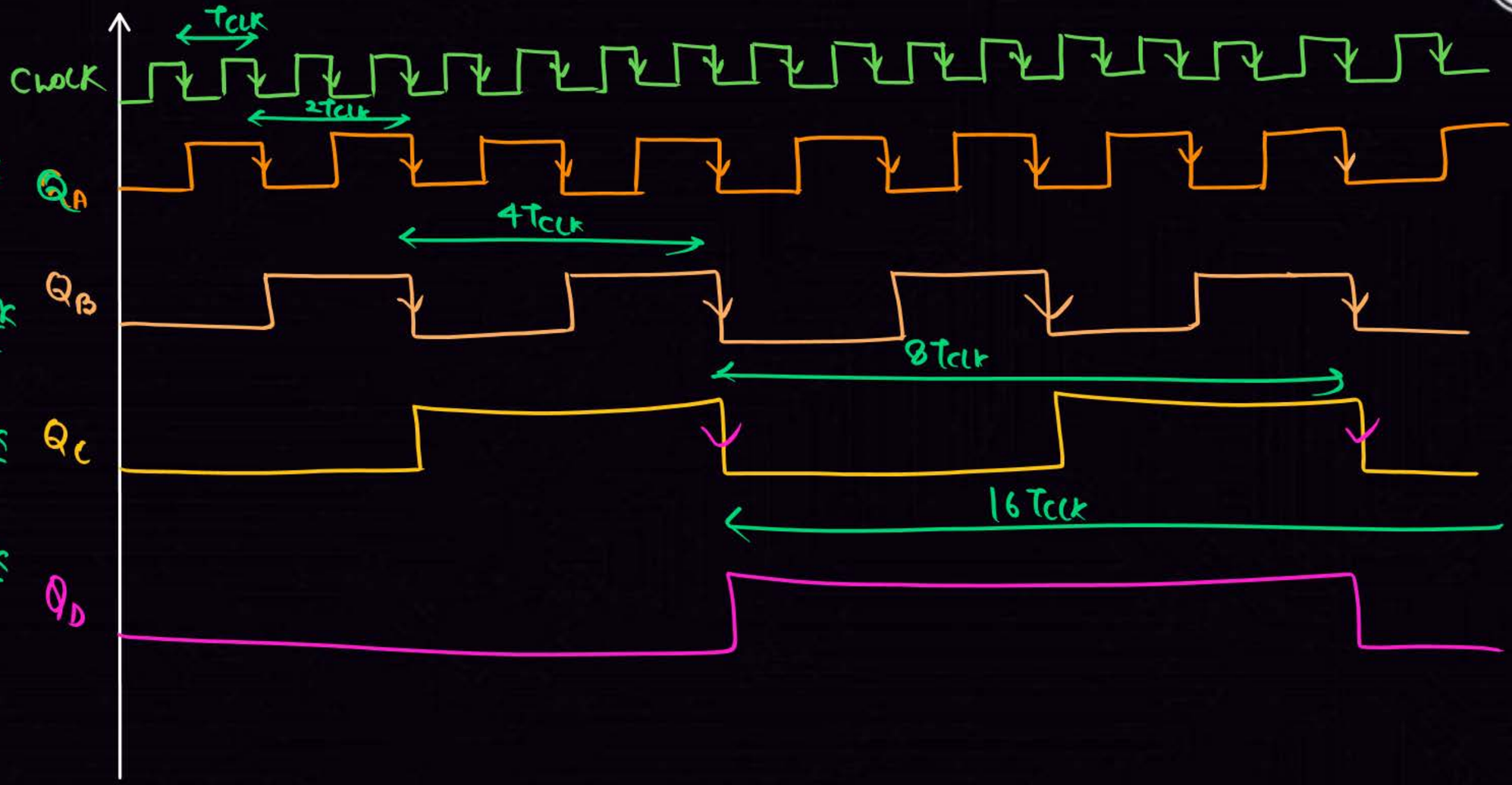
$f_{CLK} = \frac{1}{T_{CLK}}$

$f_{Q_A} = \frac{1}{2T_{CLK}} = \frac{f_{CLK}}{2}$

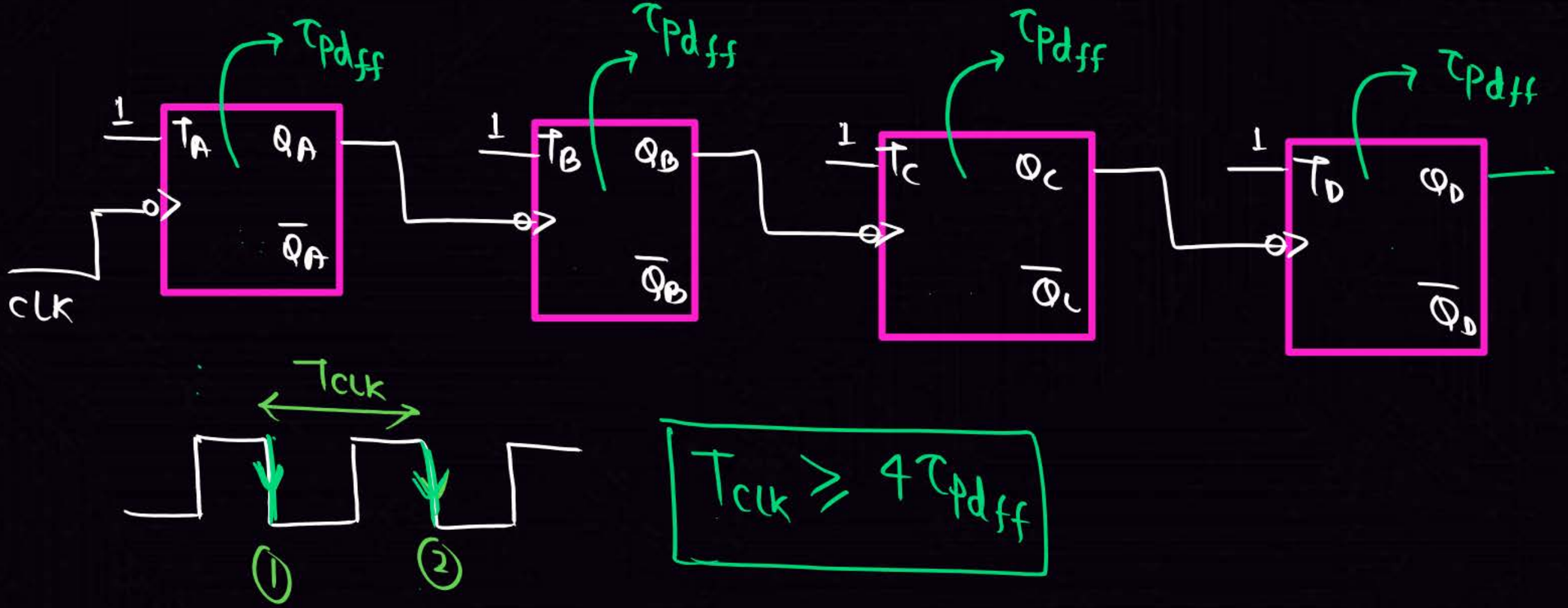
$f_{Q_B} = \frac{1}{4T_{CLK}} = \frac{f_{CLK}}{4}$

$f_{Q_C} = \frac{1}{8T_{CLK}} = \frac{f_{CLK}}{8}$

$f_{Q_D} = \frac{1}{16T_{CLK}} = \frac{f_{CLK}}{16}$



Asynchronous counter



$$T_{CLK} \geq 4\tau_{pd_{ff}}$$

n bit Asynchronous counter

$$T_{clk} \geq n \cdot \tau_{pd_{ff}}$$

$$\frac{1}{T_{clk}} \leq \frac{1}{n \cdot \tau_{pd_{ff}}}$$

$$f_{clk} \leq \frac{1}{n \cdot \tau_{pd_{ff}}}$$

$$(f_{clk})_{max} = \frac{1}{n \cdot \tau_{pd_{ff}}}$$

Synchronous counter

↳ All the FF's are synchronized with the same clock.

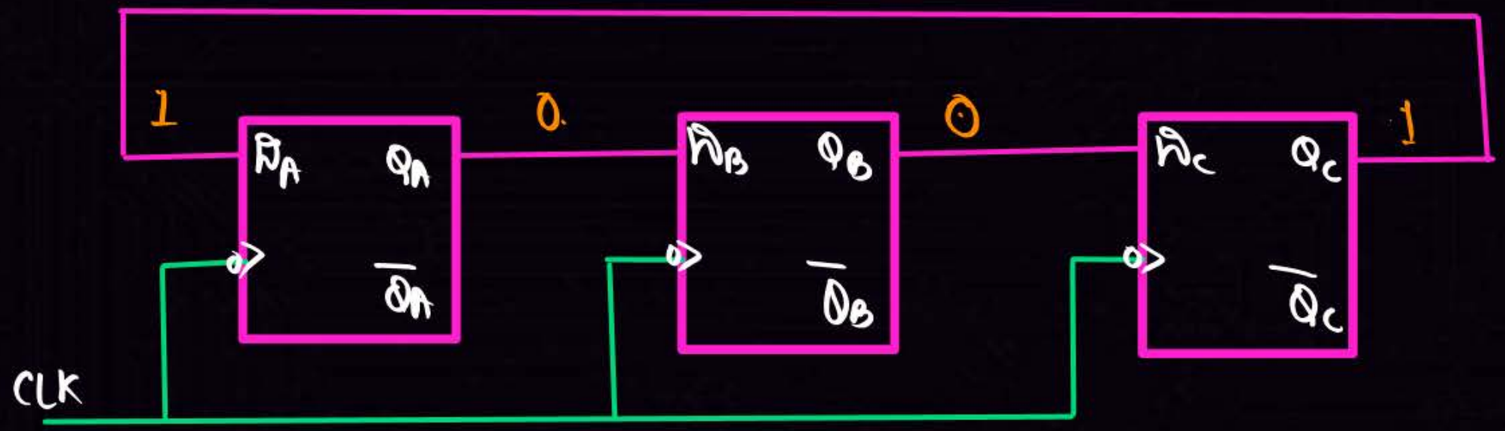
Ex. 1. Ring counter

2. Johnson counter.

① RING COUNTER

3 bit Ring counter

↳ It is a SISO Shift Register in the form of Ring.



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

↳ Ring counter is not a self starting counter, To start the Ring counter we have to place '1' at MSB along clock then that '1' will rotate among all the FF.

3 bit Ring Counter

MOD = 3

1 0 0
0 1 0
0 0 1

4 bit Ring Counter

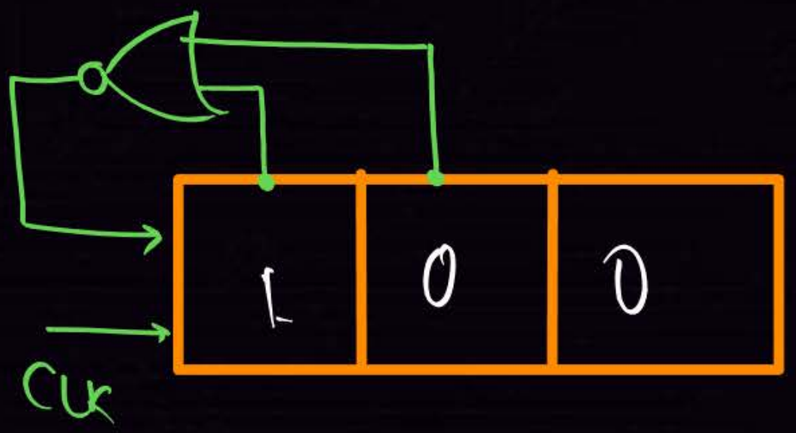
MOD = 4

1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1

"N" bit Ring counter

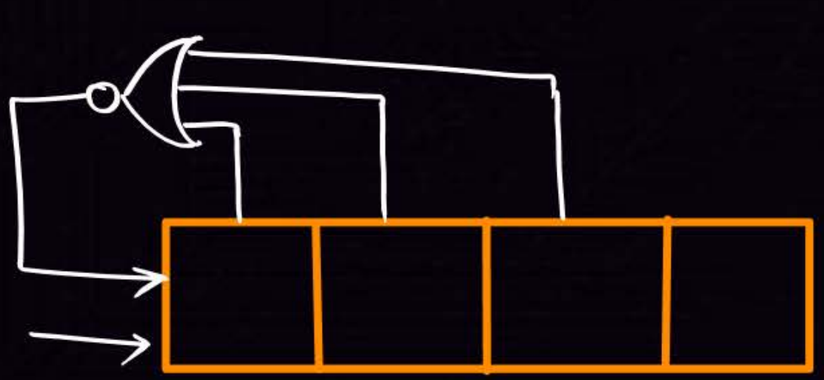
$\Rightarrow$ MOD = N

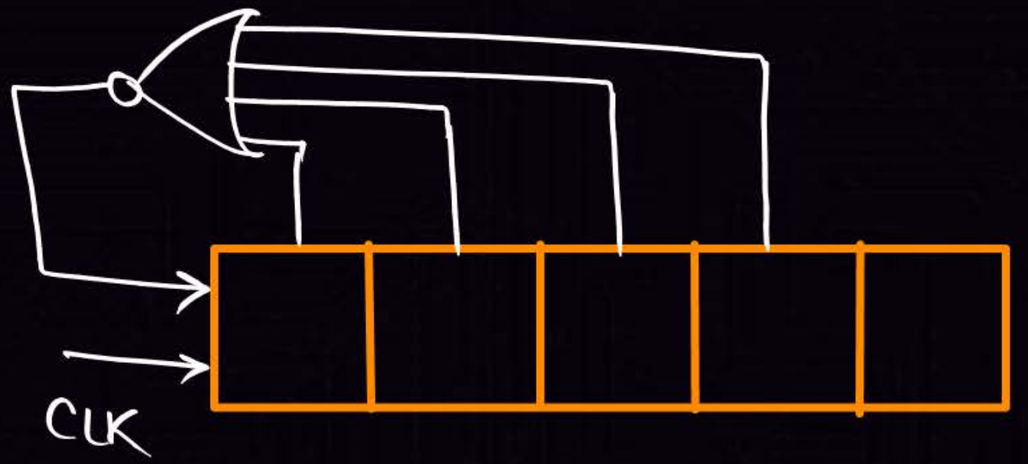
Self Starting Ring counter



CLK	Q_A	Q_B	Q_C
0	0	0	0
1	1	0	0
2.	0	1	0
3.	0	0	1
4	1	0	0

MOD = 3





Self starting Ring counter

Thank you

GW

Soldiers !