

CS & IT ENGINEERING



DIGITAL LOGIC

Sequential Circuit



Lecture No. 07



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TOPICS TO BE COVERED

01 Registers, Basic of Counters

02 PRACTICE

03 DISCUSSION

COUNTER



1. Counters are used to count Number of clock.
2. Counter are used as Frequency Divider Circuit.
3. Counter are also used in ADC.
4. Counters are also known as pulse stretcher circuit.
5. Counters also used in RADAR for detection of Range.

TYPES OF COUNTER



1. Asynchronous Counter.
2. Synchronous Counter.

TYPES OF COUNTER



- 1. Asynchronous Counter:** Only one flip flop having external clock and output of that flip flop will become clock for the next flip flop. So when clock applied only one flip flop work at that time.
- 2. Synchronous Counter:** All Flip Flops are connected with the same clock. Hence when clock is applied all the flip flops work simultaneously.



$\overbrace{0, 1}$

②



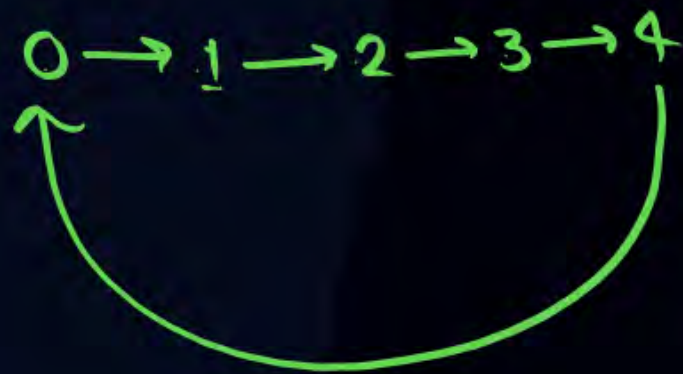
$$\left\{ \begin{array}{cc} 0 & 0 \\ 0 & 1 \\ 1 & 0 \\ 1 & 1 \end{array} \right\} \textcircled{4}$$

Maximum number of states = 2^n

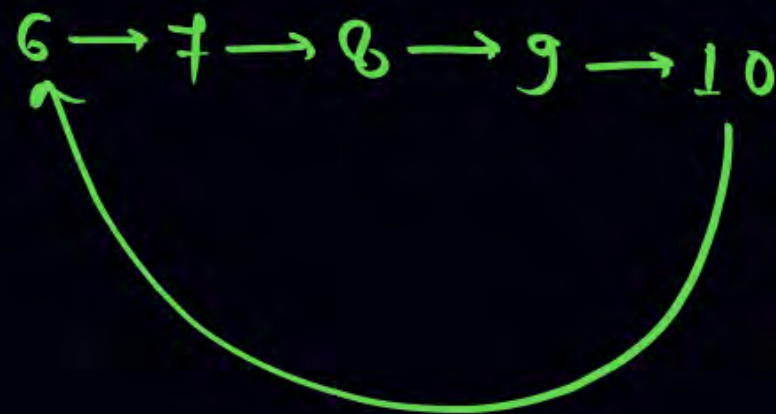
$n \rightarrow$ no. of FF's.

MODULUS OF COUNTER

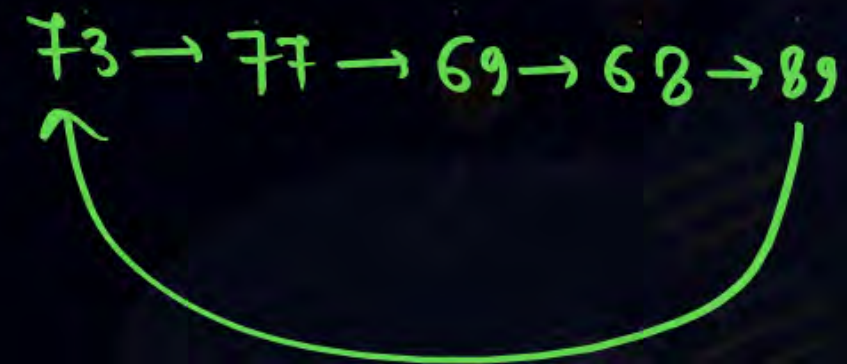
↳ Total no. of states used by the counter are called mod of the counter.



MOD=5



MOD=5



MOD=5

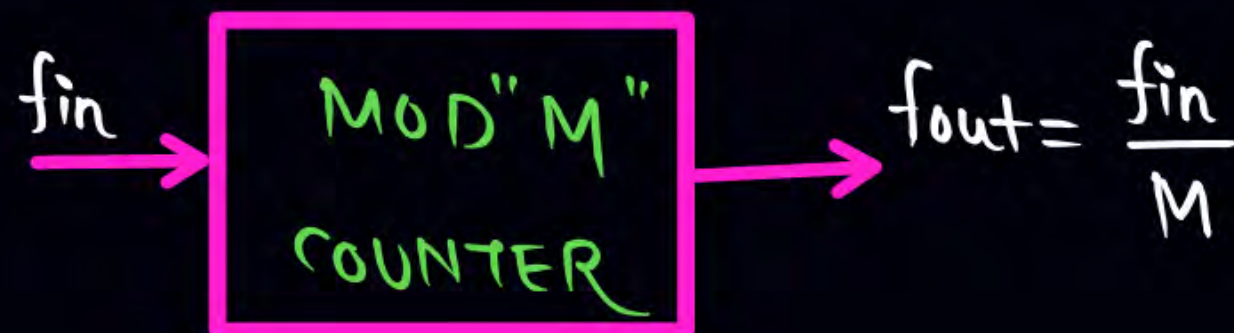
₹100

NOTE :

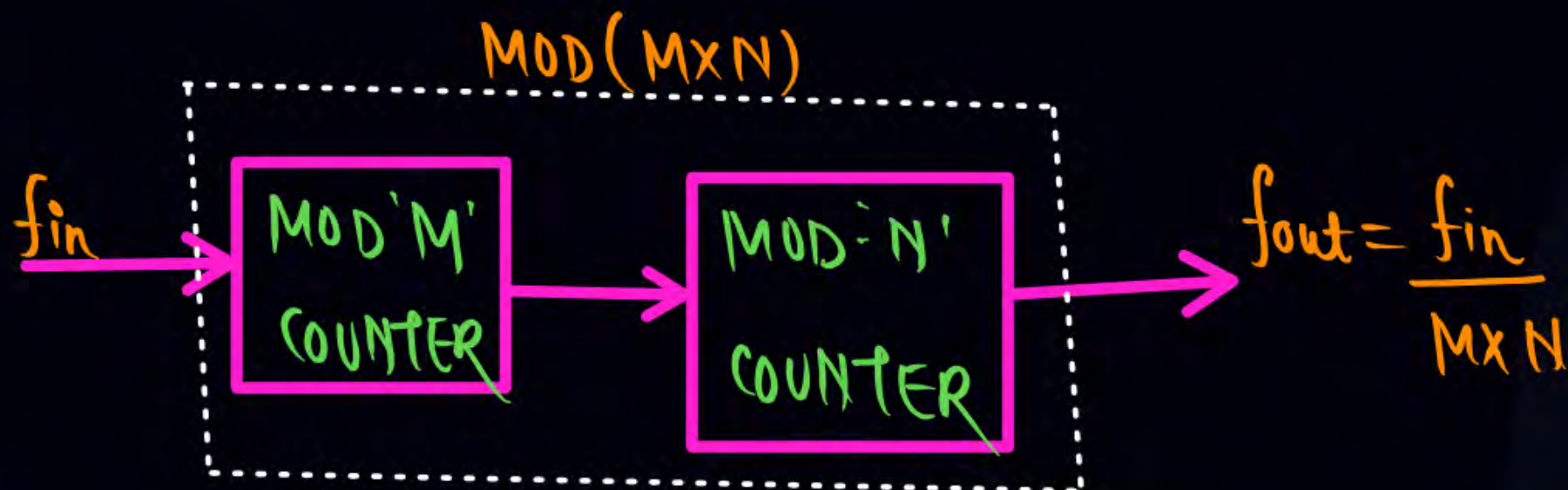
1.

$$\text{MOD}(M) \leq 2^n$$

2.



3.



BCD counter

0	→	0000
1	→	0001
2	→	0010
3	→	0011
4	→	0100
5	→	0101
6	→	0110
7	→	0111
8	→	1000
9	→	1001

MOD → 10

$$M \leq 2^n$$

$$n \geq \log_2 M$$

$$n \geq \log_2 10$$

$n \geq 3$ something

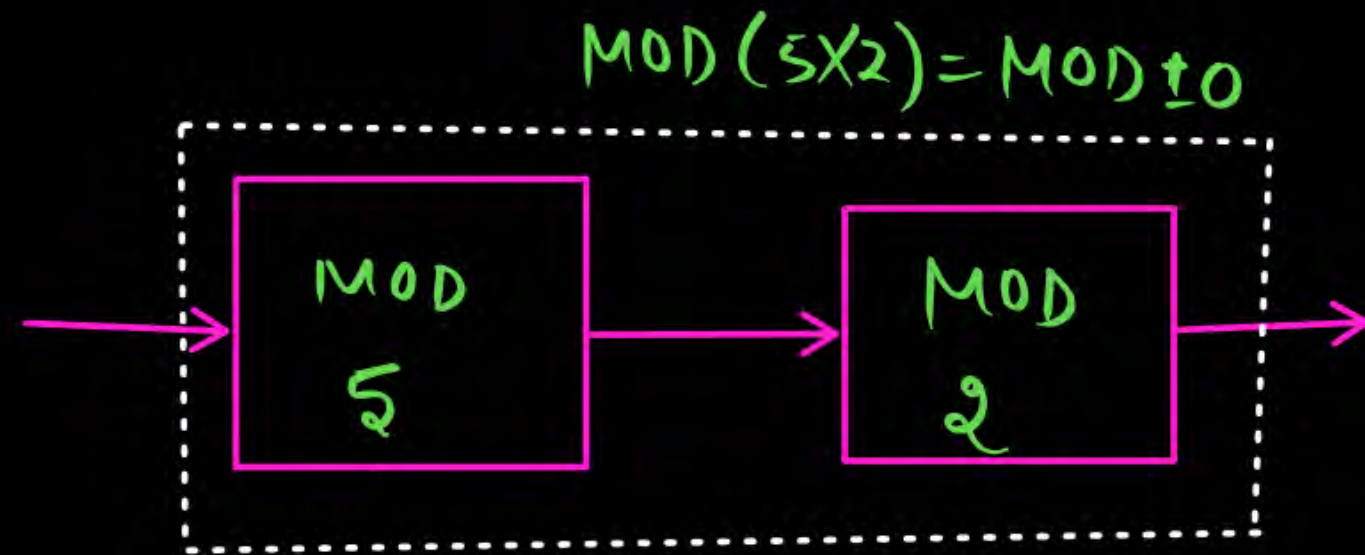
$$n \approx 4$$

Q.



If mod-5 counter is cascaded with mod-2 counter, then it will become?

- ☒ A Mod-10 counter
- ☐ B BCD Counter
- ☐ C Both A and B
- ☐ D None



Q

MOD-100No. of FF? $n \geq 7$

$$M \leq 2^n$$

$$n \geq \log_2 M$$

$$\geq \log_2 100$$

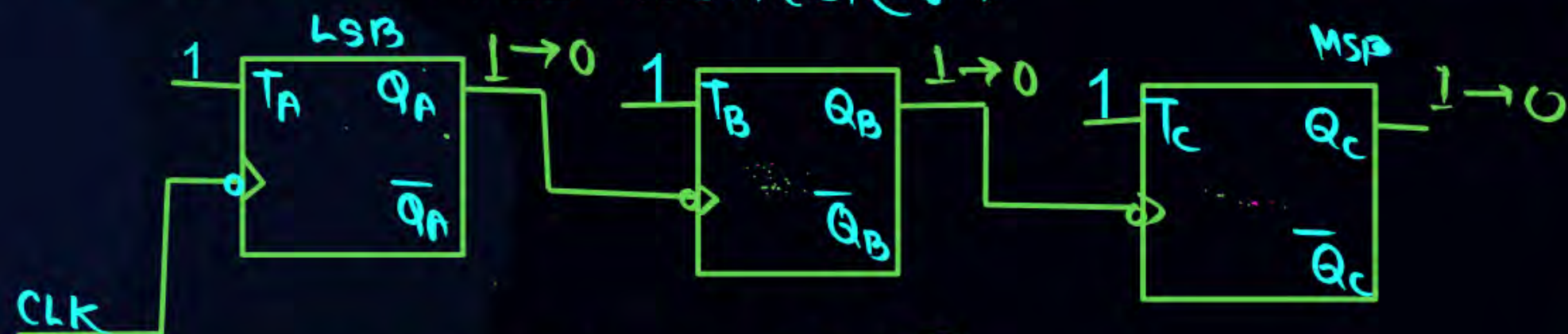
$$\geq 6. \text{ something}$$

Asynchronous counter

→ All the FF's are used in toggle mode.

3 bit Ripple counter

MOD-8 UP RIPPLE COUNTER :-



- QA will toggle when -ve edge of the external clk appear.
- QB will toggle when QA goes from 1 to 0.
- QC will toggle when QB goes from 1 to 0.

MOD-8

CLOCK	QC	QB	QA
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1
8	0	0	0
9	0	0	1
10	0	1	0

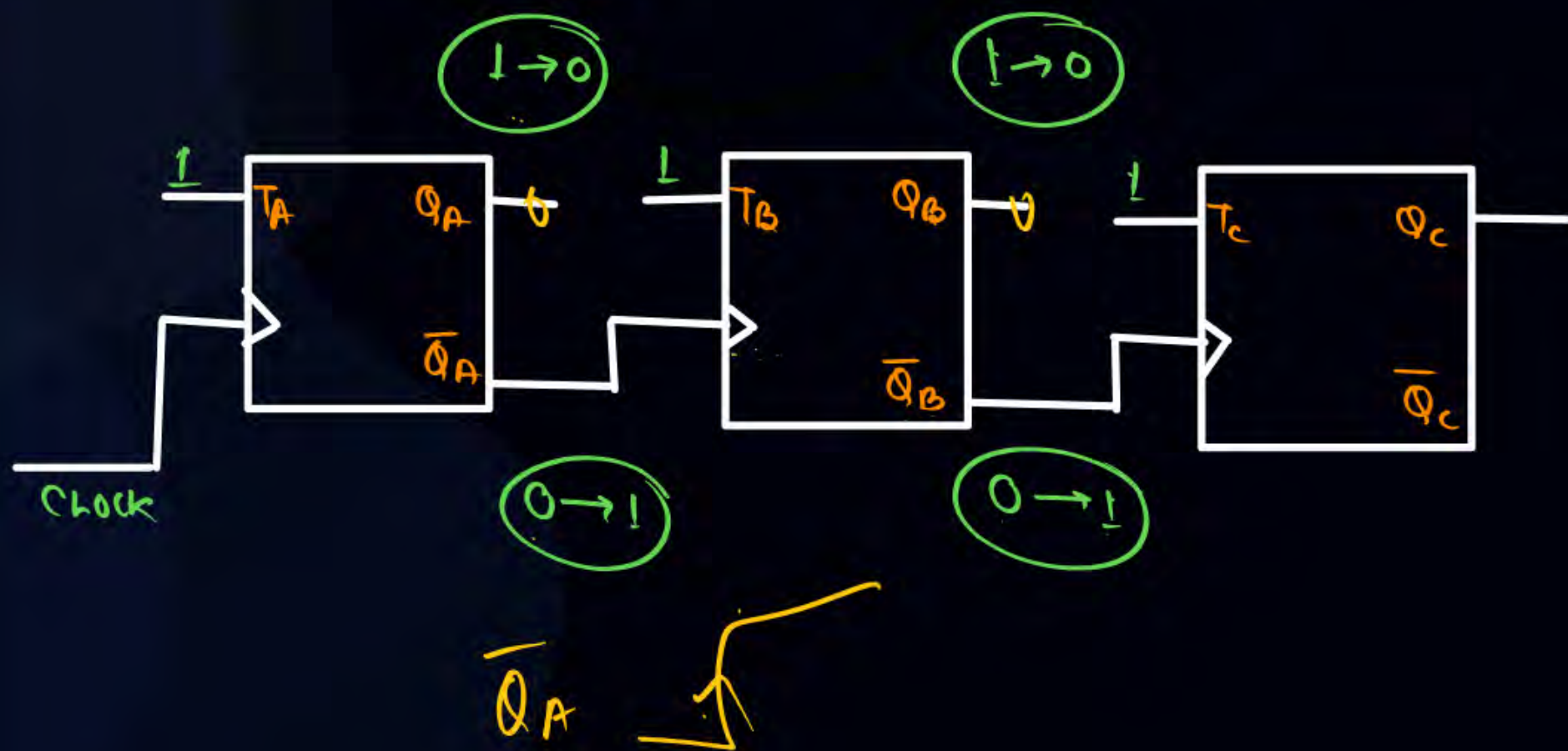
MOD-8 DOWN RIPPLE COUNTER

111 → 110 → 101 → 100 → 011 → 010 → 001 → 000



CLOCK	QC	QB	QA
0	0	0	0
✓ 1	1	1	1
✓ 2	1	1	0
✓ 3	1	0	1
✓ 4	1	0	0
✓ 5	0	1	1
✓ 6	0	1	0
✓ 7	0	0	1
✓ 8	0	0	0
✓ 9	1	1	1
	1	1	0

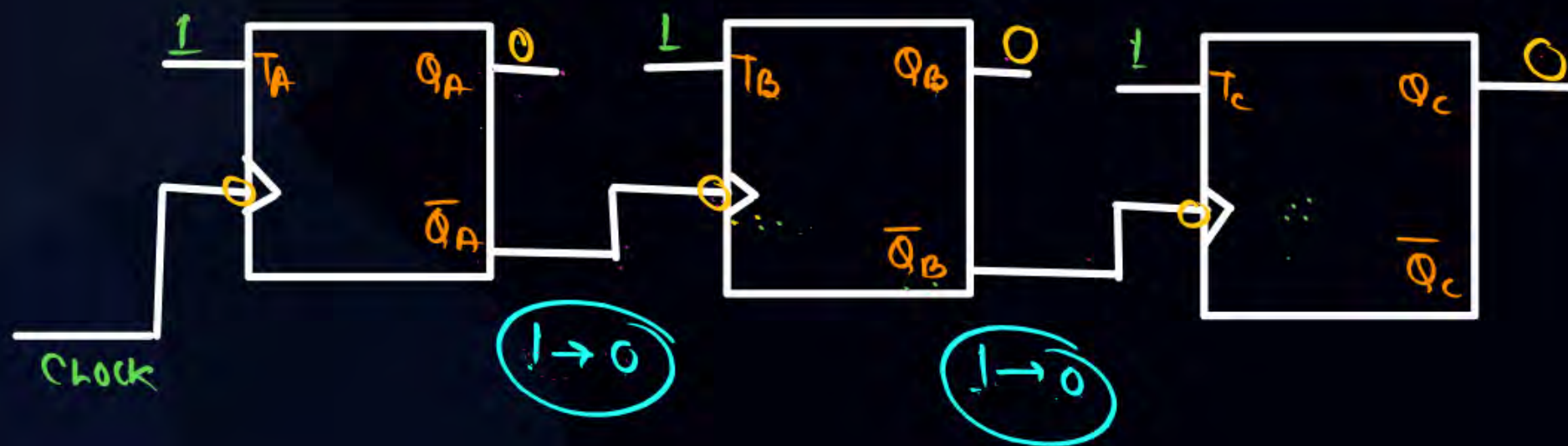
MOD-8 UP RIPPLE COUNTER



CLOCK	QC	QB	QA
0	0	0	0
✓ 1	0	0	1
✓ 2	0	1	0
3	0	1	1
✓ 4	1	0	0
✓ 5	1	0	1
✓ 6	1	1	0
7	1	1	1
8	0	0	0

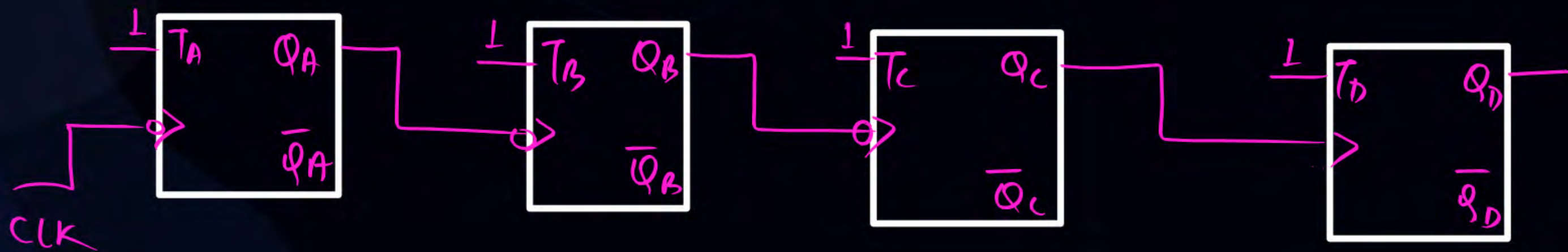
time/cjsir

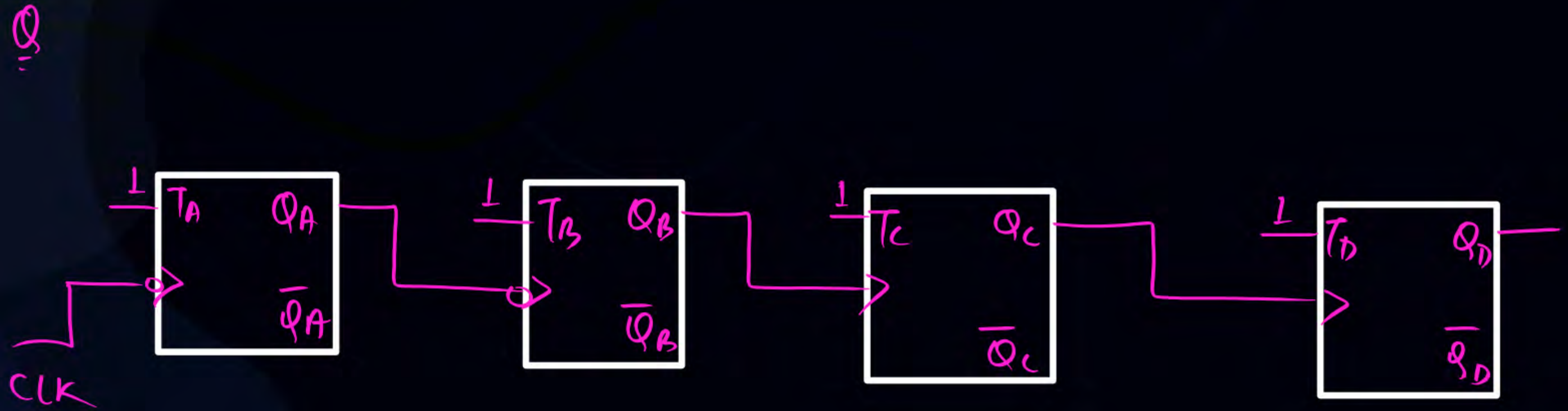
MOD-8 DOWN RIPPLE COUNTER

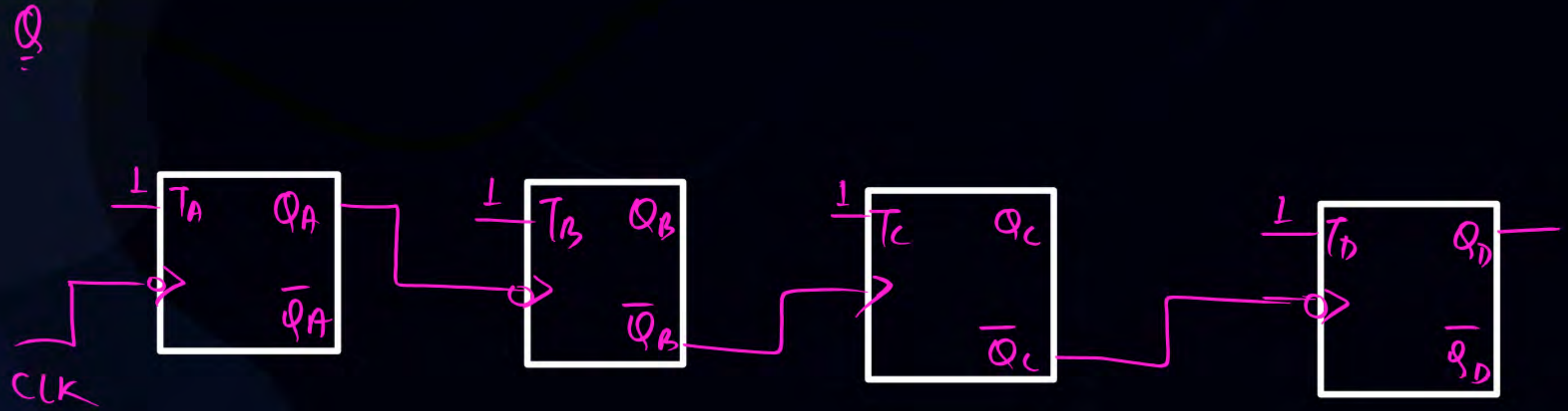


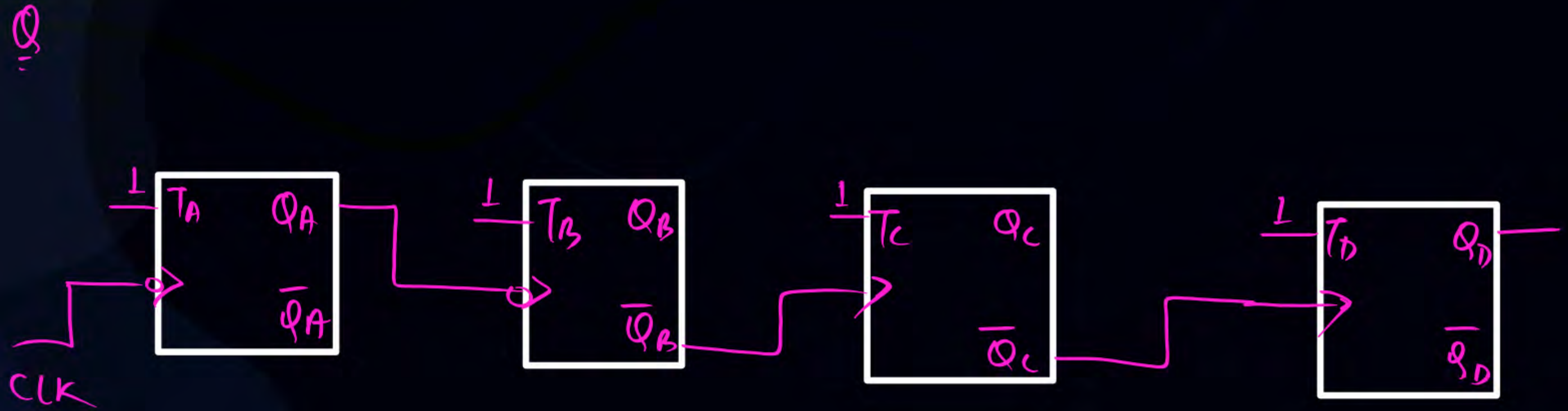
CLOCK	Q _C	Q _B	Q _A
0	0	0	0
1	1	1	1
2	1	1	0
3	1	0	1
4	1	0	0
5	0	1	1
6	0	1	0
7	0	0	1
8	0	0	0

Q









Thank you

GW
Soldiers !

