ASSIGNMENT 9

[Design a **4-BIT UP/DOWN RIPPLE COUNTER**]

NAME: ROHIT SADHU

ROLL NO.: 002010501074

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Objective:- To design a 4-bit Ripple UP/DOWN counter.

Theory:- A Ripple counter is made by connecting the output of previous flip flop with the clock of the next flip flop.

We can also use a control line to control UP/DOWN.

For, 4-bit No. of states = $2^n = 2^4 = 16$

Hence Maximum count = 16 - 1 = 15 (0 to 15 - UP)

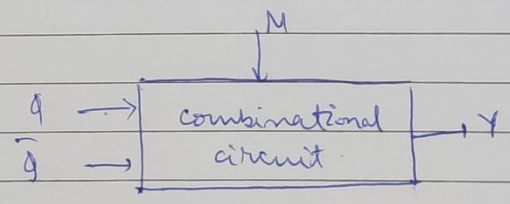
(15 to 0 - DOWN)

No. of FF's req = 4. (4-bit)

Excitation Table For T-FF :-

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

For UP/DOWN we use,



M = 0, for UP $\Rightarrow Y = q$

M = 1, for DOWN $\Rightarrow Y = \bar{q}$

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Truth Table :-

M	q	$\bar{q}$	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

K-map :-

M \ $q\bar{q}$	00	01	11	10
0	0	0	1	1
1	0	1	1	0

$$Y = M\bar{q} + \bar{M}q$$

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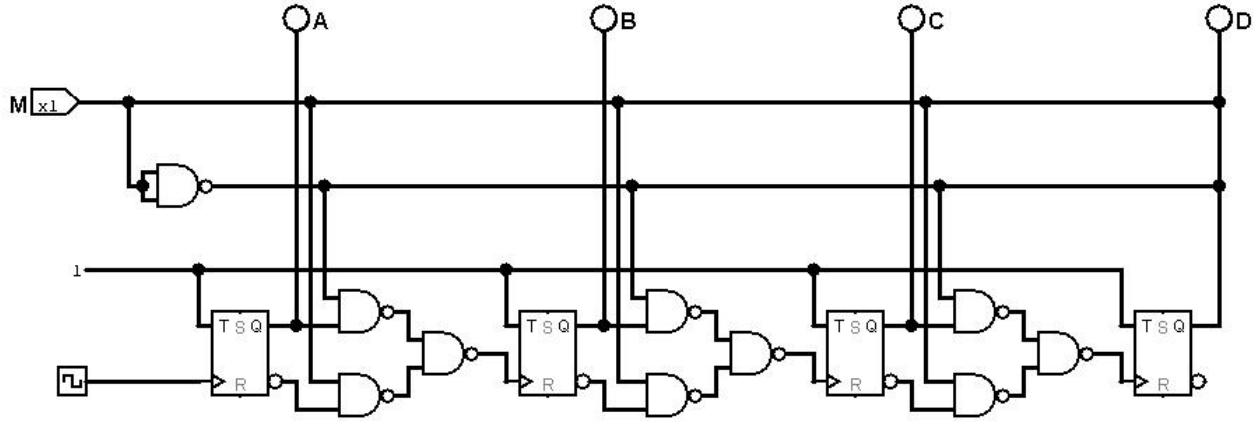
CIRCUIT DIAGRAM:

UP/DOWN RIPPLE COUNTER:



T – FF: