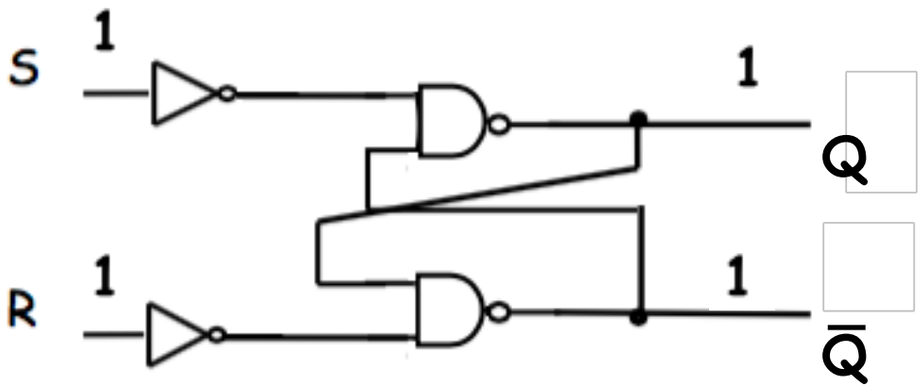
CL=CSCI 160

CLASS 20

HW 19 Evaluate the following flip-flop, by giving its truth table.



Solution

Truth table:

S	R	Q	$\bar{Q}$
0	0	PS = 0 -->stays 0 PS = 1 -->stays 1 } PS	PS
0	1	0	1
1	0	1	0
1	1	1	1

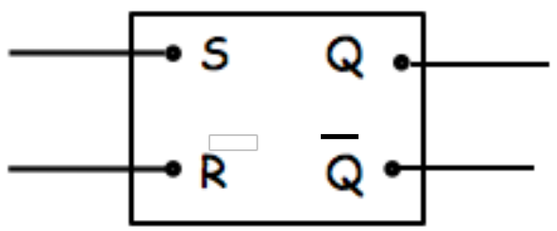
Not allowed !

Exclude the 1-1 input for S–R Flip-Flop, as we cannot have $Q = \bar{Q}$

The **truth table** then becomes:

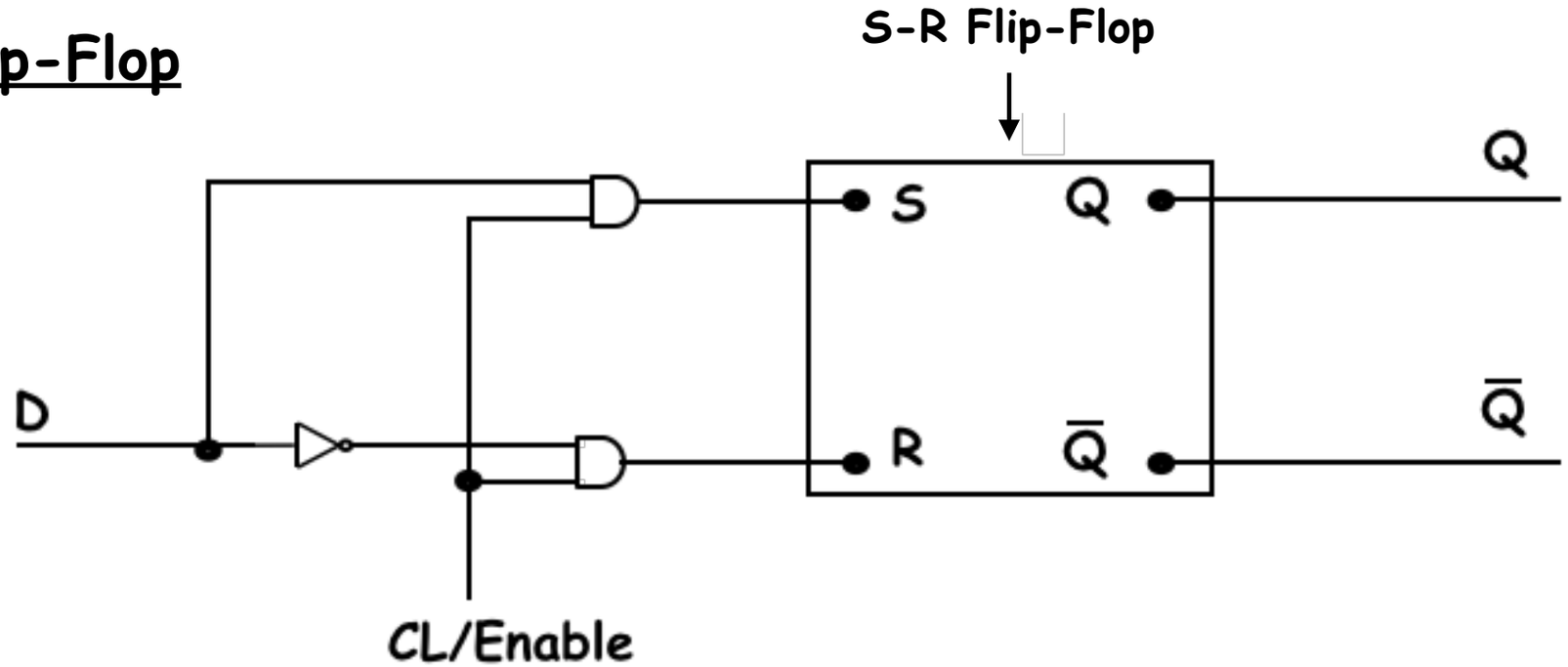
S	R	Q
0	0	PS
0	1	0
1	0	1

From now on the S-R Flip-Flop will be represented by:



Various Flip-Flops

D Flip-Flop



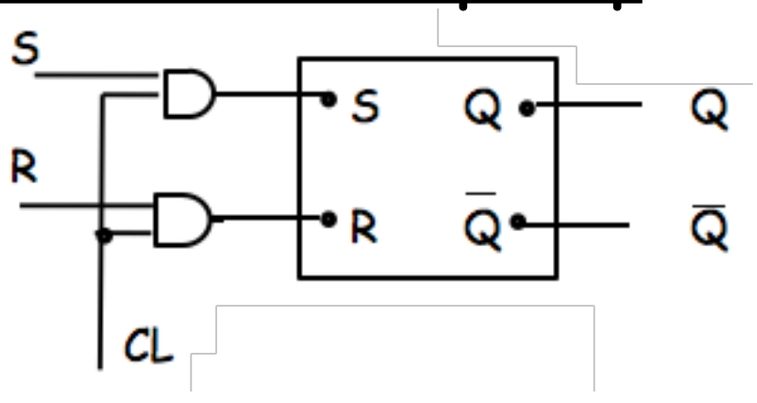
Note: CL/Enable acts as controller. Looking at the CL/Enable values, which inputs are allowed in the S-R flip-flop? S=D, and R=D', for CL=1, and S=R=0, for CL=0.

The Problem Input 1-1 is avoided!

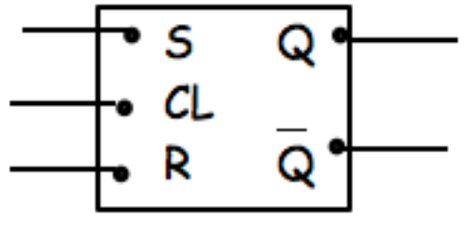
Truth table:

CL/Enable	Q
0	PS
1	D

Clocked S-R Flip-Flop



represented by:

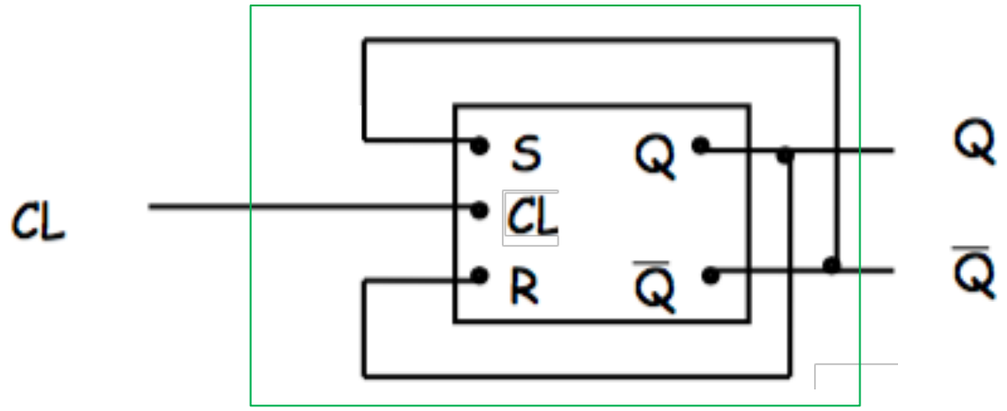


Note: Here input 1-1 is avoided only if S = $\bar{R}$, which is usually the case.

Truth table:

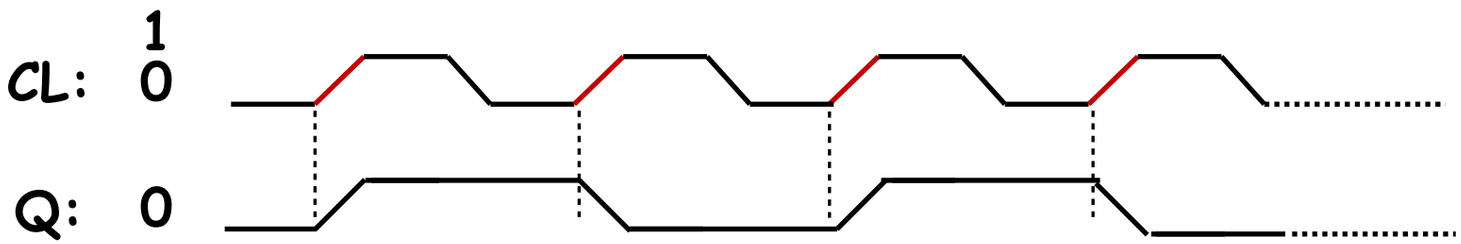
CL	Q
0	PS
1	S

T Flip-Flop



We will represent the input, namely CL, as a diagram, time being one of the coordinates, and {0, 1} the other.

We want to give the corresponding diagram for the output Q. We initialize CL = 0, and Q = 0.



Note:

It is the rising edge (red) of the CL that acts as a 1-input to the CL-S-R flip-flop.
Outside the rising edges CL acts as a 0-input to the CL-S-R flip-flop.
That is, input CL will only enable the S-R flip-flop during the rising edges of CL.

We exaggerated the duration of the rising edge (red) of the CL to show its importance.

Conclusion:

The Q signal oscillates at a speed that is 2 x slower than the CL input.

HW: Start Review for Part II.