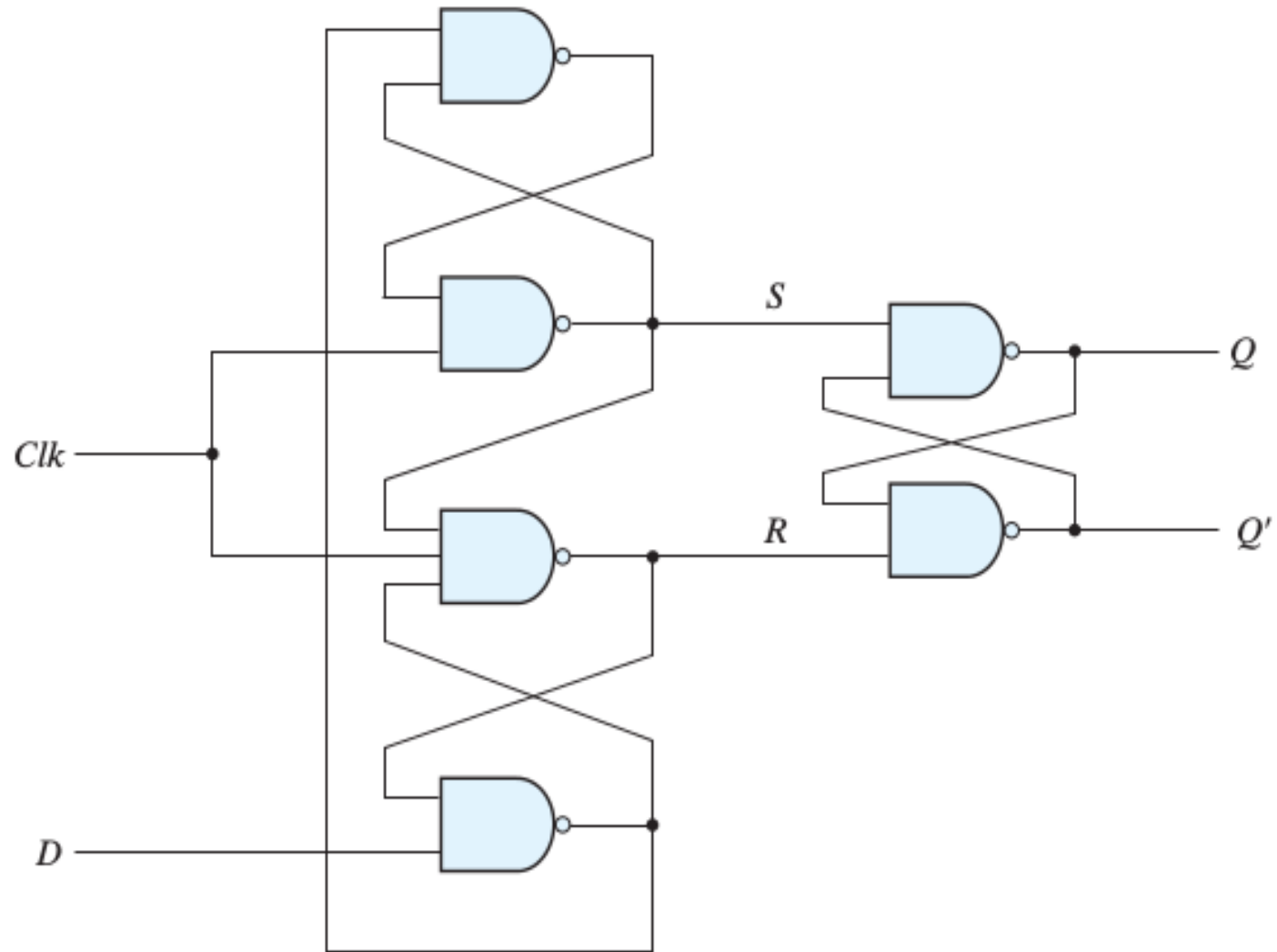# D- Type positive edge triggered flip flop

D- Type positive edge triggered flip flop

Explanation:

● Two latches respond to the external D (data) and Clk (clock) inputs.

● The third latch provides the outputs for the flip-flop.

● *CASE 1:* The S and R inputs of the output latch are maintained at the logic-1 level

   – when Clk = 0.

   – This causes the output to remain in its present state. Input D may be equal to 0 or 1.

.*CASE 2:* If D = 0 when Clk becomes 1(0 to 1 transition), R changes to 0.

- This causes the flip-flop to go to the reset state, making Q = 0. hence Q' = 1

- If there is a change in the D input while Clk = 1, terminal R remains at 0 because Q is 0. Thus, the flip-flop is locked out and is unresponsive to further changes in the input.

.*CASE 3 :* When the clock returns to 0 (From 1 to 0), R goes to 1,placing the output latch in the quiescent condition with out changing the output.

.*CASE 4:* Similarly, if D = 1 when Clk goes from 0 to 1

- S changes to 0 (because R is 1 from prev case , hence the bottom latch with D input will have output as 0 \, then this 0 is input for top latch which gives output 1. This 1 is feedback and clk 1 input gives S = 0.

- This causes the circuit to go to the set state,

- In sum, when the input clock in the positive-edge-triggered flip-flop makes a positive transition, the value of D is transferred to Q .

- A negative transition of the clock (i.e., from 1 to 0) does not affect the output, nor is the output affected by changes in D when Clk is in the steady logic-1 level or the logic-0 level.

- Hence, this type of flip-flop responds to the transition from 0 to 1 and nothing else.
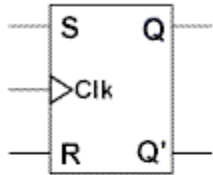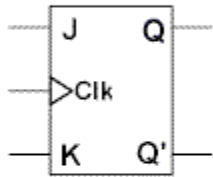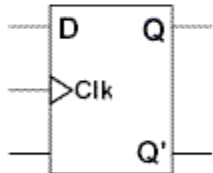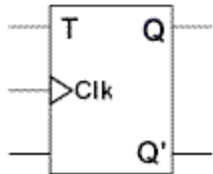
•*SETUP Time:*

– Minimum time called the setup time during which the D input must be maintained at a constant value prior to the occurrence of the clock transition

•*HOLD Time:*

– Minimum time during which the D input must not change after the application of the positive transition of the clock.

•*Propagation delay:*

– Propogation delay time of the flip-flop is defined as the intervalbetween the trigger edge and the stabilization of the output to a new state

FLIP-FLOP NAME	FLIP-FLOP SYMBOL	CHARACTERISTIC TABLE			CHARACTERISTIC EQUATION	EXCITATION TABLE			
SR		**S**	**R**	**Q(next)**	$Q_{(next)} = S + R'Q$ $SR = 0$	**Q**	**Q(next)**	**S**	**R**
		0	0	Q		0	0	0	X
		0	1	0		0	1	1	0
		1	0	1		1	0	0	1
		1	1	?		1	1	X	0
JK		**J**	**K**	**Q(next)**	$Q_{(next)} = JQ' + K'Q$	**Q**	**Q(next)**	**J**	**K**
		0	0	Q		0	0	0	X
		0	1	0		0	1	1	X
		1	0	1		1	0	X	1
		1	1	Q'		1	1	X	0
D		**D**		**Q(next)**	$Q_{(next)} = D$	**Q**	**Q(next)**	**D**	
		0		0		0	0	0	
		1		1		0	1	1	
						1	0	0	
						1	1	1	
T		**T**		**Q(next)**	$Q_{(next)} = TQ' + T'Q$	**Q**	**Q(next)**	**T**	
		0		Q		0	0	0	
		1		Q'		0	1	1	
						1	0	1	
						1	1	0	