

# CS & IT ENGINEERING



## DIGITAL LOGIC

(Sequential Circuit)

JK,D, T Flip Flop and Designing of Flip flop

### Lecture No. 2



By- CHANDAN SIR

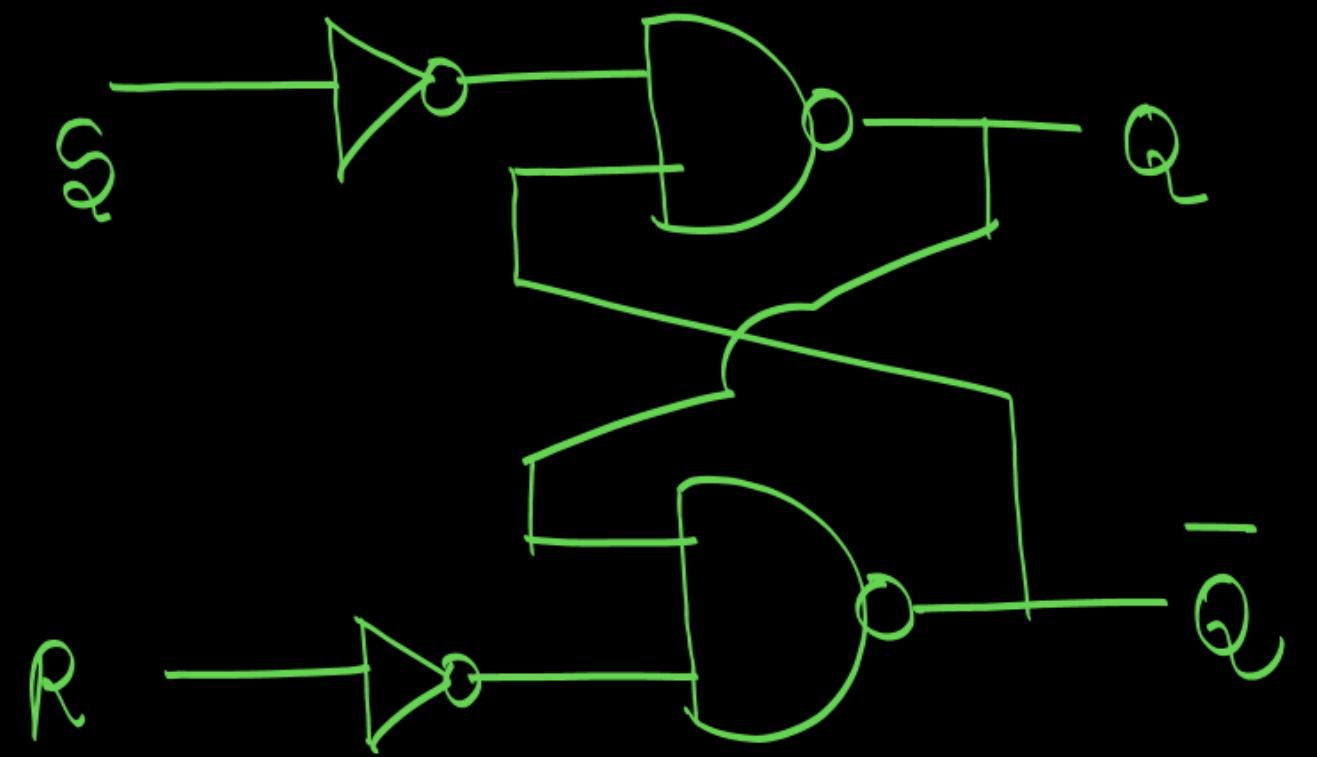
## TOPICS TO BE COVERED

01 JK,D, T Flip Flop

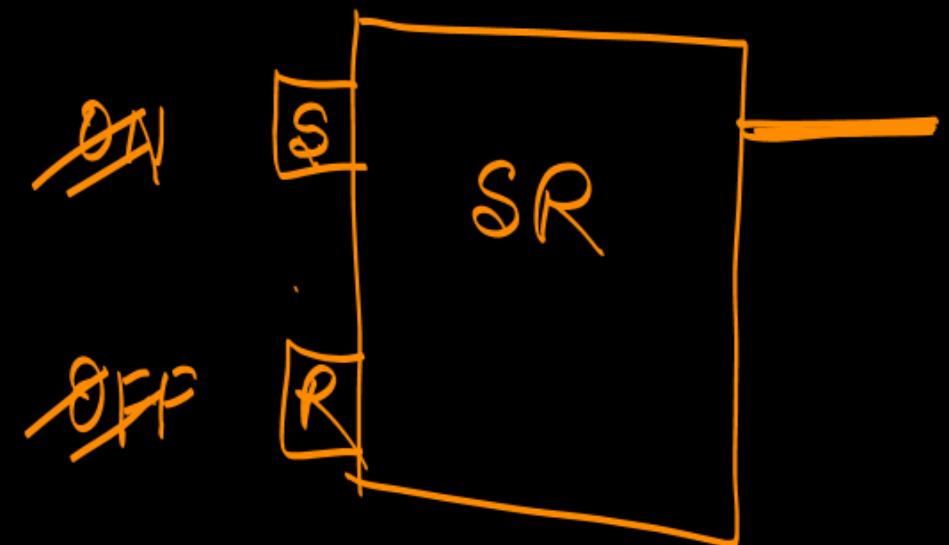
02 DESIGNING of Flip Flop

03 Discussion

## S-R latch

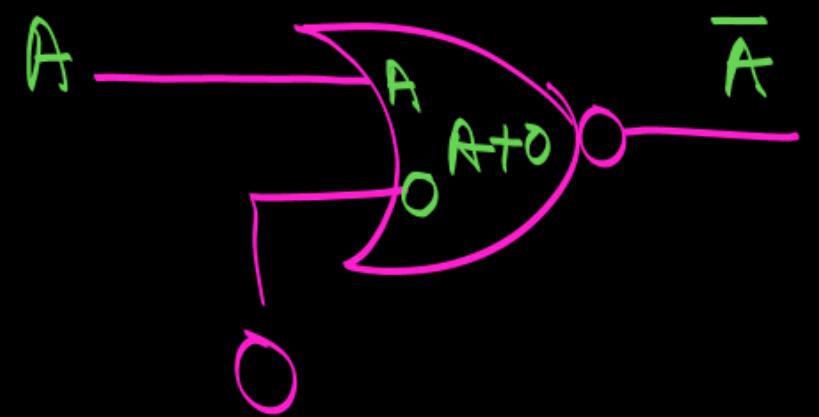
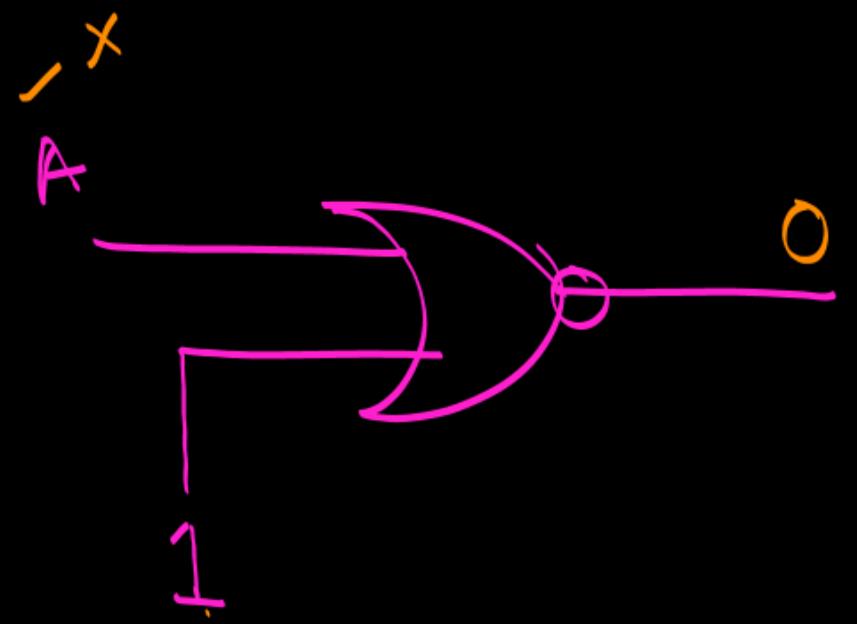


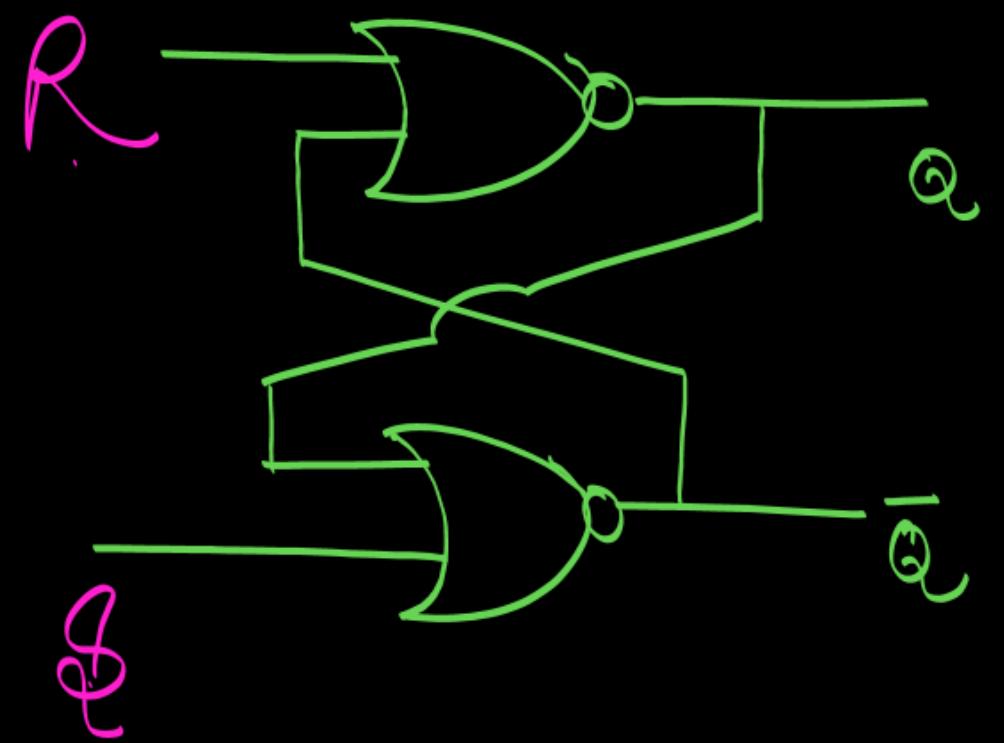
$S$	$R$	$Q$	$\bar{Q}$
0	0	Q	$\bar{Q}$ (HOLD)
0	1	0	1 (Reset)
1	0	1	0 (Set)
1	1	1	1 (Invalid)



SR

S	R	Q
0	0	Q
0	1	Q
1	0	Q
1	1	X





SR latch by using

NOR GATE

R	S	Q	$\bar{Q}$	NOTE
R	S	Q	$\bar{Q}$	NOTE
0	0	0	1	HOLD
0	1	1	0	
1	0	0	1	
1	1	0	0	X (Invalid)

(Invalid)

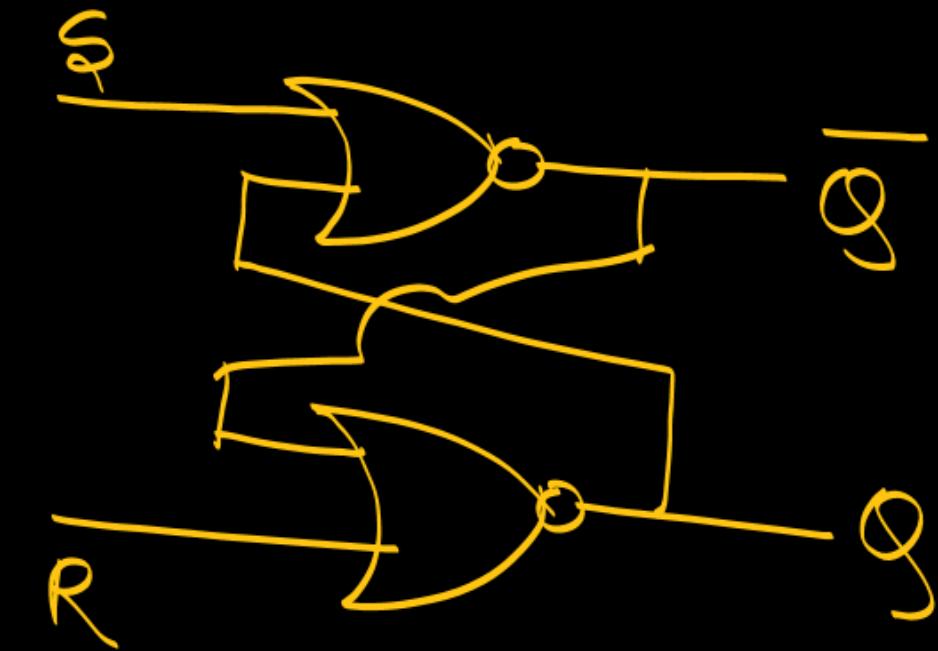
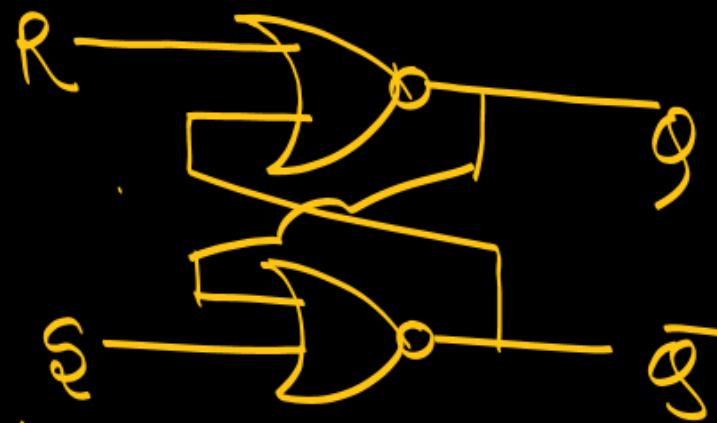
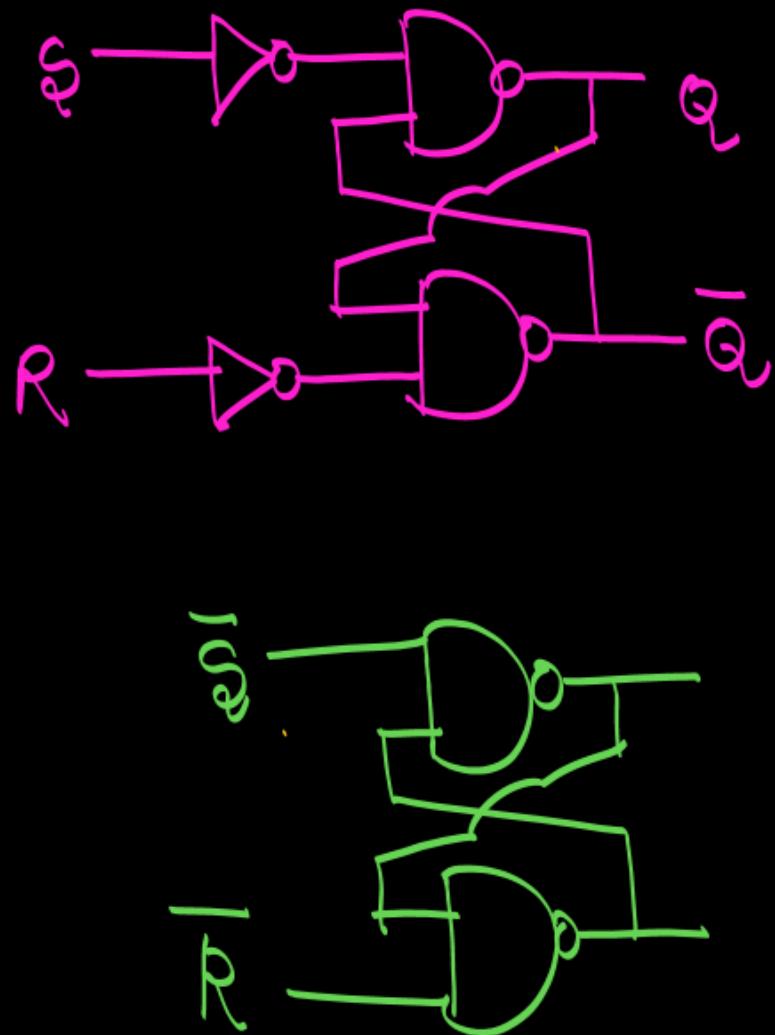
forbidden

don't care

Time [ ]

A	B	y
0	0	1
0	1	0
1	0	0
1	1	0

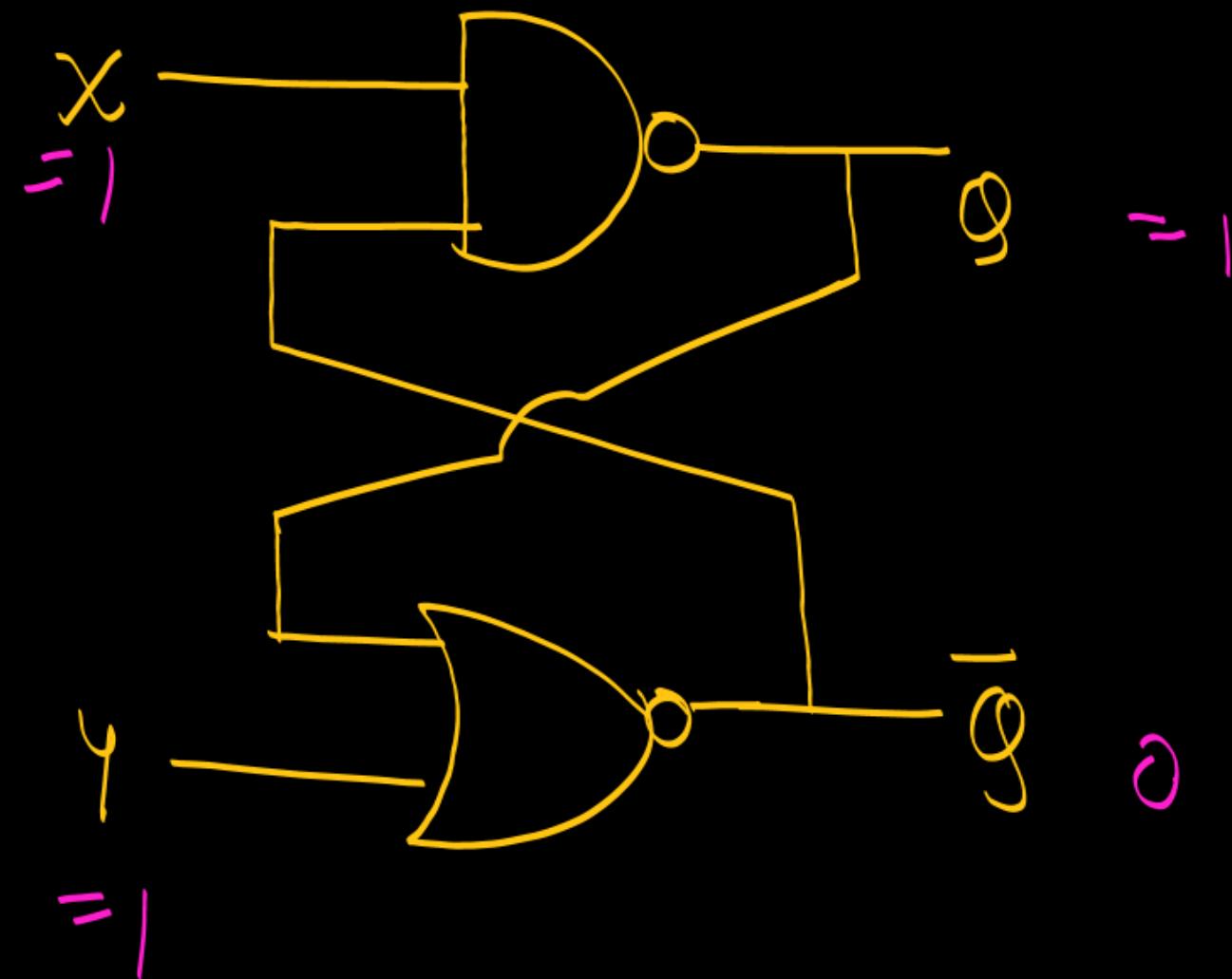
## S-R latch



Hand-drawn truth table for an S-R latch. The table shows the state transitions based on the inputs S and R. The columns are labeled S, R, and Q. The rows show the states (0, 0), (0, 1), (1, 0), and (1, 1). The output Q is green and Q̄ is red. An arrow points from the Q̄ column to the fourth row.

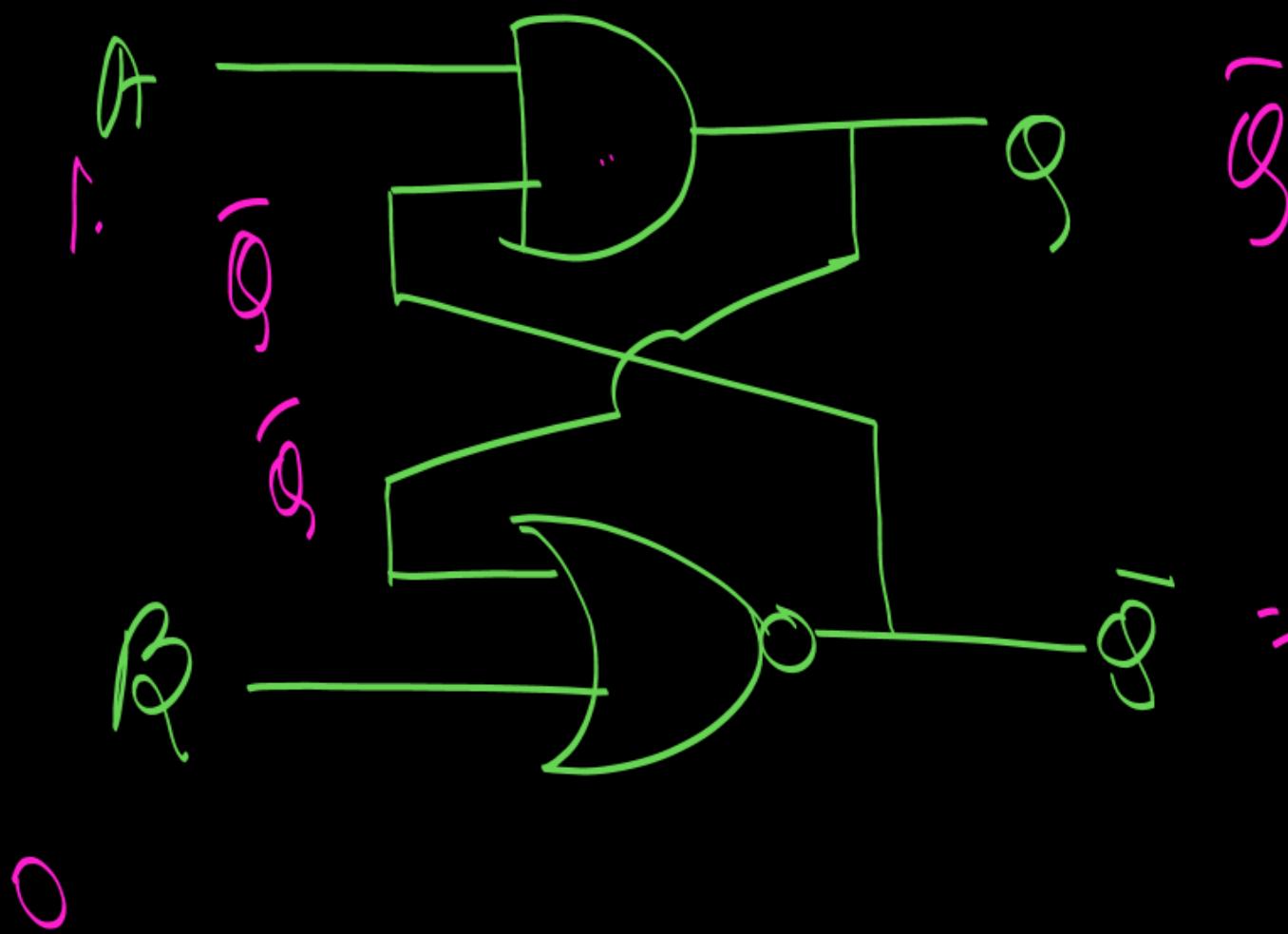
S	R	Q
0	0	0
0	1	0
1	0	1
1	1	X

## X-Y latch



$X$	$Y$	$Q$	$\bar{Q}$	Remark
0	0	1	0	
0	1	1	0	
1	0	0	1	
1	1	1	0	

A · B latch



A	B	Q	$\bar{Q}$	
0	0	0	1	
0	1	0	0	(X)
1	0	$\bar{Q}$	Q	(Toggle)
1	1	0	0	(X)

$$I = \begin{array}{c} \text{Dashed box: } \\ \begin{array}{c} \text{Input } x \rightarrow \text{ AND gate} \\ \text{Output } \bar{Q} \rightarrow \text{ NOT gate} \\ \text{Output } Q = Q \end{array} \end{array}$$

$$I = \begin{array}{c} \text{Dashed box: } \\ \begin{array}{c} \text{Input } \bar{Q} \rightarrow \text{ NOT gate} \\ \text{Output } Q \rightarrow \text{ AND gate} \\ \text{Output } \bar{Q} = \bar{Q} \end{array} \end{array}$$

$$Q \oplus I = \bar{Q}$$

$x$	$y$	$Q$	$\bar{Q}$
0	0	$\bar{Q}$	$Q$
0	1	$\bar{Q}$	$\bar{Q}$
1	0	$Q$	$Q$
1	1	$Q$	$\bar{Q}$

(Toggle)

. Hold

$$Q \oplus Q = 0$$

$$Q \oplus 0 = Q$$

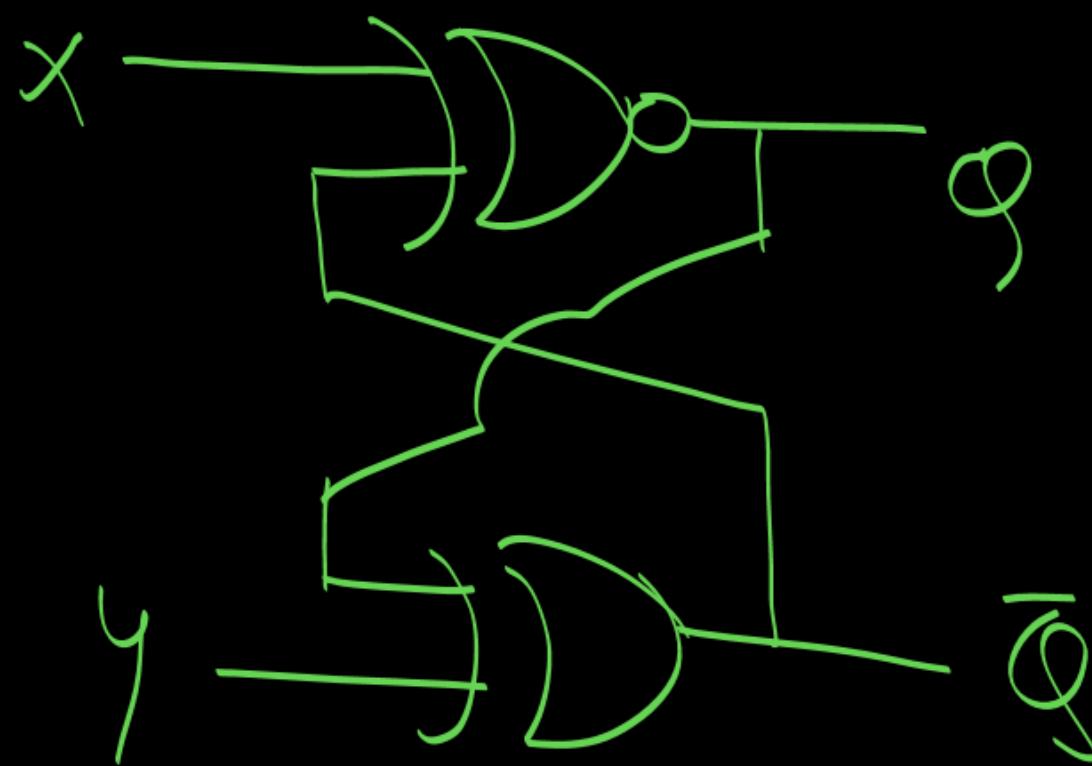
$$Q \oplus \bar{Q} = 1$$

$$Q \oplus 1 = \bar{Q}$$

$$\bar{Q} \oplus 0 = \bar{Q}$$

$$\bar{Q} \oplus 1 = Q$$

$\mathcal{P}_1$



flow

