



INDRAPRASTHA INSTITUTE *of*  
INFORMATION TECHNOLOGY  
DELHI

Department  
of  
Electronics & Communication Engineering

ECE111|Digital Circuits

**Dr. G.S. Visweswaran**

Lab\_7:  
Latches

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## Part A. NOR Latch

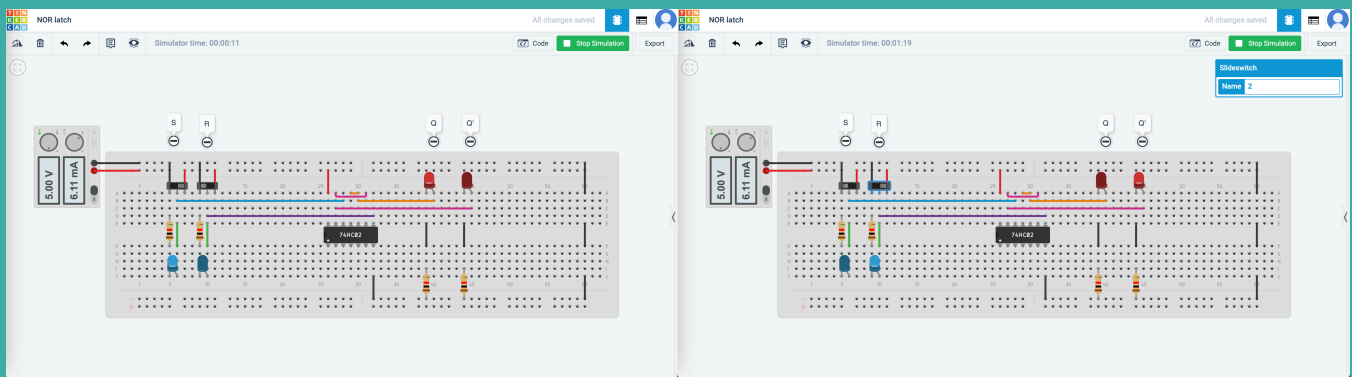
Aim: Implement a NOR Latch in Tinkercad and verify its operation.

Components/ICs Used: Breadboard, Red LED, 1 k $\Omega$  Resistor, [5,5 Power Supply], Wire, slideswitch, quad 2 input NOR IC(74HC02)

Link of TINKERCAD Workspace: <https://www.tinkercad.com/things/4tcGFkewHil>

Link of single workspace: <https://www.tinkercad.com/things/377WEAm6Q1n>(this was hanging in my system so I made separate also)

Circuit Diagram:



Characteristic Table:

S	R	$Q_{n+1}$
0	0	$Q_n$
0	1	0
1	0	1
1	1	Undefined

Transition Table:

S	R	Present	Next
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	X
1	1	1	X

Characteristic equation:

		R Q <sub>n</sub>			
		0 0	0 1	1 1	1 0
S	0	0	1	0	0
	1	1	1	X	X

$$Q_{n+1} = S + R' Q_n$$

Excitation table:

Q <sub>n</sub>	Q <sub>n+1</sub>	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

Observations/Results: The following values for Q and Q' are obtained for values of SR

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

Applications of the experiment:

- Latches are single bit storage elements which are widely used in computing as well as data storage.
- Latches are used in the circuits like power gating & clock as a storage device.

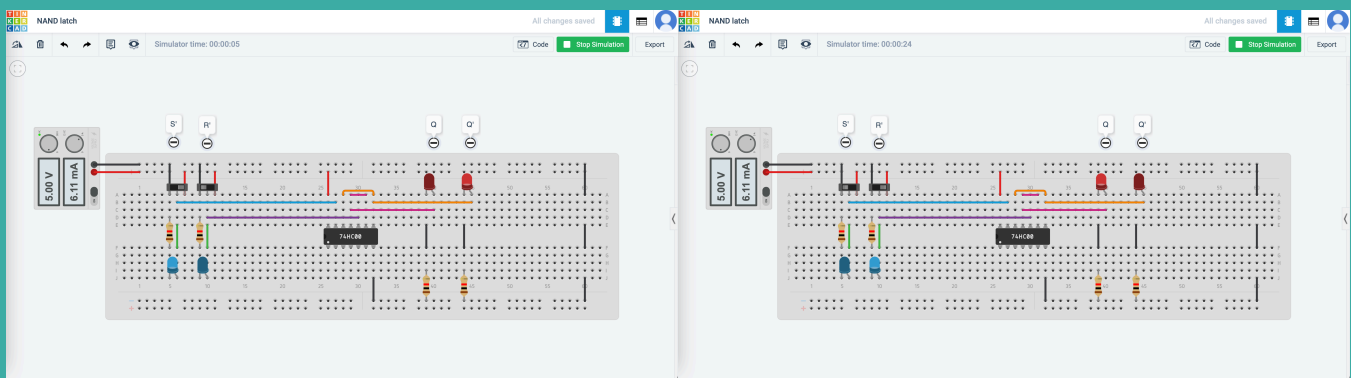
## Part B. NAND Latch

Aim: Implement a NAND Latch in Tinkercad and verify its operation.

Components/ICs Used: Breadboard, Red LED, 1 k $\Omega$  Resistor, [5,5 Power Supply], Wire, slideswitch, quad 2 input NAND IC(74HC00)

Link of TINKERCAD Workspace: <https://www.tinkercad.com/things/h36tCo3ds0K>

Circuit Diagram:



Characteristic Table:

S'	R'	$Q_{n+1}$
1	1	$Q_n$
1	0	0
0	1	1
0	0	Undefined

Transition Table:

S'	R'	Present	Next
1	1	0	0
1	1	1	1
1	0	0	0
1	0	1	0
0	1	0	1
0	1	1	1
0	0	0	X
0	0	1	X

Characteristic equation:

		R' Q <sub>n</sub>			
		0 0	0 1	1 1	1 0
S'	0	X	X	1	1
	1	0	0	1	0

$$Q_{n+1} = S + R' Q_n$$

Excitation table:

Q <sub>n</sub>	Q <sub>n+1</sub>	S'	R'
0	0	1	X
0	1	0	1
1	0	1	0
1	1	X	1

Observations/Results: The following values for Q and Q' are obtained for values of S' R'

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

Applications of the experiment:

- Generally, latches are used to keep the conditions of the bits to encode binary numbers
- Latches are single bit storage elements which are widely used in computing as well as data storage.