INDRAPRASTHA INSTITUTE *of* INFORMATION TECHNOLOGY DELHI

Department
of
Electronics & Communication Engineering

ECE111|Digital Circuits
Section: A

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Lab_7:

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1) Aim:

To make S/R Latches using cross-coupled:
- A) NOR Gates
- B) NAND Gates

2) Components/ICs Used:

- A. Power Supply
- B. Wires
- C. Resistors
- D. LEDs
- E. Quad NAND Gate IC
- F. Quad NOR Gate IC
- G. Hex Inverter
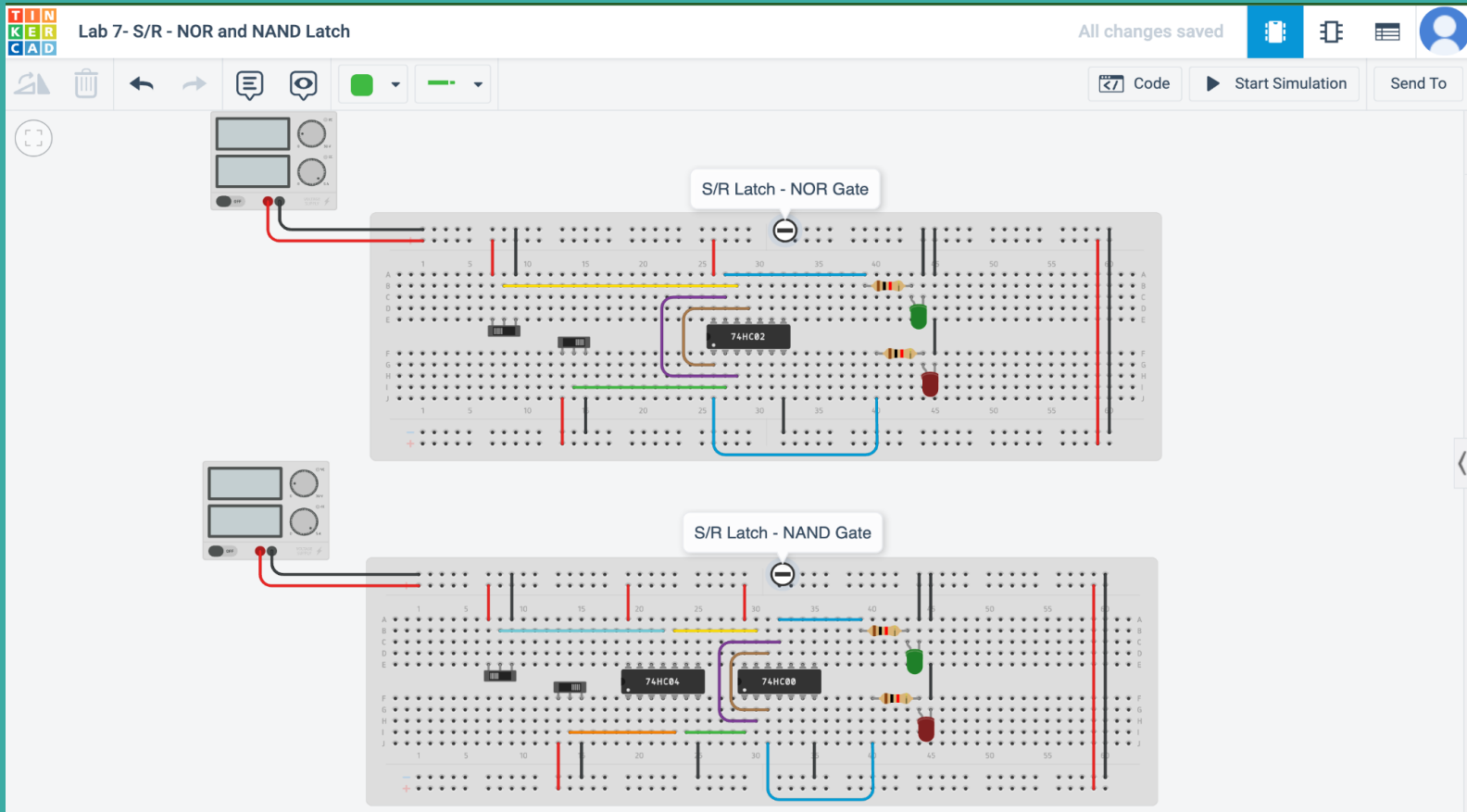- H. Breadboard
- I. Slideswitches

3) Link of TinkerCad Workspace:

- https://www.tinkercad.com/things/huMobZFmofw-lab-7-sr-nor-and-nand-latch/editel?sharecode=Si9H7jop_zEVOetPCYblpITPKRsiuRrzheyGeF1yCg4

4) Pin Diagram of ICs Used:
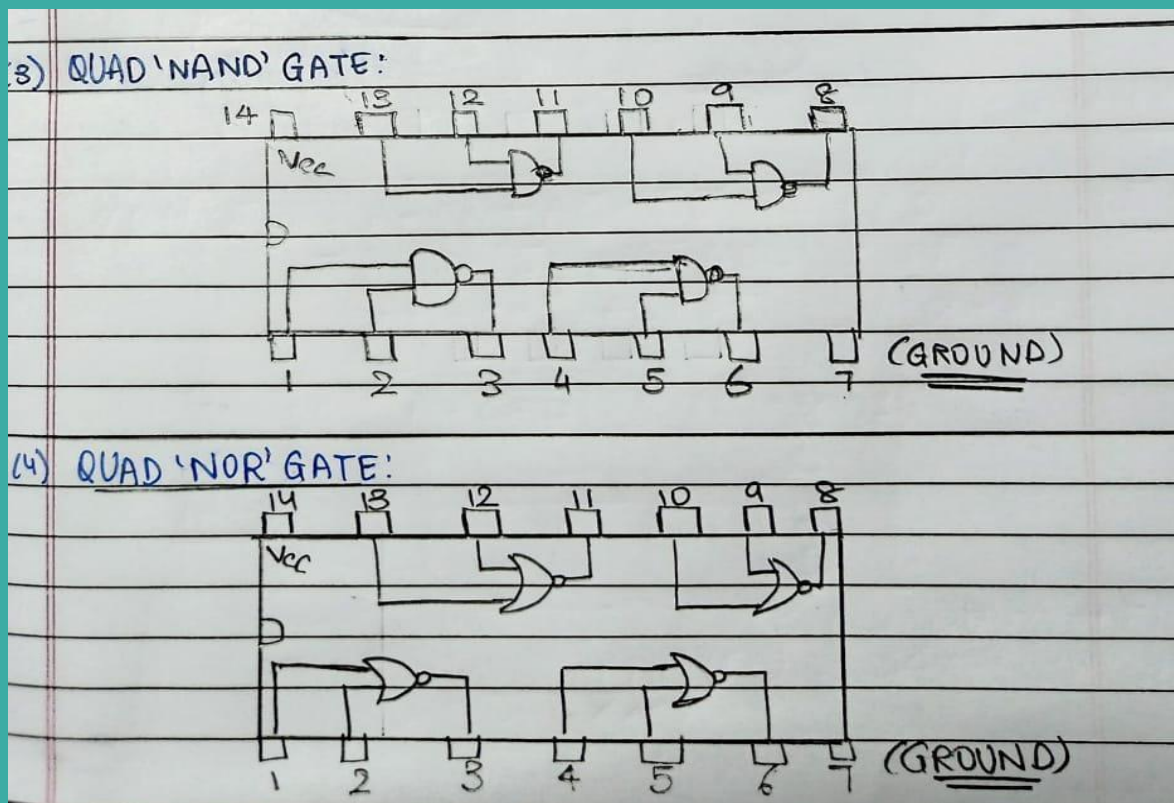
5) Screenshot of TinkerCad Workspace:

6) Characteristic Equation, Characteristic Table and Excitation Table:
A. S/R - NOR Latch:
1. Characteristic Equation:

$$Q(n+1) = (S + Q(n)).R'$$

2. Characteristic Table:

S	R	Q	Q'	State
0	0	Previous	Previous	Memory
0	1	0	1	Reset
1	0	1	0	Set

1	1	?	?	Forbidden

3. Excitation Table:

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	1	0
1	0	1	0
1	1	0	0
0	0	1	0

B. S/R - NAND Latch:
1. Characteristic Equation:

$$Q(n+1) = (S + Q(n)).R'$$

2. Characteristic Table:

S'	R'	Q	Q'	State
0	0	?	?	Forbidden

0	1	1	0	Set
1	0	0	1	Reset
1	1	Previous	Previous	Memory

3. **Excitation Table:**

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	1	0
0	1	1	0
0	0	1	1
1	1	1	0

7) **Observations/Results:**

We observed the functioning of a S/R Latch which is a memory element and we implemented it first using a NOR Gate and then using a NAND Gate, both of which were cross-coupled.

8) Applications:

A. As a S/R Latch is a single bit memory storage element, it can be used as a storage device in power gating circuits and in clocks.
B. Latches are used to keep the conditions of bits in order to encode binary numbers.
C. Used in synchronous two-phase systems to reduce the transit count.