

# Objectives

- To study basic logic gates
- To verify the truth table of logic gates using Gate Integrated Circuits (ICs)

## Components and Apparatus

- Power Supply,
- Breadboard,
- Connecting Wires
- ICs  
7400, 7402, 7404, 7408, 7432, 7486,
- DIP Switch and LEDs.

## Theory

Logic gates are the basic building blocks of any digital system. It is an electronic circuit having one or more than one input and only one output. The relationship between the input and the output is based on a certain logic. Based on this, logic gates are named as AND gate, OR gate, NOT gate etc.

AND: Logic eqn.  $Y=A.B$ . The output of AND gate is true (1) when the inputs A and B are true.

OR: Lo eqn.  $Y=A+B$ . The output of OR gate is true when one of the inputs A and B or both the inputs are true. Transistor-Transistor Logic which uses two transistors, one configured to work as a switch and the other configured to work as an amplifier. The switching transistor is used in the input circuits, and the amplifier transistor is used in the output circuits. IC 74 series are the most popular logic family in integrated circuits.

- 7400 Quad two-input NAND gate (four NAND gates)

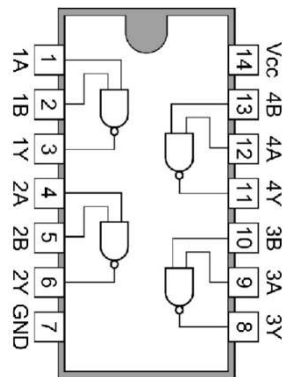


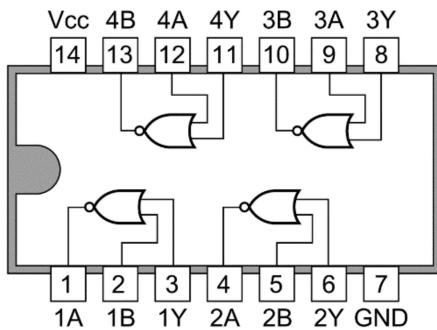
Figure 1:7400 IC

### TRUTH/FUNCTION TABLE

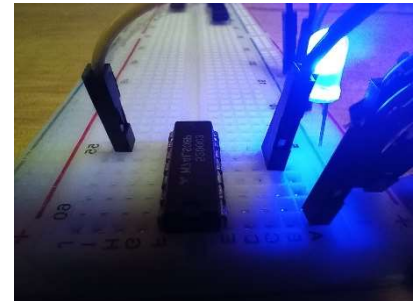
NAND		
A	B	$Y=\overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

- 7402 Quad two-input NOR gate (four NOR gates)

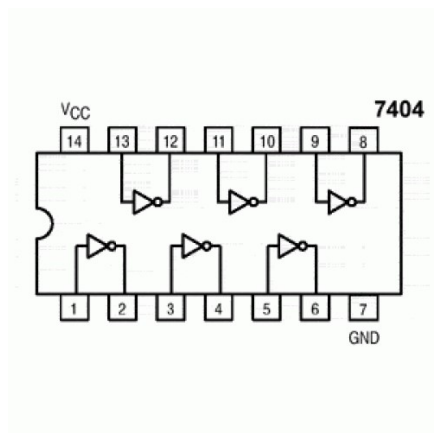
7402 Quad 2-input NOR Gates



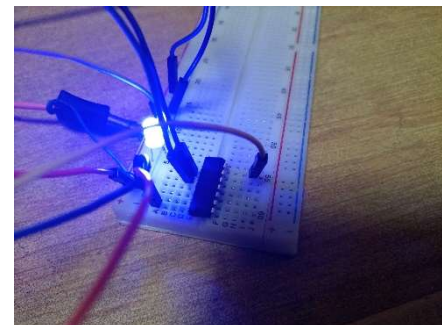
NOR		
A	B	$Y = \overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0



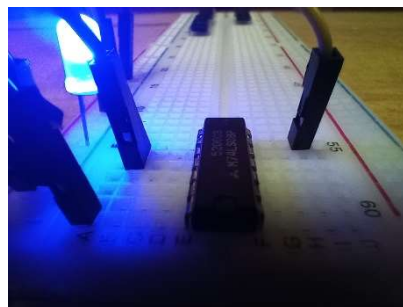
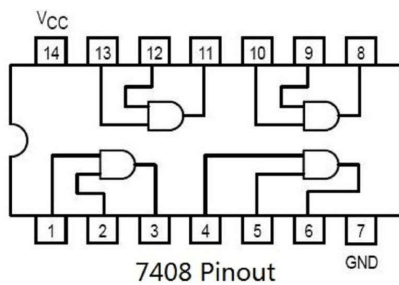
- 7404 Hex-inverter (six NOT gates)



NOT	
A	$Y = \overline{A}$
0	1
1	0

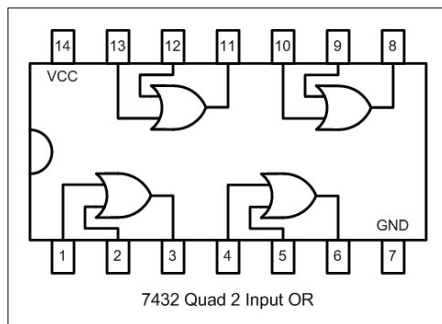


- 7408 Quad two-input AND gate (four AND gates)

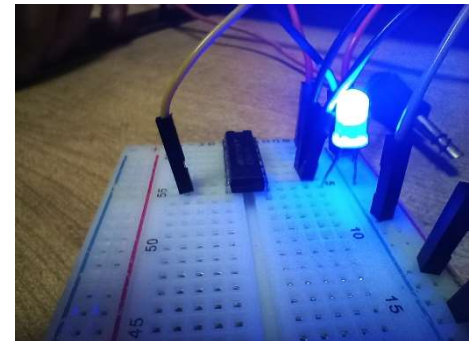


AND		
A	B	$Y = A.B$
0	0	0
0	1	0
1	0	0
1	1	1

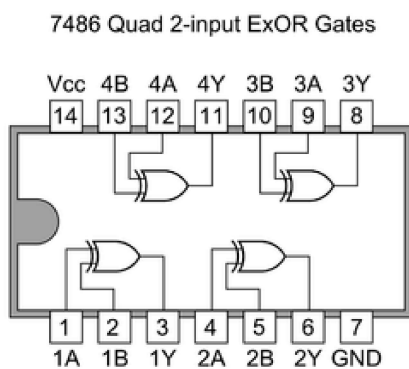
- 7432 Quad two-input OR gate (four OR gates)



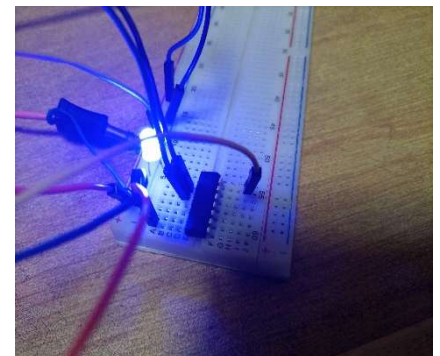
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1



- 7486 Quad two-input XOR gate (four XOR gates)



EX-OR		
A	B	$Y = \overline{A}B + A\overline{B}$
0	0	0
0	1	1
1	0	1
1	1	0



## Procedure

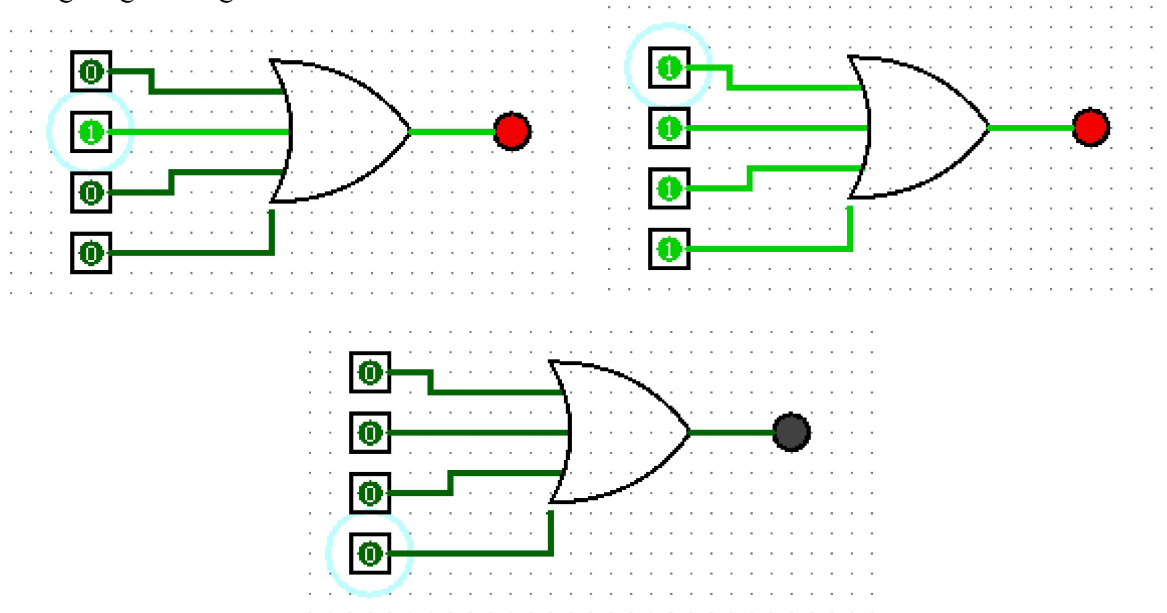
1. Biasing the ICs by connecting +V to the pin number 14 and ground to pin number 7.
2. Do the necessary connections
3. Give various combinations of inputs and note down the output with help of LED for all gates one by one.
4. Observe the output and verify the truth tables for all gates.

# Review Questions

1. A burglar alarm for a car has a normally LOW (grounded) switch on each of four doors. If any door is opened, the output of that switch goes HIGH. The alarm is set off with an activeLOW output. What type of gate will provide this logic?

Answer:

A 4-input **OR Logic Gate** will provide this logic. Since the output of OR logic gate remains low as long as all the inputs are low. If any or all of the input goes high, the output of OR gate goes High.



2. If more than two input AND & OR gates are available, how will you connect its inputs so that they work as two input gates? Perform it for three and four input AND & OR gates.

Case 1: 3-Input OR and AND Gate working as two input gates.

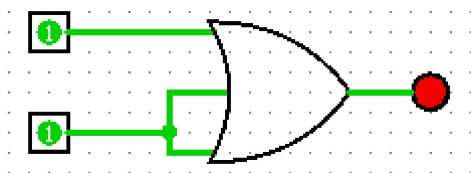


Figure : OR Gate

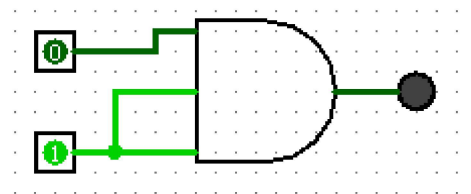
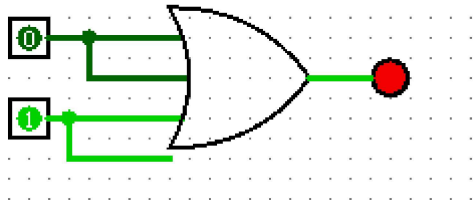
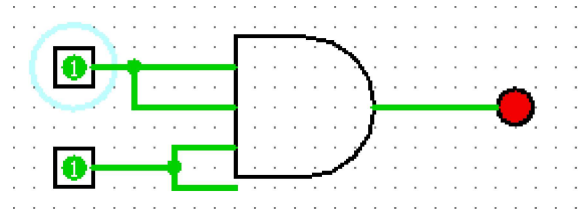


Figure : AND Gate

Case 2: 4-Input OR and AND Gate working as two input Gates



*Figure : OR Gate*



*Figure : AND Gate*

