UNIVERSITY OF ASIA PACIFIC

Department of Computer Science & Engineering

Course Title – Digital Logic & System Design Lab

Course Code – CSE 210

Experiment No. – 01

Experiment name – Analysing Digital Logic Gates.

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Problem Statement : Test and verify "Truth Table" Logic Expression, Logic Diagram and Circuit Diagram of logic gates: AND, OR, NOT, NOR, NAND and Exclusive OR(XOR).

Objective : The objective of the experiment is to analyse the Truth Table of logic gates and understand the circuit design of logic gates.

Apparatus :

- IC-7408(AND Gate)
- IC-7432(OR Gate)
- IC-7404(NOT Gate)
- IC-7400(NAND Gate)
- IC-7402(NOR Gate)
- IC-7486(XOR Gate)

Introduction :

A logic gate is an idealized model of computation or physical electronic devices implementing a "Boolean function", a "logical operation" performed on one or more binary inputs that produces a single binary output. In short "Logic Gates" are symbols that can directly replace an expression in "Boolean Arithmetic". Each one has a different shape to show its particular function. The basic 3 logic gates are AND, OR & NOT. And Compound Logic Gates are NOR, NAND, XOR(Exclusive OR), XNOR(Exclusive NOR).

- **AND Gate :** (More than one Input and only one Output) The output will be High/1 when all the input are High/1. Otherwise the output will be Low/0. We will use IC-7408 which is 2 input AND gate.

- **OR Gate :** (More than one Input and only one Output) The output will be Low/0 when all the input are Low/0. Otherwise the output will be High/1. We will use IC-7432 which is 2 input OR gate.

- **NOT Gate :** (Only one input and one output).The output will be opposite of input. The output is High/1 when the input is Low/0. And the output is Low/0 when the input is High/1. We will use IC-7404 which is a NOT logic gate.

- **NAND Gate :** (More than one Input and only one Output) The output will be Low/0 when all the input are High/1. Otherwise the output will be High/1. We will use IC-7400 which is 2 input NAND gate.

- **NOR Gate :** (More than one Input and only one Output) The output will be High/1 when all the input are Low/0. Otherwise the output will be Low/0. We will use IC-7402 which is 2 input NOR gate.

- **XOR Gate:** (For 2 Input and only one Output) The output will be High/1 when the inputs are different. Otherwise the output will be Low/0. We will use IC-7486 which is 2 input XOR gate.

Truth Table:

AND Gate

Input		**Output**
A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate

Input		**Output**
A	B	X
0	0	0
0	1	1
1	0	1
1	1	1

NOT Gate

Input	**Output**
0	1
1	0

NAND Gate

Input		**Output**
A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate

Input		**Output**
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

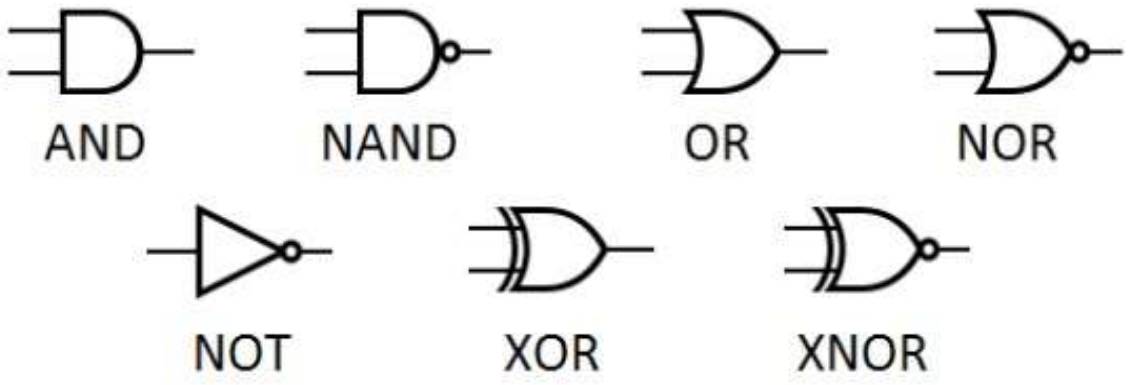
XOR Gate

Input		**Output**
A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

Logic Expressions :

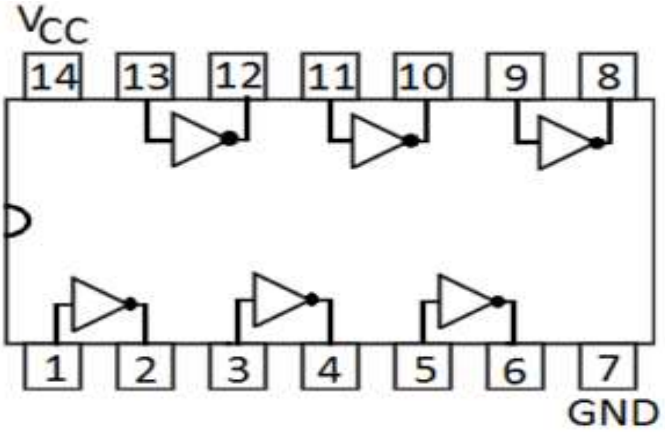
Logic Gate	Logic Expression
NOT	$X = \overline{A}$
AND	$X = A \cdot B$
OR	$X = A + B$
NAND	$X = \overline{A \cdot B}$
NOR	$X = \overline{A + B}$
XOR	$X = A \oplus B$

Logic Diagram :



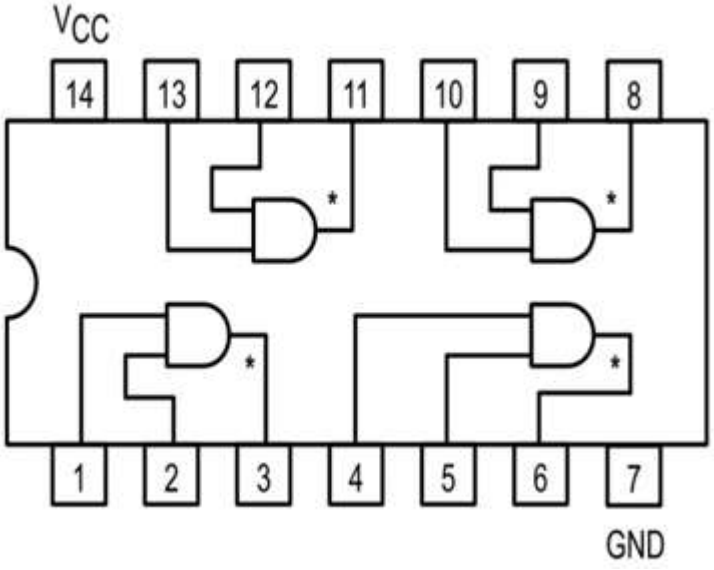
Pin Configuration

❖ **NOT Gate:**



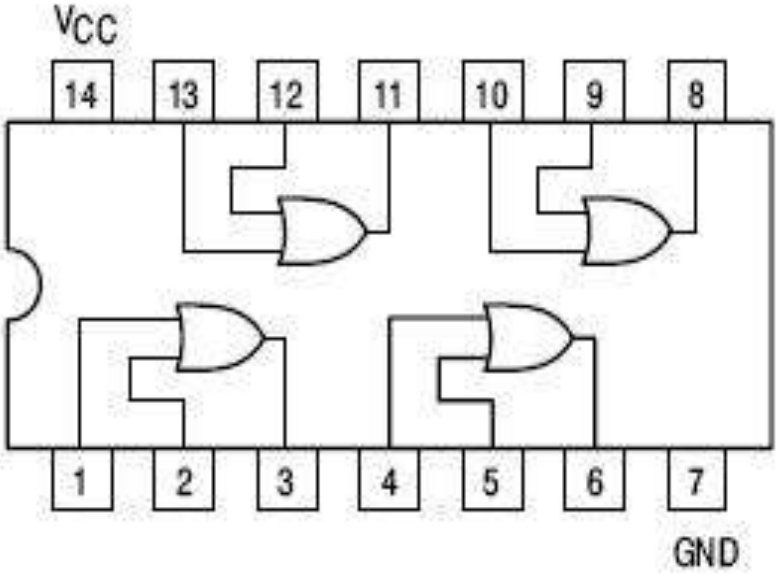
IC - 7404

❖ **AND Gate :**



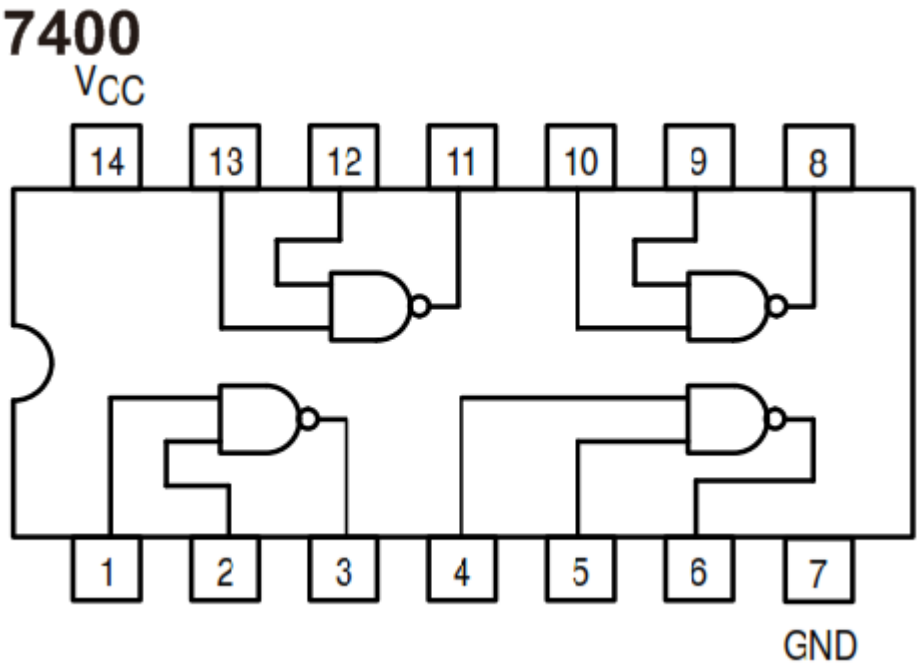
IC - 7408

❖ **OR Gate :**



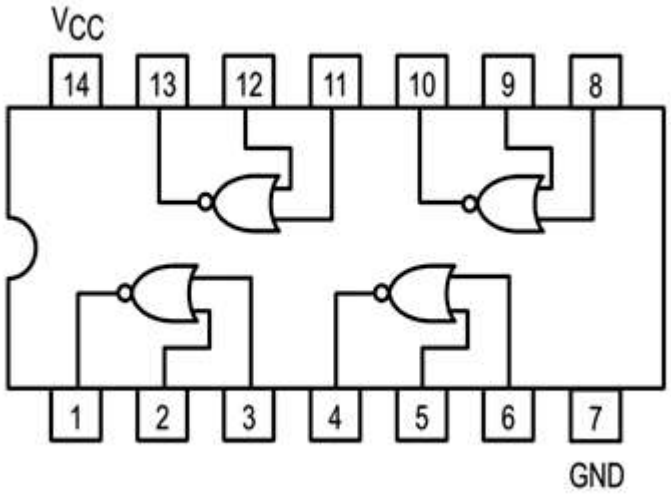
IC - 7432

❖ **NAND Gate :**



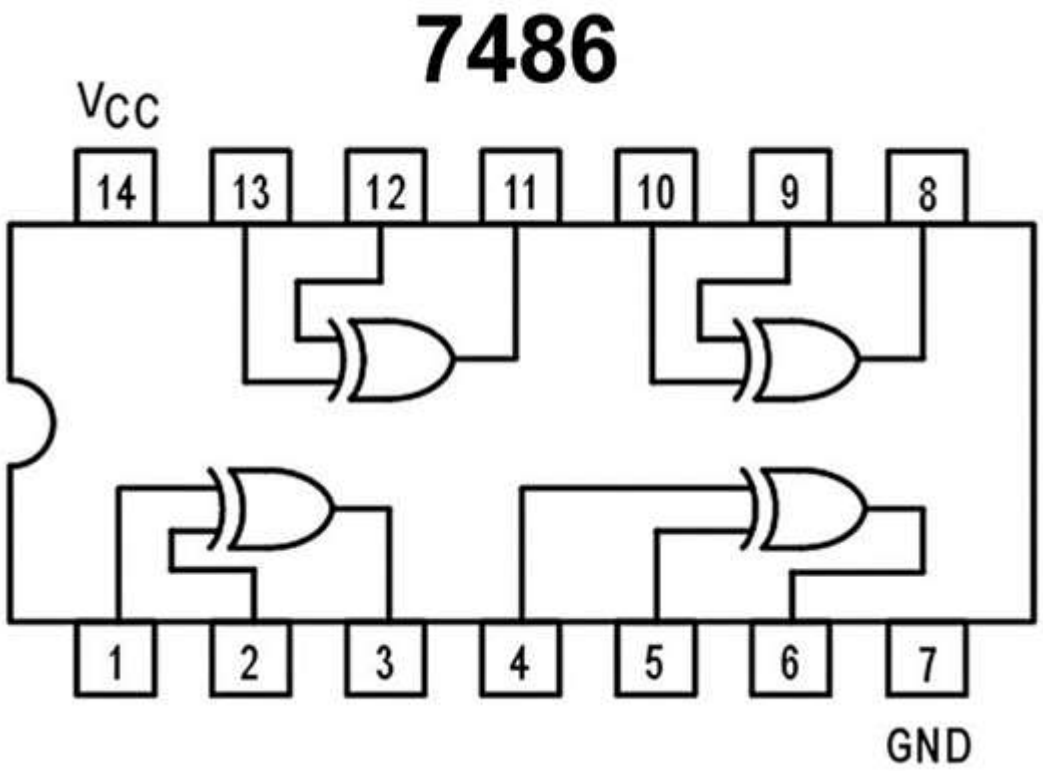
IC – 7400

❖ **NOR Gate :**



IC - 7402

❖ **XOR Gate :**

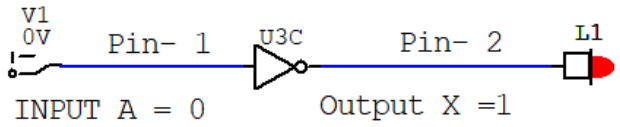


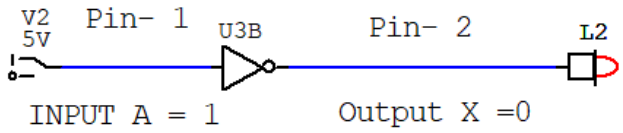
IC – 7486

Circuit Diagram

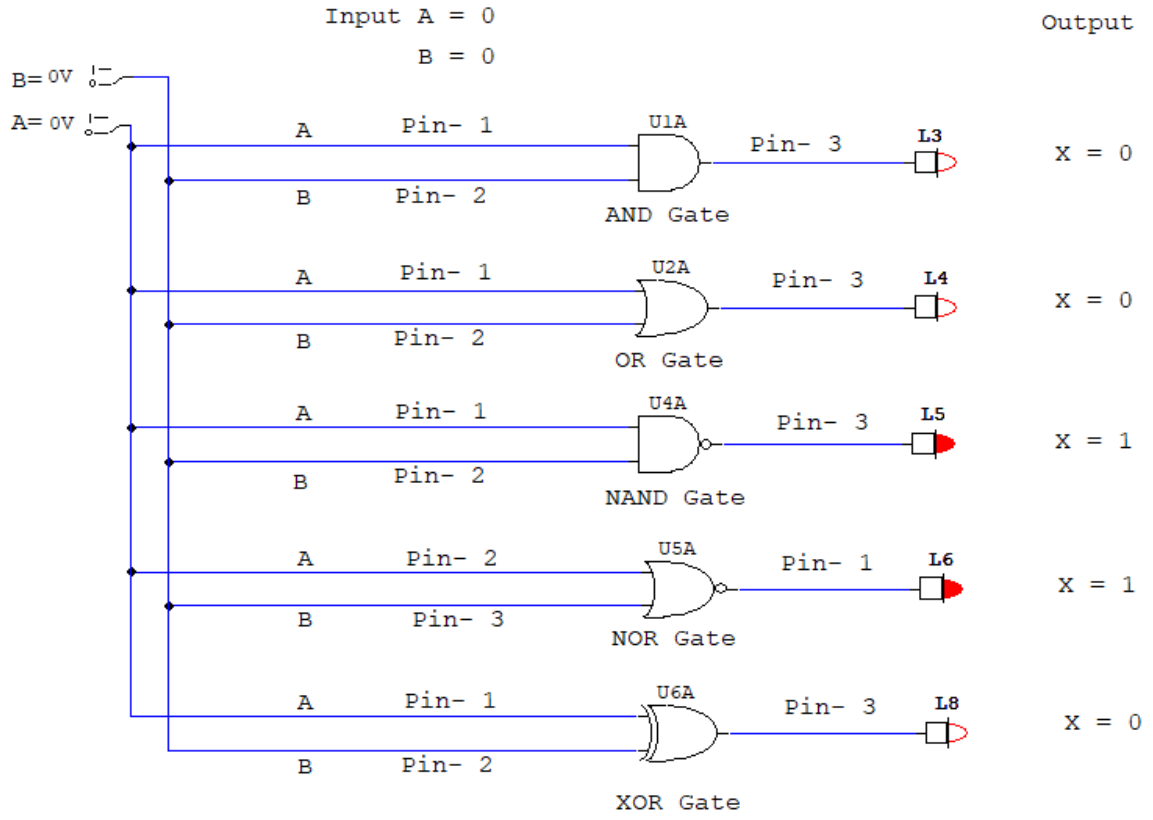
INPUT A B

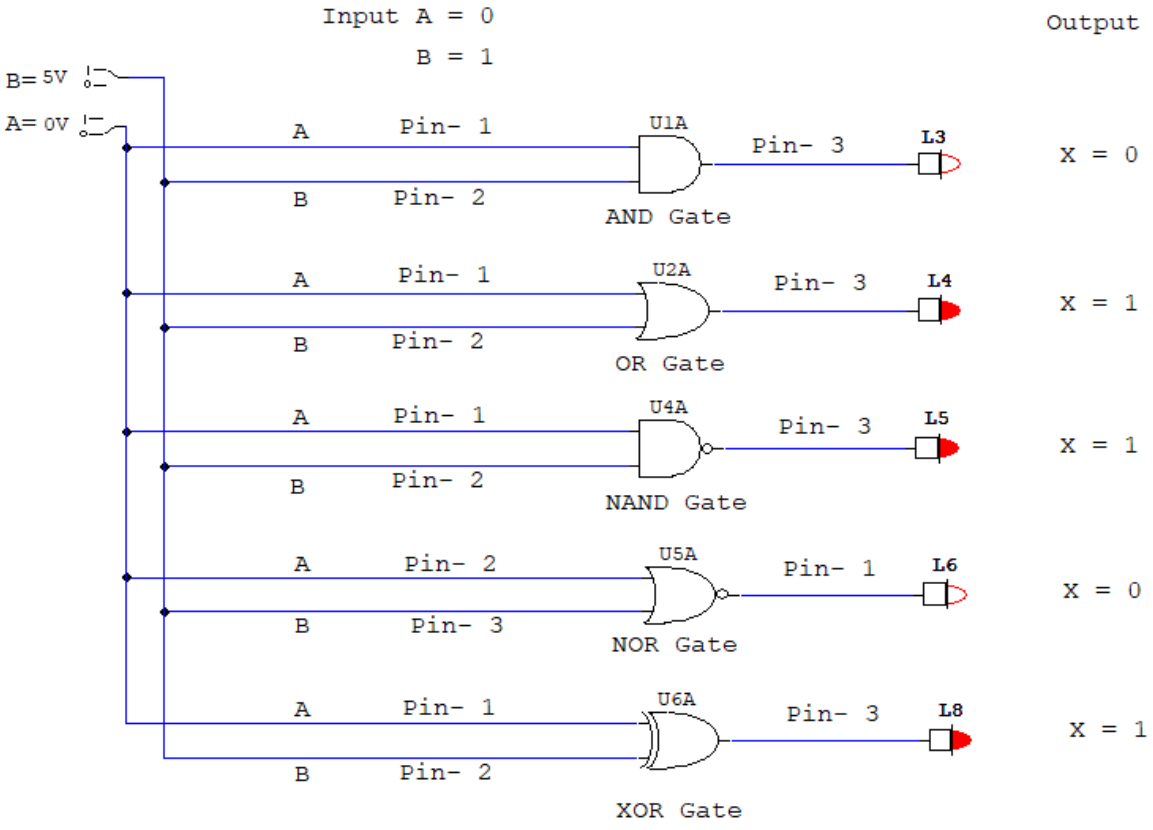
OUTPUT X

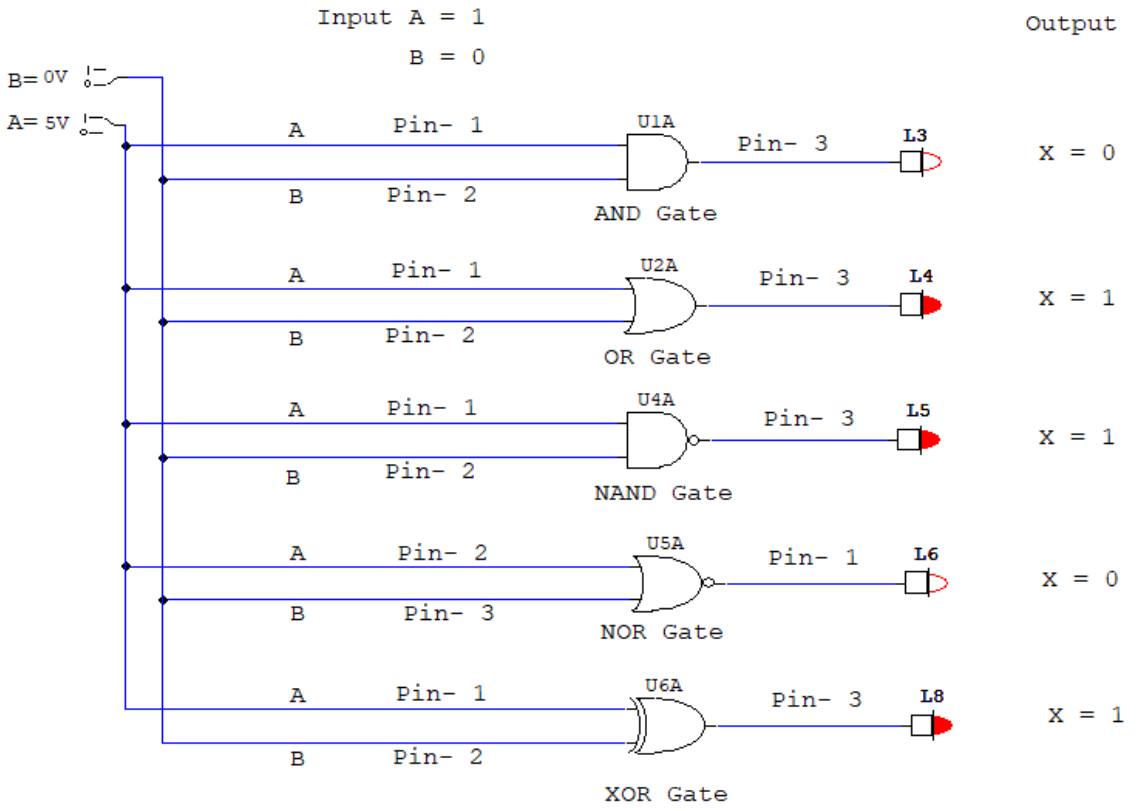


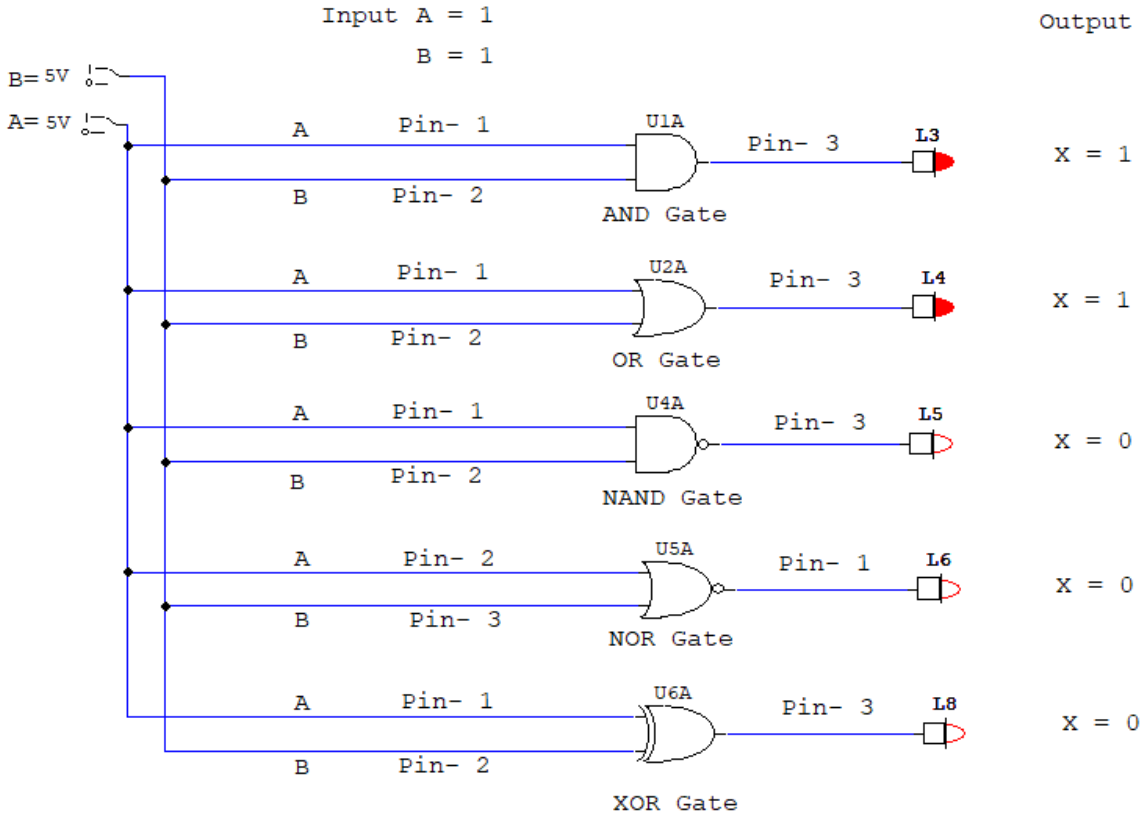


NOT Gate


Input A = 0
B = 0
Output
B= 0V
A= 0V
A
B
Pin- 1
Pin- 2
U1A
AND Gate
Pin- 3
L3
X = 0
U2A
OR Gate
L4
X = 0
U4A
NAND Gate
L5
X = 1
Pin- 2
Pin- 3
U5A
NOR Gate
Pin- 1
L6
X = 1
U6A
XOR Gate
L8
X = 0


Input A = 0
B = 1
Output
B= 5V
A= 0V
A
B
Pin- 1
Pin- 2
U1A
AND Gate
Pin- 3
L3
X = 0
U2A
OR Gate
L4
X = 1
U4A
NAND Gate
L5
X = 1
Pin- 2
Pin- 3
U5A
NOR Gate
Pin- 1
L6
X = 0
U6A
XOR Gate
L8
X = 1


Input A = 1
B = 0
Output
B= 0V
A= 5V
A
B
Pin- 1
Pin- 2
U1A
Pin- 3
L3
AND Gate
X = 0
U2A
L4
OR Gate
X = 1
U4A
L5
NAND Gate
X = 1
Pin- 2
Pin- 3
U5A
Pin- 1
L6
NOR Gate
X = 0
U6A
L8
XOR Gate
X = 1


Input A = 1
B = 1
Output
B= 5V
A= 5V
A
B
Pin- 1
Pin- 2
U1A
Pin- 3
L3
AND Gate
X = 1
U2A
L4
OR Gate
X = 1
U4A
L5
NAND Gate
X = 0
Pin- 2
Pin- 3
U5A
Pin- 1
L6
NOR Gate
X = 0
U6A
L8
XOR Gate
X = 0

Discussion : From this experiment we learned about six logic gates. Three basic gates AND, OR, NOT & tree compound gates NAND, NOR, XOR (Exclusive OR) gates. We also learned about their operations and using methods. We have verified the truth tables of those logic gates.

We have to be careful during circuit connection with their IC numbers. We are representing “1” as High or 5V. and “0” as Low or 0V for input and output.