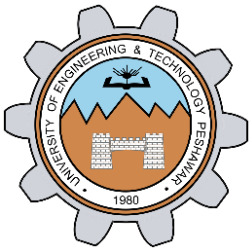
Lab 04: Universal Gates



Fall 2023

Digital Logic Design Lab

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Class Section: A

"On my honour, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Submitted to:

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1. Objective of the Lab:

To study the realization of basic gates using universal gates (NAND & NOR).

2. Apparatus:

Power Supply, Breadboard. ICs 7400 (quad 2-input NAND gate), 7402 (quad input NOR gate), DIP Switch, LED.

3. Introduction to Universal Gates:

Universal gates are fundamental digital logic gates that can be used to implement any other logic gate. They are considered universal because they can perform the same functions as other gates such as AND, OR, and NOT gates. There are two primary universal gates: the NAND gate and the NOR gate.

1. NAND Gate (NOT-AND):

The NAND gate performs the opposite of an AND gate. It produces a high output (1) only when at least one of its inputs is low (0).
The symbol for a NAND gate is a standard AND gate with a small circle (inversion) at its output, indicating the NOT operation.

Truth Table:

A	B	Output
0	0	1
0	1	1
1	0	1
1	1	0

2. NOR Gate (NOT-OR):

The NOR gate performs the opposite of an OR gate. It produces a low output (0) only when both of its inputs are high (1).
The symbol for a NOR gate is a standard OR gate with a small circle (inversion) at its output, indicating the NOT operation.

Truth table:

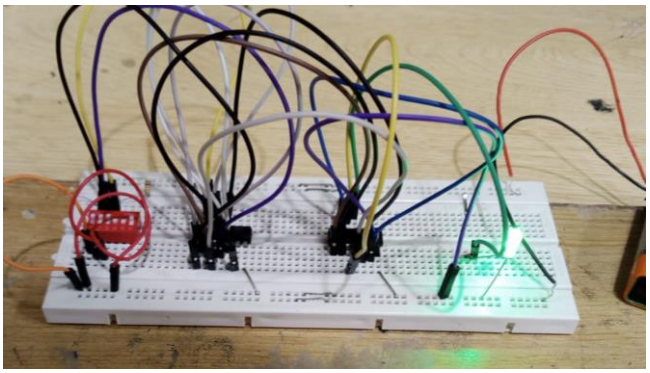
A	B	Output
0	0	1
0	1	0
1	0	0
1	1	0

4. Security Alarm Experiment Performance:

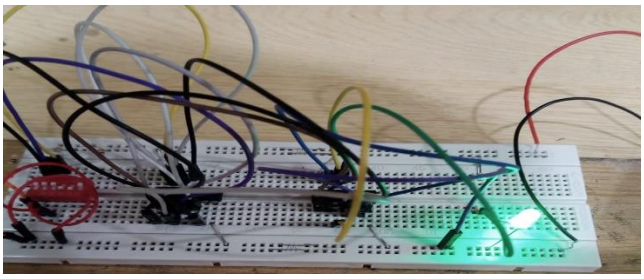
Given Conditions:

1. T represents time which maybe day (1) or night (0).
2. D represents door which maybe open (0) or close (1).
3. L user for Laser, which may be disturbed (0) or undisturbed (1).

Practical Implementations:
Using Nor:



Using NAND:



Function:

$$F=T'D'+T'L'$$

Truth Table:

T	D	L	F
0	**0**	**0**	**1**
0	**0**	**1**	**1**
0	**1**	**0**	**1**
0	**1**	**1**	**0**
1	**0**	**0**	**0**
1	**0**	**1**	**0**
1	**1**	**0**	**0**
1	**1**	**1**	**0**

Conclusion:

In this lab we learned about how we can implement other gate logics with two universal gates.