BREADBOARD NO.
MARKS
DEMO: /10
REPORT: /30
TOTAL: /40

ENT 262
DIGITAL LOGIC DESIGN
SEMESTER 1 2019/2020

LABORATORY 1

INTRODUCTION TO THE CONCEPTS OF DIGITAL ELECTRONIC SYSTEM

Student's Particular

Name:
Matrix No.:
Group:
Date of Experiment:

LAB 1: INTRODUCTION TO THE CONCEPTS OF DIGITAL ELECTRONIC SYSTEM

OBJECTIVES

1. To get familiar with logic gate IC.
2. To analyze/see the relation between voltage level and logic level.
3. To construct a simple combinational logic circuits.

EQUIPMENTS/COMPONENTS

- A DC power supply capable of 5V DC output
- An oscilloscope
- A multimeter
- Logic gates (74xx-series)
- Light Emitting Diodes (LED)
- 330 Ω resistor
- Switches (3 Units)

INTRODUCTION

Digital circuits are often referred to as switching circuits because their control devices (e.g. diodes and transistors) are switched between the two extremes of ON and OFF. Logic gates have one or more inputs with one output. They respond to various input combinations. A **truth table** shows this relationship between circuits's input combinations and its output. To determine the total number of different combinational input to be listed in the truth table, use the equation:

$$\text{Number of Combinations} = 2^N$$
where, N = number of inputs

In digital system, the ON and OFF state can be represented as logic 1 and 0 respectively. There are several other terms that are used synonymously with 0 and 1. Some of the common ones are shown in Appendix 1. For TTL circuits (74xx series), a logic 0 can be anywhere from 0V to +0.8V, and a logic 1 is in the range of +2.0 V to +5.0V. Voltage between 0.8 and 2V are undefined (neither 0 nor 1) and under normal circumstances should not occur.

Boolean algebra is the mathematical foundation of digital systems. In Boolean algebra there are three basic operations: OR, AND and NOT which can represent the three basic logic gates: OR, AND and Inverter gates respectively. In the other words, every Boolean expression has an equivalent gate description, and vice versa. The combination of logic gates is called as combinational logic circuit.

In designing a combinational logic circuit, it is highly desirable to find the simplest implementation – that is, the one with the smallest number of gates or wires. One of the platforms to simplify the circuit is simplifying the logic expressions by using Boolean theorems

PROCEDURE

1. *The Inverter/ NOT Gate*: Figure 1.1 shows the logic diagram of an inverter gate.

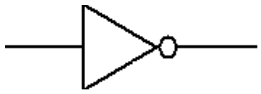


Figure 1.1 : Logic Diagram for an Inverter/ NOT Gate

2. Refer to the data sheet for the **74LS04 IC**. It contains six inverter gates. Wire one of them as follows:

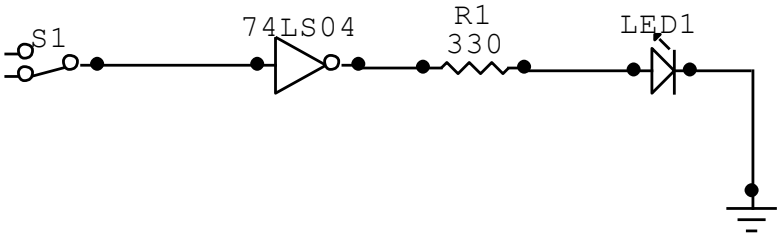


Figure 1.2 : Circuit Diagram for **74LS04**

Note: i. You may refer to Appendix to see a pinout of Inverter/NOT gate (74LS04).
ii. V_{cc} = +5V to pin 14; GND to pin 7.

3. Verify the inverter operation by completing the truth table in Table 1.1.
(Please fill Table 1.1 at the RESULTS)

4. You are given 74LS08 IC and 74LS32 IC. With reference to the given datasheets, draw the circuit diagram in Figure 1.3 for the circuit of IC either 74LS08 or 74LS32 (please choose ONE) and complete the truth table in Table 1.2 to verify its operation.
(Please fill Table 1.2 at the RESULTS)

Note: You may use a multimeter to analyze the voltage level at each pin of the IC.

Name: _____ Matrix No. : _____

RESULTS

1. Complete Table 1.1.

Table 1.1: Truth table of **INVERTER/NOT** gate [2 marks]

Input		Output		
Voltage (V)	**Logic Level (1/0)**	**LED (ON/OFF)**	**Voltage (V)**	**Logic Level (1/0)**

2. Fill in the blank the title of Figure 1.3 and draw the Circuit diagram in the given column for procedure (4) [4 marks]

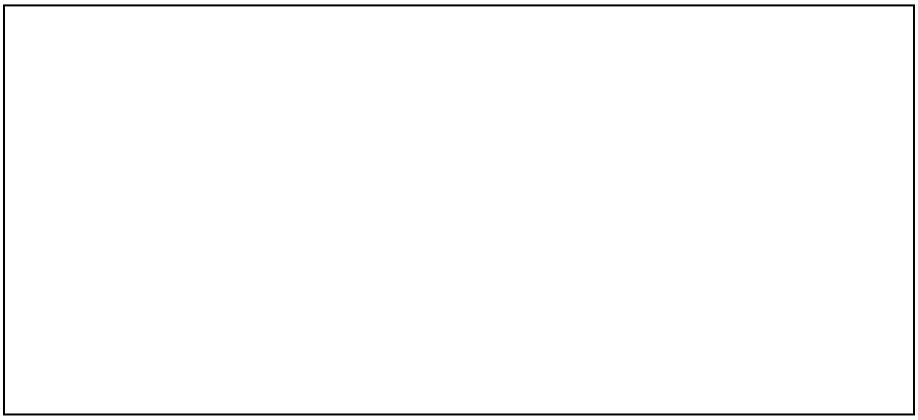


Figure 1.3: Circuit Diagram for Logic IC **74LS_____**

3. Fill in the blank the title of Table 1.2 and complete Table 1.2 [4 marks]

Table 1.2: Truth table of **_____ gate**

Input				Output		
A		**B**		**LED (ON/OFF)**	**Voltage (V)**	**Level (1/0)**
Voltage (V)	**Logic Level (1/0)**	**Voltage (V)**	**Logic Level (1/0)**			

ACTIVITY SHEET

1. Construct the circuit shown in Figure 1.4

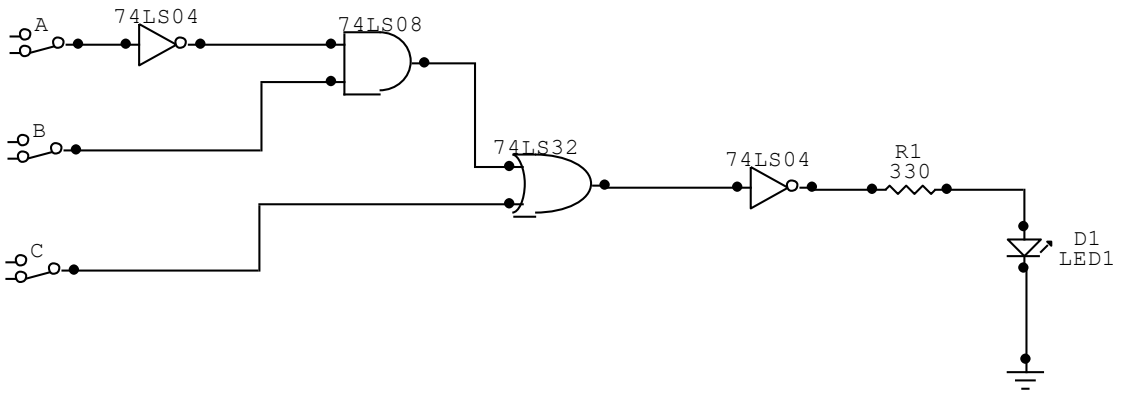


Figure 1.4

2. Construct circuit and truth table.
3. Connect the multimeter to the output.
4. Adjust the multimeter to allow accurate measurement of a 5V DC signal.
5. Set switches A , B and C to each of the input conditions in the Table 1.3 and record the output, as measured by multimeter as either a logical 1 (> 2V DC) or a logical 0 (<2V DC).
6. Get approval from Teaching Engineer.

Table 1.3: Truth table of the circuit [5 marks]

Input A	Input B	Input C	Output (V)	Output (Logic 1/0)
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

MARKS
DEMO: /10
SIGNATURE:
.....

7. Write your observation based on the results obtained in Table 1.3 [5 marks]

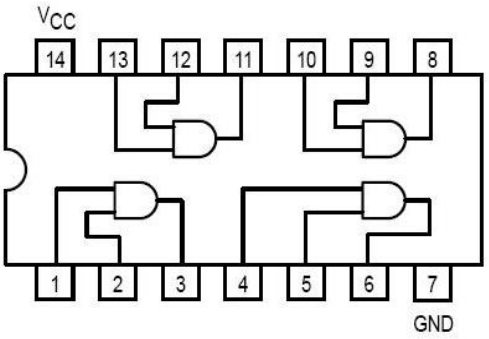
8. Write the Boolean expressions of the outputs obtained from Table 1.3 [5 marks]

DISCUSSION [3 marks]

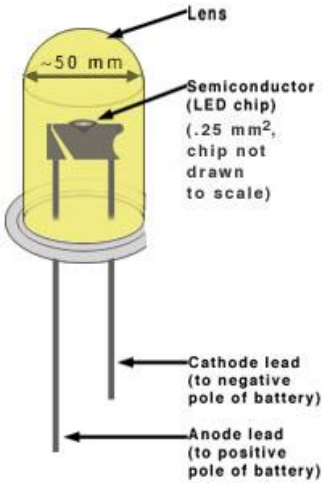
CONCLUSION [2 marks]

APPENDIX

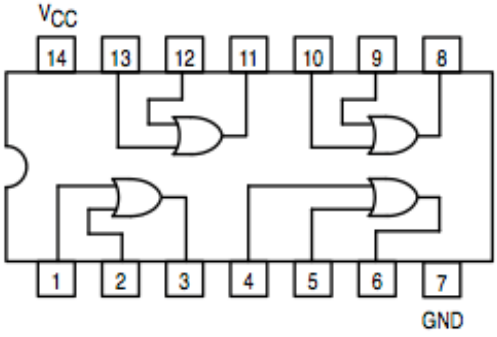
AND Gate (74LS08)



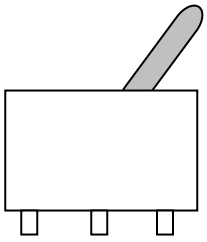
LED



OR Gate (74LS32)



Toggle Switch



+5V Pin Gnd

NOT Gate (74LS04)