



Department of Electrical Engineering

Instructor: _____

Date: _____

Course/Section: _____

Semester: _____

EE221: Digital Logic Design

Lab 1: Familiarization of Basic Gates and Digital ICs

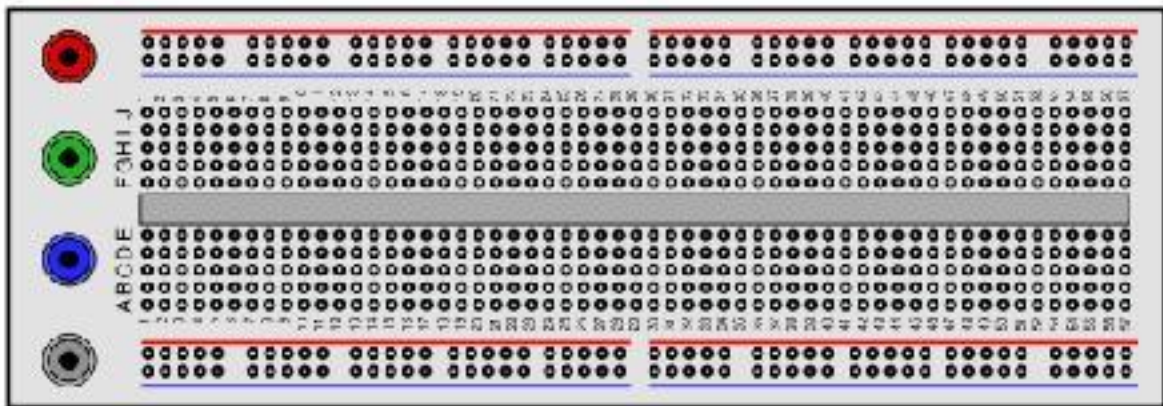
Name	Reg. No.	Report Marks / 10	Viva Marks / 5	Total Marks / 15



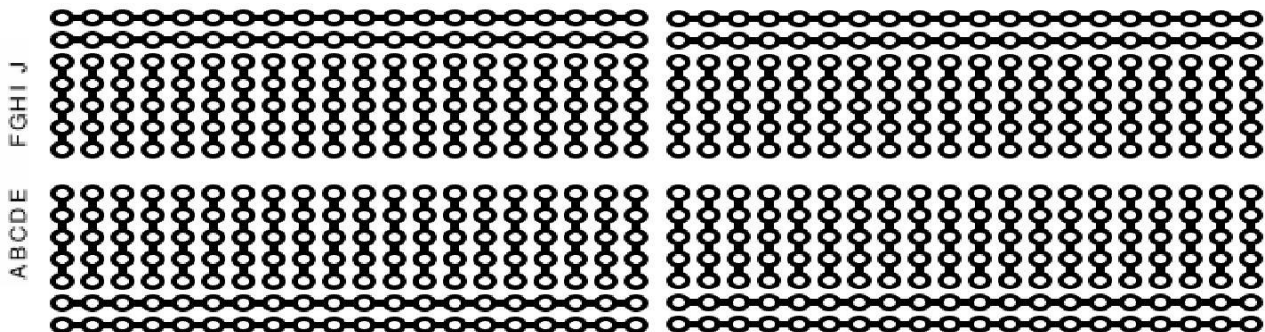
Getting Started with Circuit Patching

Breadboard:

Breadboards are usually used for patching small circuits and prototypes. A typical breadboard would look like this.



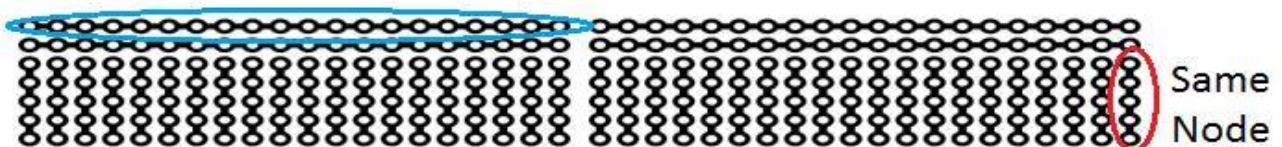
The internal connections are as shown below:



The points in ABCDE (and FGHIJ) grid are vertically connected as indicated by red circle. So all 5 points on are actually the same point. It makes No difference whether you connect a wire on any one of these points. The next vertical strip is a different point and so on.

It should be noted that upper and lower grids are horizontally connected indicated below. Each grid consists of 4 such separate horizontal strips:

Same Node

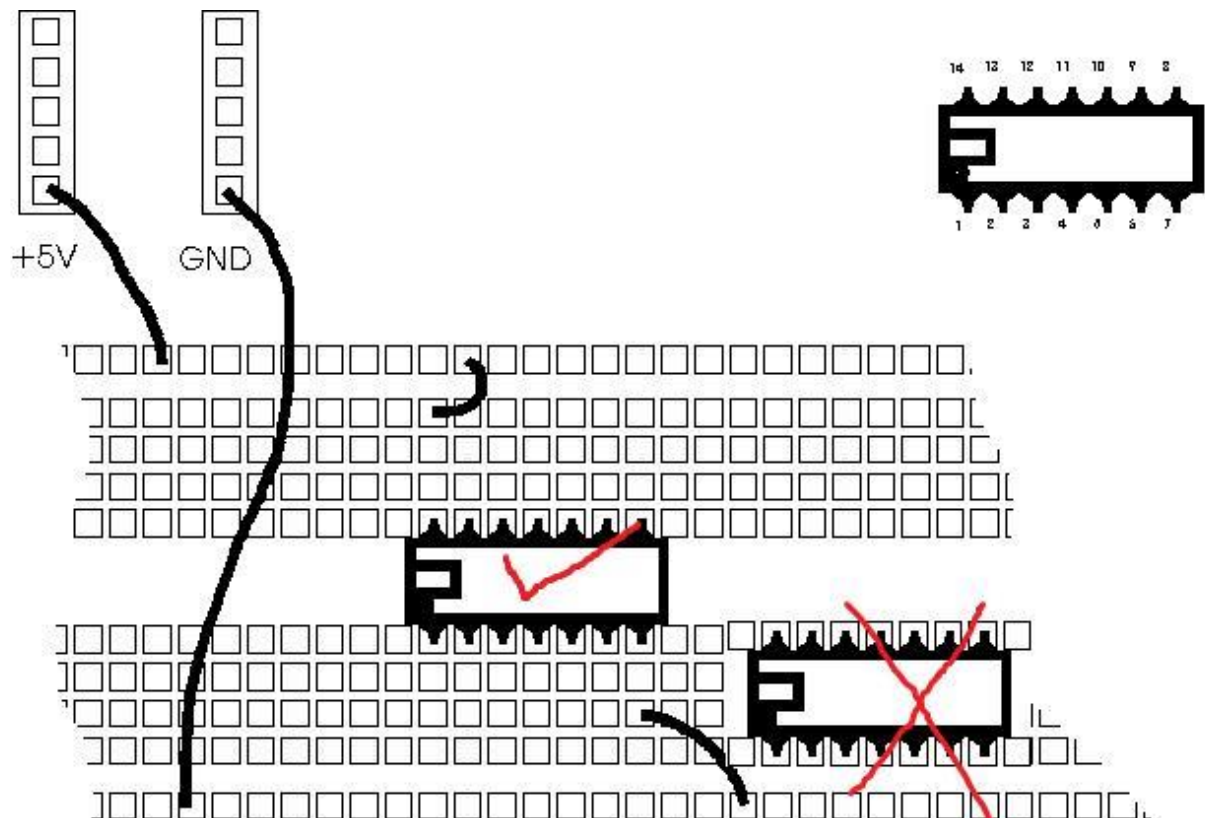




IC Placement on Breadboard

A typical 14 pin IC placement on such a bread board is shown below:

The upper and lower horizontal strips are normally served for power (+5V) and ground (0V) respectively. But it is not necessary to do so.



Never place any IC such that its opposite pins are within (connected to) the same Node on the same grid.



Procedure:

1. Make sure the trainer board is switched off while you are patching the circuit.
2. Make a neat schematic diagram clearly mentioning the IC numbers, PIN configurations and connections between different ICs.
3. Place the IC(s) such that the Notch is towards the left.
4. Provide the ground connection(s) by connecting the GND pin(s) of the IC(s) to 0 V on your trainer board power supply with the help of jumping wires. Make sure that all the ICs are properly grounded.
5. Provide the VDD or operating voltage to each IC by connecting its VDD (or VCC) terminal to +5V on your trainer board power supply.
6. Patch the circuit as per the schematic.
7. Connect the inputs of your circuit to the logic switches provided on your trainer board. Typically there are 8 such switches provided. The low position of the switch indicates a 0 logic level (0V) and the high position a logic level of 1(+5V).
8. Connect the output of your circuit to the logic probe provided on the trainer board.
9. Now switch on the trainer board and give the input sequence to your circuit with the help of logic switches. It is a good practice to give the input sequence in ascending order like this:

000, 001, 010, 011, 100, 101, 110, 111 (Here No. of inputs is 3).
This pattern can be adopted for lesser or more No. of inputs.
10. Observe the output of your circuit against different inputs and record them in the truth table.
11. Compare with theoretical values and debug the circuit if needed.
12. Give your observations and conclusion.



Lab1: Familiarization of Basic Gates and Digital ICs

This Lab Activity has been designed to familiarize the beginning students with logic gates and IC chips, using breadboard and testing of gates and logic circuits.

Objectives:

- ✓ Familiarize the students with ICs, their categories, and different logic families.
Identify ICs on the basis of series number as well as their functional behavior and pin numbers.
- ✓ Search data sheets of ICs from different sources and optimally use them in the design of digital circuits.
- ✓ Perform functional verification of basic logic gates by listing the truth tables and establishing IN/OUT relationship.
- ✓ Carry out best wiring practices in digital design.



Pre-Lab Tasks:

1. Read the topic Integrated Circuits (2.9) from your course book and answer the following questions:

Digital ICs can be categorized according to the complexity of their circuits usually termed as *scale integration*. The following are the six major categories. Give their full names and range of gates available in each of them.

SSI

MSI

LSI

VLSI

ULSI

GSI

2. Another categorization is with respect to the Logic Families of Digital ICs. The five of these are listed below. Give their full name and give their utilization in terms of speed, power etc. (e.g. Low Power, High Speed).

RTL

DTL

ECL

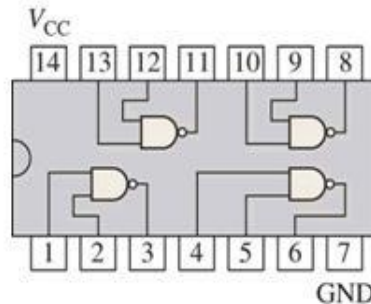
TTL

CMOS

3. Differentiate b/w Fan In and Fan Out of an IC.



IC Pin Numbers:



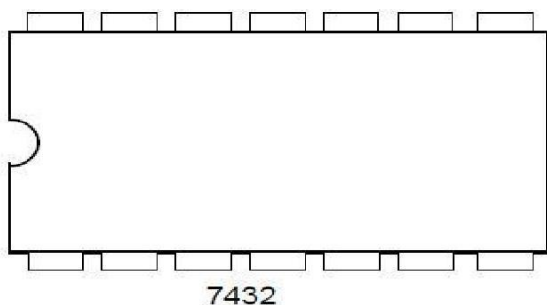
TOP VIEW

Most of the ICs have a Notch (or sometimes a dot) to denote the start of the PIN numbering. Place the IC such that the Notch is on left side, then the lower left PIN is numbered 1 and the numbering continues in the anticlockwise direction.

Datasheet:

The information about any IC (its number of pins and gates inside it) can be found by simply searching by its name on internet. The document containing information about the IC is called its **datasheet**. Different manufacturers of these chips have this information on their sites.

4. Show the correct pin numbering and connection of gates inside these blank chips with the help of their datasheets.



5. Mention the manufacturer whose datasheet you consulted.



Lab Task

Verify the functioning of the following ICs:

7408

7432

7404

Procedure

1. Make a **schematic layout diagram** in the space provided below, showing ICs pin numbers and their connections to form the logic circuit.
2. Plug in all ICs in bread board and power the ICs providing ground and $V_{CC}=5V$ to appropriate pins. The ground pin is to be connected first and then any other connections are made.
3. By looking at pin configuration apply input signals from a switch on logic lab. Connect the output to LED for display. The operation of circuit is verified. For trouble shooting of circuit use the logic probe provided in the lab.
4. Make the truth tables in the space provided below:



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In the lab you were provided with three ICs.

5. Mention the full name of each IC with the help of its datasheet (You should be able to get this information from internet).

Example: *Quad 2-Input AND Gates SN74 LS08P*

SN Standard Prefix of TEXAS
INSTRUMENT **Quad** refers to 4 AND gates
74 refers to commercial grade IC
LS means Low Power *Schottky*
P *Plastic Dual in-Line Package*
08 refers to AND gate

6. *The ICs in 7400 series are based on which logic family?*
7. *The commercial grade IC is denoted by ___ prefix. The military grade IC is denoted by ___.*

Observations/Comments: