Familiarization of Basic Gates and Digital ICs – Reference Solution

Instructor:-

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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 Small Scale Integration (< 12 gates)

MSI Medium Scale Integration (12 to 99 gates)

LSI Large Scale Integration (100 to 9999 gates)

VLSI Very Large Scale Integration (10,000 to 99,999 gates)

ULSI Ultra Large Scale Integration (100,000 to 999,999 gates)

GSI Giga Scale Integration (>1,000,000 gates)

2. Another categorization is with respect to the Logic Families of Digital ICs. The ~~seven~~ 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 Resistor Transistor logic (High Power, Low Speed)

DTL Diode Transistor Logic (Low Power, High Speed)

ECL Emitter Coupled logic (Low Power, High Speed)

TTL Transistor Transistor logic (High Power, High Speed)

CMOS Complementary Metal Oxide Semiconductor (Low Power, High Speed)

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

Fan In is basically the number of inputs a single logic gate can accept while Fan Out is the number of gate inputs that the output of a gate can drive or feed.

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IC Pin Numbers:

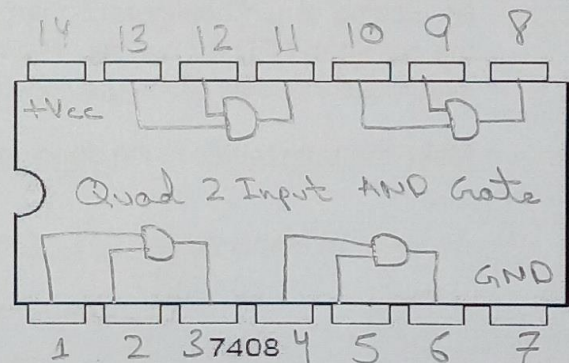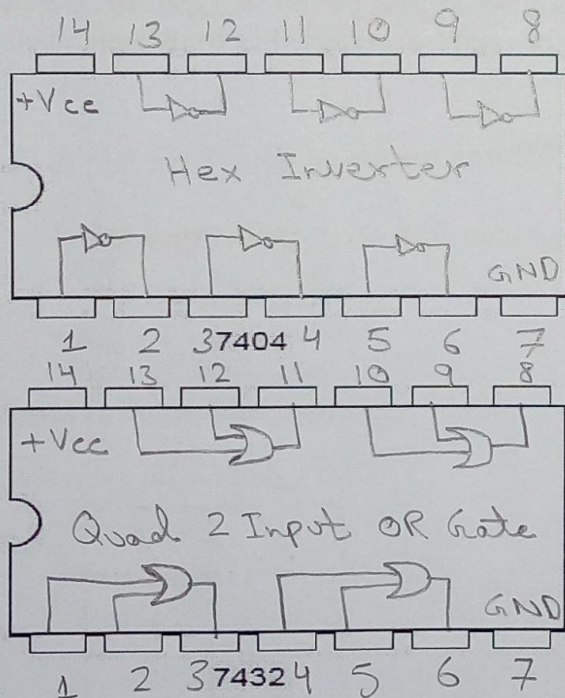V_{CC}

14 13 12 11 10 9 8

1 2 3 4 5 6 7

GND
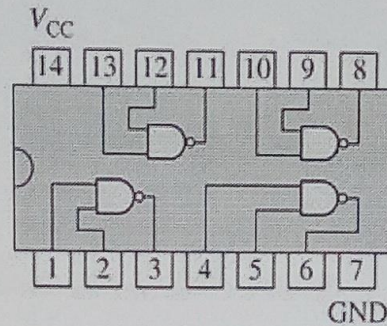
TOP VIEW

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.

14 13 12 11 10 9 8
+Vcc
Hex Inverter
GND
1 2 37404 4 5 6 7

14 13 12 11 10 9 8
+Vcc
Quad 2 Input AND Gate
GND
1 2 37408 4 5 6 7

14 13 12 11 10 9 8
+Vcc
Quad 2 Input OR Gate
GND
1 2 37432 4 5 6 7

5. Mention the manufacturer whose datasheet you consulted. Texas Instruments

EE221: Digital Logic Design

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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 VCC=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.

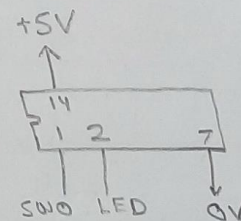4. Make the truth tables in the space provided below:
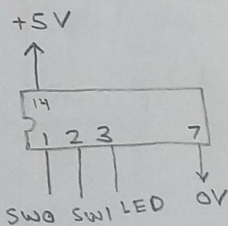
7408

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1
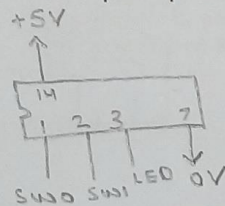
7432

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

7404

A	Y
0	1
1	0

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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
08refers to AND gate

→ Quad 2 Input AND Gate.   SN74LS08

→ Quad 2 Input OR Gate   SN74LS32

→ Hex Inverter   SN74LS04

6. *The ICs in 7400 series are based on which logic family?* Transistor Transistor Logic (TTL)

7. *The commercial grade IC is denoted by* 74 *prefix. The military grade IC is denoted by* 54.

Observations/Comments:

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