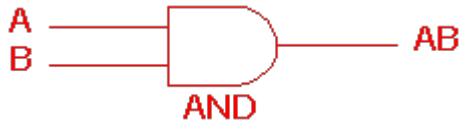
EGE UNIVERSITY
DIGITAL LOGIC DESIGN LABORATORY
EXPERIMENT-1

Introduction to TTL Gates

BACKGROUND

Logic-Gates are basic building blocks of digital circuits. Using these building blocks, complex functions or larger digital circuits can be built. Examples of the basic logic gates are AND, OR, NOT. The operation of a logic gate can be described using a ***truth-table***. A truth-table is a tabular listing of all possible inputs and corresponding outputs of a logic gate.

AND gate



2 Input AND gate		
A	B	A.B
0	0	0
0	1	0
1	0	0
1	1	1

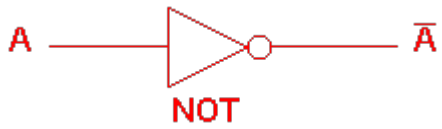
The AND gate is an electronic circuit that gives a **high** output (1) only if **all** its inputs are high. A dot (.) is used to show the AND operation i.e. A.B. Bear in mind that this dot is sometimes omitted i.e. AB

OR gate

2 Input OR gate		
A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

The OR gate is an electronic circuit that gives a high output (1) if **one or more** of its inputs are high. A plus (+) is used to show the OR operation.

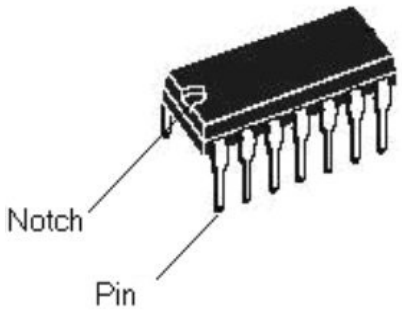
NOT gate



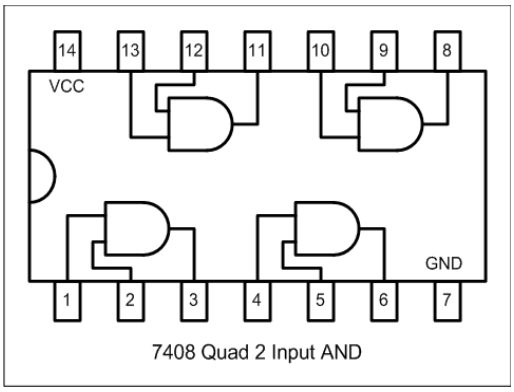
NOT gate	
A	$\overline{A}$
0	1
1	0

The NOT gate is an electronic circuit that produces an inverted version of the input at its output. It is also known as an ***inverter***. If the input variable is A, the inverted output is known as NOT A. This is also shown as A', or A with a bar over the top, as shown at the outputs.

These gates are encapsulated in **black boxes** and are called ***integrated circuits (ICs)***. Each IC or chip has an ID number that can be referenced in IC Data Book. From the book, you can get the ***pin configuration*** of that chip.

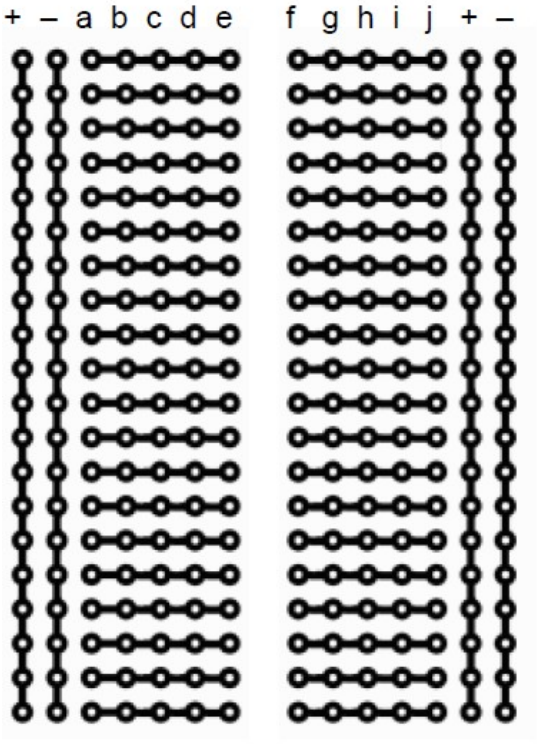


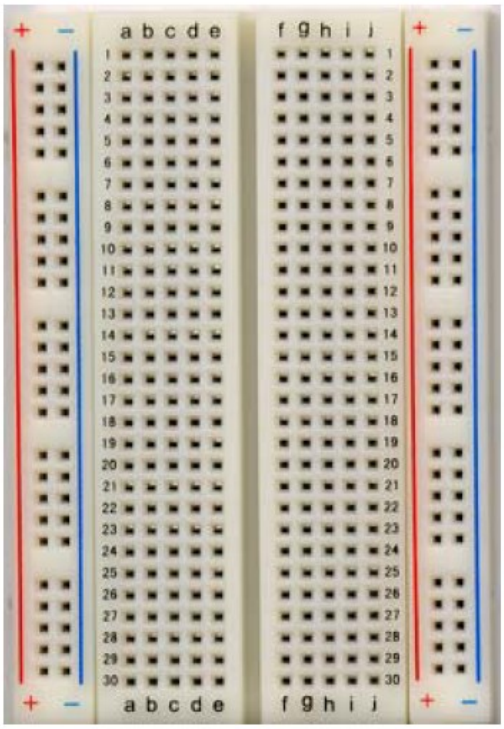
A sample IC layout of a 7408 chip is shown below. The IC contains four 2-input AND gates. The input and output of the gates are wired to a particular pin as shown in the figure. Also note a **notch** in the middle top side of the IC shown as a square in the figure. The numbering starts from the left of that notch.



The pin locations for ***power*** (i.e. VCC - **pin 14**) and g**round** (i.e GND -**pin 7**) are also shown. ICs must be provided with power and ground connections. The power supply voltage is typically **+5 Volts** and the ground which is the reference node is typically connected to **0 Volts**.

Breadboards are used to build temporary circuits during prototyping. Their name derives from little holes into which you insert electronic components and connecting wires. You can quickly assemble and disassemble circuits. Here is a picture.

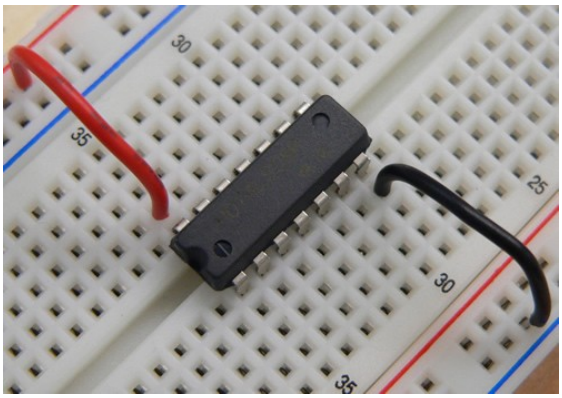




Some of these holes are **wired** together on the inside, as shown in the diagram on the left. For example, if you insert two wires into the holes labeled “a” and “e” in the same row, they will be electrically connected.

The breadboard has plugs at the top to accept power. **Do not connect the power supply until you reach the appropriate time in the experiment**. Also, your breadboard will come with some wires inserted into it already; **please do not remove them at any time**.

When inserting IC in the breadboard, ensure that it "spans" across the center divider and **all the pins are separated**. The semi-circular notch on the top of the IC goes at the LEFT side. **5V power is connected to pin 14** (top left) and **ground is connected to pin 7** (bottom right).



EXPERIMENTAL WORK

- Implement the function **F= XY** using 7408 AND gate. Use switches for input and LED for the output.
- Implement the function **F= X+Y** using 7432 OR gate. Use switches for input and LED for the output.

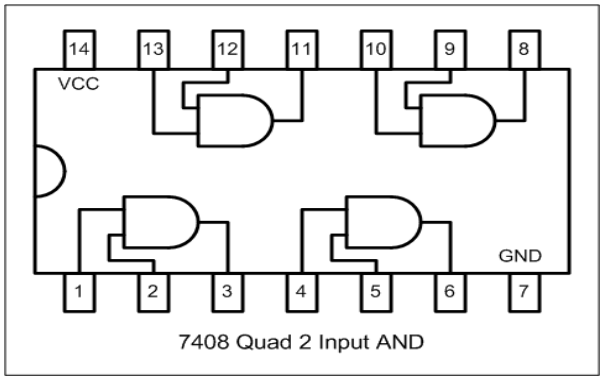
- For the function

$$F = XY' + X'Y$$

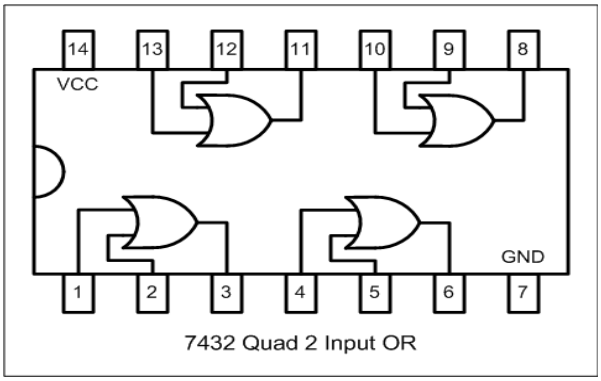
  - Draw the circuit diagram.
  - Fill in the truth table.

X	Y	F=XY' + X'Y

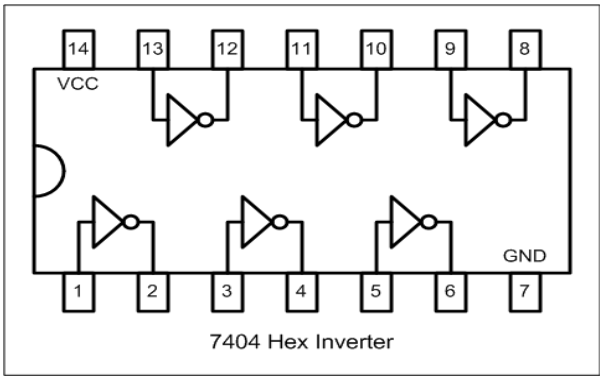
- Implement using 7408 AND, 7432 OR and 7404 NOT gates. Use switches for the input and connect the output to a led.



7408 Quad 2 Input AND



7432 Quad 2 Input OR



7404 Hex Inverter