**Lab – Implementing Combinational Logic**

In previous labs you learned about basic logic gates and determined their outputs as you varied the logic state of their inputs. In this lab you will be combining various logic gates together in a circuit to get a specific output.

**Objectives:**

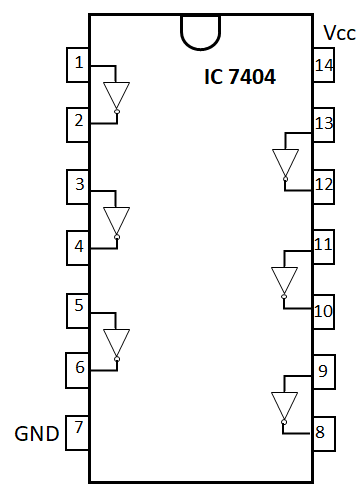
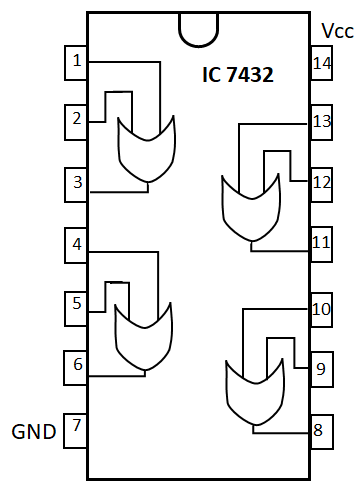
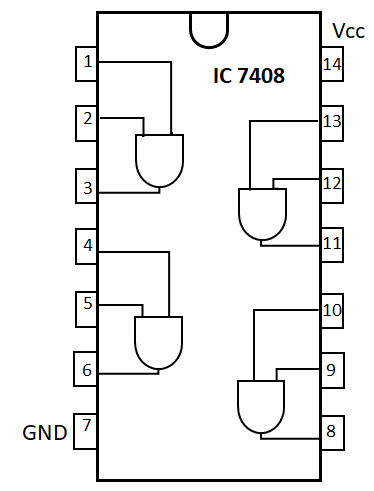
-To learn about Combinational Logic

-To learn about sum of product Boolean expressions

-To learn how to implement a logic circuit from a Boolean expression or truth table

**Equipment:**

One 7408 AND Gate, One 7404 Hex Inverter; One 7432 OR Gate; Two 300 Ohm resistor; 4 kOhm resistor; One 4 position DIP switch.; two LED

******IC Pin Diagrams

*Figure 1* – Pin layout diagrams for IC 7408, IC 7432, and IC 7404

**Procedure**

**Activity 1 - From a Boolean expression to a logic circuit**

1.Use the pin diagrams on the previous page and use AND gates, OR gates, or Inverters or combinations of all of them to implement the following logic expression:

X=A+AB

2. Create the truth table for the logic expression first, and then sketch out the circuit. Wire it up on the breadboard and test.

3. Make sure that you know which pins of the IC are the inputs and which are the outputs. Also, be sure you are applying power (Vcc) and ground to the correct pins otherwise your circuit will not function or ruin the chip. The value of Vcc should be 5 Volts.

4. Use a DIP switch for the inputs and an LED for your output. The LED should only light up when the output is ‘1’. Remember to use a 300 ohm resistor with an LED to reduce the current in the circuit and prevent the LED from burning out. Use 1 kOhm resistors in your input stage.

5. In your notebook briefly explain what you did in this activity and what you found.

**Activity 2 - From a truth table to a logic circuit**

Implement a logic circuit for the truth table below.

|  |  |
| --- | --- |
| **Inputs** | **Output** |
| **ABC** | **X** |
| 000 | 0 |
| 001 | 0 |
| 010 | 0 |
| 011 | 0 |
| 100 | 0 |
| 101 | 1 |
| 110 | 1 |
| 111 | 1 |

6.Create the Boolean expression first, simplify it using the Boolean rules and laws, and then sketch out the circuit. Wire it up on the breadboard and test. Be sure to follow steps 3-4 above when wiring up the circuit.