Engineering Challenge
Lab #1
BASIC LOGIC GATES

Purpose:

1. To become familiar with the characteristics for the AND, OR, NAND, NOR and NOT gates.
2. To read wiring (blueprint) drawings and test the Integrated Circuit for each of the basic gates.
3. To create and verify the truth table for each of the basic gates.
4. To write the correct Boolean expression for each of the basic gates.

Equipment:

1. Breadboard with jumper wires.
2. 5 volt Power supply
3. IC chips: 7400, 7402, 7404, 7408, 7431
4. LED (Light Emitting Diode)
5. Logic Switches

Procedure:

Each integrated circuit chip (IC) is a package of gates. You are to construct, wire and test each of the 2 input gate chips (7400, 7402, 7408 and 7432) to determine what the function of each chip is. You will also test a 7404 chip which has a single input and a single output.

Step 1: Breadboard Test:

Refer to the circuit diagram sheets
Start with the 7400 chip.
Record the chip # in the 1st column of the chart sheet: CHART 3.1
Wire it as it is shown in Figure 1 on the Diagrams sheet.

Demonstrate the circuit to any instructor and get signature.
_____ (7400 chip).

Test each input by switching lows and highs.
Fill the truth table recording the associated outputs during testing.

Repeat these steps using the 7408, 7432, 7402 and 7404 chips, again using the wiring schematics shown in Figure 1 of the Diagrams sheet.

Demonstrate the circuit to any instructor and get signature. _____ (7408 chip)

Demonstrate the circuit to any instructor and get signature. _____(7432 chip)

Demonstrate the circuit to any instructor and get signature. _____ (7402 chip)

Demonstrate the circuit to any instructor and get signature. _____ (7404 chip)

Step 2- Boolean expressions:

A Boolean Expression is a mathematical expression detailing the relationship between the inputs and the outputs.

The Boolean Symbol for AND is * (ex. X * Y)

The Boolean Symbol for OR is + (ex. X + Y)

One Boolean Symbol for NOT is a bar placed over the letter

Write the Boolean Expression for each gate in the space provided on Chart 3.1

Questions to Think About

1. How is a Truth Table created for a specific expression?
2. List the Boolean Symbols you learned in this lab.
3. Draw the logic symbols you learned in this lab.

Engineering Challenge
Lab #2
BASIC GATE APPLICATIONS

Purpose:

1. To be able to create a simple logic design from basic gates for given word problems.
2. To be able to construct and test this logic design.

Equipment:
Breadboard with jumper wires
5 volt Power Supply
IC chips: 7408 & 7432
LED
Logic switches

Problem:

Your uncle Lou owns a home heating and cooling company. Uncle Lou asks you to design a new automatic fan control unit for him to install in homes. He wants the fan to be ON under the following conditions:

The fan controller is in heater mode on AND the temperature is below 68 degrees OR fan controller is in air conditioning mode AND the temperature is above 75 degrees.

1. Using only 2 input AND gates (7408) and 2 input OR gates (7432) design a circuit that will satisfy these conditions. Sketch some ideas.

2. Using the breadboard, construct your design. Be sure not to forget to connect both V_{cc} (5 volts) and ground to all your chips. Use switches for the 4 inputs and a LED for the one output.

Get an instructor's signature._____

- Test your design by applying all possible inputs. If your design does not work as expected, you must have constructed the circuit improperly.

3. Record the conditions that caused the output (FAN) to be on. Put the results in the form of a truth table and record that truth table in the space below.