ECE 204L - THE VERY BASICS - LAB 4
INTRODUCTION TO INVERTERS

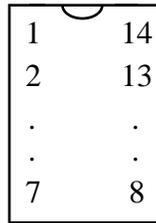WINTER 2004   A.P. FELZER

OBJECTIVE

The main objective of this lab is to introduce and measure the responses of inverters.
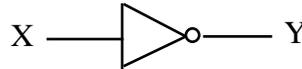
LAB

1. **Prelab -** Find and draw the following **chip diagram** for a 7404 inverter. Be sure to identify the power pin $V_{CC} = 5$ volts, the ground pin and the inputs and outputs of each of the inverters


   Note that a 5 volt source is needed to both power the chip and to supply the 5 volt inputs.

2. Given the following **logic diagram** for an inverter

   a. **Prelab** - Draw the logic diagram with pin numbers for X and Y
   b. Build the circuit. Then make use of a voltmeter to verify that pin 14 is 5 volts and pin 7 is ground. Put your results in a Table.
   c. Measure Y when X = 5 volts and then when X = GND. Put your results in a Table
   d. Make use of your results in part (c) to draw equivalent circuits for your inverter as follows
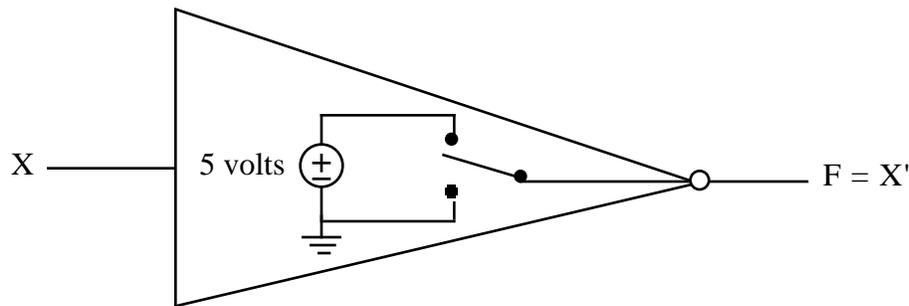

   for when X = 0 and for when X = 5 volts
   e. Make use of your measurements in part (c) to obtain the truth table of your inverter with H's and L's
   f. Make use of your results in part (d) to obtain the truth table for the inverter with 0's and 1's. Use positive logic

3. Given the following circuit
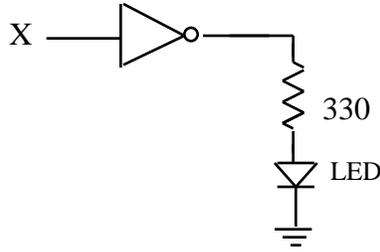
    a. **Prelab** - Draw the logic diagram with pin numbers
    b. Build and test the circuit. Put your results in a Table
    c. Describe in words what's going on

4. In Lab 2 we showed how DIP switches can be used as logic elements. The objective of this problem is to show how they can be used to control the inputs of logic gates. Given the following circuit constructed with a DIP switch
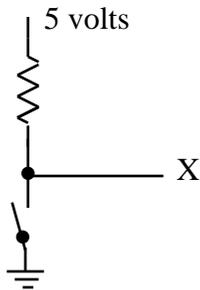
    a. **Prelab** - What is the value of X when the switch is OPEN and what is the value of X when it's CLOSED. Put your results in a table
    b. Build and test the circuit
    c. Verify that your results are what you predicted in part (a)

5. Given the following logic circuit with a DIP switch for controlling the input X
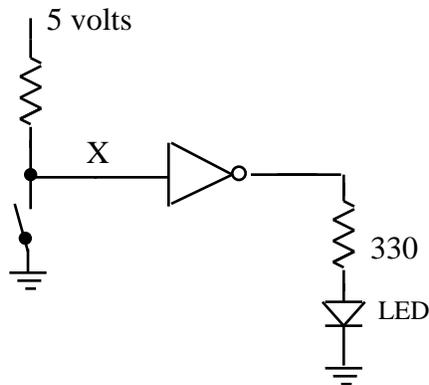
    a. **Prelab** - Draw the logic circuit with pin numbers
    b. **Prelab** - Describe in words the operation of the circuit
    c. **Prelab** - Suppose that you built the circuit but it didn't work - even after doublechecking the wiring. What measurements would you take to troubleshoot the circuit
    d. Build and test the circuit. Put your results in a Table with input X and output LED
    e. Verify that your results are what you predicted in part (b)

6. Given the following logic circuit

$$X \longrightarrow \triangleright\!\circ \longrightarrow \triangleright\!\circ \longrightarrow F$$

   a. **Prelab** - How is F related to X
   b. **Prelab** - Draw a logic diagram with switches and LED's like in Problem (5) to test this circuit
   c. Build and test the circuit. As always put your results in a Table
   d. Verify that your circuit is operating as you predicted in part (a)

7. Look up and write out the definitions for each of the following terms
   a. $V_{IH}(min)$
   b. $V_{IL}(max)$
   c. $V_{OH}(min)$
   d. $V_{OL}(max)$