ECE 1315 - Lab #2: NAND and NOR

Given the function of three variables x_2, x_1, and x_0 defined by the expression below:

$$x_1 + x_2x_0 + x_2x_1$$

implement the function two different ways *at the same time* on your breadboard,

a) $f_1(x_2,x_1,x_0)$ using only 2-input NAND gates (74_00, as many chips as needed)
b) $f_0(x_2,x_1,x_0)$ using only 2-input NOR gates (74_02, as many chips as needed)

Minimize the total number of chips (74_00 and 74_02) that you use in your implementation. Remember to show in your documentation *all* the inputs on the gates that you use, and show where they connect. You can ignore gates in the chips that you are not using in your implementation. You *do not* need to show power supply connections, as these are implied.

Input variables come from the LogiScan unit—x_2 on pin 3, x_1 on pin 2, and x_0 on pin 1. Your two function outputs go to the LogiScan unit, $f_1(x_2,x_1,x_0)$ on pin 11 and $f_0(x_2,x_1,x_0)$ on pin 12 for display on the PC. The two implementations, $f_1(x_2,x_1,x_0)$ and $f_0(x_2,x_1,x_0)$, obviously should show the same values on the LogiScan since they are two different implementations of the same function. Note that the LogiScan instrument provides variables only in *un*complemented form, so if you need a variable complemented, you'll have to use a gate to do that.

In you report show the circuit that you implement to generate the two versions of the function, and show whatever manipulations you used to arrive at that implementation. Remember to answer the questions below and get your lab instructor to check your result and sign this sheet so you can *attach it to your report*.

Q#1: What setup causes a NAND gate to function in the same manner as a NOT gate?
Q#2: How can you convert a design that uses AND, OR, and NOT gates into one that uses solely NAND or NOR gates?

Number of Chips used _____ **Signature: _____**

Other Useful Information

Using the LogiScan....
Turn on the PC and log on. Username is "ece" and password is "student" for these systems. Start up LogiScan. I think it starts automatically on most of the PC's. Connect the 24-pin plug to your breadboard, being sure to get the orientation right. Click on the boxes to select x_2, x_1, x_0, f_1, f_0. Click "Run Truth Table" to show your results.

In general, designing combinational logic can be described as the steps…
(1) State the problem, (2) Determine the required number of input and output variable, (3) Assign the input and output variables to letter symbols, (4) Derive the truth table, (5) Simplify the expressions, (6) Draw the circuit using gates, and (7) Implement and test the circuit.
Note: Some of the beginning steps are already taken care of in the description of the lab procedure.