ECE 1315 DIGITAL LOGIC DESIGN

ECE Dept, UMD
Jan 31, Tuesday, 2006

EXPERIMENT # 2: NAND and NOR

Implement each of the following two functions using a single TTL chip.

$$f_1(w,x,y) = \overline{w \cdot x} + \overline{x \cdot y}$$
$$f_2(w,x,y) = (\overline{w} + \overline{x})(\overline{x} + \overline{y})$$

The chips to be used are 74LS00 for NAND and 74LS02 for NOR. Each of these TTL chips contains only four NOR or four NAND gates. Therefore, you will need to create AND out of NOR or OR out of NAND to implement the given function. This is achieved using a digital logic principle called the "DeMorgan's Law."

The DeMorgan's law states that "complement (=inversion) of OR is AND of complements" or "complement of AND is OR of complements," that is,

$$\overline{(x+y)} = \overline{x} \cdot \overline{y}$$
$$\overline{(x \cdot y)} = \overline{x} + \overline{y}$$

Since DeMorgan's law provides OR out of AND or vice versa, it allows you to implement AND using NOR or OR using NAND. This is one of the unique features of digital logic and the learning objective in this experiment. You should also recognize that a NAND or NOR gate can be used as an inverter.

Regarding the definition of AND, OR, NOR, and NAND, please learn from the Lab #1 results (i.e., the truth table).

After learning the basic principles, design and build the circuits of the given equations, and use the LogiScan to verify the logic of your circuit. Since both functions have three inputs, you will need to connect three lines, X0, X1, and X2 from the LogiScan to your inputs. Record the truth table in the Results section when you believe that your circuits work properly. Have your instructor or TA verify the results and let him sign the Result sheet. That is it, and we see you next week.

EXPERIMENT #2 RESULTS

Your Name: _____

Witnessed by : _____

Date _____

Draw your circuit diagram here:

Truth table of your circuit observed from the LogiScan:

w	x	y	f_1	f_2
0				
0				
0				
0				
1				
1				
1				
1				