COSC 065 - Hardware Systems Homework #1 - Digital Logic

Due: 2007 September 14th, beginning of class

These questions are to be completed individually, but answers from the laboratory exercise should be based upon circuits built by your lab group.

- 1. A 7400 chip (as shown in figure 2.10 of your textbook) contains four NAND gates.
 - (a) Show how you could use two such chips (for a total of eight two-input NAND gates,) to implement each of the main two-input Boolean logic functions: AND, NAND, OR, NOR, XOR, and XNOR. Your circuit should consist only of NAND gates and connections. Clearly label your inputs and outputs. You do **not** need to include resistors, LED's, or other items from lab just the logic gates.
 - (b) If you could trade one of your two 7400 chips for a different chip with different gates on it, which gates would be the most help with the task above? Why?
- 2. In class, we examined several logic functions over two variables (logic gates with two inputs).
 - (a) How many possible logic functions over two variables are there? (Hint: How many possible truth tables are there?)
 - (b) Give a boolean formula (using variables "x" and "y" as the inputs) for each possible two-variable function.
 - (c) Draw a logic circuit (at the gate level) for each function.
- 3. Briefly explain how we get from simple Boolean logic gates to combinational logic that performs mathematics.
- 4. Lab question 1: Draw a complete schematic diagram for your circuit under the heading, "Logic Gates At Work," from laboratory handout #1. Include power, ground, switches, LEDs, and pin numbers for the logic gates.
- 5. Lab question 2: Give complete schematic diagrams and truth tables for the two gate combinations under the heading "Combinational Logic," from laboratory handout #1. Include power, ground, switches, LEDs, and pin numbers for the logic gates. Identify these logic functions.