COSC2200 -Hardware Systems  
Homework #1 -Digital Logic  

Due: September 11th, beginning of the class  
These questions are to be completed individually, but answers from the laboratory exercise should be based upon circuits built by your lab group.  

Total 20pts, each problem 4pts

1. A 7400 chip (as shown in figure 2.10 of your textbook) contains four NAND gates.  
   (a) Provide schematic circuits to 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 and wires.  
   (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,” for tasks 5 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,” for tasks 6-7 from laboratory handout #1. Include power, ground, switches, LEDs, and pin numbers for the logic gates. Identify these logic functions.