

# CS 210 Homework 6

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DUE: Monday, May 14, 2012

1. (a) Construct a circuit that implements a 1-bit half adder using XOR and NAND gates.  
(b) Give the Boolean expressions implemented by each output of your circuit diagram.  
(c) Give a truth table for your Boolean expressions.
2. (a) Construct a circuit that implements a 1-bit full adder using XOR and NAND gates.  
(b) Give the Boolean expressions implemented by each output your circuit diagram.  
(c) Give a truth table for your Boolean expressions.
3. (a) Construct a circuit that implements a 4-bit *magnitude comparator* having three outputs ( $x$ ,  $y$ , and  $z$ ). That is, given two 4-bit inputs  $A_4A_3A_2A_1$  and  $B_4B_3B_2B_1$ ,  
if  $A_4A_3A_2A_1 = B_4B_3B_2B_1$ ,  $x = 1$ ; otherwise,  $x = 0$   
if  $A_4A_3A_2A_1 < B_4B_3B_2B_1$ ,  $y = 1$ ; otherwise,  $y = 0$   
if  $A_4A_3A_2A_1 > B_4B_3B_2B_1$ ,  $z = 1$ ; otherwise,  $z = 0$   
Use the adder-subtractor from page 39 of the notes, inverters, and AND gates.  
(b) Test the circuit's operation by setting  $A_4A_3A_2A_1 = 1001$  and giving a truth table showing your outputs ( $x$ ,  $y$ , and  $z$ ) for all possible assignments to  $B_4B_3B_2B_1$ .