HOMEWORK 3

Revision **0**

*Note: Late HW is **not** accepted! Put your **"last name, first name," the course number (3701), and the HW number** in the **top right hand corner** of the first page of **all** HW assignments. Also for **all** homework, use file name **`HWx.pdf`**. Do **NOT** put your social security number or your UF ID number on your HW.*

In this course (in homework, labs, exams, etc.), for all mixed-logic circuit diagrams, write the intermediate equations at the inputs of each gate.

1. Design the logic diagrams (by hand) for the following logic equations using only AND (no bubbles), OR (no bubbles) and NOT gates of any sizes desired. Assume the inputs and outputs are all active-high. (Do not reduce the expression before implementing.) Always assume that you should try to minimize the number of gates required unless some other optimization criteria is specified.

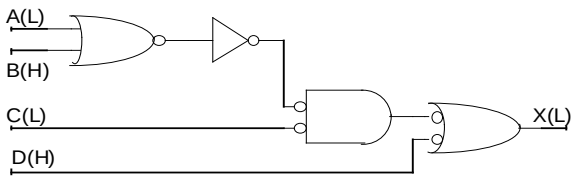
   Logic Equations:

   a) `X = /(/A + B) * (B + /C)`

   b) `Y = (A +/B) * /(/B*/C + B*C)`

2. Repeat 1a & 1b but this time assume that you can select the activation level of all signals and you can choose any real gates. Try to minimize the number of gates required.

3. Analyze the given circuit. What is the equation for X? Redraw the circuit showing pin number and chip numbers. Show all intermediate equations by writing the equations next to the inputs of each gate. (Do not simplify.)



4. What is the decimal equivalent of 1010 1111 1111 if this number is assumed to be in one of the following formats? (The spaces are added for reading clarity only.)
   a. 12 bit, unsigned binary
   b. 12 bit, sign magnitude
   c. 12 bit, 1's complement
   d. 12 bit, 2's complement
   e. 12 bit, BCD

5. For all the valid combinations of a 3-bit number (000 to 111), what decimal values do they represent in 3-bit signed-magnitude, 3-bit 1's complement, and 3-bit 2's complement representation?

6. Multiply unsigned numbers 11001 and 10110 by hand and show the final product.

7. For each of the following, determine the binary result and the decimal equivalents. Given the following eight bit numbers 1001 0101 and 0111 1111:
   a. What is the sum if they are assumed to be unsigned binary numbers?
   b. What is the sum if they are assumed to be 8-bit 2's complement numbers?
   c. What is the sum if they are assumed to be 8-bit signed-magnitude numbers?
   d. Which sums are valid as 8-bit numbers, i.e., which sums fit in their corresponding 8-bit number representation)?

8. Do the following problems from our (Roth) textbook:
   5th edition:
   - Chapter 1: 1a, 1b, 2a, 3, 5, 6a, 6b, 7a-e (2's comp only), 8, 10c, 11a, 15a, 17a, 25a, 27a-c

   6th edition:
   - Chapter 1: 1a, 1b, 2a, 3, 5, 6a, 6b, 7a-e (2's comp only), 8, 10c, 11a, 17a, 19a, 32a, 34a-c

   7th edition:
   - Chapter 1: 1a, 1b, 2a, 3, 5, 6a, 6b, 7a-e (2's comp only), 8, 10c, 11a, 17a, 19a, 35a, 37a-c