CSE140 Homework #1

Due date: 04/06/2010

You must SHOW ALL STEPS for obtaining the solution. Reporting the correct answer, without showing the work performed at each step will result in getting 0 points for that problem.

Problems:

1. Simplify using axioms and theorems of Boolean algebra. State the axioms used.
   a. F (A, B, C) = A'B'C'+AB'C'+ABC'+ABC+A'B'C+AB'C
   b. F (A, B) = (A'+B) (A+B)

2. Draw the logic diagram for the Boolean expression.
   \[ Y = ((A+B') (B+C))' \]

3. Give the Boolean equation and the truth table for the given logic diagram.

4. Do the necessary conversions.
   a. \((F23)_{16} \rightarrow \text{Decimal}\)
   b. \((1E0)_{16} \rightarrow \text{Binary}\)
   c. \((10011111)_2 \rightarrow \text{octal}\)
   d. \((104)_{10} \rightarrow \text{Binary}\)
   e. \((300)_{10} \rightarrow \text{Hex}\)
5. Perform binary addition with the following two’s complement numbers, and check whether these operations will generate an overflow or not using the two methods discussed in the course.
   
a. 11011001 + 01011100
b. 10011001 + 10111011

6. Perform binary subtraction with the following two’s complement numbers, and check whether these operations will generate an overflow or not using the two methods discussed in the course.
   
a. 011011 – 11001
b. 1100 – 1010

7. Perform binary multiplication with the following binary numbers using the method shown in class.
   
a. 101001 x 110
b. 23 x 3 (convert into binary and multiply)

8. Perform binary division with the following binary numbers using the method shown in class.
   
a. 101010 / 1100
b. 10000111 / 11011

9. a. Construct using only NAND gates.
   
   \[ F = XY + XZ' \]
   
b. Construct using NOR gates only.
   
   \[ F = (X+Z)(Y'+Z)(X'+Y+Z) \]

10. Build a Boolean expression for the following question.

    Let \( F \) be the output where you want to cross the road. Use the given signals and condition as the input. The only two directions on the road are NS (North - South) and EW (East-West). You can cross the road from NS when all the vehicles from EW are at halt and vehicles from NS are moving or vice versa.

     Assume,

     \[ A, B, C \rightarrow \text{Green Red and yellow lights for NS direction} \]
     \[ X, Y, Z \rightarrow \text{Green Red and yellow lights for EW direction} \]