CSE370: Introduction to Digital Design
Winter 1999

Homework Set 1

DUE: Jan 15,1999, 12:30 pm

No CAD tools or calculators may be used on this homework set. Please show *all* of your work. Solutions do not have to be typeset, but may be if desired. In any case, your solutions must be legible…we will not spend time trying to decipher poorly written assignments.

1) Perform the following conversions (assume all unsigned numbers):
   a) 10101101011_2 to base 10 (decimal)
   b) 617_{10} to base 2 (binary)
   c) $C46B_{16}$ to base 2 (binary) and to base 10 (decimal)
   d) 718_{10} to base 8 (octal) and to base 16 (hexadecimal)

2) $A=011010_2$, $B=100001_2$, $C=111110_2$, and $D=1101_2$ are unsigned binary numbers. Calculate:
   a) The sum, A+B+C+D
   b) The difference, B–A
   c) The product, A×D

3) Using the 2's complement system, convert the following positive numbers to negative numbers of the same value:
   a) 011010_2
   b) 000001_2

4) What is the decimal (base 10) value of 10011 when read as
   a) An unsigned binary number
   b) A sign-magnitude binary number
   c) A 1's complement binary number
   d) A 2's complement binary number
   e) A hex (base 16) number

5) What are the decimal (base 10) values of the largest and smallest binary numbers (integers) that can be expressed using the following. *Note: you may use a calculator for this question.*
   a) 16 bits with no sign bit
   b) 16 bits as signed-2's complement

6) Re-express the following 4-bit 2s complement numbers as 8-bit 2s complement numbers with the same value:
   a) 0101
   b) 1011

7) Draw a circuit diagram to implement the following logic function: $\overline{A}BC + B\overline{C} + A(\overline{BD})$

8) Simplify (i.e., minimize the number of literals) using known logic identities:
   a) $\overline{X} \bullet \overline{Y} + X \bullet Y + \overline{X} \bullet Y$
   b) $XZ + \overline{X\,\overline{Z} + Y} + \overline{Y}Z + X\overline{Y}Z + X\overline{Z} + XYZ + X\overline{Y}\,\overline{Z}$

9) Find and simplify the complement of the following functions:
   a) $F = X \bullet \overline{Y} \bullet \overline{Z} + X \bullet \overline{Y} \bullet Z + X \bullet Y \bullet Z$
   b) $G = X(\overline{Y}Z + Y)$

10) Draw the truth table for a two input XOR gate. Give a Boolean function that cannot be realized using only XOR gates.

11) Katz Problem 1.19

12) Where did Prof. Dickey get his Ph.D., and what was his thesis about?

13) What degree does your TA, Jeffrey Hightower hold, and from what institution?

14) Randy Katz is a professor at what institution?

15) I have subscribed to the cse370 mailing list. (T/F)