KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-202 – Fundamentals of Computer Engineering

Assignment # 1: Due Sunday Nov 23rd, 2008 – in class.

1) Convert the following numbers from the given base to the bases indicated:

(a) Decimal 255.225 to binary, octal, and hexadecimal.
(b) Hexadecimal 2AC5.D to decimal, octal, and binary.
(c) Hexadecimal EF.C to base 5
(d) Binary 1010101111.01101 to base 3

2) Perform the following unsigned arithmetic operations using the designated bases without converting to decimal. Verify your result by converting the numbers to decimal and then performing the operation in decimal.

(a) $(10111011)_2 - (01001111)_2$
(b) $(10E)_{16} - (13F)_{16}$
(c) $(54)_{16} * (20)_{16}$
(d) $(11011.0111)_2 + (11.1101)_2$

3) In each of the following cases, determine the radix *r*:

(a) $(121)_r = (25)_{10}$
(b) $(345)_r = (180)_{10}$

4) Show how the decimal integers +120 and -120 would be represented in signed magnitude, 1's complement, and 2's complement notation using 8 bits and 10 bits, respectively.

5) Perform the operations *M*+*N*, *M*-*N*, and *N*-*M* using both radix and diminished radix complement systems using the specified number of digits. Specify when an overflow condition has occurred.

(a) $n = 4$, $M = (A2B)_{16}$, $N = (56C)_{16}$
(b) $n = 3$, $M = (821)_{10}$, $N = (785)_{10}$
(c) $n = 8$, $M = (10010)_2$, $N = (11011)_2$
(d) $n = 6$, $M = (10010)_2$, $N = (10011)_2$

6) A microcontroller uses 16-bit registers. Give the following in both binary and decimal:

(a) The maximum unsigned integer number that can be stored.

(b) The smallest (negative) number and the largest (positive) number that can be stored using the sign-magnitude notation.

(c) The smallest (negative) number and the largest (positive) number that can be stored using the 2`s complement notation.

7) Prove the following Identities using Boolean algebraic manipulation:

a) x'y' + xy + x'y = x' + y
b) x'y + xy' + xy + x'y' = 1

c) xy' + y'z' + x'z' = xy' + x'z'

8) Simplify the following expressions to a minimum number of "*literals*" using Boolean algebraic manipulation

a) ABC + A'B + ABC'

b) (x + y)' (x' + y')

c) (BC' + A'D)(AB' + CD')

9) Using De-Morgan's theorem to derive the complement (F') of the function F = xy +z
Using algebraic manipulations verify (for this function) that F.F'=0 as well as F + F' = 1

10) Derive the truth table and draw the logic diagram of the following function:

f(A,B, C, D) = BC' + AB + ACD

11) For the Boolean functions E and F, as given in the following truth table:

a) List the minterms and the maxterms of each function
b) List the minterms of $\overline{E}$ and $\overline{F}$
c) List the minterms of $E + F$ and EF
d) Express E and F in the sum-of-minterms algebraic form
e) Simply E and F to expressions with a minimum number of literals

X	Y	Z	E	F
0	0	0	1	0
0	0	1	1	0
0	1	0	1	1
0	1	1	0	1
1	0	0	0	0
1	0	1	1	0
1	1	0	0	1
1	1	1	0	1

12) Convert the following expressions into sum-of-products and product of sums forms:

a) (AB+C)(B+C'D)

b) X'+X(X+Y')(Y+Z')

c) (A+BC'+CD)(B'+EF)