KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-202 – Fundamentals of Computer Engineering

Assignment # 1: Due Tuesday April 3rd, 2007 – in class.

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1) Perform the following arithmetic operations using r's complement and using the specified number of digits. Also, specify when an overflow condition has occurred:

Hint: Assume the specified number are UNSIGNED, i.e. only the magnitude is specified in the problem statement and the –ve sign is used to explicitly indicate that the number is negative.

(a) $(821)_{10} + (785)_{10}$ using 3-digits

(b) $(821)_{10} + (785)_{10}$ using 4-digits

(c) $(–A2B)_{16} + (–56C)_{16}$ using 4-digits

(d) $(56C)_{16} – (A2B)_{16}$ using 4-digits

(e) $(10010)_2 – (11011)_2$ using 8-bits

(f) $(11010)_2 – (10000)_2$ using 6- bits

2) A microcontroller uses 8-bit registers. Give the following in both binary and decimal:

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

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

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

3) Prove the following Identities using Boolean algebraic manipulation:

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

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

c) x'y + xy' + xy + x'y' = 1

d) x' + xy + xz' + xy'z' = y + x' + z'

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

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

a) *ABC + A'B + ABC'*

b) x'yz + xz

c) (x + y)' (x' + y')

d) xy + x(wz + wz')

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

5) Reduce the following Boolean Expressions to the indicated number of "*literals*" using Boolean algebraic manipulation

a) *A'C' + ABC + AC'* ↬ (3 *literals*)

b) ((CD)' +A)' + A + CD + AB ↬ (3 *literals*)

c) (A' + C)(A' + C')(A + B +C'D) ↬ (4 *literals*)

d) A' (A + B +C'D) ↬ (4 *literals*)

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

7) Derive the truth table and draw the logic diagram of the following functions:

a) BC' + AB + ACD

b) (A + B)(C+D)(A' + B +D)

c) (AB +A'B')(CD' + C'D)