Student name: _____Section 4(**9.05**) or 3(**12.20**)

Midterm Exam - I for CSE 271 Sections (3) and (4) Fall 2005

10/6/2005 - 8:15-10:15 p.m. - 112 Kern

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Answer all questions. (If you need more space use backside). (Total 100 points)

1. Perform the following operations on each of the pairs of signed (2's complement) six bit binary numbers. Show the decimal equivalents of each operands and results. Indicate if there is overflow (10 points)

   a. 110101 – 000011

   b. 110101 – 011000

   c. 010000 - 100100

   d. 111111 + 001011

   e. 101001 + 110001

2a. Convert the number 275_{10} to: (6 points)

i. Hexadecimal number
ii. Binary number
iii. Octal number

2b What is range of numbers that can be represented using a signed 8 bit binary digits? What is the largest integer represented by a 8 bit unsigned number? (4 points)

3a. List all maxterms of f(A,B,C) = 0 and in Π M( ) notation (5 points)

3b. List all minterms of f(x,y,z) = x both as product terms and using ∑ notation. (5 points)

4a.Simplify the switching function f(w,x,y,z) = w'yz + wx + w'y'z + w'xyz' + wxy + w'y'z using switching algebra indicating the properties you used and obtain a least cost sum of products form for the function. (Use properties of switching algebra, including consensus) (5 points)

4 (b) Use the Karnaugh map method to minimize the function in 4(a) and confirm the best SOP solution. (5 points)

4©. Draw the 2 level combinational circuit (using AND and OR) to realize the simplified function in 4(a). (5 points).

5(a). Given A and B are switching variables, prove the property (AB)' = A' + B'(4 points) Next write down the dual of the property (1 point).

5b. Find the complement of the expression h = (a+b'c)d' + a(a' + c')(c+d). Make sure that only single variable may be complemented in the answer. (5 points)

6a. Plot the function f (w,x,y,z) = $\sum$ m(0, 7,8,10,12) +d(2,6,11) on the Karnaugh map and obtain the minimal sum of product form for f (w,x,y,z). (5 points)

6 b List the minterms of the function f'(w,x,y,z), the complement of f(w,x,y,z) = $\sum$ m(0, 7,8,10,12) +d(2,6,11). Use Karnaugh and obtain the minimal SOP form for the function f'(w,x,y,z) and give the number of terms (T) and total literals (L) needed. (5 points)

6c Take the complement of the MSOP results for f'(w,x,y,z) found in 6(b) and obtain the minimal product of sum (POS) form of the function f(w,x,y,z). Find the number of sum terms and total literals needed (5 points)

6d. Which of the solution for f(w,x,y,z) is better if any and why. (2 points bonus). Provide a circuit diagram realizing the best solution. You may use Only NAND gates or (AND, OR, NOT) gates to realize your solution (3 points bonus)

7. Using K- map, find the minimal sum of product form for the expression
   g = wxz +xy'z + wz' +xyz + wxy'z + w' y' z' 10 points

8. Answer the following in the space provided. (2.5 each) (10 points)

a. Consensus between the two terms a'bc'f, gaxcd is _____

b. Evaluate: {(a+a') EXCLUSIVE OR 1} = _____

c. A 14 pin chip can provide a maximum of _____ two input NAND gates

d. Define an essential prime implicant.

_____
_____
_____

e. NAND and NOR operators are said to be _____ and only one type of gate is adequate for realization of combinational logic circuits.

10. G' = A'BC'D + B'CD' is given to be a minimal SOP solution for G'. It is also given that G = C'D'+ B'D + BC + AB is a minimal SOP solution that is realized by five gates. Using these information, design a solution for G that uses only 4 NAND Gates. (10 points)