Test 3

1. Implement each of the following function using only two-input NAND gates. NO GATE MAY BE USED AS A NOT GATE. The functions are in minimum sum of product form. Assume all inputs are available both uncomplemented and complemented.

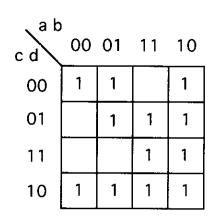   a) (15) $f = w x' + w' y + y z' + x y' z$ (7 gates)

    b) (15) $G = A B C E + A C' D E' + D' E + B D' + A' B' D$
                                                      (12 gates)

2. Find the minimum sum of products expression(s) for each of the following functions (that is, circle the terms on the map and write the algebraic expressions.

    a) (10) one solution   b) (15) two solutions

a b / c d map:

c d \ a b	00	01	11	10
00	1		1	1
01		1		
11	1			
10	1		1	1

w x / y z map:

y z \ w x	00	01	11	10
00	1			1
01		1	1	1
11		1	1	1
10	1		1	1

3. (15) Find both minimum sum of product expressions for the following function. (Two copies of the map are given for your convenience.)

a b / c d map:

c d \ a b	00	01	11	10
00	1	1		1
01		1	1	1
11			1	1
10	1	1	1	1

a b / c d map:

c d \ a b	00	01	11	10
00	1	1		1
01		1	1	1
11			1	1
10	1	1	1	1

4. (15) For the following function (three copies of map shown).

    a) List all of the prime implicants. Indicate which, if any, are essential.

    b) Find all four minimum sum of products expressions.

wx \ yz

yz \ wx	00	01	11	10
00	X	1	X	1
01	X	1	X	
11		1	X	X
10			X	1

yz \ wx	00	01	11	10
00	X	1	X	1
01	X	1	X	
11		1	X	X
10			X	1

yz \ wx	00	01	11	10
00	X	1	X	1
01	X	1	X	
11		1	X	X
10			X	1

5. (15) For the following function, f, find BOTH minimum sum of products expressions and the minimimum product of sums expression.

wx \ yz

yz \ wx	00	01	11	10
00		1		
01	X	1		
11	X	1	1	X
10		1	X	

yz \ wx	00	01	11	10
00				
01				
11				
10				