SANTA CLARA UNIVERSITY
Electrical Engineering Department

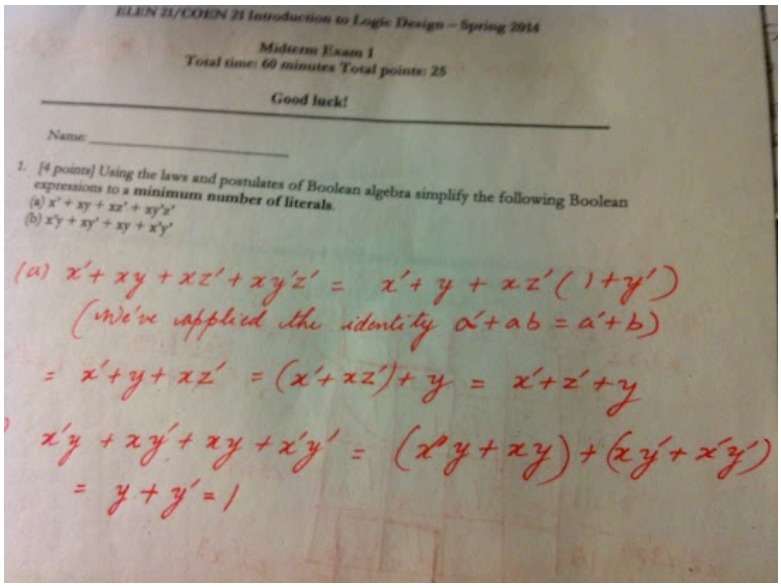
ELEN 21/COEN 21 Introduction to Logic Design – Spring 2014

Midterm Exam 1 solution
Total time: 60 minutes Total points: 25

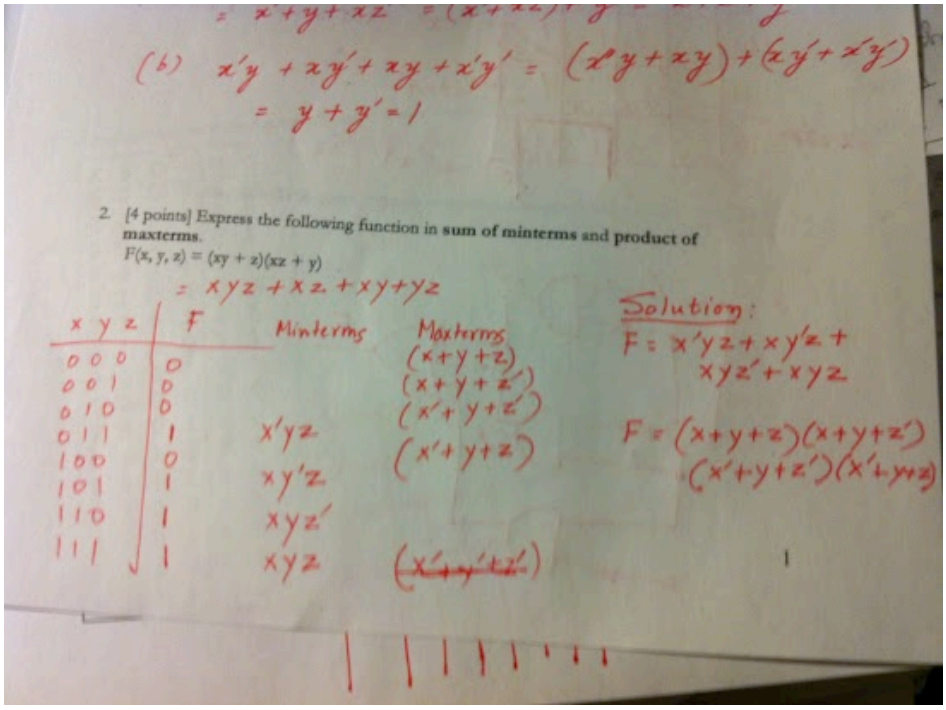
Good luck!

Name: _____

1. [4 points] Using the laws and postulates of Boolean algebra simplify the following Boolean expressions to a **minimum number of literals**.
   (a) x' + xy + xz' + xy'z'
   (b) x'y + xy' + xy + x'y'

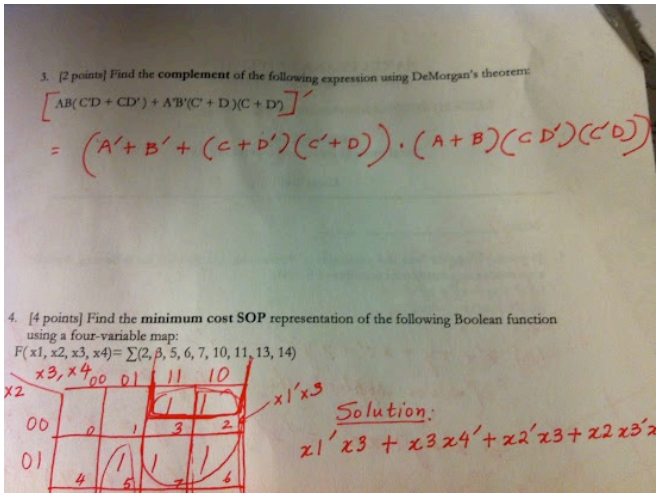


2. [4 points] Express the following function in **sum of minterms** and **product of maxterms**.
F(x, y, z) = (xy + z)(xz + y)

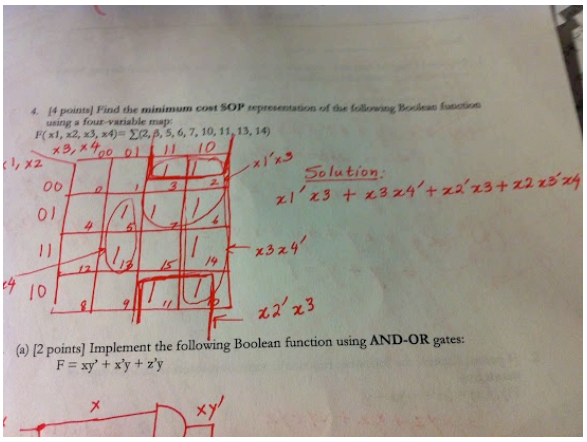


3. [2 points] Find the **complement** of the following expression using DeMorgan's theorem:

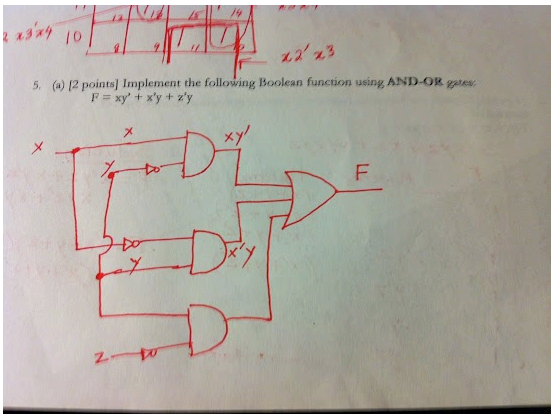
AB(C'D + CD') + A'B'(C' + D)(C + D')



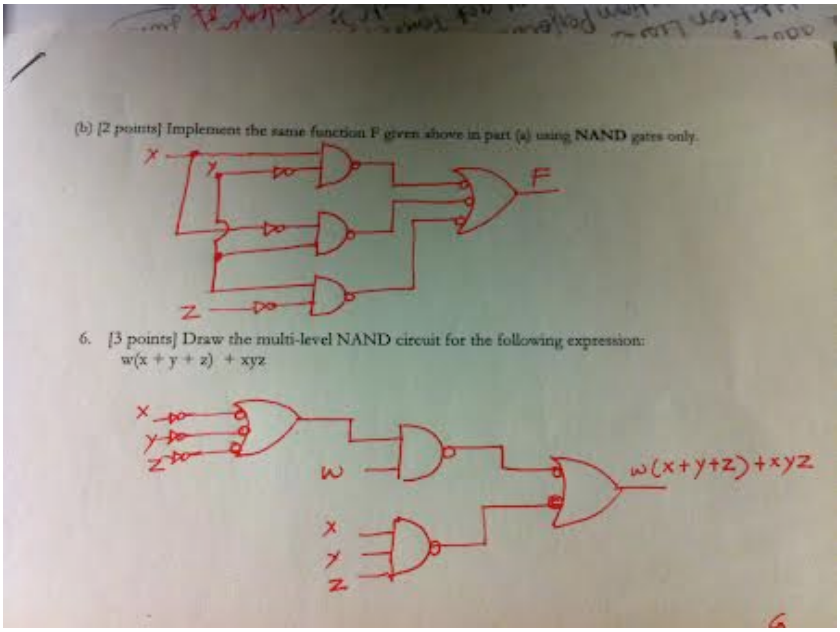
4. [4 points] Find the **minimum cost SOP** representation of the following Boolean function using a four-variable map:
F(x1, x2, x3, x4)= ∑(2, 3, 5, 6, 7, 10, 11, 13, 14)



5. (a) [2 points] Implement the following Boolean function using **AND-OR** gates:
F = xy’ + x’y + z’y



(b) [2 points] Implement the same function F given above in part (a) using **NAND** gates only.



6. [4 points] Implement the functions F and G shown in this table on a PLA:

A	B	C	D	F	G
0	0	0	0	1	0
0	0	0	1	0	0
0	0	1	0	0	1
0	0	1	1	0	0
0	1	0	0	0	0
0	1	0	1	1	0
0	1	1	0	1	1
0	1	1	1	1	1
1	0	0	0	0	0
1	0	0	1	0	0
1	0	1	0	X	X
1	0	1	1	X	X
1	1	0	0	X	X
1	1	0	1	X	X
1	1	1	0	X	X
1	1	1	1	X	X

7. [4 points] Implement the functions F and G shown in this table on a PLA:

A	B	C	D	F	G
0	0	0	0	1	0
0	0	0	1	0	0
0	0	1	0	0	1
0	0	1	1	0	0
0	1	0	0	0	0
0	1	0	1	1	0
0	1	1	0	1	1
0	1	1	1	1	1
1	0	0	0	0	0
1	0	0	1	0	0
1	0	1	0	X	X
1	0	1	1	X	X
1	1	0	0	X	X
1	1	0	1	X	X
1	1	1	0	X	X
1	1	1	1	X	X