CSCE 211 CHAPTER 2 PROBLEM ASSIGNMENT SEP 13 2022

You must show all your work! Answers without supporting work will not be given credit. Write answers in spaces provided. Illegible work falls under the *Intended Purpose* policy.

You must upload your submission as a SINGLE PDF DOCUMENT. Multiple file submissions or files of any other type will not be accepted.

This assignment is worth 4.0/21.0 ($\approx$ 19%) of Problem Assignment points

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1. Show the truth table for a system with four inputs, *a, b, c,* and *d,* and two outputs, *f* and *g*. The inputs represent a BCD digit between 1 and 9 (8421 code). All other inputs never happen. The output *f* is 1 if and only if the input represents an odd number larger than 6 or an even number less than 7. The output *g* is 1 iff the input represents a perfect square. (A perfect square is a number whose square root is an integer.) (0.4 points)

a	b	c	d		f	g
1	1	1	1		X	X
1	1	1	0		X	X
1	1	0	1		X	X
1	1	0	0		X	X
1	0	1	1		X	X
1	0	1	0		X	X
1	0	0	1		1	1
1	0	0	0		0	0
0	1	1	1		1	0
0	1	1	0		1	0
0	1	0	1		0	0
0	1	0	0		1	1
0	0	1	1		0	0
0	0	1	0		1	0
0	0	0	1		0	1
0	0	0	0		1	0

2. For each of the following two expressions, select all of the following definitions which (if any) apply. (0.4 points)
   i. Product term iii. Sum term
   ii. SoP expression iv. PoS expression

   (a) $b'c'd'$

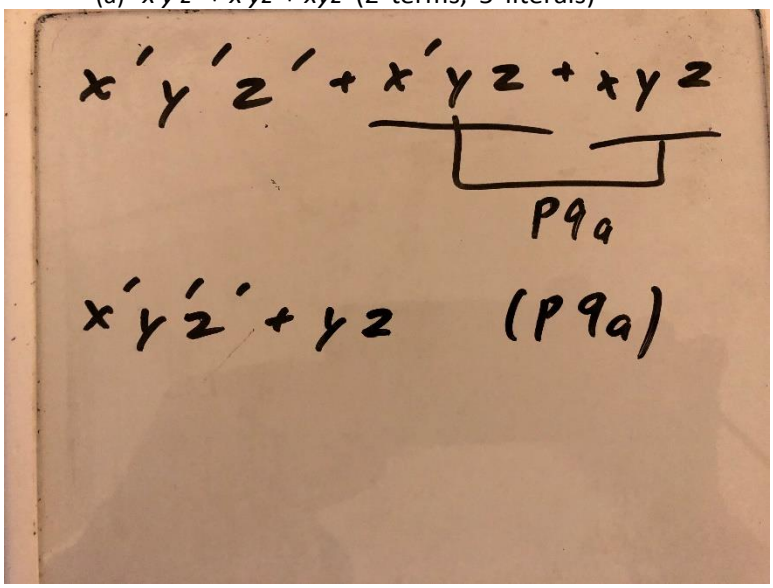
   Answer: Product Term, SoP

   (b) $a' + b$

   Answer: Sum term

3. Using properties 1 to 10, reduce the following expressions to a minimum SOP form. Show each step; the numbers of terms and literals in minimum form are shown in parentheses. (0.4 points)

   (a) $x'y'z' + x'yz + xyz$ (2 terms, 5 literals)



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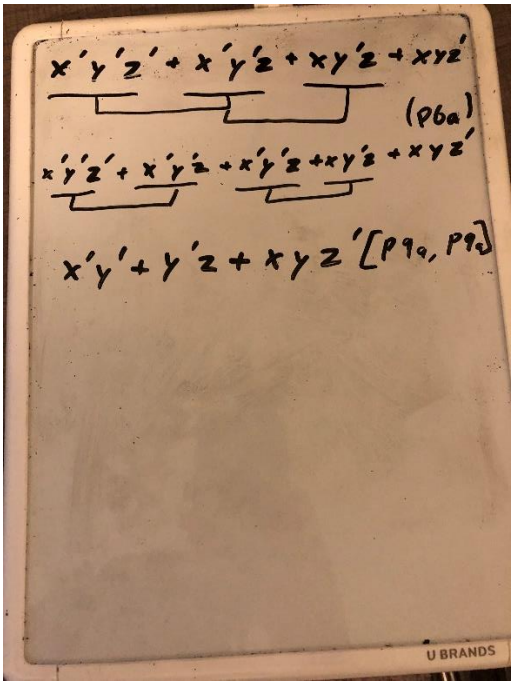
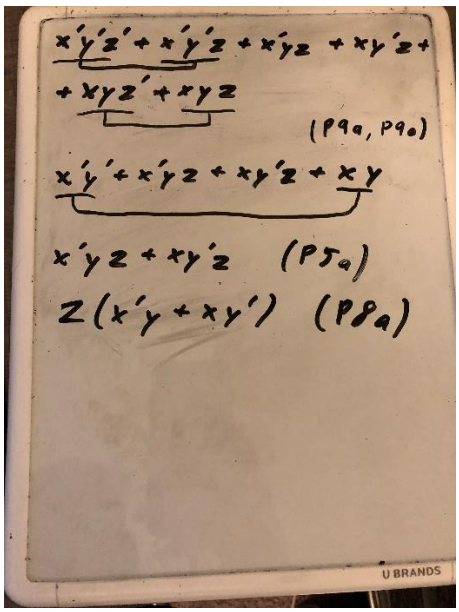
(b) $x'y'z' + x'y'z + xy'z + xyz'$ (3 terms, 7 literals)



(c) $x'y'z' + x'y'z + x'yz + xy'z + xyz' + xyz$ (3 terms, 5 literals)



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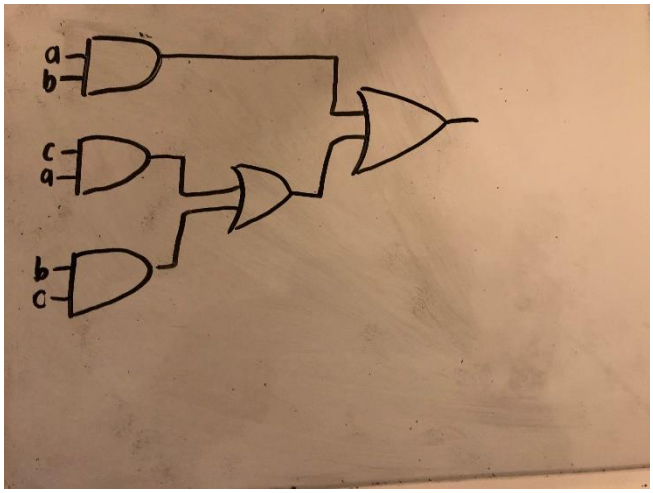
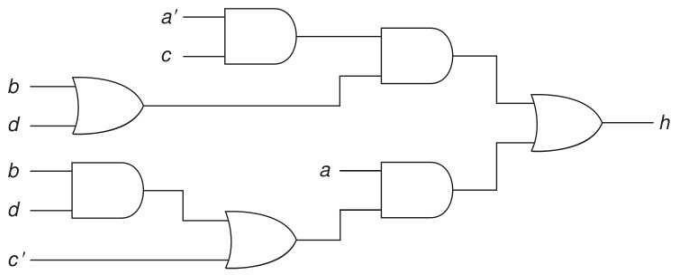
4. Show a block diagram of a system using AND, OR, and NOT gates to implement the following functions. Assume that variables are available only uncomplemented (this means NOT gates are required when variables are complemented). Do not manipulate the algebra. (0.4 points)

$$ab + c(a + b)$$



5. Translate the following circuit into an algebraic expression, then put it in sum of product form. (0.4 points)



Answer: (a'c)(b+d)+a(bd+c')

[P8a, P8a]

Answer: ba'c+da'c+abd+ac'

Cont.

6. Given the following function *h*, find the complement, h'. Only single variables may be complemented in the answer. (0.4 points)

$$h = (a + b)(b' + c) + d'(a'b + c)$$

h' = (a' + b')(b + c') + d(ab' + c')

7. For each of the following functions:

$f(x, y, z) = \Sigma m(1, 3, 6)$
$g(x, y, z) = \Sigma m(0, 2, 4, 6)$

(a) Provide truth table for both *f* and *g* behavior.
(b) Convert to an algebraic expression in sum of minterms form.
(c) Convert to a minimum SoP expression (2 terms, 5 literals and 1 term, 1 literal, respectively)

x	y	z		f	g
0	0	0		0	1
0	0	1		1	0
0	1	0		0	1
0	1	1		1	0
1	0	0		0	1
1	0	1		0	0
1	1	0		1	1
1	1	1		0	0

F = x'y'z + x'yz + xyz'

F (SoP) = x'z + xyz [P9a]

G = x'y'z' + x'yz' + xy'z' + xyz'

X'z' + xz' [P9a, P9a]

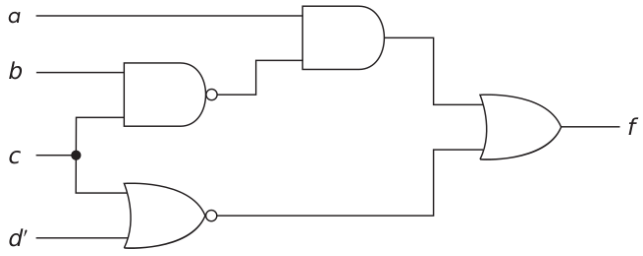
G (SoP) = z'

Cont.

8. For the following circuit,

   (i) write an algebraic expression representing the circuit without modification.

   (ii) rewrite the expression from (i) in SoP form.



a(bc)'+(cd')'

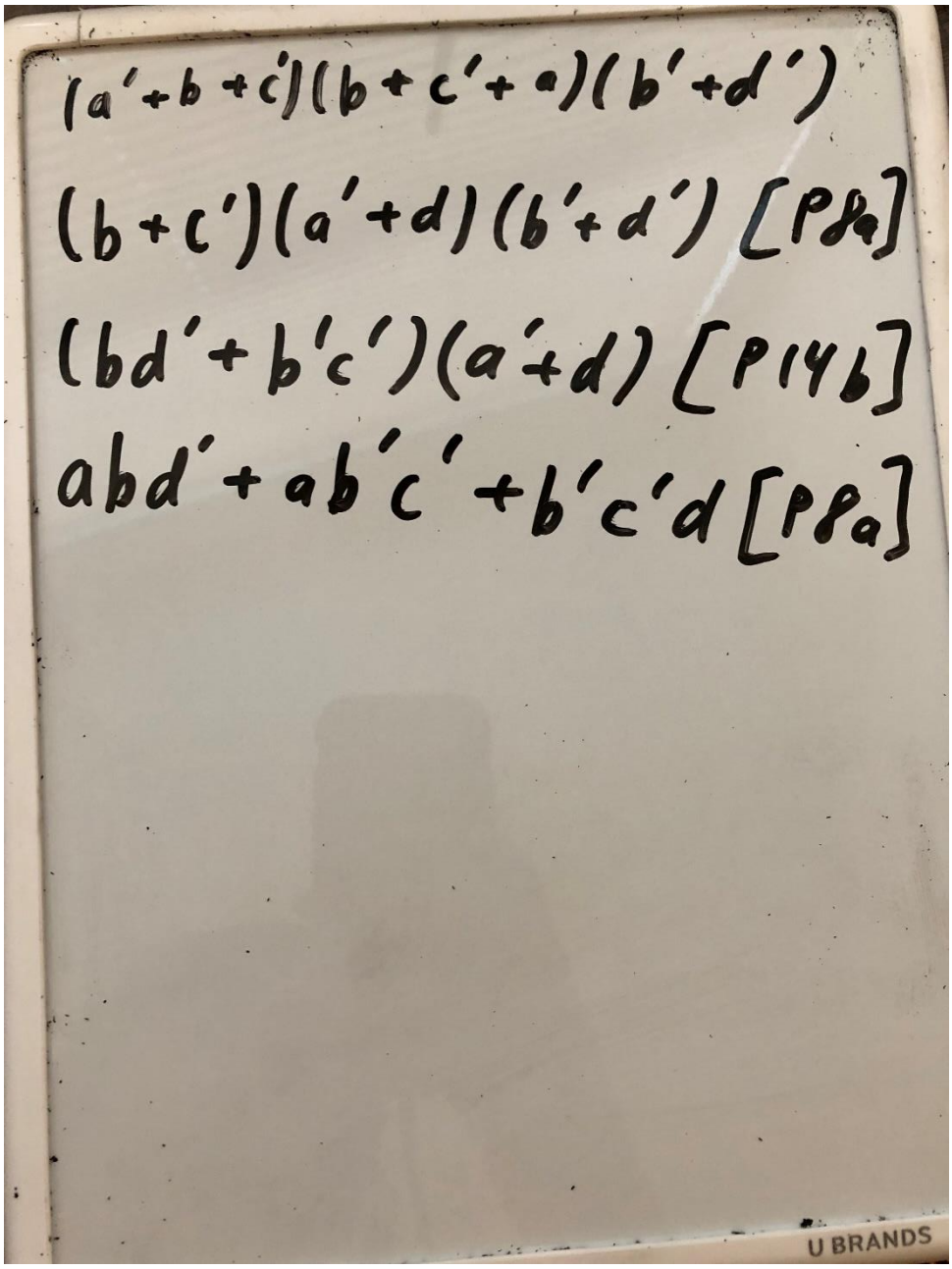
a(b' + c') + (c' + d) [P11b, P11b]

(ab'+ac')+(c'+d) [P8a]

Cont.

9. Convert the following PoS algebraic expression into SoP form

$(a' + b + c')(b + c' + d)(b' + d')$



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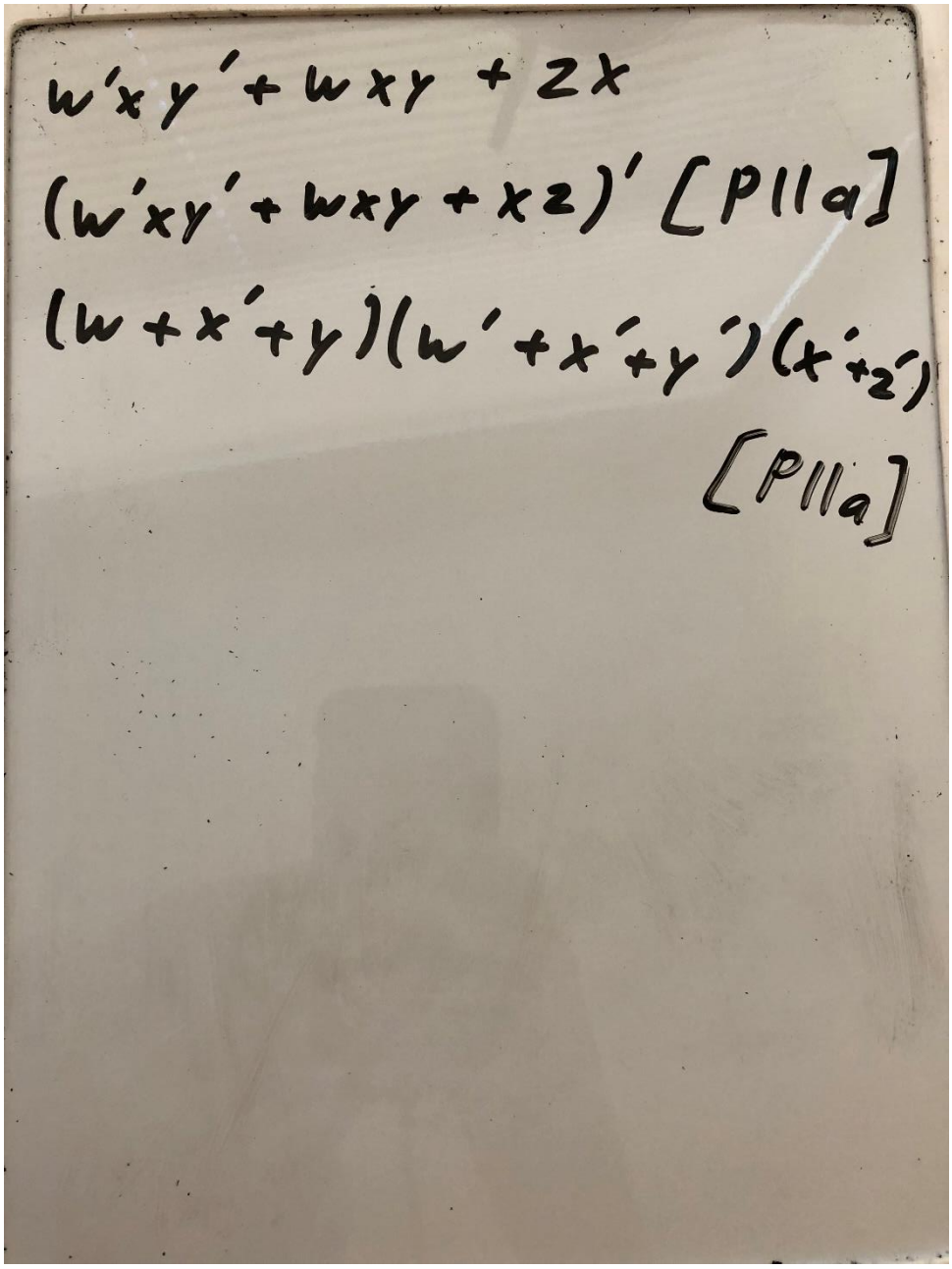
10. Convert the following SoP algebraic expression into PoS form

$w'xy' + wxy + xz$



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