IC220: HW 5

Due: 20 Feb 2019

Full Name: _____ **Alpha:** _____

Circle Your Section: Aviv/1001 Aviv/2001 Aviv/4001 Choi/5001 Missler/5002

Preliminary: Carefully do the assigned reading for Chapter 2 (2.1-2.3,2.5-2.10,2.12)

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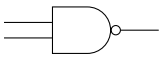
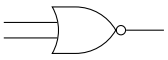
1. **[5 points]** Complete the truth table for the NAND and NOR gates

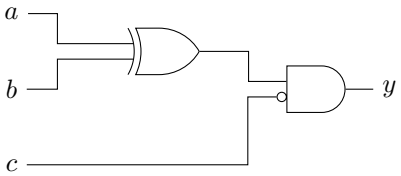


A	B	x
0	0	
0	1	
1	0	
1	1	



A	B	x
0	0	
0	1	
1	0	
1	1	

2. For the following logic circuit



(a) **[3 points]** Complete the truth table for all 3 bit inputs for a, b, c and output y

a	b	c	y

(b) **[2 points]** Write the boolean equation for this circuit.

3. **[5 points]** Draw a circuit for the following formula

$$f = \overline{(A + B) \cdot C) + D}$$

4. **[5 points]** Show the sum of products for the following truth table

a	b	c	f
0	0	0	1
0	1	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	1	1	1
1	1	0	0
1	1	1	0

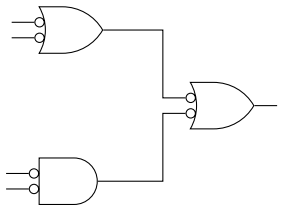
5. Simplify the following equations (use Boolean laws)
   (a) **[1 point]** $B(A+0)$

   (b) **[1 point]** $B(A\overline{A})$

   (c) **[1 point]** $(A+\overline{B})(\overline{A}+B)$

   (d) **[2 points]** $\overline{(A+B)}\cdot(A+B+C)$

6. **[5 points]** Use bubble pushing to simplify this circuit



7. Using the following truth table

a	b	c	f
0	0	0	0
0	1	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	1	1	1
1	1	0	1
1	1	1	1

(a) **[5 points]** Show the sum of products.

(b) **[5 points]** Simplify the above equation.

8. Simplify the following equations

(a) **[2 points]** $C(A+1)$

(b) **[2 points]** $AB(A+C)$

(c) **[2 points]** $(A+\overline{B})(\overline{A}+c)$

(d) **[2 points]** $(B+0)(C+D+1)$

9. Using the following truth table

a	b	c	f
0	0	0	1
0	1	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	1	1	0
1	1	0	1
1	1	1	0

(a) **[3 points]** Fill in the following K-Map

	$\overline{b}\overline{c}$	$\overline{b}c$	bc	$b\overline{c}$
a				
$\overline{a}$				

(b) **[2 points]** Minimize the function using the K-map

(c) **[5 points]** Draw the two-level circuit for this function

10. **[5 points]** Suppose we already have this k-Map.

	$\overline{C}\,\overline{D}$	$\overline{C}D$	CD	$C\overline{D}$
$\overline{A}\,\overline{B}$	1	0	0	1
$\overline{A}B$	1	1	1	1
AB	1	1	0	0
$A\overline{B}$	0	0	0	1

Minimize the function

11. Consider your answer to question 9.c, the particular two-level, minimal circuit.

    (a) **[1 point]** Is your answer unique? In other words, is there only one possible two-level circuit for that K-Map that is minimal, or is there another one that is logically different but still correct and just as small? (**Answer either UNIQUE or NOT UNIQUE**)

    (b) **[3 points]** Will this always be the case, or could a different K-map change your answer?

12. [**10 points**] Suppose we already have this K-map. Minimize the function.

	$\overline{C}\overline{D}$	$\overline{C}D$	CD	$C\overline{D}$
$\overline{A}\overline{B}$	1	0	1	1
$\overline{A}B$	0	1	1	1
AB	1	1	1	0
$A\overline{B}$	1	0	1	1

13. [**10 points**] Suppose we already have this K-map. Minimize the function.

	$\overline{C}\overline{D}$	$\overline{C}D$	CD	$C\overline{D}$
$\overline{A}\overline{B}$	0	X	0	0
$\overline{A}B$	1	1	1	1
AB	0	1	0	X
$A\overline{B}$	0	X	0	0