Section 4 Assignment (123 points) – Boolean Functions

To receive credit, you must either show your work on the worksheet or explain how you got the answer.

1. (12 points) Indicate whether the following Boolean expressions are in conjunctive normal form (CNF), disjunctive normal form (DNF), both (B), or neither (N).

   a. (4 pts) CNF / DNF / B / N $(\overline{x} + \overline{y})(\overline{z} + x)$

   b. (4 pts) CNF / DNF / B / N $xz + \overline{y}$

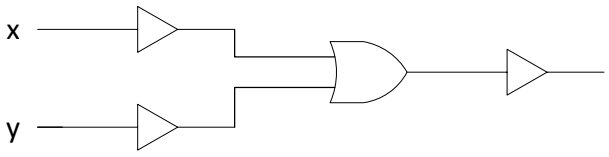
   c. (4 pts) CNF / DNF / B / N $(\bar{x} + 3)$

2. (10 points) Using the *Simplification Rules for Boolean Variables* and the *Laws of Boolean Algebra,* determine if the two Boolean expressions in each pair are equivalent:

   $\overline{x + \overline{y}} + \overline{x}\,\overline{y} = \overline{y}$

3. (20 points) Give the Boolean function described by the following digital logic (circuit) diagrams

   a. (4 pts)



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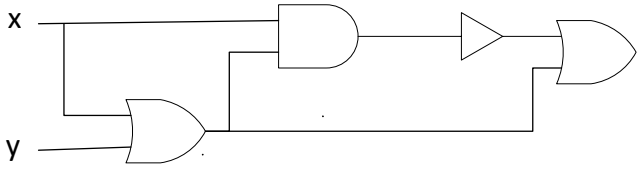
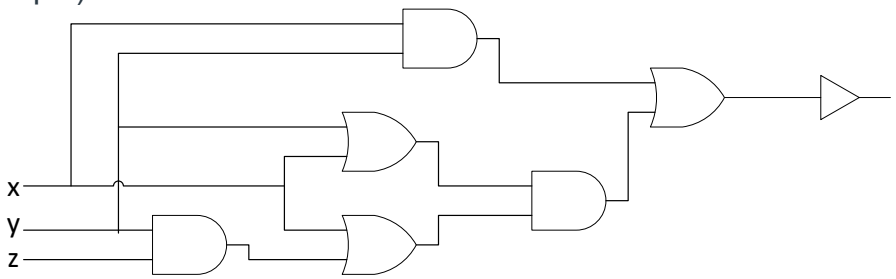
b. (6 pts)



c. (10 pts)



4. (15 pts) For question 3c, use the laws of Boolean algebra to find a simpler circuit that computes the same function (you don't need to draw it). How many gates would it use?

5. (18 points) Draw the digital logic (circuit) diagrams for the following Boolean functions
   a. (6 pts) $(xy)(y + \bar{z})$

   b. (6 pts) $(x + y + z) + \bar{y}z$

   c. (6 pts) $xz + \overline{y + z}$

6. (18 points) For each Karnaugh map, use the *Kmap Grouping Rules* to group the elements and then list the simplified Boolean expression:

a. (4 pts)

	y`	*y*
x`	1	
x		1

b. (6 pts)

	y`	*y`*	*y*	*y*
x`				
x	1	1	1	1
	z`	z	z	z`

c. (8 pts)

	z`	*z`*	*z*	*z*	
x`	1	1	1	1	y`
x`	1	1	1	1	y
x				1	y
x	1			1	y`
	w`	w	w	w`	

7. (30 points) For each truth table, fill in the k-map, use the *Kmap Grouping Rules* to group the elements, and then list the simplified Boolean expression:

a. (4 pts)

x	***y***	***f(x,y)***
1	1	0
1	0	1
0	1	0
0	0	1

	y	*y`*
x		
x`		

b. (4 pts)

x	***y***	***f(x,y)***
1	1	1
1	0	0
0	1	1
0	0	1

	y	*y`*
x		
x`		

c. (6 pts)

x	***y***	***z***	***f(x,y,z)***
1	1	1	1
1	1	0	1
1	0	1	0
1	0	0	1
0	1	1	1
0	1	0	1
0	0	1	0
0	0	0	1

	z	*z`*
xy		
x`y		
x`y`		
xy`		

d. (6 pts)

x	*y*	*z*	*f(x,y,z)*
1	1	1	1
1	1	0	1
1	0	1	1
1	0	0	1
0	1	1	0
0	1	0	0
0	0	1	0
0	0	0	0

	z	*z`*
xy		
x`y		
x`y`		
xy`		

e. (10 pts)

x	*y*	*z*	*w*	*f(x,y,z,w)*
1	1	1	1	1
1	1	1	0	1
1	1	0	1	0
1	1	0	0	0
1	0	1	1	1
1	0	1	0	1
1	0	0	1	0
1	0	0	0	0
0	1	1	1	0
0	1	1	0	1
0	1	0	1	1
0	1	0	0	1
0	0	1	1	0
0	0	1	0	1
0	0	0	1	0
0	0	0	0	0

	zw	*z`w*	*z`w`*	*zw`*
xy				
x`y				
x`y`				
xy`				