Chapter 1 Prablem 3

a. Simplify A+AB using boolean algebra

$$A+AB = A(1+B) \quad (X+1=1)$$
$$= A(1) \quad (X \cdot 1 = X)$$
$$= A$$

b Simplify $AB+AB'$ using boolean algebra

$$= A(B+B') \quad (X+X'=1)$$
$$= A(1) \quad (X \cdot 1 = 1)$$
$$= A$$

c Simplify $A'BC+AC$ using boolean Algebra

$$= C(A'B+A)$$
$$= C(A+A'B)$$
$$= C((A+A')(A+B)) \quad \text{(distributive law)}$$
$$= C((1)(A+B)) \quad (X+X'=1)$$
$$= C(A+B) \quad (X \cdot 1 = X)$$
$$= CA+CB$$

d Simplify $A'B+ABC'+ABC$

$$= A'B+AB(C'+C)$$
$$= A'B+AB(1) \quad (X+X'=1)$$
$$= A'B+AB \quad (X \cdot 1 = X)$$
$$= B(A+A') \quad (X(Y+Z)=XY+XZ))$$
$$= B(1) \quad (X+X'=1)$$
$$= B \quad (X \cdot 1 = X)$$

Chapter 1 Problem 8

a. Use De Morgan's theorem to show that

$(A+B)'(A'+B')' = 0$

De Morgan's Theorem:

(1) $(A+B)' = (A' \cdot B')$

(2) $(A \cdot B)' = (A' + B')$

Let $Y = (A+B)'(A'+B')'$

$= (A+B)'(A'' \cdot B'')$ — equation (1)

$= (A+B)'(A \cdot B)$ — $(x')' = x$

$= (A' \cdot B')(A \cdot B)$ — equation (1)

$= A' \cdot A \cdot B' \cdot B$ — $x \cdot y = y \cdot x$

$= 0 \cdot 0$ — $x' \cdot x = 0$

$= 0$

b. Use De Morgan's theorem to show that

$A + A'B + A'B' = 1$

$= A + A'B + (A+B)'$ — equation 2

$= (A+A')(A+B) + (A+B)'$ — $x+yz = (x+y)(x+z)$

$= 1 \cdot (A+B) + (A+B)'$ — $x + x' = 1$

$= (A+B) + (A+B)'$ — $x \cdot 1 = x$

$= 1$ — $x + x' = 1$

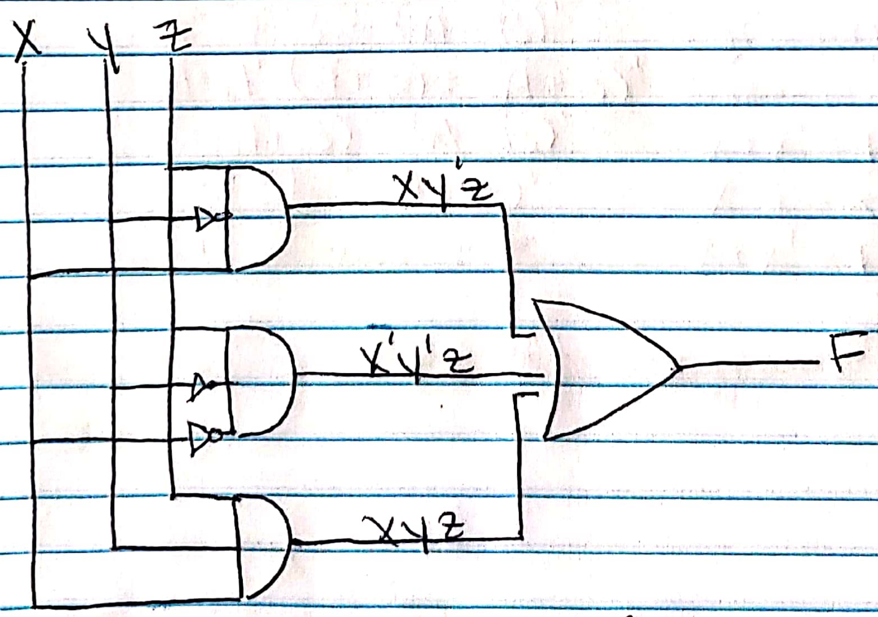
Chapter 1 Problem 7 (a-b)

$F = xy'z + x'y'z + xyz$

a. List the truth table

x	y	z	x'	y'	z'	xy'z	x'y'z	xyz	F
0	0	0	1	1	1	0	0	0	0
0	0	1	1	1	0	0	1	0	1
0	1	0	1	0	1	0	0	0	0
0	1	1	1	0	0	0	0	0	0
1	0	0	0	1	1	0	0	0	0
1	0	1	0	1	0	1	0	0	1
1	1	0	0	0	1	0	0	0	0
1	1	1	0	0	0	0	0	1	1

b. Draw the logic diagram using the original boolean expression



* Sorry I'm bad at drawing logic diagrams. My circuits are actually worse...

Chapter 1 Problem 7 (c-e)

c. Simplify using boolean algebra

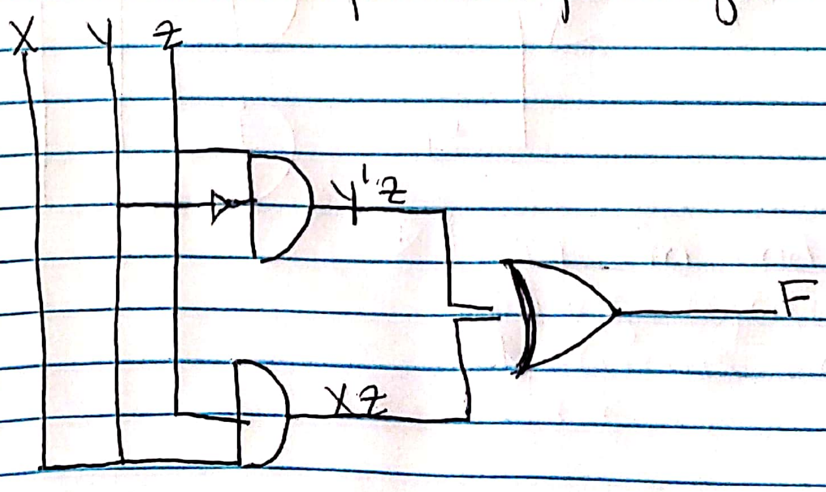
$$F = xy'z + x'y'z + xyz$$
$$= y'z(x+x') + xyz$$
$$= y'z(1) + xyz$$
$$= z(y' + xy)$$
$$= z(y'+x)(y'+y)$$
$$= z(y'+x)$$
$$= zy' + zx$$

d. Show the simplified truth table

X	Y	Z	X'	Y'	Z'	ZY'	ZX	F
0	0	0		1		0	0	0
0	0	1		1		1	0	1
0	1	0		0		0	0	0
0	1	1		0		0	0	0
1	0	0		1		0	0	0
1	0	1		1		1	1	1
1	1	0		0		0	0	0
1	1	1		0		0	1	1

Not needed oops

e. Draw the simplified logic diagram



Chapter 1 Problem 8

b Simplify $F(x,y,z) = \Sigma(1,2,3,6,7)$ using 3-variable maps

$x \backslash yz$	00	01	11	10
00	0	1	1	1
01	0	0	1	1

Small box reduces to: $x'z$
Large box reduces to: y
So, $f(x,y,z) = y + x'z$

c Simplify $f(x,y,z) = \Sigma(3,5,6,7)$

$x \backslash yz$	00	01	11	10
00			1	
01		1	1	1

The 1's in 5,7 reduce to: xz
The 1's in 7,6 reduce to: xy
The 1's in 3,7 reduce to: yz

$$f(x,y,z) = xy + xz + yz$$

Chapter 1 Problem 9

b Simplify $F(A,B,C,D) = \Sigma(3,7,11,13,14,15)$
Using 4-Variable Maps

AB \ CD	00	01	11	10
00			1	
01			1	
11		1	1	1
10			1	

The 1's in 3, 7, 15, 11 reduce to: CD
The 1's in 13, 15 reduce to: ABD
The 1's in 15, 14 reduce to: ABC
$f(A,B,C,D) = ABC + ABD + CD$

d Simplify $F(A,B,C,D) = \Sigma(0,2,4,5,6,7,8,10,13,15$

AB \ CD	00	01	11	10
00	1			1
01	1	1	1	1
11		1	1	
10	1			1

The 1's in 5, 7, 13, 15 will reduce to: BD
The corners reduce to: $B'D'$
The edges reduce to: $A'BD'$
$f(A,B,C,D) = A'BD' + B'D' + BD$