specific law usage denoted by # on pg 42-43 of Katz/Borriello

2. Katz and Borriello 2.6

A.) Prove $(x+y)(x+\bar{y}) = x$

$= (x+y)(x+\bar{y})$	
$= x + (y \cdot \bar{y})$	Distributive #8D
$= x + \emptyset$	Complimentarity #5D
$= \underline{x}$	Operations with $\emptyset$ and 1 #1

B) Prove $x(x+y) = x$

$= x(x+y)$	
$= (x+\emptyset)(x+y)$	Ops w/ $\emptyset$ and 1 #1
$= x + (\emptyset \cdot y)$	Distributive #8D
$= x + \emptyset$	Ops w/ $\emptyset$ and 1 #2D
$= \underline{x}$	Ops w/ $\emptyset$ and 1 #1

C) Prove $(x+\bar{y})y = xy$

$= (x+\bar{y})y$	
$= (xy) + (y\bar{y})$	Distributive #8
$= (xy) + \emptyset$	Complimentarity #5D
$= \underline{xy}$	Ops w/ $\emptyset$ and 1 #1

D) Prove $(x+y)(\bar{x}+z) = xz + \bar{x}y$

$= (x+y)(\bar{x}+z)$	
$= x\bar{x} + xz + y\bar{x} + yz$	Distributive #8D
$= \emptyset + xz + y\bar{x} + yz$	Complementarity #5D
$= xz + y\bar{x} + yz$	Ops w/ $\emptyset$ and 1 #1
$= xz + \bar{x}y + (1 \cdot z \cdot y)$	Ops w/ $\emptyset$ and 1 #1D
$= xz + \bar{x}y + (x+\bar{x})zy$	Complementarity #5
$= xz + \bar{x}y + xzy + \bar{x}zy$	Distributive #8D
$= xz + \bar{x}y + (xz)y + (\bar{x}y)z$	Associative #7D
$= xz + (xz)y + \bar{x}y + (\bar{x}y)z$	Commutative #6D
$= (xz)\cdot 1 + (xz)y + (\bar{x}y)\cdot 1 + (\bar{x}y)z$	Ops w/ $\emptyset$ and 1 #1D
$= (xz)(1+y) + (\bar{x}y)(1+z)$	Distributive #8D
$= (xz)1 + (\bar{x}y)1$	Ops w/ $\emptyset$ and 1 #2
$= \underline{(xz) + (\bar{x}y)}$	Ops w/ $\emptyset$ and 1 #1D

3. Katz and Borriello 2.17

A) Simplify $f(x,y) = xy + x\bar{y}$

$= xy + x\bar{y}$

$= x(y + \bar{y})$ — Distributive #8

$= x(1)$ — Complimentarity #5

$= x$ — Ops w/ Ø and 1 #1D

Representation reduced by 3 literals

B) Simplify $f(x,y) = (x+y)(x+\bar{y})$

$= (x+y)(x+\bar{y})$

$= x + (y \cdot \bar{y})$ — Distributive #8D

$= x + \emptyset$ — Complimentarity #5D

$= x$ — Ops w/ Ø and 1 #1

Representation reduced by 3 literals

C) Simplify $f(x,y,z) = \bar{y}z + \bar{x}yz + xyz$

$= \bar{y}z + \bar{x}yz + xyz$

$= z(\bar{y} + \bar{x}y + xy)$ — Distributive #8

$= z(\bar{y} + y)$ — Simplification Theorem #9

$= z(1)$ — Complementarity #5

$= z$ — Ops w/ Ø and 1 #1D

Representation reduced by 7 literals

D) Simplify $f(x,y,z) = (x+y)(\bar{x}+y+z)(\bar{x}+y+\bar{z})$

$= (x+y)(\bar{x}+y+z)(\bar{x}+y+\bar{z})$

$= y + (x(\bar{x}+z)(\bar{x}+\bar{z}))$ — Distributive #8D

$= y + ((x \cdot z)(\bar{x}+\bar{z}))$ — Simplification theorem #11

$= y + ((x \cdot z)(\overline{x \cdot z}))$ — De Morgans Law #12D

$= y + (\emptyset)$ — Complementarity #5D

$= y$ — Ops w/ Ø and 1 #1

Representation reduced by 7 literals

3. Katz and Boriello 2.17 Continued

E) Simplify $F(w,x,y,z) = x + xyz + \bar{x}yz + \bar{x}y + wx + w\bar{x}$

$= x + xyz + \bar{x}yz + \bar{x}y + wx + w\bar{x}$	
$= x + xyz + \bar{x}yz + \bar{x}y + w$	Simplification Theorem #9
$= x + y(xz + \bar{x}z + \bar{x}) + w$	Distributive #8
$= x + y(z + \bar{x}) + w$	Simplification Theorem #9
$= x + yz + y\bar{x} + w$	Distributive #8

Representation reduced by 7 literals

4. Katz and Boriello 2.30 (parts a and b)

A) Simplify $W(A,B,C) = \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C$

$= \bar{A}(B\bar{C} + BC) + A(\bar{B}\bar{C} + \bar{B}C)$	Distributive #8
$= \bar{A}(B(\bar{C} + C)) + A(\bar{B}(\bar{C} + C))$	Distributive #8
$= \bar{A}(B(1)) + A(\bar{B}(1))$	Complimentarity #5
$= \bar{A}B + A\bar{B}$	Commutative #6
$= A\bar{B} + \bar{A}B$	

XOR Gate

B) Simplify $X(A,B,C) = \bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + ABC$

$= \bar{A}(\bar{B}\bar{C} + BC) + A(\bar{B}\bar{C} + BC)$	Distributive #8
$= (\bar{B}\bar{C} + BC)\bar{A} + (\bar{B}\bar{C} + BC)A$	Commutative #6D
$= (\bar{B}\bar{C} + BC) \cdot (\bar{A} + A)$	Distributive #8
$= (\bar{B}\bar{C} + BC) \cdot 1$	Complementarity #5
$= \bar{B}\bar{C} + BC$	Ops w/ Ø and 1 #1D
$= BC + \bar{B}\bar{C}$	Commutative #6

XNOR Gate

8.) Katz and Boriello 2.41

for 2.40 A)

For reference, the truth table is located in problem-set-1.txt file

- for this question Shift = A i$\emptyset$ = B i1 = C from truth table

SOP Form

$$O_\emptyset = \bar{A}B\bar{C} + \bar{A}BC$$

$$O_1 = \bar{A}\bar{B}C + \bar{A}BC + AB\bar{C} + ABC$$

$O_\emptyset$) K-Map

C \ AB	00	01	11	10
0	0	1	0	0
1	0	1	0	0

$f = \bar{A}B$

O_1) K-Map

C \ AB	00	01	11	10
0	0	0	1	0
1	1	1	1	0

$f = AB + BC + \bar{A}C$

for 2.40 B)

- for this question SELECT = A, IN = B from truth table

SOP forms

$$O_\emptyset = \bar{A}B$$

$$O_1 = AB$$

$O_\emptyset$ = K-Map

B \ A	0	1
0	0	0
1	1	0

$f = \bar{A}B$

O_1 = K-Map

B \ A	0	1
0	0	0
1	0	1

$f = AB$

8) Katz and Boriello 2.41 (continued)

for 2.40 C)

- for this question SELECT = A i∅ = B i1 = C from

so SOP form → $OUT = \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}C + ABC$

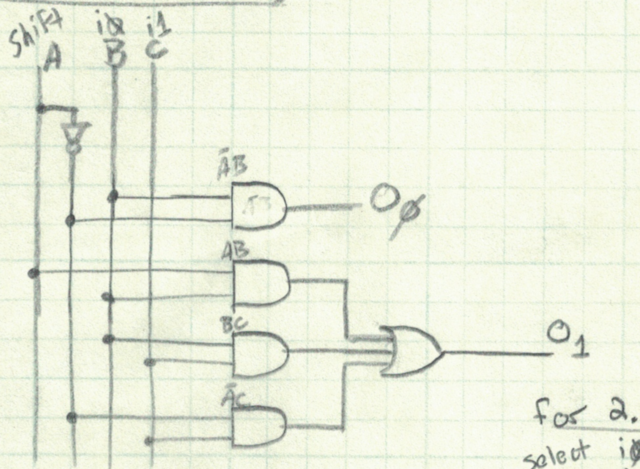
OUT K-Map

C \ AB	00	01	11	10
0	0	1	0	0
1	0	1	1	1

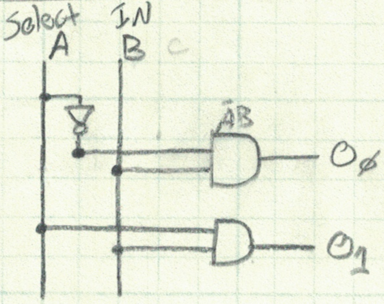
$f = AC + BC + \bar{A}B$

9) Katz and Boriello 2.42

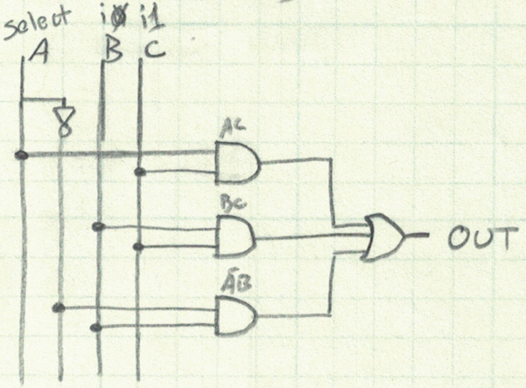
for 2.41-2.40 A)



for 2.41-2.40 B)



for 2.41-2.40 C)



10) Katz and Boriello 2.46

A). 4 variable truth table for F and G

truth table is in the problem-set-1.txt file

B) K-Map for the function f

CD \ AB	00	01	11	10
00	0	0	1	1
01	X	0	1	0
11	X	X	0	X
10	X	X	0	0

$f = A\bar{C}\bar{D} + AB\bar{C}$

K-Map for the function G.

CD \ AB	00	01	11	10
00	0	1	1	0
01	X	0	0	1
11	X	X	0	X
10	X	X	1	0

$G = B\bar{C}\bar{D} + A\bar{B}D + BC\bar{D}$