Note Title 3/1/2009

HW 4 due ~~Friday~~ ~~Monday~~ Friday 2009/03/~~16~~ 20

~~(possible ext, to Wed, to be confirmed on Friday)~~

Instructions

- Show all your steps--answers alone are not sufficient.
- Homework must be done neatly.
- Use straight-edged paper (no notebook tear-outs with ragged edges).
- Please STAPLE papers to a signed cover sheet.

Homework Problems

Problem 5.4 (a). Plot the expression on a 4-variable K-map. (10 points)

Problem 5.4 (b). Simplify the K-map from 5.4 (a) into SOP form. Begin with a fresh map. (10 points)

Problem 5.4 (c). Simplify the K-map from 5.4 (a) into POS form. Begin with a fresh map. (10 points)

Problem 5.6 (a). To work, use guideline summary from class; ignore “essential prime implicants.” (20 points)

Problem 5.8 (a). (Note that the problem asks for both SOP and POS simplifications.) (20 points)

Problem 5.12 (c). (POS simplification.) (10 points)

Problem 5.21 (b). (Note that POS form is requested even though the problem statement is given in min-terms.) Plot the min-term map, then redraw with 0’s, and group the 0’s. (20 points)

Ex. on p. 121 top. Find a minimum sum-of-product expression for $f(a,b,c) = \sum m(0, 1, 2, 5, 6, 7)$

$F = a'b'c' + a'b'c + a'bc' + ab'c + abc' + abc$

$= a'b' + b'c + bc' + ab$

?

$f = a'b'c' + a'b'c + a'bc' + ab'c + abc' + abc$

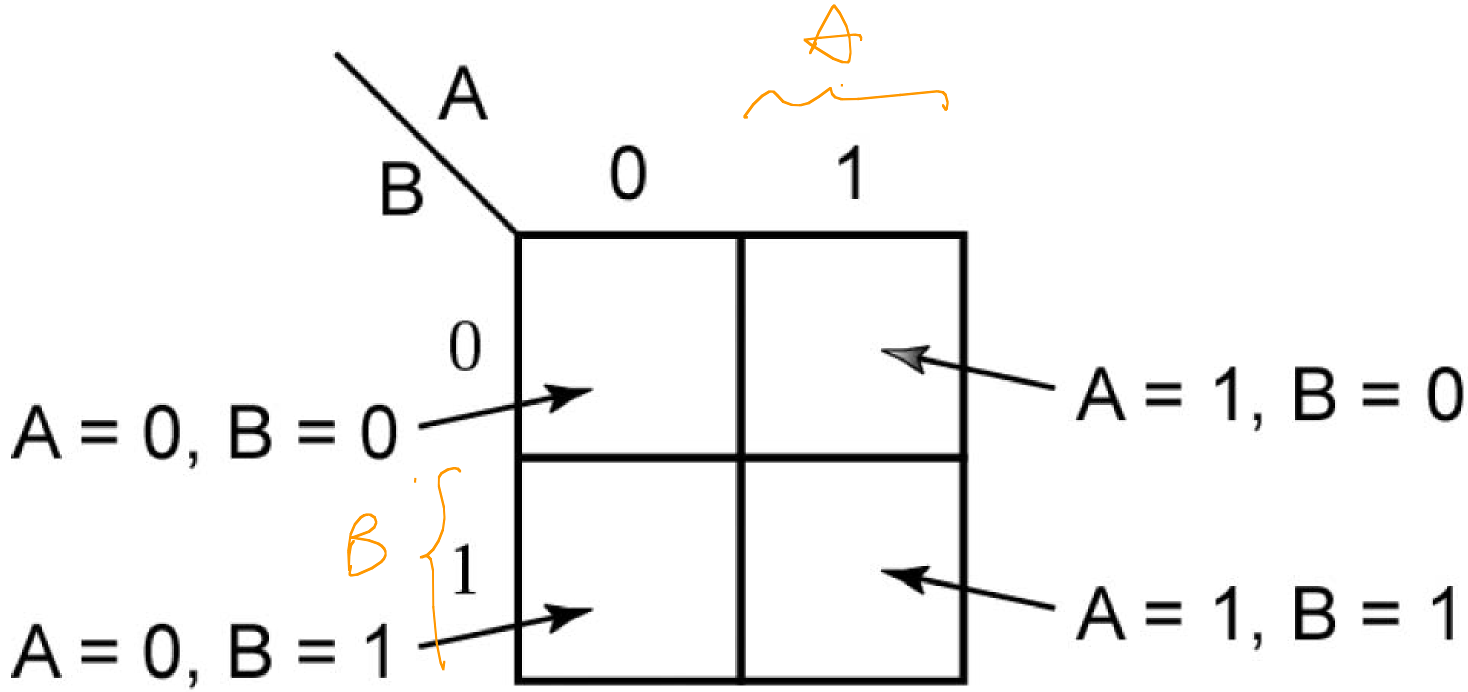
$= a'b' + bc' + ac$

abc	ab + b'c	ac
000	0	0
001	1	0
010		0
011		0
100		
101		
110		
111		

Unfortunately, there is no (easy?) way of achieving from without backtracking, using the laws & theorems of p. 52!

Chapter 5

A K[illegible] for two variables (A and B)



Veitch diagram (alternate labeling)

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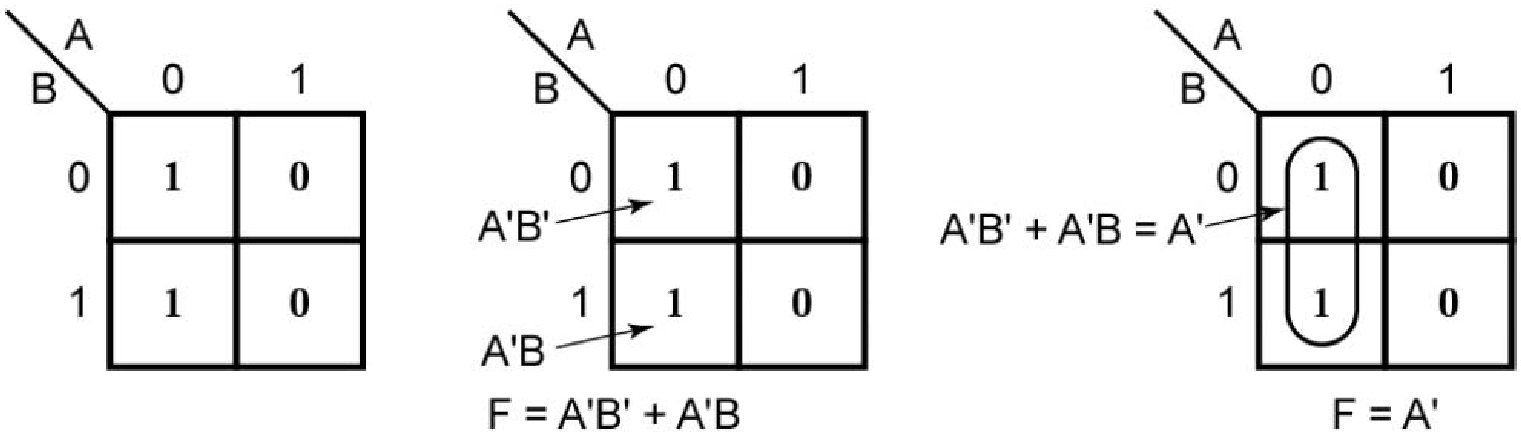
(a)

A	B	F
0	0	1
0	1	1
1	0	0
1	1	0

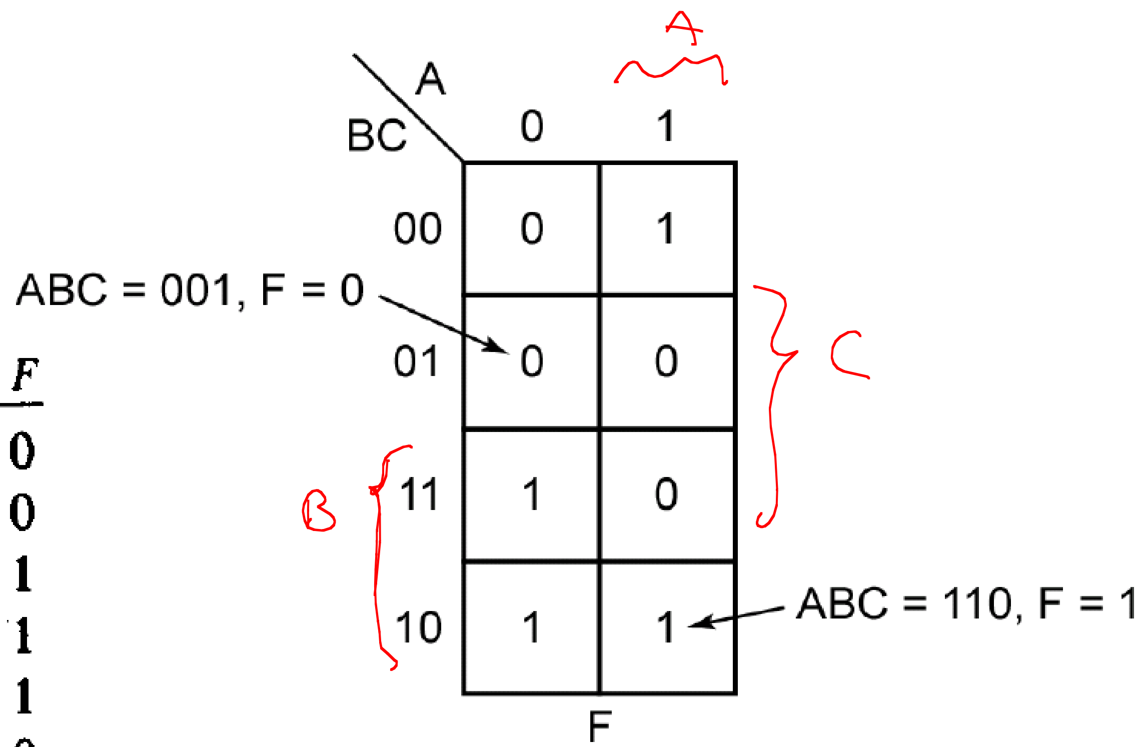


(b) (c) (d)

Figure 5-1a, b, c, and d

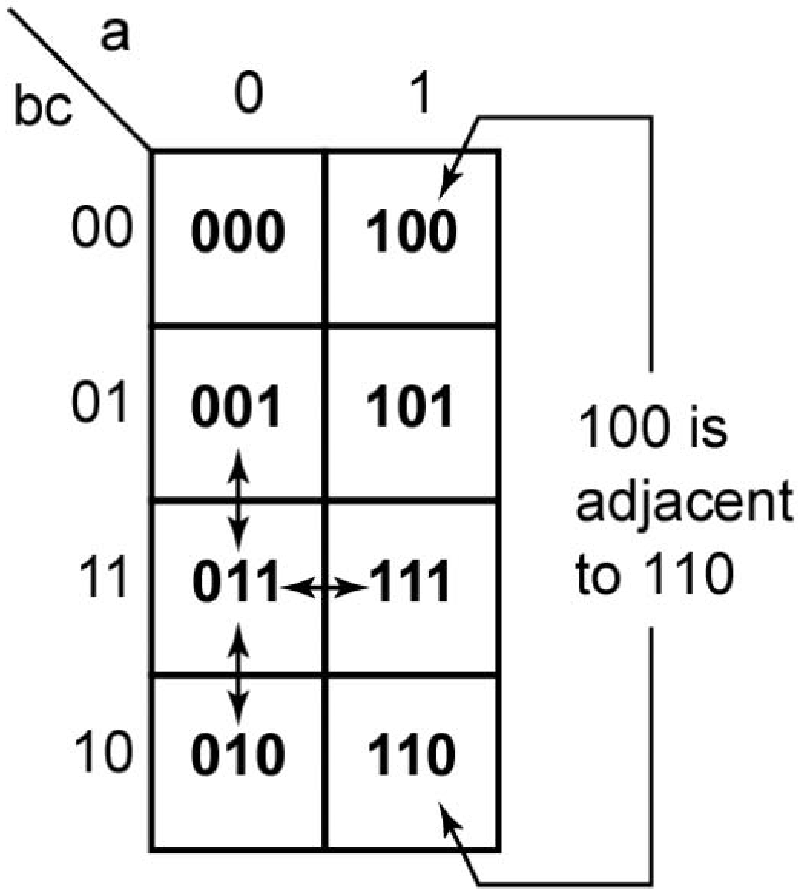
A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

(a)

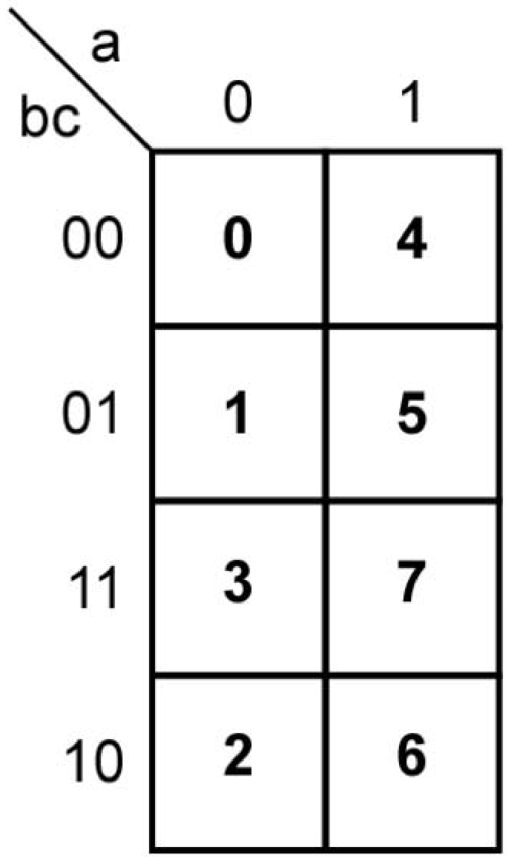


(b)

Figure 5-2: **Karnaugh Map for Three-Variable Function**



(a) Binary notation



(b) Decimal notation

Figure 5-3: **Location of Minterms on a Three-Variable Karnaugh Map**

bc \ a	0	1
00	**0** $_{0}$	**0** $_{4}$
01	**1** $_{1}$	**1** $_{5}$
11	**1** $_{3}$	**0** $_{7}$
10	**0** $_{2}$	**0** $_{6}$

Figure 5-4: **Karnaugh Map of $F(a, b, c) = \Sigma m(1, 3, 5) = \prod M(0, 2, 4, 6, 7)$**

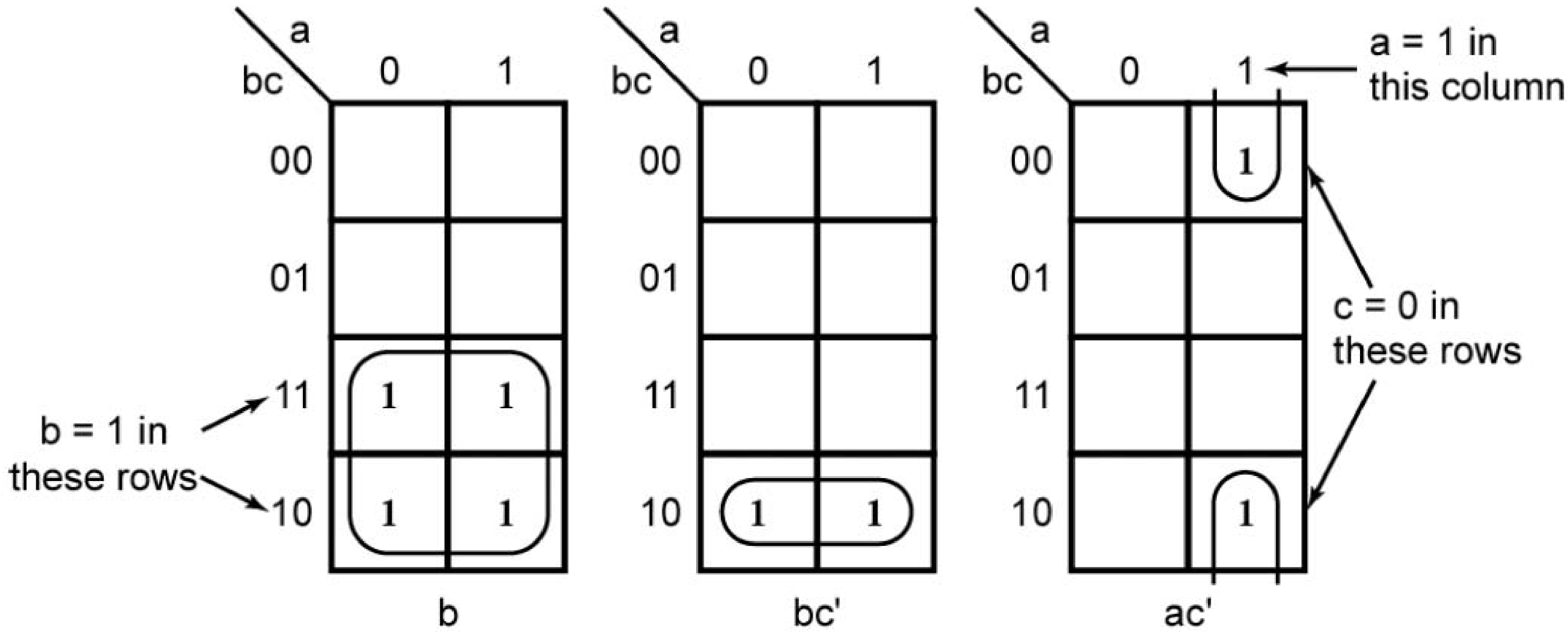
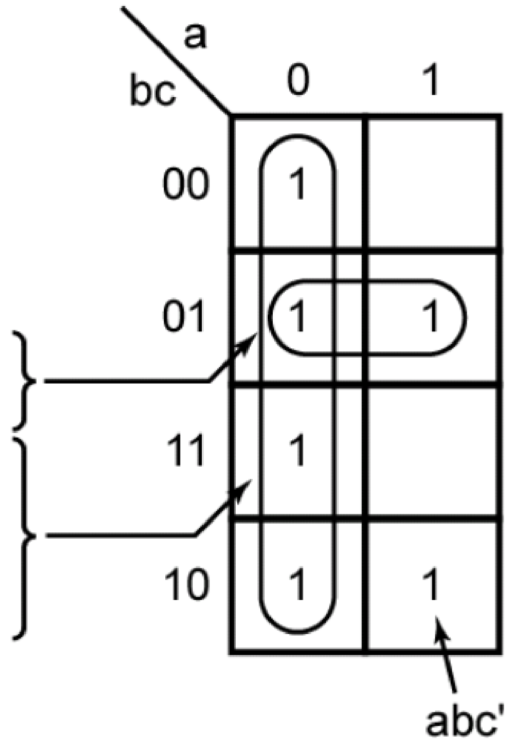


Figure 5-5: **Karnaugh Maps for Product Terms**

$$f(a,b,c) = abc' + b'c + a'$$

1. The term abc' is 1 when a = 1 and bc = 10, so we place a 1 in the square which corresponds to the a = 1 column and the bc = 10 row of the map.
2. The term b'c is 1 when bc = 01, so we place 1's in both squares of the bc = 01 row of the map.
3. The term a' is 1 when a = 0, so we place 1's in all the squares of the a = 0 column of the map. (Note: Since there already is a 1 in the abc = 001 square, we do not have to place a second 1 there because x + x = x.)



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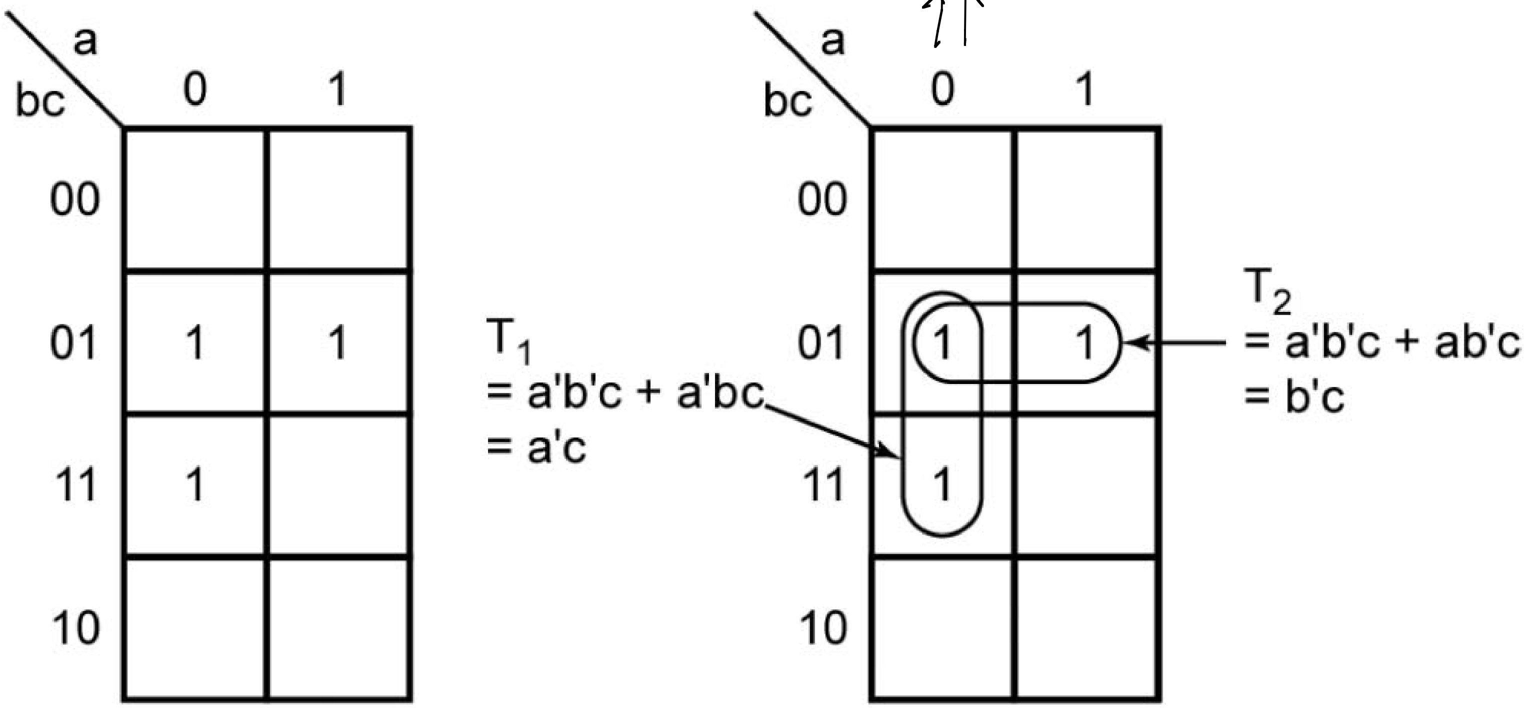
$f = a'b'c + a'bc + ab'c = a'c + b'c$



F = Σm (1, 3, 5)

(a) Plot of minterms

F = a'c + b'c

(b) Simplified form of F

Figure 5-6: **Simplification of a Three-Variable Function**

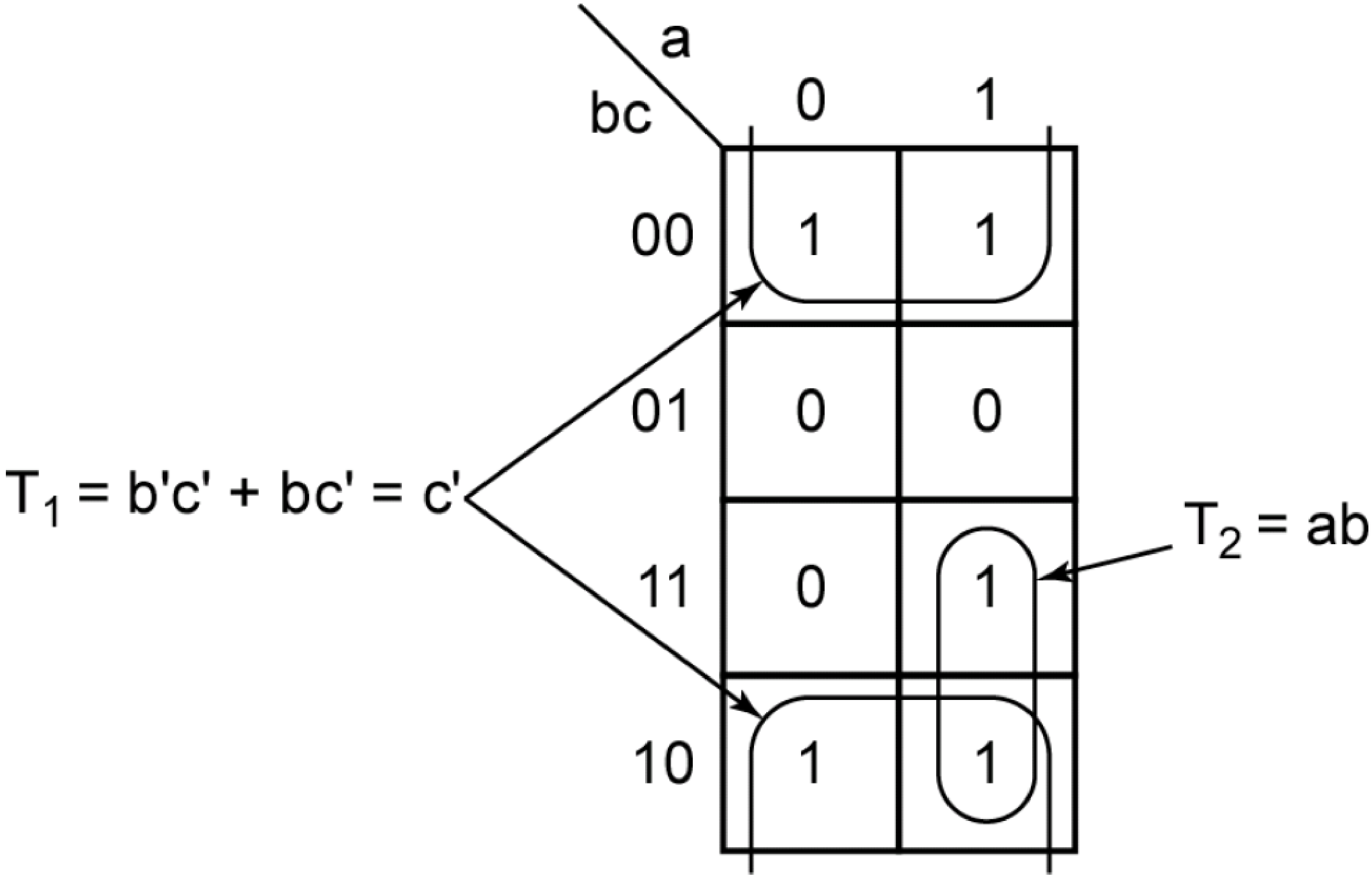
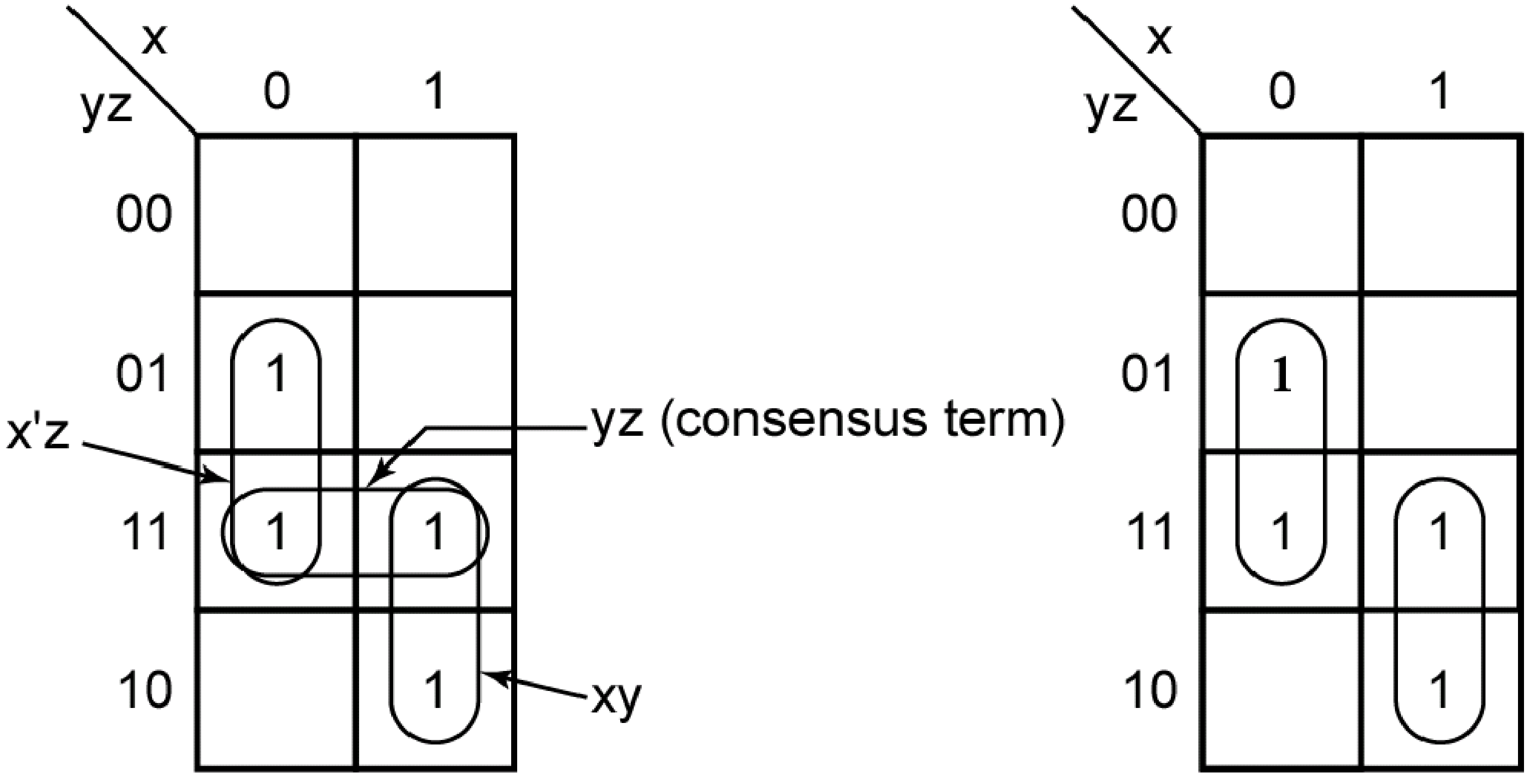
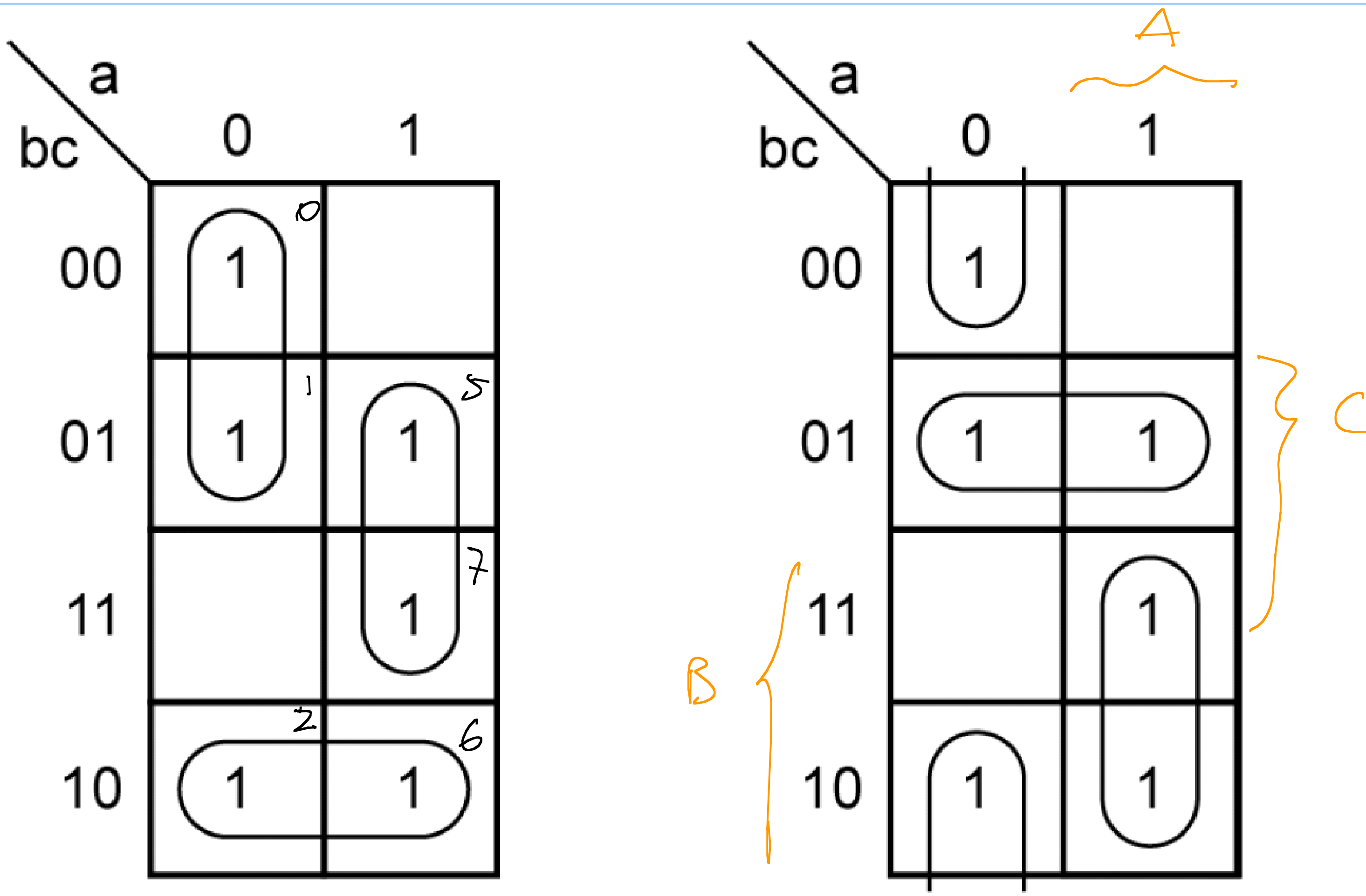


Figure 5-7: **Complement of Map in Figure 5-6a**



$$xy + x'z + yz = xy + x'z$$

Figure 5-8: **Karnaugh Maps Which Illustrate the Consensus Theorem**



$F = a'b' + bc' + ac$ $\qquad$ $F = a'c' + b'c + ab$

Figure 5-9: **Function with Two Minimal Forms**

Section 5.3 Four-variable Karnaugh Maps

A

CD \ AB	00	01	11	10
00	0	4	12	8
01	1	5	13	9
11	3	7	15	11
10	2	6	14	10

C D

B

Figure 5-10: **Location of Minterms on Four-Variable Karnaugh Map**

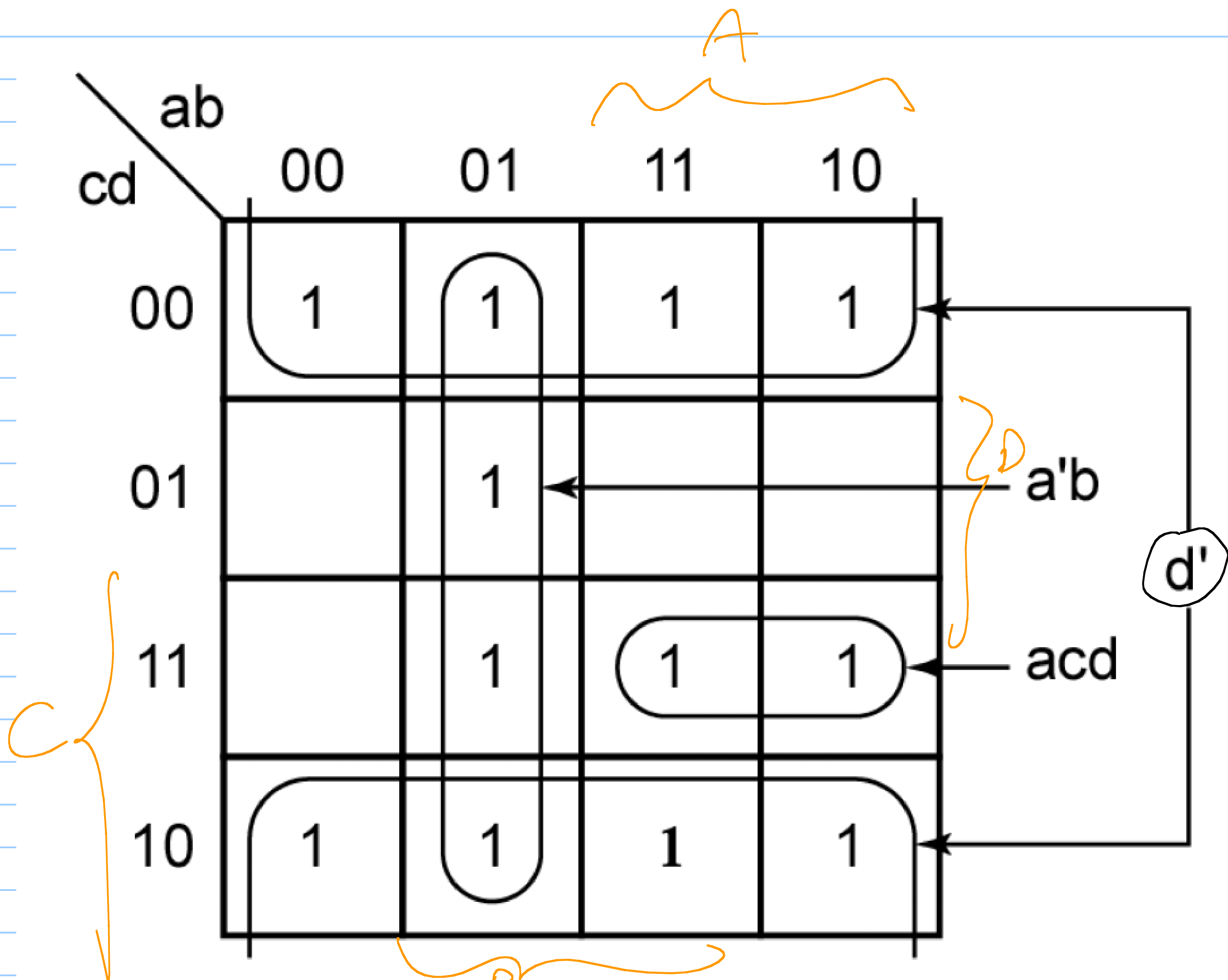
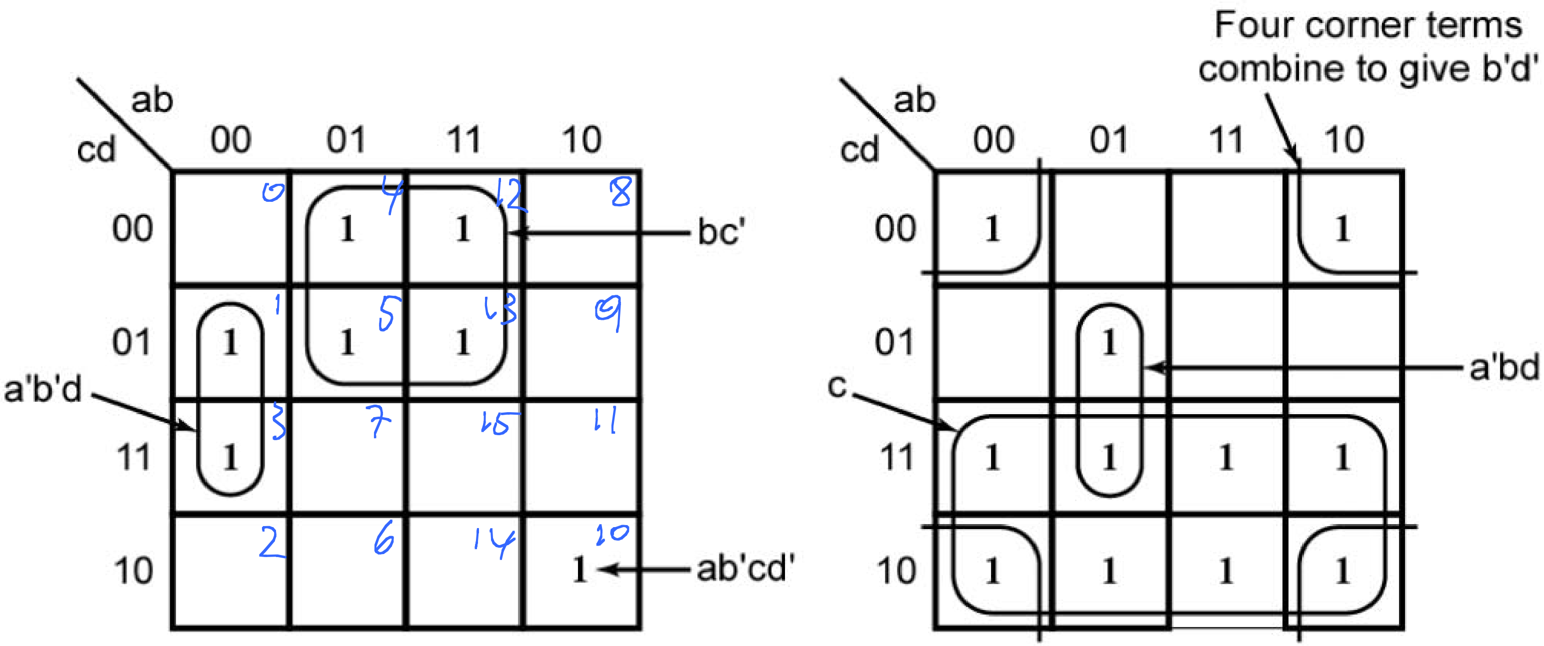


Figure 5-11: **Plot of *acd + a'b + d'***



$f_1 = \Sigma m(1, 3, 4, 5, 10, 12, 13)$
$= bc' + a'b'd + ab'cd'$

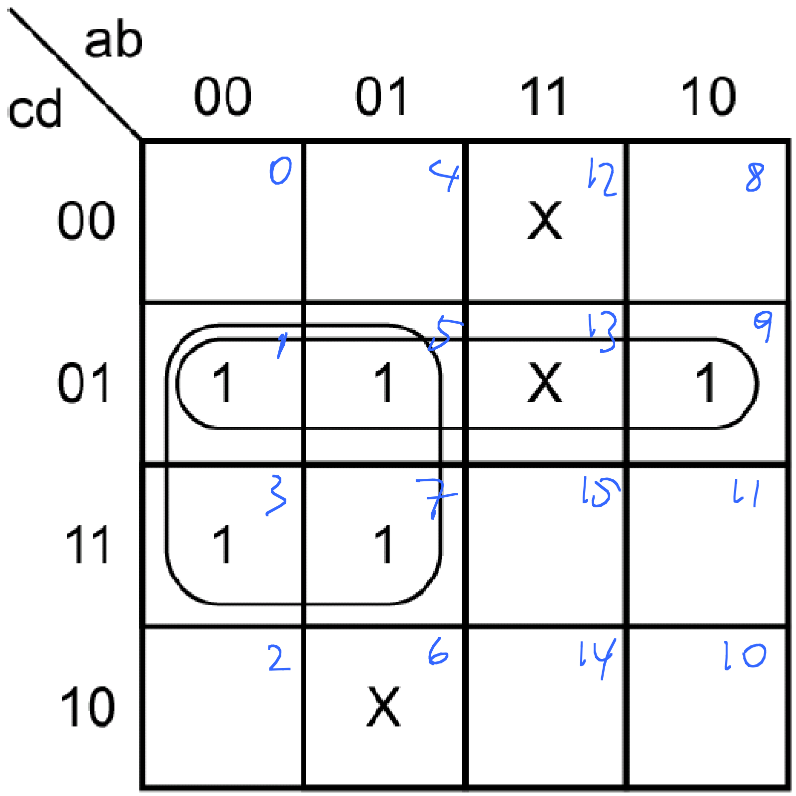
(a)

$f_2 = \Sigma m(0, 2, 3, 5, 6, 7, 8, 10, 11, 14, 15)$
$= c + b'd' + a'bd$

(b)

$= c + \underbrace{b'c'd' + b'cd'}_{b'd'(c'+c)} + \cdot$

Figure 5-12: Simplification of Four-Variable Functions



Important for Circuit 2!

$$f = \Sigma m(1, 3, 5, 7, 9) + \Sigma d(6, 12, 13)$$
$$= a'd + c'd$$

Figure 5-13: **Simplification of an Incompletely Specified Function**

Find the minimum product of sums realization for

$f = x'z' + wyz + w'y'z' + x'y$

yz \ wx	00	01	11	10
00	1	1	0	1
01	0	0	0	0
11	1	0	1	1
10	1	0	0	1

$y'z$ $w'xy$ wxz'

Figure 5-14

Use the Karnaugh map to realize f' and obtain

$f' = y'z + wxz' + w'xy$

Use DeMorgan's law

$f'' = (y + z') \cdot (w' + x' + z) \cdot (w + x' + y')$

(a product of sums)