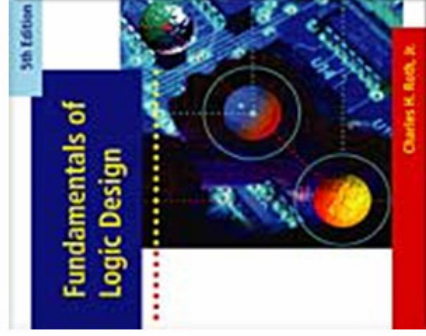


FIGURES FOR CHAPTER 5

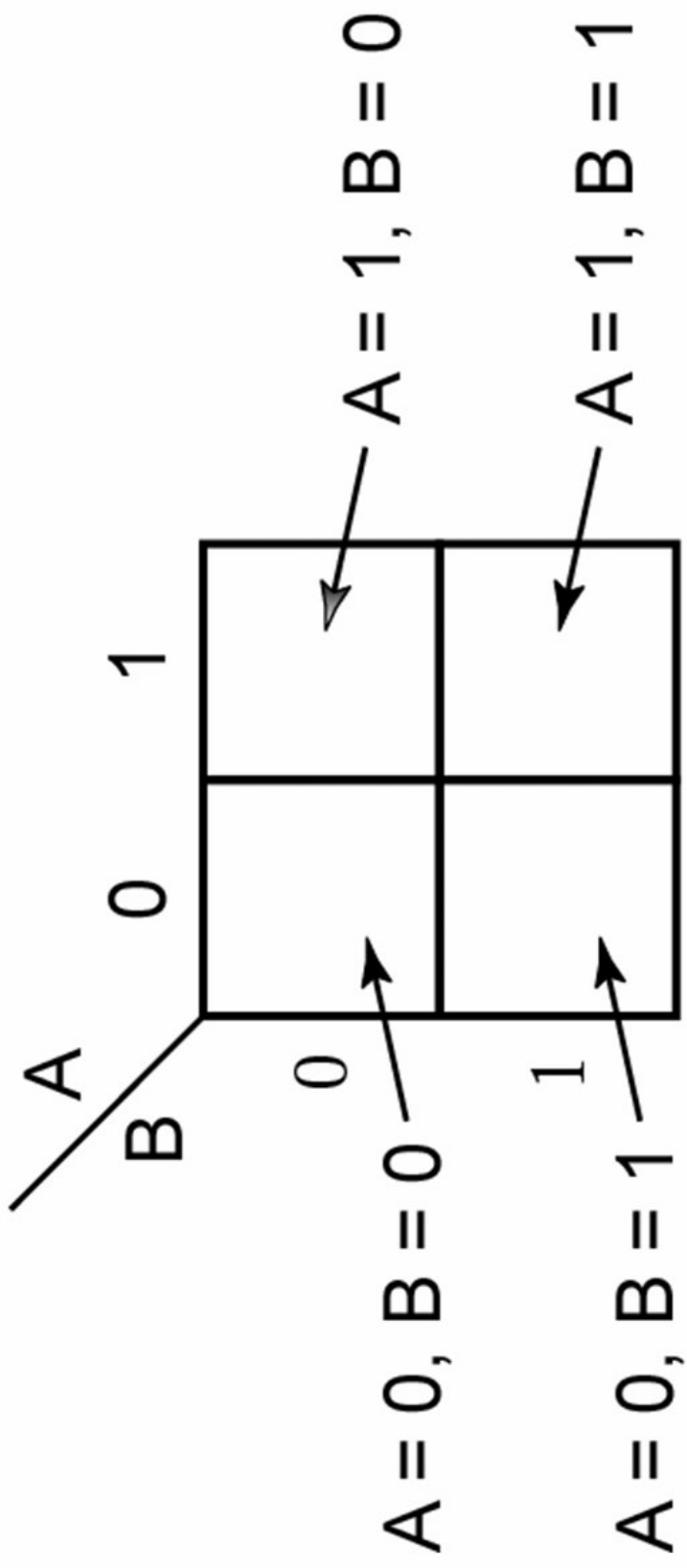
KARNAUGH MAPS



This chapter in the book includes:

- Objectives
- Study Guide
- 5.1 Minimum Forms of Switching Functions
- 5.2 Two- and Three-Variable Karnaugh Maps
- 5.3 Four-Variable Karnaugh Maps
- 5.4 Determination of Minimum Expressions
- 5.5 Five-Variable Karnaugh Maps
- 5.6 Other Uses of Karnaugh Maps
- 5.7 Other Forms of Karnaugh Maps
- Programmed Exercises
- Problems

Click the mouse to move to the next page.
Use the ESC key to exit this chapter.

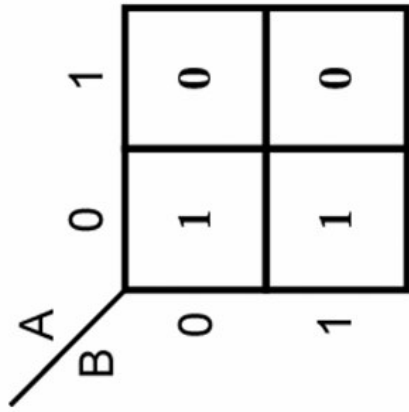


Section 5.2, p. 121

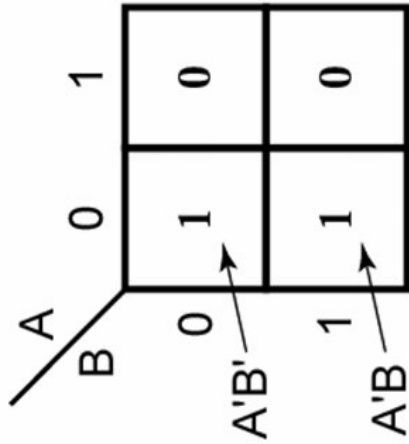


A	B	F
0	0	1
0	1	1
1	0	0
1	1	0

(a)

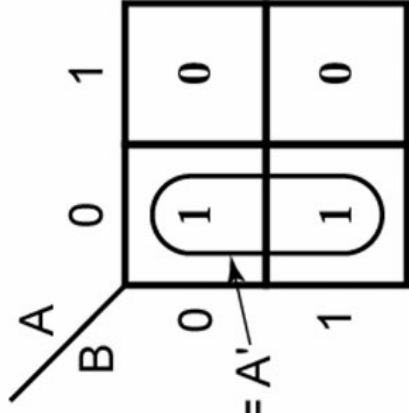


(b)



$F = A'B' + A'B$

(c)

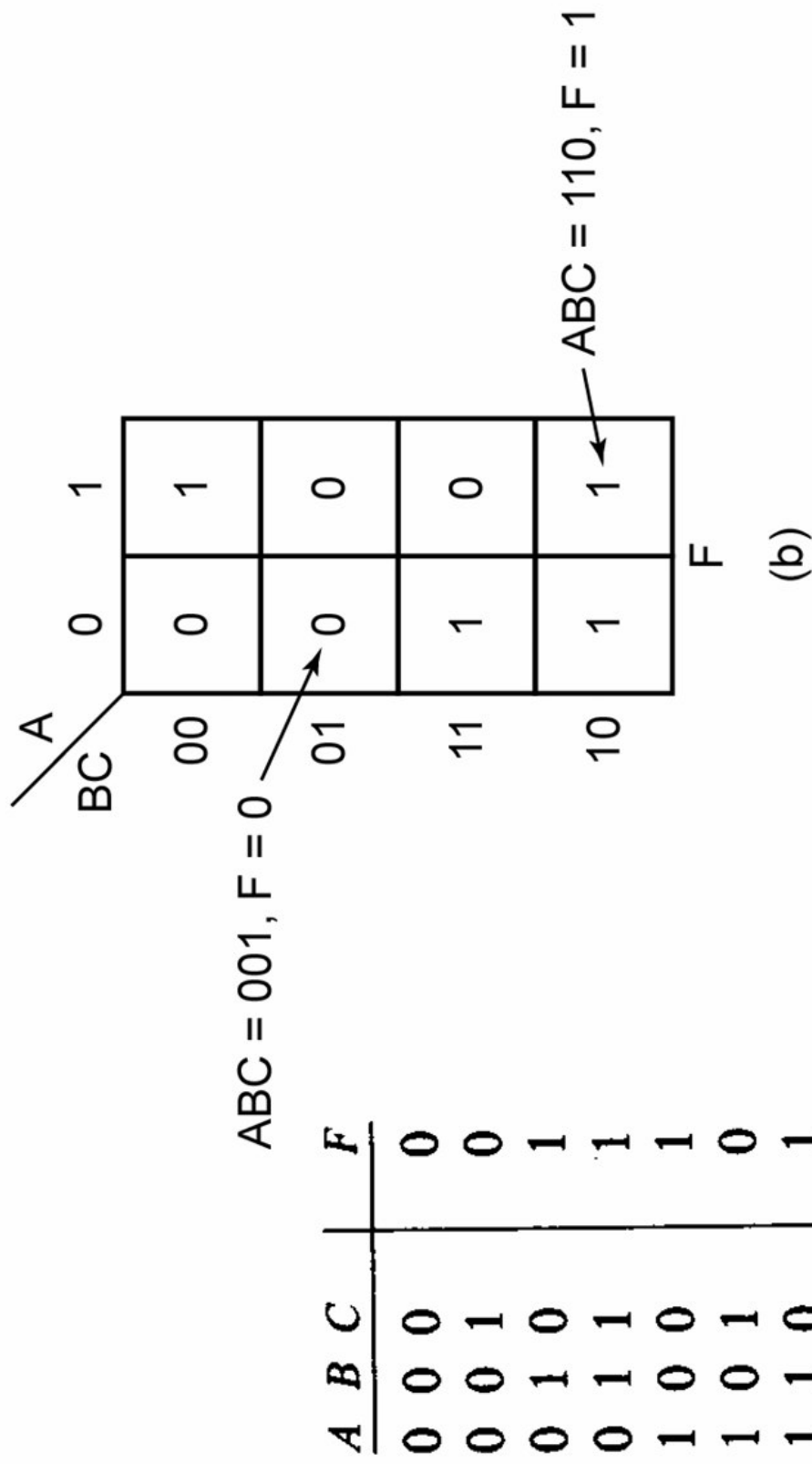


$F = A'$

(d)

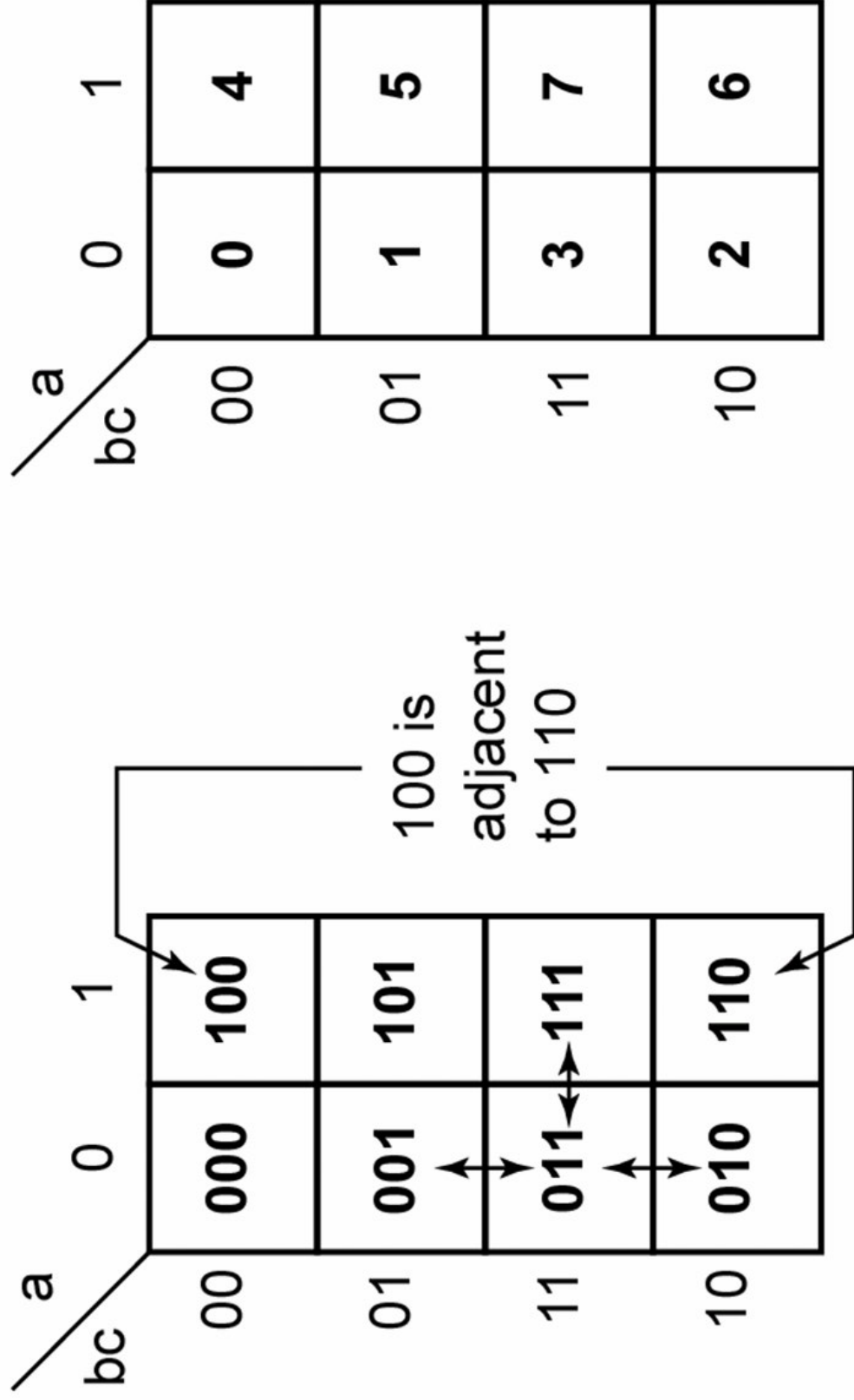
Figure 5-1a, b, c, and d





(a)

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

		0	1
a	bc		
	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 $F(a, b, c) = \sum m(1, 3, 5) = \prod M(0, 2, 4, 6, 7)$

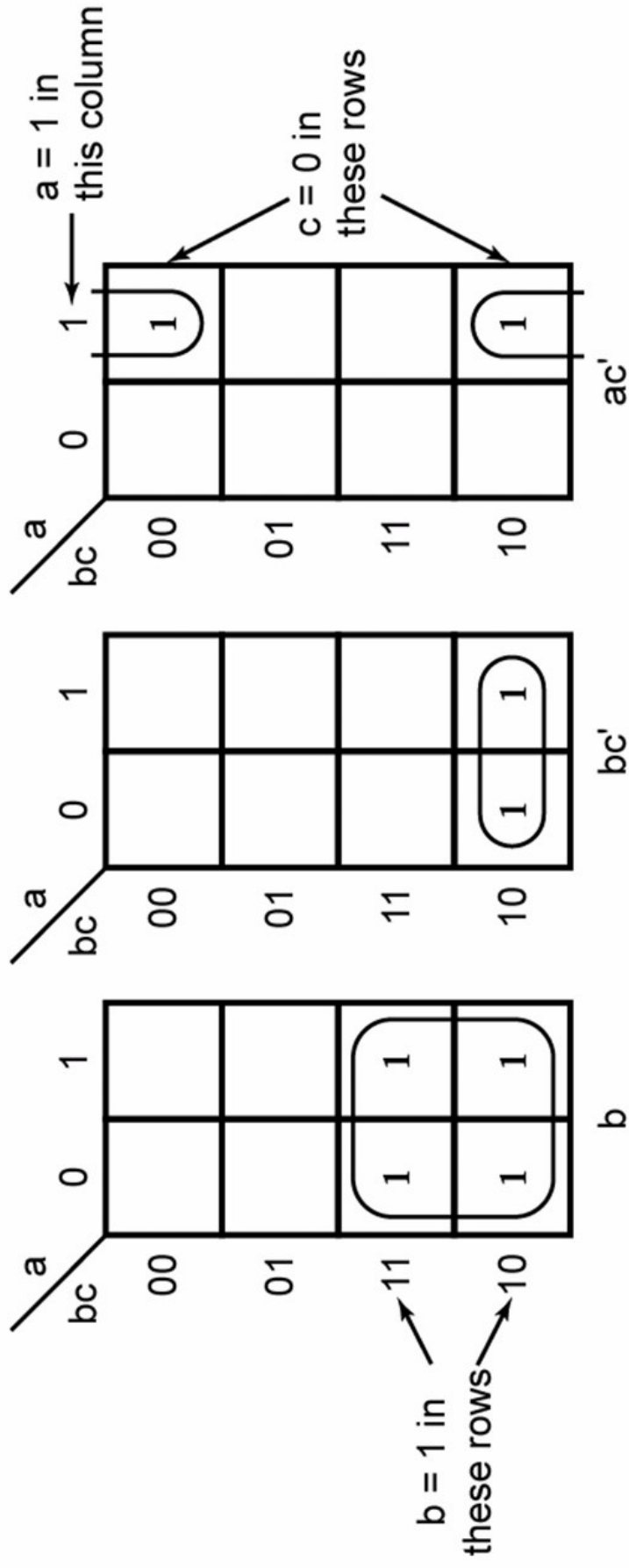


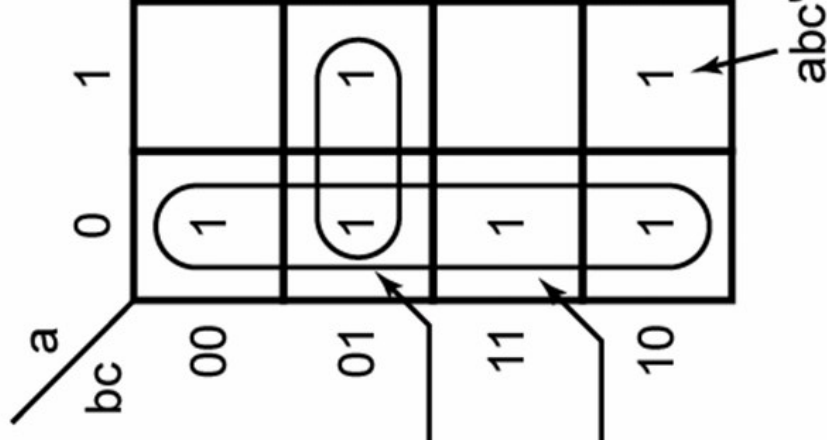
Figure 5-5: Karnaugh Maps for Product Terms

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

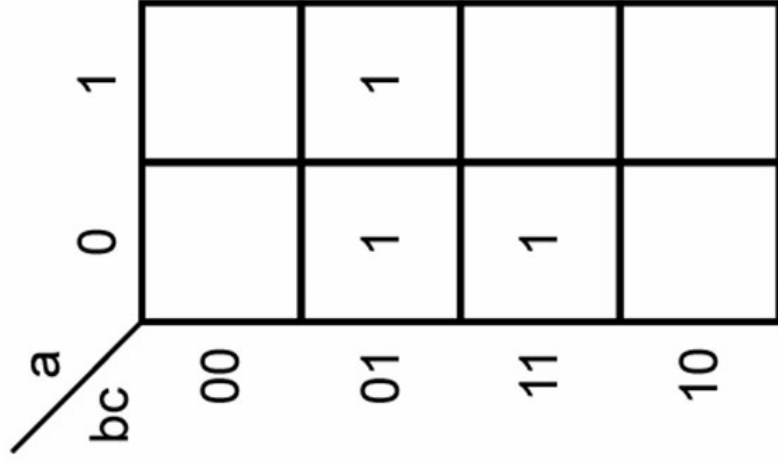
1. The term abc' is 1 when $a = 1$ and $bc = 10$, so we place a 1 in the square which corresponds to the $a = 1$ column and the $bc = 10$ row of the map.

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 $x + x = x$.)

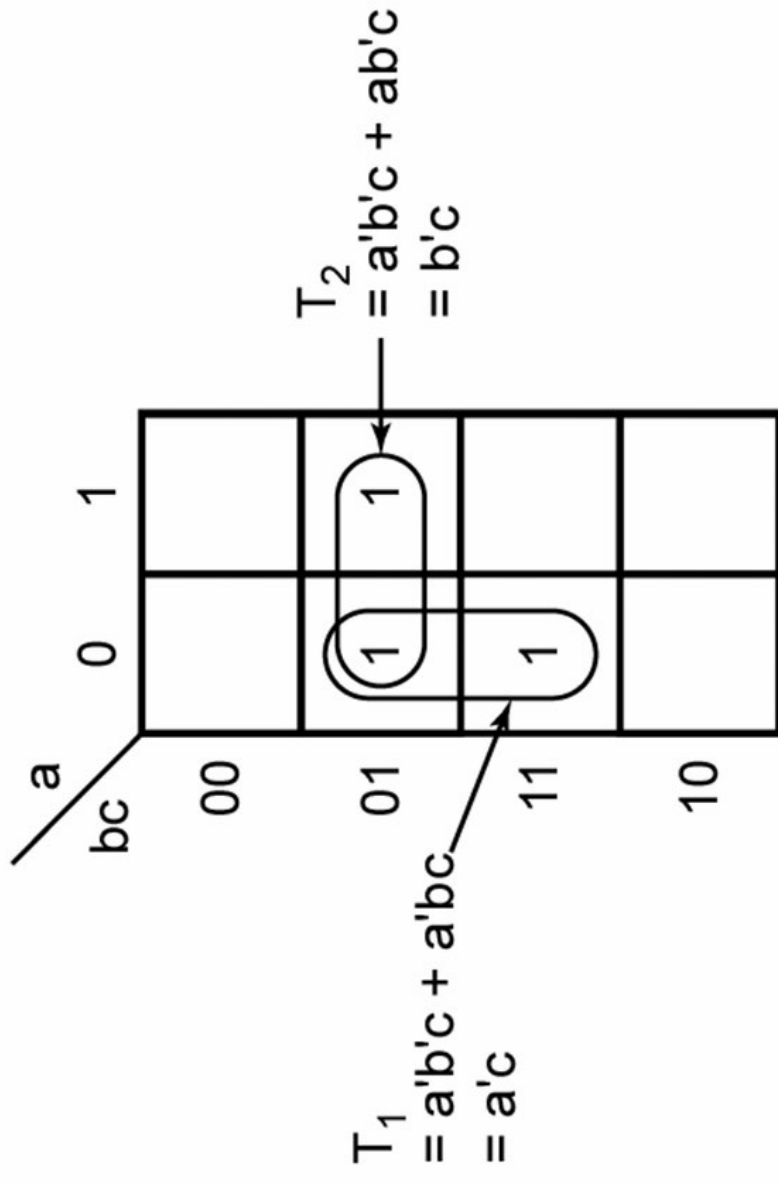


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$$F = \sum m(1, 3, 5)$$

(a) Plot of minterms



$$F = a'c + b'c$$

(b) Simplified form of F

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

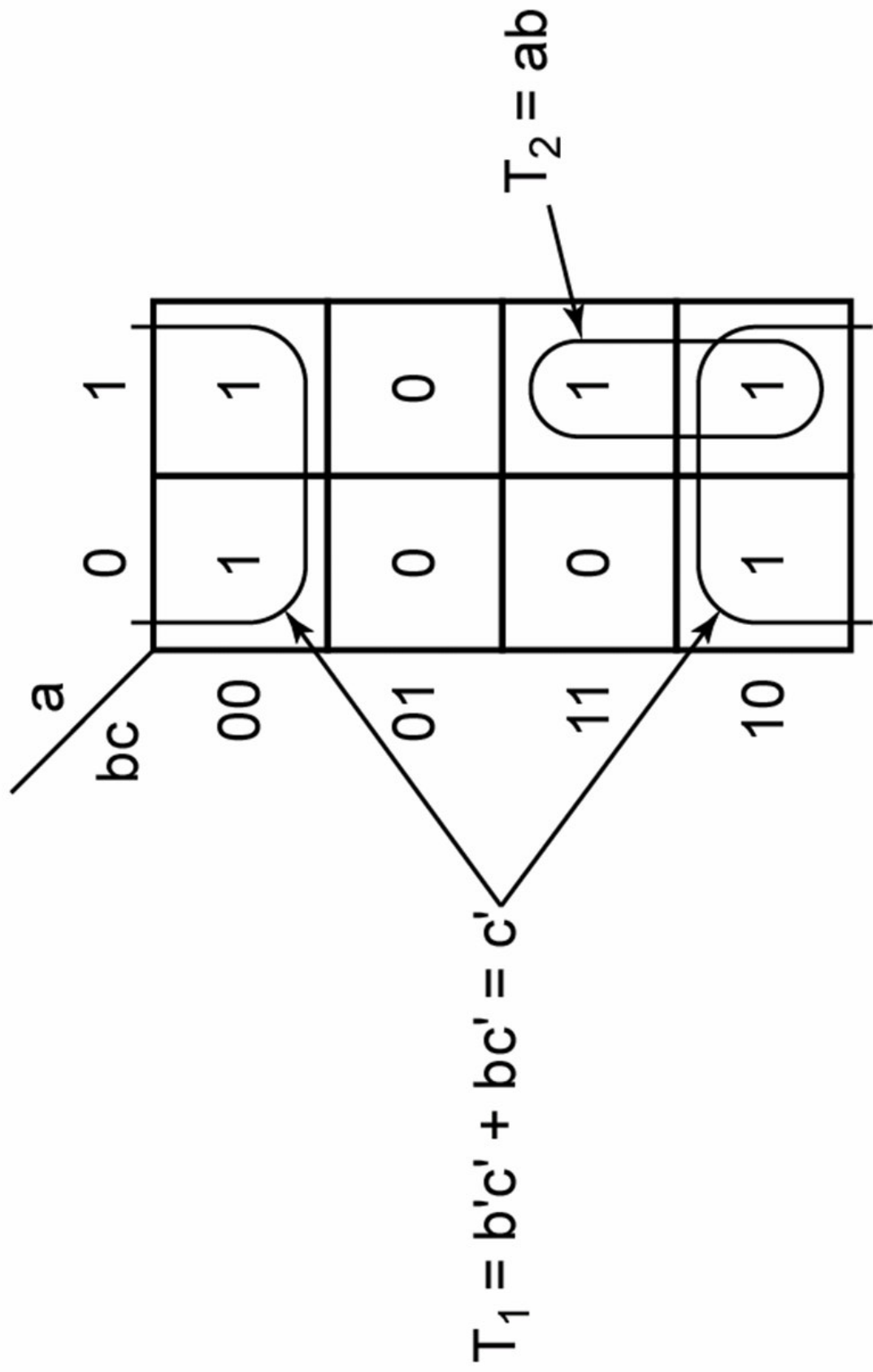
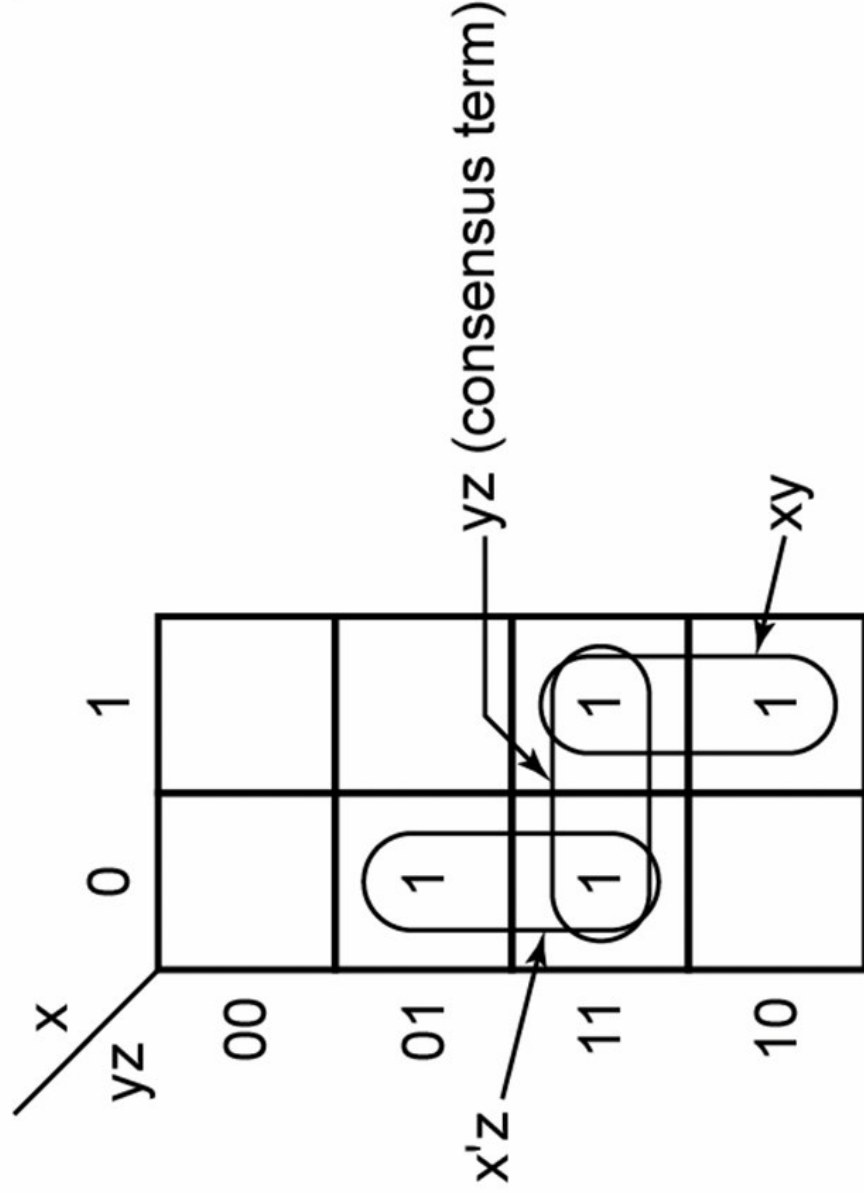
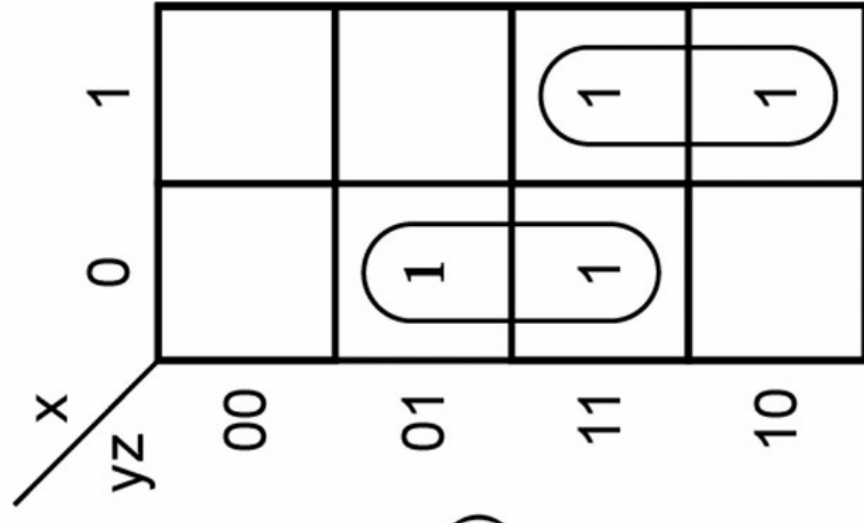


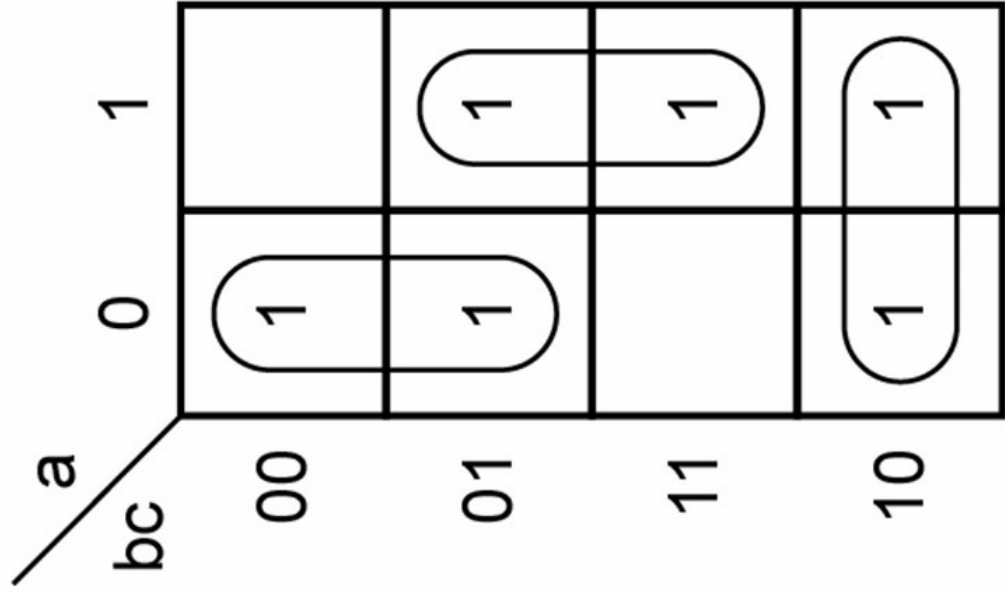
Figure 5-7: Complement of Map in Figure 5-6a



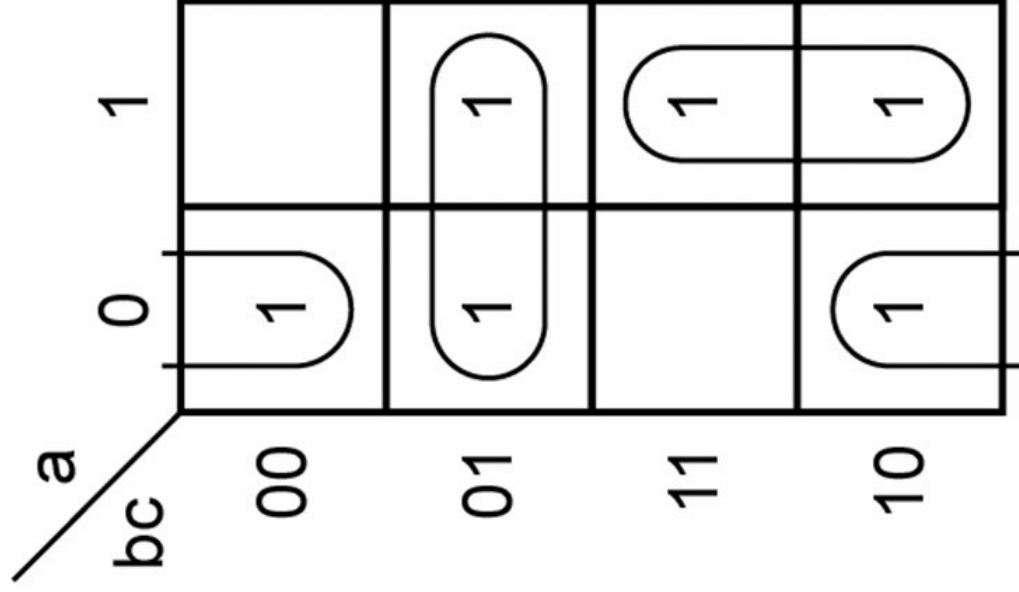
$$xy + x'z + yz = xy + x'z$$

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





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



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

Figure 5-9: Function with Two Minimal Forms

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

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

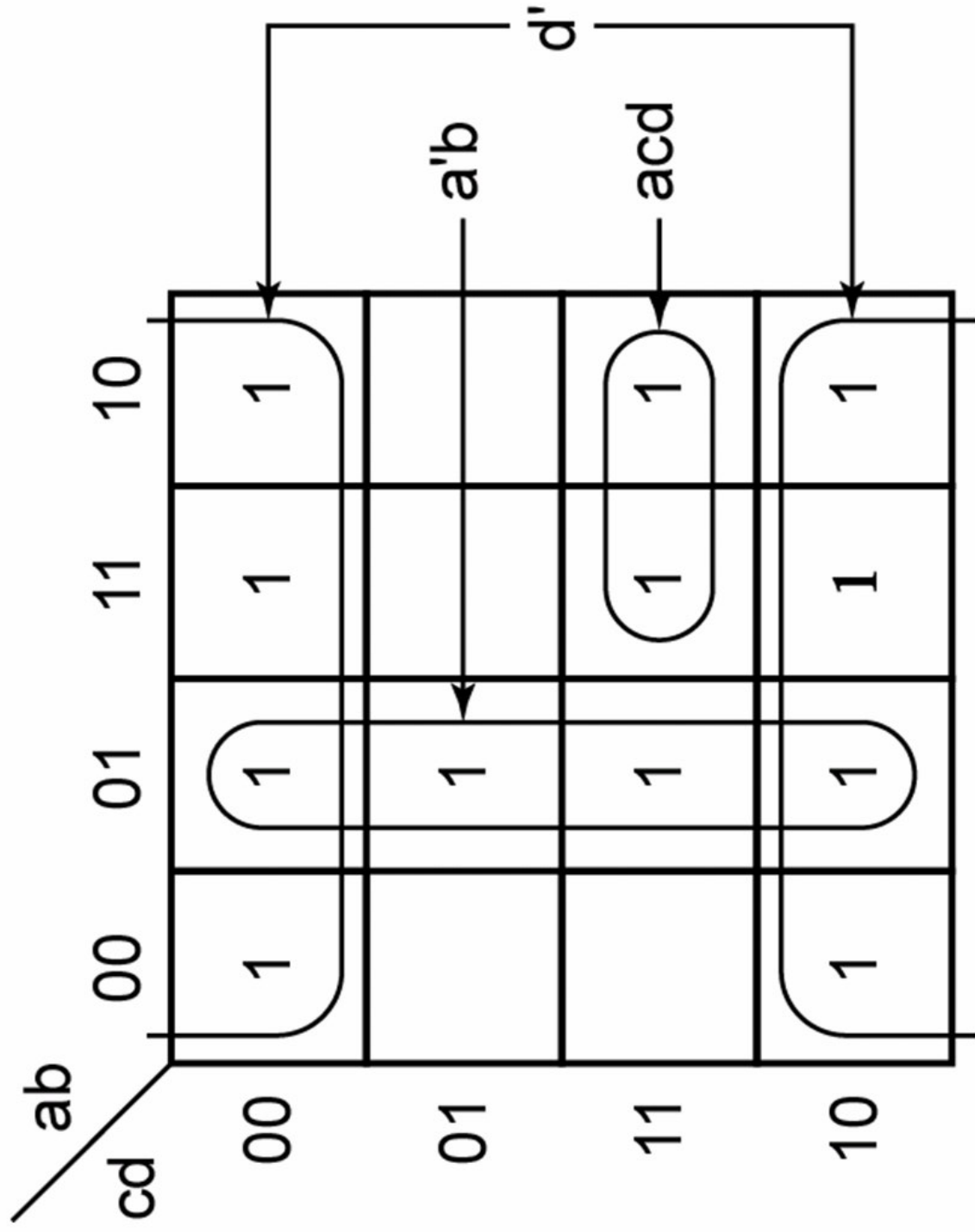


Figure 5-11: Plot of $acd + a'b + d'$

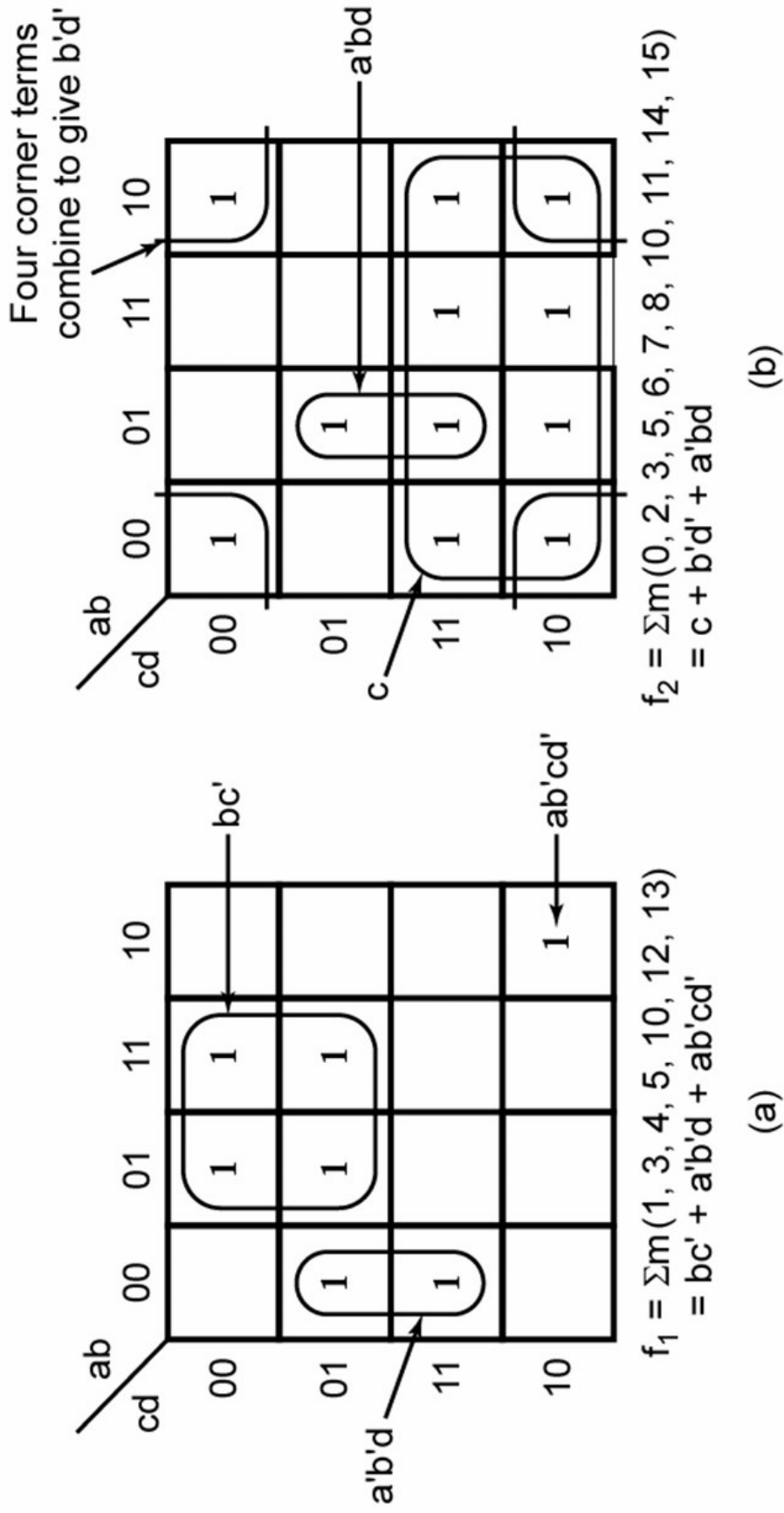


Figure 5-12: Simplification of Four-Variable Functions

		00	01	11	10
ab	cd				
	00			X	
	01	1	1	X	1
	11	1	1		
	10		X		

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

$$= a'd + c'd$$

Figure 5-13: Simplification of an Incompletely Specified Function

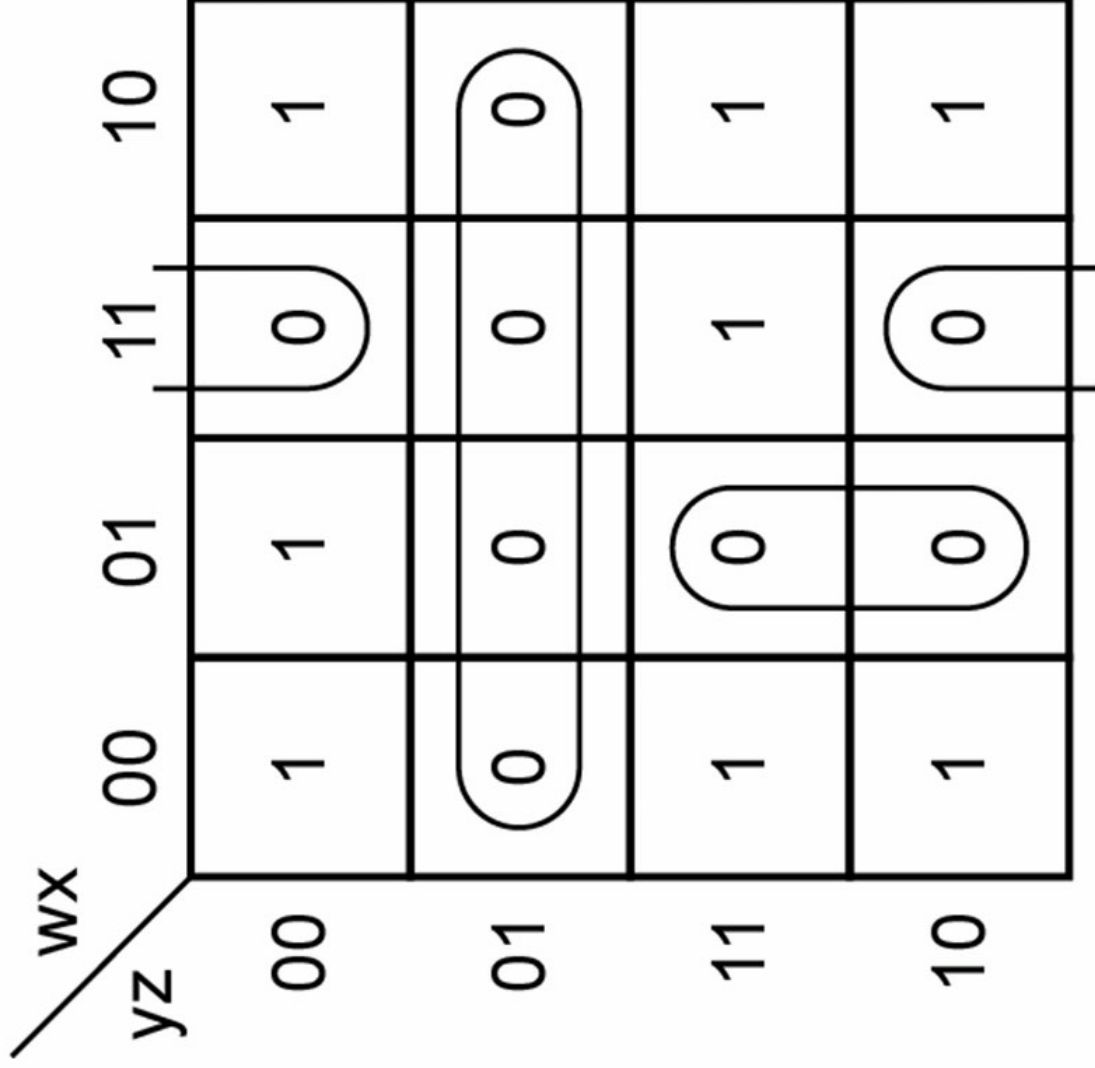


Figure 5-14

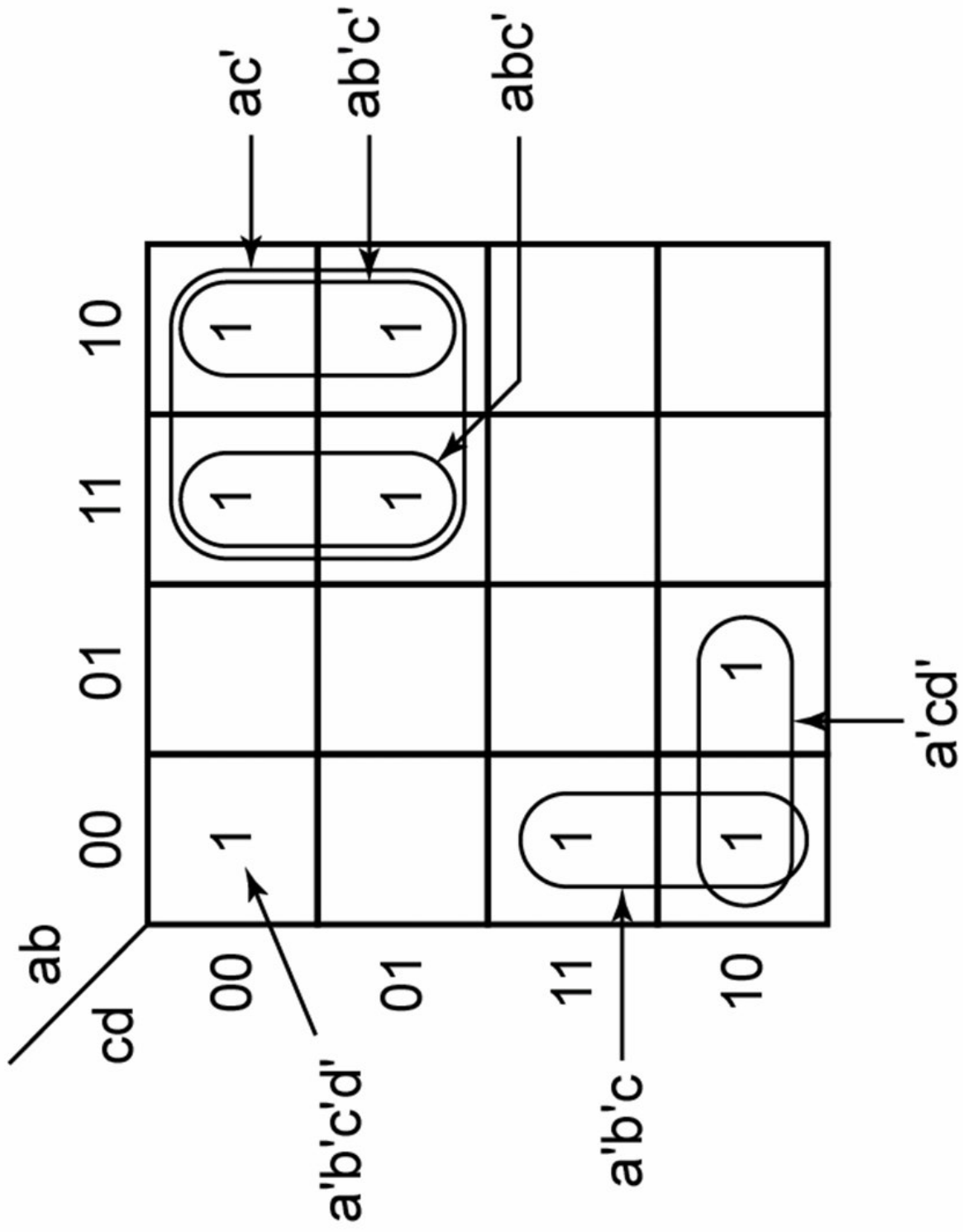


Figure 5-15

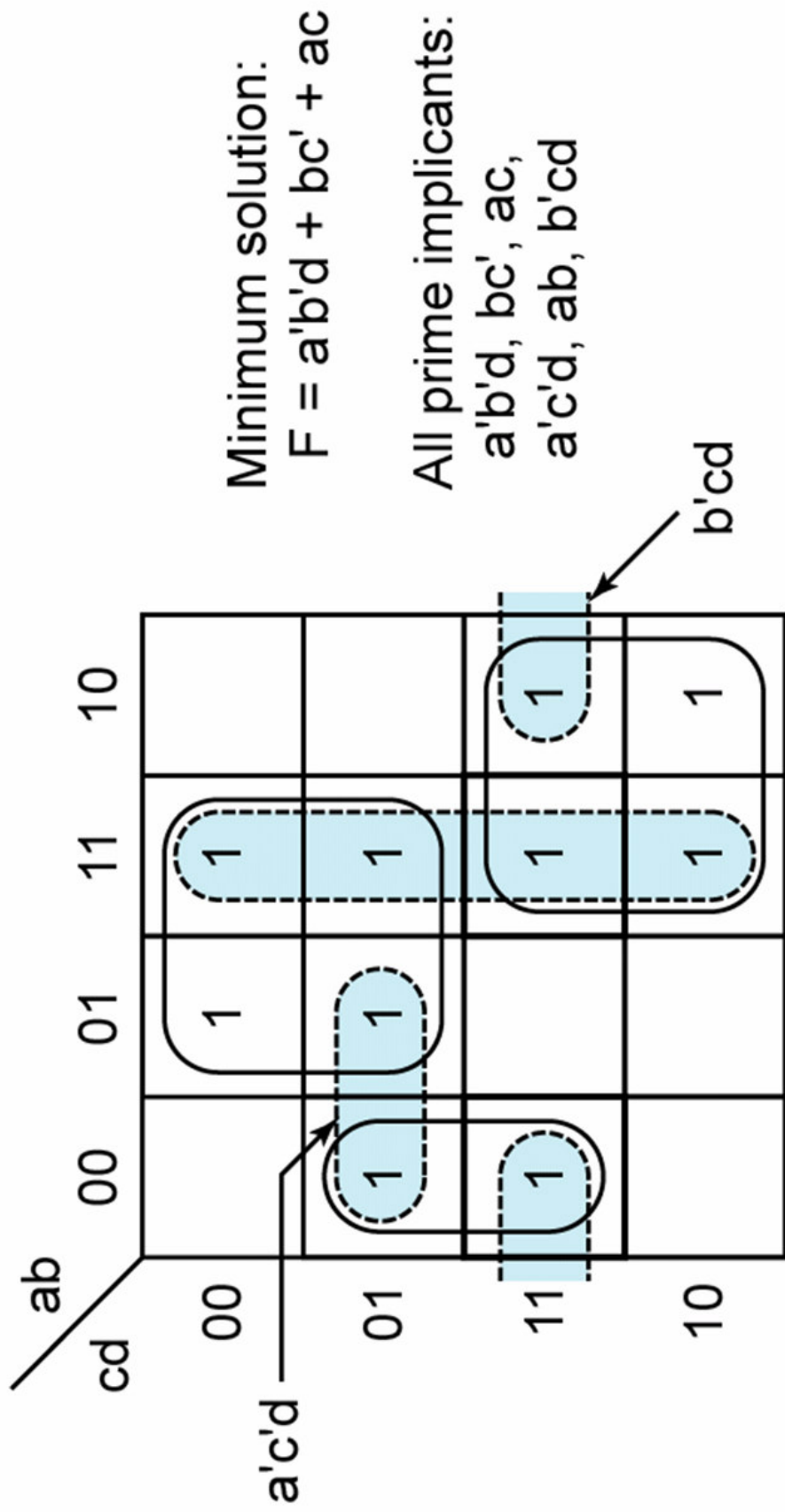
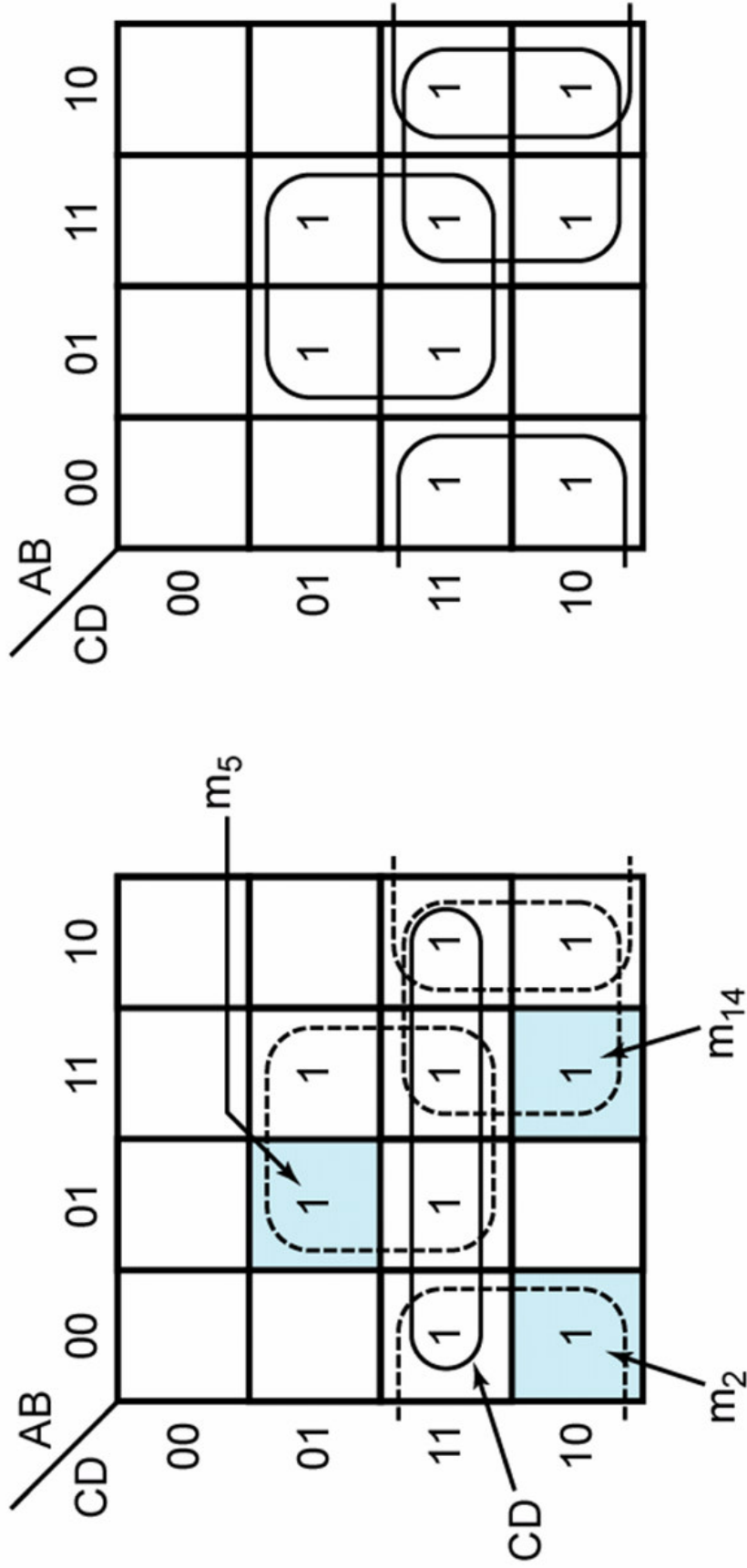
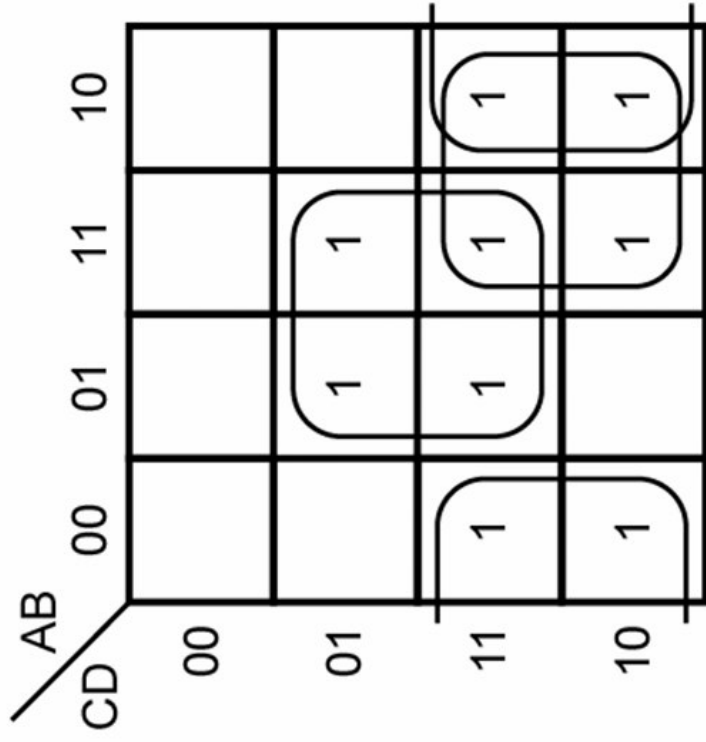


Figure 5-16: Determination of All Prime Implicants



$$f = BD + B'C + AC$$

(a)



(b)

Figure 5-17

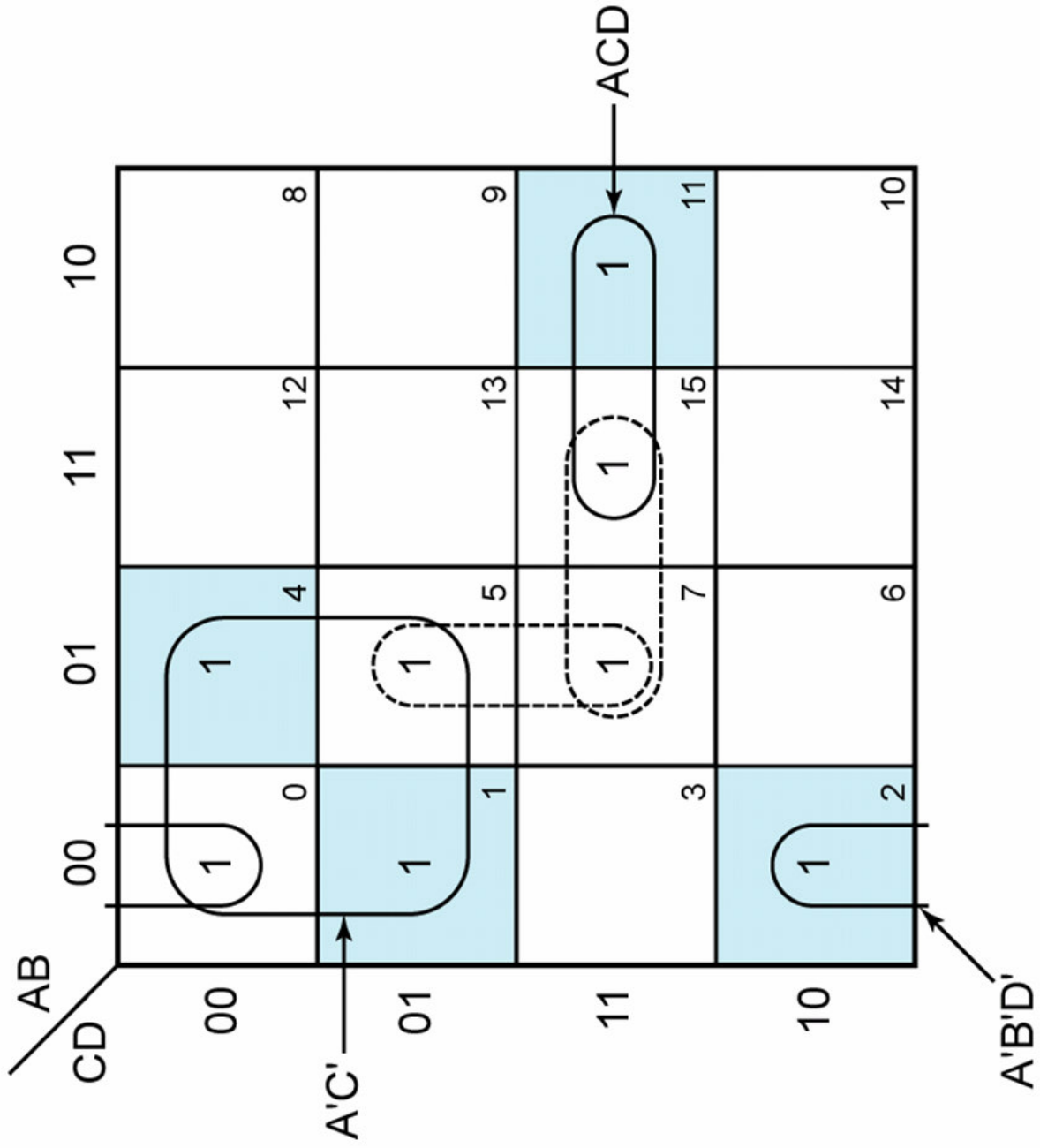


Figure 5-18



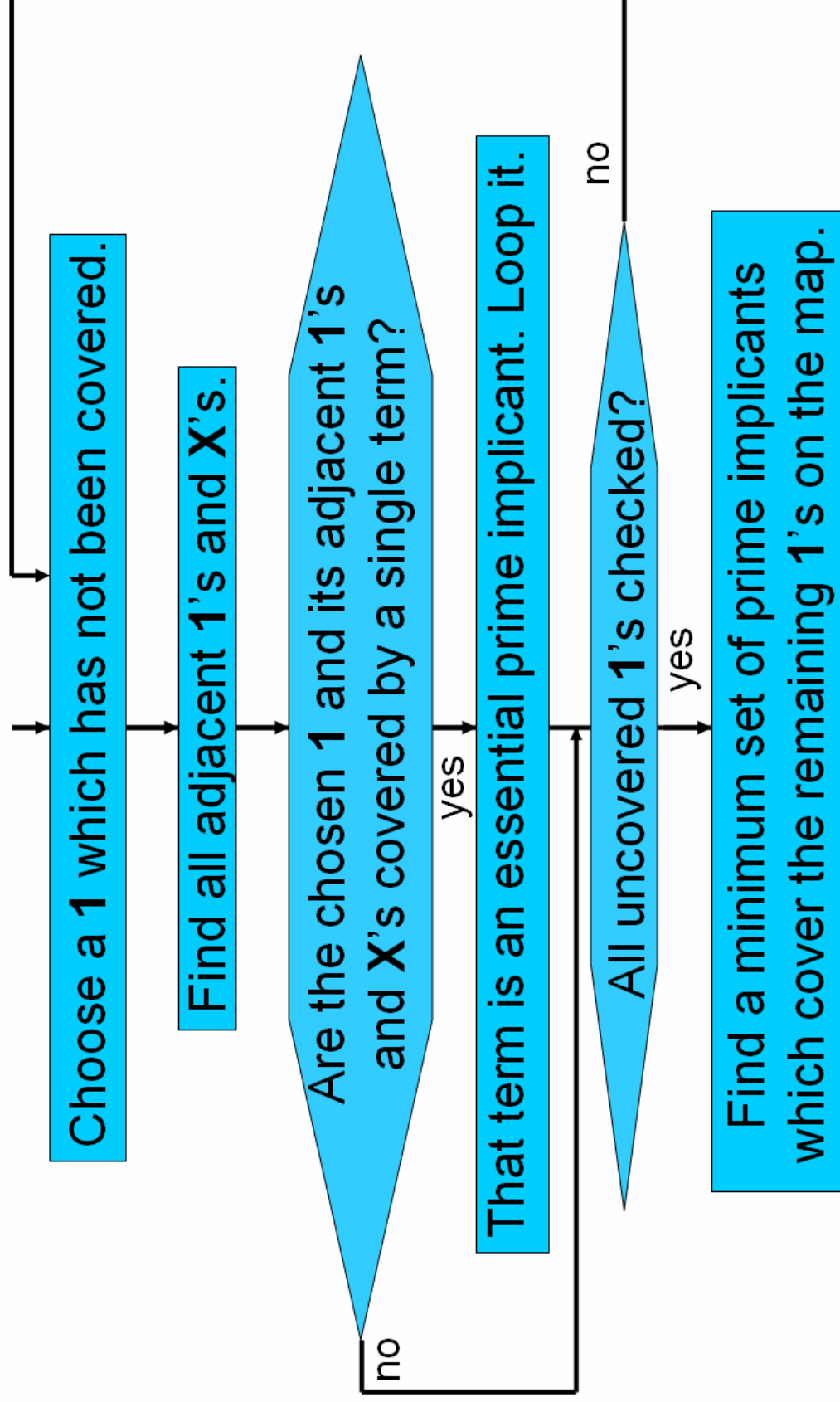
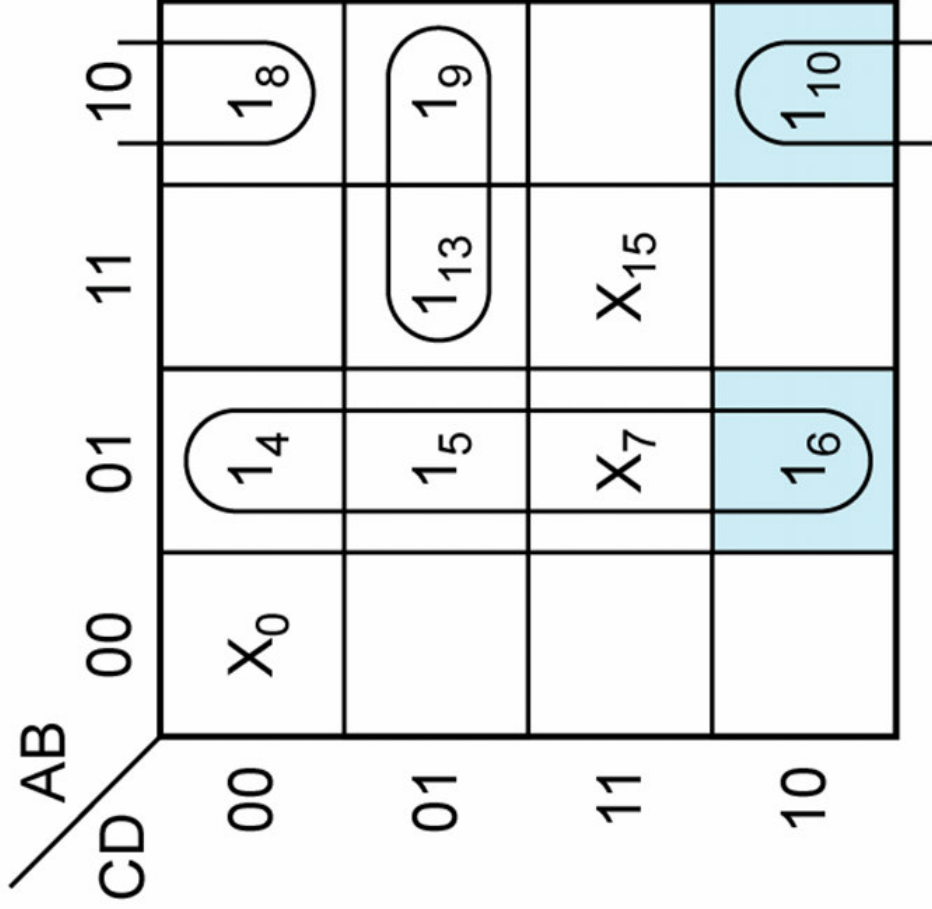


Figure 5-19:
Flowchart for Determining a Minimum Sum of Products
Using a Karnaugh Map



Shaded 1's are covered by only one prime implicant.

Figure 5-20

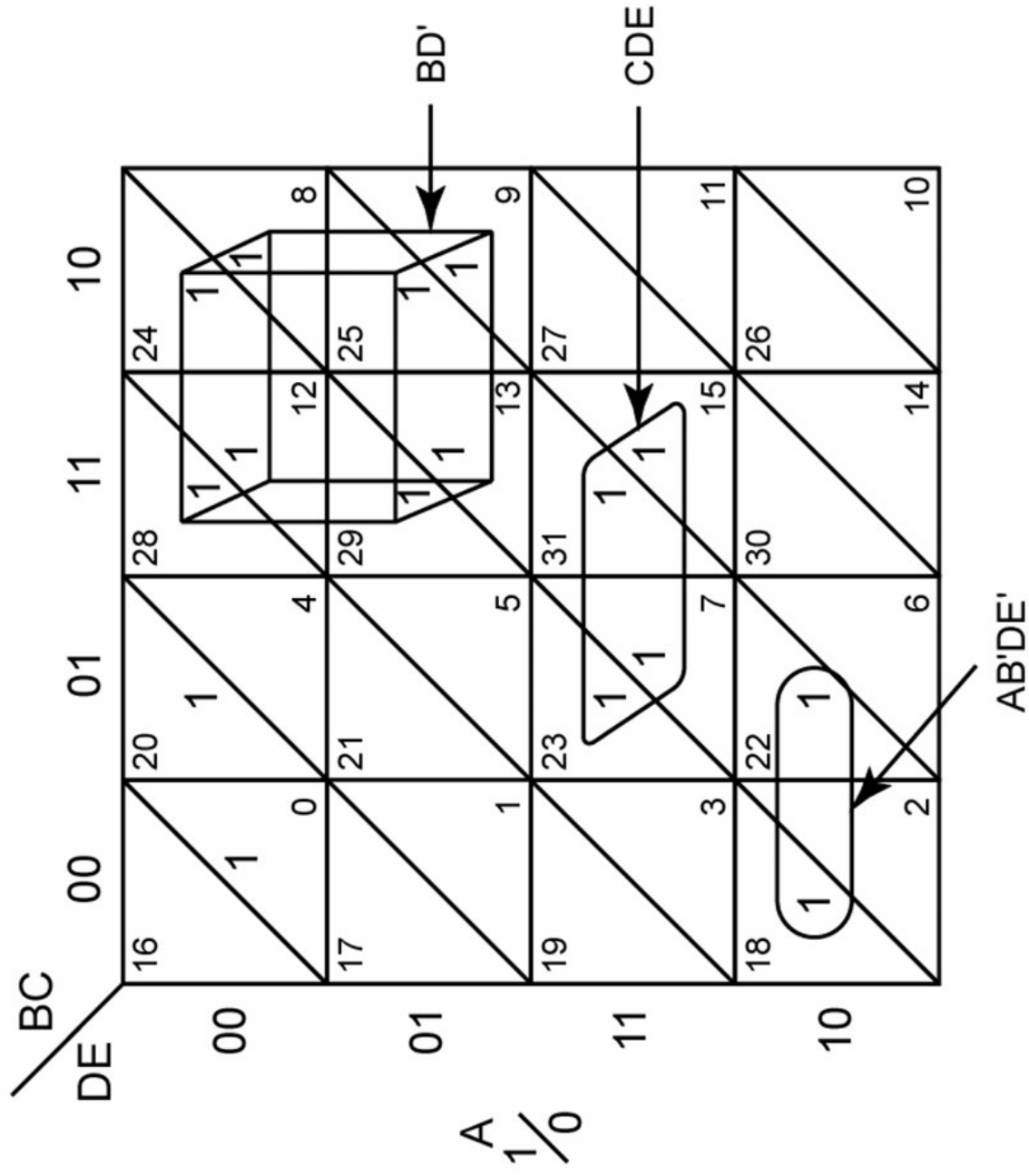


Figure 5-21: A Five-Variable Karnaugh Map

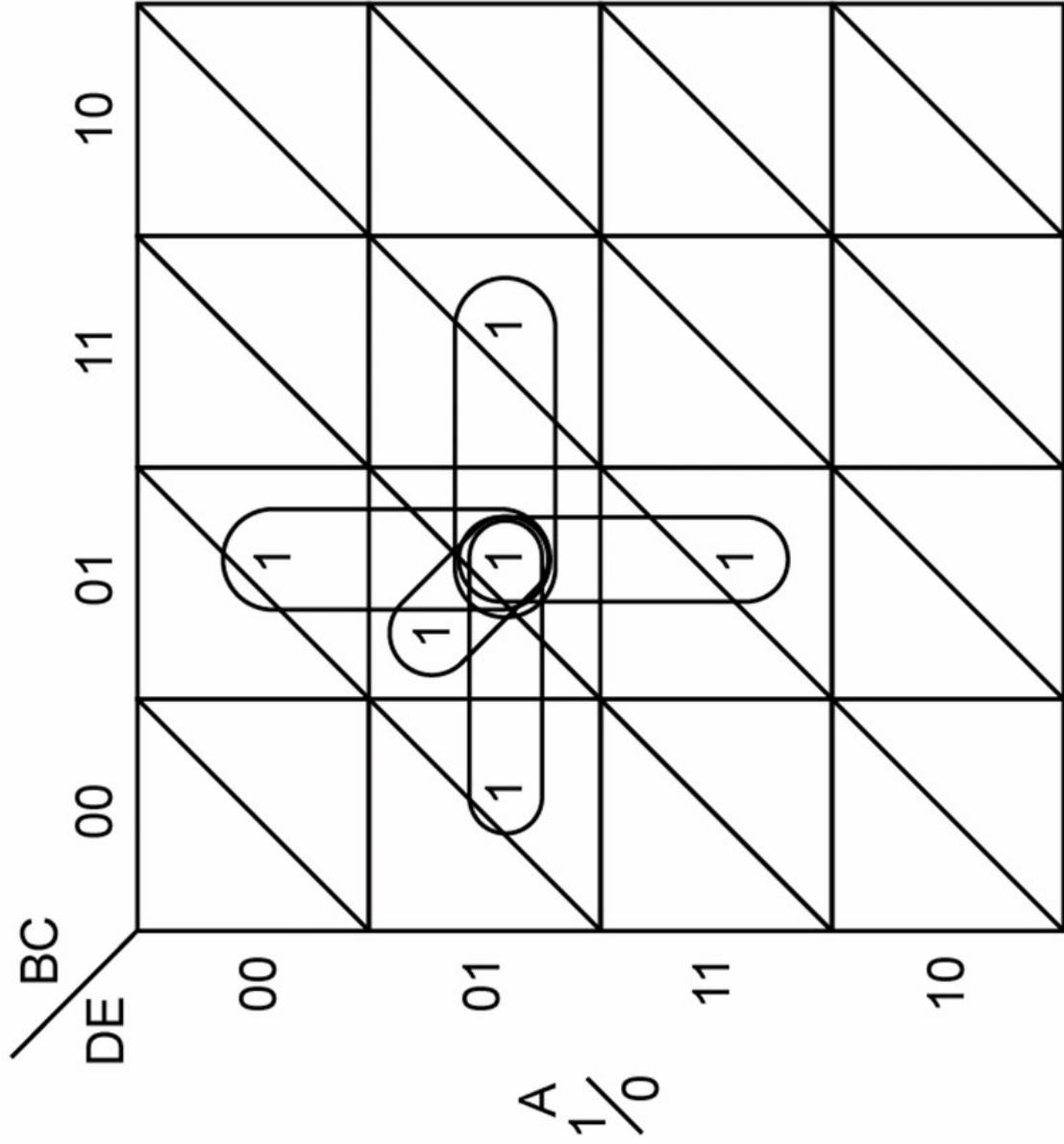


Figure 5-22



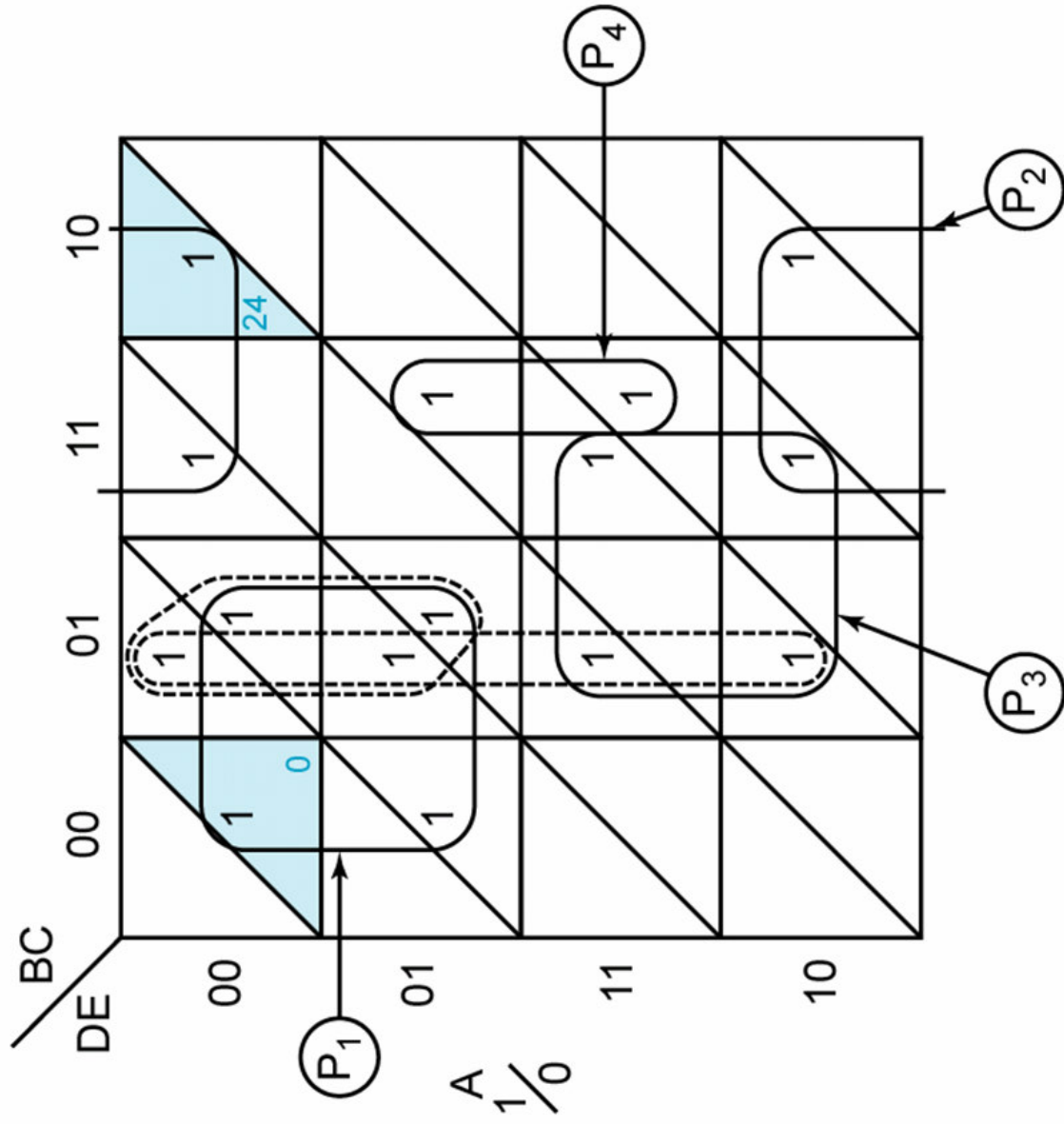


Figure 5-23

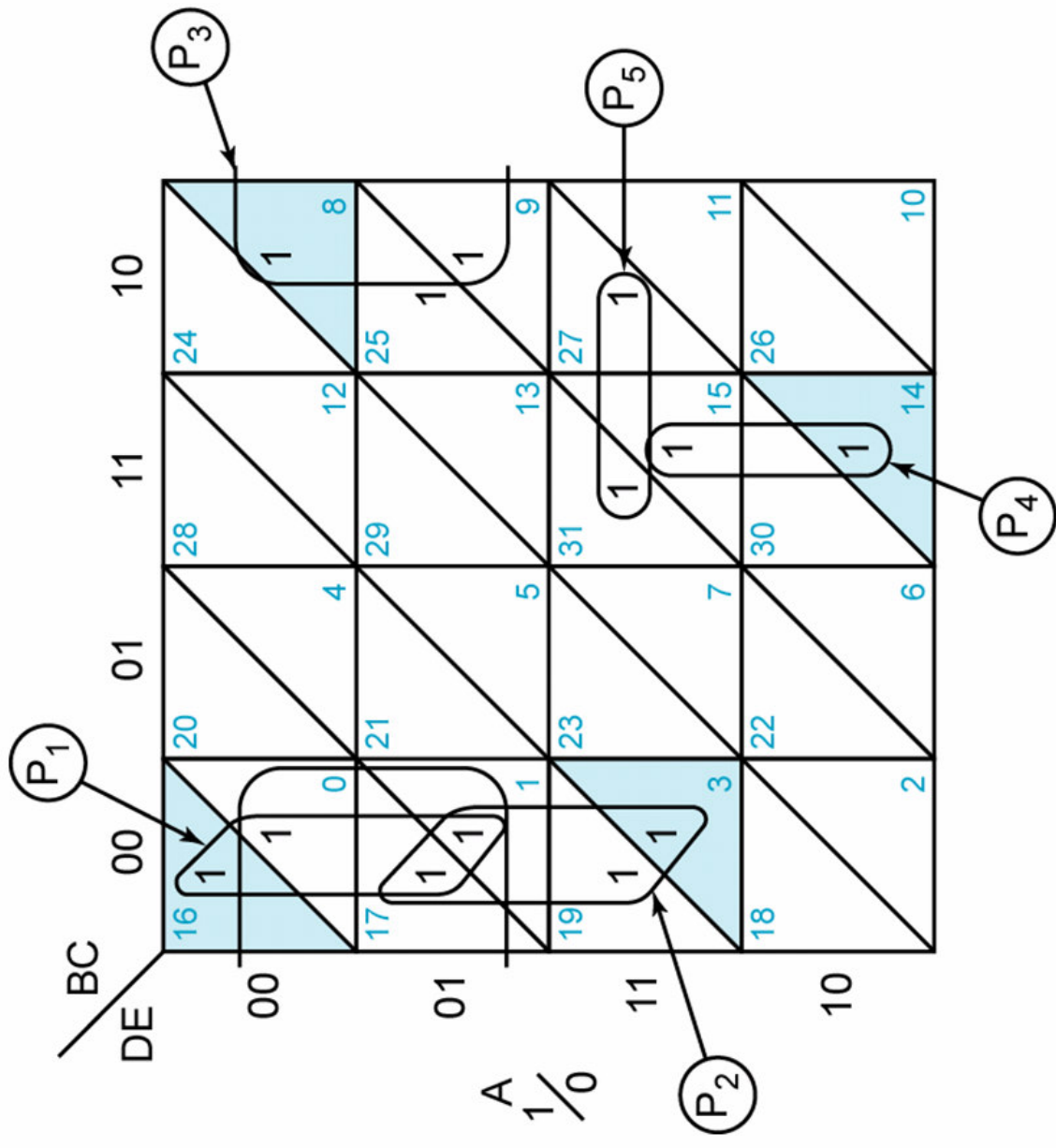
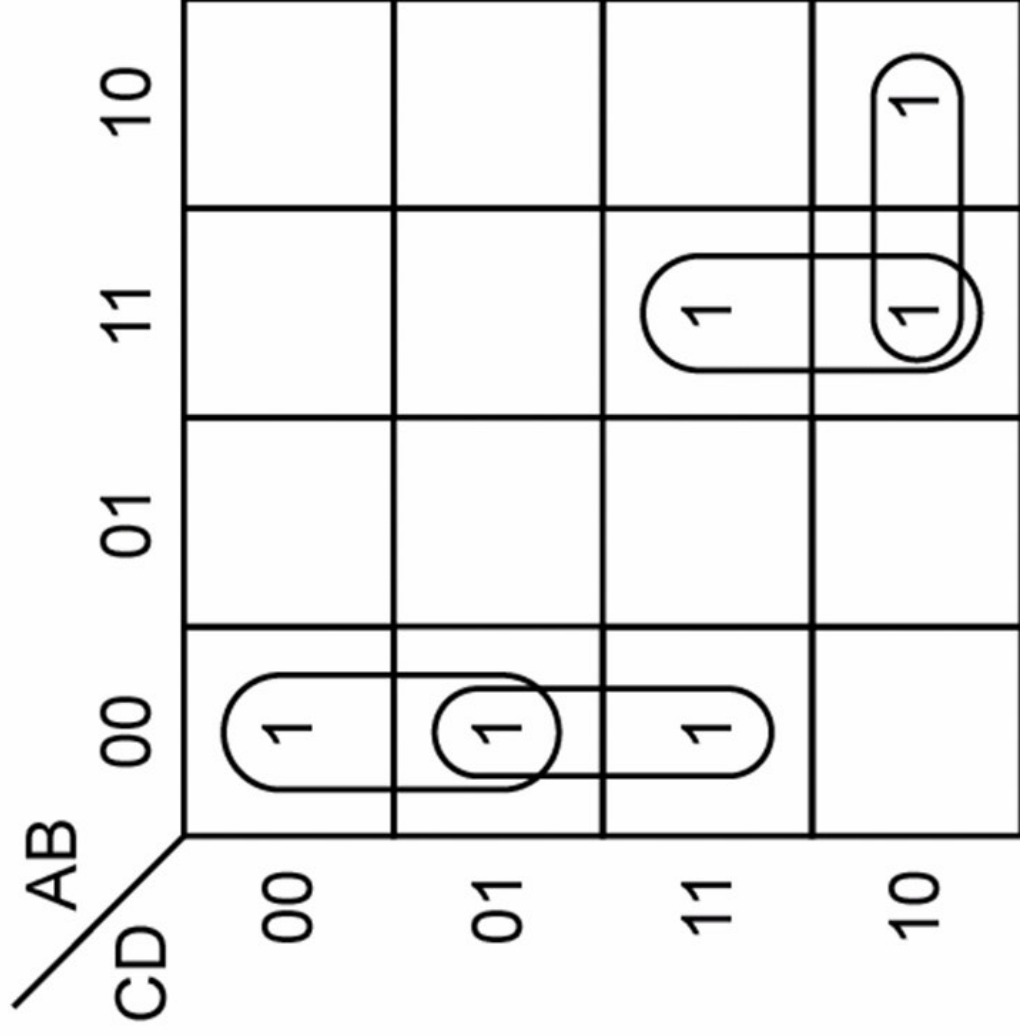


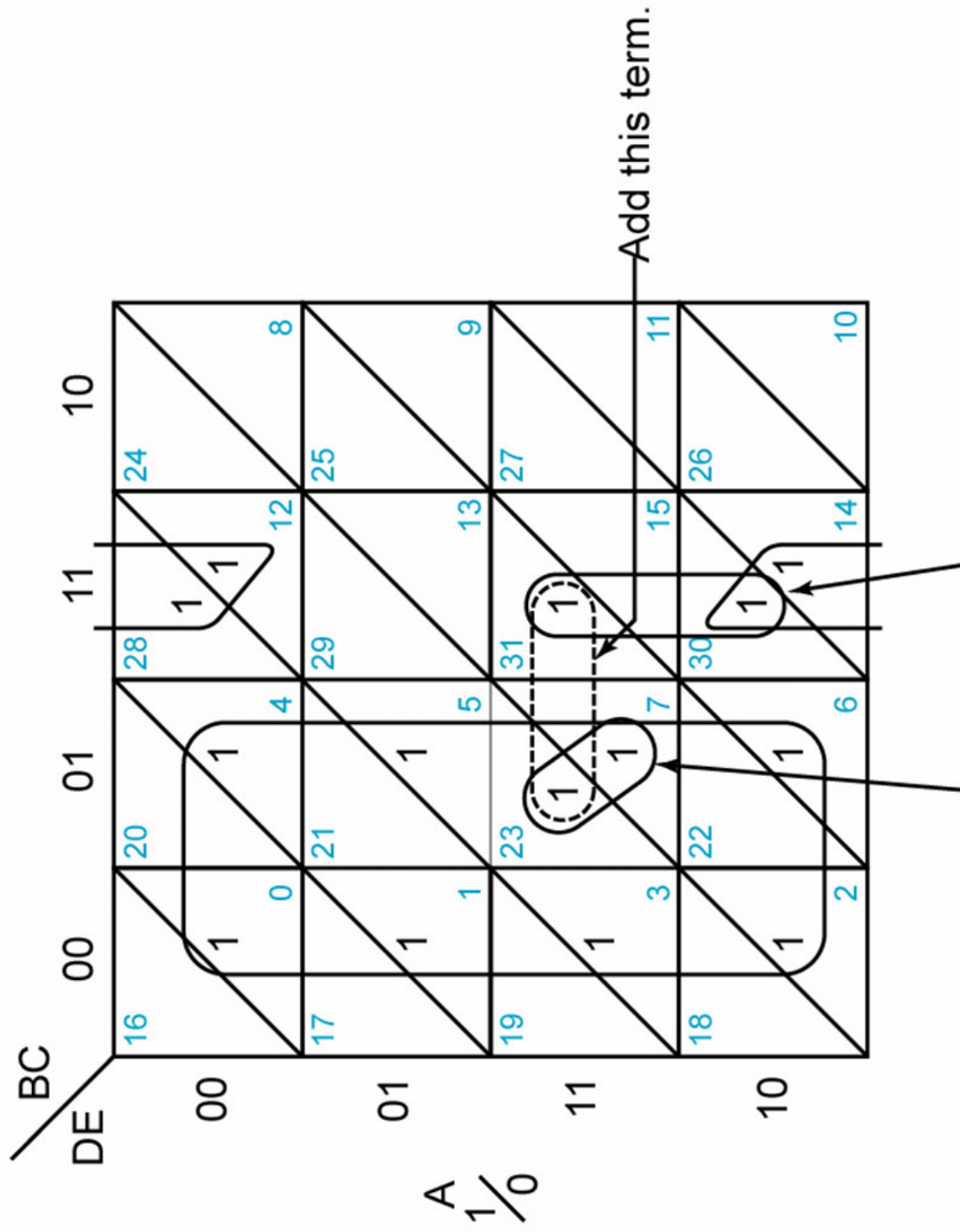
Figure 5-24





$$F = A'B'(C' + D) + AC(B + D')$$

Figure 5-25



Then these two terms can be eliminated.

Figure 5-26



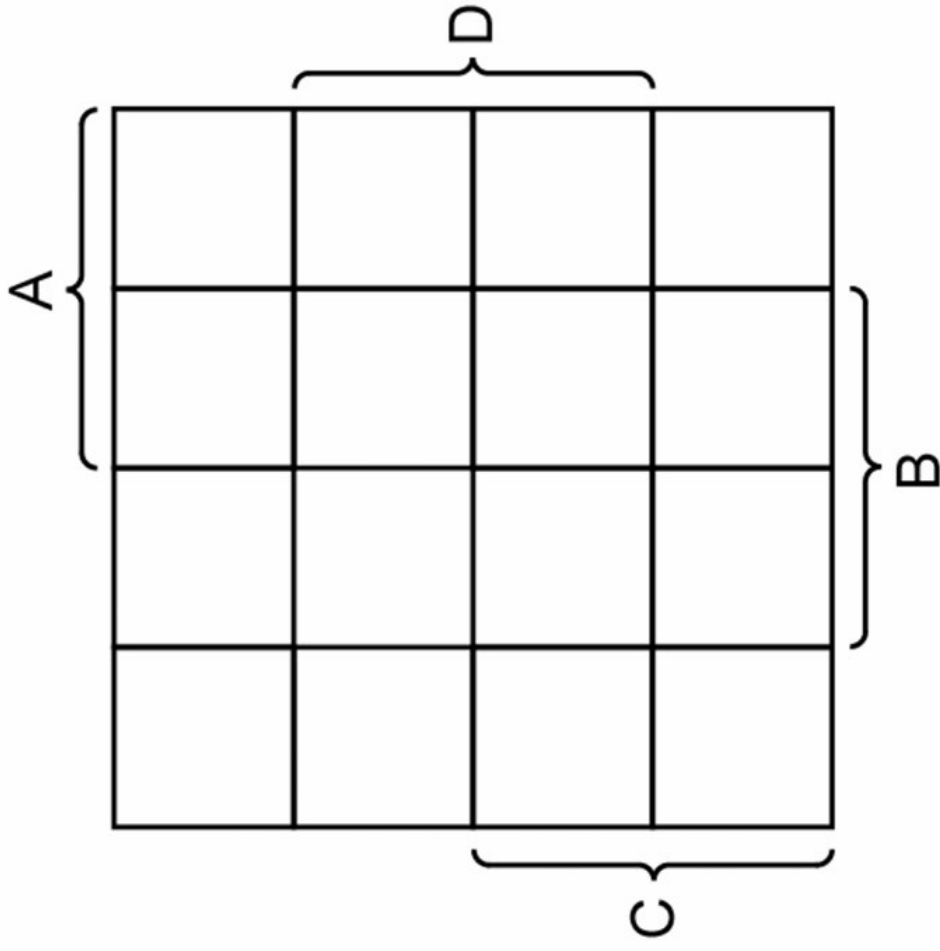
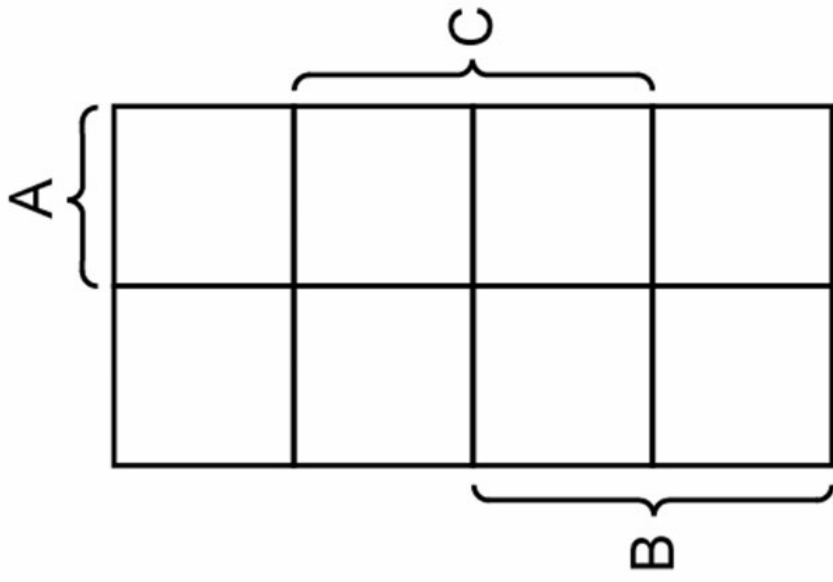
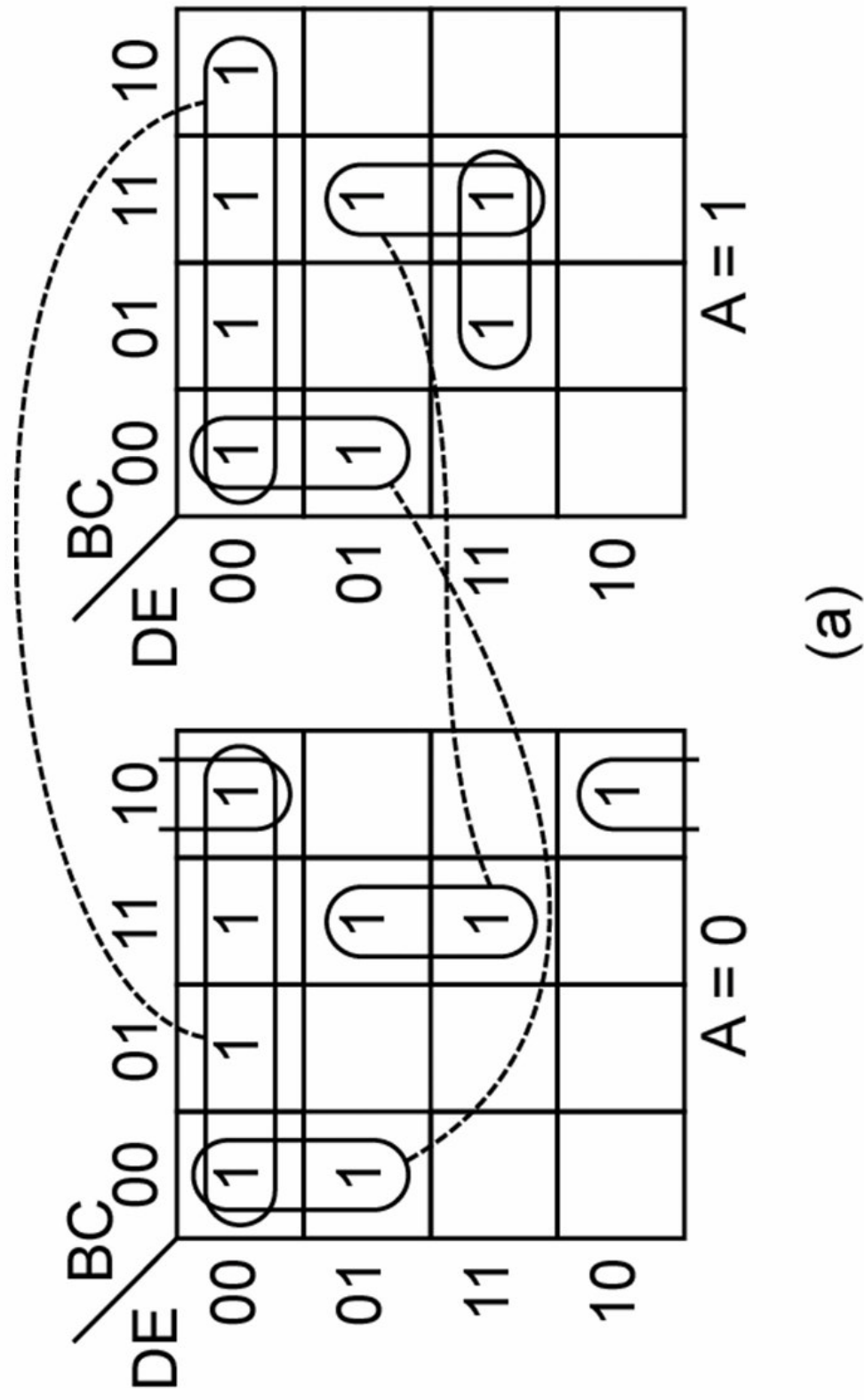


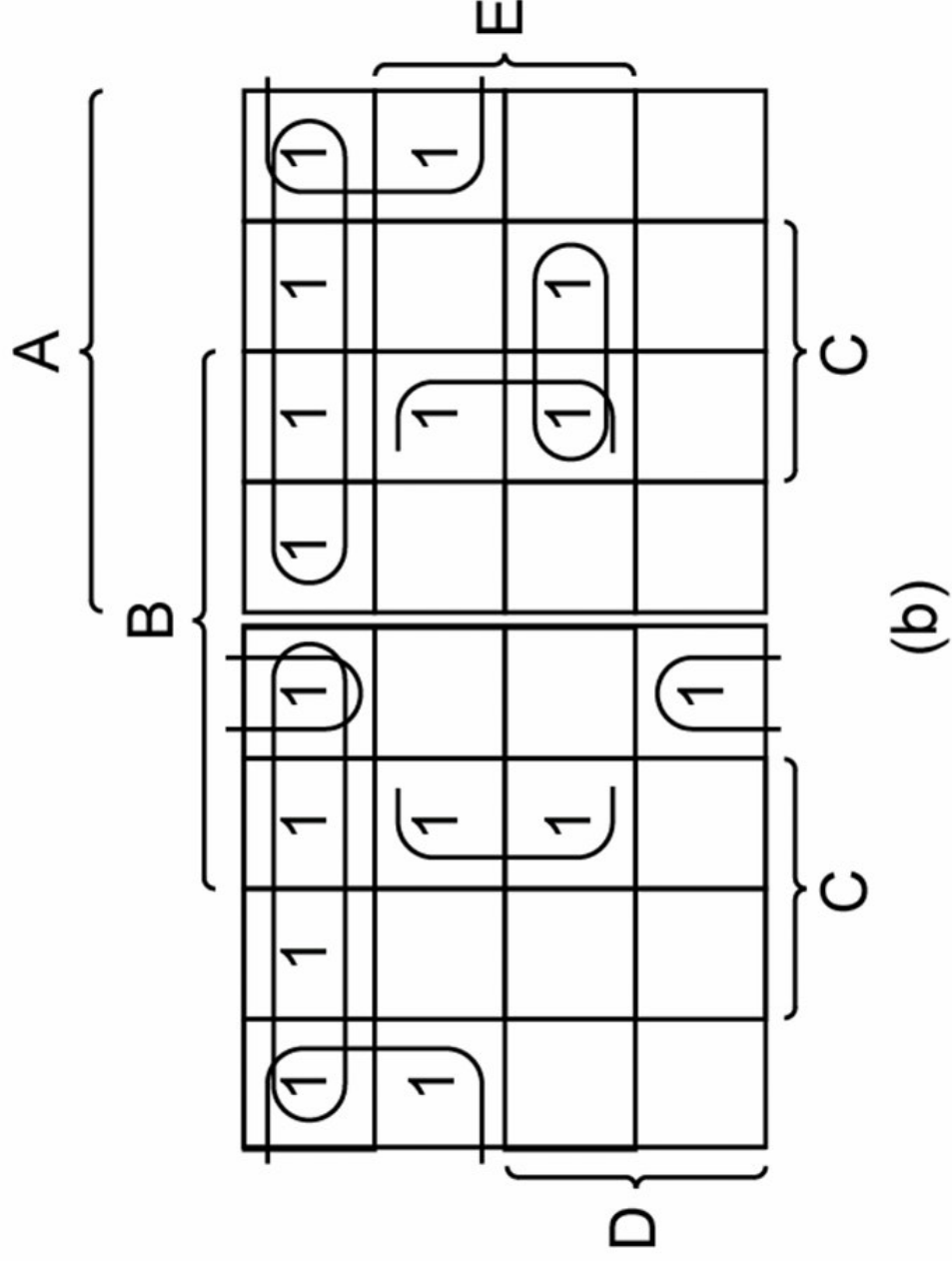
Figure 5-27: Veitch Diagrams





$F = D'E' + B'C'D' + BCE + A'BC'E' + ACDE$

Figure 5-28: Other Forms of Five-Variable Karnaugh Maps



$$F = D'E' + B'C'D' + BCE + A'BC'E' + ACDE$$

Figure 5-28: Other Forms of Five-Variable Karnaugh Maps