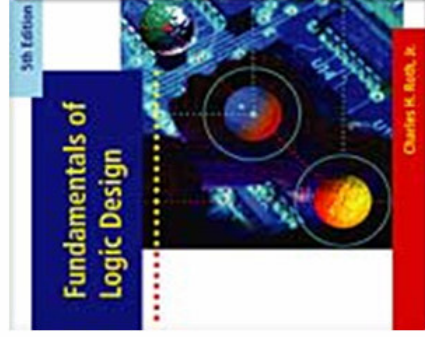


FIGURES FOR CHAPTER 6

QUINE-MCCLUSKEY METHOD



This chapter in the book includes:

- Objectives
- Study Guide
- 6.1 Determination of Prime Implicants
- 6.2 The Prime Implicant Chart
- 6.3 Petrick's Method
- 6.4 Simplification of Incompletely Specified Functions
- 6.5 Simplification Using Map-Entered Variables
- 6.6 Conclusion
- Programmed Exercises
- Problems

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

$$AB'CD' + AB'CD = AB'C$$

$$\underbrace{1010}_{X \ Y} + \underbrace{1011}_{X \ Y'} = \underbrace{101-}_{X}$$

(the dash indicates a missing variable)

$$A'BC'D + A'BCD' \quad (\text{won't combine})$$

$$0101 + 0110 \quad (\text{won't combine})$$

Equation (6-1)



$$f(a, b, c, d) = \sum m(0, 1, 2, 5, 6, 7, 8, 9, 10, 14)$$

group 0	0	0000	
group 1	{	1	0001
		2	0010
		8	1000
group 2	{	5	0101
		6	0110
		9	1001
		10	1010
group 3	{	7	0111
		14	1110

Equation (6-2)

Table 6-1. Determination of Prime Implicants

	Column I	Column II	Column III
group 0	0 0000 ✓	0, 1 000- ✓	0, 1, 8, 9 -00-
group 1	1 0001 ✓	0, 2 00-0 ✓	0, 2, 8, 10 -0-0
	2 0010 ✓	0, 8 -000 ✓	0, 8, 1, 9 -00-
	8 1000 ✓	<u>1, 5 0-01</u>	<u>0, 8, 2, 10 -0-0</u>
group 2	5 0101 ✓	1, 9 -001 ✓	2, 6, 10, 14 --10
	6 0110 ✓	2, 6 0-10 ✓	<u>2, 10, 6, 14 ---10</u>
	9 1001 ✓	2, 10 -010 ✓	
	10 1010 ✓	8, 9 100- ✓	
group 3	7 0111 ✓	8, 10 10-0 ✓	
	14 1110 ✓	<u>5, 7 01-1</u>	
		6, 7 011-	
		6, 14 -110 ✓	
		<u>10, 14 1-10 ✓</u>	

Table 6-2. Prime Implicant Chart

	0	1	2	5	6	7	8	9	10	14
(0, 1, 8, 9) $b'c'$	X	X					X	\textcircled{X}		
(0, 2, 8, 10) $b'd'$	X		X				X		X	
(2, 6, 10, 14) cd'			X		X				X	\textcircled{X}
(1, 5) $a'c'd$		X		X						
(5, 7) $a'bd$				X		X				
(6, 7) $a'bc$					X	X				

Table 6-3.

	0	1	2	5	6	7	8	9	10	14
(0, 1, 8, 9)	*	*					*	*		
$b'c'$	*	*					*	*		
(0, 2, 8, 10)	*		*				*		*	
$b'd'$	*		*				*		*	
(2, 6, 10, 14)		*	*		*				*	*
cd'		*	*		*				*	*
(1, 5)		*		*						
$a'c'd$		*		*						
(5, 7)				*		*				
$a'bd$				*		*				
(6, 7)					*	*				
$a'bc$					*	*				

0	000	✓	0, 1	00-
1	<u>001</u>	✓	0, 2	0-0
2	010	✓	<u>1, 5</u>	<u>-01</u>
5	<u>101</u>	✓	2, 6	-10
6	110	✓	<u>5, 7</u>	<u>1-1</u>
7	<u>111</u>	✓	6, 7	11-

Derivation of prime implicants:

Table 6-4.

		0	1	2	5	6	7
① →	(0, 1)		*				
	$a'b'$	*	*				
	(0, 2)	*		*			
	$a'c'$	*		*			
	(1, 5)		*		*		
	$b'c'$		*		*		
② →	(2, 6)			*		*	
	bc'			*		*	
③ →	(5, 7)				*		*
	ac				*		*
	(6, 7)					*	*
	ab					*	*



Table 6-5.

	0	1	2	5	6	7
P_1 (0, 1)	$a'b'$	X	X			
P_2 (0, 2)	$a'c'$	X	X			
P_3 (1, 5)	$b'c$			X		
P_4 (2, 6)	bc'		X	X		
P_5 (5, 7)	ac			X	X	
P_6 (6, 7)	ab				X	X



1	0001	✓	(1, 3)	00-1	✓	(1, 3, 9, 11)	-0-1
2	0010	✓	(1, 9)	-001	✓	(2, 3, 10, 11)	-01-
3	0011	✓	(2, 3)	001-	✓	<u>(3, 7, 11, 15)</u>	--11
9	1001	✓	(2, 10)	-010	✓	(9, 11, 13, 15)	1---1
10	1010	✓	<u>(3, 7)</u>	<u>0-11</u>	✓		
7	0111	✓	(3, 11)	-011	✓		
11	1011	✓	(9, 11)	10-1	✓		
13	1101	✓	(9, 13)	1-01	✓		
15	1111	✓	(10, 11)	101-	✓		
			<u>(7, 15)</u>	<u>-111</u>	✓		
			(11, 15)	1-11	✓		
			(13, 15)	11-1	✓		

$$F(A, B, C, D) = \Sigma m(2, 3, 7, 9, 11, 13) + \Sigma d(1, 10, 15)$$

	2	3	7	9	11	13
(1, 3, 9, 11)		*		*	*	*
*(2, 3, 10, 11)	*	*			*	*
*(3, 7, 11, 15)		*	*		*	*
*(9, 11, 13, 15)				*	*	*

$$F = B'C + CD + AD$$

* indicates an essential prime implicant.

Prime Implicant Chart with Don't Cares Omitted

(a)

AB \ CD	00	01	11	10
00	1			
01	X	E	X	F
11	1	E	1	1
10	1			X

G

(b)

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

$E = F = 0$

$MS_0 = A'B' + ACD$

(c)

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

$E = 1, F = 0$

$MS_1 = A'D$

(d)

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

$E = 0, F = 1$

$MS_2 = AD$

Figure 6-1: Use of Map-Entered Variables

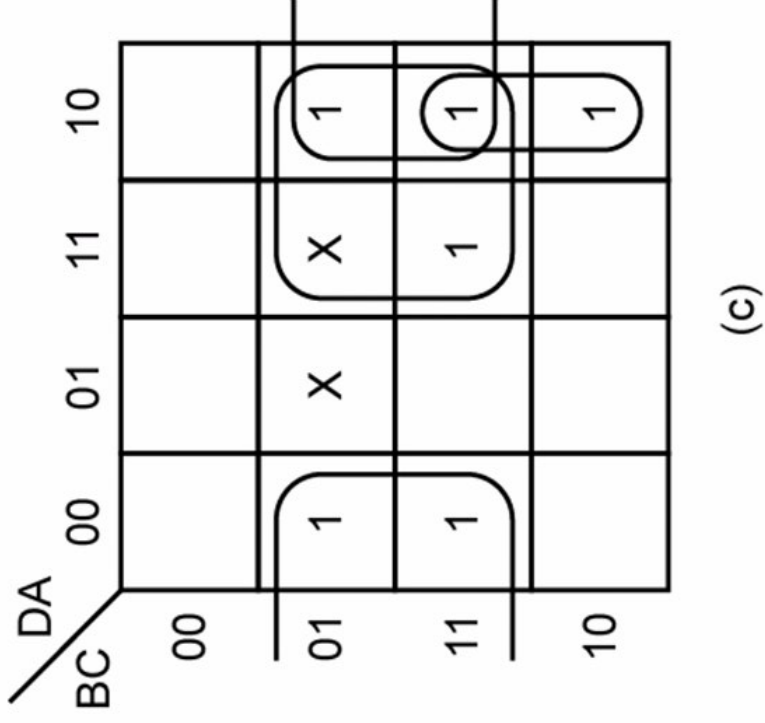
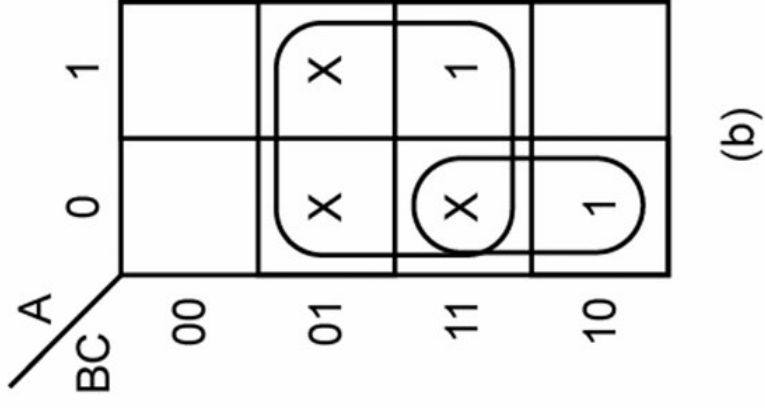
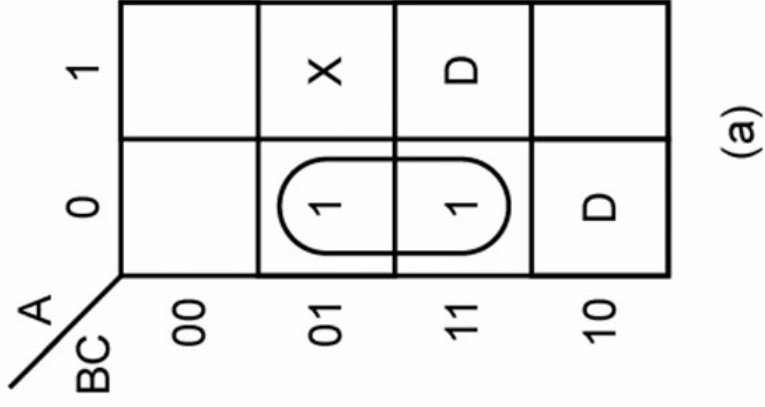


Figure 6-2: Simplification Using a Map-Entered Variable