

Implicant, prime implicant and essential prime implicant

- Implicant : “1” “X” cube
- Prime implicant : implicant implicant
- Essential prime implicant : implicant가 “1” prime implicant

(ex) $f(A,B,C,D) = (0,2,3,5,7,8,9,10,11,13,15)$

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

PI : CD, B' C, AD, AB' , BD, B' D'

EPI : BD, B' D'

$f = BD+B' D' +CD+AD$

$= BD+B' D' +CD+AB'$

$= BD+B' D' +B' C+AD$

$= BD+B' D' +B' C+AB'$

PI & EPI

(ex) $f(A,B,C,D) = (0,2,3,5,7,8,9,10,11,13,15)$

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

				0	2	3	5	7	8	9	10	11	13	15
	CD													
	B'C													
	AD													
	AB'													
	BD													
	B'D'													

PI : CD, B' C, AD, AB' , BD, B' D'

EPI : BD, B' D'

$$\begin{aligned}
 f &= BD+B' D' +CD+AD = BD+B' D' +CD+AB' = BD+B' D' +B' C+AD \\
 &= BD+B' D' +B' C+AB'
 \end{aligned}$$

PI & EPI

(ex) $f(A,B,C,D) = (1,3,4,5,10,11,12,13,14,15)$

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

				1	3	4	5	10	11	12	13	14	15
	A'B'D												
	BC'												
	AC												
	A'C'D												
	AB												
	B'CD												

PI : A' B' D, BC' , AC, A' C' D, AB, B' CD

EPI : AC, BC'

f = AC+BC' +A' B' D

PI & EPI

(ex) $f(A,B,C,D) = (1,5,6,7,11,12,13,15)$

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

			1	5	6	7	11	12	13	15
	BD									
	ABC'									
	ACD									
	A'BC									
	A'C'D									

PI : BD, ABC' , ACD, A' BC, A' C' D

EPI : ABC' , ACD, A' BC, A' C' D

f = ABC' +ACD+A' BC+A' C' D

PI & EPI

(ex) $f(A,B,C,D) = (2,3,5,7,10,11,13,14,15)$

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

			2	3	5	7	10	11	13	14	15
	BD										
	CD										
	AC										
	B'C										

PI : BD, CD, AC, B' C

EPI : BD, AC, B' C

f = BD+AC+B' C

Tabulation method or Quine-McClusky method

- 가
- (1) prime implicant (PI)
- (2) , literal (PI)

(ex) $f(w,x,y,z) = (0,1,2,8,10,11,14,15)$

	w	x	y	z	
0	0	0	0	0	
1	0	0	0	1	
2	0	0	1	0	
8	1	0	0	0	
10	1	0	1	0	
11	1	0	1	1	
14	1	1	1	0	
15	1	1	1	1	

	w	x	y	z	
0, 1	0	0	0	-	
0, 2	0	0	-	0	
0, 8	-	0	0	0	
2, 10	-	0	1	0	
8, 10	1	0	-	0	
10, 11	1	0	1	-	
10, 14	1	-	1	-	
11, 15	1	-	1	1	
14, 15	1	1	1	-	

	w	x	y	z	
0, 2, 8, 10	-	0	-	0	
0, 8, 2, 10	-	0	-	0	
10, 11, 14, 15	1	-	1	-	
10, 14, 11, 15	1	-	1	-	

w	x	y	z		
0	0	0	0	0	
0	0	0	0	1	
0	0	1	0	2	
1	0	0	0	8	
1	0	1	0	10	
1	0	1	1	11	
1	1	1	0	14	
1	1	1	1	15	

0, 1	(1)	
0, 2	(2)	
0, 8	(8)	
2, 10	(8)	
8, 10	(2)	
10, 11	(1)	
10, 14	(4)	
11, 15	(4)	
14, 15	(1)	

0, 2, 8, 10	(2, 8)	
0, 2, 8, 10	(2, 8)	
10, 11, 14, 15	(1, 4)	
10, 11, 14, 15	(1, 4)	

Decimal		w x y z	term
0, 1	(1)	0 0 0 -	w'x'y'
0, 2, 8, 10	(2, 8)	- 0 - 0	x'z'
10, 11, 14, 15	(1, 4)	1 - 1 -	wy

			0	1	2	8	10	11	14	15
	w'x'y'	1								
	x'z'	2, 8								
	wy	10, 11, 14, 15								

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

(1) Prime implicant

(ex) $f(w,x,y,z) = (1,4,6,7,8,9,10,11,15)$

w	x	y	z	
0	0	0	1	1
0	1	0	0	4
1	0	0	0	8
0	1	1	0	6
1	0	0	1	9
1	0	1	0	10
0	1	1	1	7
1	0	1	1	11
1	1	1	1	15

1,9	(8)	
4,6	(2)	
8,9	(1)	
8,10	(2)	
6,7	(1)	
9,11	(2)	
10,11	(1)	
7,15	(8)	
11,15	(4)	

8,9,10,11	(1,2)	
8,9,10,11	(1,2)	

Decimal		w	x	y	z	term
1,9	(8)	-	0	0	1	$x'y'z$
4,6	(2)	0	1	-	0	$w'xz'$
6,7	(1)	0	1	1	-	$w'xy$
7,15	(8)	-	1	1	1	xyz
11,15	(4)	1	-	1	1	wyz
8,9,10,11	(1,2)	1	0	-	-	wx'

(2) Prime implicant

			1	4	6	7	8	9	10	11	15
	$x'y'z$	1, 9									
	$w'xz'$	4, 6									
	$w'xy$	6, 7									
	xyz	7, 15									
	wyz	11, 15									
	wx'	8, 9, 10, 11									

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