Logical Implication
P → F
P implies F
If F also takes the value of 1 whenever P equals 1
P is an implicant of F
P is a product term

F(x,y,z,w) = xy + yz +w

xy → F
Then xyz → F, xyzw → F
In this case, xy is a prime implicant,
And xyz, xyzw is not a prime implicant

Essential prime implicants are
prime implicants that cover an output of the function
that no combination of other prime implicants is able to cover.

A prime implicant that that includes one or more distinguished one cells (★).
Essential prime implicants are important
because a minimal sum contains all essential prime implicants.

(http://web.cecs.pdx.edu/~mcnames/ECE171/Lectures/Lecture10.html)

F(A,B,C,D) = Sum(0, 2, 3, 5, 7, 8, 9, 10, 11, 13, 15)

f		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00	m0	m1	m3	m2
AB=01	01	m4	m5	m7	m6
AB=11	11	m12	m13	m15	m14
AB=10	10	m8	m9	m11	m10

f		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00	1		1	1
AB=01	01		1	1	
AB=11	11		1	1	
AB=10	10	1	1	1	1

BD		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00	1		1	1

AB=01	01		★1	1		essential
AB=11	11		1	1		prime
AB=10	10	1	1	1	1	implicant

AD

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

A prime implicant is a product term (eg. B'C, AB' …)
Obtained by combining the maximum possible number of adjacent squares in the map.
If a minterm ina square is covered by only one prime impicant,
That prime implicant is said to be essential. (essential prime implicant)

CD

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

B'D'

		CD=00	CD=01	CD=11	CD=10	
		00	01	11	10	
AB=00	00	★1		1	1	essential
AB=01	01		1	1		prime
AB=11	11		1	1		implicant
AB=10	10	1	1	1	1	

AB

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

f

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

BD

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

B'D'

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

f

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

CD

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

AD

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

B'C

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

AB'

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

CD

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

AD

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

CD+AD

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

CD

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

AB'

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

CD + AB'

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

B'C

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

AD

AB	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

B'C+AD

AB \ CD	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

B'C

AB \ CD	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

AB'

AB \ CD	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

B'C+AB'

AB \ CD	CD=00 (00)	CD=01 (01)	CD=11 (11)	CD=10 (10)
AB=00 (00)	1		1	1
AB=01 (01)		1	1	
AB=11 (11)		1	1	
AB=10 (10)	1	1	1	1

A prime implicant is a product term (eg. B'C, AB' …)
Obtained by combining the maximum possible number of adjacent squares in the map.
If a minterm ina square is covered by only one prime impicant,
That prime implicant is said to be essential. (essential prime implicant)

f=w'x'+yz

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

w'x'

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

yz

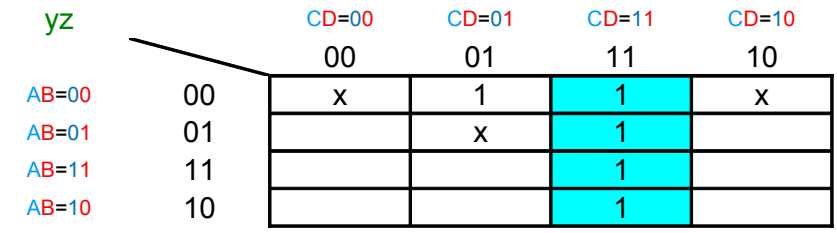
AB \ CD	00	01	11	10
00	x	1	1	x
01		x	1	
11			1	
10			1	

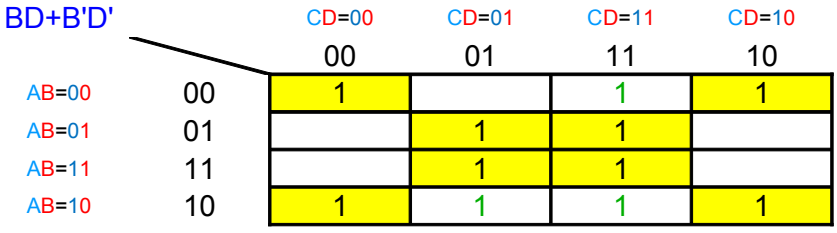
f=w'z+yz

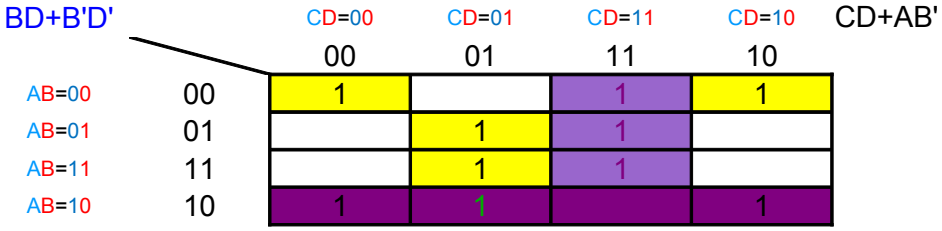
AB \ CD	00	01	11	10
00	x	1	1	x
01		x	1	
11			1	
10			1	

w'z

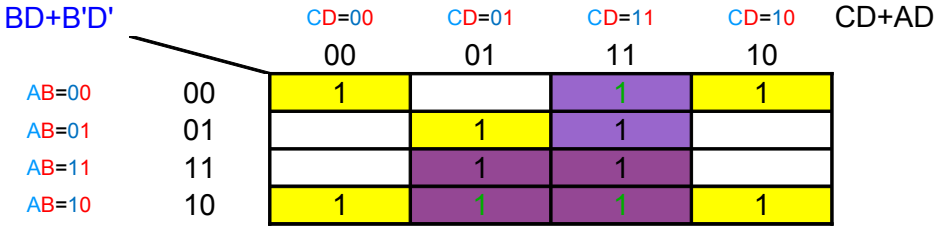
AB \ CD	00	01	11	10
00	x	1	1	x
01		x	1	
11			1	
10			1	



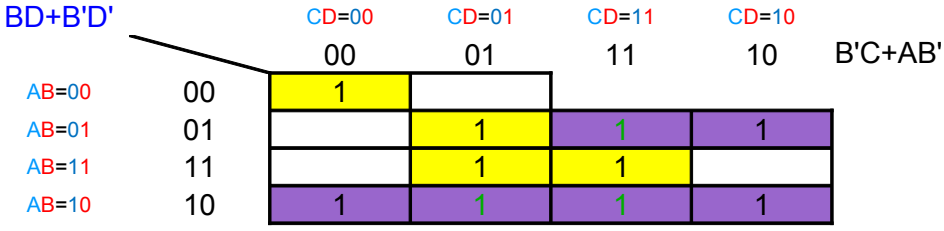




(1) F= BD+B'D+CD+AB'



(2) F = BD+B'D'+CD+AD



(3) F= BD + B'D+B'C+AB'