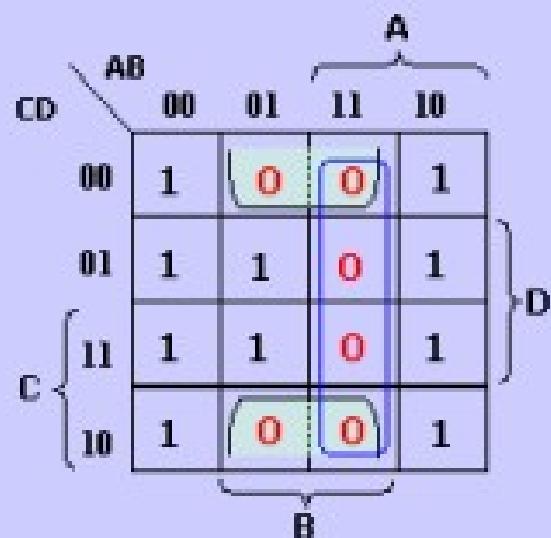


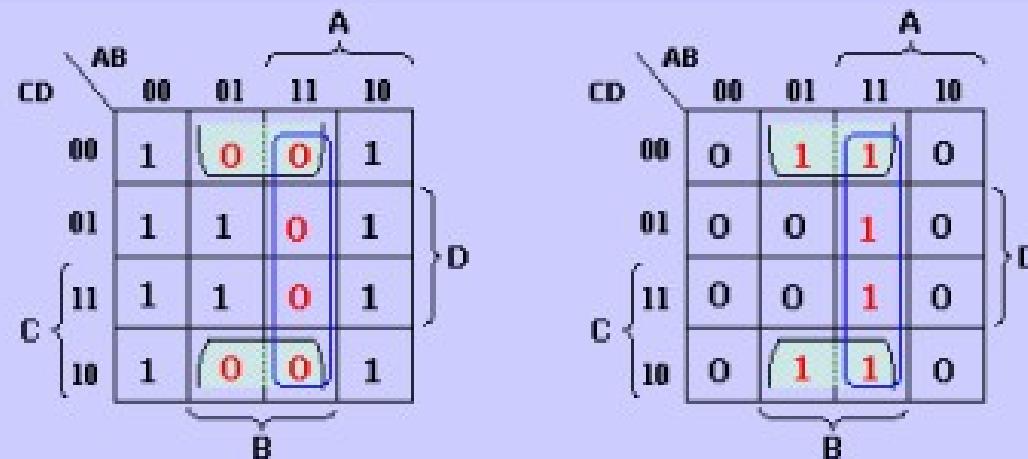
Obtaining POS Expression

- Simplified POS expression can be obtained by collecting maxter (I.e. 0) for the given function.
- Example

Given $F=\Sigma m(0,1,2,3,5,7,8,9,10,11)$, we start with draw K-map, then cluster the maxterm



Obtaining POS Expression



- Given SOP for F' is:
$$F' = BD' + AB$$
- To obtain POS for F , we do:

$$\begin{aligned} F &= (BD' + AB)' \\ &= (BD')'(AB)' \quad \text{DeMorgan} \\ &= (B'+D)(A'+B') \quad \text{DeMorgan} \end{aligned}$$

Don't Care Condition

- In certain problems, some of the output is not determined
- The output can be ‘1’ or ‘0’
- This is known as don’t care which is mark by X
- Example: In odd parity executor for BCD code, 6 is not used

No.	A	B	C	D	P
0	0	0	0	0	1
1	0	0	0	1	0
2	0	0	1	0	0
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	1
7	0	1	1	1	0
8	1	0	0	0	0
9	1	0	0	1	1
10	1	0	1	0	X
11	1	0	1	1	X
12	1	1	0	0	X
13	1	1	0	1	X
14	1	1	1	0	X
15	1	1	1	1	X

Don't Care Condition

- Don't care condition can be used to help us in simplifying Boolean expression in K-map
- It can be '1' or '0' depends on which expression is simpler

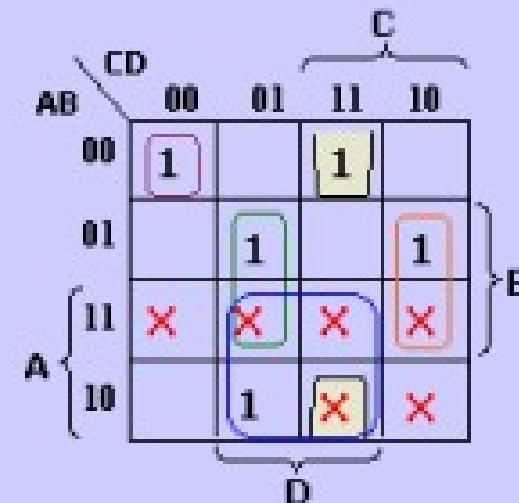
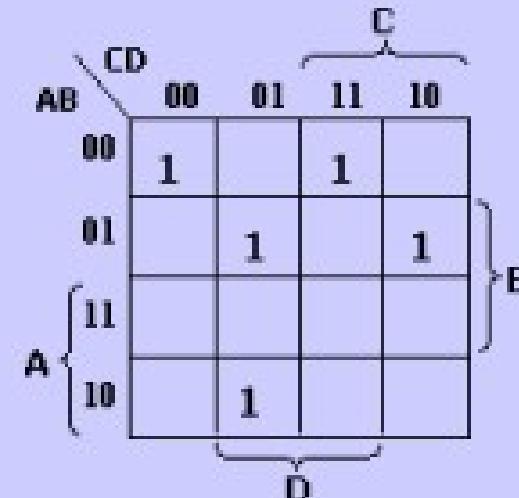
Don't Care Condition

- As a comparison
 - Without don't cares

$$P = A'B'C'D' + A'B'CD + A'BC'D \\ + A'BCD' + AB'C'D$$

- With don't cares

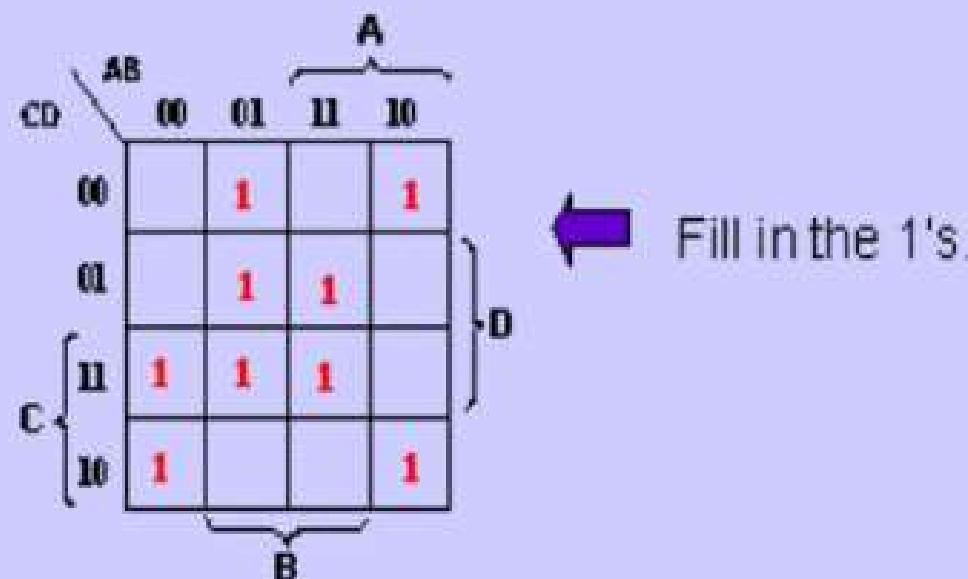
$$P = A'B'C'D' + B'CD + BC'D \\ + BCD' + AD$$



Simplification of SOP Expression

- Example 1

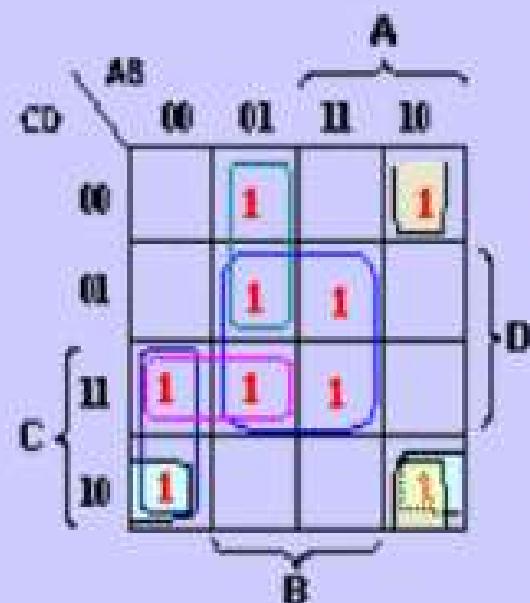
$$f(A,B,C,D) = \sum m(2,3,4,5,7,8,10,13,15)$$



Simplification of SOP Expression

- Example 1

$$f(A,B,C,D) = \sum m(2,3,4,5,7,8,10,13,15)$$

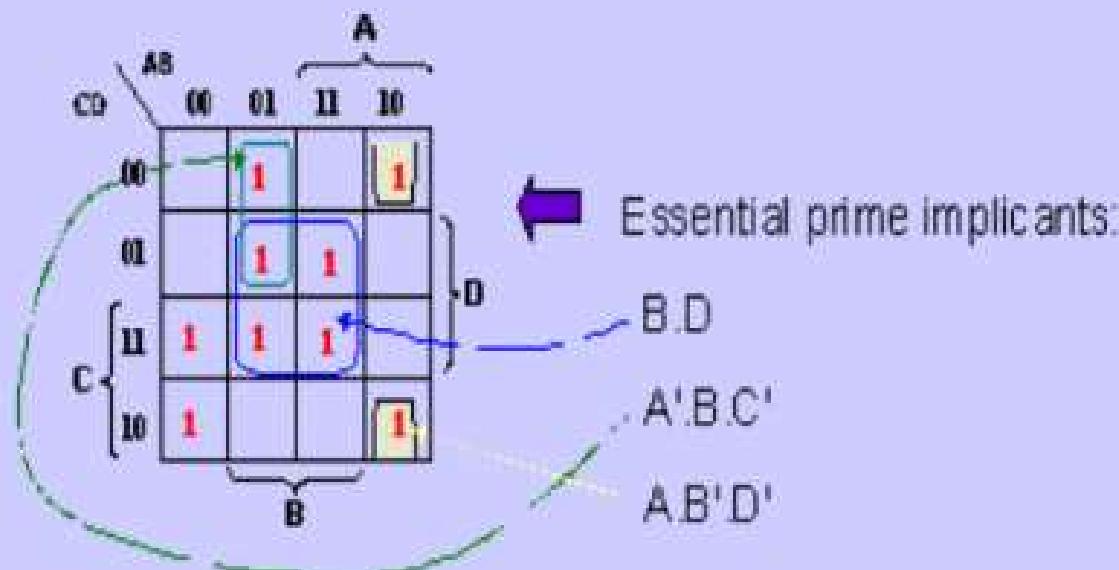


These are all the prime implicants; but do we need them all?

Simplification of SOP Expression

- Example 1

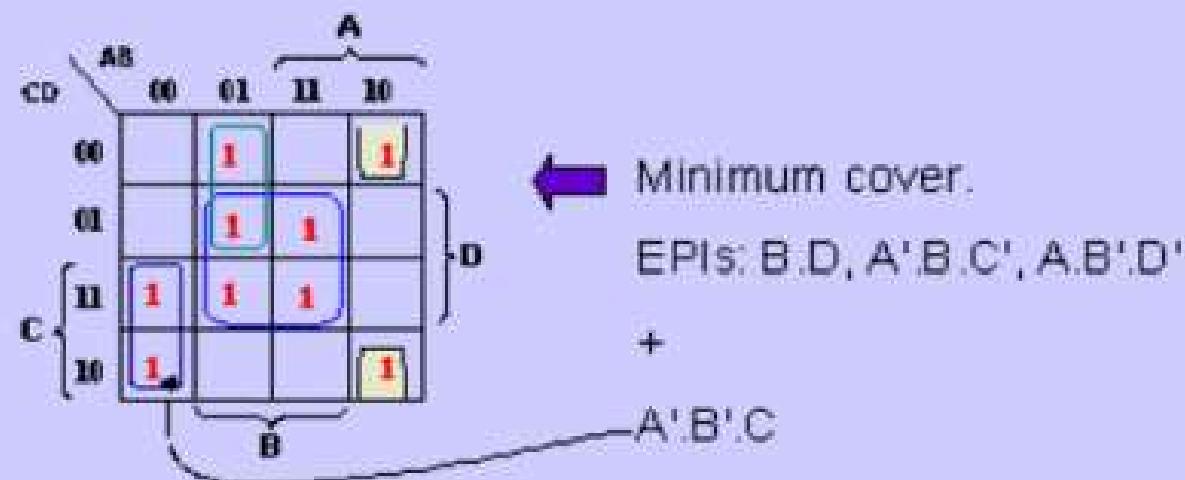
$$f(A,B,C,D) = \sum m(2,3,4,5,7,8,10,13,15)$$



Simplification of SOP Expression

- Example 1

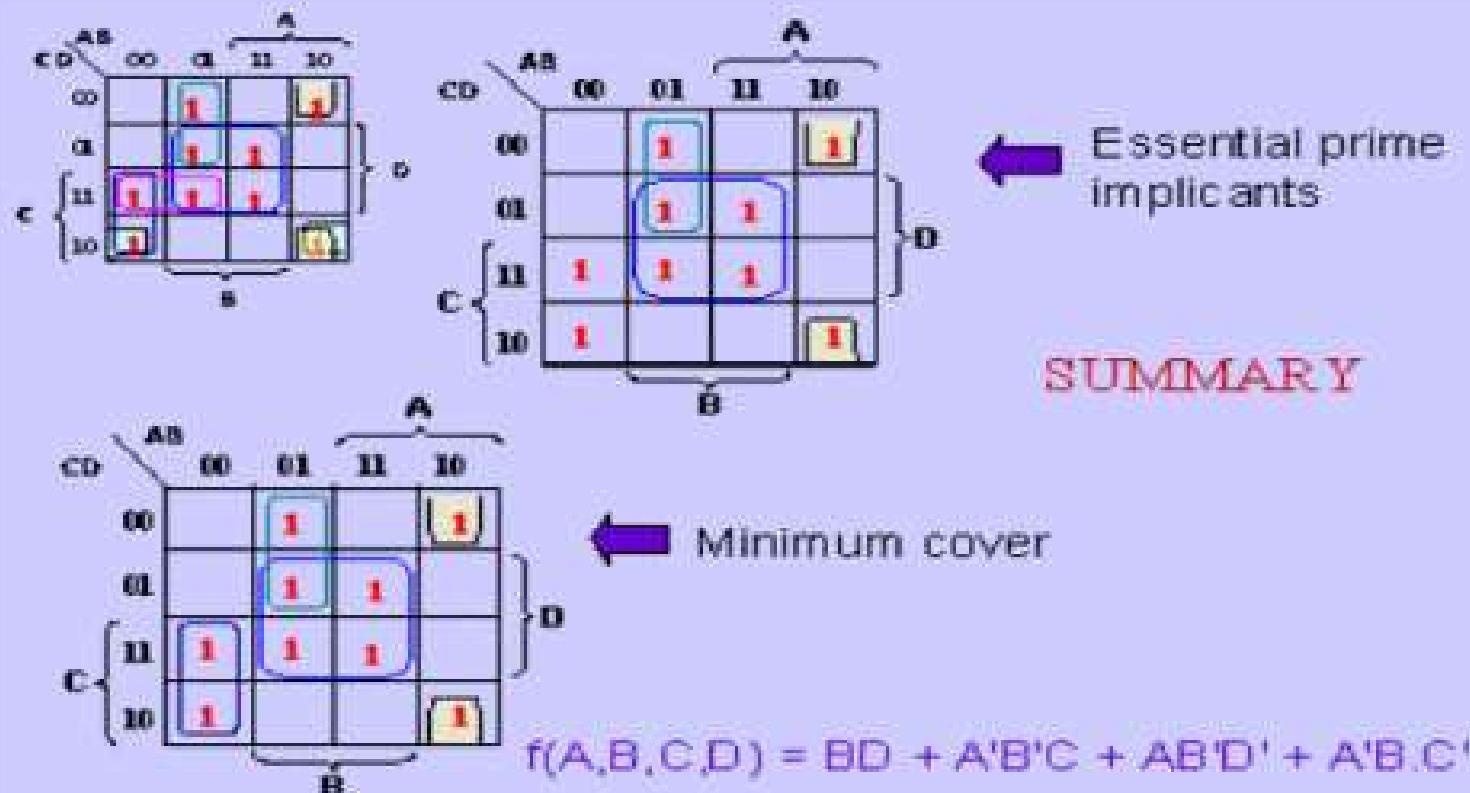
$$f(A,B,C,D) = \sum m(2,3,4,5,7,8,10,13,15)$$



$$f(A,B,C,D) = B'D + A'B'C' + A'B'D' + A'B'C$$

Simplification of SOP Expression

- Example 1



Simplification of SOP Expression

- Example 2

$$f(A,B,C,D) = A \cdot B \cdot C + B' \cdot C \cdot D' + A \cdot D + B' \cdot C' \cdot D'$$

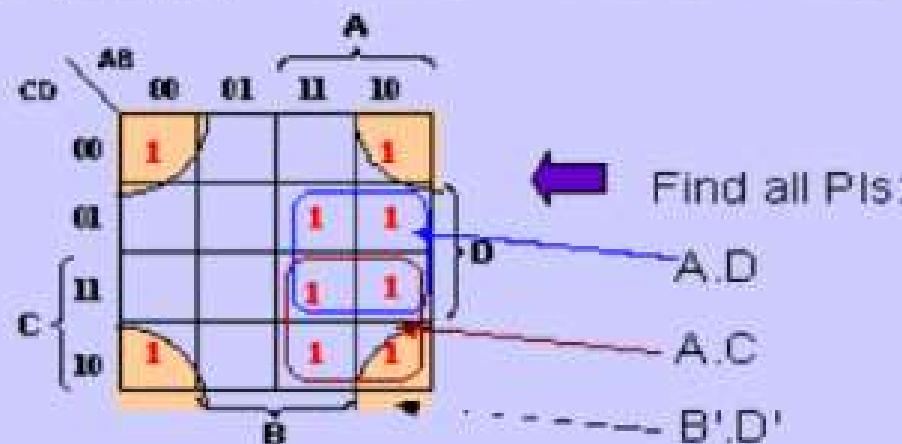
		A	
		00	01
CD	00	1	
	01		1
	11		1
	10	1	1
B		D	
C	00	01	11

Fill in the 1's.

Simplification of SOP Expression

- Example 2

$$f(A,B,C,D) = A \cdot B \cdot C + B' \cdot C \cdot D' + A \cdot D + B' \cdot C' \cdot D'$$

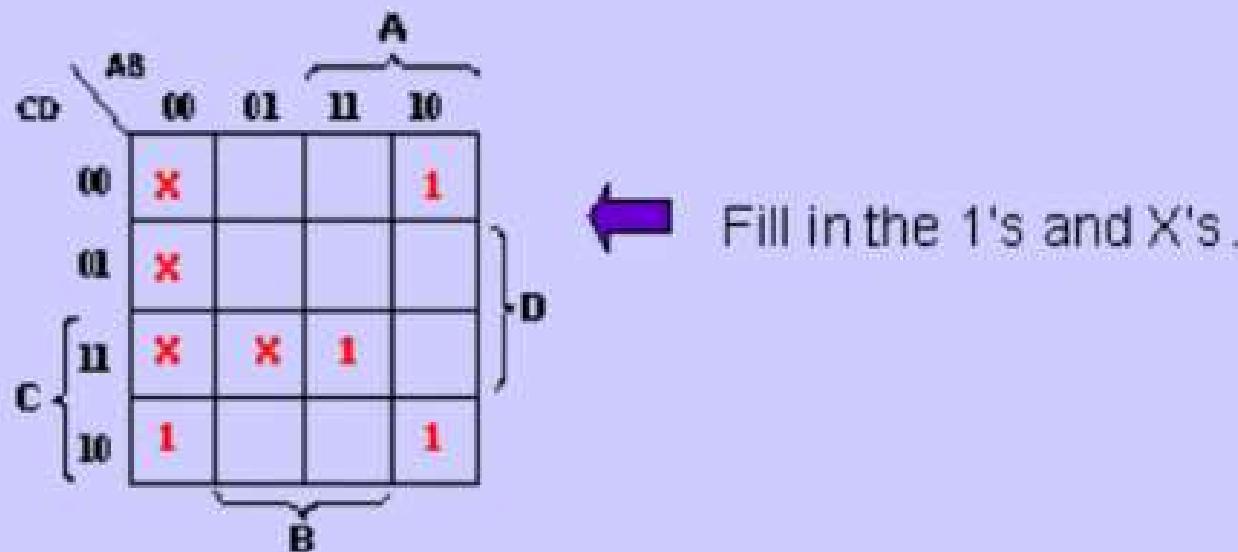


Are all '1's covered by the PIs? Yes, so the answer is: $f(A,B,C,D) = A \cdot D + A \cdot C + B' \cdot D'$

Simplification of SOP Expression

- Example 3

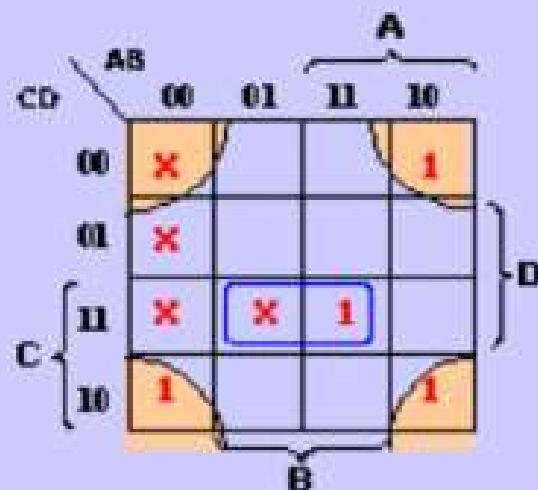
$$f(A,B,C,D) = \sum m(2,8,10,15) + \sum d(0,1,3,7)$$



Simplification of SOP Expression

- Example 3

$$f(A,B,C,D) = \sum m(2,8,10,15) + \sum d(0,1,3,7)$$



Do we need to have an additional term $A'B'$ to cover the 2 remaining x's?

No, because all the 1's (minterms) have been covered.

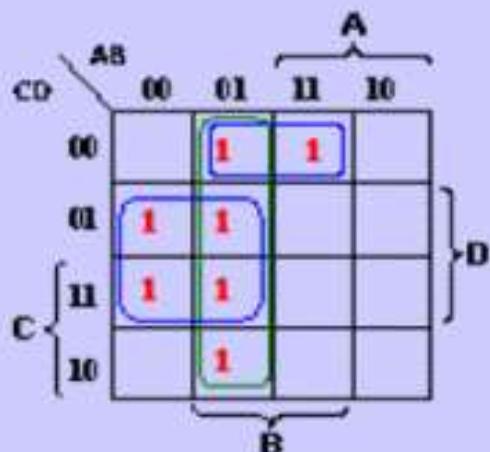
$$f(A,B,C,D) = B'D' + B.C.D$$

Simplification of POS Expression

- To obtain POS expression for example 2

$$f(A,B,C,D) = A \cdot B \cdot C + B' \cdot C \cdot D' + A \cdot D + B' \cdot C' \cdot D'$$

- Draw K-map for f complement which is f'



From K-map,

$$f' = A' \cdot B + A' \cdot D + B \cdot C' \cdot D'$$

Using DeMorgan's theorem,

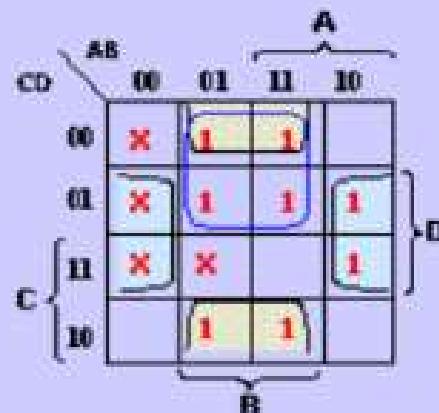
$$f = (A' \cdot B + A' \cdot D + B \cdot C' \cdot D')'$$

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

Simplification of POS Expression

- To obtain POS expression for example 3
 $f(A,B,C,D) = \sum m(2,8,10,15) + \sum d(0,1,3,7)$
- Draw K-map for f complement which is f'

$$f'(A,B,C,D) = \sum m(4,5,6,9,11,12,13,14) + \sum d(0,1,3,7)$$



From K-map,

$$f' = B.C' + B.D' + B'.D$$

Using DeMorgan's theorem,

$$\begin{aligned}f &= (B.C' + B.D' + B'.D)' \\&= (B'+C).(B'+D).(B+D')\end{aligned}$$