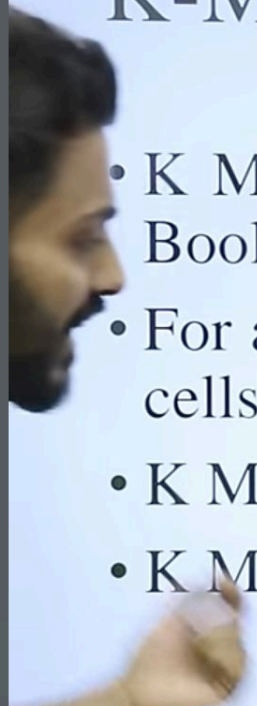
# K-Map (Karnaugh Map)

- K Map is a graphical representation used for simplifying the Boolean expressions.
- For a Boolean expression consisting of n-variables, number of cells required in K Map = $2^n$ cells.
- K Map is based on Grey code(Unit distance code).
- K Map is based on three types of Input values(0, 1, don't care)



View key concept

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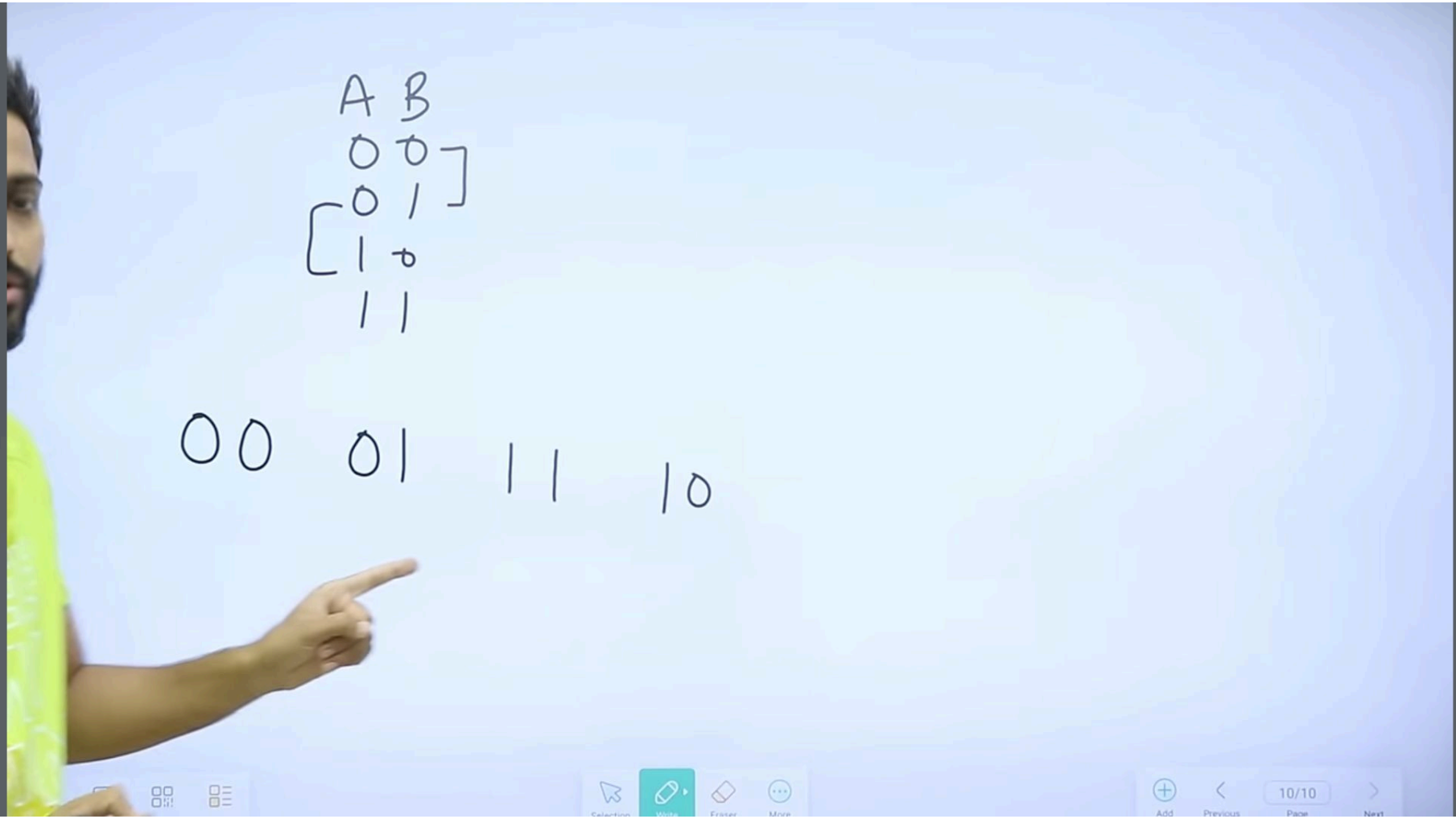
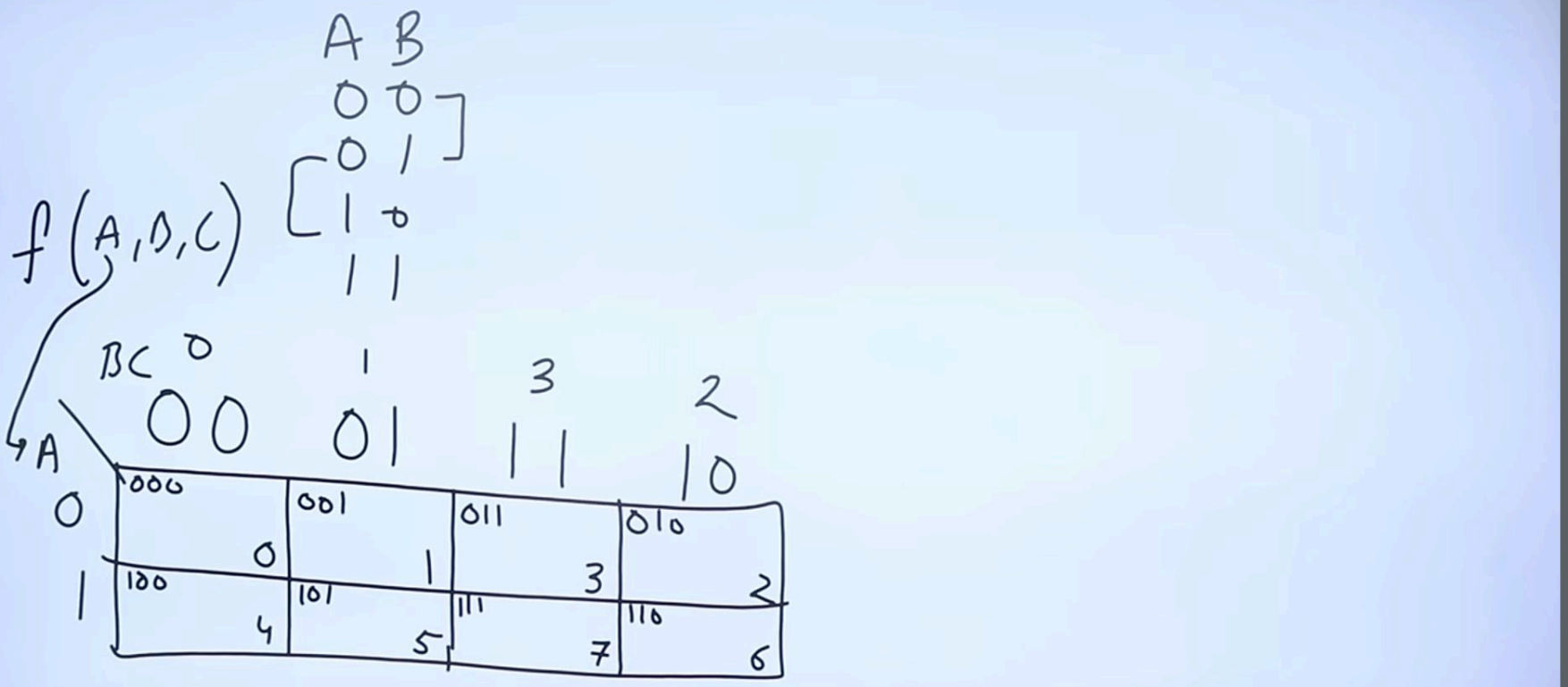

A B
0 0 ]
0 1
[ 1 0
1 1
00 01 11 10
SUBSCRIBE
10/10


A B
0 0
0 1
1 0
1 1
f(A,B,C)
BC 0 1 3 2
00 01 11 10
A
0
1
000 0
001 1
011 3
010 2
100 4
101 5
111 7
110 6

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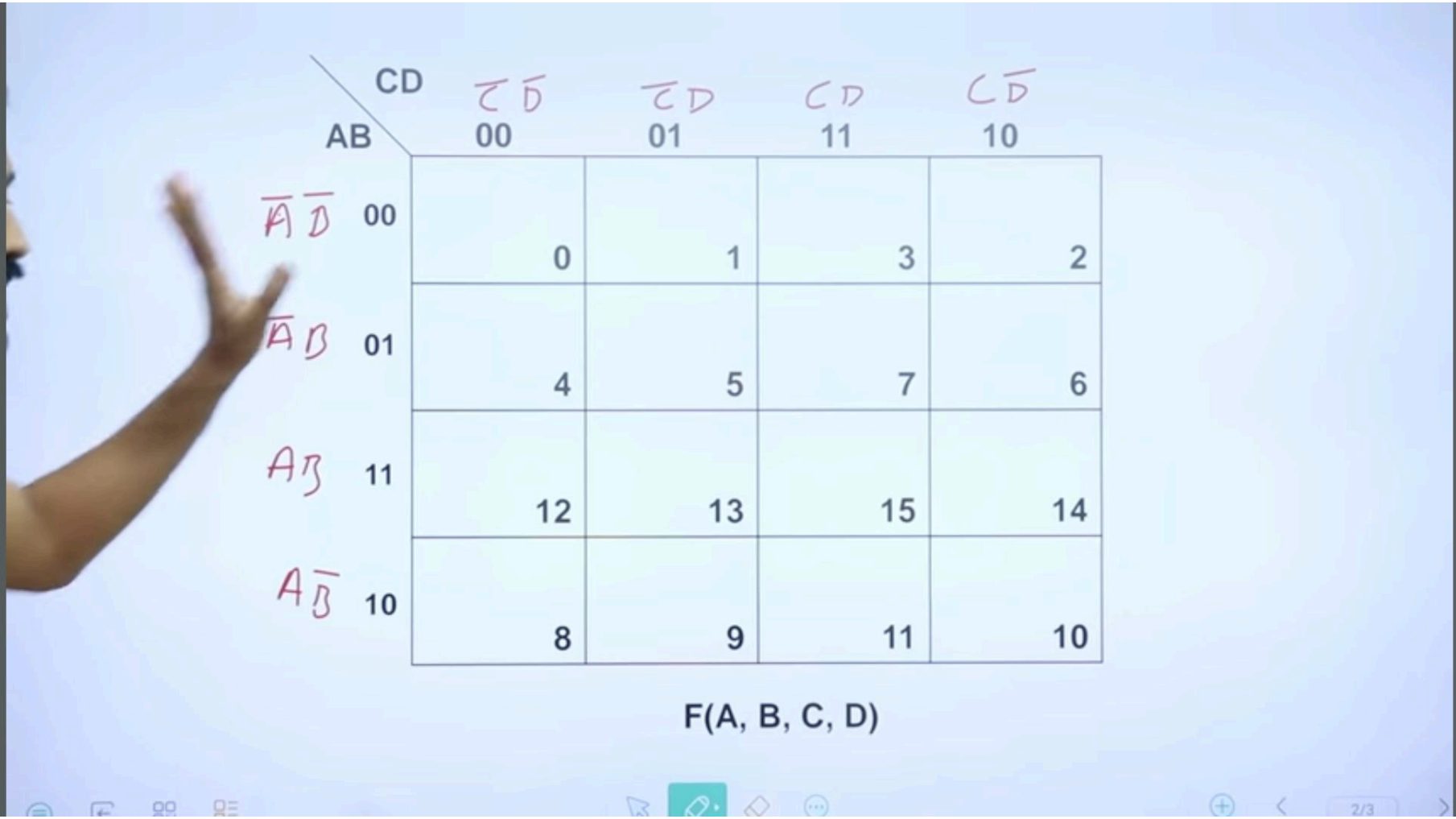
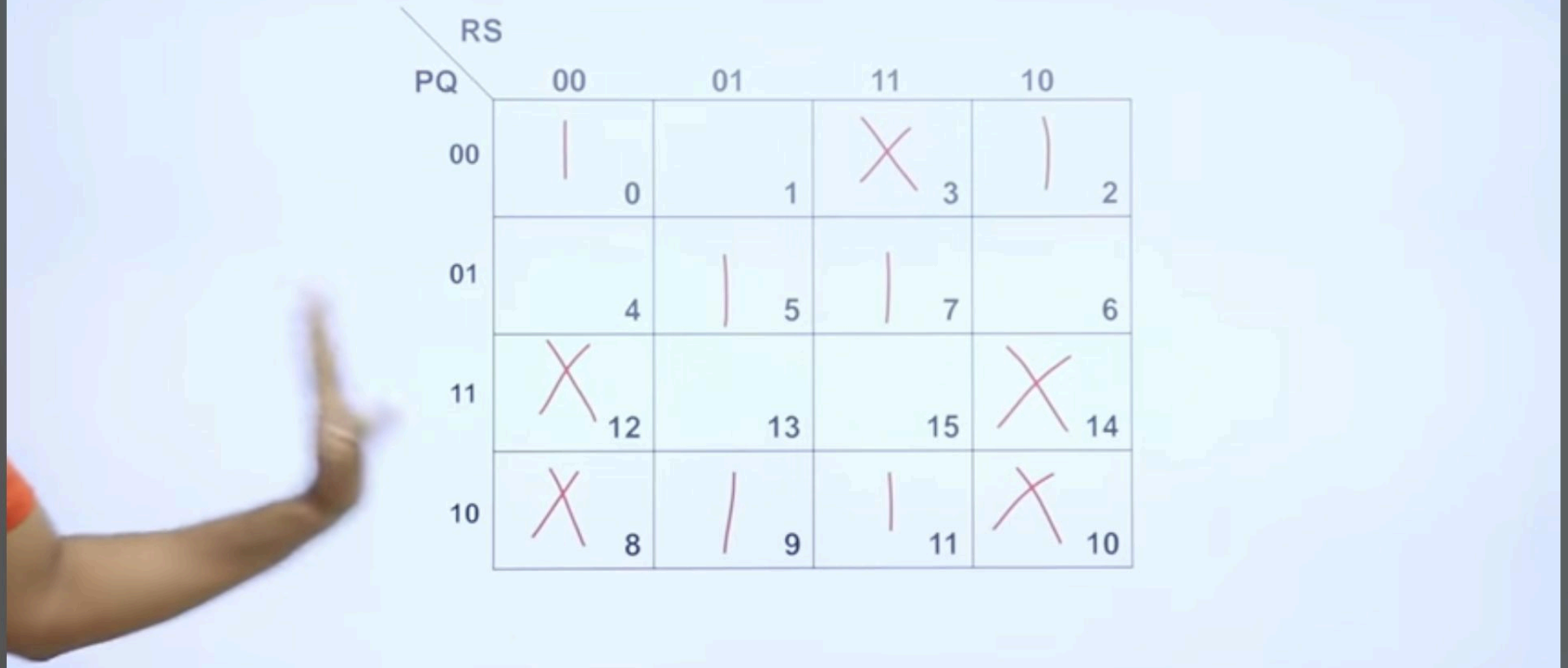

CD
AB
$\bar{C}\bar{D}$
$\bar{C}D$
$CD$
$C\bar{D}$
00
01
11
10
$\bar{A}\bar{B}$
$\bar{A}B$
$AB$
$A\bar{B}$
0 1 3 2
4 5 7 6
12 13 15 14
8 9 11 10
F(A, B, C, D)

$$F(P, Q, R, S) = \Sigma m(0, 2, 5, 7, 9, 11) + d(3, 8, 10, 12, 14)$$

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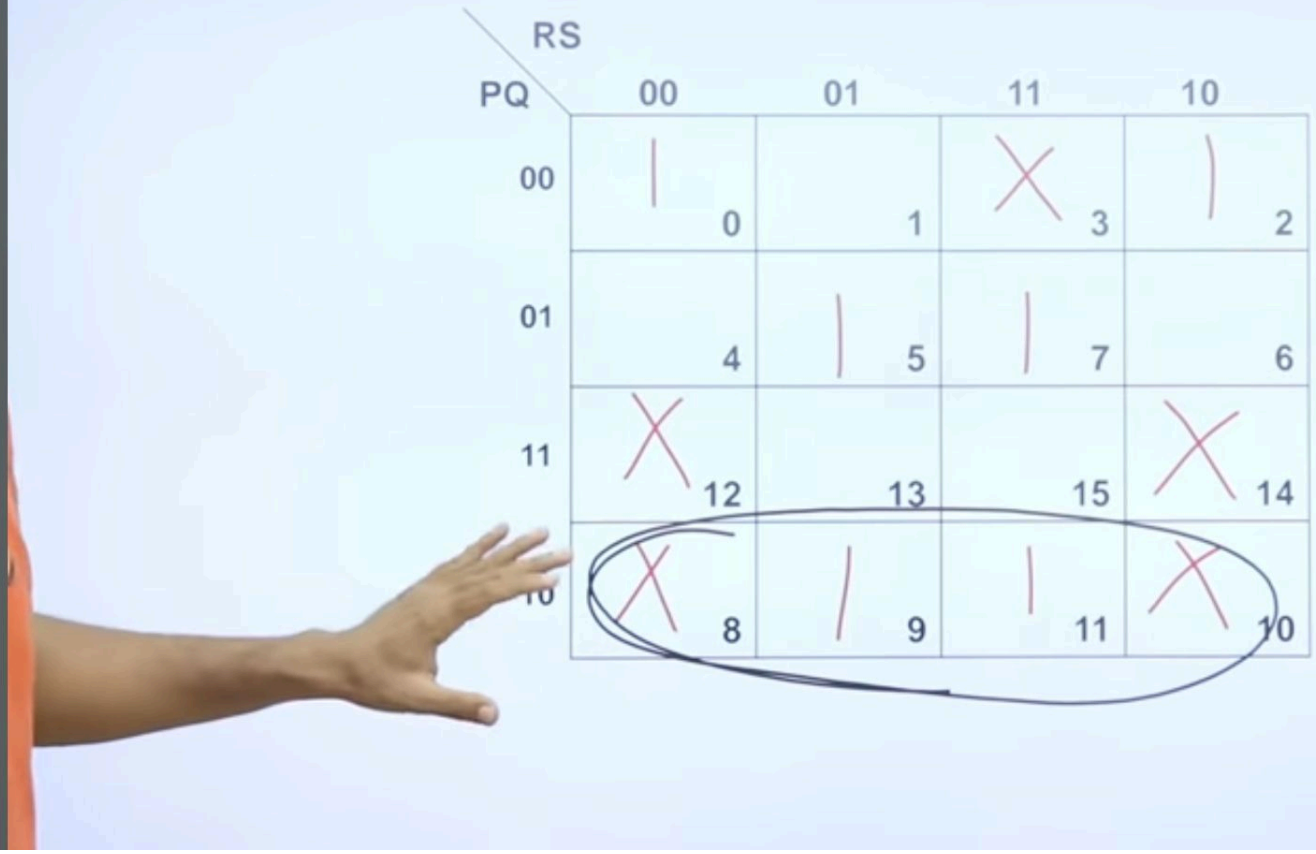
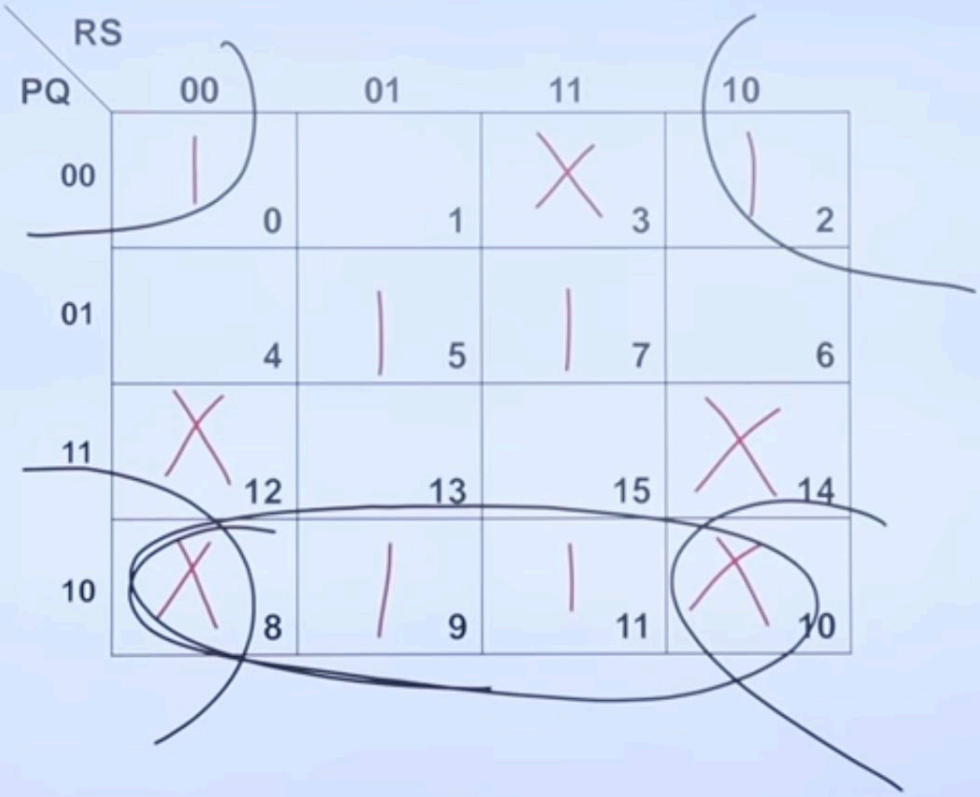
$$F(P, Q, R, S) = \Sigma m(0, 2, 5, 7, 9, 11) + d(3, 8, 10, 12, 14)$$



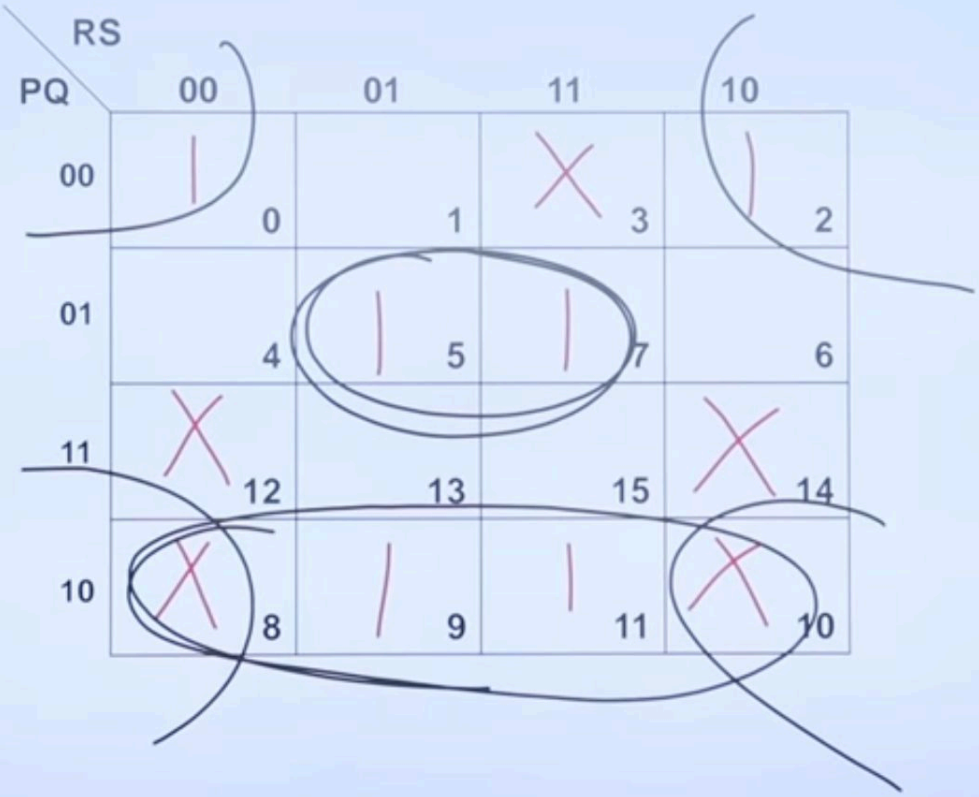

SUBSCRIBE

$$F(P, Q, R, S) = \Sigma m(0, 2, 5, 7, 9, 11) + d(3, 8, 10, 12, 14)$$



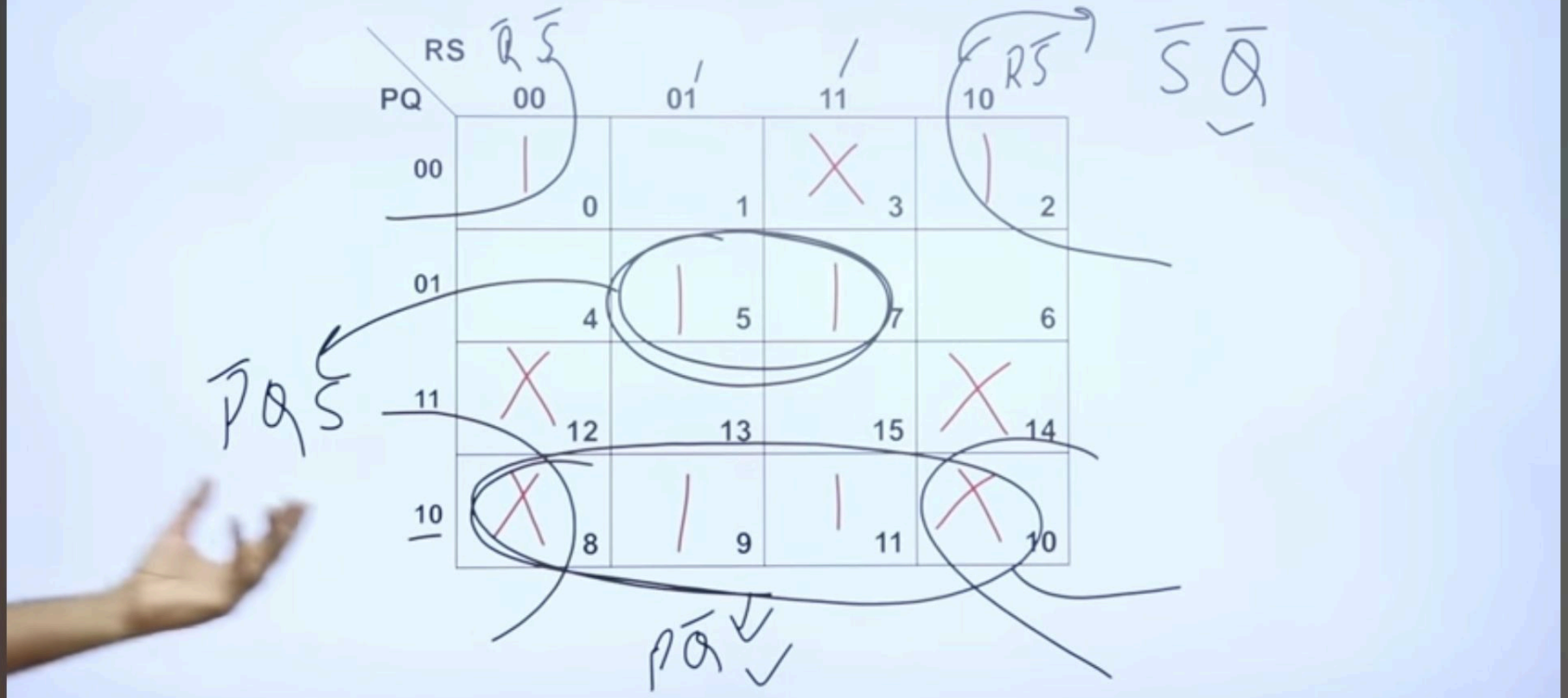

SUBSCRIBE

$$F(P, Q, R, S) = \Sigma m(0, 2, 5, 7, 9, 11) + d(3, 8, 10, 12, 14)$$




SUBSCRIBE

$$F(P, Q, R, S) = \Sigma m(0, 2, 5, 7, 9, 11) + d(3, 8, 10, 12, 14)$$



Two possibilities

Minterms , Maxterms will be given in question

$\Sigma m(1,2,3,5,6,7,10)$

$\pi M(1,2,4,5)$

Boolean Expression will be given in question

$F(A,B,C,D) = A\bar{B} + AB\bar{C} + C\bar{D}$

Title

**Q1.** Simplify boolean function using K-map in SOP and POS forms and implement with gates.

$$f(A,B,C) = \Sigma m(0,2,3,4,5,6)$$

Note → $\Sigma m(\ )$ Minterms → SOP → when $F = 1$

So put '1' in kMap

$\Pi M$ → Maxterms → POS → When $F = 0$

and implement with gates.

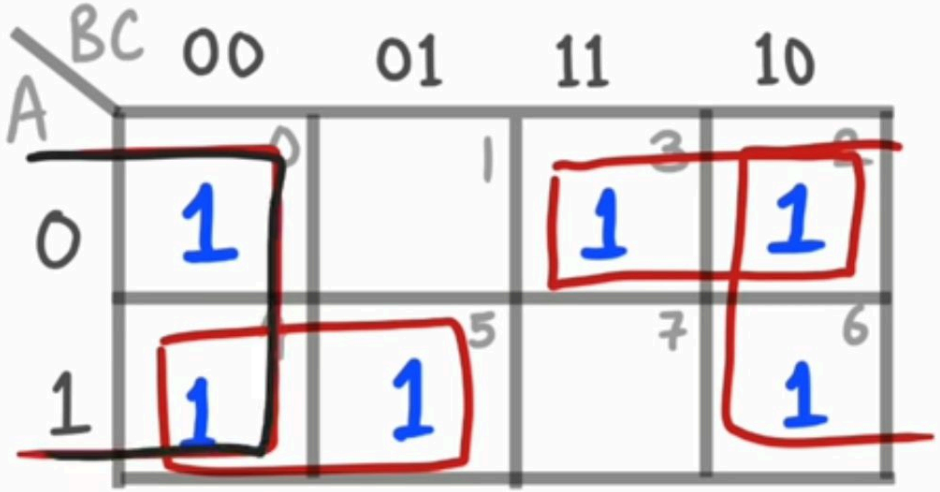
$$f(A,B,C) = \Sigma m(0,2,3,4,5,6)$$

Note → $\Sigma m( )$ Minterms → SOP → when $F = 1$

So put '1' in kMap

$\pi M$ → Maxterms → POS → When $F = 0$

So put '0' in kMap




$$\Sigma m(0,2,3,4,5,6)$$

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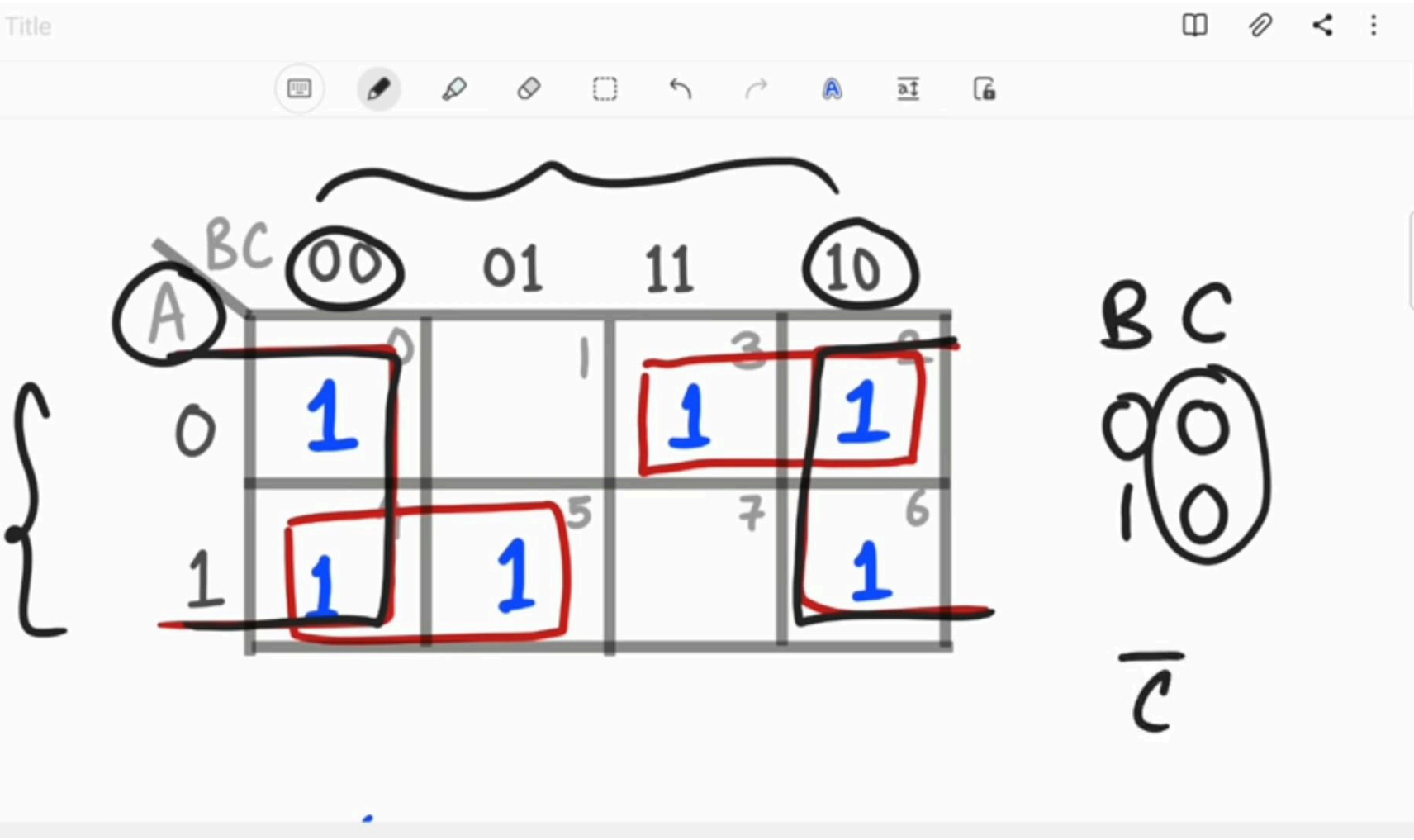
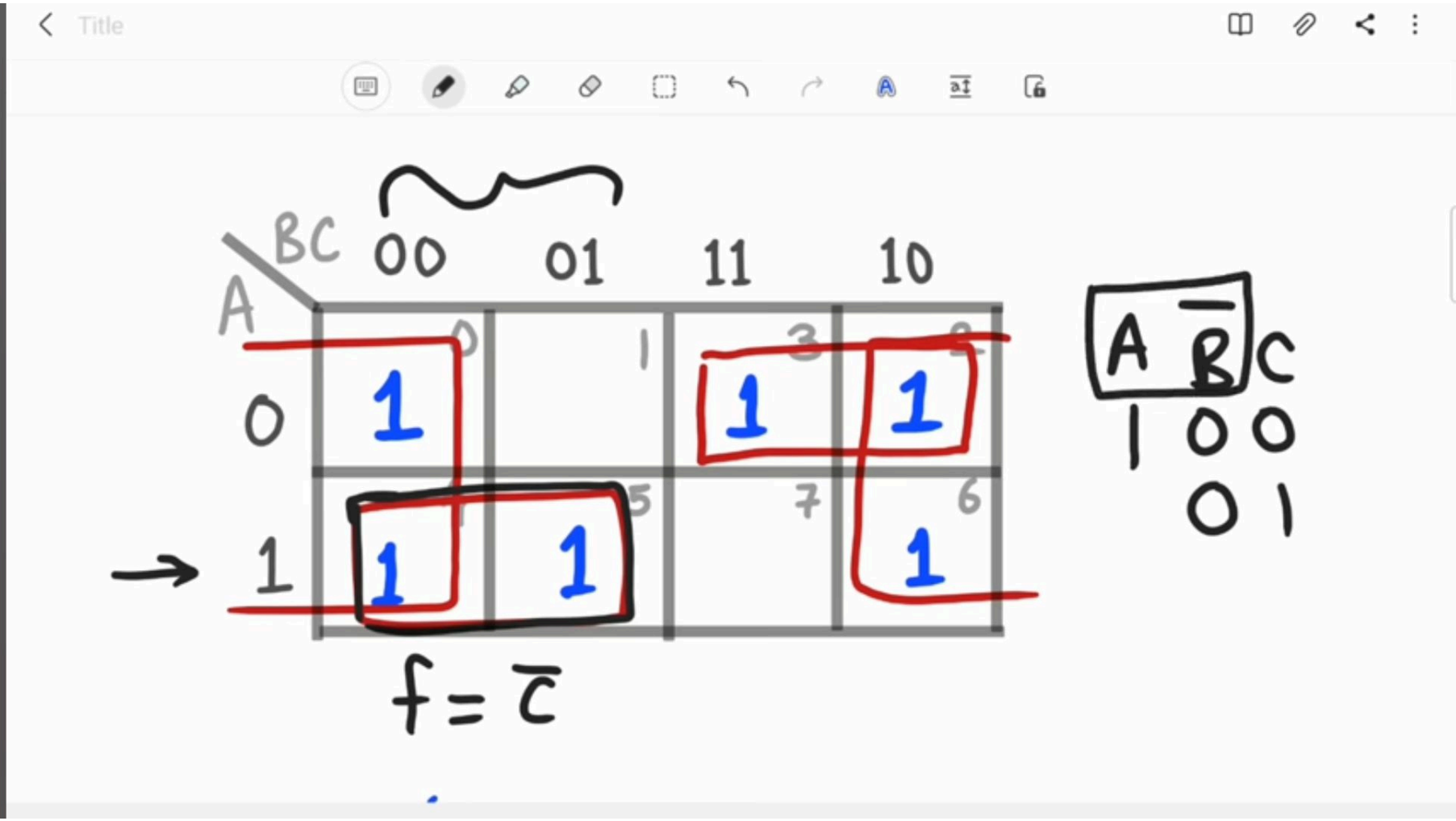
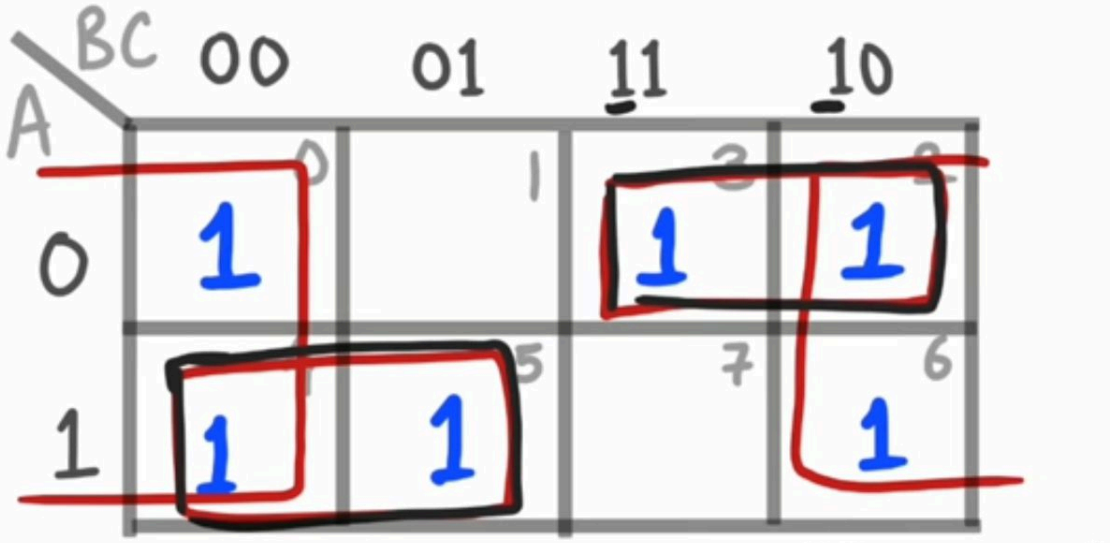

Title
BC
00
01
11
10
A
0
1
3
2
0
1
1
1
1
4
5
7
6
1
1
1
1
B C
0
0
1
0
$\overline{C}$


Title
BC
A
00
01
11
10
0
1
0
1
3
2
5
7
6
1
1
1
1
1
1
1
A $\bar{B}$ C
1 0 0
0 1
f = $\bar{C}$

Title

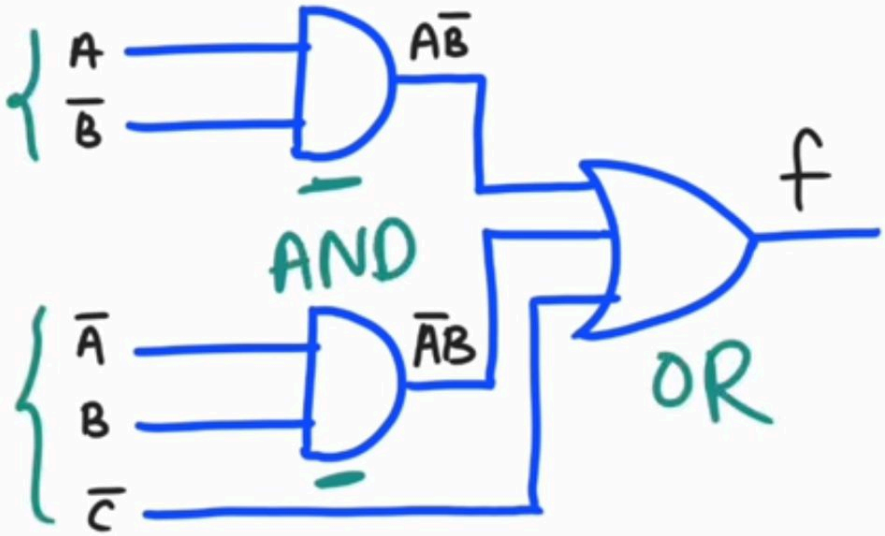



$$f = \bar{C} + A\bar{B} + \bar{A}B$$ ✓

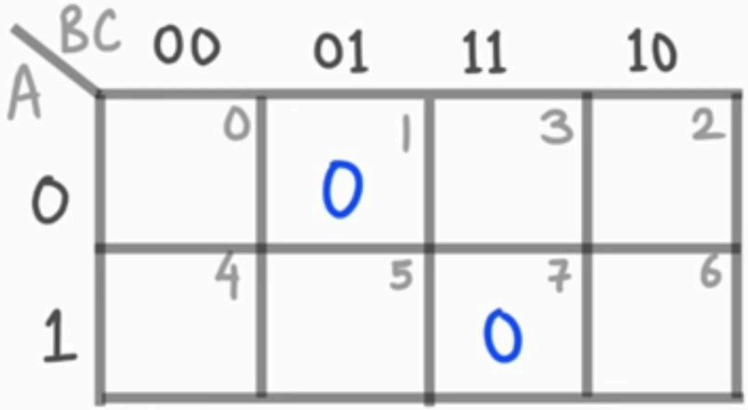
Title

SOP

$$f = \bar{C} + A\bar{B} + \bar{A}B$$



Title




$\pi M(1,7)$

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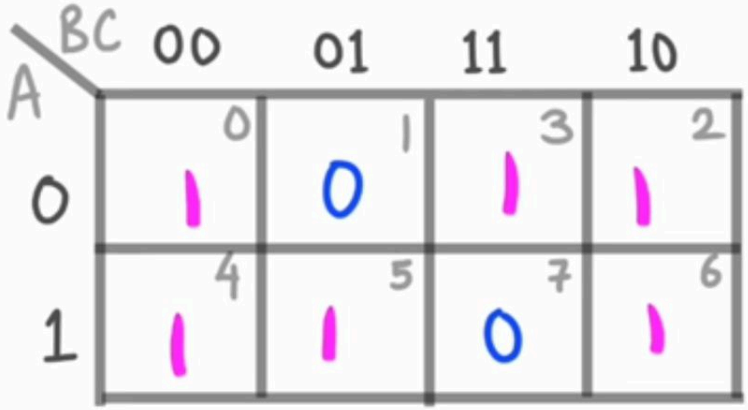
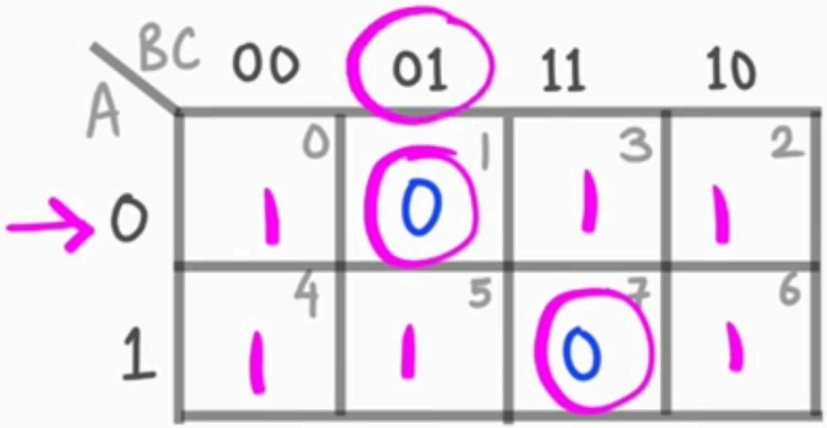
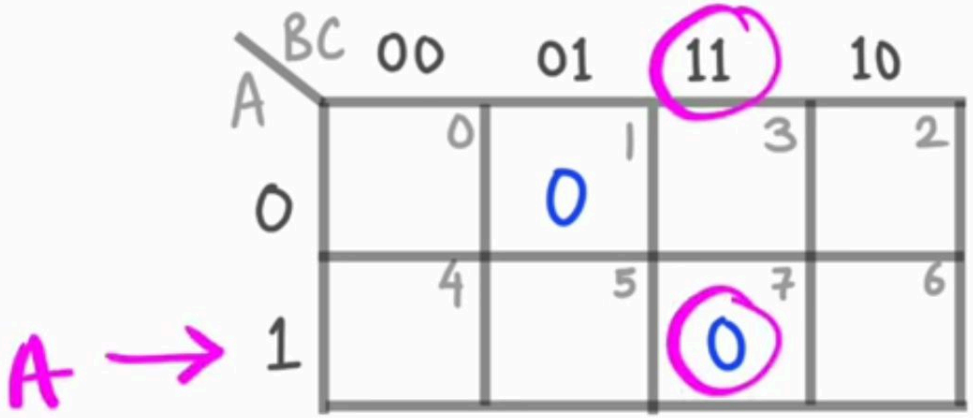



$\pi M(1,7)$




$\pi M(1,7)$

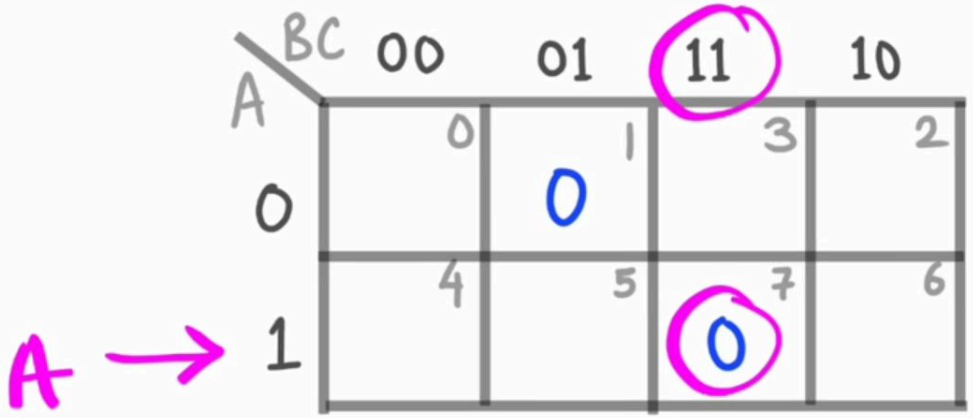
$f = \bar{A}\bar{B}C + ABC$ ..... SOP




$\pi M(1,7)$

$f = \bar{A}\bar{B}C + A\underline{BC}$ ..... SOP

ELECTRONICS SUBJECTIFIED




$\pi M(1,7)$

✓ $f = \bar{A}\bar{B}C + A\bar{B}C$ ..... SOP

Note → for POS

1 → $\bar{A}$

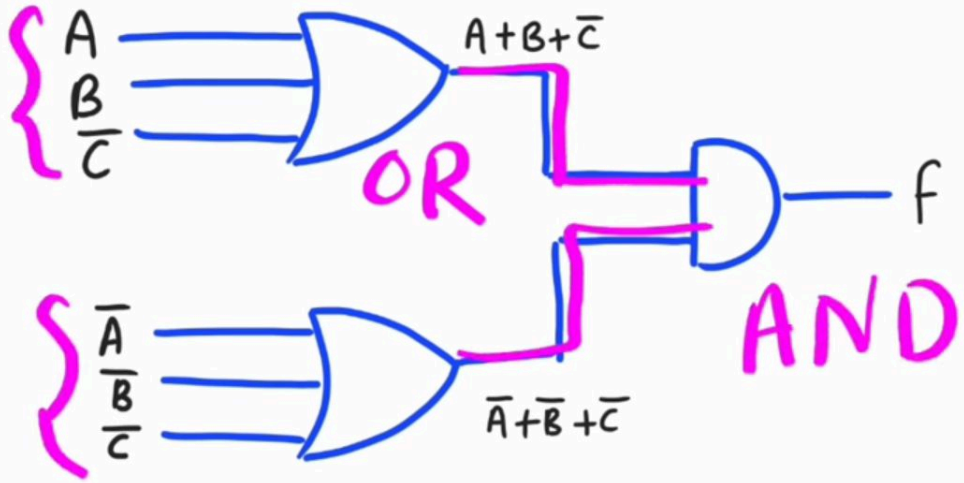
0 → A

$f = (A+B+\bar{C}) \cdot (\bar{A}+\bar{B}+\bar{C})$ ..... POS

ELECTRONICS SUBJECTIFIED

Title

$f = (A+B+\bar{C}) \cdot (\bar{A}+\bar{B}+\bar{C})$ ..... POS

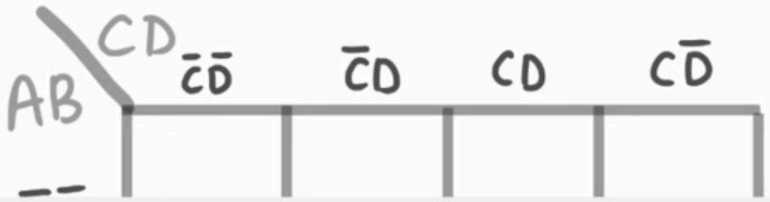


Title

**Q2.** Simplify the following expression

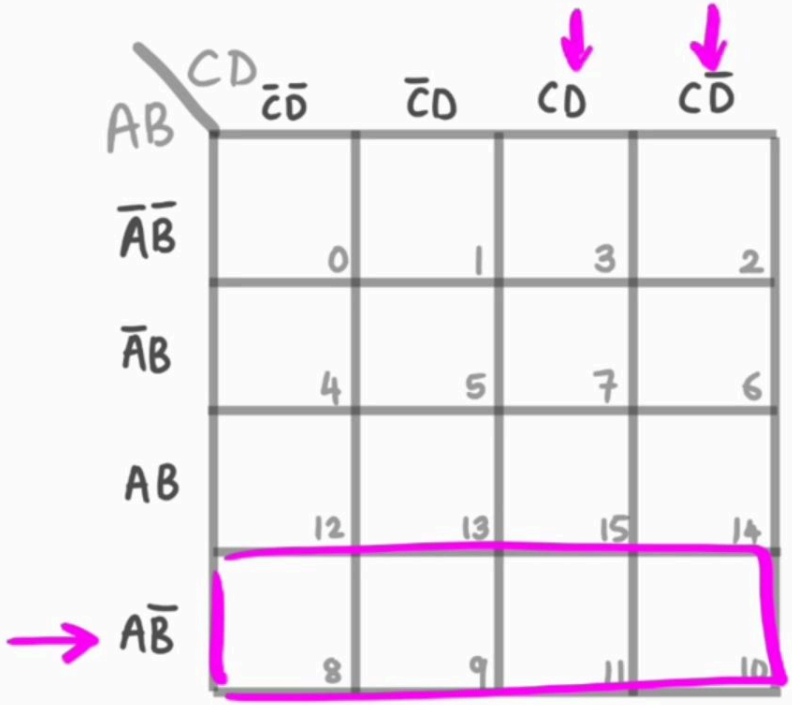
1. SOP ✓
2. POS ✓

$$f(A,B,C,D) = A\bar{B}C + \bar{A}BC\bar{D} + AB\bar{C}D + ABC$$



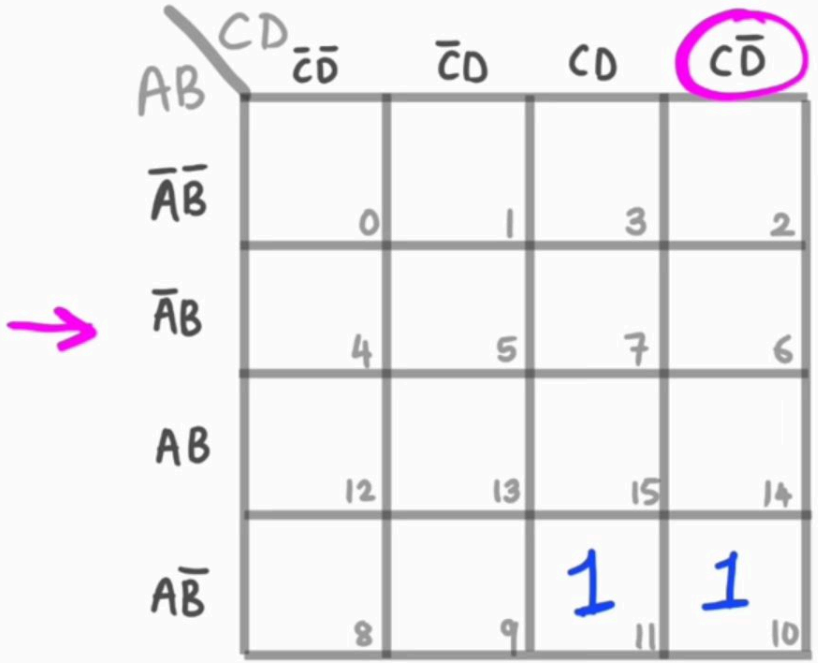
Title

$f(A,B,C,D) = A\bar{B}\bar{C} + \bar{A}BC\bar{D} + AB\bar{C}D + ABC$



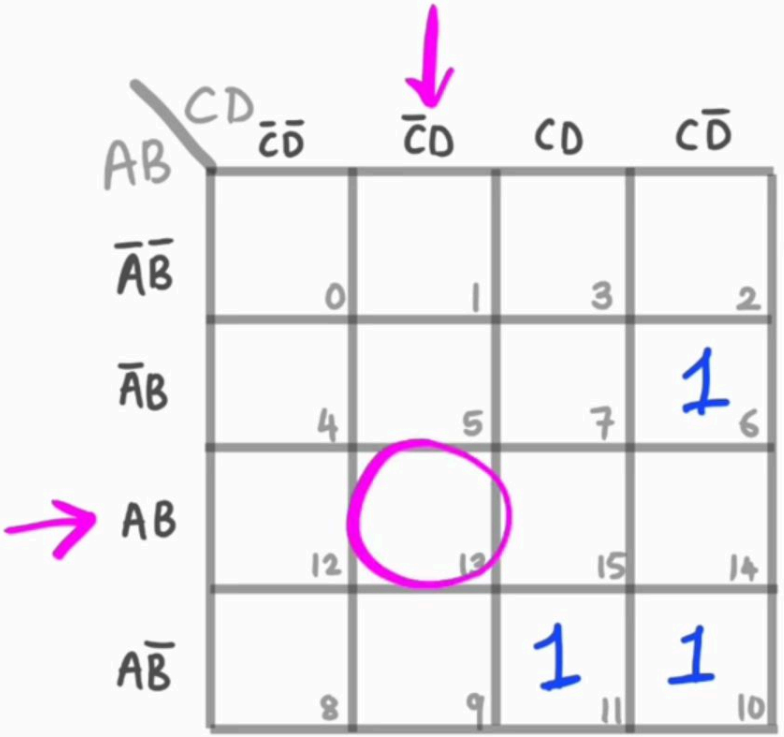
Title

$$f(A,B,C,D) = A\bar{B}C + \bar{A}BC\bar{D} + AB\bar{C}D + ABC$$



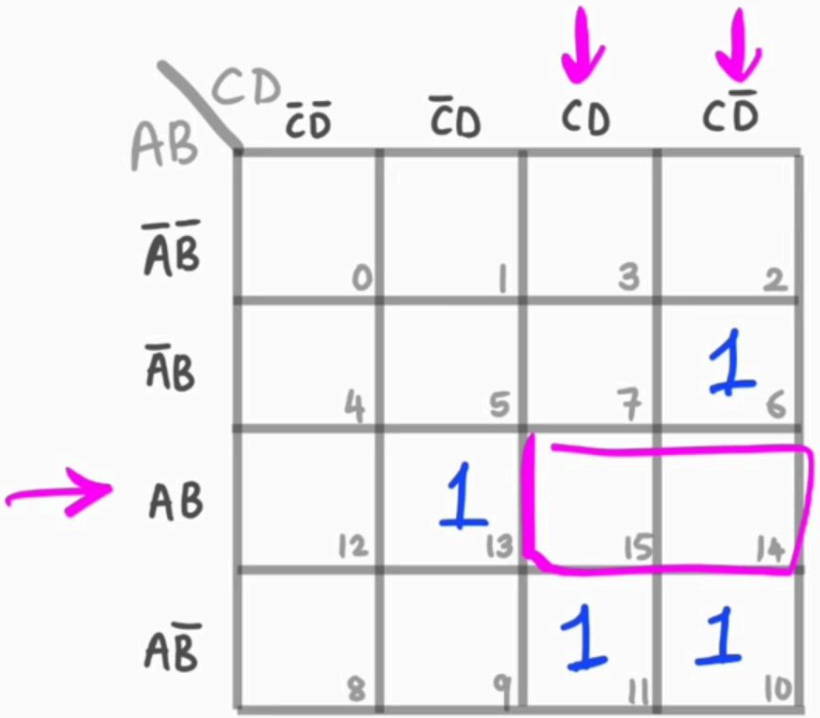
Title

$f(A,B,C,D) = A\bar{B}C + \bar{A}BC\bar{D} + AB\bar{C}D + ABC$



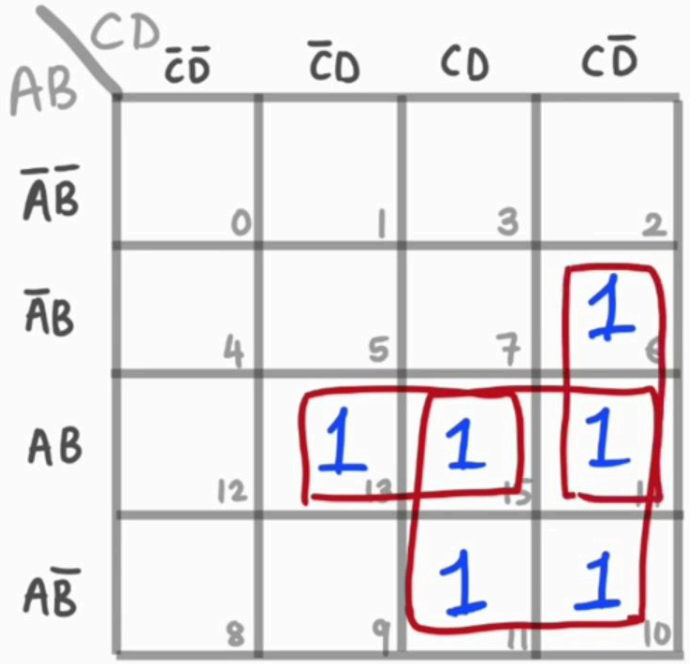
Title

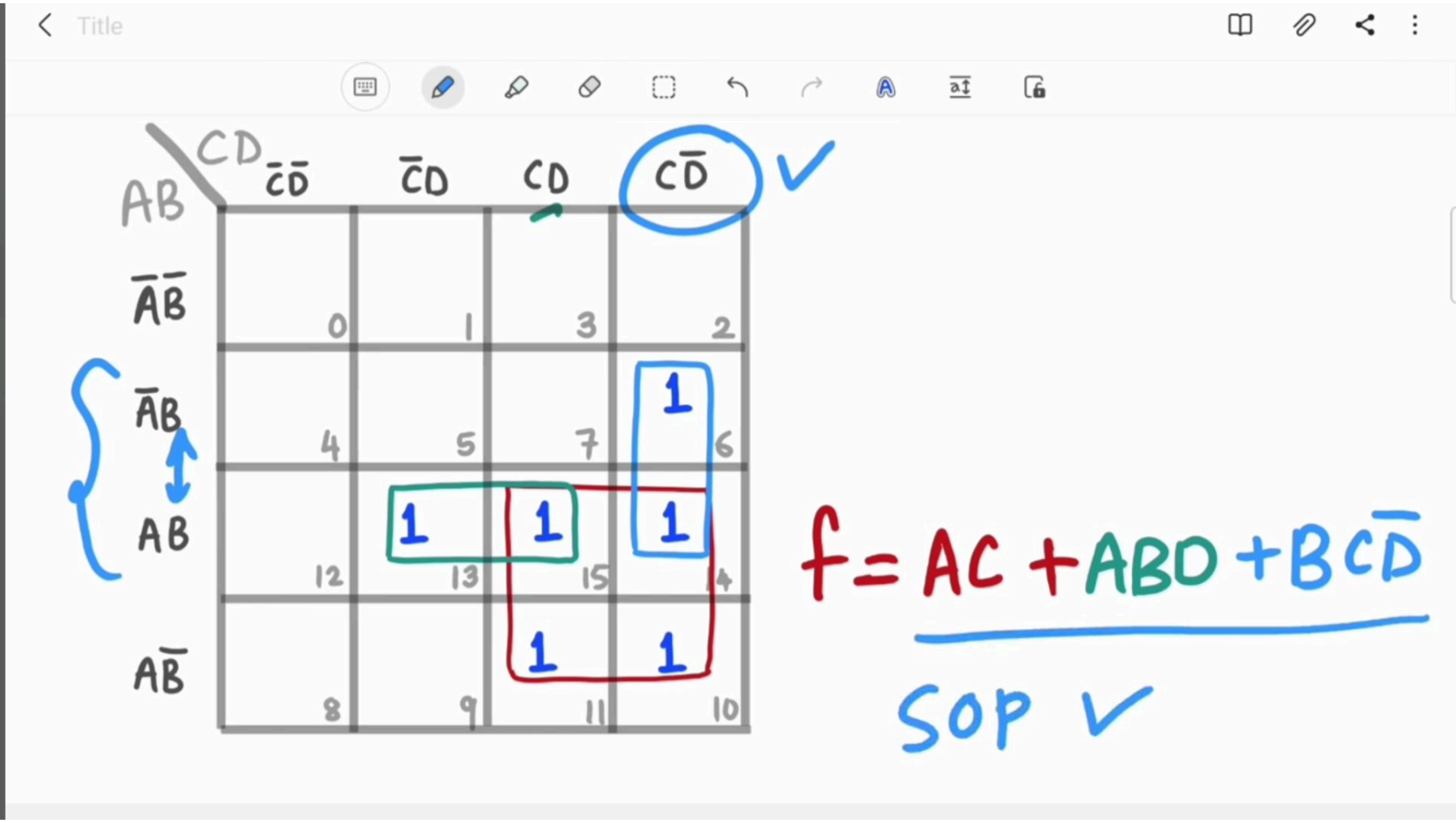
$$f(A,B,C,D) = A\bar{B}C + \bar{A}BC\bar{D} + AB\bar{C}D + ABC$$

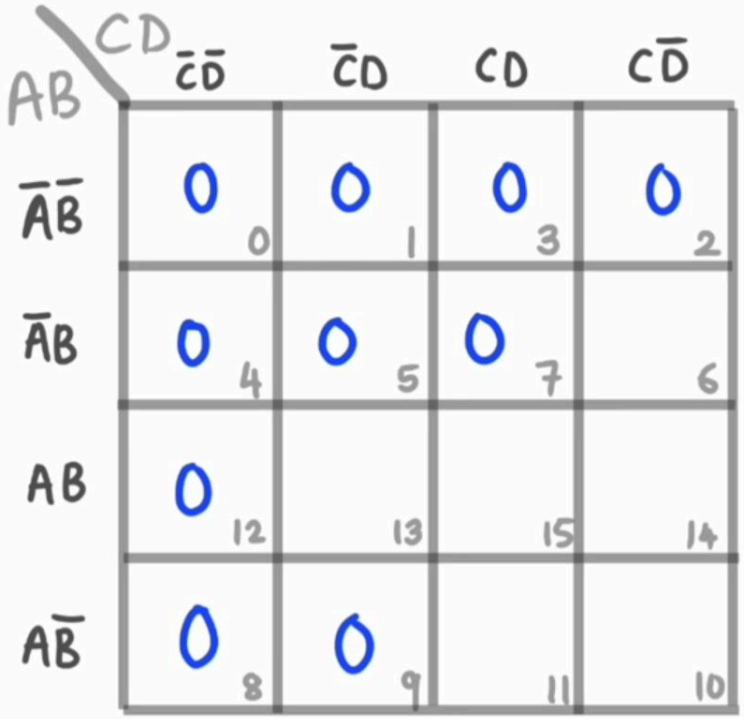


Title

$$f(A,B,C,D) = A\bar{B}C + \bar{A}BC\bar{D} + AB\bar{C}D + ABC$$




Title
CD
AB
$\bar{C}\bar{D}$
$\bar{C}D$
CD
$C\bar{D}$
$\bar{A}\bar{B}$
$\bar{A}B$
AB
$A\bar{B}$
0
1
3
2
4
5
7
6
12
13
15
14
8
9
11
10
1
$f = AC + ABD + B\bar{C}\bar{D}$
SOP

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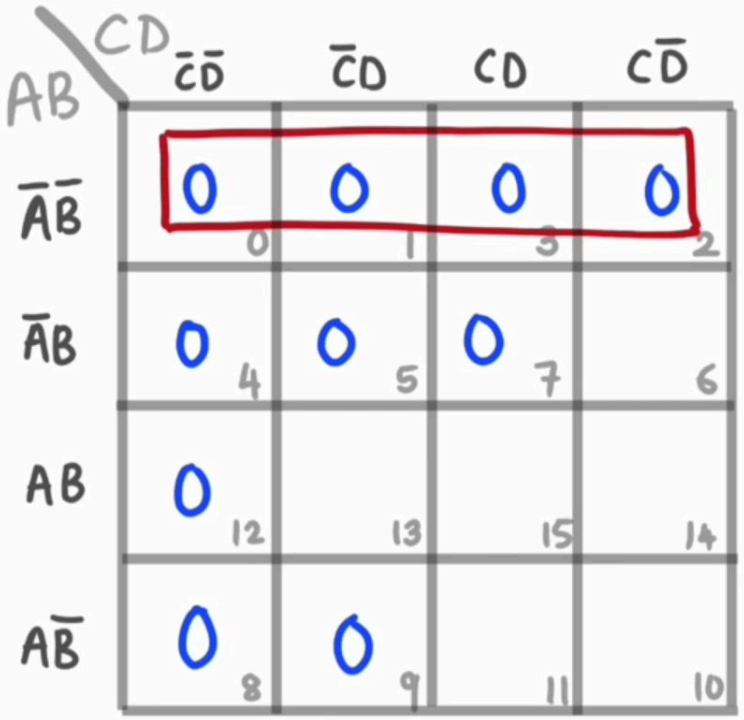


$\bar{A}\bar{B} \rightarrow A+B$

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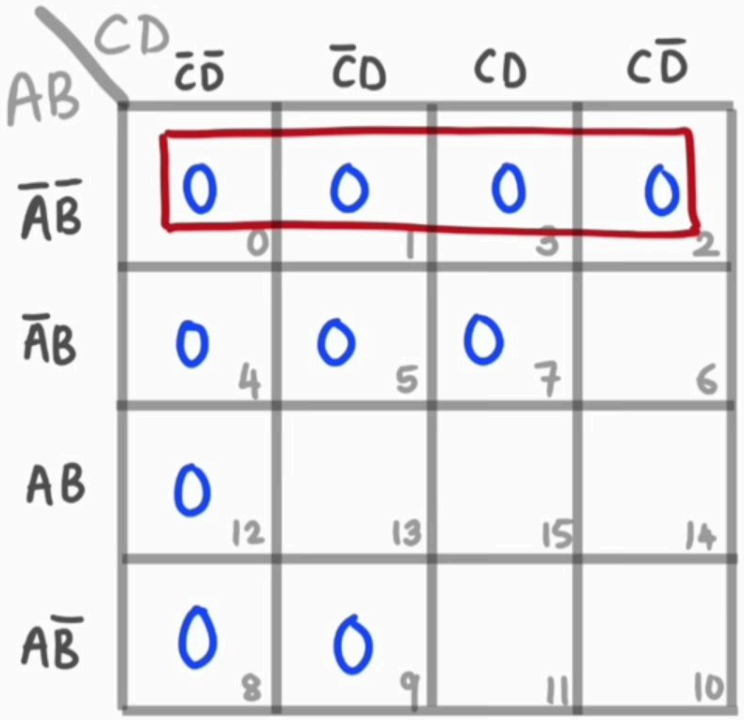


SOP

$\bar{A}\bar{B}$ → $A+B$

POS

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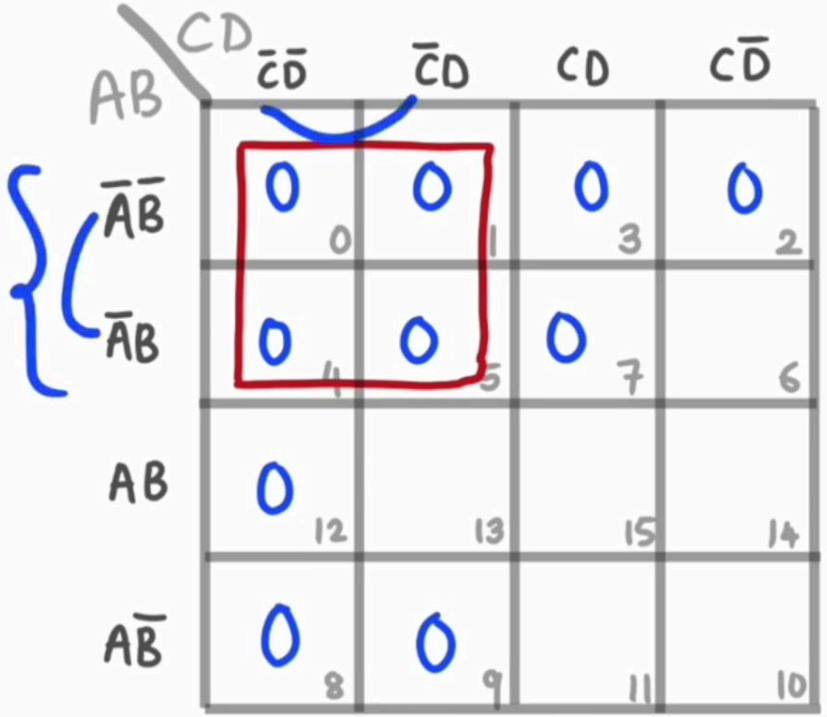
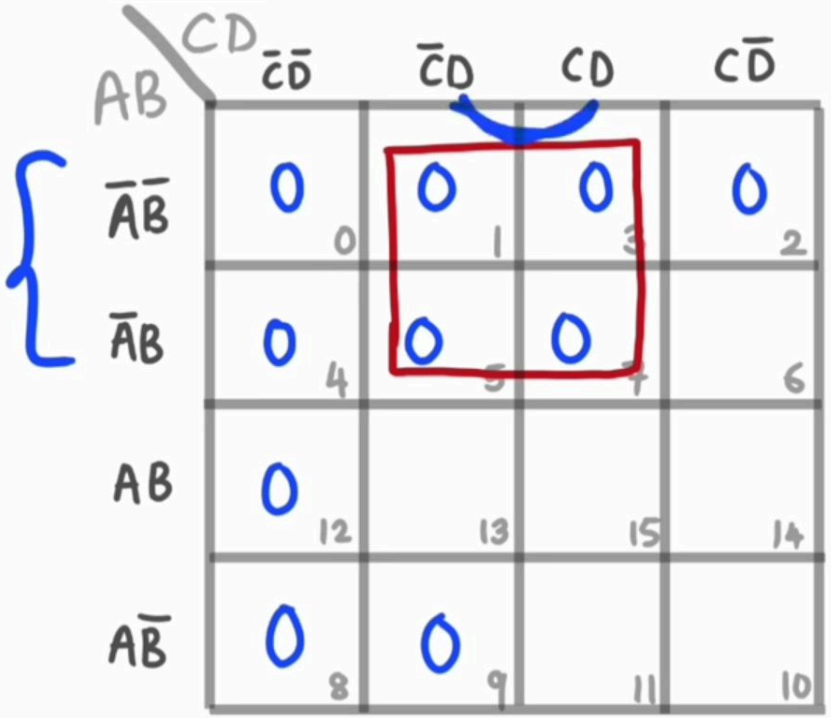
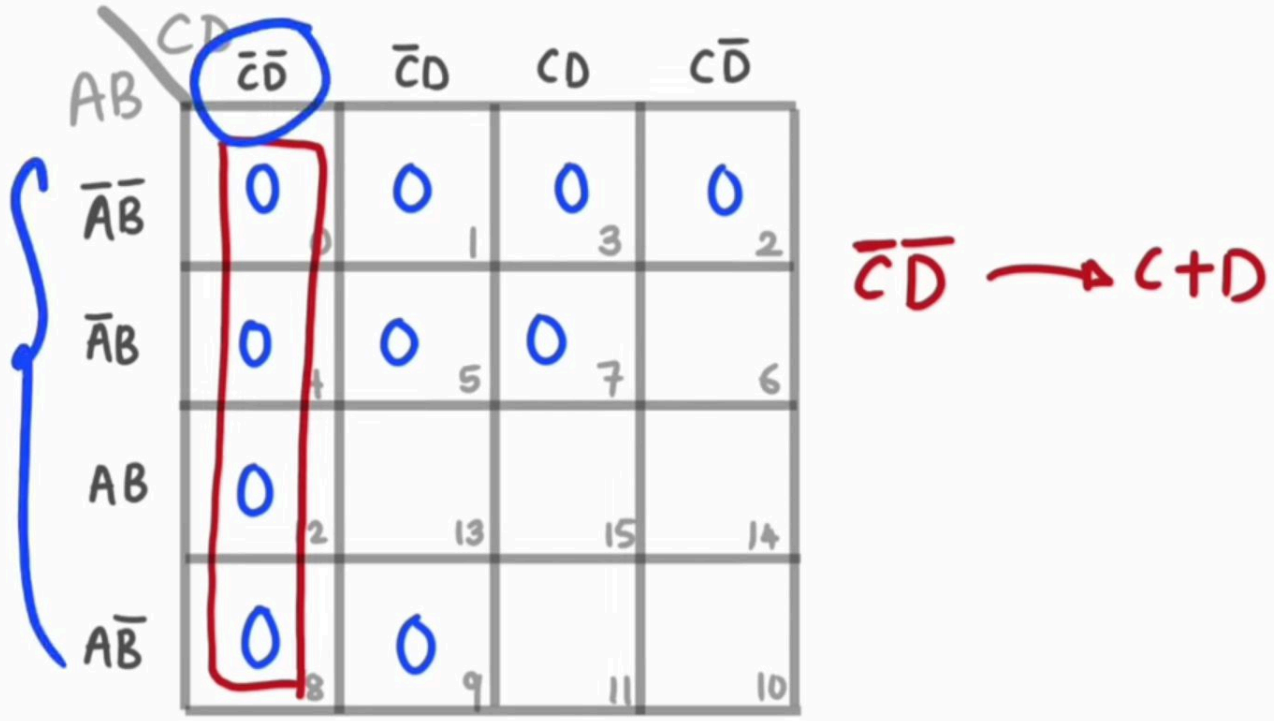
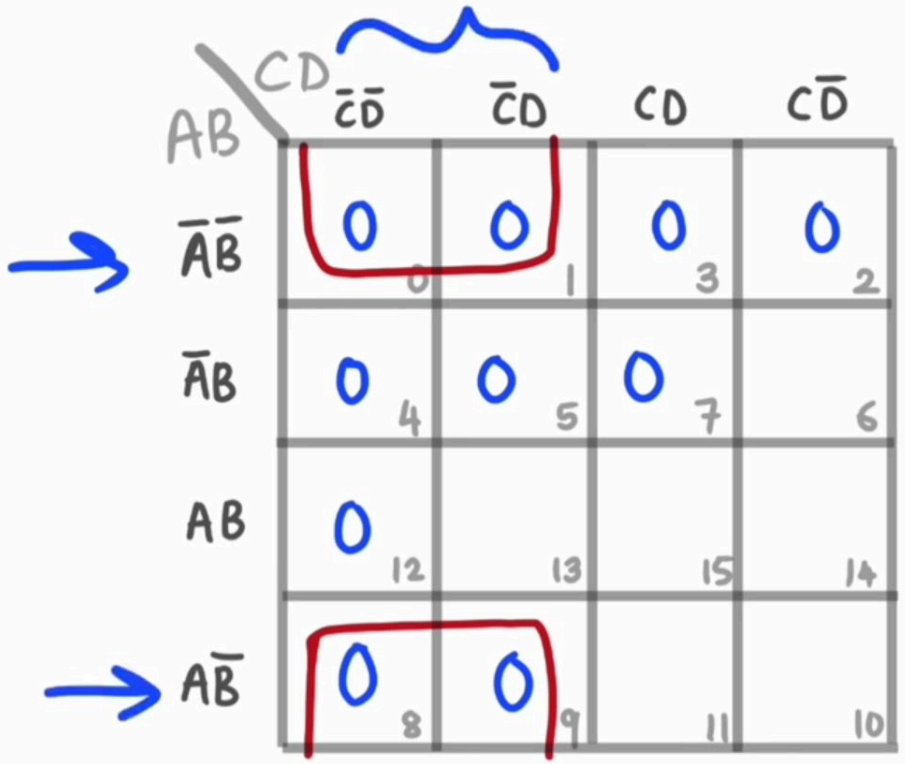



$\bar{A}\bar{C} \rightarrow A+C$




$\bar{A}D \rightarrow A+\bar{D}$


CD
AB
$\bar{C}\bar{D}$
$\bar{C}D$
CD
$C\bar{D}$
$\bar{A}\bar{B}$
$\bar{A}B$
AB
$A\bar{B}$
0
1
3
2
4
5
7
6
12
13
15
14
8
9
11
10
$\bar{C}\bar{D} \rightarrow C+D$




$\bar{B}\bar{C} \rightarrow B + C$

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Title

$\bar{A}\bar{B} + \bar{A}\bar{C} + \bar{A}D + \bar{C}\bar{D} + \bar{B}\bar{C}$ → SOP

$(A+B)(A+C)(A+\bar{D})(C+D)(B+C)$ → POS

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