CS & IT ENGINEERING

DIGITAL LOGIC

MINIMIZATION

Lecture No. – 04

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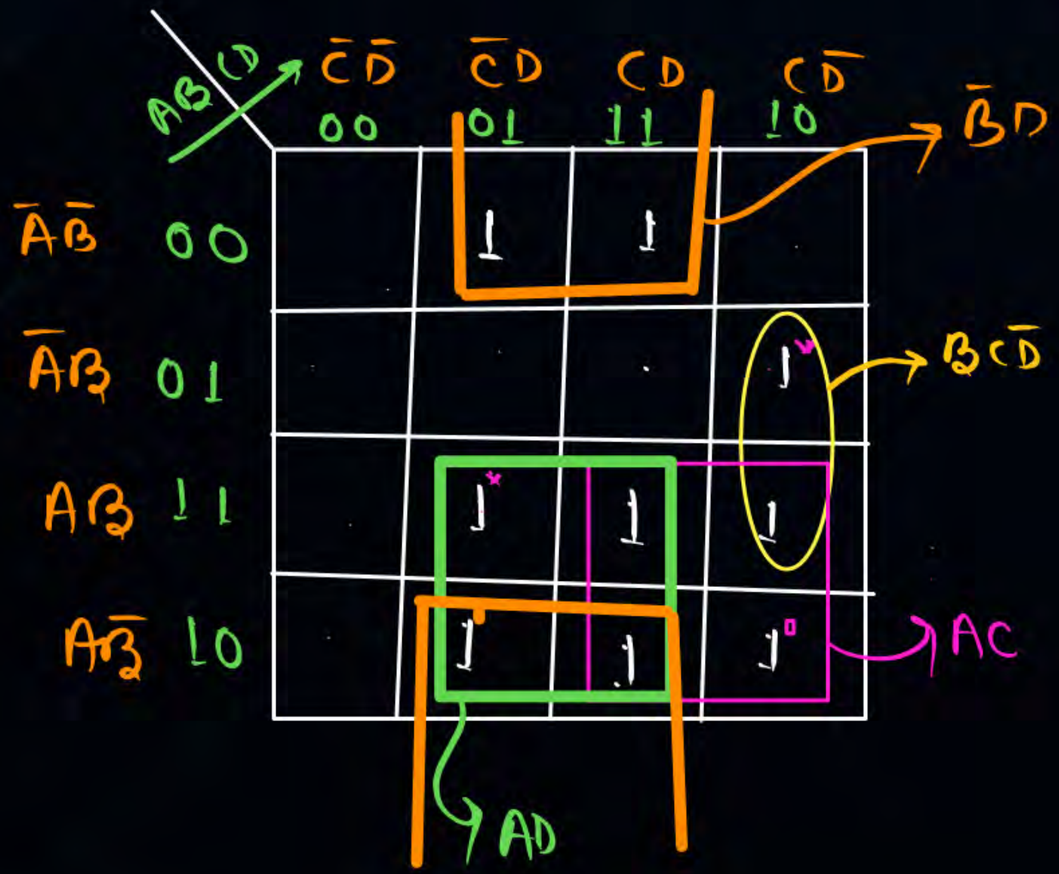
01 QUESTION PRACTICE

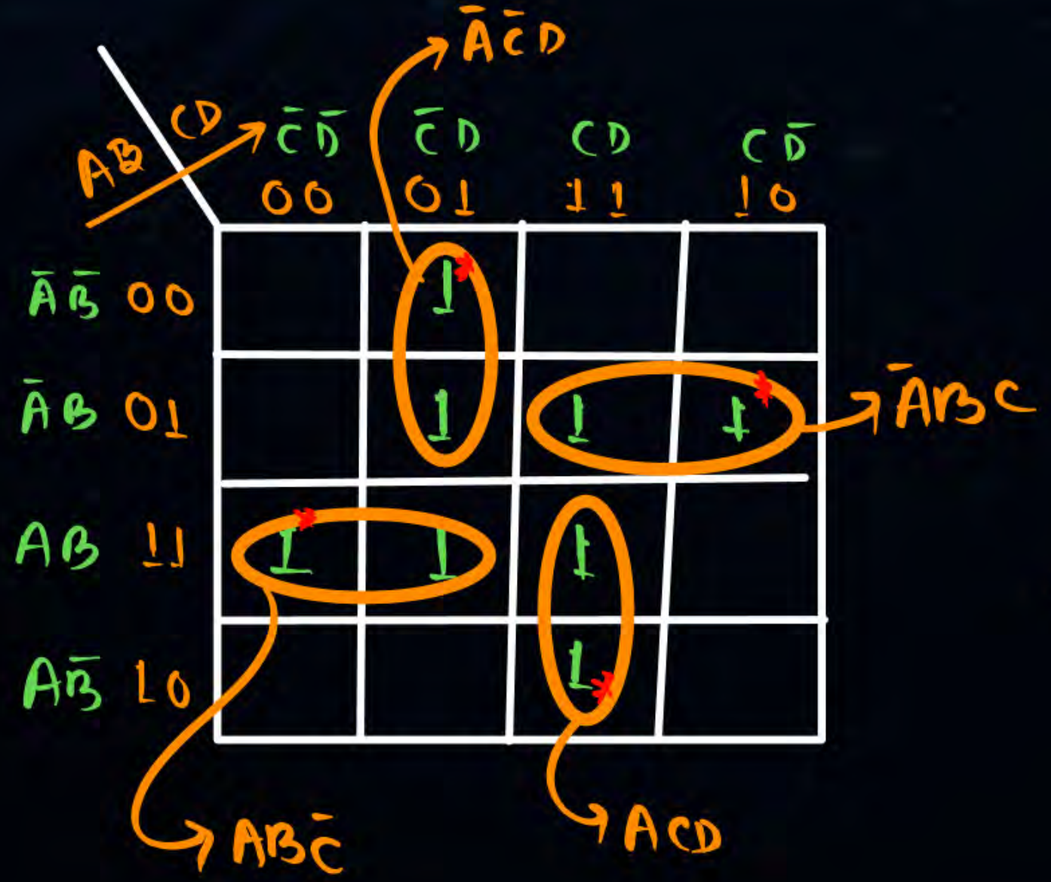
02 DISCUSSION

Q $f(A,B,C,D) = \Sigma m(1,3,6,9,10,11,13,14,15)$



$B\bar{C}\bar{D} + AC + AD + \bar{B}D$

Question



$\Rightarrow \bar{A}BC + ACD + \bar{A}\bar{C}D + AB\bar{C}$

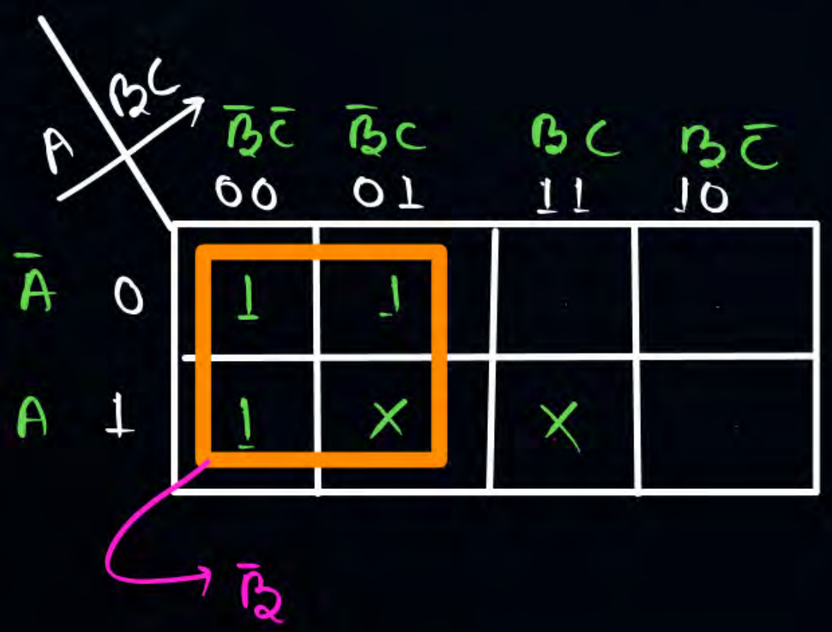
Don't care

$$f(A,B) = \bar{A}\bar{B} + A\bar{B} + \bar{A}B$$

$\bar{A}B$ → don't care.

Question :- $f(A,B,C) = \Sigma m(0,1,4) + \Sigma d(5,7)$

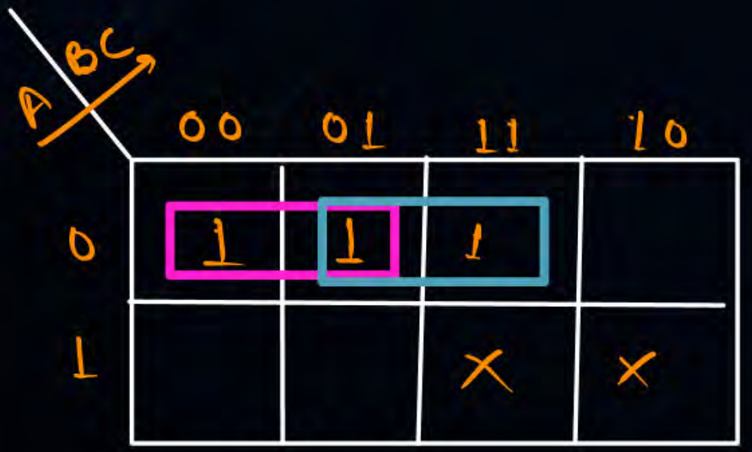
- Treated as '0'
- Treated as 1



$\Rightarrow \bar{B}$

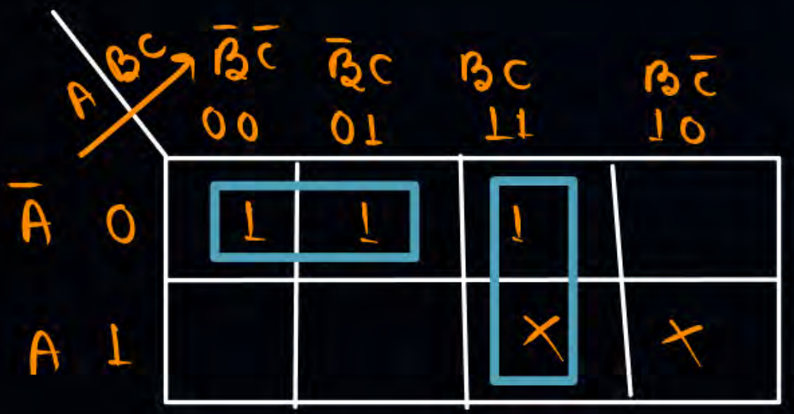
Q =

(a)



$\Rightarrow \bar{A}\bar{B} + \bar{A}C$

(b)



$\Rightarrow \bar{A}\bar{B} + BC$

(a) > (b)

NAT

Consider the Karnaugh map given below, where X represents "don't care" and blank represents 0.

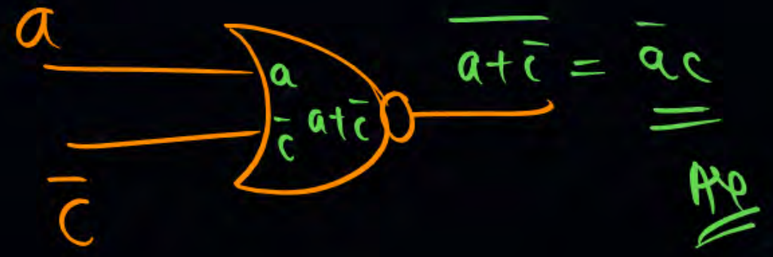
Assume for all inputs(a, b, c, d) , the respective complements $(\bar{a}, \bar{b}, \bar{c}, \bar{d})$ are also available. The above logic is implemented using 2-input NOR gates only. The minimum number of gates required is _____.

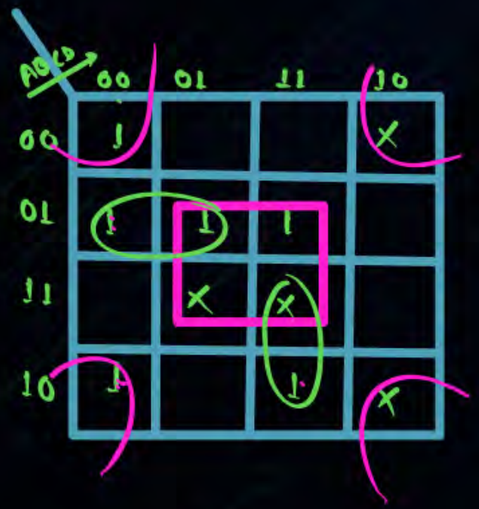
$f = \bar{a}c$ $\qquad \overline{a+\bar{c}}$

$c\bar{a} = \overline{\bar{c}+a}$

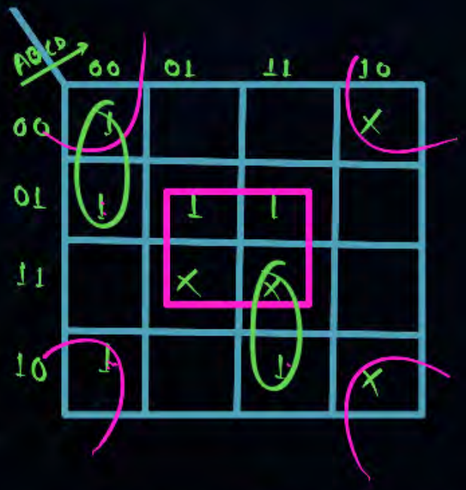
$=$

$\bar{a}c = \overline{a+\bar{c}}$

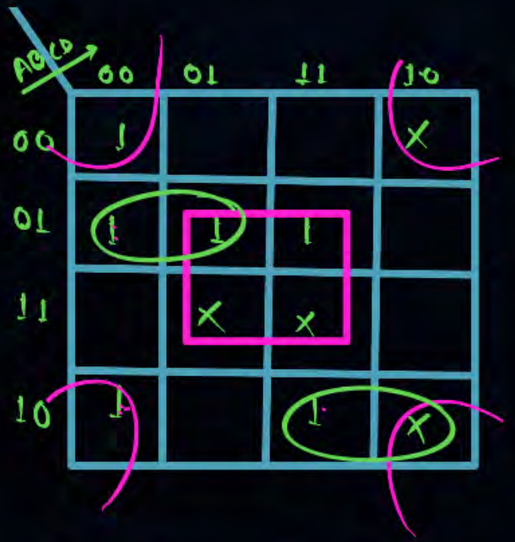




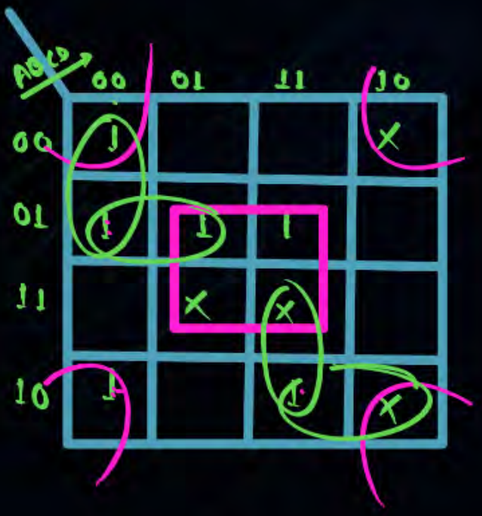
$BD + \bar{B}\bar{D} + \bar{A}B\bar{C} + ACD$



$\bar{B}\bar{D} + BD + \bar{A}\bar{C}\bar{D} + A\bar{C}D$



$\bar{B}\bar{D} + BD + \bar{A}B\bar{C} + A\bar{B}C$

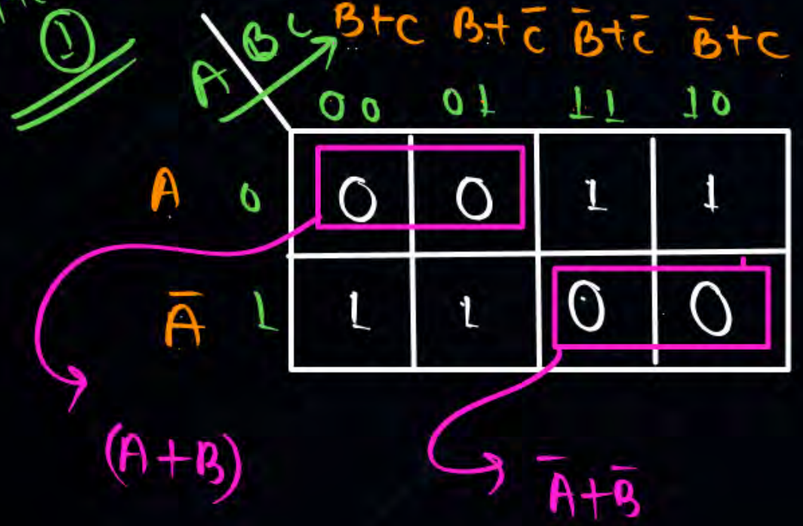


$\bar{B}\bar{D} + BD + \bar{A}\bar{C}\bar{D} + A\bar{B}C$

POS → Product of sum

$F(A,B,C) = \Pi M(0, 1, 6, 7)$

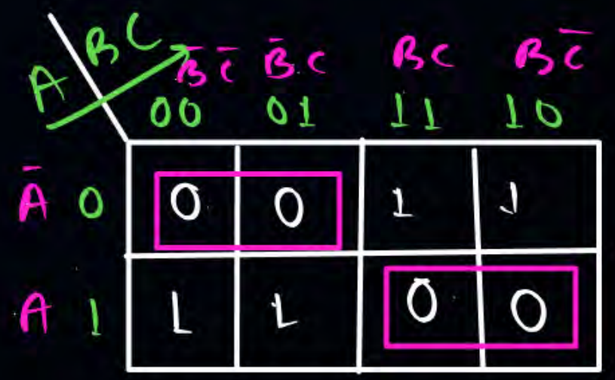
Method ①



$\Rightarrow (A+B)(\bar{A}+\bar{B})$

AHP

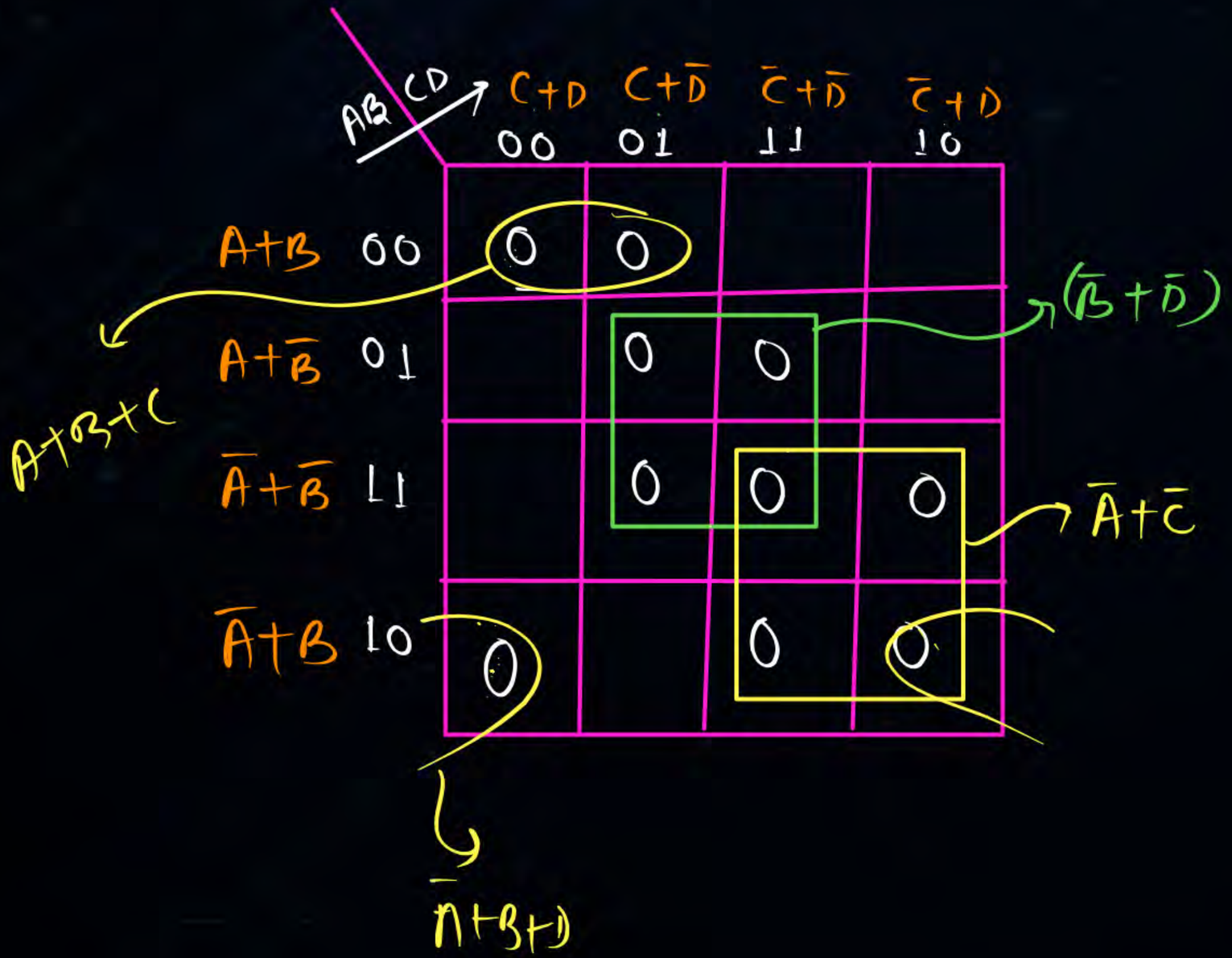
Method ②



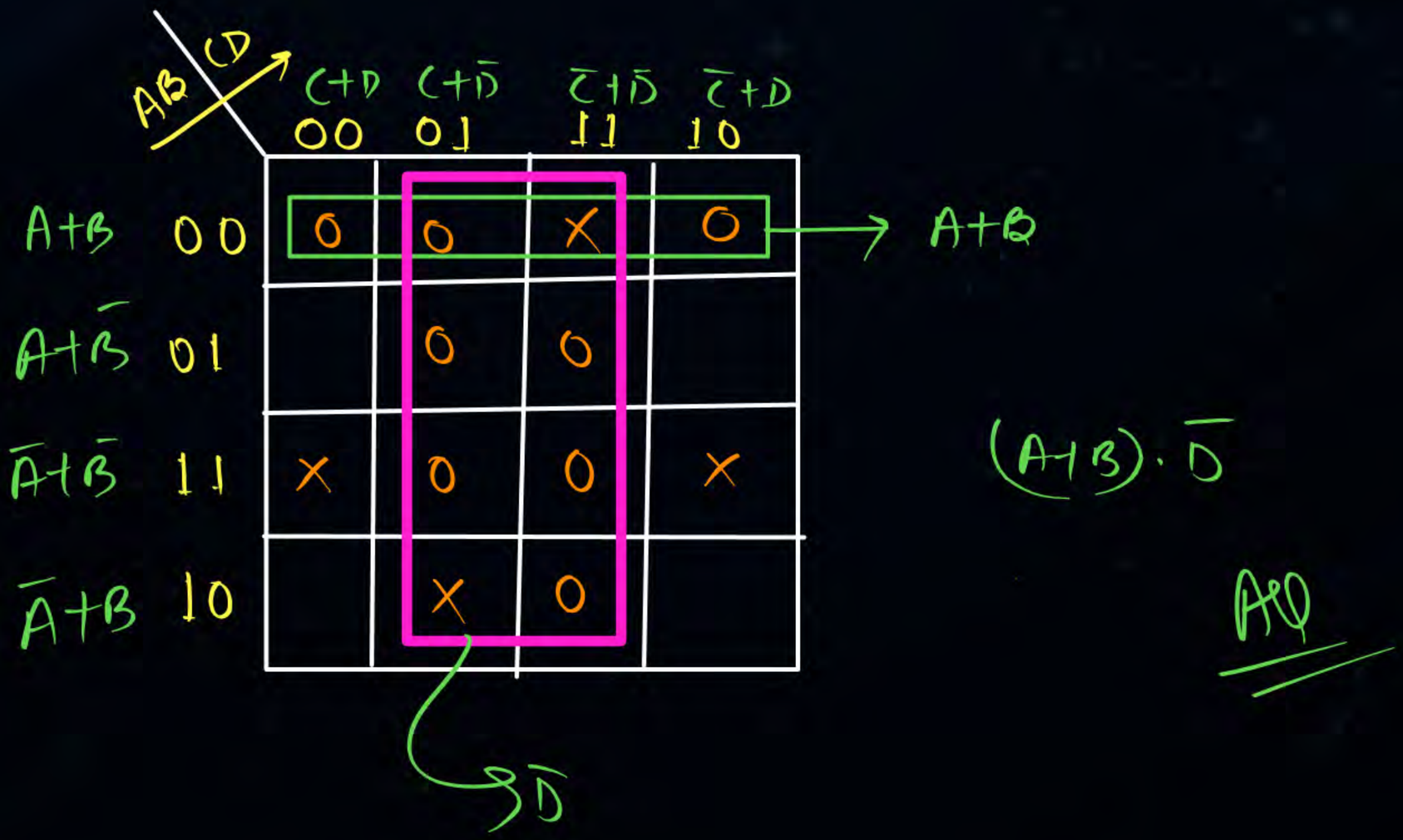
$\bar{F} = \bar{A}\bar{B} + AB$

$F = \overline{\bar{A}\bar{B} + AB} \Rightarrow \overline{\bar{A}\bar{B}} \cdot \overline{AB}$

$\Rightarrow (A+B)\cdot(\bar{A}+\bar{B})$



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


AB CD
C+D
C+D̄
C̄+D̄
C̄+D
00
01
11
10
A+B 00
A+B̄ 01
Ā+B̄ 11
Ā+B 10
0 0 X 0
0 0
X 0 0 X
X 0
A+B
(A+B)·D̄
D̄

MCQ

Given $f(w, x, y, z) = \Sigma_m(0, 1, 2, 3, 7, 8, 10) + \Sigma_d(5, 6, 11, 15)$, where d represents the don't-care condition in Karnaugh maps. Which of the following is a minimum product-of-sums (POS) form of f(w, x, y, z)?

A $f = (\bar{w} + \bar{z})\ (\bar{x} + z)$

B $f = (\bar{w} + z)\ (x + z)$

C $f = (w + z)\ (\bar{x} + z)$

D $f = (w + \bar{z})\ (\bar{x} + z)$

MCQ

HW

The number of min-terms after minimizing the following Boolean expression is _____ .

[D' + AB' + A'C + AC'D + A'C'D]'

Boolean ugebra

A 1

B 2

C 3

D 4

MCQ

Consider the following minterm expression for F:

$F(P,Q,R,S) = \sum 0, 2, 5, 7, 8, 10, 13, 15$

The minterms 2, 7, 8 and 13 are 'do not care' terms.

The minimal sum-of-products form for F is

A $Q\bar{S} + \bar{Q}S$

B $\bar{Q}\bar{S} + QS$

C $\bar{Q}R\bar{S} + \bar{Q}R\bar{S} + Q\bar{R}S + QRS$

D $\bar{P}Q\bar{S} + \bar{P}QS + PQS + P\bar{Q}\bar{S}$

MCQ

HW

What is the minimal form of the Karnaugh map shown below? Assume that X denotes a don't care term

cd \ ab	00	01	11	10
00	1	×	×	1
01	×			1
11				
10	1			×

A $\bar{b}\bar{d}$

B $\bar{b}\bar{d} + \bar{b}\bar{c}$

C $\bar{b}\bar{d} + a\bar{b}\bar{c}d$

D $\bar{b}\bar{d} + \bar{b}\bar{c} + \bar{c}\bar{d}$

MCQ

The minterm expansion of $f(P, Q, R) = PQ + Q\bar{R} + P\bar{R}$ is

A $m_2 + m_4 + m_6 + m_7$

B $m_0 + m_1 + m_3 + m_5$

C $m_0 + m_1 + m_6 + m_7$

D $m_2 + m_3 + m_4 + m_5$

MCQ

Hw

In the Karnaugh map shown below, X denotes a don't care term. What is the minimal form of the function represented by the Karnaugh map?

A $\bar{a}.\bar{b} + \bar{b}.\bar{d} + \bar{a}.\bar{d}$

B $\bar{b}.\bar{d} + \bar{a}.b.\bar{d}$

C $\bar{a}.\bar{b} + \bar{b}.\bar{d} + \bar{a}.b.\bar{d}$

D $\bar{b}.\bar{d} + \bar{a}.\bar{d}$

cd \ ab	00	01	11	10
00	1	1		1
01	X			
11	X			
10	1	1		X

MCQ

A K-map is given as below:
It minimized solution will be

	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{x}$	1	1		X
x	X		1	1

A $x \odot y$

B $x \oplus y$

C $\bar{z} + \bar{x}\bar{y}$

D $\bar{z} + xy + \bar{x}\bar{y}$

MCQ

4m

$F(x, y, z) = \overline{x\bar{y} + \bar{x}y} + x\,\bar{y}\,z + x\,\bar{y}\,\bar{z}$

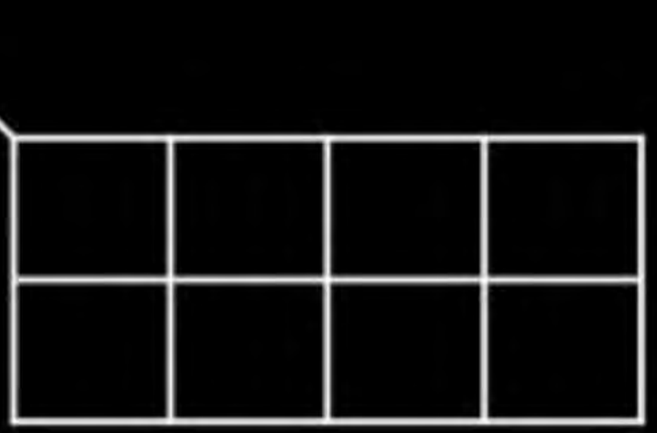
Then the minimized solution of F(x, y, z) will be

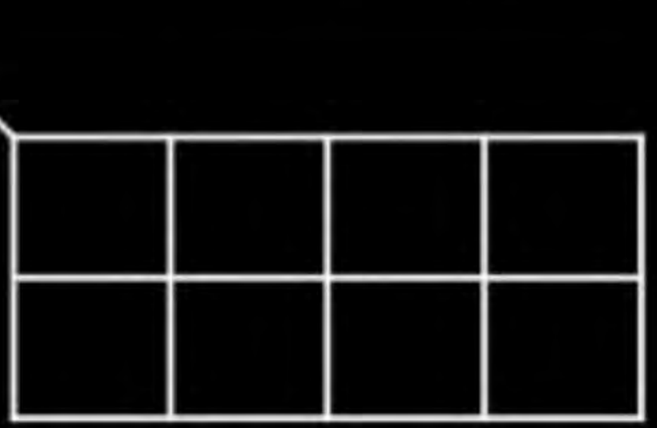
A $x + \bar{y}$

B $\bar{x}\,y$

C $x\,y\,\bar{z}$

D $x + \bar{y} + z$





MCQ

A K-map is as given below:

Then the minimized solution of K-map is:

	$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
$\bar{A}B$	1	1	1	
$\bar{A}B$	1	1	1	X
AB			1	
$A\bar{B}$		X	X	

A $\bar{A}\bar{C} + \bar{A}D + CD$

B $\bar{A}\bar{C} + CD$

C $\bar{A}B + CD + \bar{A}\bar{C}$

D None of these

MCQ

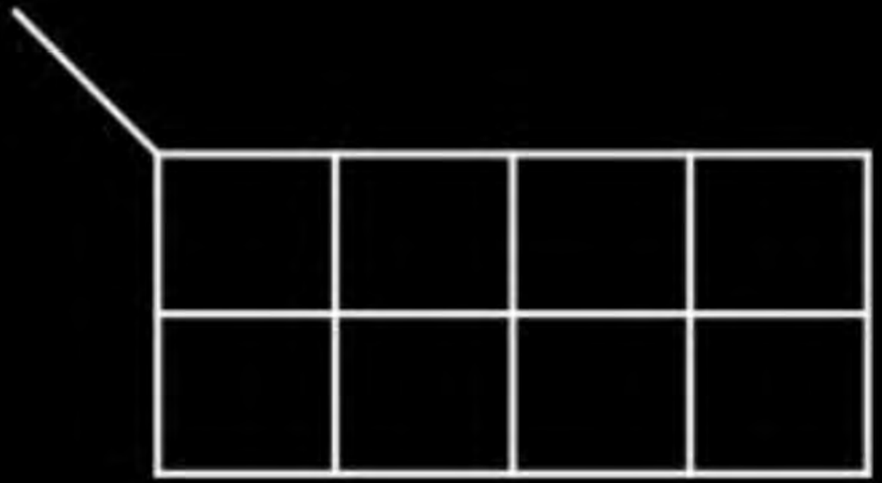
$f(x, y, z)$ is given as : $f(x, y, z) = \bar{x}\,\bar{y} + \bar{x}\,z + xy$,
The equivalent $f(x, y, z)$ can also be

A $(\bar{x} + y + \bar{z})(x + \bar{y} + \bar{z})(x + \bar{y} + z)$

B $(x + \bar{y} + z)\,(\bar{x} + \bar{y} + z)(\bar{x} + y + \bar{z})$

C $(\bar{x} + \bar{y})\,(\bar{x} + z)\,(x + y)$

D None of these



Thank you

GW

Soldiers !