

CS & IT ENGINEERING

DIGITAL Logic

MINIMIZATION

Lecture No. 06



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TOPICS TO BE COVERED

01 Prime Implicants

02 Essential Prime Implicants

03 Question Practice

03 Discussion

Q $F(A,B,C) = \Pi M(0,1,3,6,7)$ ✓
 $= \Sigma m(2,4,5)$ ✓

Method ①

			$B+C$	$B+\bar{C}$	$\bar{B}+\bar{C}$	$\bar{B}+C$
			$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
			00	01	11	10
A	\bar{A}	0	0	0	0	1
\bar{A}	A	1	1	1	0	0

POS $F = (A+B) \cdot (\bar{A}+\bar{B}) \cdot (A+\bar{C})$ ✓
 $\bar{F} = (A+B) (\bar{A}+\bar{B}) (\bar{B}+\bar{C})$ ✓

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

Method ②

		$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
		00	01	11	10
\bar{A}	0	0	0	0	1
A	1	1	1	0	0

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

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

$F = (A+B) \cdot (\bar{A}+\bar{B}) \cdot (A+\bar{C})$ ✓

$$= \prod M(2, 4, 5, 8, 9, 12, 13) (4, 15)$$

Q $f(A, B, C, D) = \sum m(0, 1, 3, 6, 7, 10, 11)$

minimize it in pos form 2

$AB \searrow \begin{matrix} C \\ D \end{matrix}$		$C+D$ 00				$C+\bar{D}$ 01		$\bar{C}+\bar{D}$ 11		$\bar{C}+D$ 10	
$A+B$ 00		1	1	1	0						
$A+\bar{B}$ 01		0	0	1	1						
$\bar{A}+\bar{B}$ 11		0	0	0	0						
$\bar{A}+B$ 10		0	0	1	1						

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

AB ↗

	$C+D$ 00	$C+\bar{D}$ 01	$\bar{C}+\bar{D}$ 11	$\bar{C}+D$ 10
$A+B$ 00	0	0		
$A+\bar{B}$ 01	0		0	X
$\bar{A}+\bar{B}$ 11		X	X	
$\bar{A}+B$ 10		0	0	X

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

Ans

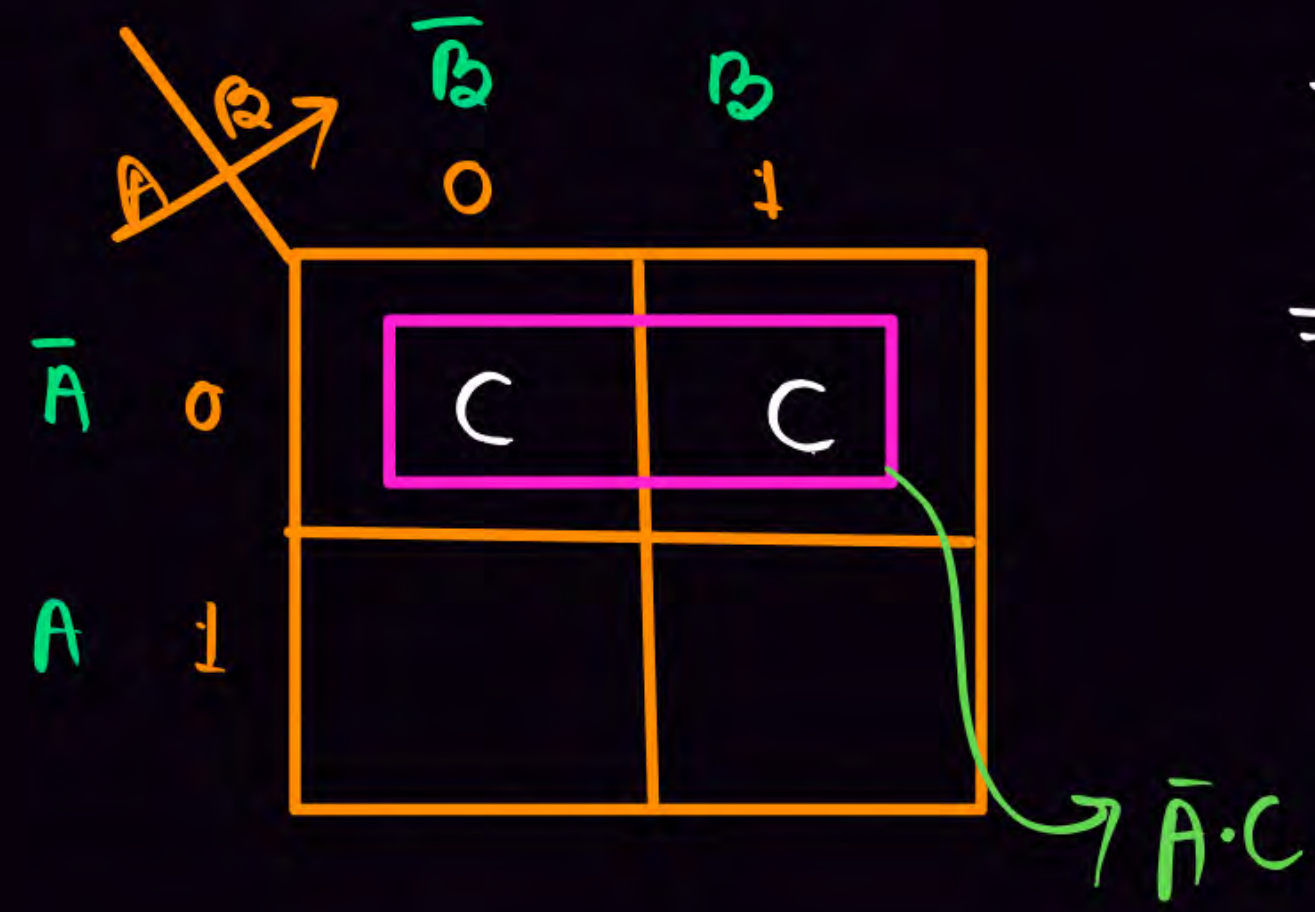
	\bar{B}	B
\bar{A}	1	1
A		

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

$$= \bar{A}\bar{B} \cdot 1 + \bar{A}B \cdot 1$$

Variable inside the K-MAP

Ex. 1



$$\begin{aligned} & \bar{A}\bar{B}C + \bar{A}BC \\ &= \bar{A}\bar{B} \cdot C + \bar{A}B \cdot C = \bar{A}C(\bar{B} + B) \\ &= \bar{A}C \quad \underline{Ans} \end{aligned}$$

$$Ans = \bar{A}C \quad \underline{Ans}$$

Ex. 2.

		$\overline{A} \rightarrow B$	
		\overline{B}	B
\overline{A}	0	1	C
A	1	0	0

$$\begin{aligned}
 f(A, B, C) &= \overline{A}\overline{B} \cdot 1 + \overline{A}BC \\
 &= \overline{A}[\overline{B} + Bc] \\
 &= \overline{A}[(\overline{B} + B) \cdot (\overline{B} + c)] \\
 &= \overline{A} \cdot (\overline{B} + c) \\
 &\quad \underline{\underline{Ans}}
 \end{aligned}$$

Case (1) $C=0$

		$\overline{A} \rightarrow B$	
		\overline{B}	B
\overline{A}	0	1	0
A	1	0	0

$= \overline{A}\overline{B}\overline{C}$

Case (2) $C=1$

		$\overline{A} \rightarrow B$	
		\overline{B}	B
\overline{A}	0	1	1
A	1	0	0

$= \overline{A}C$

$$\begin{aligned}
 &\overline{A}C + \overline{A}\overline{B}\overline{C} \\
 &\overline{A}[C + \overline{B}\overline{C}] \\
 &\overline{A}[(\overline{B} + C)] \\
 &\overline{A} \cdot (\overline{B} + C) \quad \underline{\underline{Ans}}
 \end{aligned}$$

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

Method ① Boolean algebra

$$\begin{aligned} f(A, B, C) &= \bar{A} [\bar{B} + B C] \\ &= \bar{A} [(\bar{B} + B) (\bar{B} + C)] \\ &= \bar{A} (\bar{B} + C) \end{aligned}$$

Ans

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

Method (2) $f(A, B, C) = \bar{A}\bar{B}(\bar{C} + C) + \bar{A}Bc$

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

$$= \sum m(0, 1, 3) = \prod M(2, 4, 5, 6, 7)$$

		$\bar{B}\bar{C}$ $\bar{B}C$ BC $B\bar{C}$			
		00	01	11	10
\bar{A}	0	1	1	1	0
A	1	0	0	0	0

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

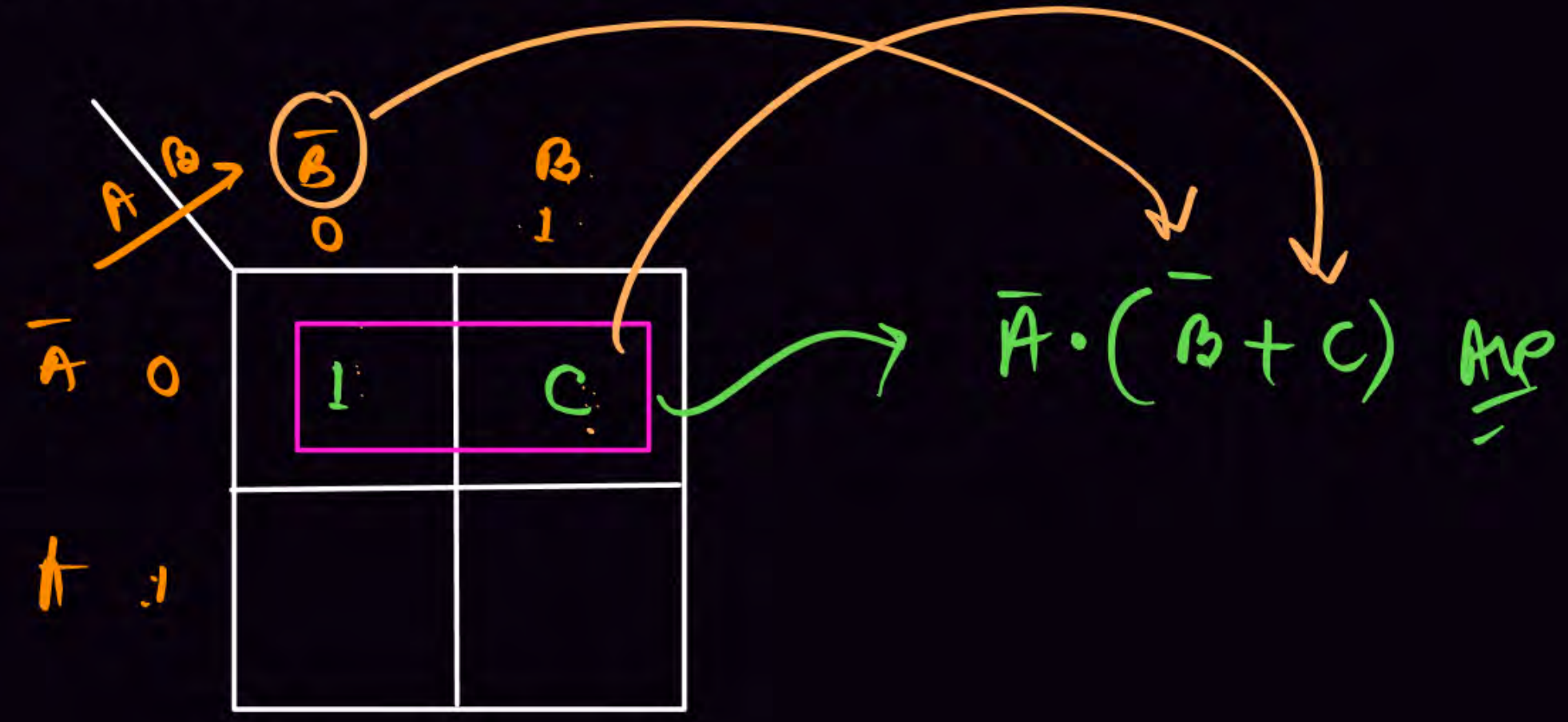
		$\bar{B}\bar{C}$ $\bar{B}C$ BC $B\bar{C}$			
		00	01	11	10
\bar{A}	0	1	1	1	0
A	1	0	0	0	0

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

Q $f(A,B,C) = \bar{A}\bar{B} + \bar{A}BC = \bar{A}\bar{B} \cdot 1 + \bar{A}B \cdot C$

Method ③

Short trick



Q $f(A,B,C) = \bar{A}\bar{B} + \bar{A}BC = \bar{A}\bar{B} \cdot 1 + \bar{A}B \cdot C$

Method (4)

		$B \rightarrow$	
		\bar{B}	B
$A \downarrow$	\bar{A}	1	C
	A		

1>

		$C = 0$	
		\bar{B}	B
A	\bar{A}	1	0
	A		

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

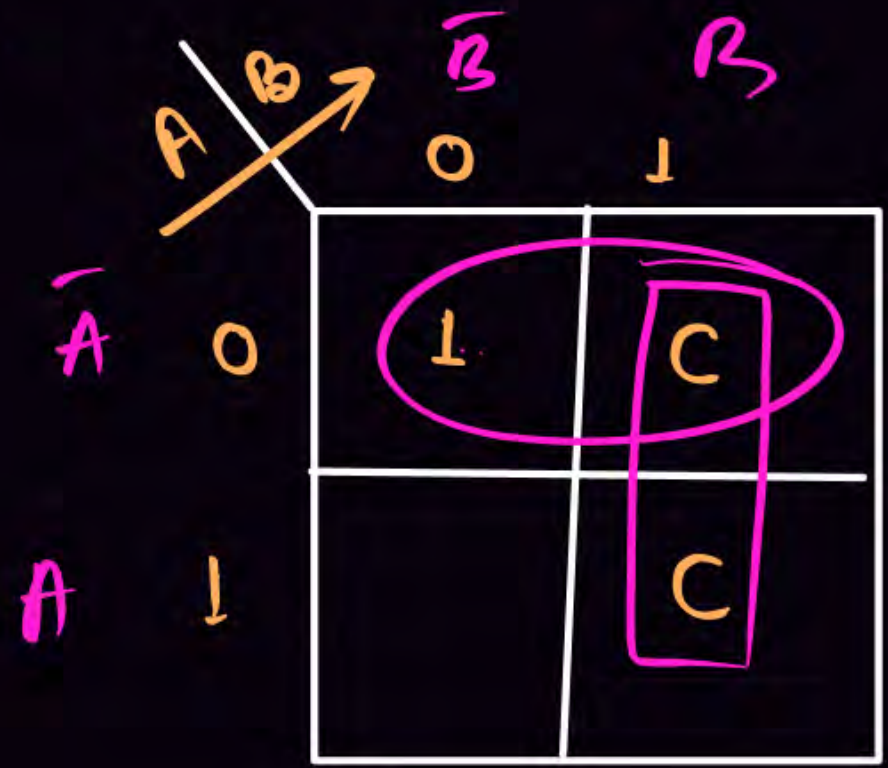
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		$C = 1$	
		\bar{B}	B
A	\bar{A}	1	1
	A		

$$\bar{A}C$$

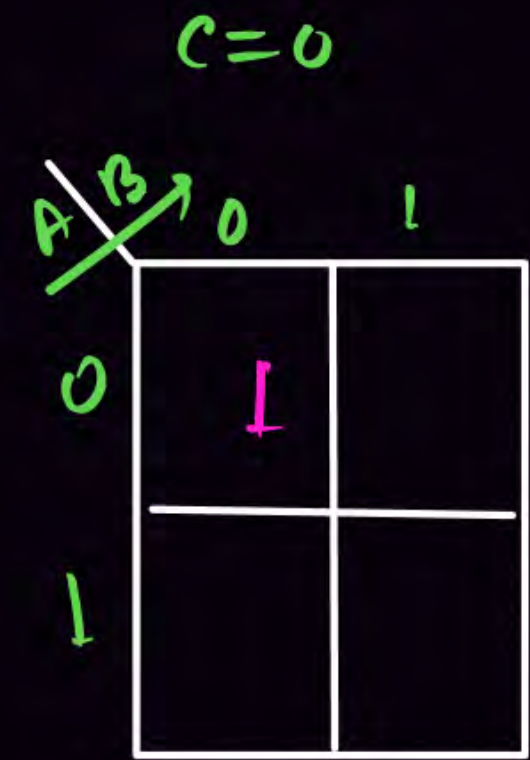
$$\begin{aligned} f &= \bar{A}C + \bar{A}\bar{B}\bar{C} \\ &= \bar{A} [C + \bar{B}\bar{C}] = \bar{A} [(\bar{B} + C)(C + \bar{C})] \\ &= \bar{A}(\bar{B} + C) \quad \text{Ans.} \end{aligned}$$

Q

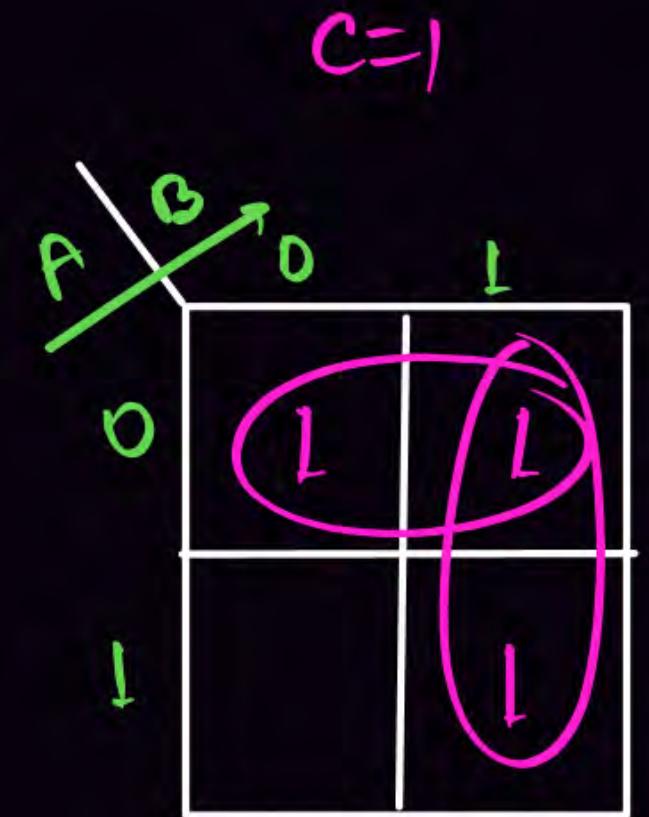


$$B \cdot C + \bar{A} \cdot (\bar{B} + C)$$

Ans



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

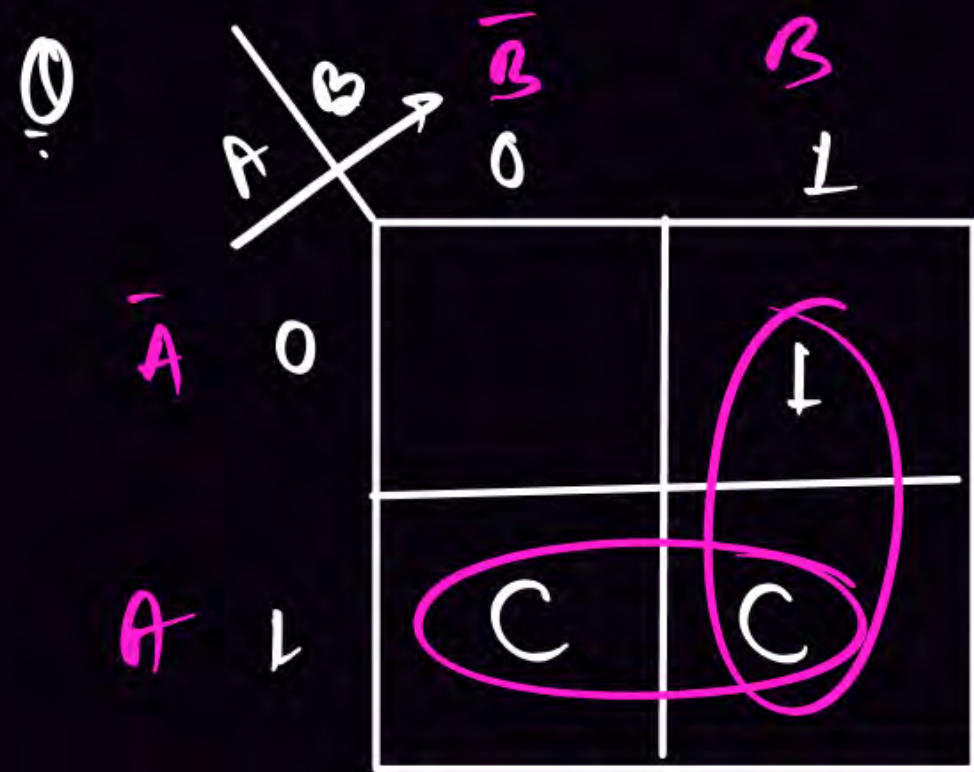


$$(\bar{A} + B)C$$

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

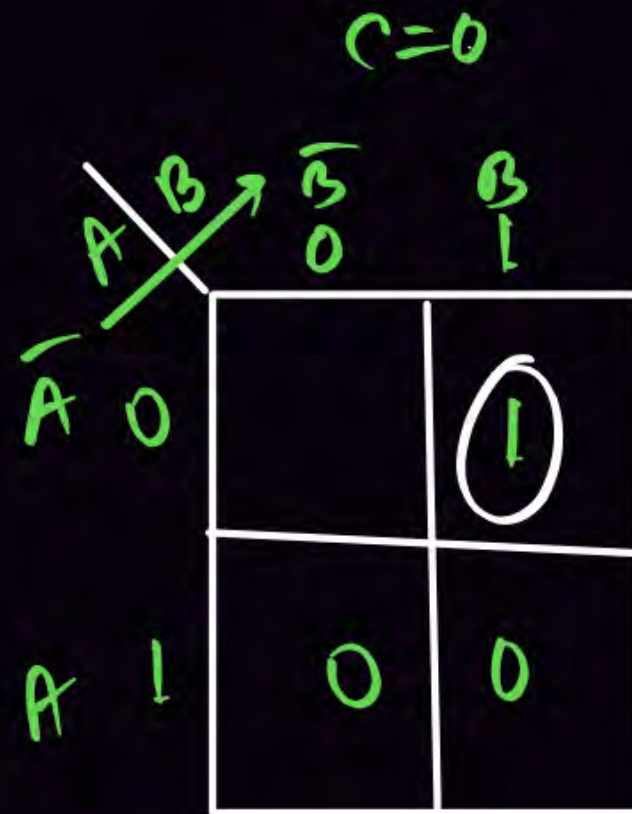
$$\bar{A}(\bar{B}\bar{C} + C) + BC$$

$$\bar{A}(\bar{B} + C) + BC \text{ (Ans)}$$



$$AC + B(\bar{A} + C)$$

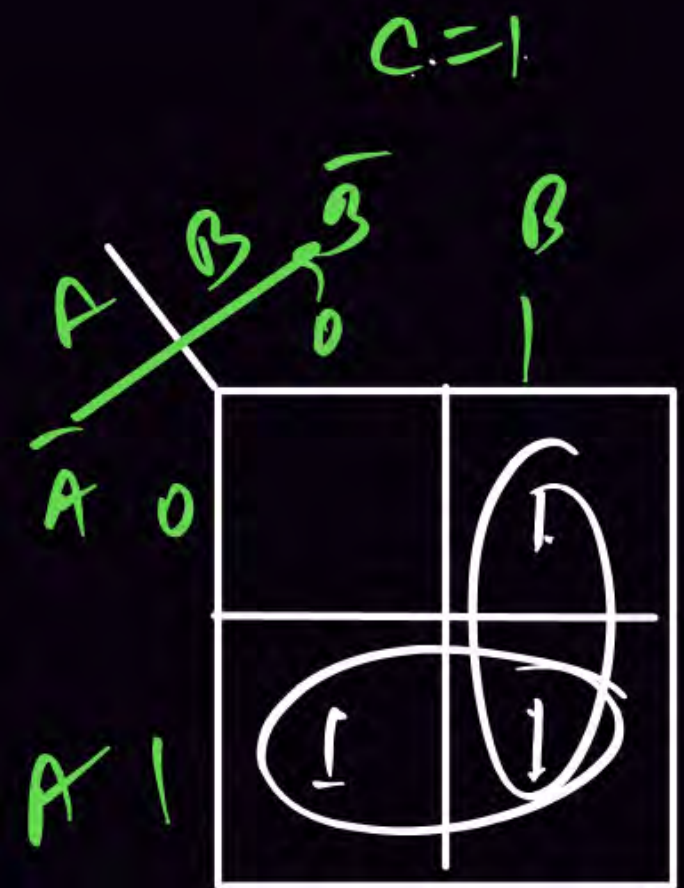
$$AC + \bar{A}B + BC$$



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

$$\bar{A}\bar{B}\bar{C} + AC + BC$$

$$AC + B(\bar{A}\bar{C} + C) = AC + B(\bar{A} + C) \quad \underline{\underline{P2}}$$



$$(A+B)C$$

HW

Q

A \ BC				
	00	01	11	10
0	1	0	0	
1			0	1

Thank you

GW
Soldiers!

