

# CS & IT ENGINEERING

## DIGITAL LOGIC



Combinational Circuit

Lecture No. 04



By- CHANDAN SIR

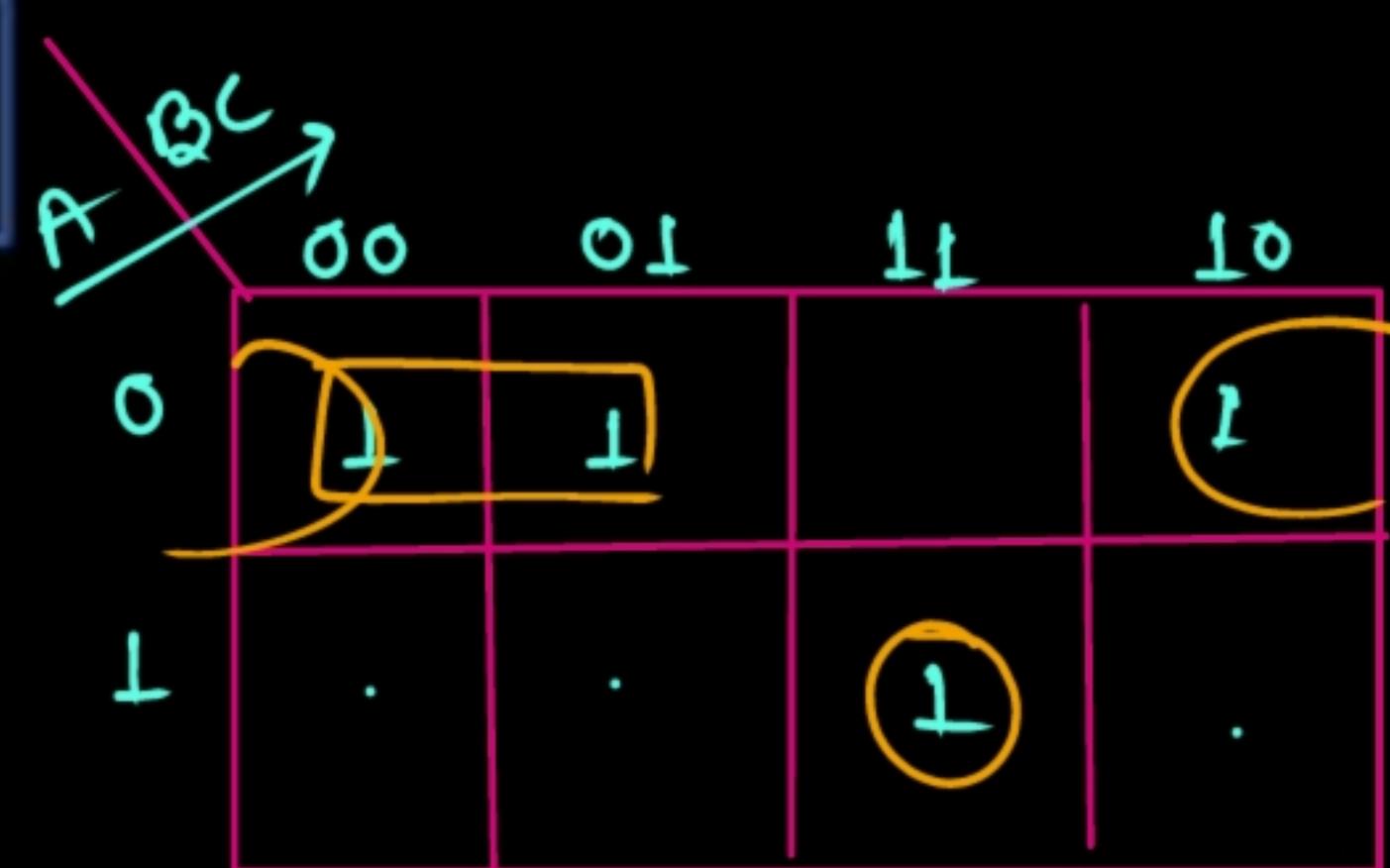
## TOPICS TO BE COVERED

- ... ► **01 MULTIPLEXER**
- ... ► **02 QUESTION PRACTICE**
- ... ► **03 DISCUSSION**

## Type-3 Minimization

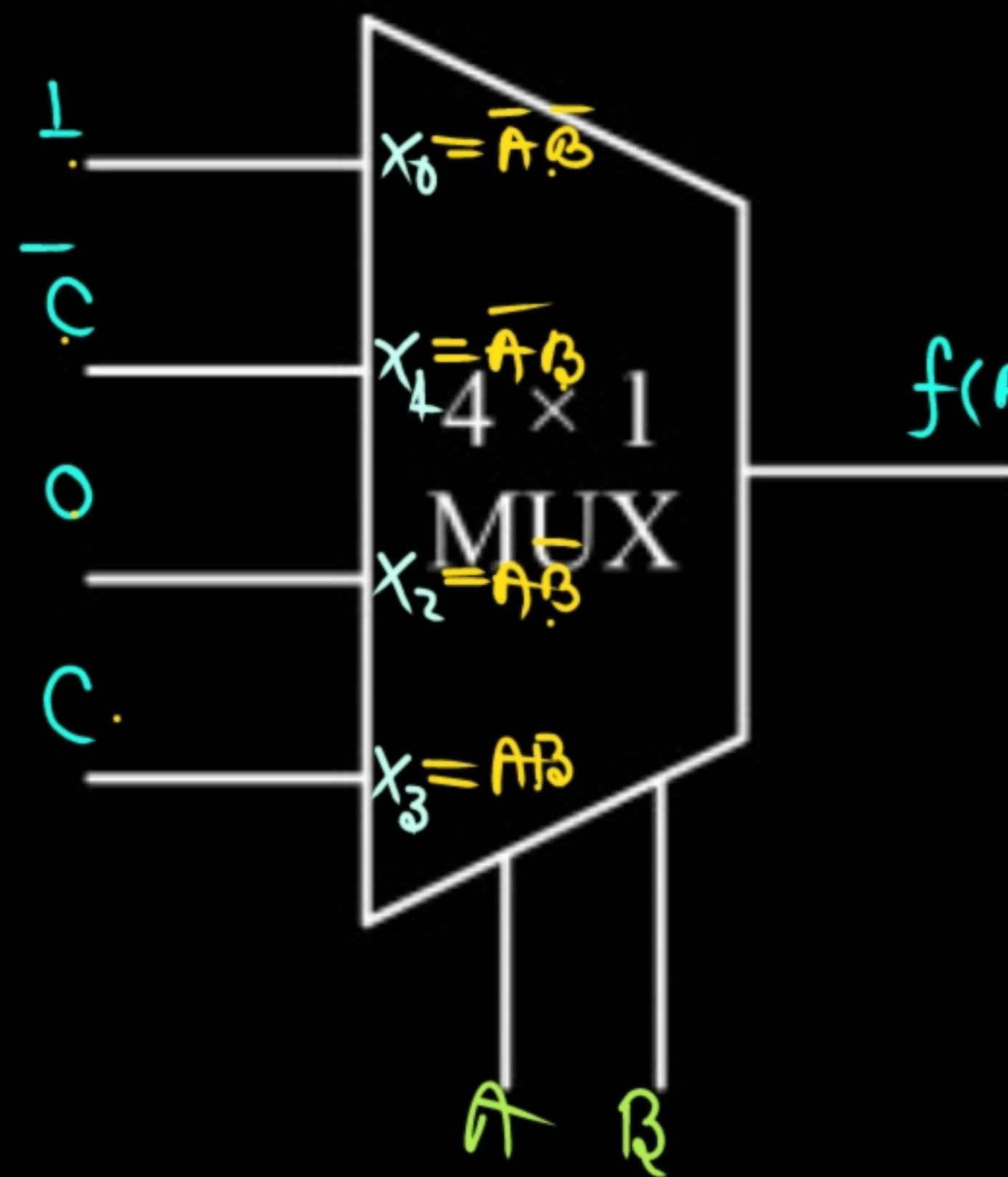
Q.

Find the output f.



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

Ans



$$\begin{aligned}
 f(A, B, C) &= \bar{A}\bar{B} \cdot 1 + \bar{A}B\bar{C} + A\bar{B} \cdot 0 + AB \cdot C \\
 &= \bar{A}\bar{B} + \bar{A}B\bar{C} + AB\bar{C} \\
 &= \bar{A}\bar{B}(\bar{C} + C) + \bar{A}B\bar{C} + AB\bar{C} \\
 &= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + AB\bar{C} \\
 &= \sum m(0, 1, 2, 7)
 \end{aligned}$$



FMD f=?

Q =	<table border="1"><tr><td><math>\bar{C}</math></td><td><math>x_0 = \bar{A}\bar{B} \quad \{0,1\}</math></td></tr><tr><td>1</td><td><math>x_1 = \bar{A}B \quad \{2,3\}</math></td></tr><tr><td>C</td><td><math>x_2 = A\bar{B} \quad \{4,5\}</math></td></tr><tr><td>1</td><td><math>x_3 = AB \quad \{6,7\}</math></td></tr></table>	$\bar{C}$	$x_0 = \bar{A}\bar{B} \quad \{0,1\}$	1	$x_1 = \bar{A}B \quad \{2,3\}$	C	$x_2 = A\bar{B} \quad \{4,5\}$	1	$x_3 = AB \quad \{6,7\}$
$\bar{C}$	$x_0 = \bar{A}\bar{B} \quad \{0,1\}$								
1	$x_1 = \bar{A}B \quad \{2,3\}$								
C	$x_2 = A\bar{B} \quad \{4,5\}$								
1	$x_3 = AB \quad \{6,7\}$								
	<table border="0"><tr><td>A</td><td>B</td></tr><tr><td><math>\bar{A}\bar{B}</math></td><td></td></tr></table>	A	B	$\bar{A}\bar{B}$					
A	B								
$\bar{A}\bar{B}$									

010 = 2      011 = 3      110 = 6      111 = 7  
 $\bar{A}\bar{B}\bar{C}$        $\bar{A}\bar{B}C$        $AB\bar{C}$        $ABC$

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

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

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

$$= \Sigma m(0, 2, 3, 5, 6, 7)$$

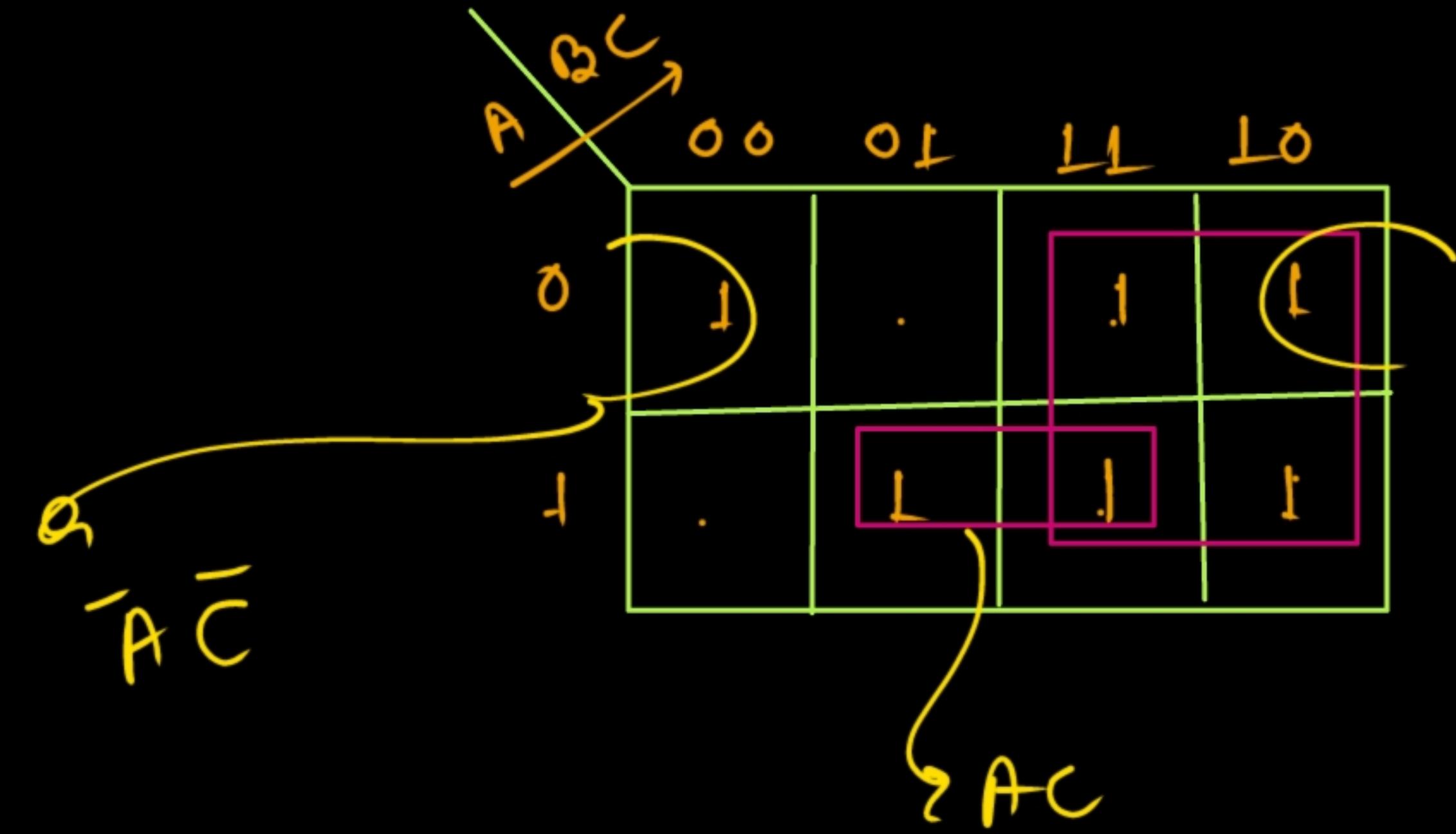
$$\begin{array}{l} 011 \rightarrow 3 \\ 010 \rightarrow 2 \\ \bar{A}\bar{B} \end{array}$$

$$AB$$

$$110 = 6$$

$$111 \Rightarrow$$

1



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

Ans

Q

$\bar{N}$	$x_0 = \bar{A}\bar{B}\bar{C} \{0, 1\}$
1	$x_1 = \bar{A}\bar{B}C \{2, 3\}$
0	$x_2 = \bar{A}B\bar{C} \{\cancel{4}, \cancel{5}\}$
$\bar{B}$	$x_3 = \bar{A}BC \{6, 7\}$
1	$x_4 = A\bar{B}\bar{C} \{8, 9\}$
0	$x_5 = A\bar{B}C \{\cancel{10}, \cancel{11}\}$
$\bar{B}$	$x_6 = AB\bar{C} \{12, 13\}$
1	$x_7 = ABC \{14, 15\}$

5 pairs

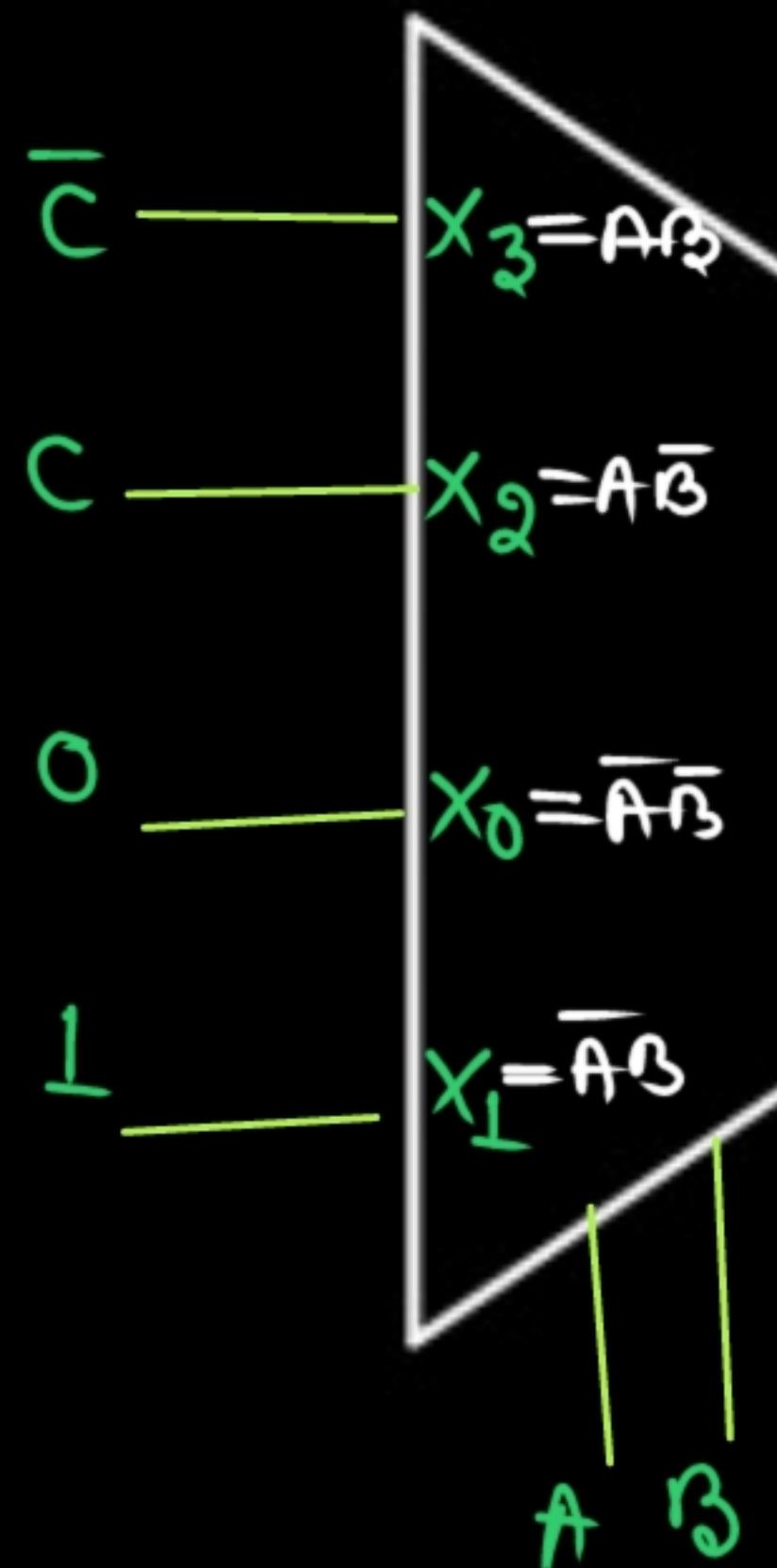
$$f(A, B, C, N) = \bar{A}\bar{B}\bar{C}\bar{N} + \bar{A}\bar{B}C + \bar{A}B\bar{C}\bar{N} + A\bar{B}\bar{C} + AB\bar{C}\bar{N} + ABC$$

$$= \sum m(1, 2, 3, 6, 8, 9, 12, 14, 15)$$

~~ABCD~~

	00	01	11	10
00	1	1	1	1
01	.	.	.	1
11	1	.	1	1
10	1	1	.	.

Q Find  $f = ?$



		$\bar{B}C'$	$\bar{B}C$	$B'C$	$B\bar{C}$
		00	01	11	10
$\bar{A}$	0	.	.	1	1
	1	(L)	.	1	1

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

Ans

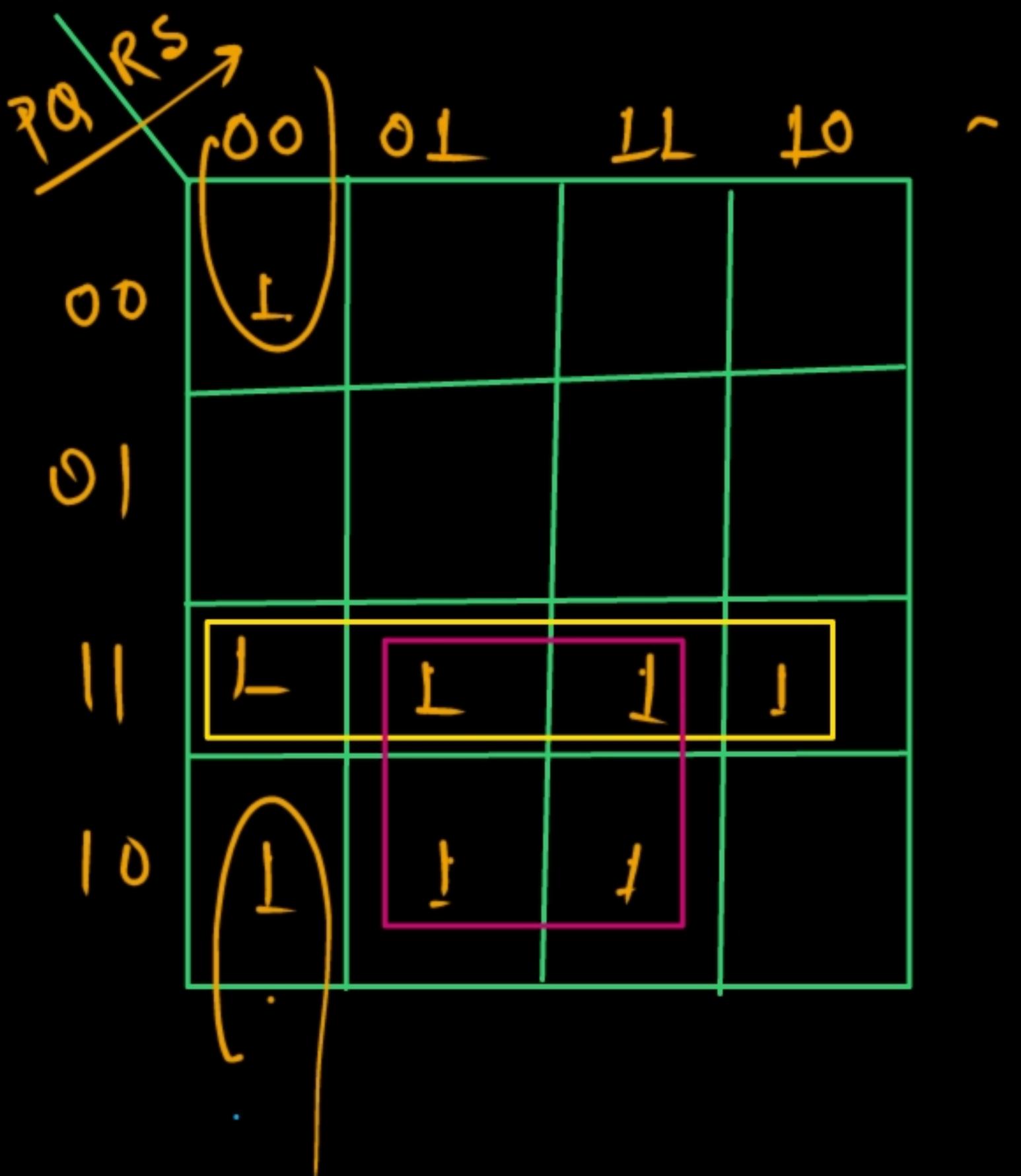
$$\begin{aligned}
 f(A, B, C) &= AB\bar{C} + A\bar{B}C + \bar{A}B \\
 &= AB\bar{C} + A\bar{B}C + \bar{A}B\bar{C} + \bar{A}\bar{B}C \\
 &= \sum m(2, 3, 5, 6)
 \end{aligned}$$

$$\begin{aligned}
 &= P\bar{R}\bar{S} + \bar{Q}\bar{R}\bar{S} + P\bar{R}S + P\bar{Q}\bar{R}\bar{S} + PRS \\
 &= 1000(8) \quad 0000(0) \quad 1001(5) \quad 1110(4) \quad 1011(11) \\
 &\quad 1100(R) \quad 1000(6) \quad 1101(13) \quad 1111(15)
 \end{aligned}$$

$P(\bar{Q}+Q)\bar{R}\bar{S}$

$P$	$=RS$	$P\bar{Q}\bar{R}\bar{S} = 1000$
$PQ$	$=R\bar{S}$	$PQ\bar{R}\bar{S} = 1100$
$P$	$=\bar{R}S$	$\underbrace{(P,Q,R,S)}_{=} = (\bar{P}+\bar{Q})\bar{R}\bar{S} + P\bar{R}S + P\bar{Q}\bar{R}\bar{S} + PRS$
$\bar{P}+\bar{Q}$	$=\bar{R}\bar{S}$	$= \sum m(0, 1, 8, 9, 11, 12, 13, 14, 15)$

$$f(P, Q, R, S) = \sum m(0, 8, 9, 11, 12, 13, 14, 15)$$

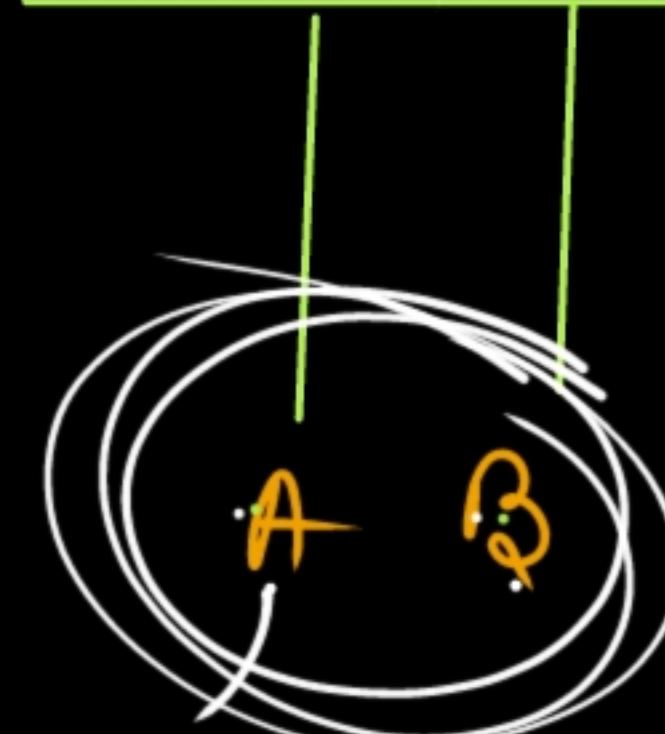


$$= P\bar{Q} + P\bar{S} + \bar{Q}\bar{R}\bar{S}$$

Q Find  $f = ?$

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

$\bar{C}$	$x_0 = \bar{B}\bar{A} / \bar{A}\bar{B}$
$C$	$x_1 = \bar{B}A / \bar{A}B$
$\perp$	$x_2 = B\bar{A} / A\bar{B}$
$\bar{C}$	$x_3 = BA / AB$



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

$$f(B, A, C) = \bar{B}\bar{A}\bar{C} + \bar{B}\bar{A}C + B\bar{A}\bar{C} + BA\bar{C} \\ = \sum m(0, 3, 4, 5, 6)$$

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

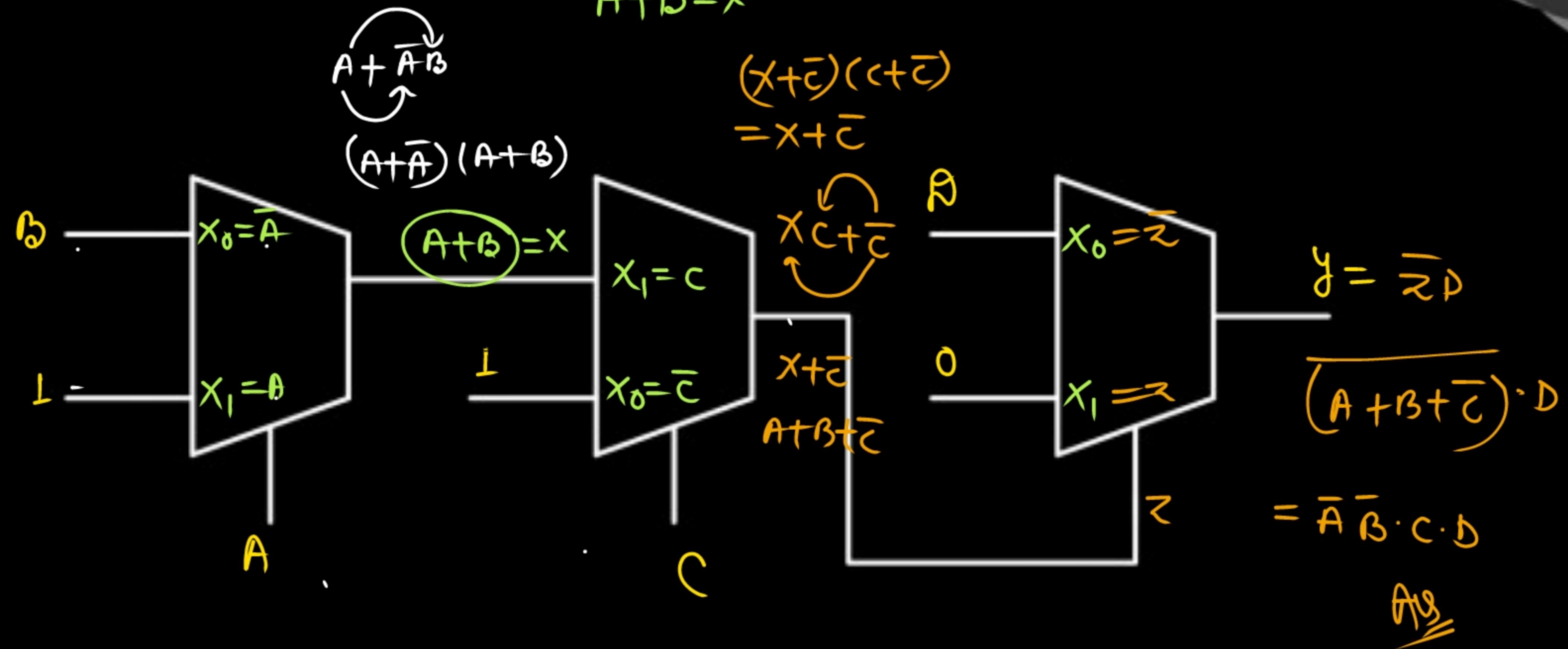
0      5      2      3      6

✓ 2

## Type(4) Cascading of MUX :-



Ex



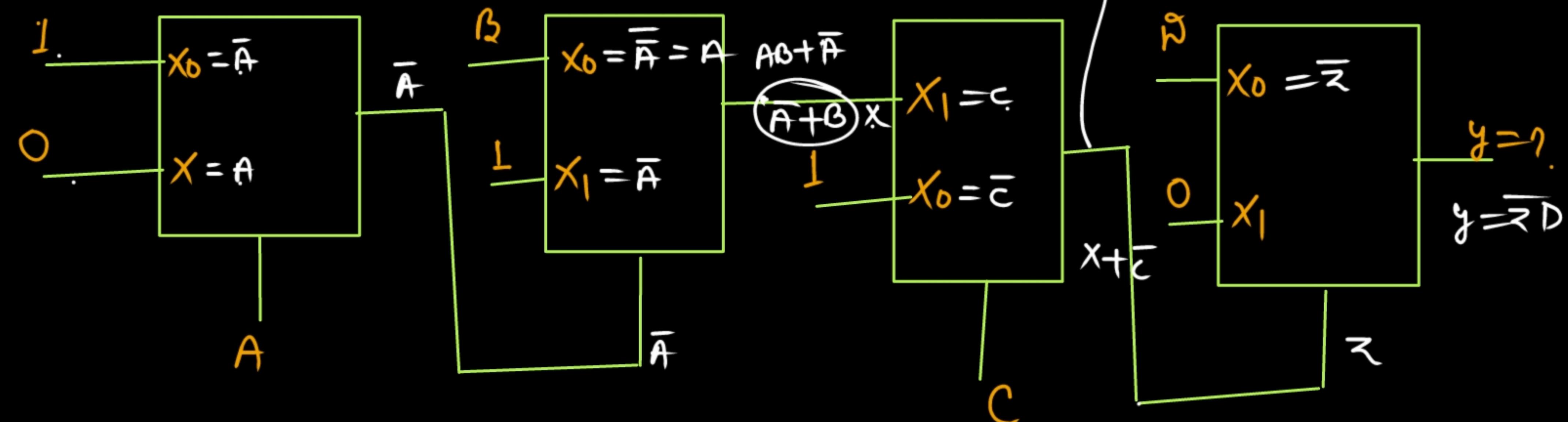
$$A + B + \bar{C} = z$$

Q

Find the O/P  $y=?$ .

$$\overline{A+B} = (\bar{A}+A)(\bar{A}+B) \\ = \bar{A}+B$$

$$x\bar{c}+\bar{c} = (x+\bar{c})(c+\bar{c}) \\ = x+\bar{c}$$



$$\dot{\bar{A}} + B = X$$

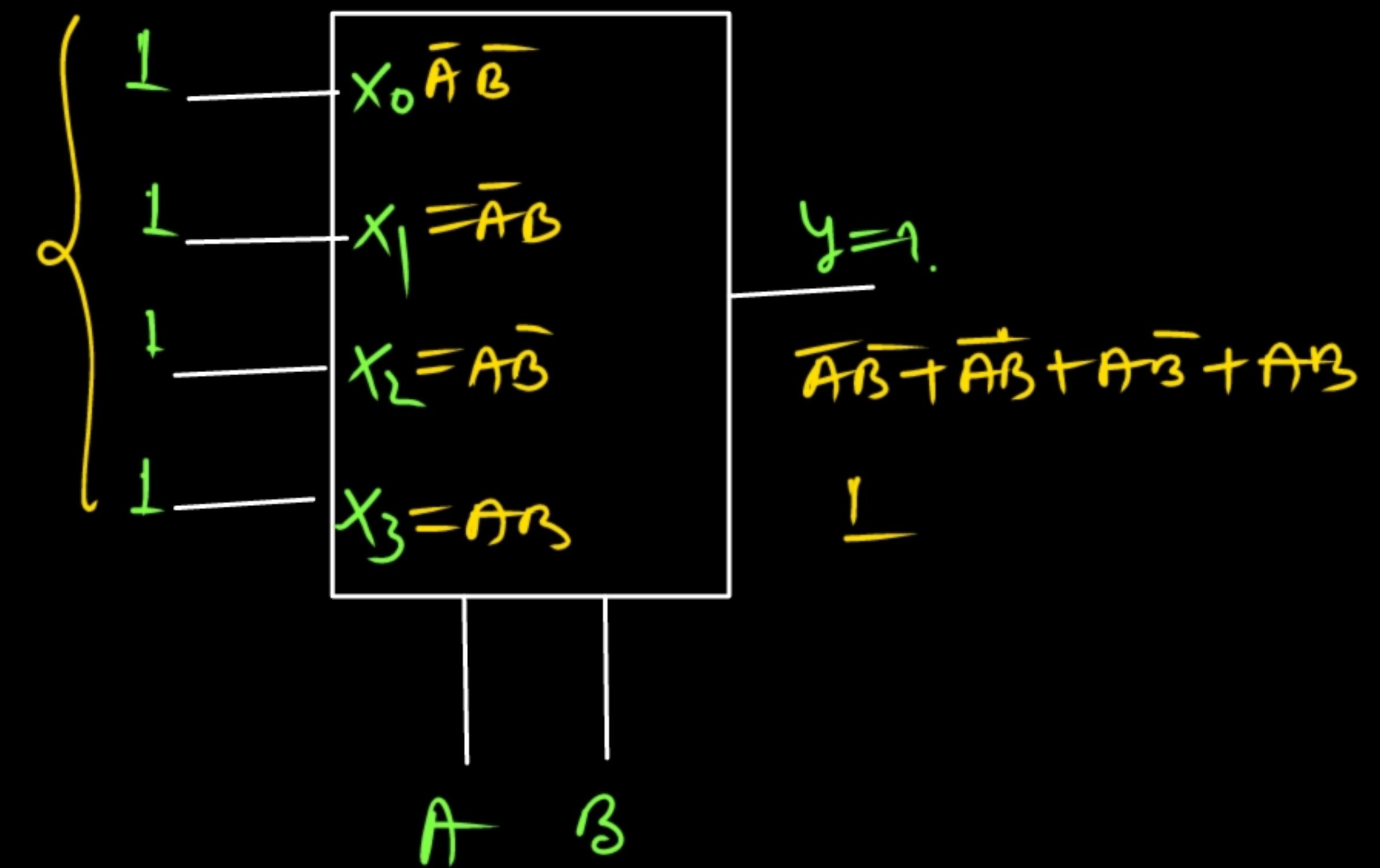
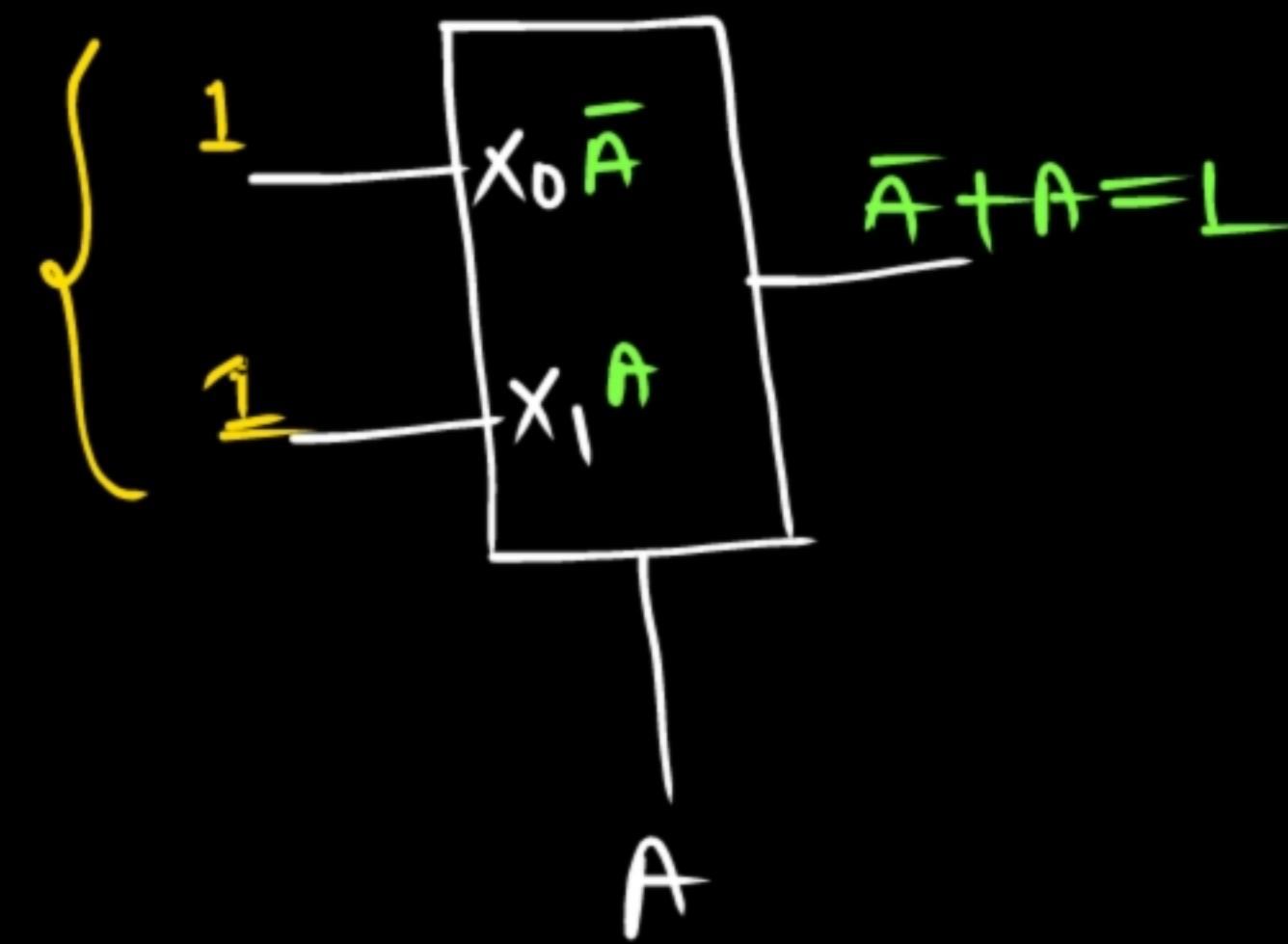
$\approx$

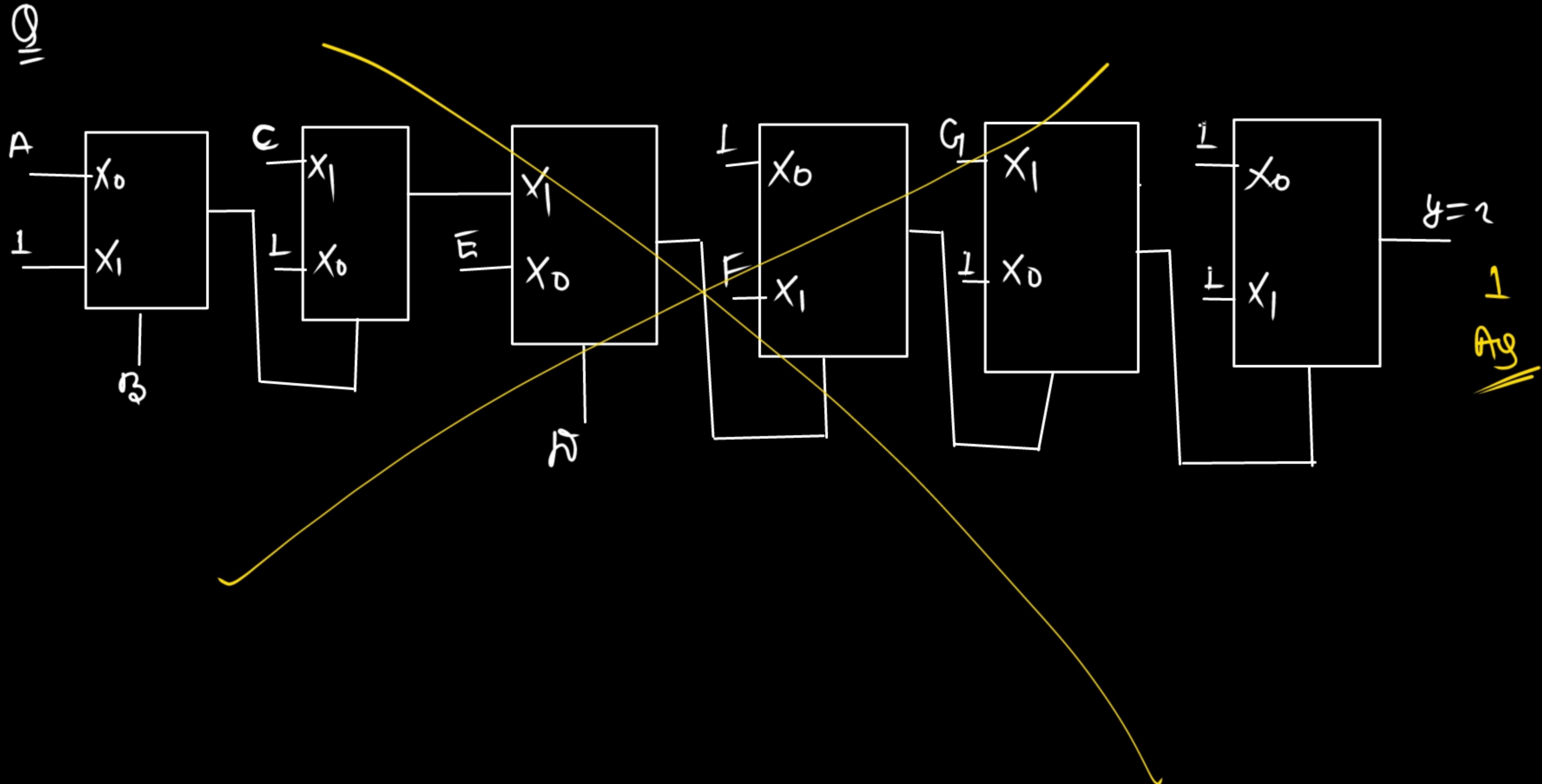
$$\dot{\bar{A}} + B + \bar{C} = z$$

$$y = \overline{\bar{A} + B + \bar{C}}D = \bar{A}\bar{B}CD$$

NAND = ⊕

NOTE





Thank you  
**GW**  
*Soldiers!*

