CS & IT ENGINEERING

Minimization

BOOLEAN ALGEBRA

Lecture No. 1

By- CHANDAN SIR

TOPICS TO BE COVERED

01 XOR,XNOR gate,THEOREM

02 D-MORGAN'S Law

03 QUESTION PRACTICE

04 DUAL & SELF DUAL

05 DISCUSSION

	NAND	NOR
$f = A \cdot B \cdot \bar{C} \cdot D \cdots$	$(2n-2)+K$	$(3n-3)-K$
$f = A+B+\bar{C}+D \cdots$	$(3n-3)-K$	$(2n-2)+K$

$AB+CD \longrightarrow$ Ans = 3 NAND

NOTE

X-OR

X-NOR

SOP	POS
AND-OR	OR-AND
NAND-NAND	NOR-NOR
Bubbled Method	Bubbled Method

XOR GATE, X-NOR GATE

Odd parity detector

Even parity Generator

XOR GATE

1) Symbol

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

$(A+B)(\bar{A}+\bar{B}) \rightarrow$ POS.

O/p = 1 when odd no. of 1's are connected in the inputs.

2) Truth Table

$A = B \quad y = 0$

$A = \bar{B} \quad y = 1$

A	B	$y = A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

XOR GATE, X-NOR GATE

XOR GATE

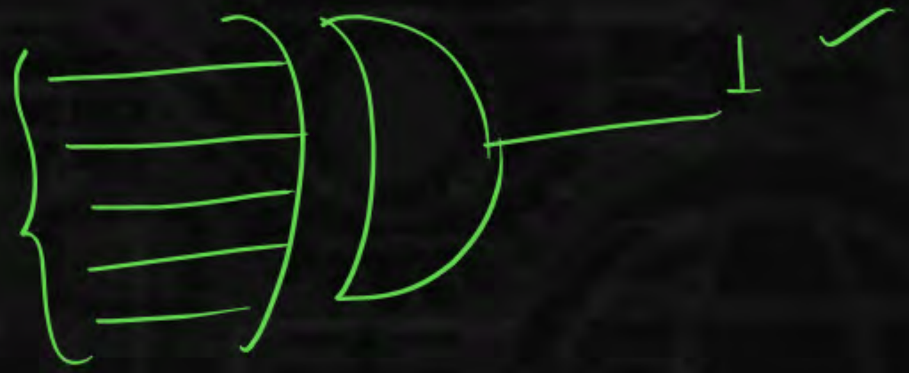
3) $A \oplus A = 0$

$A \oplus 0 = A$

$A \oplus \overline{A} = 1$

$A \oplus 1 = \overline{A}$

$\{1, 3, 5\}$

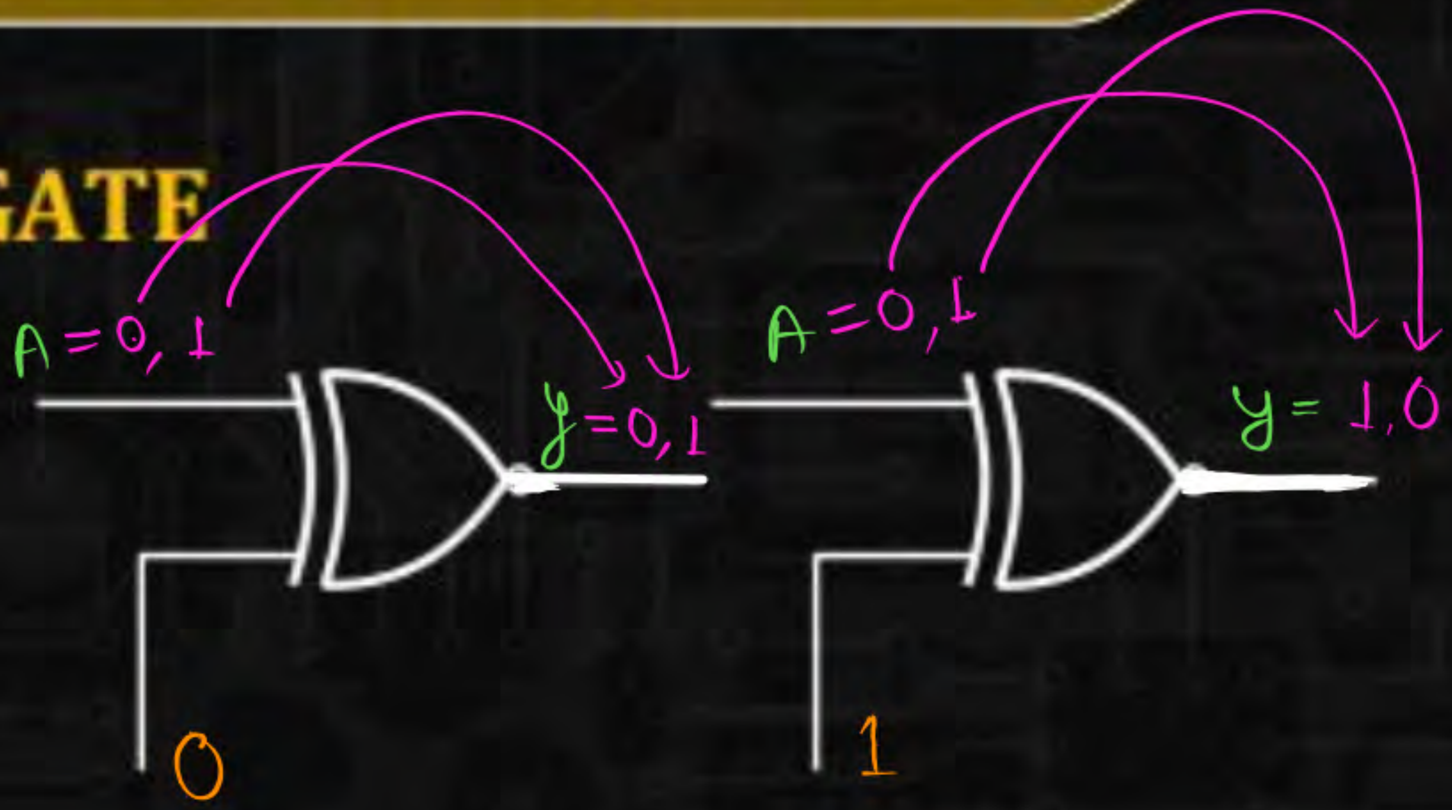


4) Odd parity detector ✓
Even parity generator ✓

XOR GATE, X-NOR GATE

XOR GATE

5)



"BUFFER"   "INVETER"

XOR GATE, X-NOR GATE

$\underbrace{A \oplus A}_{0} \oplus A$

$0 \oplus A = A$

XOR GATE

6) $A \oplus A = 0$

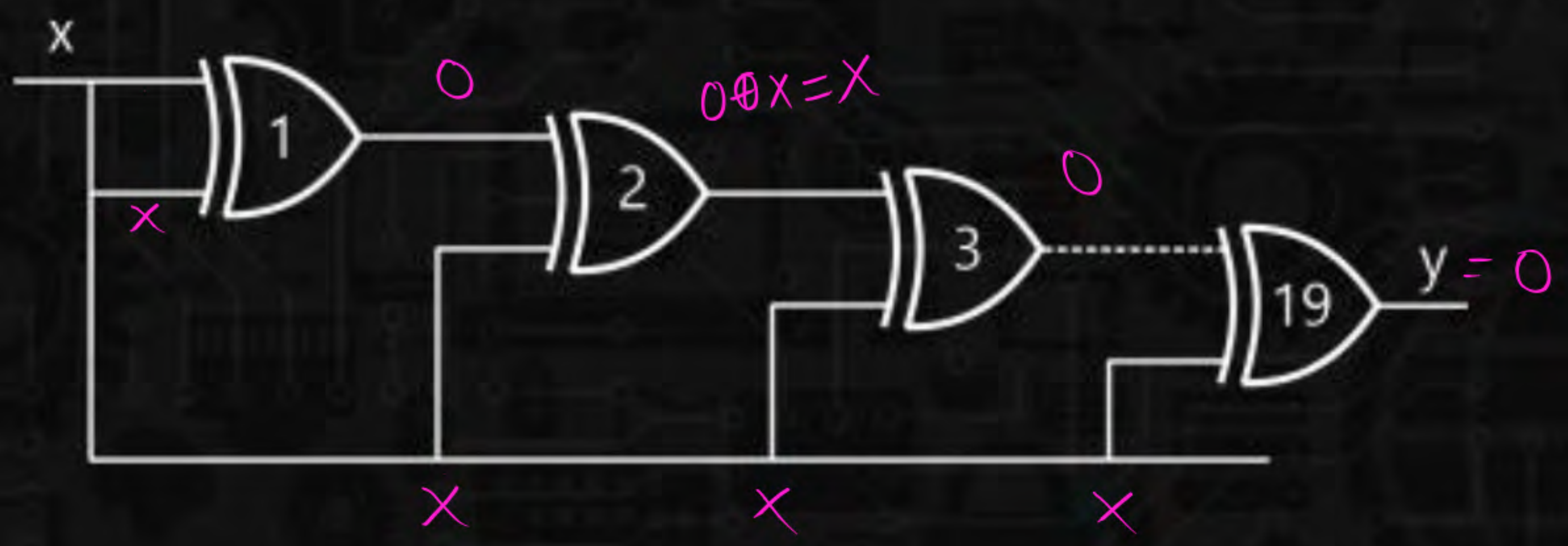
$A \oplus A \oplus A = A$

$A \oplus A \oplus A \oplus A = 0$

$A \oplus A \oplus A \ldots \oplus A =$

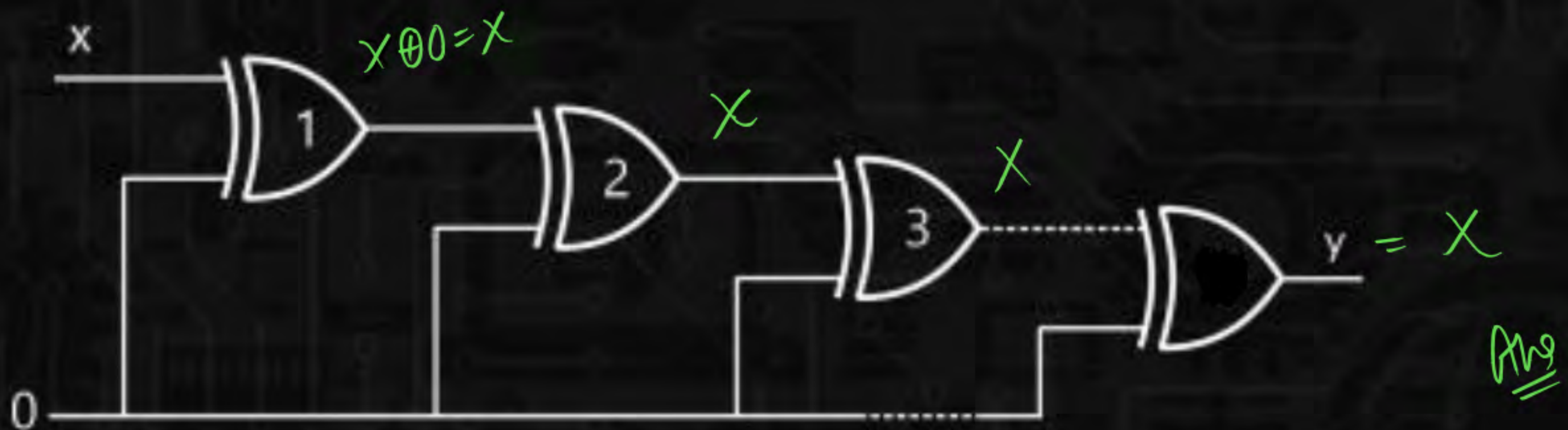
$$A \oplus A \oplus A \oplus A \cdots \oplus A = \begin{cases} 0 & \text{Even no. of 'A'} \\ A & \text{Odd no. of 'A'} \end{cases}$$

Q.1 Find the output y.

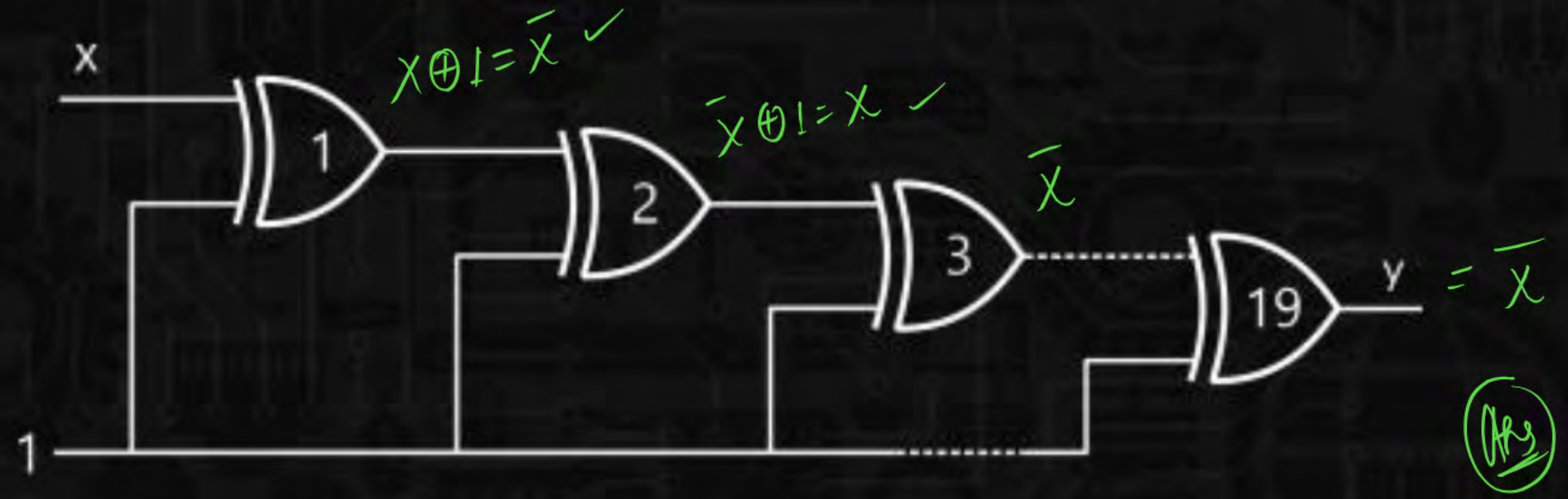


Q.2 Find the output y.

CJ sir



Q.3 Find the output y.

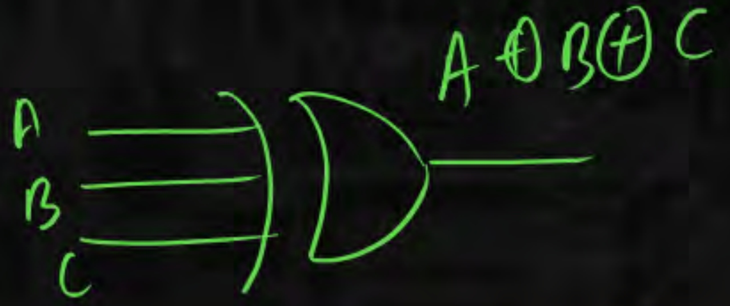


XOR GATE, X-NOR GATE

7) X-OR follows the commutative as well as associative Law

$A \oplus B = B \oplus A \Rightarrow$ commutative Law

$A \oplus (B \oplus C) = (A \oplus B) \oplus C$ Associative Law



	ABC	A⊕B⊕C	(A⊕B)⊕C
0	000	0	0
1	001	1	1
2	010	1	1
3	011	0	0
4	100	1	1
5	101	0	0
6	110	0	0
7	111	1	1

$\boxed{A \oplus B \oplus C = \sum m(1,2,4,7)}$

XOR GATE, X-NOR GATE

X-NOR GATE

1) Symbol

$A \odot B = \overline{A \oplus B}$

$SOP \rightarrow \bar{A}\bar{B} + AB.$

$POS \rightarrow (\bar{A}+B)(A+\bar{B})$

2) Truth Table

A	B	$y = A \odot B$
0	0	1
0	1	0
1	0	0
1	1	1

XOR GATE, X-NOR GATE

X-NOR GATE

3) $A = B$ $\quad\quad y = 1$

$A \neq B$ $\quad\quad y = 0$

$A = \bar{B}$

$A \odot A = 1$

$A \odot 1 = A$

$A \odot \bar{A} = 0$

$A \odot 0 = \bar{A}$

A	B	$y = A \odot B$
0	0	1
0	1	0
1	0	0
1	1	1

XOR GATE, X-NOR GATE

X-NOR GATE

4) Even parity detector

   Odd parity generator

   Equivalence Logic

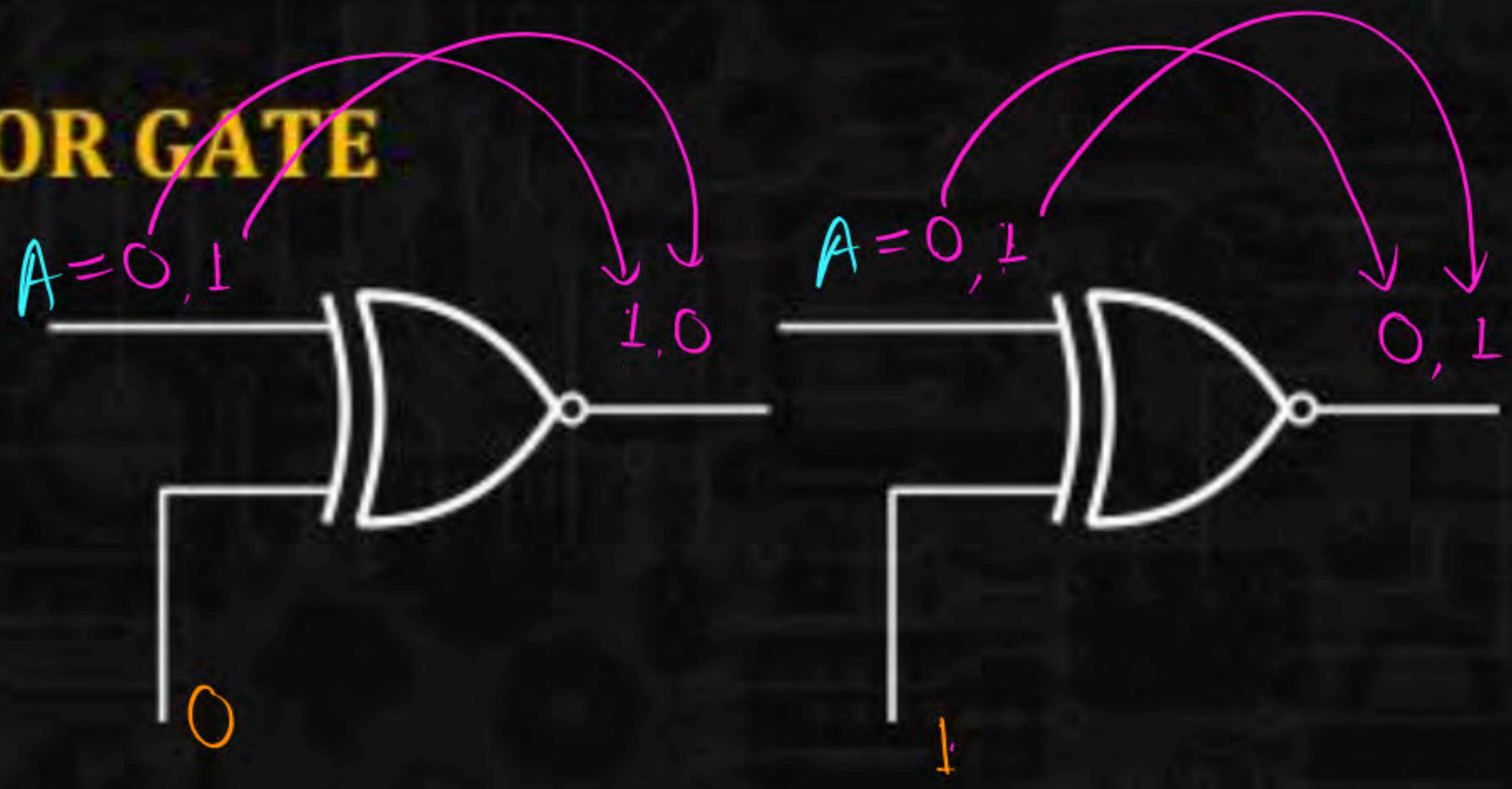
   Coincidence Logic

A	B	$y = A \odot B$
0	0	1
0	1	0
1	0	0
1	1	1

XOR GATE, X-NOR GATE

X-NOR GATE

5)



INVERTER

BUFFER

XOR GATE, X-NOR GATE

Commutative Law

$A \odot B = B \odot A$

FOR EVEN NUMBER OF INPUTS :→

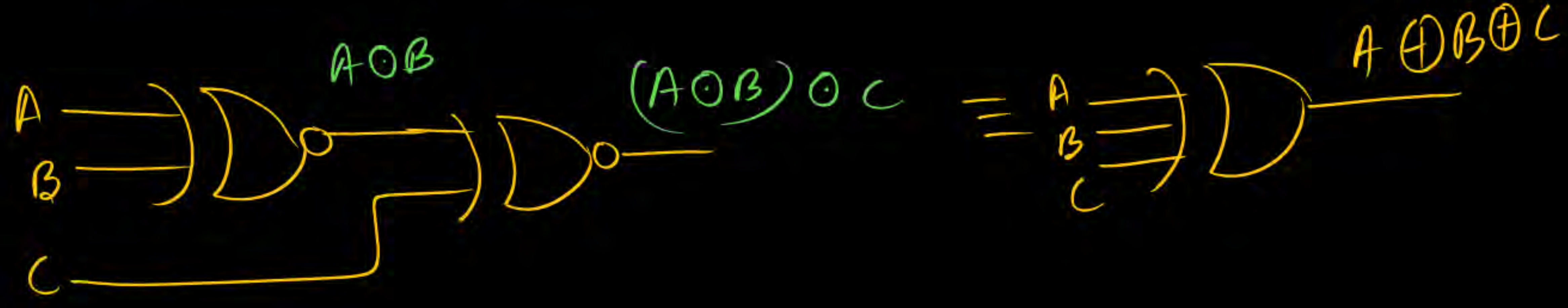
$$A \odot B = \overline{A \oplus B}$$

$$A \odot B \odot C \odot D = \overline{A \oplus B \oplus C \oplus D}$$

$$A \odot B \odot C \odot D = ((A \odot B) \odot C) \odot D = (A \odot B) \odot (C \odot D)$$

X-NOR follows the associative law ✓

Odd no. of Variables



XOR GATE, X-NOR GATE

$(A \odot B) \odot C = \Sigma m(1,2,4,7)$

$= A \oplus B \oplus C$

Associative Law

	A B C	$A \odot B \odot C$	$(A \odot B) \odot C$
0 →	0 0 0	1	0
1 →	0 0 1	0	1
2 →	0 1 0	0	1
3 →	0 1 1	1	0
4 →	1 0 0	0	1
5 →	1 0 1	1	0
6 →	1 1 0	1	0
7 →	1 1 1	0	1

$$A \odot B \odot C \odot D = \overline{A \oplus B \oplus C \oplus D}$$

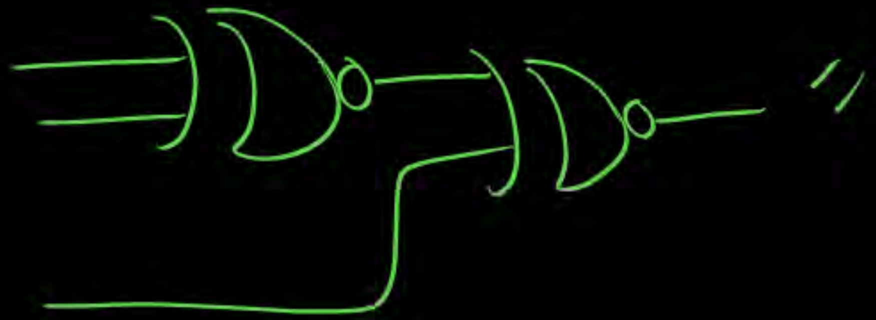
Even no. of Variables.

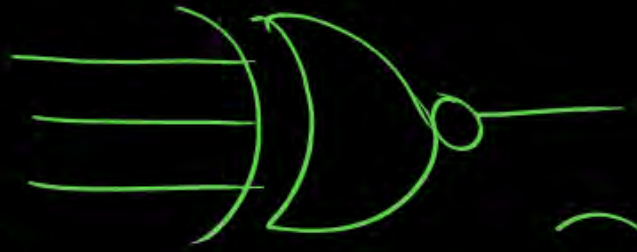
O/P will be high when Even no. of 1's are connected in the inputs.

$$(A \odot B) \odot C = A \oplus B \oplus C$$

Odd no. of Variables.

O/P will be high when ODD number of 1's are connected in the inputs.





✓

Theortical

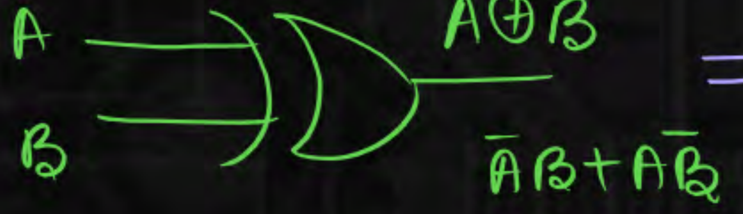
X

even number of 1 in the inputs $\longrightarrow$ o/p = 1

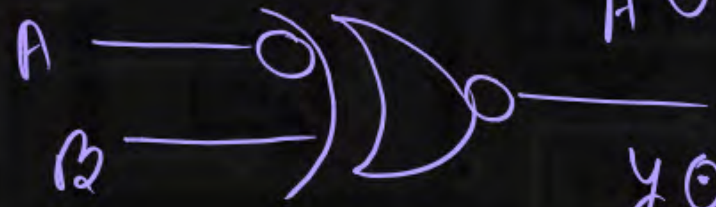
XOR GATE, X-NOR GATE

$\bar{A} = y$

Alternate Symbol



$=$



$\bar{A} \odot B$

$y \odot B = \bar{y}\bar{B} + yB$

$A\bar{B} + \bar{A}B = A \oplus B$

$$A \oplus B = \bar{A} \odot B = A \odot \bar{B} = \overline{A \odot B} = \bar{A} \oplus \bar{B}$$

$$A \oplus B = \overline{A \odot B} = \bar{A} \odot B = A \odot \bar{B} = \bar{A} \oplus \bar{B}$$

$\bar{A} \oplus B \qquad \bar{A} = X$

$X \oplus B$

$\bar{X}B + X\bar{B}$

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

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

$A \odot B$

$$A \odot B = \overline{A \oplus B} = \bar{A} \odot \bar{B} = \bar{A} \oplus B = A \oplus \bar{B}$$

Q.4 The Boolean function given below:
$f(A, B) = (A \oplus B) \oplus AB$
which statement is/are correct?

MSQ

A. It is a OR GATE

B. It is a NAND GATE

C. It requires 3 NAND gate to implement the function

D. It required 2 NAND gates to implement the function

$(A \oplus B) \oplus (AB)$

$(\overline{A \oplus B})AB + (A \oplus B)\overline{AB}$

$(A \odot B)AB + (A \oplus B)(\bar{A} + \bar{B})$

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

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

$B + A\bar{B}$

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

$A+B$

$$(A\oplus B)\oplus(AB)$$

$$(\overline{A\oplus B})AB + (A\oplus B)\cdot\overline{AB} = (A\odot B)AB + (A\oplus B)(\bar A+\bar B)$$

$$\Rightarrow(\bar A\bar B+AB)AB + (\bar AB+A\bar B)(\bar A+\bar B)$$

$$= \cancel{\bar A\bar B AB}^{\,0} + AB\cdot AB + \bar A\cdot\bar AB + \cancel{\bar A\cdot A\bar B}^{\,0}$$

$$+ \cancel{\bar AB\cdot\bar B}^{\,0} + A\bar B\cdot\bar B$$

$$= AB + \bar AB + A\bar B$$

$$AB + A\bar B + \bar AB$$

$$A[B+\bar B] + \bar AB$$

$$A + \bar AB$$

$$(A+\bar A)(A+B)$$

$$A+B$$

OR


THANK YOU GW
SOLDIERS !