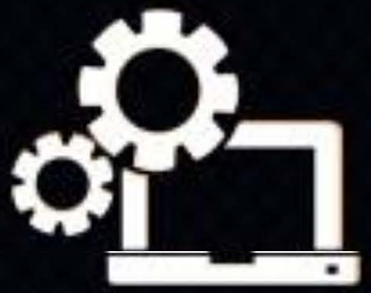
CS & IT ENGINEERING

Digital Logic

Logic Gate



Lecture No. 04

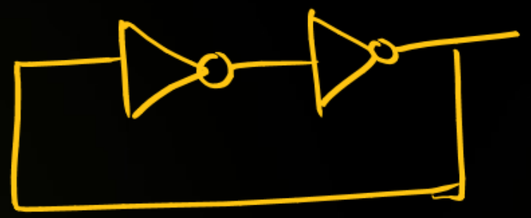
By- CHANDAN SIR

01 NAND GATE

02 NOR GATE

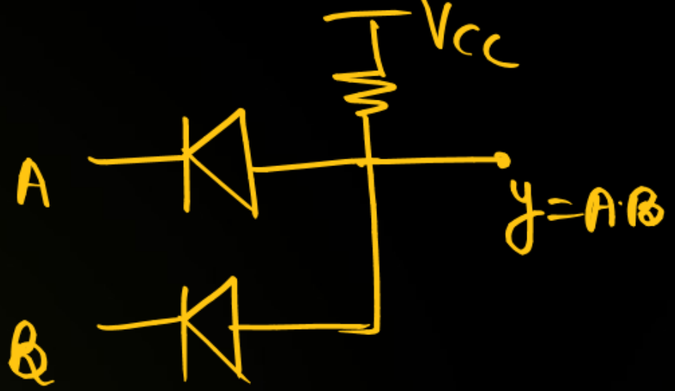
03 Discussion

INVERTER

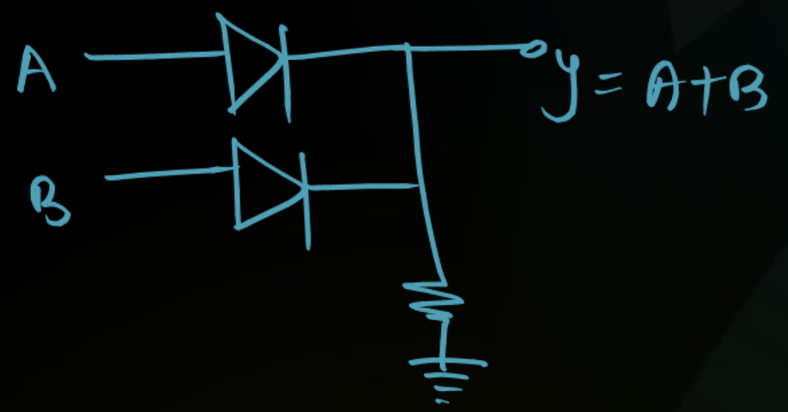


$$f = \frac{1}{2N \times C_{pd}}$$

AND GATE

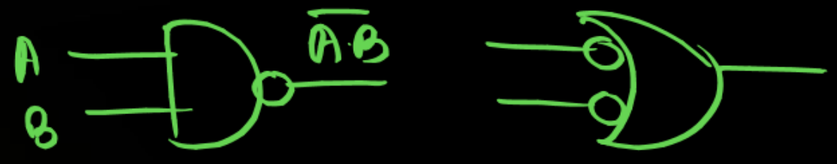


OR GATE



A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

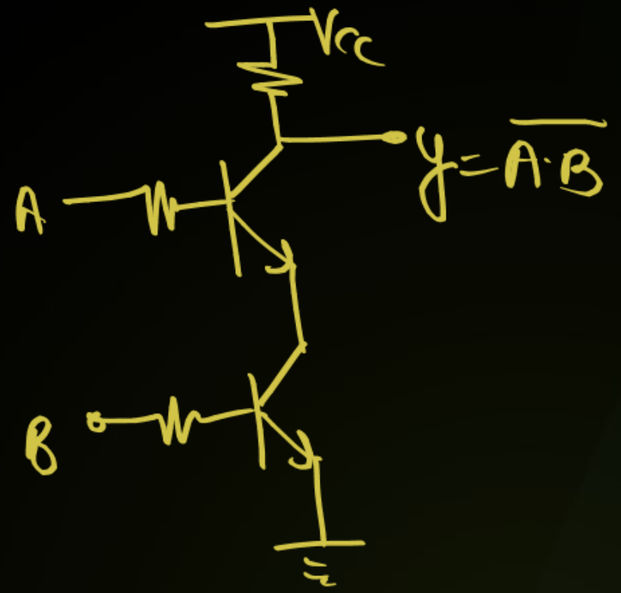
NAND



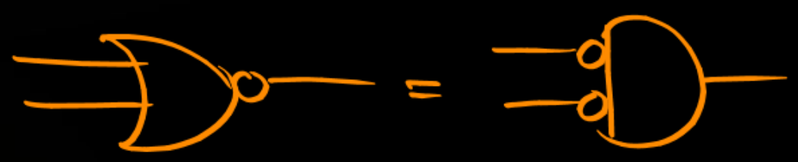
$\overline{A \cdot B} = \overline{B \cdot A}$ ✓

$\overline{(\overline{A \cdot B}) \cdot C} \neq \overline{A \cdot (\overline{B \cdot C})}$ X → Associative Law X

A	B	$Y = \overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0



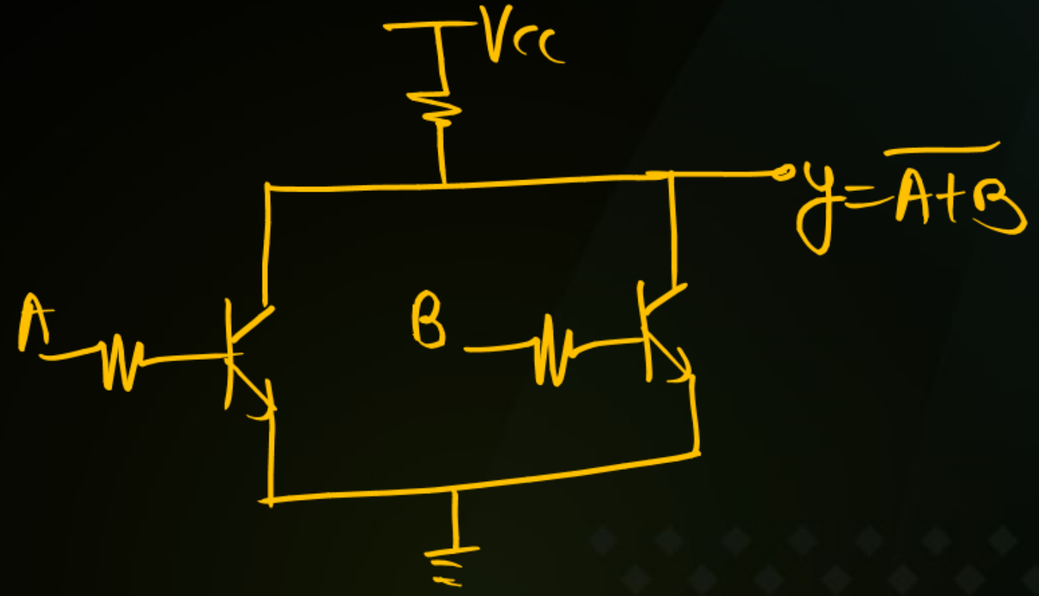
NOR GATE



$\overline{A+B} = \overline{B+A}$ Commutative Law ✓

$\overline{\overline{(A+B)}+C} \neq \overline{A+\overline{(B+C)}}$ ✗

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



Q.

MSQ

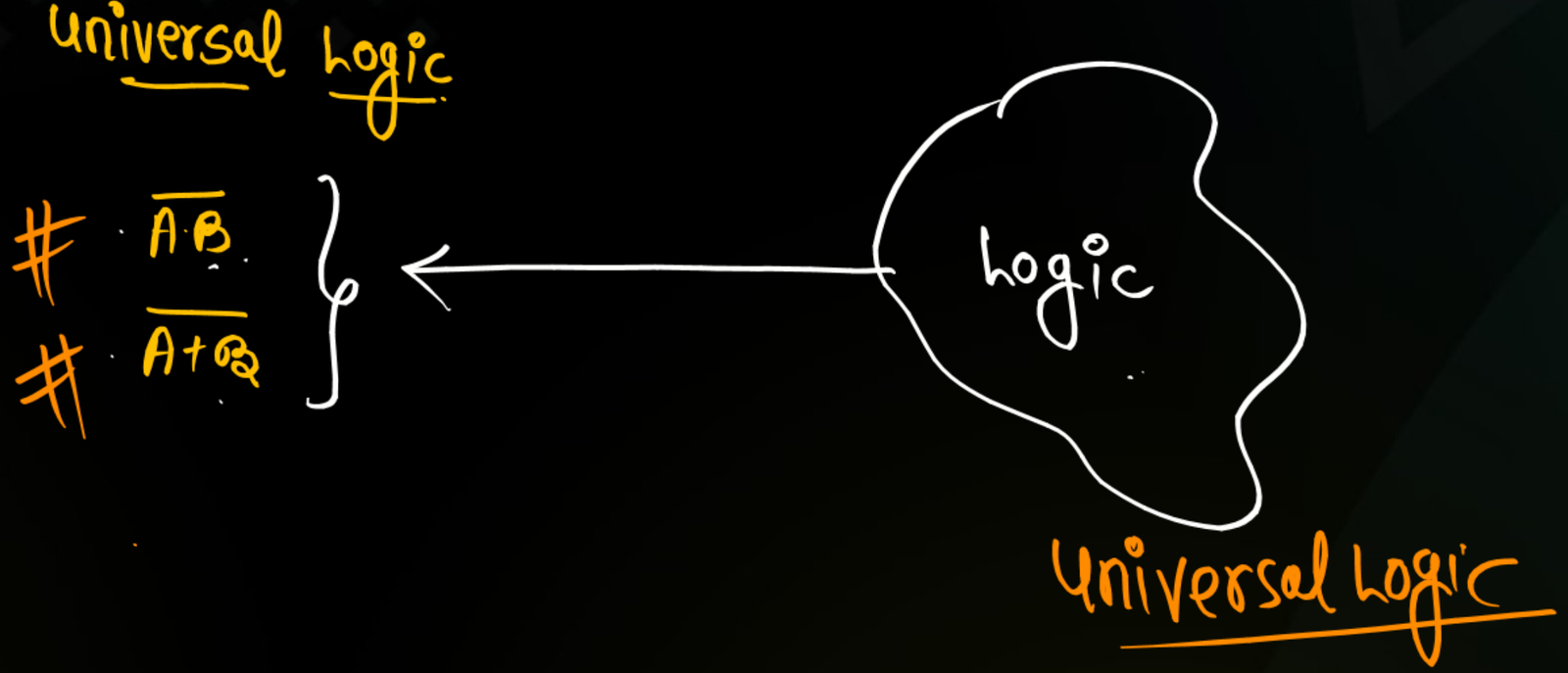
Which of the following option(s) is/are called universal logic?

A. $\left(\overline{A+B}\right)$

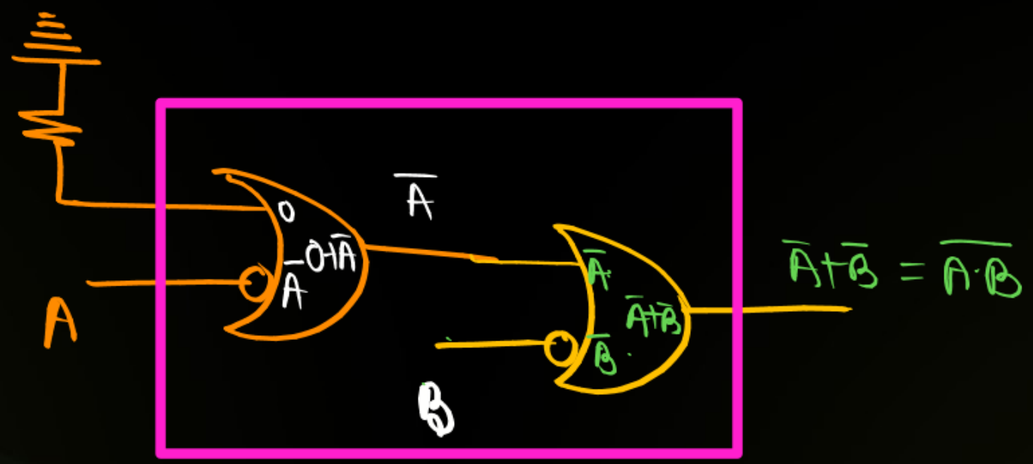
B. $\left(\overline{A \cdot B}\right)$

C. $\left(A+\overline{B}\right)$

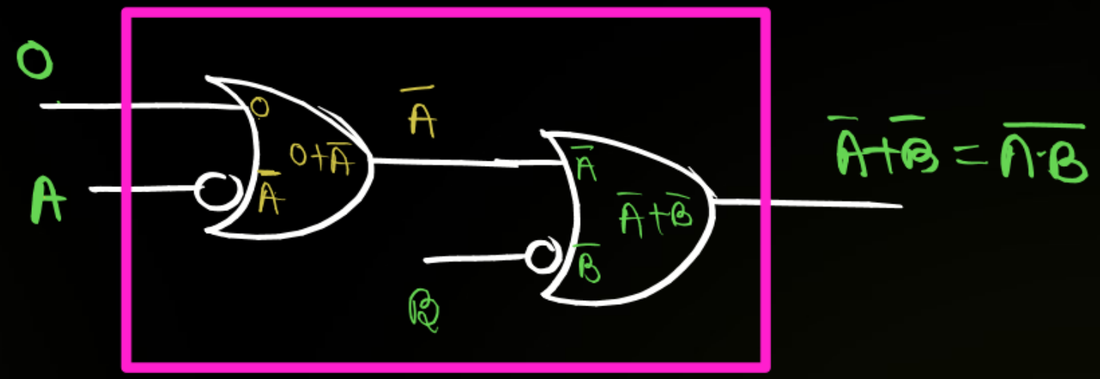
D. $A \cdot \overline{B}$


Universal Logic
$\overline{A \cdot B}$
$\overline{A + B}$
logic
Universal Logic

$A + \bar{B}$

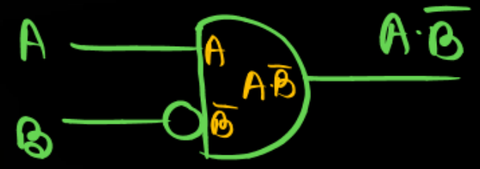


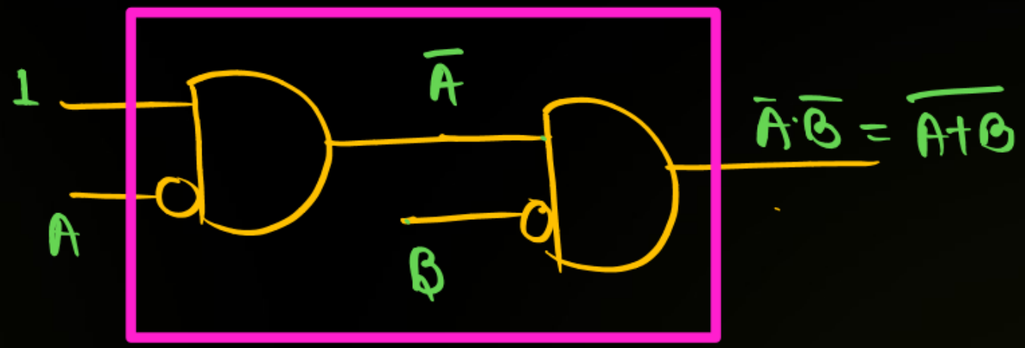
NAND


0
A
0
$\bar{A}$
$0+\bar{A}$
$\bar{A}$
$\bar{A}$
$\bar{A}+\bar{B}$
$\bar{B}$
B
$\bar{A}+\bar{B}=\overline{A \cdot B}$

NAND

$A \cdot \bar{B}$





NOR

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

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

$\bar{A} + B$

$A + \bar{B}$

$\bar{A} \cdot B$

$A \cdot \bar{B}$

Multiplexer

Decoder + OR Logic

$\Longrightarrow$ Universal Logic

X-OR GATE

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

X-NOR GATE

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

Distribution Theorem

$A + BC = (A+B)(A+C)$

Ex. $A + \bar{A}B = (A+\bar{A})(A+B)$

$= 1 \cdot (A+B)$

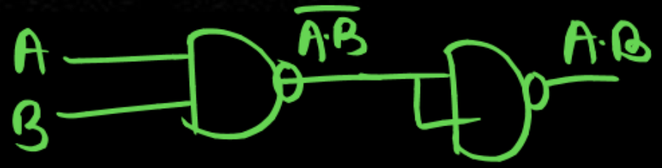
$= A + B$

NAND, NOR GATE

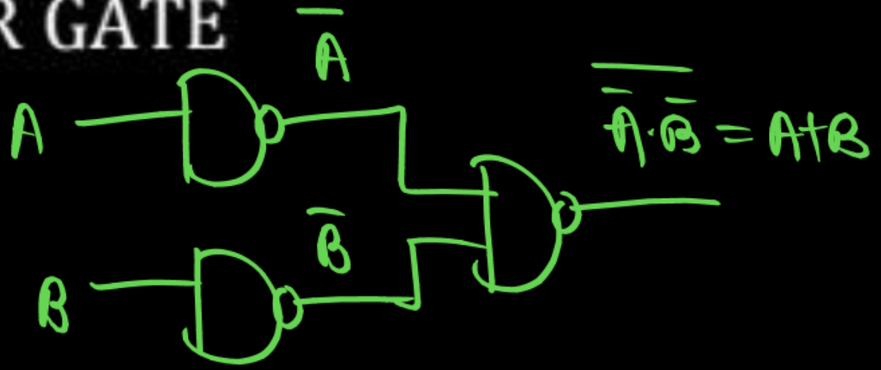
NAND AS UNIVERSAL LOGIC

1. NOT GATE

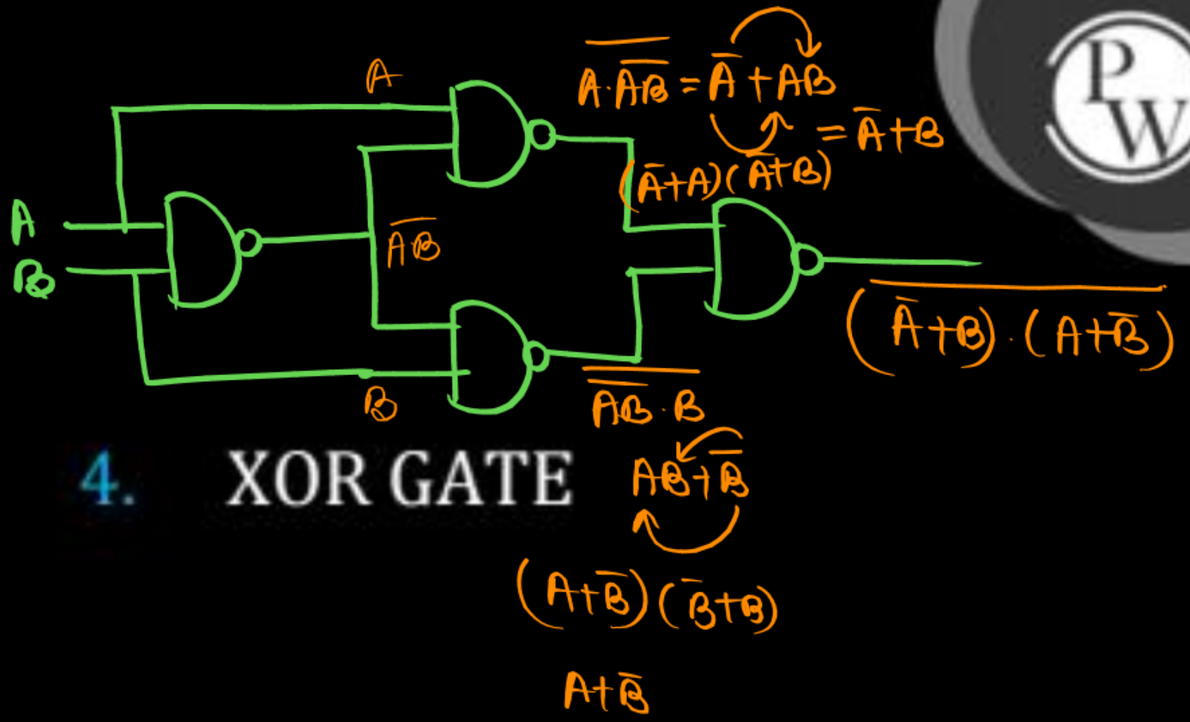
2. AND GATE



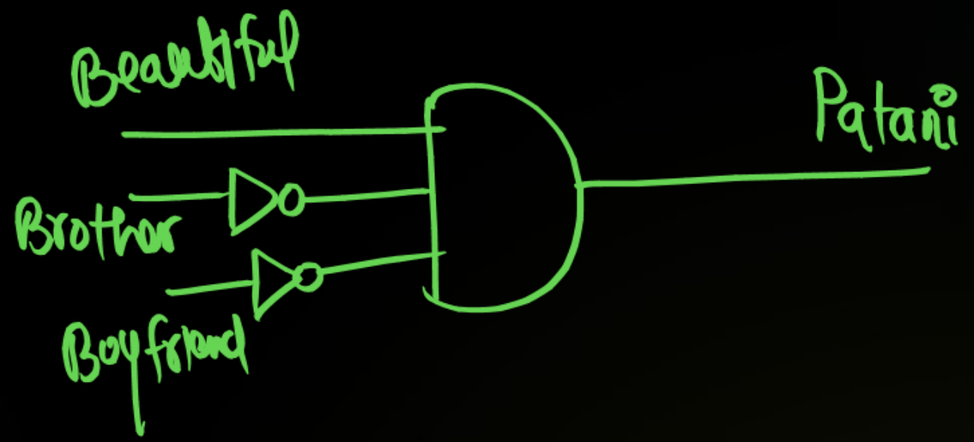
3. OR GATE



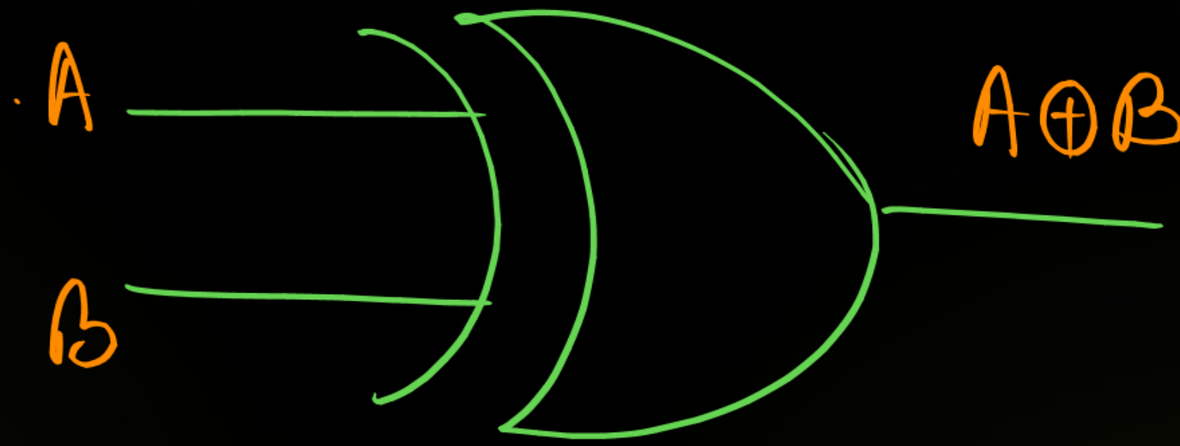
4. XOR GATE



5. XNOR GATE


Beautiful
Brother
Boyfriend
Patani

X-OR



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

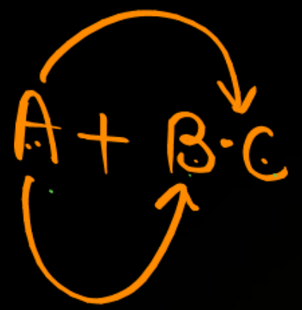
X-NOR

Law

Theorem

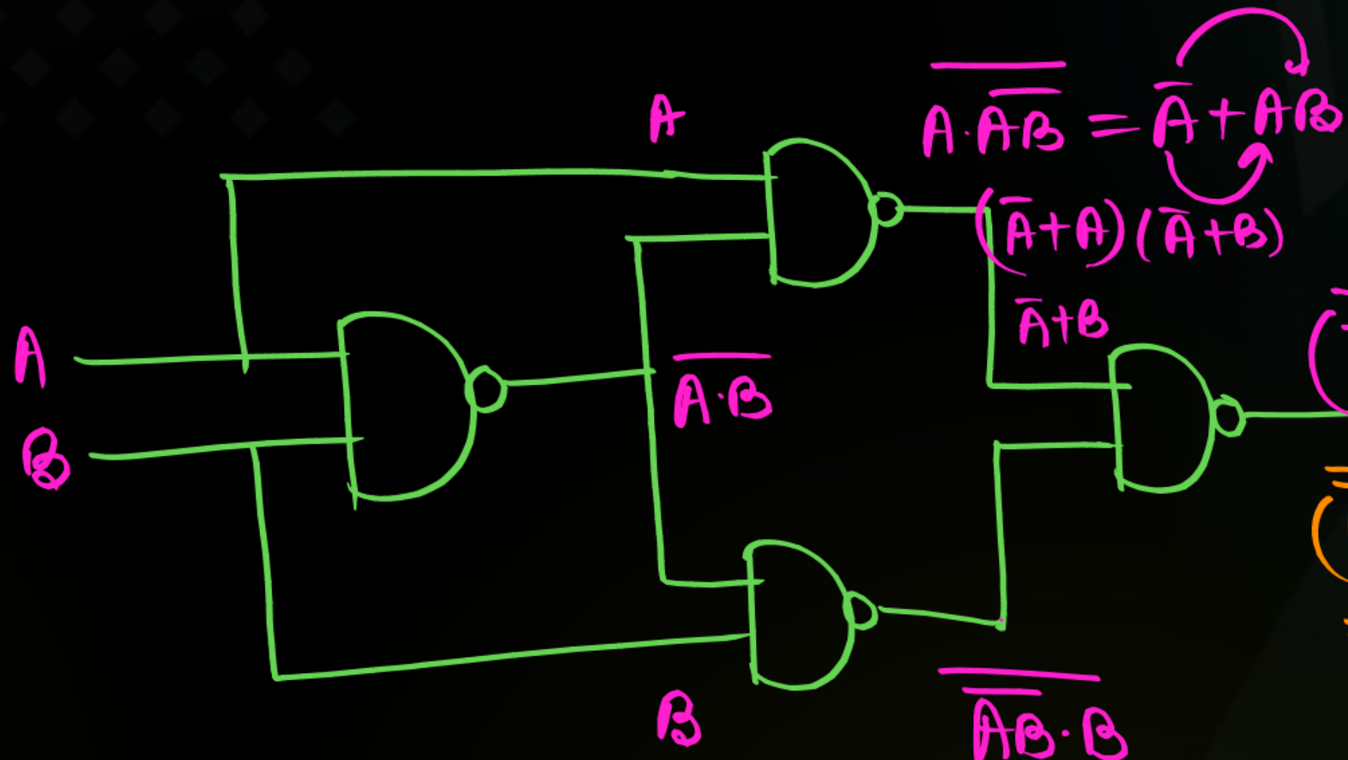
$$A \odot B = \bar{A}\bar{B} + AB$$

Distribution Theorem

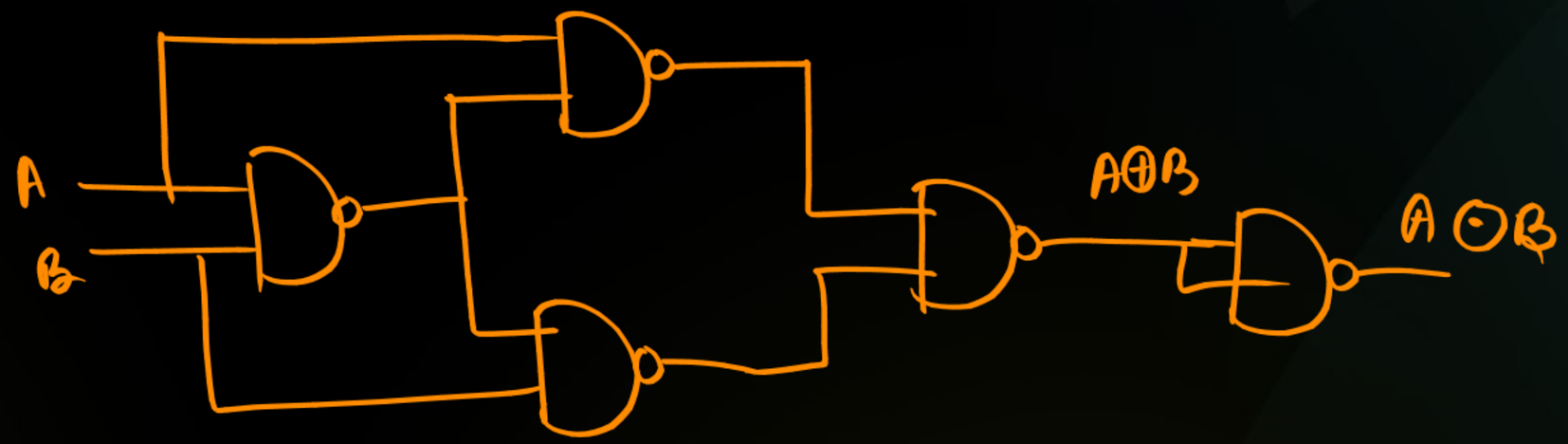


$$A + B \cdot C = (A+B)(A+C)$$

$$X + YZ = (X+Y)(X+Z)$$


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

Telegram → t.me/CJSIR



	NAND	NOR
NOT	1	1
AND	2	3
OR	3	2
X-OR	4	5
X-NOR	5	4
NAND	1	4
NOR	4	1

Q Find the minimum no. of two input NAND GATE required to the Implement the Logic given below—

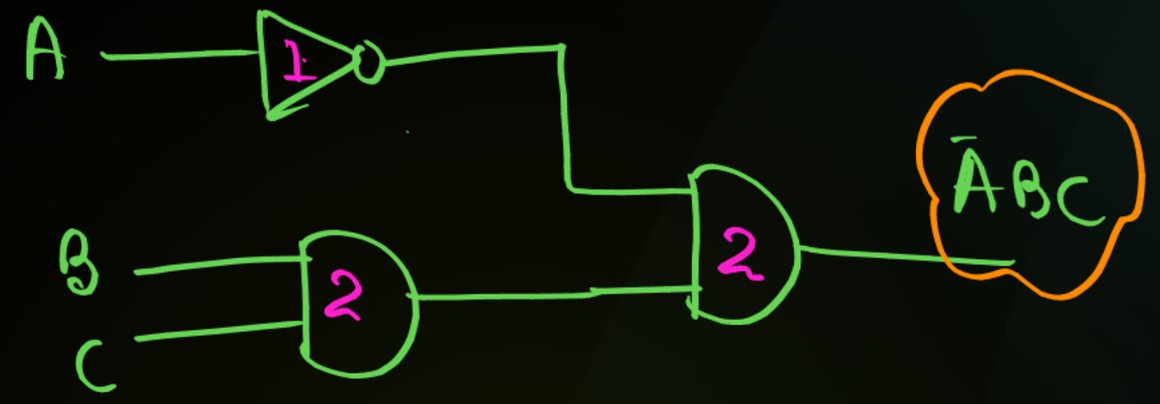
$$f(A,B,C) = \bar{A} \cdot BC$$

(A) 3

(B) 4

(C) 5

(D) None



1 + 2 + 2 = (5)

Q Find the minimum no. of two input NAND GATE required to implement the Logic given below?

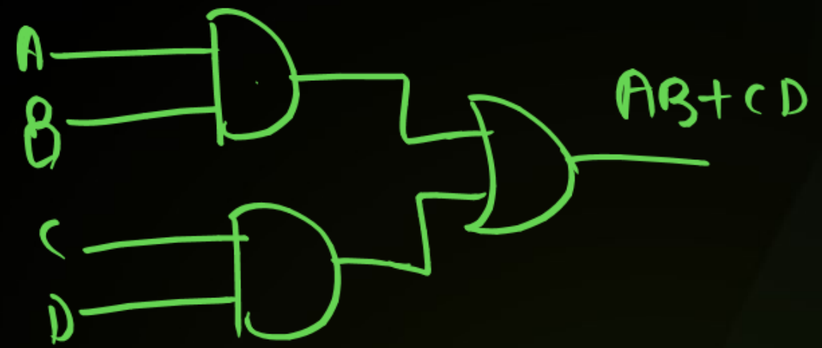
$$f(A,B,C,D) = AB + CD$$

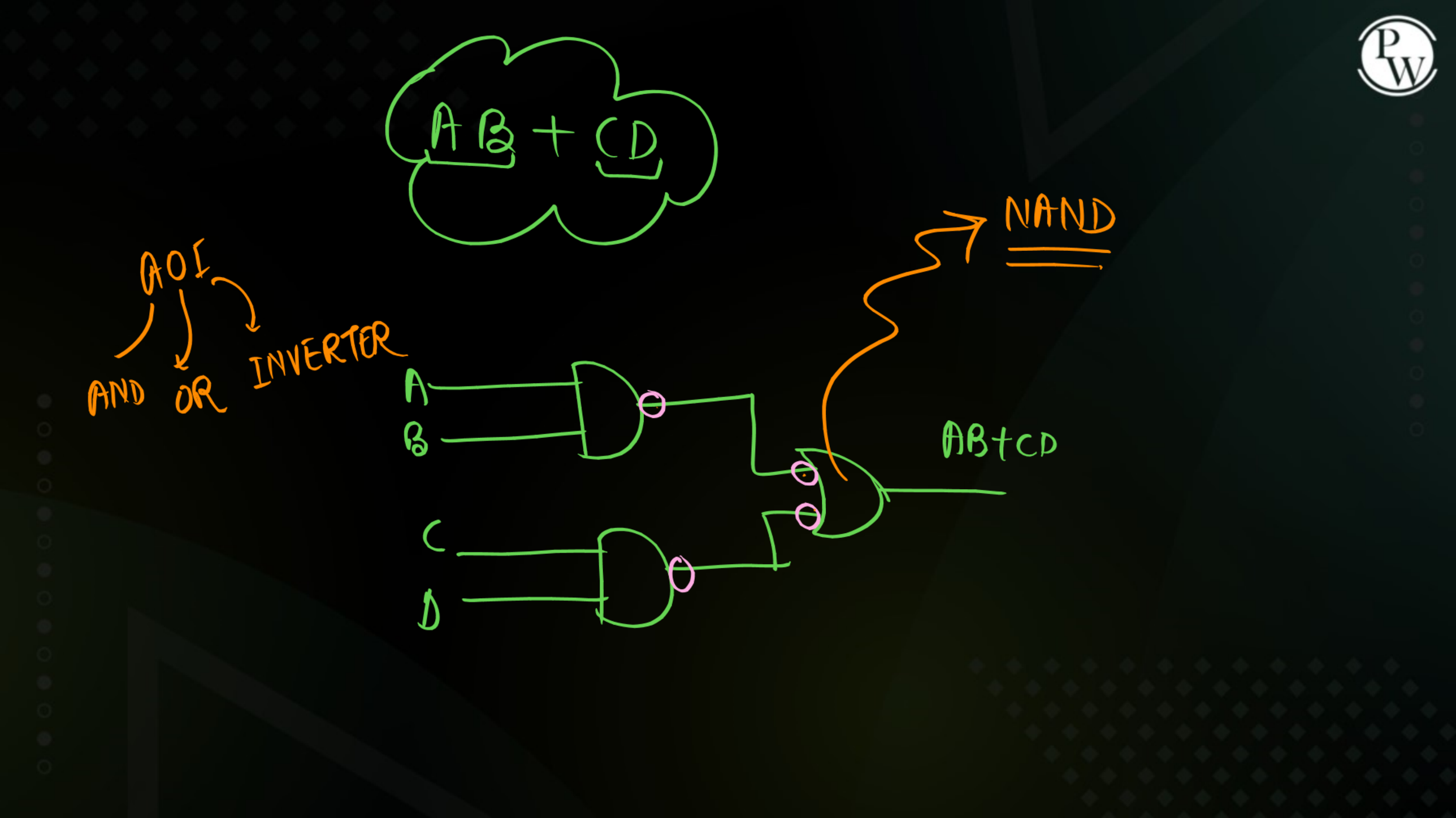
(A) 1

~~(B) 3~~

~~(C) 7~~

(D) 5




AB + CD
AOI
AND
OR
INVERTER
NAND
A
B
C
D
AB+CD

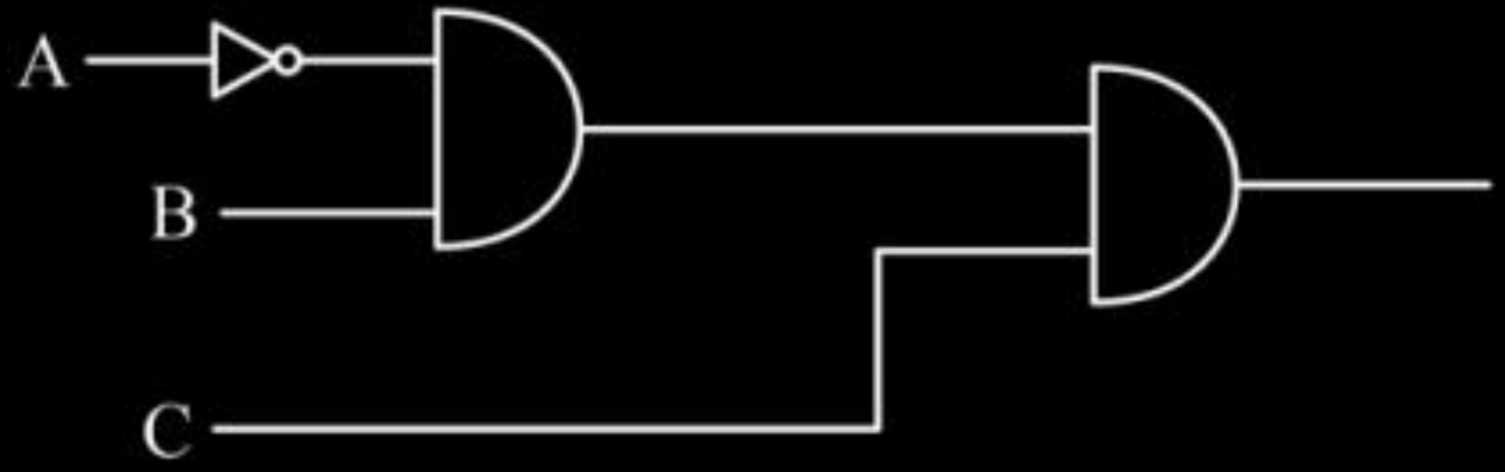
Q $A + BC$

NAND = 2

Q.

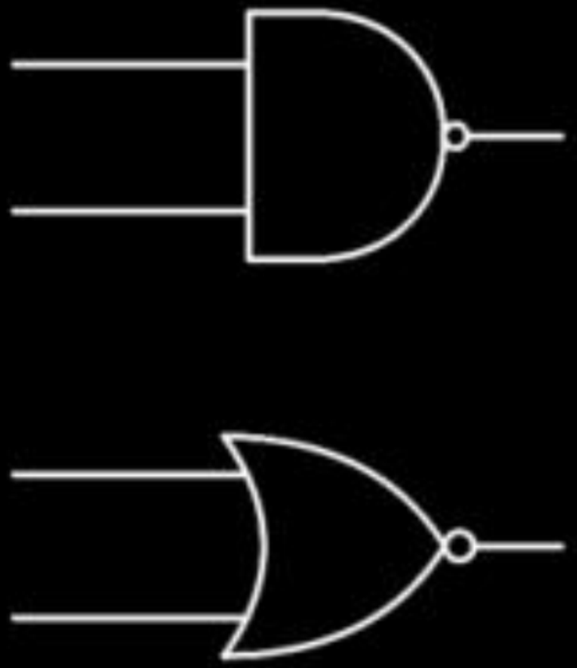
NAT

For the following circuit diagram minimum numbers two NAND gate required.



NAND, NOR GATE

- **Alternate Symbol**



Telegram channel

t.me/CJ sir

Thank you GW Soldiers !