CS & IT ENGINEERING

Digital Logic

Logic Gate

Lecture No. 07

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TOPICS TO BE COVERED

X-NOR GATE

01 Question Practice

02 Discussion

Tel → time/CJSIR

number of 1 = parity

Odd number of 1 detector

Odd parity detector

X-NOR GATE :-

① Symbol

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

② Truth Table

A	B	$A \odot B$
0	0	1
0	1	0
1	0	0
1	1	1

③ $A = B \quad y = 1$

$A = \bar{B} \quad y = 0$

④ Even parity Detector

Equal Detector

Equivalance Logic

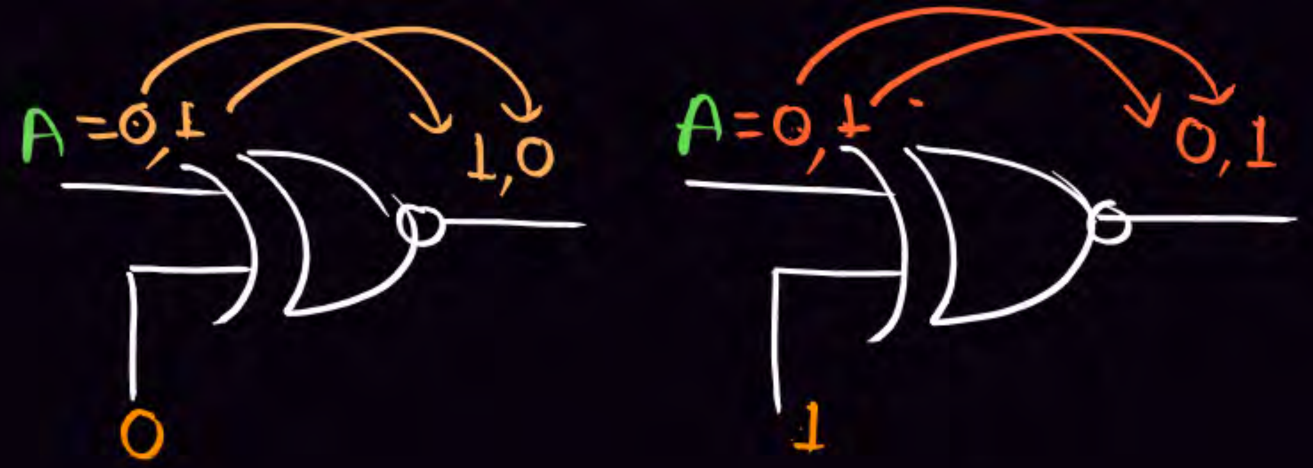
Coincidance Logic

(5) $A \odot A = 1$

$A \odot 1 = A$

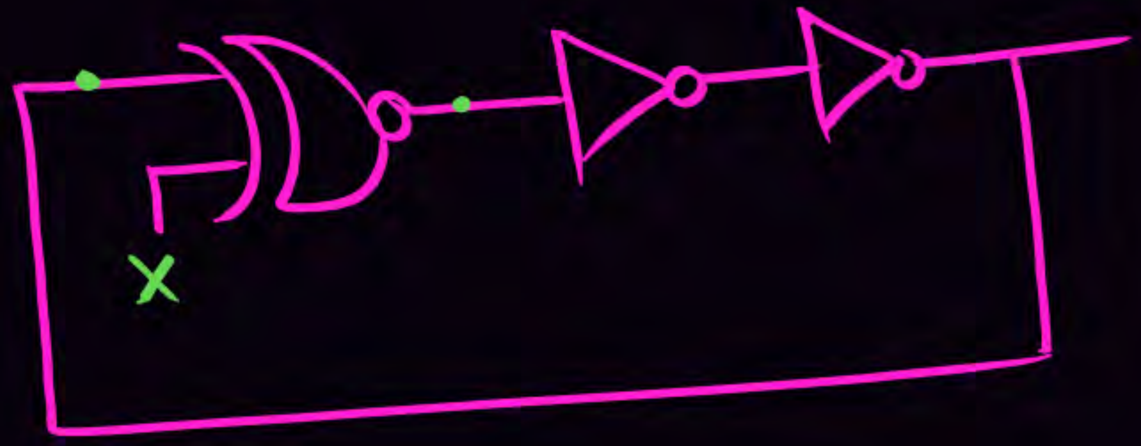
$A \odot \bar{A} = 0$

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

(6) 

INVERTER BUFFER

Ex



(A) Astable Multivibrator $x = 0$

(B) Bistable Multivibrator $x = 1$

(7) X-NOR GATE Commutative as well as associative Law follow karta hai...

EVEN NUMBER OF INPUT :→

Case (1)

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

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

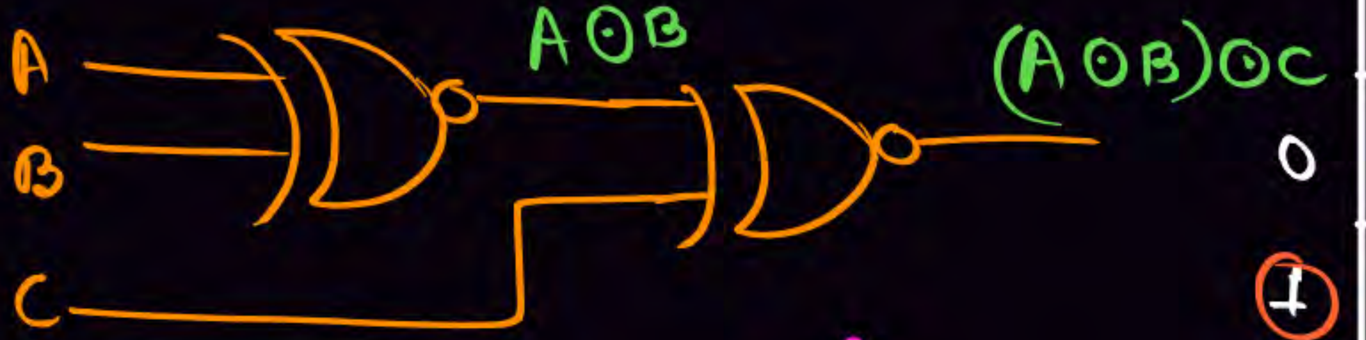
$= A \odot B \odot C \odot D$

Output will be high for even no. of inputs are high.

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

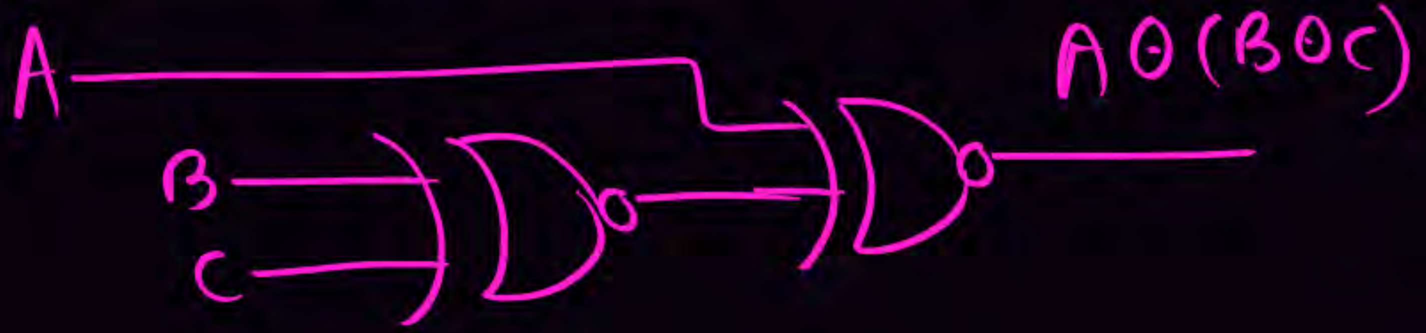
$A \odot B \odot C \odot D = \overline{A \oplus B \oplus C \oplus D}$

Case (2)



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

└──> Associative Law ✓



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

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

For Even Variables.

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

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

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

* O/P will be high for even no. of 1's in the inputs.

For Odd Variables.

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

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

O/P will be high for odd number of 1's in the inputs.

Impractical (Theortical)

o/p will be high for even inputs are high.

Magic

$A \odot B$

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

=

$A \oplus \bar{B}$

$\bar{B} = X$

$A \oplus X$

$\bar{A}X + A\bar{X}$

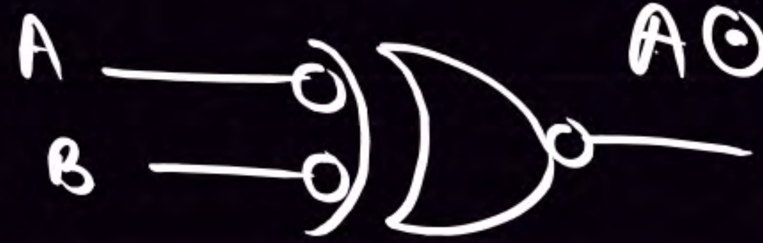
$\bar{A}\bar{B} + A\bar{\bar{B}}$

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

=

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

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



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

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

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

HW

Q1 $\overline{A} \oplus B \oplus C =$

Q2 $A \oplus B \oplus AB$

Q3 $(A \odot B) \oplus C$

Q4 $(A \oplus B) \odot C$

Q.1 "MSQ"

The Boolean function given below:

$f(A, B) = A \oplus B \oplus AB$ $= A \oplus B \oplus x$

which statement is/are correct?

A	B	$\overset{x}{AB}$	$\overset{f}{A \oplus B \oplus x}$
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	1

A, C

$\boxed{f = A+B}$

(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

$$f(A,B) = \underbrace{(A \oplus B)} \oplus AB$$

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

$$\overline{A \oplus B} = \bar{X} = A \odot B = \bar{A}\bar{B} + AB$$

$$= X \oplus AB$$

$$= \bar{X}AB + X\overline{AB}$$

$$= [\bar{A}\bar{B} + AB] \cdot AB + [\bar{A}B + A\bar{B}] \cdot [\bar{A} + \bar{B}]$$

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

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

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

$$= A[B + \bar{B}] + \bar{A}B$$

$$= A \cdot 1 + \bar{A}B \Rightarrow A + \bar{A}B = (A + \bar{A})(A + B) = A + B$$

OR

Q.2 MCQ

Minimized expression will be $Y = A \oplus \underline{(A + B)}$

(A) $A \oplus B$

(B) $A \odot B$

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

(D) $A + B$

Associative Law does not follow by X-OR GATE over OR GATE

$\cancel{A \oplus (A+B)}$

$\cancel{(A \oplus A) + (A \oplus B)}$

$\cancel{0 + A \oplus B}$

$\cancel{A \oplus B}$

$A + B = x$

$A \oplus x$

$\bar{A}x + A\bar{x}$

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

$\bar{A}[A+B] + A[\overline{A+B}]$

$\underbrace{\bar{A} \cdot A}_{0} + \bar{A} \cdot B + \underbrace{A \cdot \bar{A}}_{0} \cdot \bar{B}$

$= \bar{A}B$

$$A \oplus (A+B)$$

$$A \oplus X$$

A	B	A	$A+B$ X	$A \oplus X$
0	0	0	0	0
0	1	0	1	1
1	0	1	1	0
1	1	1	1	0

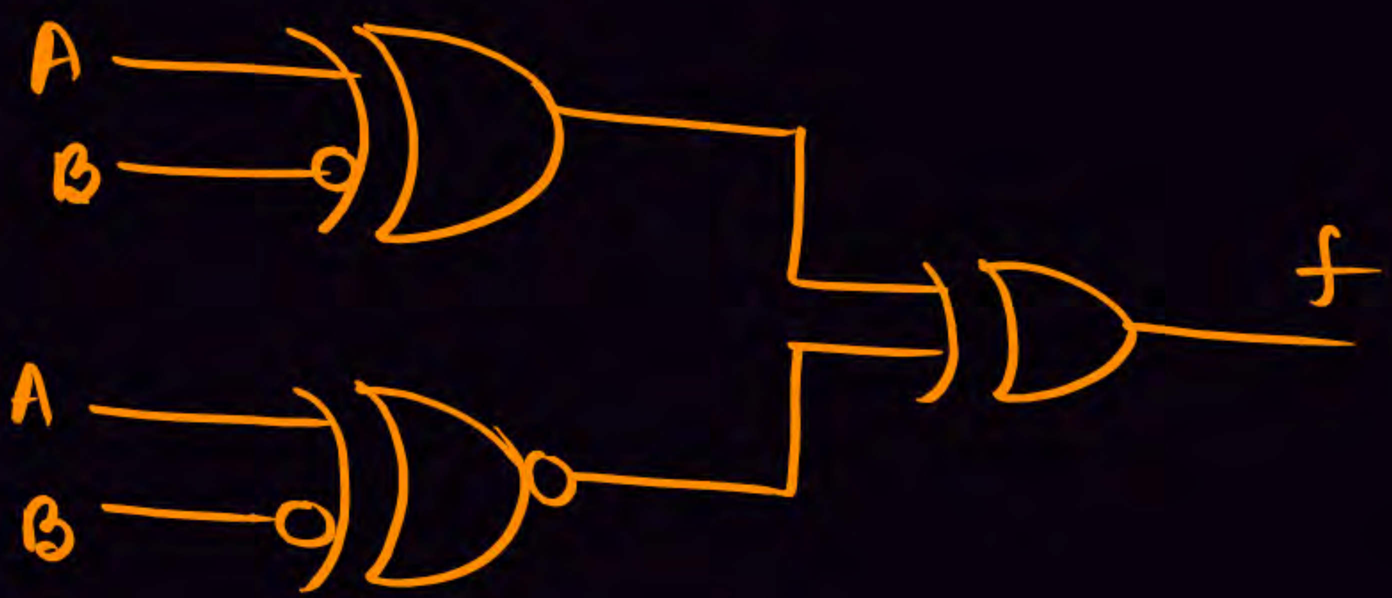
$$A \oplus X = \bar{A} X$$

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

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

$$= \bar{A} B \quad \text{Ans}$$

Q



f will be = ?

(A) 

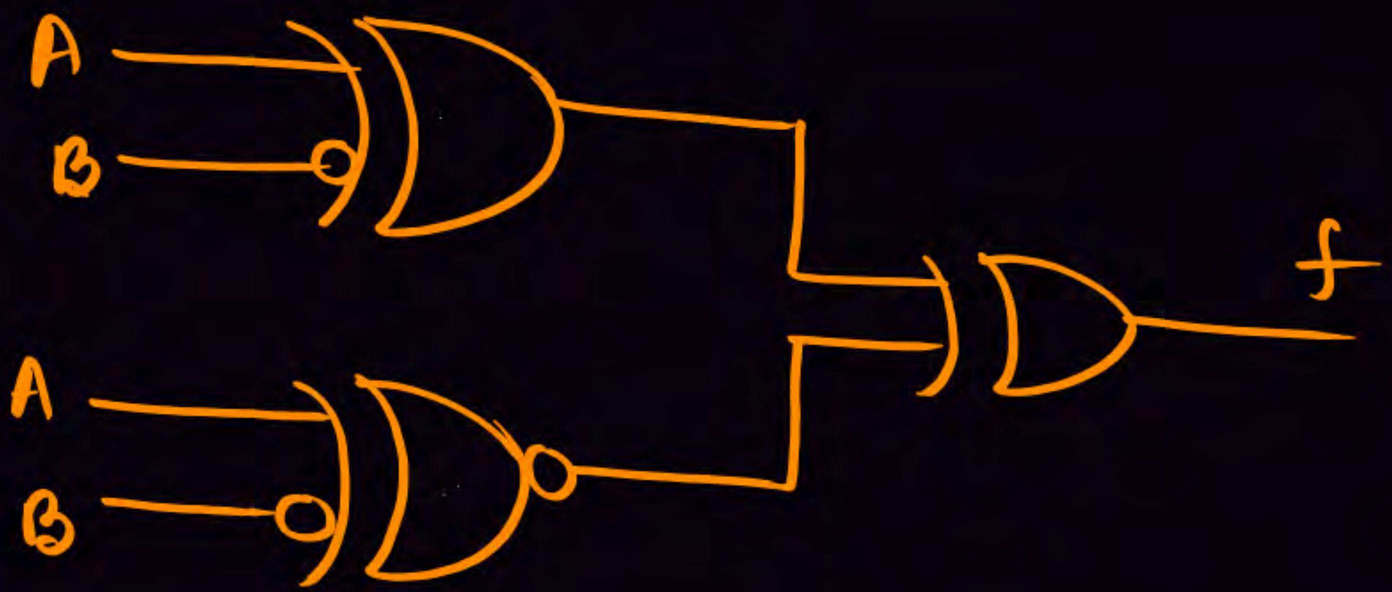
~~(B)~~ 1

(C) $A \oplus B$

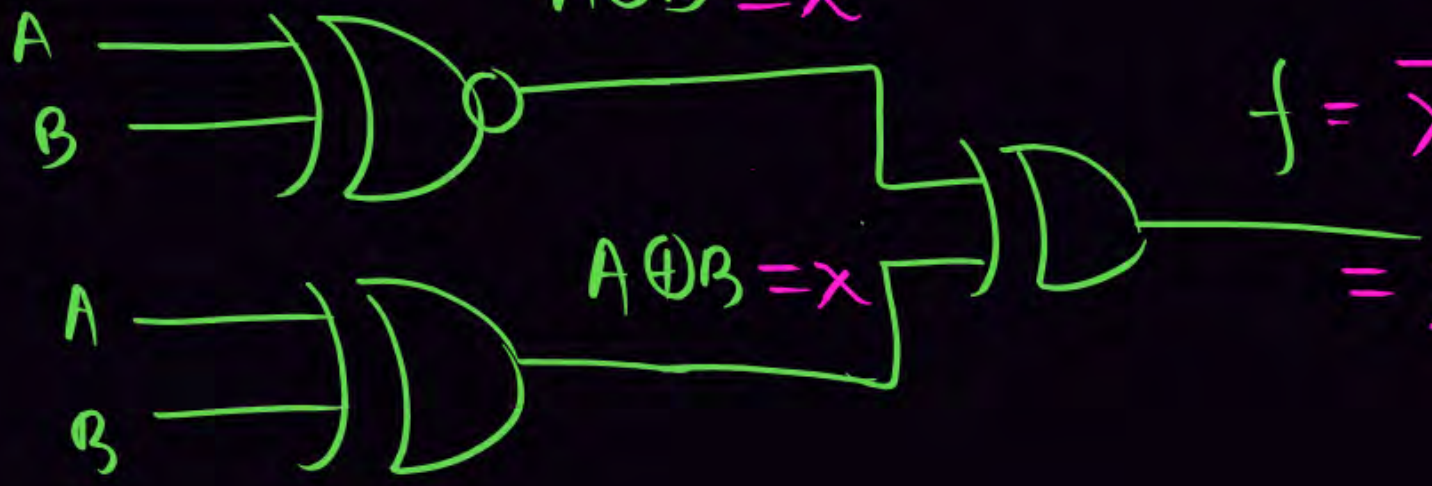
(D) $A \odot B$

(E) Aaa...aaa...aaa

Q



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



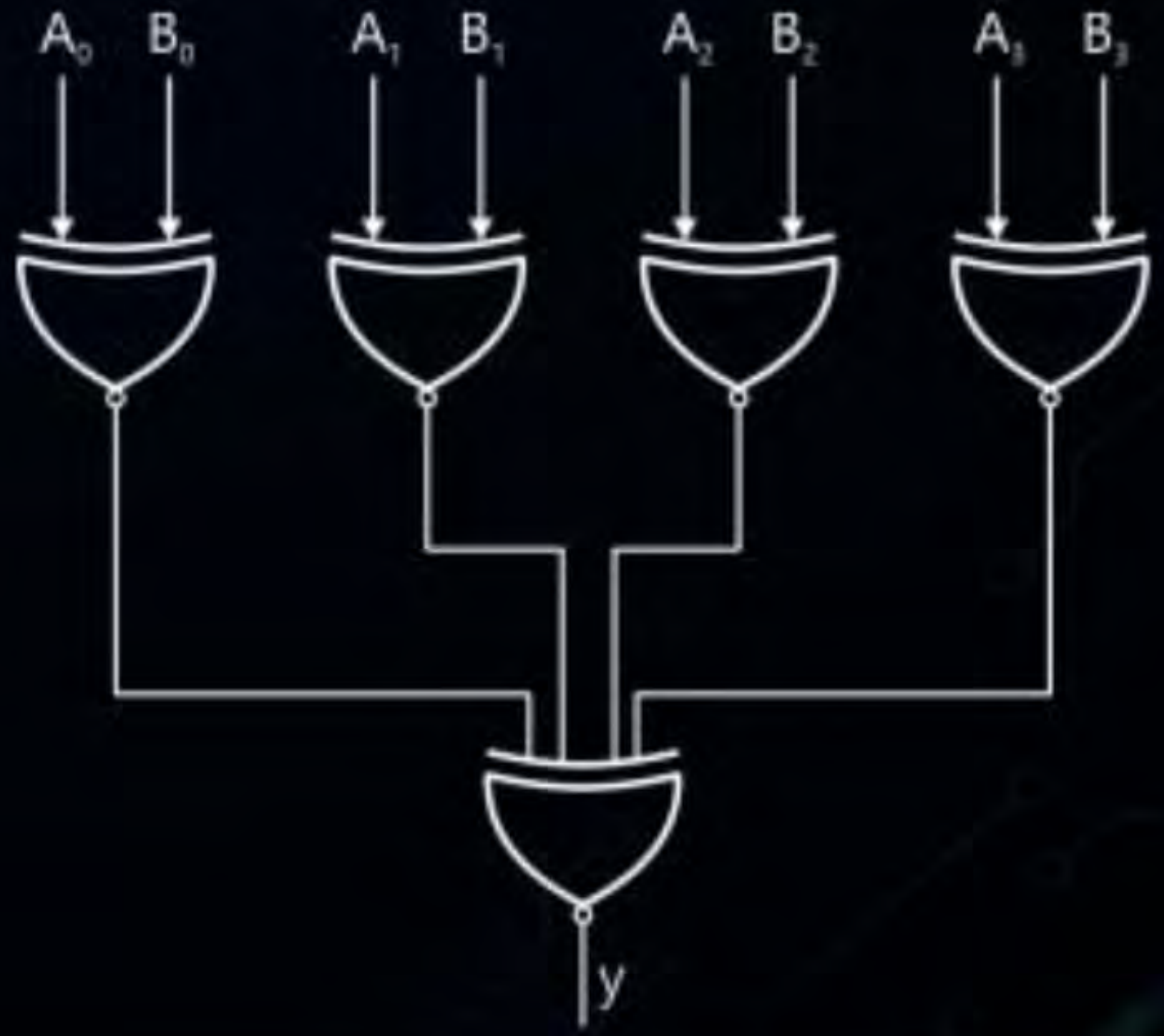
$A \oplus B = x$

$f = \bar{x} \oplus x$

$= 1$

Q.3 MSQ

If the output y = 1
Then correct input is/are-



(A) 1111, 0000

(B) 1010, 0111

(C) 0101, 0101

(D) 1100, 1110

Q.4

Output y will be-

(A) 0

(B) 1

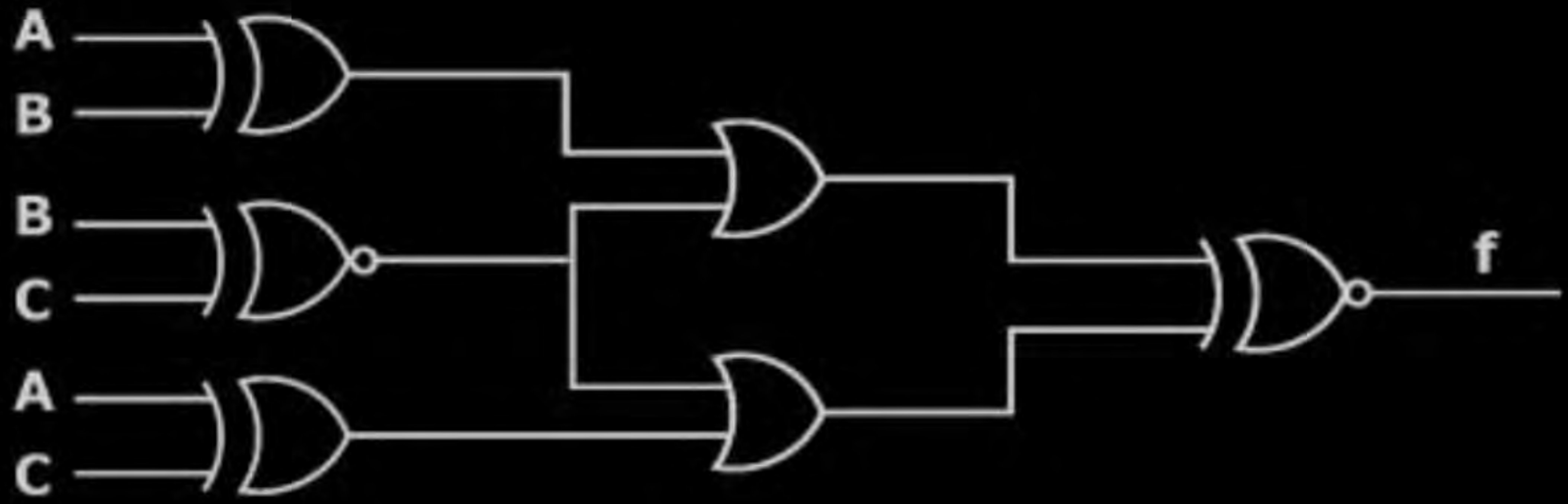
(C) $A \oplus B$

(D) $A \oplus B \oplus C \oplus D$

Logic Gates

Q.5

The output f for the given logic circuit will be-



(A) 0

(B) 1

(C) A + B

(D) None

Logic Gates

Q.6

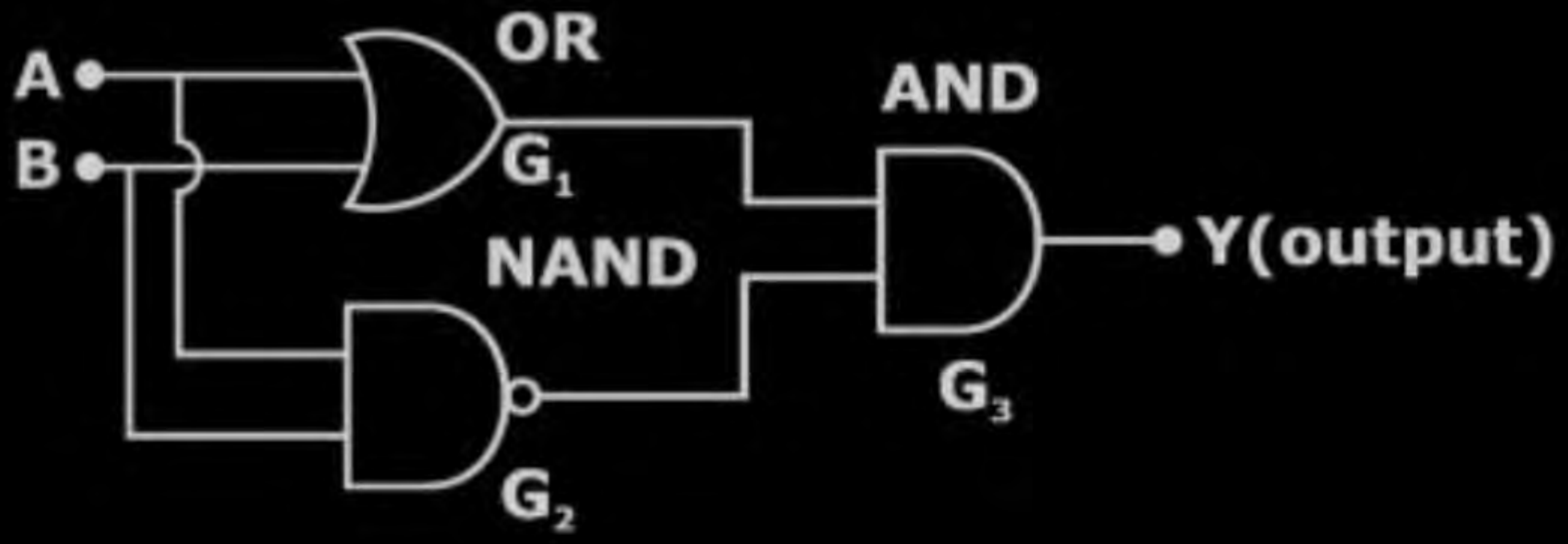
The Following logic gate circuit is equivalent to

(A) NAND

(B) OR

(C) XOR

(D) NOT



Logic Gates

Q.7

The minimum number of two input NAND gates required to implement $y = abcd$ is

(A) 3

(B) 4

(C) 5

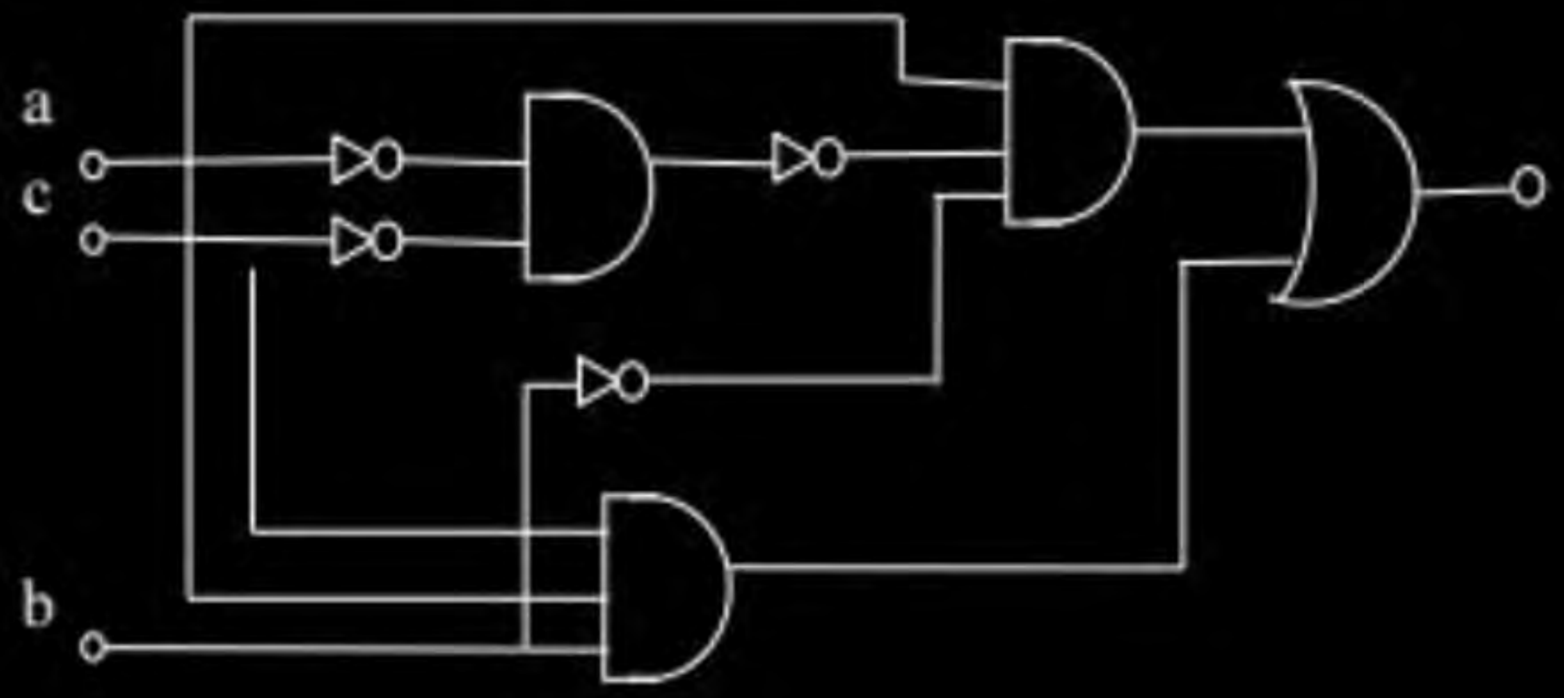
(D) 6

Logic Gates

MSQ

Q.8

In the logic circuit shown below, how many AND, how many OR and how many NOT gates are redundant?



(A) 2 AND gates and 3 NOT gates

(B) 2 AND gates and 2 NOT gates

(C) 2 AND gates, 2 NOT gates

(D) 3 AND gates and 3 NOT gates

Logic Gates

Q.8

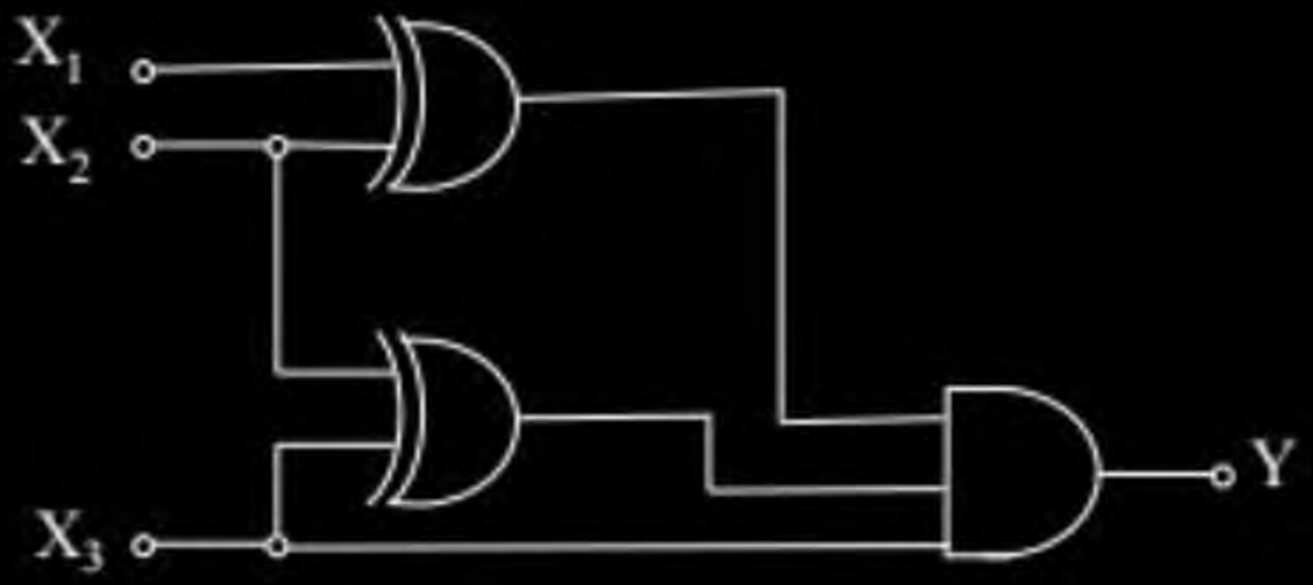
The digital circuit shown below, is observed to generate output $y = 1$. Which one of the following input condition does so?

(A) $x_1 = x_3 = 1, x_2 = 0$

(B) $x_1 = 0, x_2 = x_3 = 1$

(C) $x_1 = x_2 = x_3 = 0$

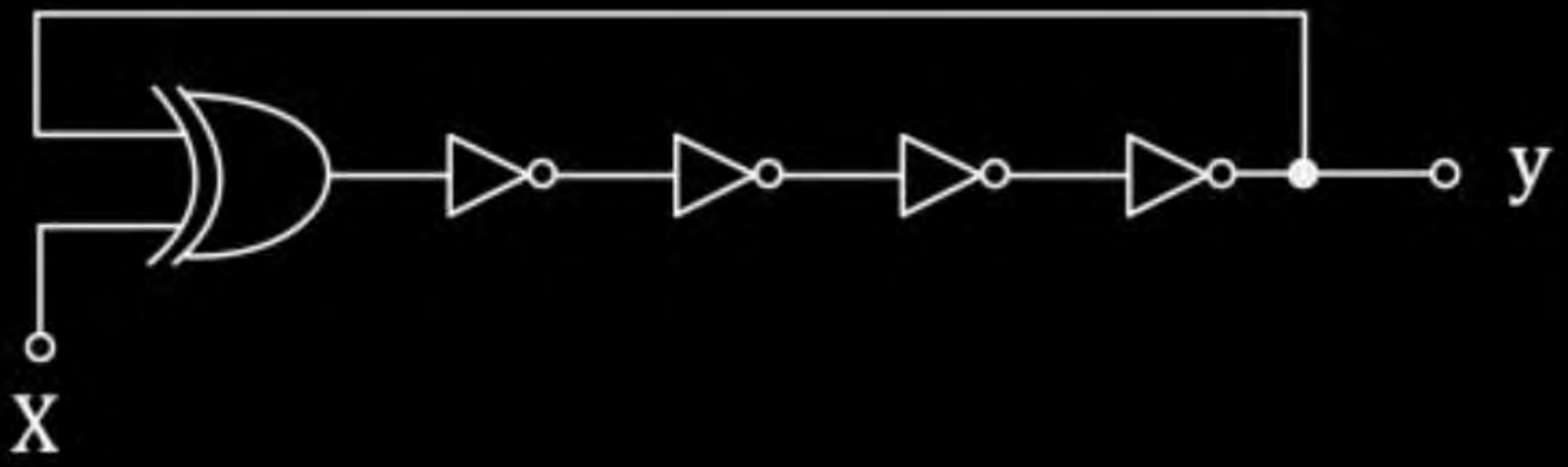
(D) $x_1 = x_2 = x_3 = 1$



Logic Gates

Common data for Questions Q.9 and Q.10

All the logic gates in the circuit shown below, have equal finite propagation delay.



Logic Gates

Q.9

The circuit can be used as clock generator, if

(A) $x = 0$

(B) $x = 1$

(C) $x = 0$ or 1

(D) $x = y$

Logic Gates

Q.10

If the output waveform has frequency of 10 MHz, the propagation delay of each logic gate, is

(A) 5 ns

(B) 10 ns

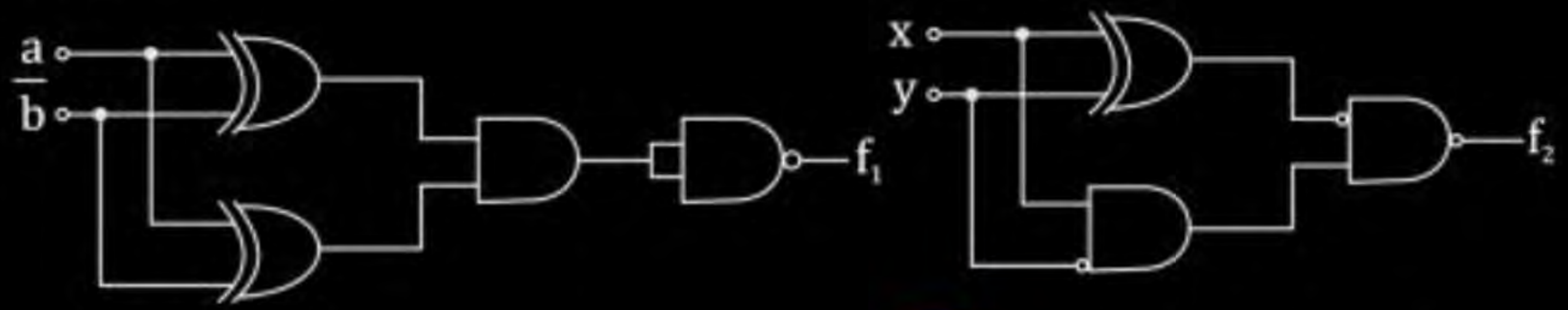
(C) 20 ns

(D) 50 ns

Logic Gates

Q.11

The Boolean expressions $f_1(a, b)$ and $f_2(x, y)$ in the following two circuits, are



(A) $f_1(a, b) = 0, f_2(x, y) = 1$

(B) $f_1(a, b) = \overline{a \oplus b}, f_2(x, y) = x \oplus y$

(C) $f_1(a, b) = a \oplus b, f_2(x, y) = 1$

(D) $f_1(a, b) = 1, f_2(x, y) = 0$

Thank you

GW Soldiers !