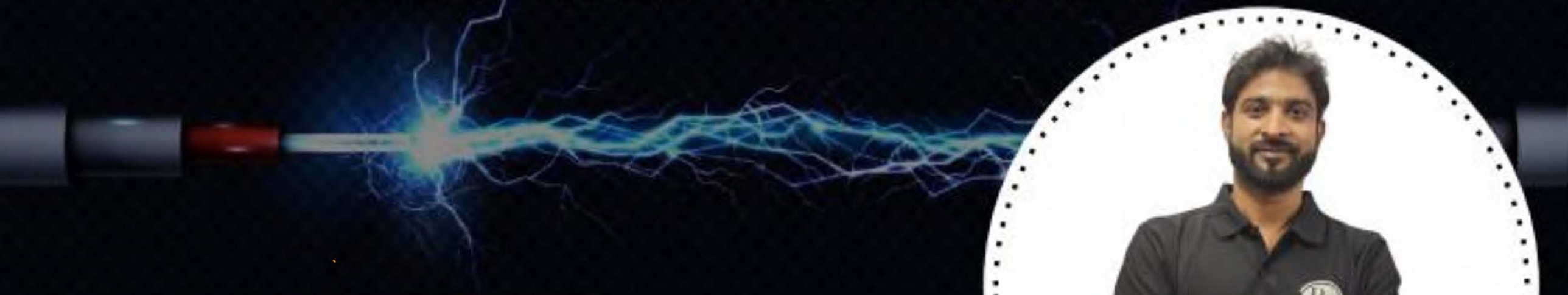
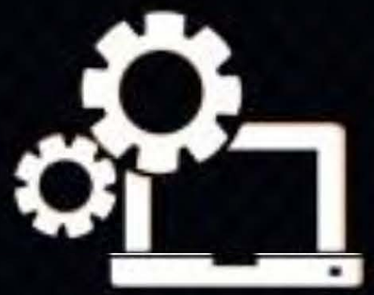
CS & IT ENGINEERING





Digital Logic
Minimization
Lecture No. 04

By- CHAN DAN SIR

01 Question Practice

02 Discussion

Logic Gates

Q.1

If $x \copyright y = \bar{x} + y$ and $z = x \copyright y$.
Then $z \copyright y$ will be -

A $\bar{x} + y$

B $x + y$ Ans

C 0

D 1

$z \copyright y = \bar{z} + y$

$= \overline{x \copyright y} + y$

$= \overline{\bar{x} + y} + y$

$= \bar{\bar{x}} \cdot \bar{y} + y$

$= x \cdot \bar{y} + y$

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

$= x + y$

Logic Gates

Q.2

MSQ

A, B

If $A * B = AB + \overline{A}\,\overline{B}$ and $C = A * B$.
Then which one is/are correct

A $A = B * C$

B $B = A * C$

C $A \circledast B \circledast C = 1$

D $A = B$

$A \odot B = X$

$(A \odot B) \odot (A \odot B)$

$X \odot X = 1$

A	B	C = A ⊙ B	B ⊙ C	A ⊙ C
0	0	1	0	0
0	1	0	0	1
1	0	0	1	0
1	1	1	1	1

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

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

$A = B$

$A * A = A + \bar{A}$

$= L$

$A * B = L$

$A = B$

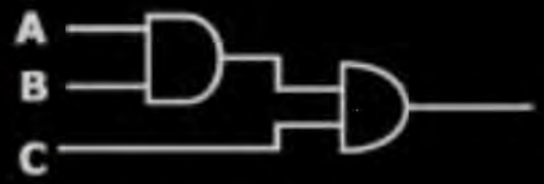
$C = 1$

Logic Gates

Q.3

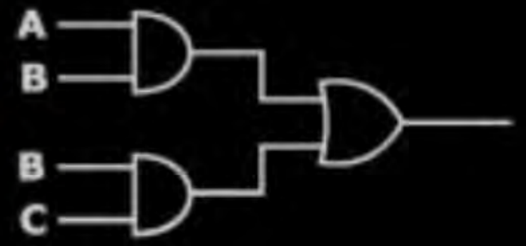
$f(A,B,C) = A \cdot B \cdot (AB+C)$
$= AB \cdot AB + ABC$
$= AB + ABC = AB(1+C) = AB$

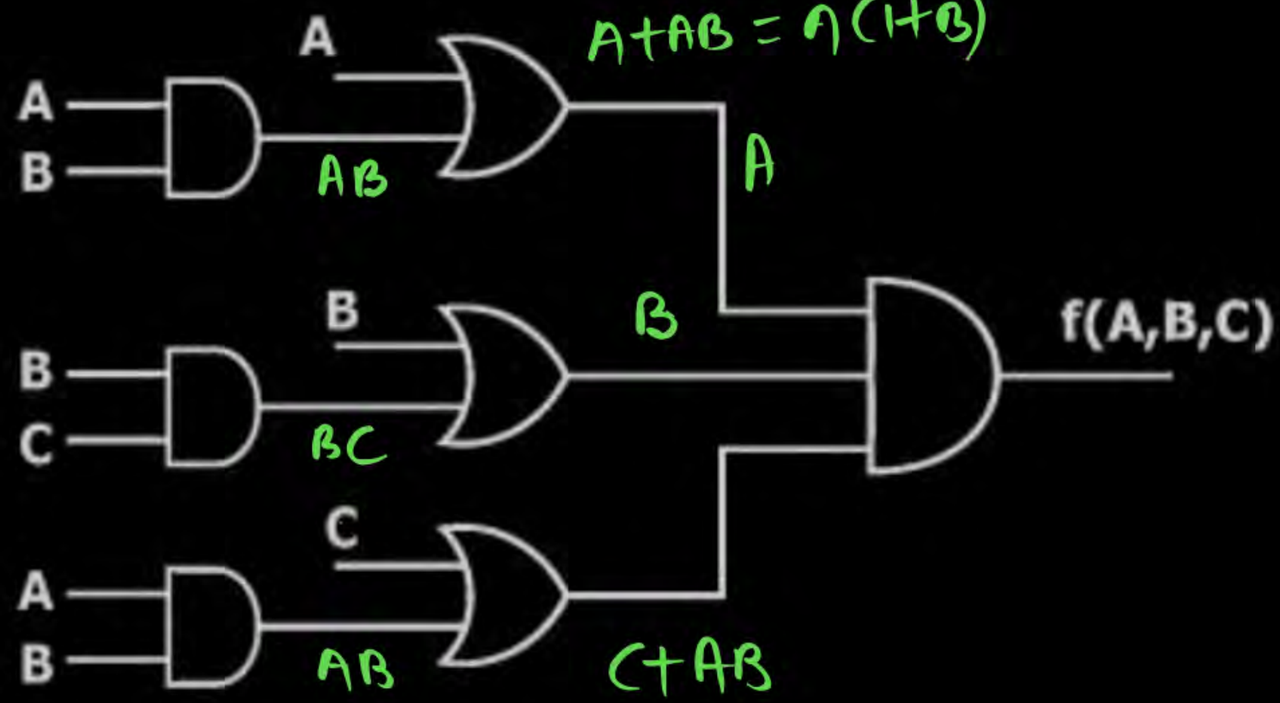
Consider the given logic circuit with the inputs A, B and C, then f(A, B, C) will be-

A)


B)


C)


D)




Logic Gates

Q.4

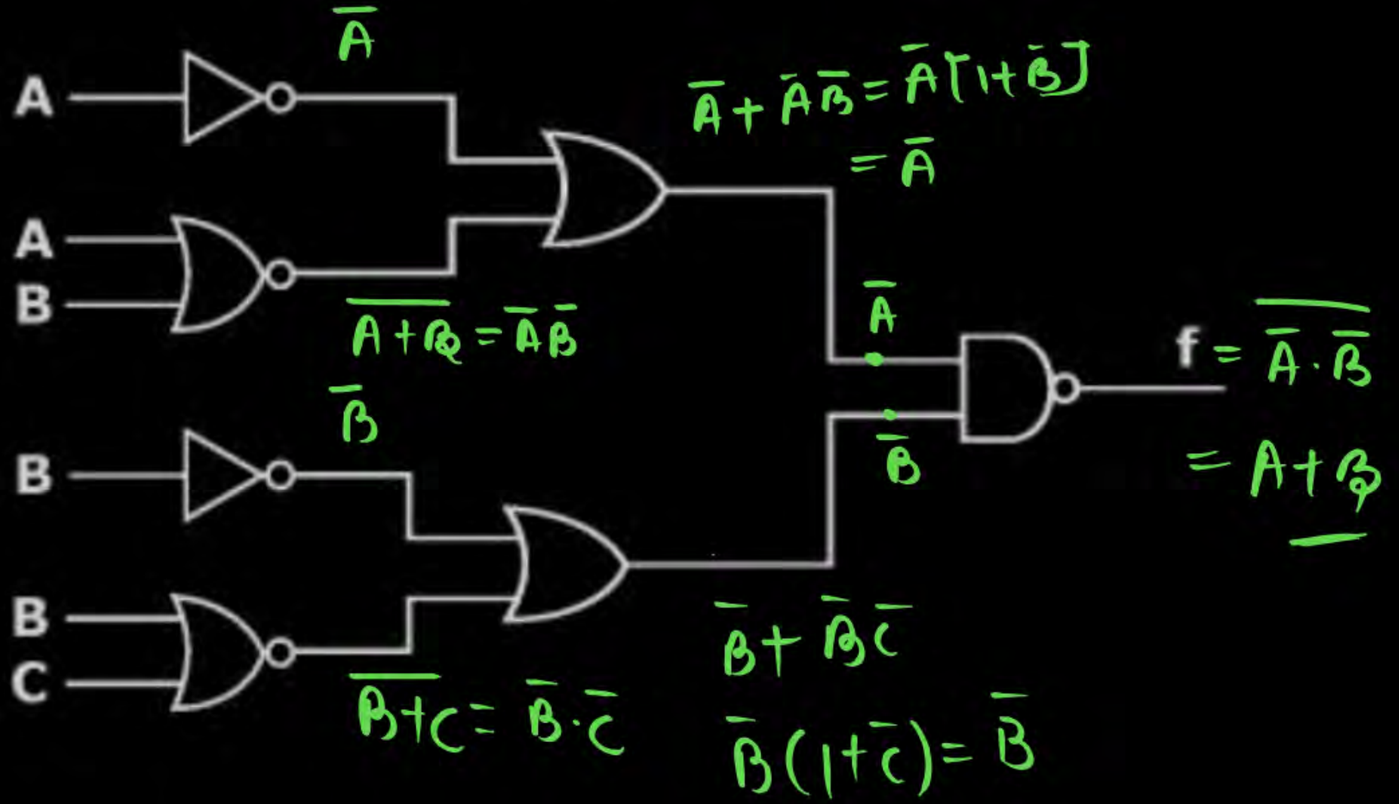
The output f for the given logic circuit will be-

(A) AB

(B) $A + B$

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

(D) $A\bar{B}$



Logic Gates

Q.5

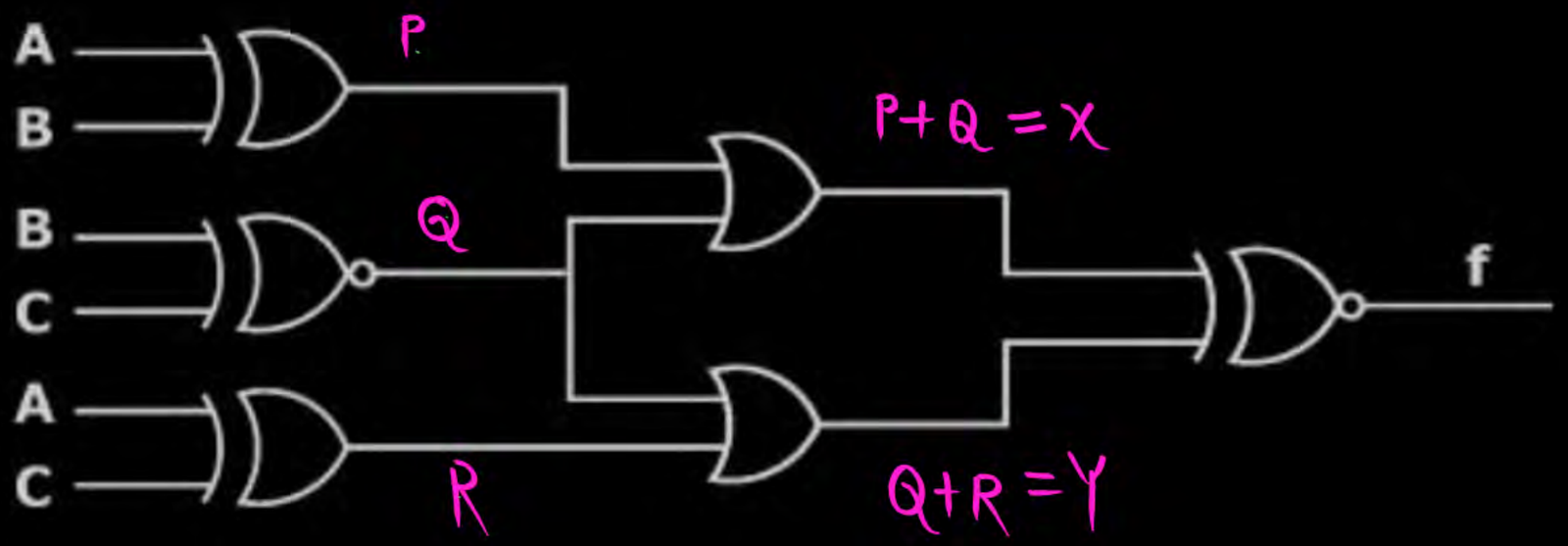
The output f for the given logic circuit will be-

(A) 0

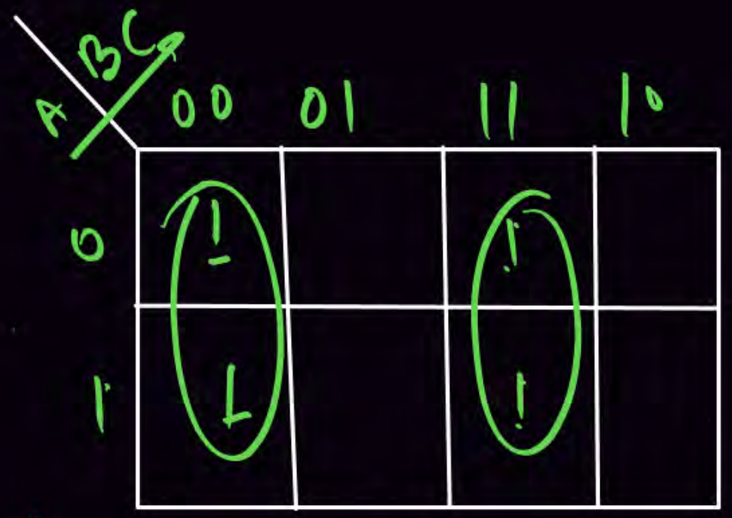
(B) 1

(C) A + B

(D) None



	A	B	C	P A⊕B	Q B⊙C	R A⊕C	X P+Q	Y Q+R	f X⊙Y
0	0	0	0	0	1	0	1	1	1
1	0	0	1	0	0	1	0	1	0
2	0	1	0	1	0	0	1	0	0
3	0	1	1	1	1	1	1	1	1
4	1	0	0	1	1	1	1	1	1
5	1	0	1	1	0	0	1	0	0
6	1	1	0	0	0	1	0	1	0
7	1	1	1	0	1	0	1	1	1



$f = \bar{B}\bar{C} + BC$

$B \odot C$

=

$$f = \bar{P}\bar{Q}\bar{R} + PQ + PR + Q + QR$$

$$f = \bar{P}\bar{Q}\bar{R} + Q[P + 1 + R] + PR$$

$$f = \bar{P}\bar{Q}\bar{R} + Q + PR$$

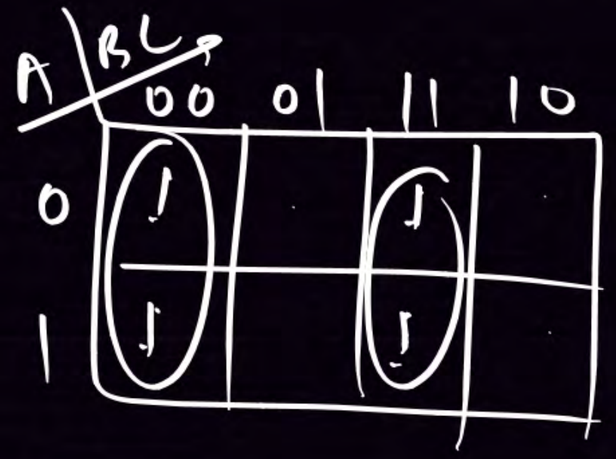
$$f = \bar{P}\bar{R}\bar{Q} + Q + PR$$

$$f = (\bar{P}\bar{R} + Q) + PR$$

$$f = \bar{P}\bar{R} + PR + Q$$

$$(P \odot R) + Q$$

A B C	P: A⊕B	Q: B⊙C	R: A⊙C	X	Y	X⊙Y
0 0 0	0	1	0	1	1	1
0 0 1	0	0	1	0	1	0
0 1 0	1	0	0	1	0	0
0 1 1	1	1	1	1	1	1
1 0 0	1	1	1	1	1	1
1 0 1	1	0	0	1	0	0
1 1 0	0	0	1	0	1	0
1 1 1	0	1	0	1	1	1



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

$$f = (A \oplus B) + X \odot (A \oplus C) + X$$

$$= \overline{(A \oplus B) + X} \cdot \overline{(A \oplus C) + X} + [(A \oplus B) + X] \cdot [(A \oplus C) + X]$$

$$= \overline{A \oplus B}\,\bar{X} \cdot \overline{A \oplus C}\,\bar{X} + (A \oplus B)(A \oplus C) + (A \oplus B)X + (A \oplus C)X + X \cdot X$$

$$= \overline{A \oplus B} \cdot \overline{A \oplus C}\; B \oplus C + (A \oplus B)(A \oplus C) + X[A \oplus B + A \oplus C + 1]$$

$$= \overline{A \oplus B} \cdot \overline{A \oplus C}\;\bar{X} + (A \oplus B)(A \oplus C) + X$$

Logic Gates

Q.6

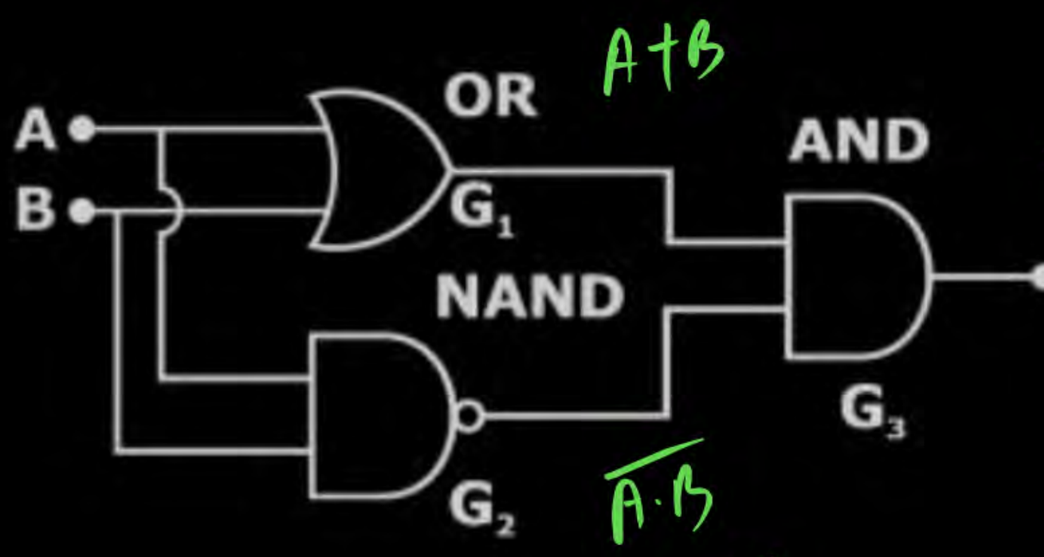
The Following logic gate circuit is equivalent to

A NAND

B OR

C XOR

D NOT

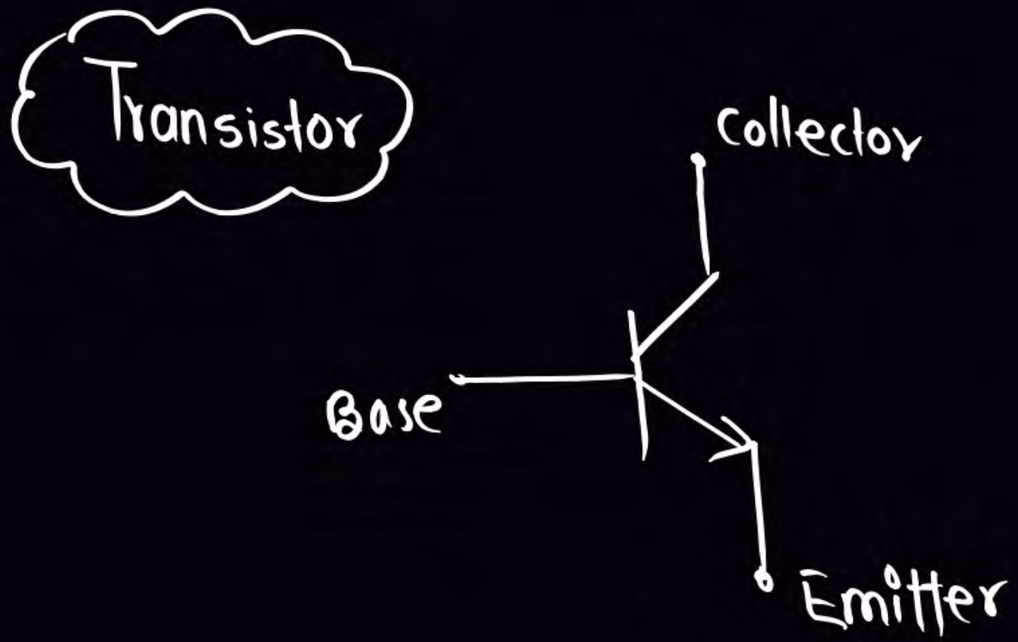


$= (A+B) \cdot (\bar{A}+\bar{B})$

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

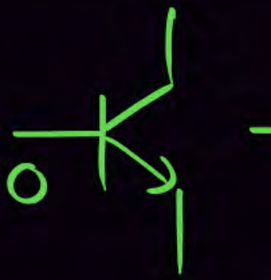
$A \oplus B$

NOT GATE :→



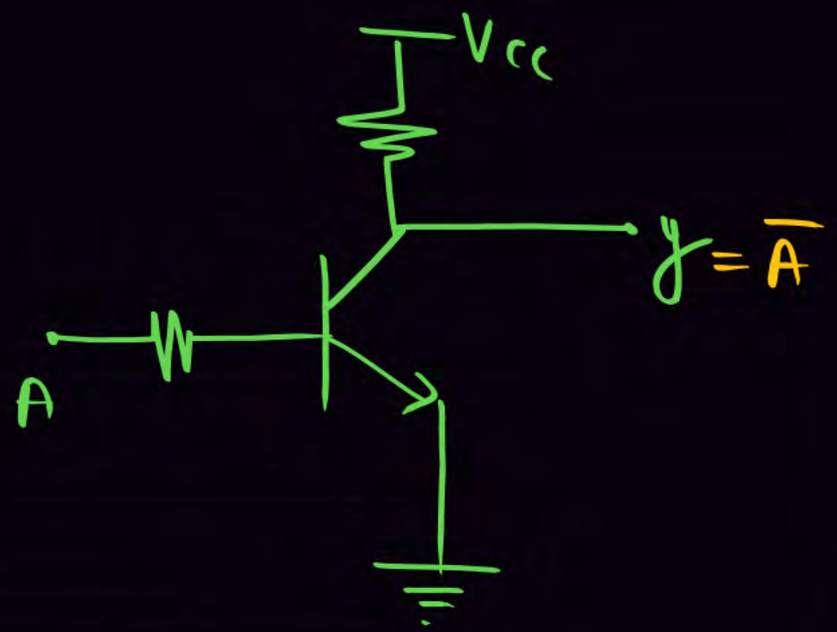
(Saturation)

→ ON → short circuit



cutoff

→ OFF → open ckt

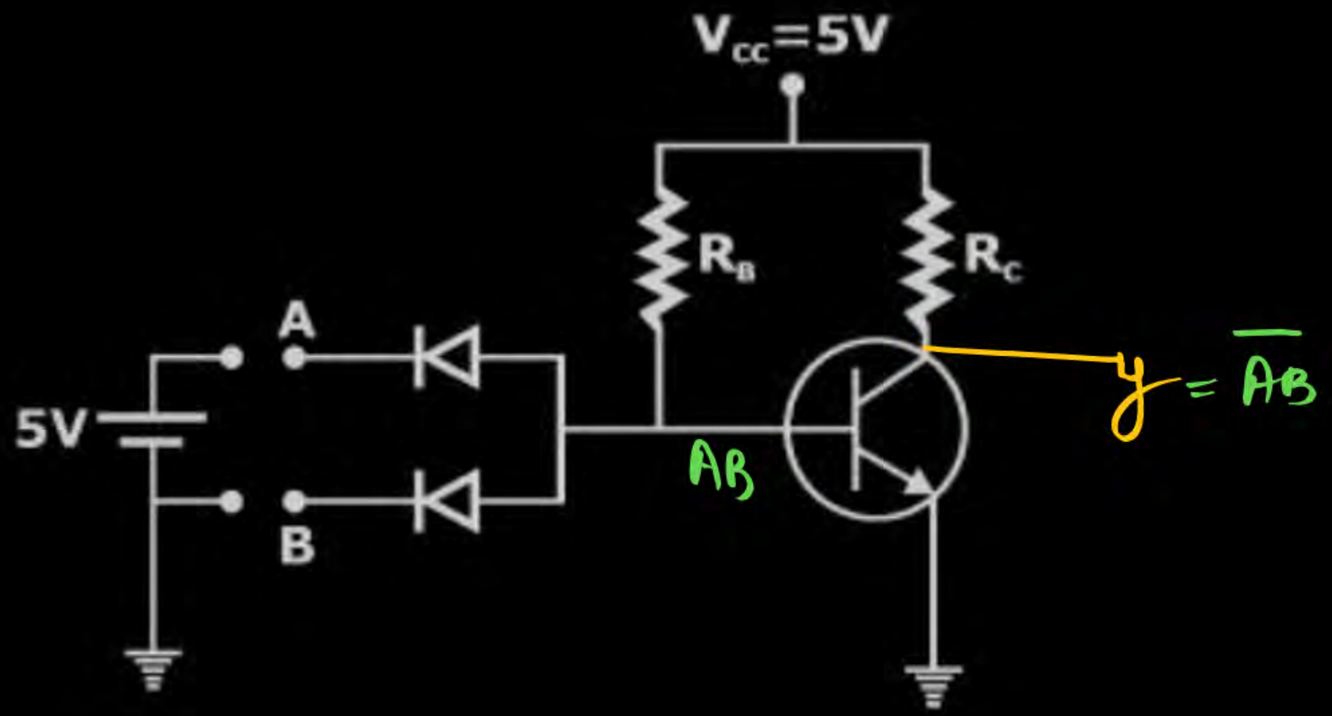


A	Transistor	y
0	cut off	1
1	Saturation	0

Logic Gates

Q.8

Figure shows the particle realization of a logic gate. Identify the logic gate.

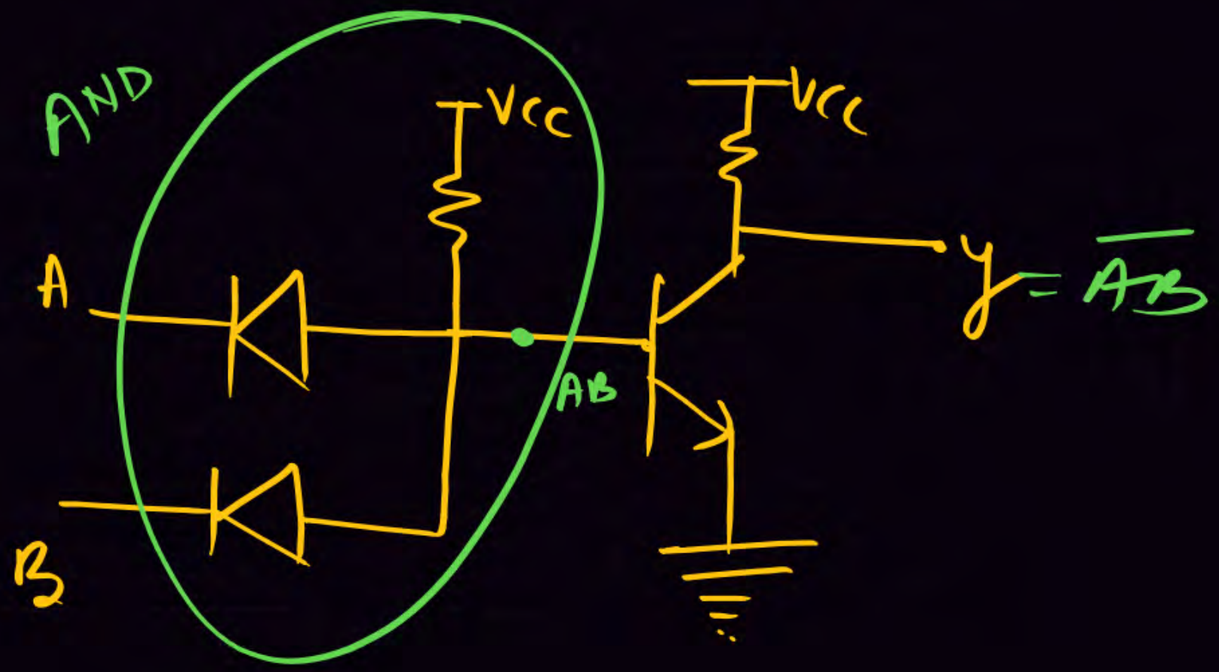


(A) NAND

(B) NOR

(C) XOR

(D) XNOR


AND
Vcc
Vcc
A
B
AB
$y = \overline{AB}$

Logic Gates

Q.10

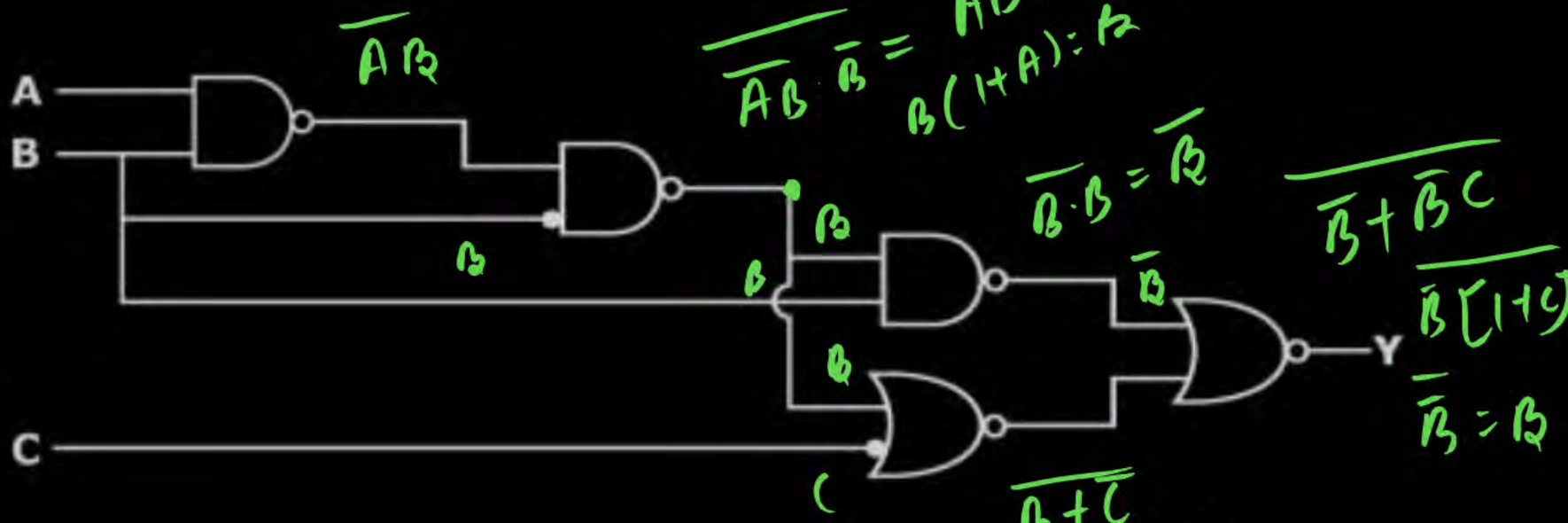
For the logic circuit shown, the simplified Boolean expression for the output Y is

A. A + B + C

B. A

C. B

D. C



Logic Gates

Q.13

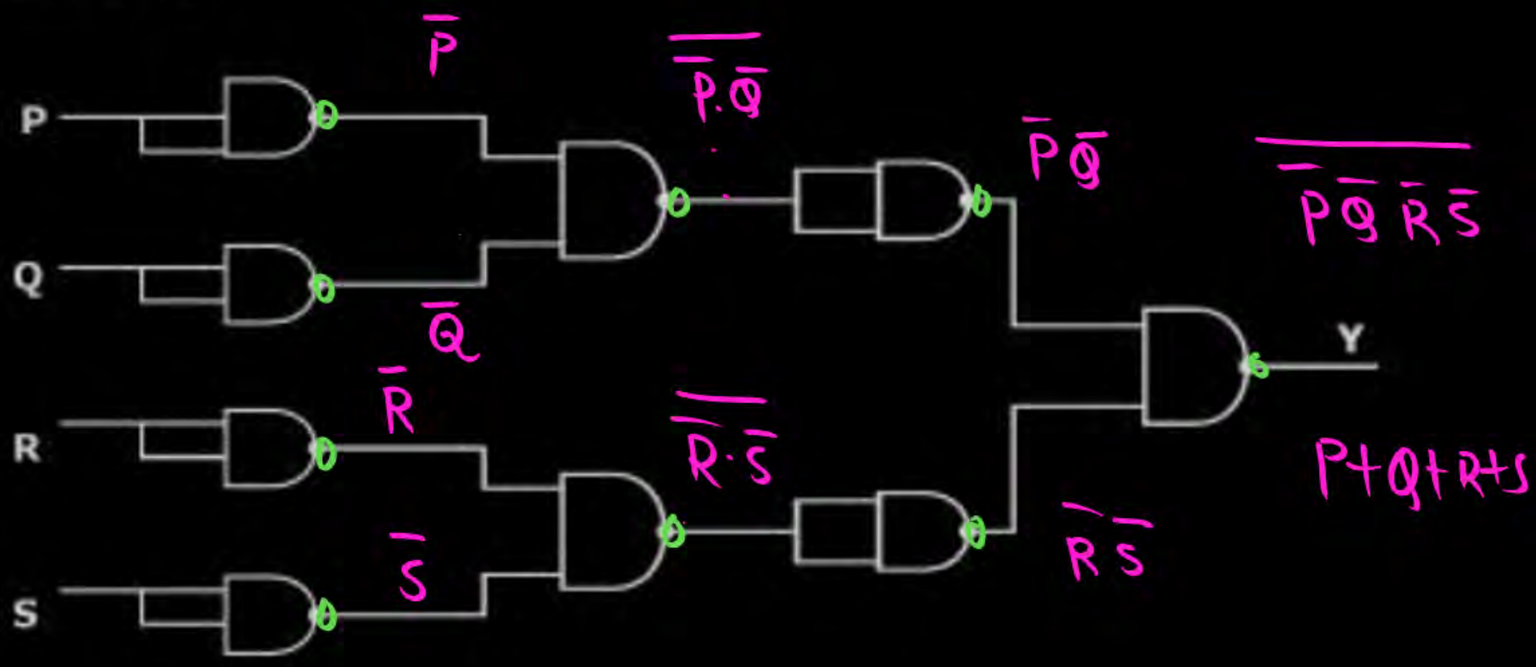
For the circuit shown in fig. the Boolean expression for the output Y in terms of inputs P, Q, R and S is

(A) $\overline{P} + \overline{Q} + \overline{R} + \overline{S}$

(B) $P + Q + R + S$

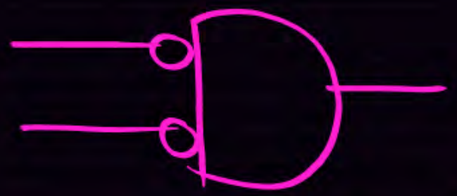
(C) $(\overline{P} + \overline{Q})(\overline{R} + \overline{S})$

(D) $(P + Q)(R + S)$

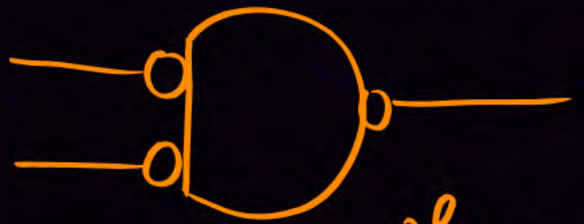


NAND

AND



NOR

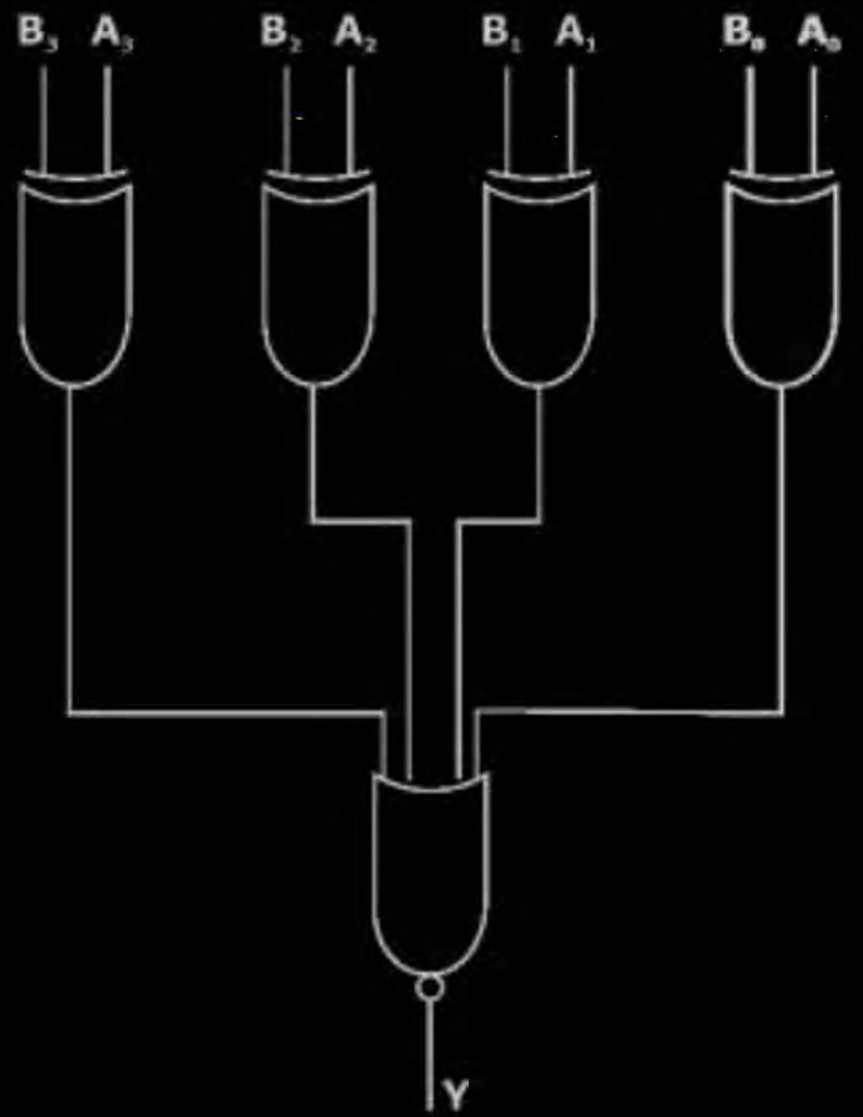


OR

Logic Gates

Q.14

$A_3A_2A_1A_0$, $B_3B_2B_1B_0$ is shown in fig. To get output Y = 0, choose one pair of correct input numbers



(A) 1010, 1010

(B) 0101, 0101

(C) 0010, 0010

(D) 0010, 1011

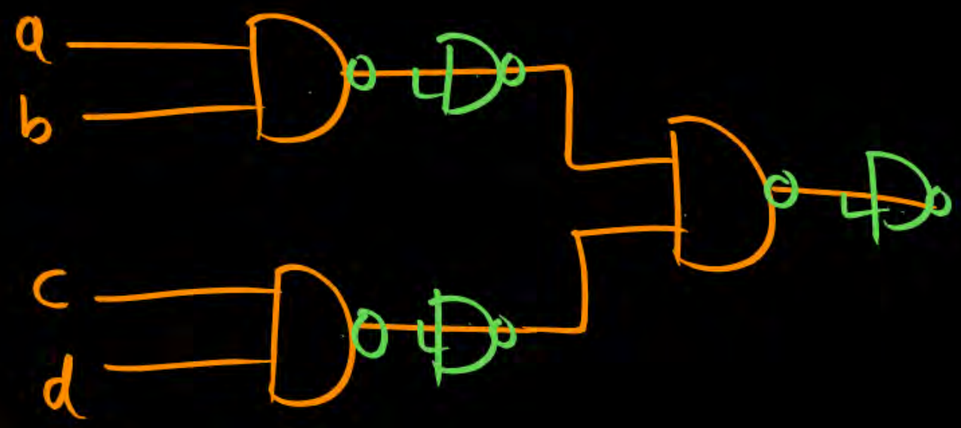
Logic Gates

Q.18

$(2n-2)+k$

$(2\times4-2)+0 = 6$

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



A 3

B 4

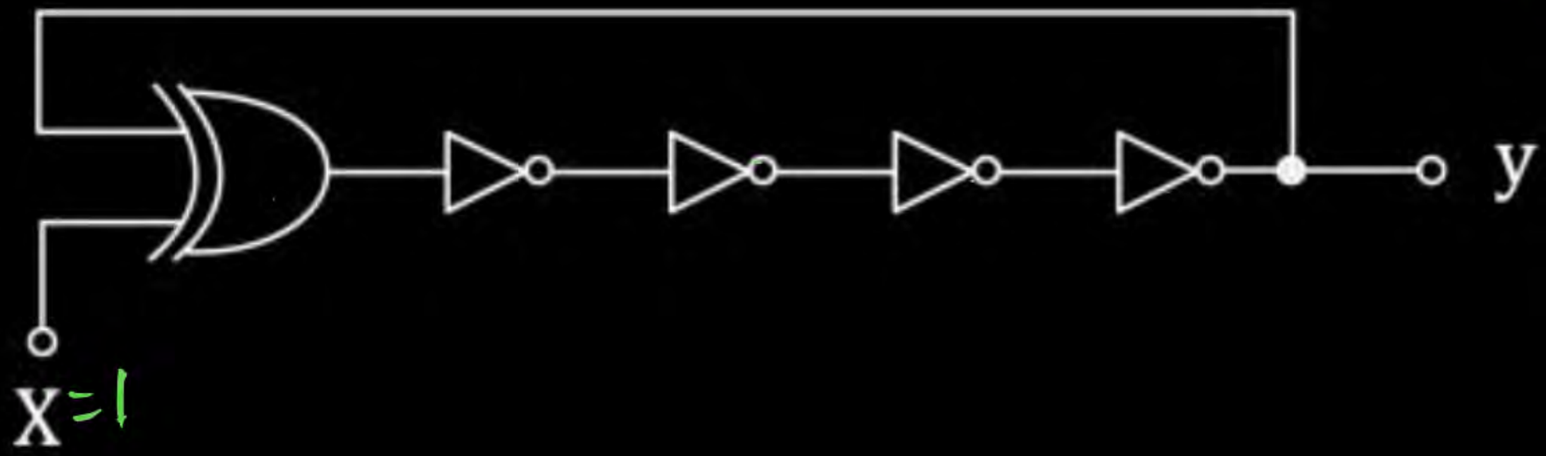
C 5

D 6

Logic Gates

Common data for Questions Q.21 and Q.22

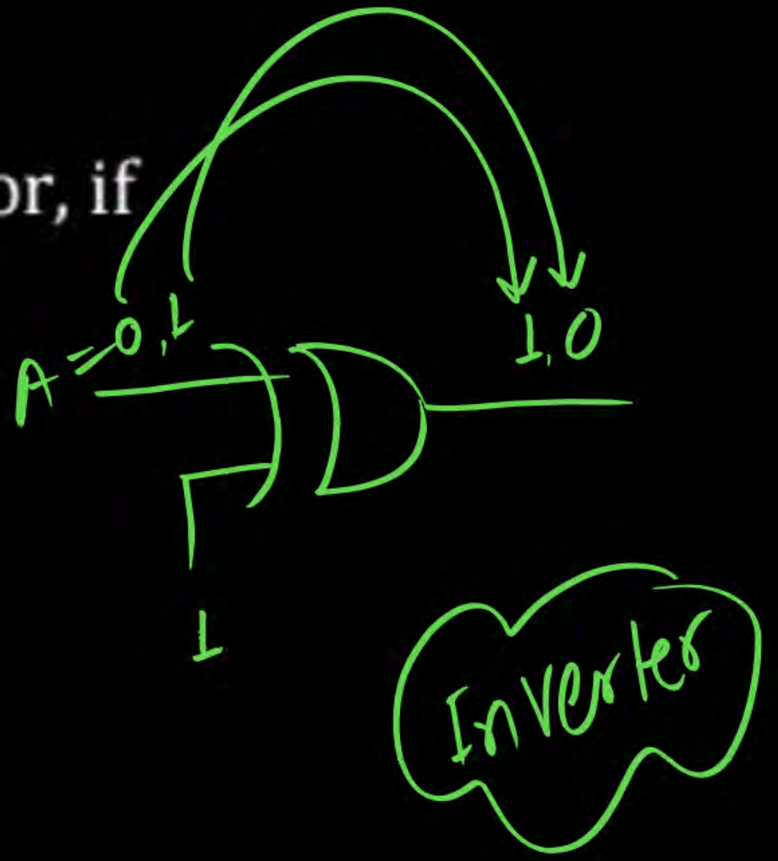
All the logic gates in the circuit shown below, have equal finite propagation delay.



Logic Gates

Q.21

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.22

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

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

$$\tau_{pd} = \frac{1}{2 \times N \times f} = \frac{1}{2 \times 5 \times 10 \times 10^{6}}$$

$$\frac{10^{-7}}{10} = 10^{-8}$$

$$= 10 \times 10^{-9} \text{ sec.}$$

$$= 10 \text{ ns}$$

Q.14

$\bar{A}B + AC + \bar{B}C$ is equivalent to

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

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

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

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

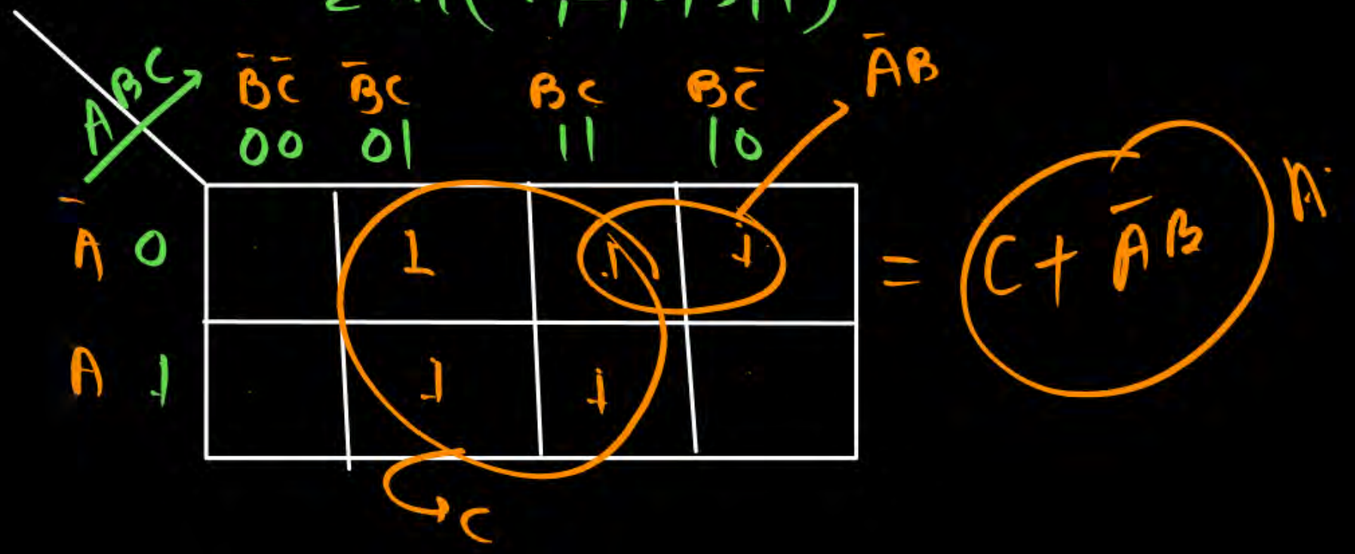
$f = \bar{A}B + AC + \bar{B}C$

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

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

$= \Sigma m(2,3,5,7,1)$

$= \Sigma m(1,2,3,5,7)$



Q.15

$\overline{A\bar{B} + (\bar{A}B + \bar{B}C + A\bar{B}D + A\bar{B}\bar{D})}$ is equal to

(a) $(\bar{A} + B)$ ✗

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

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

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

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

$B(\bar{A} + 1 + \bar{C}) + \bar{A}C$

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

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

$AB(1 + \bar{C}) + \bar{A}\bar{B}\bar{C}$

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

AB

$\overline{A\bar{B} + \bar{A}B + \bar{B}C + A\bar{B}D + A\bar{B}\bar{D}}$

$\overline{A\bar{B}[1 + D + \bar{D}] + \bar{A}B + \bar{B}C}$

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

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

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

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

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

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

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

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

$AB(1+\bar{C}) + \bar{A}\bar{B}\bar{C}$

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

Q.16

$\overline{(\bar{A}+\bar{B})(\bar{B}+\bar{C})}$ is equal to

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

(b) $A\,(B+C)$

(c) $B(A+C)$

(d) $C(A+B)$

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

$AB + BC$

$B(A+C)$

Q.17

$\bar{A}\bar{B} + AC + \bar{B}C$ is equivalent to

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

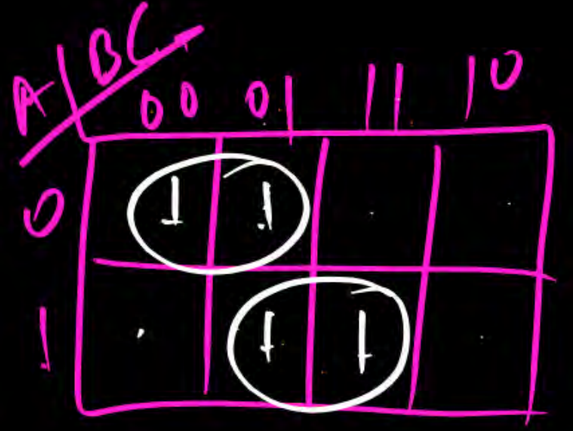
(b) $\bar{A}\bar{B} + AC$

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

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

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

$\Sigma m(0,1,5,7)$



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

Q.18

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

$(A + B)\,(A + C)\,(A + \bar{C})$ is equivalent to

(a) $A + BC$

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

(c) 0

(d) A

$(A+BC)(A+\bar{C})$ Distribution theor.

$A+BC\bar{C}$

A

Q.19

HW

A logical function is given as:

$f(A, B, C, D) = B\bar{C}[A + B\bar{C}D + \bar{B}CD + \bar{A}B\bar{C} + \bar{A}\bar{B}\bar{C}]$

is equivalent to

(a) $A\bar{B}CD$

(b) $B\bar{C}$

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

(d) $AB\bar{C}D$

Q.20

A logical function

$f(A, B, C) = (A + B)(\overline{B} + C)(A + C)$, then will be equal to

(a) $AB + \overline{B}C$

(b) $\overline{A}\overline{B} + B\overline{C}$

(c) $\overline{A}\overline{B} + \overline{A}\overline{C}$

(d) $AB + AC$

Q.21

Which of the following is true?

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

(b) $\overline{AB\overline{CD}} = \bar{A} + \bar{B} + \bar{C} + \bar{D}$

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

(d) None of these

Q.21

A logical function

$f(A, B, C) = (A + B)(\overline{B} + C)(A + C)$, then will be equal to

(a) $AB + \overline{B}C$

(b) $\overline{A}\overline{B} + B\overline{C}$

(c) $\overline{A}\overline{B} + \overline{A}\overline{C}$

(d) $AB + AC$

Thank you

GW

Soldiers !