TOPICWISE : DIGITAL LOGIC-1 (GATE - 2019) - REPORTS

Q. 1

Which one of the following statement is true when the function is having cyclic prime implicant K-map?

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A. Two minimal forms with one common prime implicant.

B. Two minimal forms with two common prime implicant. — Your answer is **Wrong**

C. Two minimal forms with no common prime implicant — Correct Option

Solution :
(c)

D. None of the above

QUESTION ANALYTICS +

Q. 2

If the value of $X + Y = 1$, then the value of $X \oplus Y$ is equal to

Solution Video | Have any Doubt ?

A. X

B. $\overline{X} + \overline{Y}$ — Correct Option

Solution :
(b)

$$\begin{aligned} X \oplus Y &= \overline{X \odot Y} = \overline{\overline{X}\,\overline{Y} + XY} \\ &= \overline{(\overline{X}\,\overline{Y})}\,(\overline{XY}) \\ &= (X+Y)(\overline{X}+\overline{Y}) \\ &= \overline{X}+\overline{Y} \qquad (\because\ X + Y = 1 \text{ which is given}) \end{aligned}$$

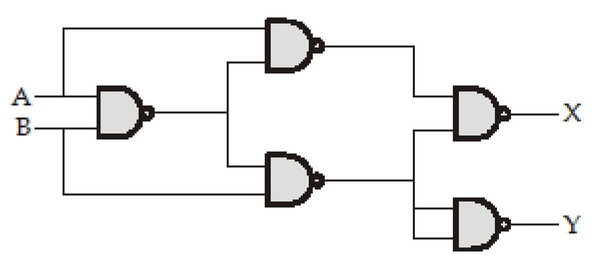
C. 1 — Your answer is **Wrong**

D. 0

QUESTION ANALYTICS +

Q. 3

Consider the circuit shown below:



Then, which of the following statement is true.

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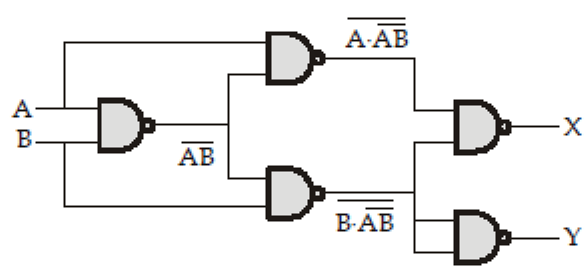
A. When A = 1 and B = 1, Output X = 0 and Y = 1

B. When A = 1 and B = 0, Output X = 0 and Y = 1 — Your answer is **Wrong**

C. When A = 0 and B = 1, Output X = 1 and Y = 1 — Correct Option

Solution :
(c)



$$\begin{aligned} X &= \overline{B}(A+B) + \overline{A}(A+B) \\ &= A\overline{B} + \overline{A}B = A \oplus B \\ Y &= B(\overline{AB}) \\ &= B(\overline{A}+\overline{B}) = \overline{A}B \end{aligned}$$

The above circuit represents a half subtracter constructed using only NAND gates. Thus the truth table can be written as

A	B	Difference (X)	Difference (Y)
0	0	0	0
0	1	1	1

0	1	1	1
1	0	1	0
1	1	0	0

D When A = 0 and B = 0, Output X = 1 and Y = 0

QUESTION ANALYTICS +

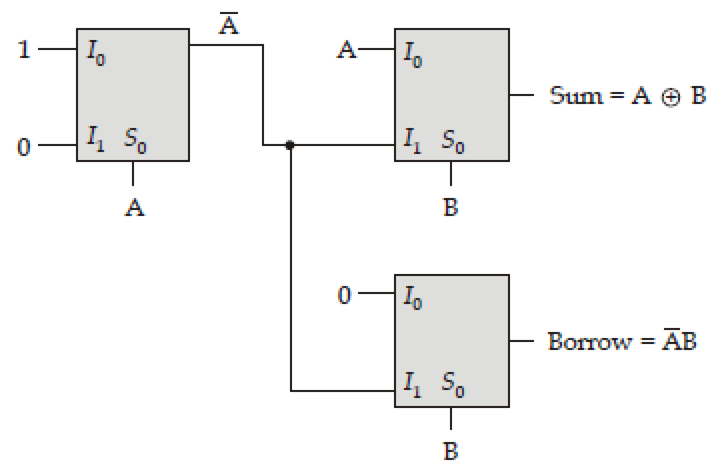
Q. 4

The minimum number of 2 × 1 MUX required to implement a half-subtracter circuit when only basic inputs 0, 1, A and B are available is

Solution Video | Have any Doubt ?

A 3 Correct Option

Solution :
(a)



B 4

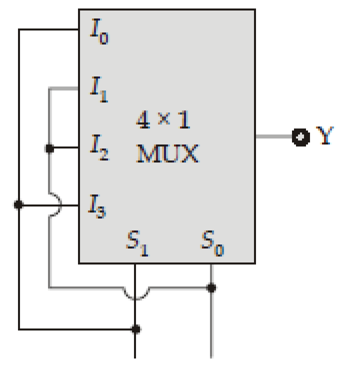
C 5

D 6

QUESTION ANALYTICS +

Q. 5

A gate have two inputs (A, B) and one output (Y) is implemented using a 4 × 1 MUX as shown in the figure below:



If the function 'Y' = B then the select line will be:

Solution Video | Have any Doubt ?

A $S_0 = B, S_1 = A$ Correct Option

Solution :
(a)
By taking $S_0 = B, S_1 = A$

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

B $S_0 = A, S_1 = \bar{B}$

C $S_0 = \bar{A}, S_1 = B$

D $S_0 = \bar{A}, S_1 = \bar{B}$

QUESTION ANALYTICS +

Q. 6

The minimum decimal equivalent of the number $(1AC)_x$ is equal to ________.

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311 Correct Option

Solution :
(311)
According to the given number, the least value of 'x' can be

'12 + 1' = 13

Therefore, the least decimal equivalent

$= (13)^2 + 10 \times 13 + 12 = 311$

Your Answer is 458

QUESTION ANALYTICS +

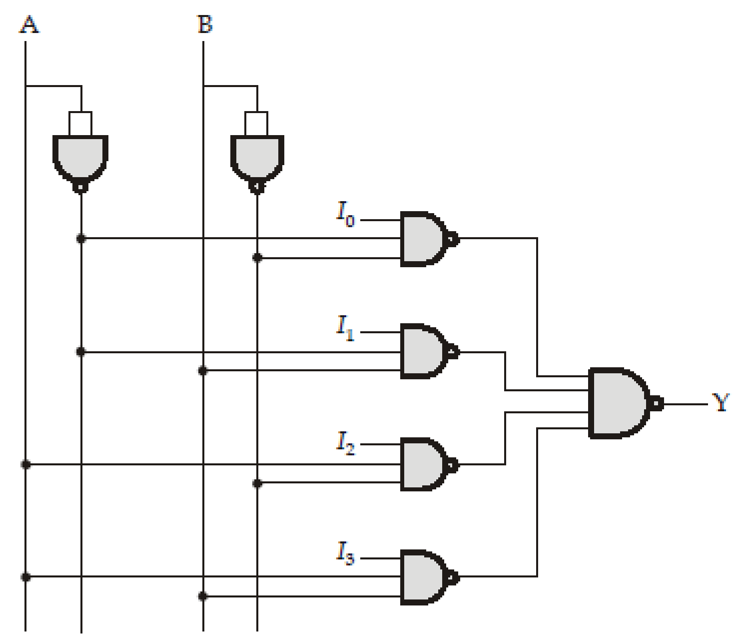
Q. 7

The total number of NAND gates required to implement a 4 × 1 multiplexer is (assuming a NAND gates of any number of inputs are available) ________.

Solution Video | Have any Doubt ?

7 | Correct Option

Solution :
7



Your Answer is 8

QUESTION ANALYTICS +

Q. 8

Consider, the Karnaugh map given below, where x represents "dont care" in function $f(w, x, y, z)$

yz \ wx	00	01	11	10
00	1			
01	1	1	x	
11		x	1	1
10				1

Total number of essential prime implicants are ________.

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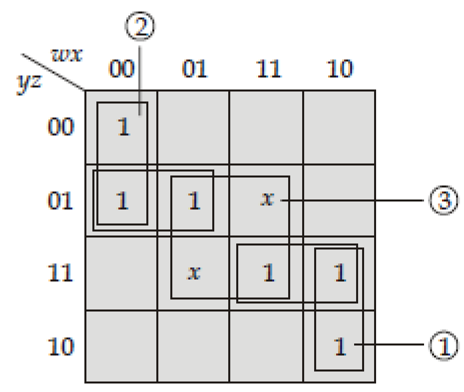
3 | Correct Option

Solution :
3



Here 3 essential prime implicants are presents, while 5 prime implicants are presents.

Your Answer is 2

QUESTION ANALYTICS +

Q. 9

If a Boolean function is having cyclic prime implicants K-map, then the number of minimal forms for function is ________.

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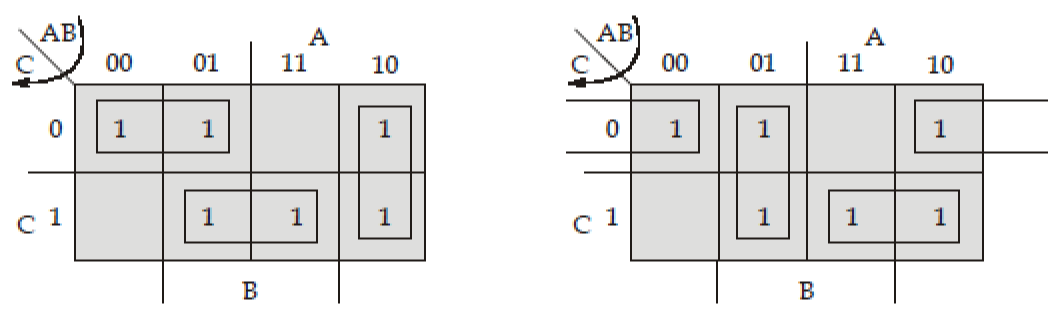
2 | Your answer is **Correct**2

Solution :
2

Example: $F(A, B, C) = \Sigma m(0, 2, 3, 4, 5, 7)$



$F(A, B, C) = \bar{A}\bar{C} + BC + A\bar{B}$ $\quad$ $F(A, B, C) = \bar{B}\bar{C} + \bar{A}B + AC$

F(A, B, C) is having cyclic PI K-map and it is having '2' minimal forms.
In general, based on above example when the Boolean function is having cyclic prime implicants K-map it will be having 2 minimal forms.

QUESTION ANALYTICS +

Q. 10

Let A, B and C are Boolean variables, then which of the following is true?

Solution Video | Have any Doubt ?

Your answer is **Wrong**

A $(AB+C)(A+C)=(A+B)C$ Your answer is Wrong

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

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

D All of the above Correct Option

Solution :
(d)

$$
\begin{aligned}
&\text{(a)} & \overline{(\overline{A}B+\overline{C})}(A+C) &= (A+\overline{B})C\\
& & (A+\overline{B})\cdot C\cdot(A+C) &= (A+\overline{B})C\\
& & (AC+\overline{B}C)(A+C) &= (A+\overline{B})C\\
& & AC+A\overline{B}C+\overline{B}C &= (A+\overline{B})C\\
& & AC+\overline{B}C &= (A+\overline{B})C\\
& & (A+\overline{B})C &= (A+\overline{B})C \quad \because \text{ True}\\
&\text{(b)} & \overline{(A+\overline{B}+\overline{C})(A+\overline{B}C)} &= \overline{A}(B+\overline{C})\\
& & (\overline{A}BC)+\overline{A}(B+\overline{C}) &= \overline{A}B+\overline{A}\overline{C}\\
& & \overline{A}BC+\overline{A}B+\overline{A}\overline{C} &= \overline{A}B+\overline{A}\overline{C}\\
& & \overline{A}B(C+1)+\overline{A}\overline{C} &= \overline{A}B+\overline{A}\overline{C}\\
& & \overline{A}\overline{C}+\overline{A}B &= \overline{A}B+\overline{A}\overline{C} \quad \because \text{ True}\\
&\text{(c)} & (A+\overline{A}\overline{B}\overline{C})B+\overline{A}B &= BA+\overline{A}B\\
& & (A+\overline{B}\overline{C})B+\overline{A}B &= (A+\overline{A})B\\
& & AB+\overline{A}B &= B\\
& & B(A+\overline{A}) &= B\\
& & B &= B \quad \because \text{ True}
\end{aligned}
$$

So, all the expression are correct.

QUESTION ANALYTICS +

Q. 11

Let $X = X_2X_1X_0$ and $Y = Y_1Y_0$ be unsigned positive 3-digit and 2-digit numbers respectively. The output function 'f' = 1 only when $X > Y$ otherwise '0'. Then the value of output f is equal to

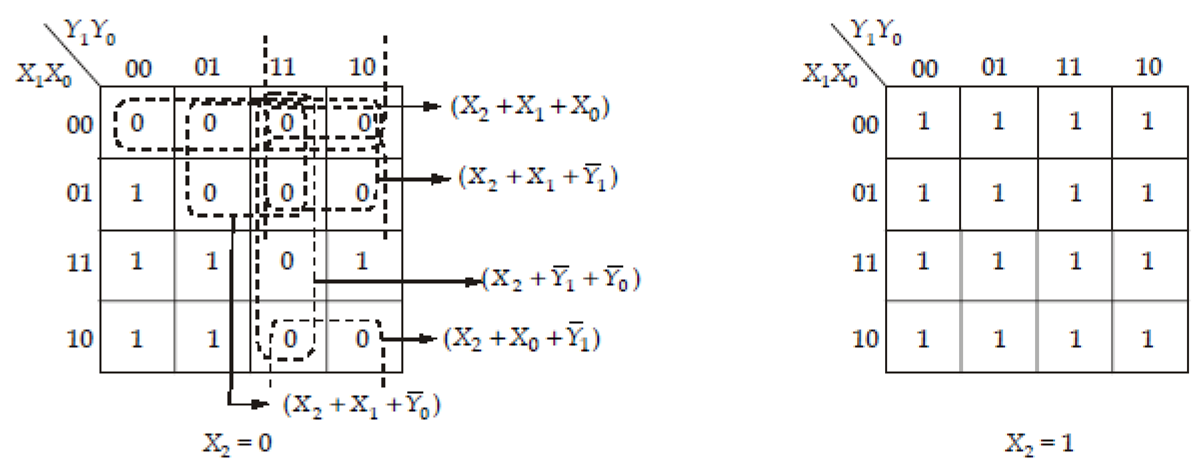
FAQ Solution Video Have any Doubt ?

A $(X_2+Y_1+Y_0)(X_2+\overline{X}_1+\overline{Y}_0)(X_2+X_1+\overline{Y}_1)(X_2+X_1+X_0)(X_2+X_0+\overline{Y}_1)$

B $(X_2+\overline{Y}_1+\overline{Y}_0)(X_2+X_1+\overline{Y}_0)(X_2+\overline{X}_1+Y_1)(X_2+X_1+X_0)(X_2+X_0+\overline{Y}_1)$

C $(X_2+\overline{Y}_1+\overline{Y}_0)(X_2+X_1+\overline{Y}_0)(X_2+X_1+\overline{Y}_1)(X_2+X_1+X_0)(X_2+X_0+\overline{Y}_1)$ Correct Option

Solution :
(c)
Now, $X > Y$ if
(a) $X_2 = 1$
(b) $X_2 = 0$ and $X_1X_0 > Y_1Y_0$



D $(X_2+\overline{Y}_1+\overline{Y}_0)(X_2+\overline{X}_1+\overline{Y}_0)(X_2+X_1+\overline{Y}_1)(X_2+\overline{X}_1+\overline{X}_0)(X_2+X_0+\overline{Y}_1)$

QUESTION ANALYTICS +

Q. 12

Consider the function $F=A(\overline{A}+B)(\overline{A}+B+\overline{C})$, where F is a function in three Boolean variables A, B and C and $\overline{A},\overline{C}$ are complement of variable A and C. Consider the following statements:

$S_1 : F = \Sigma(6, 7)$
$S_2 : F = \Sigma(0, 1, 2, 3, 4, 5)$
$S_3 : F = \Pi(0, 1, 2, 3, 4, 5)$
$S_4 : F = \Pi(6, 7)$

Which of the following is true?

Solution Video Have any Doubt ?

A S_1 = true, S_2 = false, S_3 = false, S_4 = true

B S_1 = false, S_2 = true, S_3 = false, S_4 = true

C S_1 = true, S_2 = false, S_3 = true, S_4 = false Your answer is Correct

Solution :
(c)

$$F = A(\overline{A}+B)(\overline{A}+B+\overline{C})$$

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

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

$$\text{POS (F)} = M_0, M_1, M_2, M_3, M_4, M_5$$

$$= \Pi(0, 1, 2, 3, 4, 5)$$

So, $$\text{SOP (F)} = (0, 1, 2, 3, 4, 5, 6, 7) - (0, 1, 2, 3, 4, 5)$$

$$= \Sigma(6, 7)$$

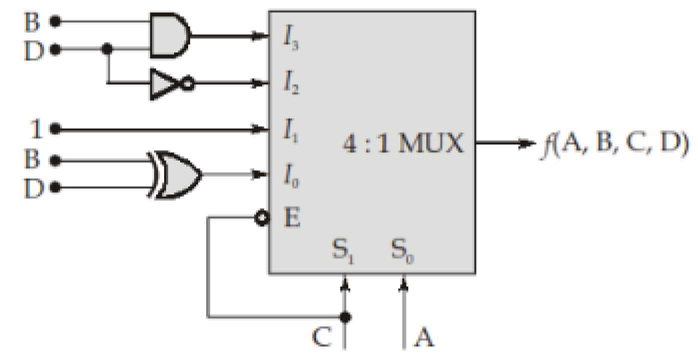
So, $$F = \Sigma(6, 7) \text{ and } F = \Pi(0, 1, 2, 3, 4, 5)$$

D S_1 = false, S_2 = true, S_3 = true, S_4 = false

QUESTION ANALYTICS +

Q. 13

Identify the function f(A, B, C, D), which is realised by the given 4 × 1 multiplexer circuit.



FAQ Solution Video Have any Doubt ?

A $f = \Sigma m(0, 4, 8, 9, 12, 13)$

B $f = \Sigma m(1, 4, 8, 9, 12, 13)$ Correct Option

Solution :
(b)

$$\left.\begin{array}{l} S_2 = C \\ S_0 = A \end{array}\right\}$$

$$I_0 = B \oplus D$$

$$I_2 = \bar{D}$$

$$E = C$$

$$I_1 = 1$$

$$I_3 = BD$$

Mux output is

$$Y = [\bar{S}_1 \bar{S}_0 I_0 + \bar{S}_1 S_0 I_1 + S_1 \bar{S}_0 I_2 + S_1 S_0 I_3]\bar{E}$$

Substituting the values

$$f(A, B, C, D) = [\bar{C}\bar{A}(B \oplus D) + \bar{C}A(1) + C\bar{A}(\bar{D}) + CA(BD)]\bar{C}$$

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

$$= \underset{1}{\bar{A}\bar{B}\bar{C}D} + \underset{4}{\bar{A}B\bar{C}\bar{D}} + \underset{(8,9,12,13)}{A\bar{C}}$$

$$= \Sigma m(1, 4, 8, 9, 12, 13)$$

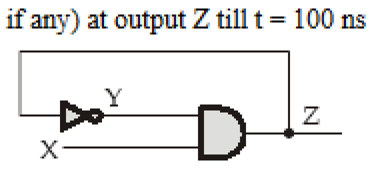
C $f = \Sigma m(1, 4, 8, 9, 12, 15)$

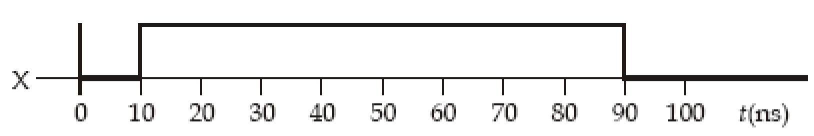
D None of the above Your answer is **Wrong**

QUESTION ANALYTICS +

Q. 14

Assume that the inverter in the network below has a propagation delay of 5 ns and the AND gate has a propagation delay of 10 ns. Draw a timing diagram for the network showing X, Y and Z. Assume Y is initially 1 and X waveform is given. Then the number of points where level changes is (excluding at t = 0 ns if any) at output Z till t = 100 ns is

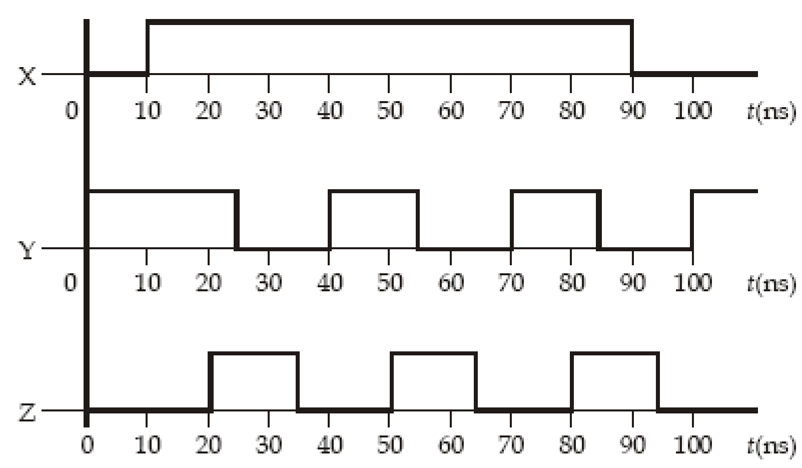




FAQ Solution Video Have any Doubt ?

A 6 Correct Option

Solution :
(a)



Level changes at points are t = 20, 35, 50, 65, 80, 95 ns

B 7

C 8

D these

QUESTION ANALYTICS +

Q. 15

Consider the following arithmetic equation:

$$\frac{302}{20} = 12.1$$

The minimum possible non-zero base for the given system is ________.

Solution Video | Have any Doubt ?

4 — Your answer is **Correct**4

Solution :
4

Let the base be 'x'. Thus the decimal equivalent can be written as,

$$\begin{aligned} \frac{3x^2+2}{2x} &= x+2+\frac{1}{x} \\ 3x^2+2 &= 2x^2+4x+2 \\ x^2-4x &= 0 \\ x(x-4) &= 0 \end{aligned}$$

$\therefore$ $x = 0$ and $x = 4$

Since, we require non-zero number, thus $x = 4$.

QUESTION ANALYTICS +

Q. 16

The number of minterms after minimizing the following Boolean expression is ________.

$$[D' + AB' + A'C + AC'D + A'C'D]'$$

Solution Video | Have any Doubt ?

1 — Your answer is **Correct**1

Solution :
1

$[D' + AB' + A'C + AC'D + A'C'D]'$

$= [D' + AC'D + AB' + A'C + A'C'D]'$

$= [D' + AC' + AB' + A' [C + C'D]]'$

$= [D' + AC' + AB' + A' [C + D]]'$

$= [D' + AC' + AB' + A'C + A'D]'$

$(\because\ D' + A'D = D' + A')$

$= [D' + A' + AC' + AB' + A'C]'$

$(\because\ A' + A'C = A')$

$(\because\ A' + AC' + AB' = A'+A(C'+B') = A' + C' + B')$

$= [D' + A' + C' + B']'$

$= ABCD$

Hence, only 1 minterm is required.

QUESTION ANALYTICS +

Q. 17

Consider a 3-bit number A and 2 bit number B are given to a multiplier. The output of multiplier is realized using AND gate and one bit full adders. If minimum number of AND gates required are X and one bit full adders required are Y, then X + Y = ________.

FAQ | Solution Video | Have any Doubt ?

9 — Correct Option

Solution :
9

Let,

A =		a_2	a_1	a_0
B =			b_1	b_0
A × B =		a_2b_0	a_1b_0	a_0b_0
	b_1a_2	b_1a_1	b_1a_0	$\downarrow$
	b_1a_2	$(a_2b_0 + a_1b_1)$	$(a_1b_0 + b_1a_0)$	a_0b_0
	C_3	C_2	C_1	C_0

Number of AND gates required X = 6

Number of one bit full adders required Y = 3

$$X + Y = 6 + 3 = 9$$

QUESTION ANALYTICS +