Kunal Jha
Course: GATE
Computer Science Engineering(CS)

MULTIPLE SUBJECT : DIGITAL LOGIC + DISCRETE MATHEMATICS (GATE - 2020) - REPORTS

Q. 1 Solution Video | Have any Doubt ?

Consider the following premises P_1, P_2, P_3 and P_4:
P_1 : Every computer science major is rich.
P_2 : All rich people are happy.
P_3 : Varun is rich.
P_4 : Suresh is not happy.
Which of the following conclusion(s) does not follow from the above premises?

A. Suresh is not a computer science major.

B. Varun is happy.

C. All poor people are unhappy. Correct Option

Solution :
(c)
Let's see option (a) first.
Suresh being unhappy, implies that Suresh is not rich. And from P_1, we can clearly say that Suresh is not a computer science major. Hence (a) is true.
Now as far as option (b) is concerned, P_3 says that Varun is rich. And we know from P_2, that all rich people are happy. This implies Varun is also happy. Hence (b) is also true.
However (c) is incorrect. Yes, every rich person is happy as it is given in P_2, but nowhere are we told in the question that the inverse of P_2 also holds true. Hence it is not a correct conclusion, and therefore (c) is the most appropriate choice.

D. None of these

QUESTION ANALYTICS +

Q. 2 Solution Video | Have any Doubt ?

A boolean function is represented as $f(X, Y, Z) = XY + XZ$. The POS representation of the function in K-map can be best described by
(Assuming no don't care condition is present)

A.

X \ YZ	00	01	11	10
0				
1		0	0	0

B.

X \ YZ	00	01	11	10
0		0	0	0
1			0	

C. Correct Option

X \ YZ	00	01	11	10
0	0	0	0	0
1	0			

Solution :
(c)
From the options it can be seen that for the option (c), we get

X \ YZ	00	01	11	10
0	0	0	0	0
1	0	1	1	1

Thus,
$$f = X(Y + Z)$$
$$= XY + XZ$$

D.

X \ YZ	00	01	11	10
0			0	
1	0	0	0	0

QUESTION ANALYTICS +

Q. 3

Solution Video | Have any Doubt ?

Let square (x): x is a square; white (x): x is white; empty (x, t): x is empty at time t.
Consider the sentence S as "White squares are always empty". Now consider the following first order logic sentences.

I. $\forall x\ ((\text{square}(x) \wedge \text{white}(x)) \rightarrow \forall t\ \text{empty}(x, t))$

II. $\forall x\ ((\text{square}(x) \rightarrow (\text{white}(x) \rightarrow \forall t\ \text{empty}(x, t)))$

Which of the above are correct first order logic translations of S ?

A. Only I

B. Only II

C. Both I and II — Correct Option

Solution :
(c)
Both are correct translations of the sentence S.
Hence (c) is correct.

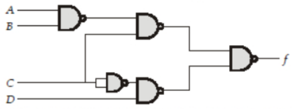
D. None of these

QUESTION ANALYTICS +

Q. 4

Solution Video | Have any Doubt ?

Consider the circuit shown in the figure below:



The circuit consists of NAND gates only. Then which one of the following options represents the output of the logic circuit?

A. $f = (\overline{A} + \overline{B})C + \overline{C}D$ — Correct Option

Solution :
(a)
The output logic function of the given circuit can be expressed as,

$$\begin{aligned} f &= \overline{\left(\overline{(\overline{AB})C}\right)\left(\overline{\overline{C}D}\right)} \\ &= (\overline{AB})C + \overline{C}D \\ &= (\overline{A} + \overline{B})C + \overline{C}D \end{aligned}$$

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

C. $f = \overline{\overline{A\overline{B}\overline{C}} + \overline{D}C}$

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

QUESTION ANALYTICS +

Q. 5

Solution Video | Have any Doubt ?

Consider the following statements:
I. Every group of finite order is abelian.
II. Every subgroup of cyclic group is abelian.
Which of the above statements is/are true?

A. Only I

B. Only II — Correct Option

Solution :
(b)
Only the second statement is true. The first statement is clearly false. There is no relation between abelian groups and finiteness.
2nd statement is true. A popular theorem says "Every subgroup of a cyclic group is cyclic"; and since every cyclic group is abelian, we can say that Every subgroup of cyclic group is abelian.

C. Both I and II

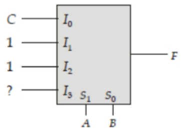
D. None of these

QUESTION ANALYTICS +

Q. 6

Solution Video | Have any Doubt ?

For the 4 × 1 MUX shown below:



If the output $F = A + B + C$, then I_3 will be

A A — Correct Option

Solution :
(a)

$$F = \bar{S}_1\bar{S}_0I_0 + \bar{S}_1S_0I_1 + S_1\bar{S}_0I_2 + S_1S_0I_3$$
$$= \bar{A}\bar{B}C + \bar{A}B\cdot 1 + A\bar{B}1 + ABI_3$$
$$= \bar{A}\bar{B}C + \bar{A}B + A\bar{B} + ABI_3$$
$$= B(\bar{A} + AI_3) + \bar{B}(\bar{A}C + A)$$
$$= B(\bar{A} + I_3) + \bar{B}(A + C) \qquad ...(i)$$

Let $I_3 = A$,
$$F = B(A + \bar{A}) + \bar{B}(A + C) = B + \bar{B}(A + C)$$
$$= (B + \bar{B})(A + B + C)$$
$$= A + B + C$$

Let $I_3 = C$,

$\therefore$
$$F = B(\bar{A} + C) + \bar{B}(A + C)$$
$$= \bar{A}B + BC + A\bar{B} + C\bar{B}$$
$$F = \bar{A}B + C + A\bar{B} \neq A + B + C$$

Let $I_3 = 0$,

$\therefore$
$$F = B(\bar{A} + 0) + \bar{B}(A + C)$$
$$= \bar{A}B + A\bar{B} + \bar{B}C \neq A + B + C$$

B 0

C C

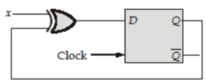
D All of the above

QUESTION ANALYTICS +

Q. 7

Solution Video | Have any Doubt ?

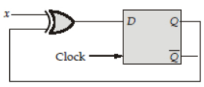
The circuit acts as



A D-Flip Flop

B T-Flip Flop — Correct Option

Solution :
(b)



x	Q_n	Q_{n+1}	$D = x \oplus Q_n$
0	0	0	0
0	1	1 $\}\ Q_n$	1
1	0	1	1
1	1	0 $\}\ \bar{Q}_n$	0

x	Q_{n+1}
0	Q_n
1	$\bar{Q}_n$

So, it is a T-Flip Flop.

C Both (a) and (b)

D None of these

QUESTION ANALYTICS +

Q. 8

Solution Video | Have any Doubt ?

For the following characteristic table using XY flip-flop, the characteristic equation $Q(t + 1)$ = _______.

X	Y	$Q(t+1)$
0	0	1
1	0	$Q(t)$

0	1	$\bar{Q}(t)$
1	1	0

A $Y\bar{Q}(t)+\bar{X}\bar{Q}(t)$

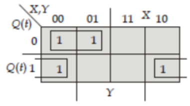
B $\bar{Y}Q(t)+X\bar{Q}(t)$

C $\bar{Y}Q(t)+\bar{X}\bar{Q}(t)$ — Correct Option

Solution :
(c)

	X	Y	Q(t)	Q(t + 1)
0	0	0	0	1
1	0	0	1	1
2	0	1	0	1
3	0	1	1	0
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	0

$$Q(t+1) = \Sigma m(0, 1, 2, 5)$$



$$Q(t+1) = \bar{X}\bar{Q}(t)+\bar{Y}Q(t)$$

D $YQ(t)+X\bar{Q}(t)$

QUESTION ANALYTICS

Q. 9

Solution Video | Have any Doubt ?

Let $f(x)$ satisfies the equation, $f(x) + 2f(1 - x) = 3x$, where x is a real number. Then the value of $f(9)^2$ is equal to ______.

625 — Correct Option

Solution :
(625)

Given, $f(x) + 2f(1 - x) = 3x$ ...(i)

Replacing x by $1 - x$, we get

$f(1 - x) + 2f(x) = 3 - 3x$ ...(ii)

Solving (i) and (ii), we get

$f(x) = 2 - 3x$

Therefore, $f(9)^2 = [2 - 3(9)]^2 = 625$

QUESTION ANALYTICS

Q. 10

Solution Video | Have any Doubt ?

We are given a tripartite graph G having 27 vertices respectively. Let X be the maximum number of edges possible in G. Then the value of X is ______.

243 — Correct Option

Solution :
243

In order to get the maximum number of edges, it can be shown that vertices should get uniformly distributed between the 3 partitions. That is, each partition should get $\frac{27}{3} = 9$ vertices respectively.

Therefore the edges will be maximum when G is a complete tripartite graph $K_{9,9,9}$. And we know that number of edges in $K_{m,n,p}$ is equal to $mn + np + mp$, which is equal to 9.9 + 9.9 + 9.9 = 243.

QUESTION ANALYTICS

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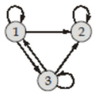
Q. 11 Solution Video | Have any Doubt ?

The cardinality of the transitive closure of a relation R over the set {1, 2, 3} whose matrix representation is given below, is equal to ______.

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$$

7 — Correct Option

Solution :
7
The cardinality will be 7 – here's the transitive closure.



$$\rightarrow \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$

Hence (7) will be the answer.

QUESTION ANALYTICS +

Q. 12 Solution Video | Have any Doubt ?

Consider the following languages M and N over the alphabet {0, 1}.

$M = \{w \mid w \in \{0, 1\}^8;\ w = w^R\}$

$N = \{w \mid w \in \{0, 1\}^8;\ n_0(w) = n_1(w)\}$

Then the sum of cardinalities of M and N is equal to ________.

86 — Correct Option

Solution :
(86)
The set M consists of even palindromes of length 8 over the alphabet {0, 1}.

Hence cardinality of M $= 2^{8/2} = 2^4 = 16$

Now coming to set N, it contains 8 bit strings which contain the same number of 0's and 1's. This too is pretty straightforward - out of 8 places choose 4 places to place the 0's, and the remaining 4 places will automatically get assigned to 1's.

Therefore N will be as big as ${}^8C_4$ which is equal to 70.

So the required answer will be the sum of M and N's cardinality which is, 16 + 70 = 86.

QUESTION ANALYTICS +

Q. 13 Solution Video | Have any Doubt ?

We are given two graphs *G* and *H*. *G* has 10 vertices and an unknown number of edges. It is given that *H* happens to be a tree, and *G* is isomorphic to *H*, (where *H* denotes the complement of *H*). Then the number of edges in *G* is equal to ______.

36 — Correct Option

Solution :
(36)

Given, $v(G) = 10$

Also, G is isomorphic to $\bar{H} \Rightarrow v(G) = v(\bar{H}) = 10$

Since $v(\bar{H}) = 10$, $v(H)$ is also equal to 10.

H forms a tree, therefore $e(H) = v(H) - 1$
$= 10 - 1 = 9$

We need to find $e(G)$.

So let's find $e(\bar{H})$ first

Now, $e(H) + e(\bar{H}) = \dfrac{n(n-1)}{2}$

Here, $n = 10$, $e(H) = 9$; so putting values

$9 + e(\bar{H}) = \dfrac{10(9)}{2}$

Since, $e(G) = e(\bar{H})$

We get $e(G) = 36$

Therefore the correct answer is 36.

QUESTION ANALYTICS +

Q. 14

Solution Video | Have any Doubt ?

A boolean function is given as,

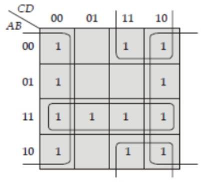
$f(A,B,C,D) = B\bar{D} + \bar{B}CD + ABC + AB\bar{C}D + \bar{B}\bar{D}$

Then the minimum number of two input NAND gates required to implement this function is _______.

6

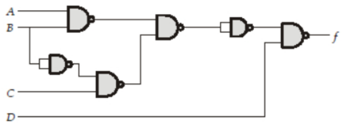
Correct Option

Solution :
(6)



From the K-map, we have,

$$f = \bar{D} + AB + \bar{B}C$$



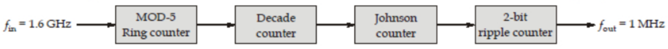
QUESTION ANALYTICS

+

Q. 15

Solution Video | Have any Doubt ?

Consider the figure shown below. The four counters are connected in cascade. The number of flip-flops used to construct the third block which is a Johnson counter is _______.



4

Correct Option

Solution :
(4)

$$f_{out} = \frac{f_{in}}{\text{MOD (total)}}$$

$$\therefore \quad \text{MOD} = \frac{f_{in}}{f_{out}} = 5 \times 10 \times 2x \times 4$$

$$x = \frac{1}{400} \times \frac{1.6 \times 10^9}{1 \times 10^6} = \frac{1600}{400}$$

$$x = 4 \text{ bits}$$

QUESTION ANALYTICS

+

Q. 16

Solution Video | Have any Doubt ?

A MOD-8 gray up-counter is designed using T-flip-flops. If the initial state of the counter is S_0 = 110, then the minimum number of clock cycles required to reach a state of (101) will be _______.

2

Correct Option

Solution :
2

3-bit gray code is

000
001
011
010
110
111 ⇒ Two clock cycles are required
101
100

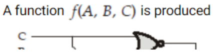
QUESTION ANALYTICS

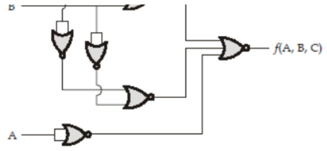
+

Q. 17

Solution Video | Have any Doubt ?

A function $f(A, B, C)$ is produced by using NOR-gates as shown in the figure below:





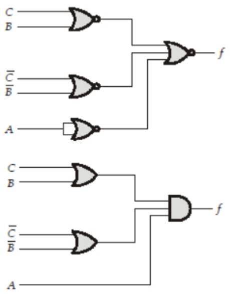
The function 'f' can be represented as

A $f = \Sigma m\ (0, 1, 3, 2, 7)$

B $f = \Sigma m\ (0, 1, 3)$

C $f = \Sigma m\ (5, 6)$ Correct Option

Solution :
(c)
The above circuit can be drawn as,



From the above figure, we can write,

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

The output is in POS form, we can use this expression to fill the K-map.

A \ BC	00	01	11	10
0	0	0	0	0
1	0	1	0	1

Thus from the figure, we can deduce

$$f(A, B, C) = \Sigma m\ (5, 6)$$

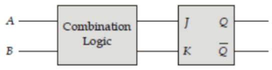
D $f = \Sigma m\ (1, 5, 7)$

QUESTION ANALYTICS +

Q. 18 Solution Video Have any Doubt ?

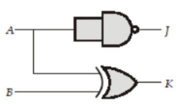
A new two input flip flop is designed as shown in figure. The table shows the characteristic table of the A - B flip-flop.

A	B	Q_{n+1}
0	0	$\overline{Q}_n$
0	1	1
1	0	Q_n
1	1	0

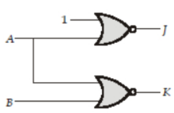


The combination logic is

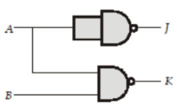
A



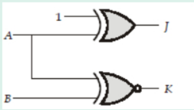
B



C



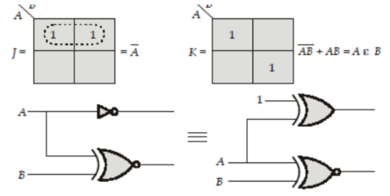
D Correct Option



Solution :
(d)

A	B	Q_{n+1}	J	K
0	0	$\overline{Q}_n$	1	1
0	1	1	1	0
1	0	Q_n	0	0
1	1	0	0	1

State Table

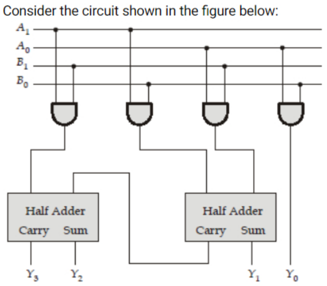


QUESTION ANALYTICS +

Q. 19

Solution Video | Have any Doubt ?

Consider the circuit shown in the figure below:



The input to the circuit is two, 2-bit numbers. The numbers are represented as (A_1A_0) and (B_1B_0). The function of the circuit is

A. A look ahead carry adder circuit

B. An array divider circuit

C. A parity check circuit

D. An array multiplier circuit — Correct Option

Solution :
(d)

The output,

$$Y_0 = A_0B_0$$
$$Y_1 = B_0A_1 \oplus B_1A_0$$
$$Y_2 = B_1A_1 \oplus \text{Carry } 1$$
$$Y_3 = \text{Carry } 2$$

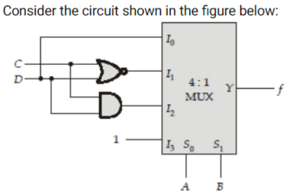
Thus, it can be seen that the output is equal to multiplication of 2-bit number (A_1A_0) and (B_1B_0).

QUESTION ANALYTICS +

Q. 20

Solution Video | Have any Doubt ?

Consider the circuit shown in the figure below:



If *A* and *B* are connected to the select lines of the MUX circuit, then the boolean function realized by the circuit is

A. $f(A, B, C, D) = \Pi M\ (1, 3, 7, 8, 12, 13, 14, 15)$

B. $f(A, B, C, D) = \Sigma m\ (1, 3, 7, 9, 12, 13, 14, 15)$

C. $f(A, B, C, D) = \Pi M\ (0, 2, 4, 5, 6, 9, 10, 11)$ — Correct Option

Solution :
(c)

$$f = \overline{S}_1\,\overline{S}_0\,I_0 + \overline{S}_1\,S_0\,I_1 + S_1\,\overline{S}_0\,I_2 + S_1\,S_0\,I_3$$

Now, $S_1 = B,\ S_0 = A$

$$I_0 = D$$
$$I_1 = \overline{(C+D)} = \overline{C}\,\overline{D}$$
$$I_2 = CD \text{ and } I_3 = 1$$

$\therefore$ $f = \overline{B}\,\overline{A}\,D + \overline{B}\,A\,\overline{C}\,\overline{D} + B\,\overline{A}\,C\,D + AB$

Expressing the boolean function in canonical form by using *K*-map, we get,

AB \ CD	00	01	11	10
00	0	1	1	0
01	0	0	1	0
11	1	1	1	1

10	1	0	0	0

$f(A, B, C, D) = \Pi M\ (0, 2, 4, 5, 6, 9, 10, 11)$

D $f(A, B, C, D) = \Sigma m\ (0, 1, 4, 5, 6, 9, 10, 11)$

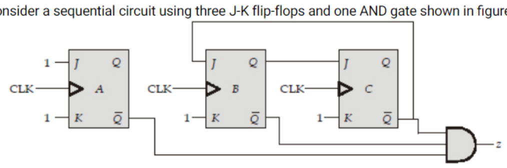
QUESTION ANALYTICS +

MULTIPLE SUBJECT : DIGITAL LOGIC + DISCRETE MATHEMATICS (GATE - 2020) - REPORTS

Q. 21

Solution Video | Have any Doubt ?

Consider a sequential circuit using three J-K flip-flops and one AND gate shown in figure. Output (z) of the circuit becomes '1' after every *N*-clock cycles.



Which of the following represent the value of *N*?

A 4

B 5

C 6 — Correct Option

Solution :
(c)
The output z is connected from inverted outputs of the FFs through AND gate, i.e.

$$z = \bar{Q}_A . \bar{Q}_B . \bar{Q}_C = \overline{Q_A + Q_B + Q_C}$$

Hence, the output z will be high only when all FF's output is zero, i.e.

$$Q_A = Q_B = Q_C = 0$$

Let initially $z = 1$, then we obtain the truth table for the circuit as

CLK	$J_A = 1$	$K_A = 1$	$J_B = \bar{Q}_C$	$K_B = 1$	$J_C = Q_B$	$K_C = 1$	Q_A	Q_B	Q_C	z
1	1	1	1	1	0	1	1	1	0	0
2	1	1	1	1	1	1	0	0	1	0
3	1	1	0	1	0	1	1	0	0	0
4	1	1	1	1	0	1	0	1	0	0
5	1	1	1	1	1	1	1	0	1	0
6	1	1	0	1	1	1	0	0	0	1

It is MOD-6 counter. So, output z will be 1 after 6 clock pulses.

D 7

QUESTION ANALYTICS +

Q. 22

Solution Video | Have any Doubt ?

The value of summation $\sum_{r=0}^{n}\left[\frac{{}^nC_r}{r+1}\right]$ is equal to

A 2^n

B 3^n

C $\frac{2^n}{n+1}$

D $\frac{2^{n+1}}{n+1}$ — Correct Option

Solution :
(d)

Consider, $(1+x)^n = {}^nC_0 + {}^nC_1 x + {}^nC_2 x^2 + ... + {}^nC_n x^n$

Integrating both sides,

$$\frac{(1+x)^{n+1}}{n+1} = \left[{}^nC_0 x + \frac{{}^nC_1 x^2}{2} + \frac{{}^nC_2 x^3}{3} + ... + \frac{{}^nC_n x^{n+1}}{n+1}\right]$$

Put $x = 1$ to get,

$$\frac{2^{n+1}}{n+1} = {}^nC_0 + \frac{{}^nC_1}{2} + \frac{{}^nC_2}{3} + ... + \frac{{}^nC_n}{n+1}$$

RHS is nothing but the required summation, which is equal to $\frac{2^{n+1}}{n+1}$.

Hence option (d) is the answer.

QUESTION ANALYTICS +

Q. 23

Solution Video | Have any Doubt ?

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

A The function is having two minimal forms, with one common prime implicant

B The function is having two minimal forms, with two common prime implicants

C The function is having two minimal forms, with no common prime implicants. Correct Option

Solution :
(c)

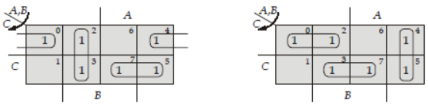
Cyclic prime implicant K-map function will be having two minimal forms, with no common prime implicant.

Example:

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

$$f(A, B, C) = \bar{A}\bar{C} + BC + A\bar{B} \quad \text{...(i)}$$

$$f(A, B, C) = \bar{B}\bar{C} + \bar{A}B + AC \quad \text{...(ii)}$$



Number of minimal expressions = 2

No common prime implicant.

∴ Option (c) is correct.

D The function is having two minimal forms and one essential prime implicant.

QUESTION ANALYTICS +

Q. 24

Solution Video | Have any Doubt ?

Let A, B and C be three sets such that A ⊆ B, B ⊆ C and C ⊆ A. Then which of the following is not a viable possibility?

A All the sets are empty

B One of the sets is non empty, and the other two sets are empty Correct Option

Solution :
(b)

A ⊆ B, B ⊆ C and C ⊆ A implies that A = B = C. So (a) is fine, as all are empty and thus equal to each other. Options C and D are also correct as equality of two sets implies that both are subsets and supersets of each other. But what option (b) claims indirectly is that, the sets are not equal, and therefore this is something that cannot happen as the sets are equal.

Therefore (b) is the most appropriate choice.

C C ⊆ B

D A ⊆ C

QUESTION ANALYTICS +

Q. 25

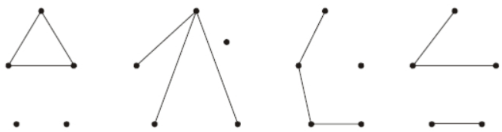
Solution Video | Have any Doubt ?

The number of unlabelled simple graphs possible with 5 vertices and 3 edges is equal to ________.

4 Correct Option

Solution :
4

There are totally 4 unlabelled graphs possible with 5 vertices and 3 edges, each of which is given below.



I. II. III. IV.

QUESTION ANALYTICS +

Q. 26

Solution Video | Have any Doubt ?

4 dice are rolled. The outcome is defined as the number of times each of the numbers 1 to 6 appears. For example, two 6's and one 5 is an outcome. All 3's is another outcome. Then the number of different outcomes possible is equal to

126 Correct Option

Solution :
(126)
The above problem can be reduced to finding the number of integral solutions to the equation,
$x1 + x2 + x3 + x4 + x5 + x6 = 4$; where $x1, x2, \dots, x6 >= 0$.
Therefore the answer will be, ${}^{6-1+4}C_4 = {}^{9}C_4 = 126$.

QUESTION ANALYTICS +

Q. 27 Solution Video Have any Doubt ?

Consider the following set of integer (Z_{360}, +) under the addition modulo 360 operation. The value of $(2^{-1} + 3^{-1})$ = _______.

355 Correct Option

Solution :
355
We know that,
$$x^{-1} = m - x$$
So, $$2^{-1} + 3^{-1} = [(360 - 2) + (360 - 3)] \bmod 360 = 715 \bmod 360 = 355$$

QUESTION ANALYTICS +

Q. 28 Solution Video Have any Doubt ?

Let S be the set of all boolean square matrices of order 2 × 2. A matrix is picked at random from S. Let E_1 denote the event that the chosen matrix is singular. Let E_2 denote the event that the sum of all entries in the matrix is equal to 3. Then the value of $P\left(\frac{E_1}{E_2}\right)$ is equal to _______.

0 Correct Option

Solution :
(0)
'Sum of all entries in the matrix equals 3 implies that the matrix has three 1s and one 0. It can be easily seen that there will be 4 such matrices possible.
We need to find the probability that the chosen matrix is singular, given that the matrix carries three 1's and one 0. It's quite easy to see that the determinant in each of the 4 cases turns out to be non zero, as with just one 'zero' entry it is not possible to make the determinant vanish, which means that every such matrix is non singular. Therefore the required probability turns out to be zero.

QUESTION ANALYTICS +

Q. 29 Solution Video Have any Doubt ?

The number of relations are possible on a set of 10 elements which are both symmetric and antisymmetric is _______.

1024 Correct Option

Solution :
1024
Only the diagonal elements will be symmetric as well as antisymmetric.
So, total number of such relations = 2^{10} = 1024.

QUESTION ANALYTICS +

Q. 30 Solution Video Have any Doubt ?

A lawn-sprinkling system is controlled automatically by certain combination of following variables.
Season (S = 1, if summer ; 0, otherwise)
Moisture content of the soil (M = 1, if high ; 0, if low)
Outside temperature (T = 1, if high ; 0, if low)
Outside humidity (H = 1, if high ; 0, if low)
The sprinkler is turned 'ON' under any of the following conditions.
1. The moisture content is low in winter.
2. The temperature is high and moisture content is low in summer.
3. The temperature and humidity is high in summer.
4. The temperature and moisture content is low in summer.
5. The temperature is high and the humidity is low.
Then the minimum number of two input NAND gates required to implement this function is _______.

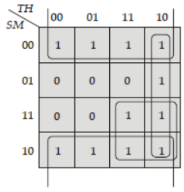
6 Correct Option

Solution :
(6)

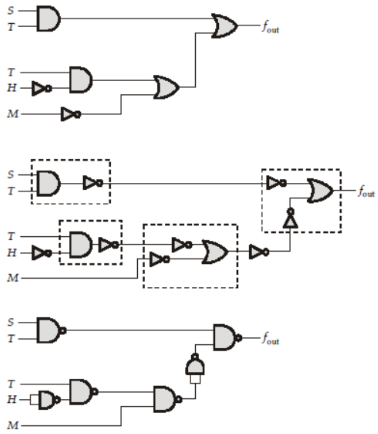
Boolean function that can be expressed in the form of a function can be represented as

$$f(S, M, T, H) = \bar{S}\bar{M} + S\bar{M}T + STH + S\bar{M}\bar{T} + T\bar{H}$$

Plotting the above result on K-map, we get,



$$\Rightarrow \quad f_{out} = \bar{M} + ST + T\bar{H}$$



Hence, 6 two-input NAND gates are required.

QUESTION ANALYTICS +

MULTIPLE SUBJECT : DIGITAL LOGIC + DISCRETE MATHEMATICS (GATE - 2020) - REPORTS

Q. 31 Solution Video Have any Doubt ?

The number of perfect matching in K_6, where K_n represents the complete graph on n vertices is equal to ______.

15 Correct Option

Solution :
15

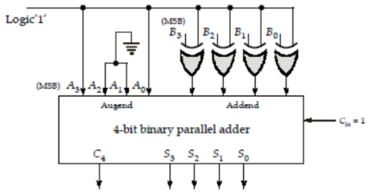
$$\text{Number of perfect matchings in } K_{2n} = \frac{2n!}{(2!)^n n!}$$

Putting $2n = 6$ i.e. $n = 3$, we get 15 as the answer.

QUESTION ANALYTICS +

Q. 32 Solution Video Have any Doubt ?

Consider the digital circuit shown below, single digit number (B) is converted into its 4 bit binary equivalent ($B_3B_2B_1B_0$) and then applied to the addend bits of the adder as shown below:



If number B is 15 then the output $S_3\ S_2\ S_1\ S_0$ is ______.

1010 Correct Option

Solution :
(1010)

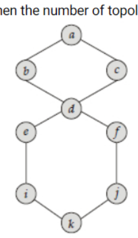
Since number B is 15 thus its 4 bit binary equivalent ($B_3B_2B_1B_0$) will be 1111. Thus the addend will be 0000 and augend will be 1001. The output of the parallel adder will be

$$\begin{aligned} \text{Output} &= \text{addend} + \text{augend} + C_{in} \\ &= 0000 + 1001 + 1 \\ &= 1010 \end{aligned}$$

QUESTION ANALYTICS +

Q. 33 Solution Video Have any Doubt ?

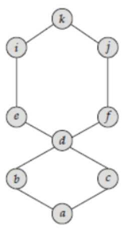
Consider the POSET X whose Hasse diagram is shown below. Let X^d be the dual of the POSET X.
Then the number of topological orderings of X^d is equal to ______.



12 Correct Option

Solution :
12

Dual of X can be obtained by turning the Hasse diagram upside down. Then X^d will be



Now we simply need to fill in the following blanks to find the topological orders of X.

$\boxed{a}$ .... $\boxed{k}$

$$a\begin{pmatrix} b & c \\ c & b \end{pmatrix} d \left\langle \begin{array}{l} e\,i\,f\,j\,k \\ e\,f \left\langle \begin{array}{l} i\,j\,k \\ j\,i\,k \end{array} \right. \end{array} \right.$$

So here number of topological sorts = 2 × 3 = 6

Now,

$$a\begin{pmatrix} b & c \\ c & b \end{pmatrix} d \left\langle \begin{array}{l} f\,j\,e\,i\,k \\ f \left\langle \begin{array}{l} e\,j\,i\,k \\ e\,i\,j\,k \end{array} \right. \end{array} \right.$$

Here number of topological sorts = 2 × 3 = 6

So, total number of topological sorts = 6 + 6 = 12.

QUESTION ANALYTICS +