



GATE 2024

COMPUTER SCIENCE & IT

Exam held on
10/02/2024
(Forenoon
Session)

Memory based
**Questions
& Solutions**



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SECTION - A

GENERAL APTITUDE

Q.1 A rectangular sheet of $54 \times 4 \text{ cm}^2$ is taken. The two longer edges of the sheet are joined together to create a cylindrical tube. A cube whose surface area is equal to the area of sheet is taken. Then the ratio of the volume of the cylindrical tube to the volume of the cube is ____.

Ans. (1 : π)

$$\begin{aligned} \text{Area of rectangular sheet} &= 54 \times 4 \\ &= 216 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Surface area of cube} &= 6 (\text{side})^2 \\ 216 &= 6 (\text{side})^2 \\ \text{side} &= 6 \end{aligned}$$

$$\text{Volume of cube} = 6^3 = 216$$

$$\text{radius of cylinder} = \frac{4}{2\pi}$$

$$\text{Volume of cylinder} = \pi r^2 h$$

$$= \pi \left(\frac{4}{2\pi} \right)^2 \times 54$$

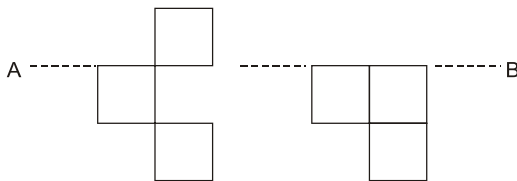
$$= \frac{216}{\pi}$$

$$\frac{\text{Volume of cylinder}}{\text{Volume of cube}} = \frac{216/\pi}{216}$$

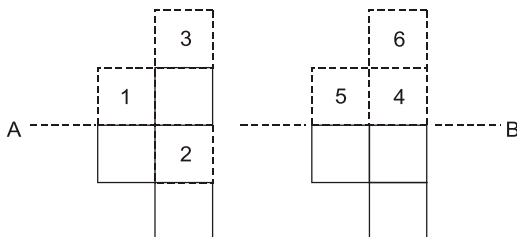
$$= 1 : \pi$$

End of Solution

Q.2 Least number of square to be added in figure to make AB a line of symmetry is

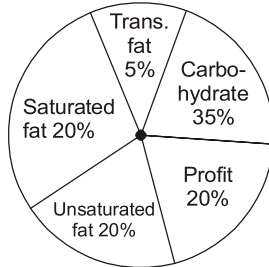


Ans. (6)



End of Solution

Q.3 Pie chart represent, 2000 Kcal diet of a person the typical energy density (Kcal/g) of there is given carbohydrates = 4, proteins = 4, unsaturated fat = 9, saturated fat = 9, transfat = 9, then the total fat (all 3) in grams, this person consumes is



Ans. (100)

$$\begin{aligned} \text{Total Fat} &= \text{Saturated fat} + \text{unsaturated fat} \\ &= 20 + 20 + 5 \\ &= 45\% \end{aligned}$$

$$\text{Total fat in Kcal} = 2000 \times \frac{45}{100} = 900 \text{ Kcal}$$

Given all fat energy density = 9 Kcal/g

$$\text{There of total fat in gram} = \frac{900}{9} = 100 \text{ g}$$

End of Solution

Q.4 $\log(p^2 + q^2) = \log p + \log q + 2 \log 3$

Find the value of $\frac{p^4 + q^4}{p^2 q^2} =$

- (a) 81
- (b) 83
- (c) 79
- (d) 9

Ans. (c)

$$\begin{aligned} \log(p^2 + q^2) &= \log p + \log q + 2 \log 3 \\ &= \log p + \log q + \log 9 \end{aligned}$$

$$\log(p^2 + q^2) = \log(9pq)$$

$$p^2 + q^2 = 9pq$$

$$p^4 + q^4 + 2p^2q^2 = 81p^2q^2$$

$$p^4 + q^4 = 79p^2q^2$$

$$\text{The value of } \frac{p^4 + q^4}{p^2 q^2} = \frac{79p^2q^2}{p^2 q^2} = 79$$

End of Solution

Q.5 Two distinct non-zero variable x and y are such that $(x + y) \propto (x - y)$ then value of $\frac{x}{y}$

will be

(a) depend only on x

(b) is a constant

(c) depends on y

(d) depends on x and y

Ans. (b)

Given $(x + y) \propto (x - y)$
 $\therefore (x + y) = k(x - y)$
 $x + y = kx - ky$
 $(k - 1)x = (k + 1)y$

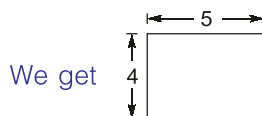
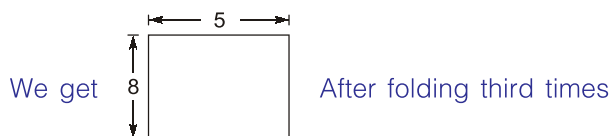
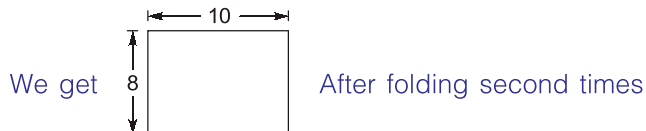
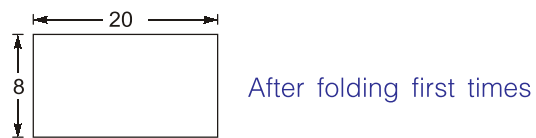
$$\frac{x}{y} = \frac{k+1}{k-1} = k' \text{ (constant)}$$

End of Solution

Q.6 Sheet of dimension 20×8 folded 3 times symmetrically along perpendicular to its longest edge the perimeter of final figure is _____.

Ans. (18)

Given dimension 20×8 folded 3 times symmetrically along perpendicular to its longest edge.



So, the perimeter of final figure = $2(4 + 5)$
 $= 18$ unit

End of Solution



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Q.7 Median of
9, 10, 11, 14, 15, 17, 10, 69, 11, 13 is _____.

Ans. (12.5)
Arrange given series in ascending order
9, 10, 10, 11, 11, 13, 14, 15, 17, 69
Median of the given data

$$= \frac{11+13}{2} = 12.5$$

End of Solution

Q.8 A person has denomination Rs. 1, 5 and 10 in ratio 5 : 3 : 13, then percentage of Rs. 5 coin of total amount is

Ans. (10)

$$\begin{aligned} \text{Percentage of Rs 5} &= \frac{5 \times 3}{1 \times 5 + 5 \times 3 + 10 \times 13} \times 100 \\ &= \frac{15}{150} \times 100 \\ &= 10\% \end{aligned}$$

End of Solution

Q.9 Increasing order of the intensity

Dry → Arid → Parched
The same intensity order for

Diet → Fast → ?

- (a) Feast (b) Starve
(c) Deny (d) Reject

Ans. (b)

End of Solution



SECTION - B

TECHNICAL

Algorithms

Q.10 $T(n) = \sqrt{n} T(\sqrt{n} + n)$

What is $T(n)$?

- (a) $\theta(n^2 \log n)$ (b) $\theta(n \log n)$
 (c) $\theta(n^2 \log \log n)$ (d) $\theta(n \log \log n)$

Ans. (d)

$$T(n) = \begin{cases} \sqrt{n} \cdot T(\sqrt{n} + n) & n > 2 \\ 1 & n \leq 2 \end{cases}$$

$$\begin{aligned} T(n) &= n^{1/2} \cdot T(n^{1/2}) + n \\ &= n^{1/2} [n^{1/2} T(n^{1/2}) + n^{1/2}] + n \\ &= n^{3/2} \cdot T\left(\frac{1}{n^{2^2}}\right) + n + n \\ &= n^{3/2} \left[n^{1/2^3} + T\left(\frac{1}{n^{2^3}}\right) + n^{1/2^2} \right] + 2n \\ &= n^{7/2} \cdot T\left(\frac{1}{n^{2^3}}\right) + 3n \end{aligned}$$

$$= n^{\frac{2^k - 1}{2^k}} \cdot T\left(\frac{1}{n^{2^k}}\right) + k \cdot n$$

$$\begin{cases} n^{1/2^k} = 2 \\ 2^k = \log_2 n \\ k = \log_2 \log_2 n \end{cases}$$

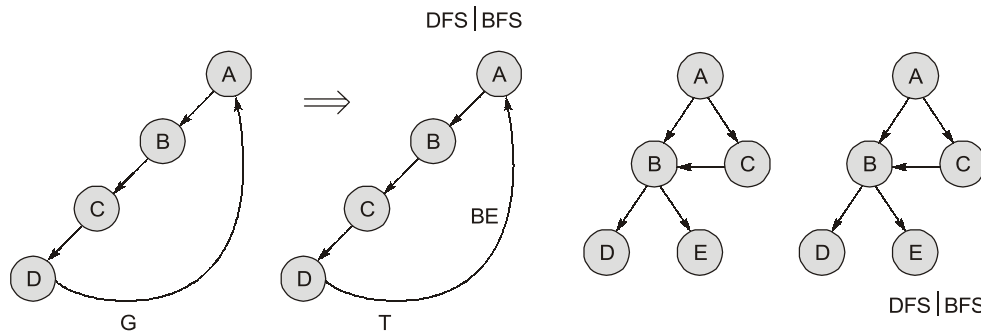
$$= \frac{n}{1} \cdot T(2) + n \cdot \log_2 \log_2 n$$

$$T(n) = \frac{n}{2} + n \cdot \log_2 \log_2 n = \theta(n \log_2 \log_2 n)$$

End of Solution

- Q.11** Directed graph G, there is subgraph T which is DFS of G and also BFS of G:
- (a) Every edge in G is in T
 - (b) No forward edge in T
 - (c) No cross edge in T
 - (d) No back edge in T

Ans. (b)



End of Solution

- Q.12** Algorithm used to identify in an array ascending or descending order. The algo uses single pass by comparing only adjacent elements. The TC of algo?
- (a) $O(n)$ and not $\Omega(n)$
 - (b) $\Omega(n)$ but not $O(n)$
 - (c) Both $O(n)$ and $\Omega(n)$
 - (d) Not $O(n)$ and $\Omega(n)$

Ans. (c)

$$TC = O(n)$$

Run bubble sort for one pass.

End of Solution

- Q.13** A binary min heap of 105 distinct elements. The number of possible values for maximum element.
- (a) 50
 - (b) 45
 - (c) 53
 - (d) 60

Ans. (53)

⇒ Max key of leaf levels

⇒ CBT of n nodes number of leaf nodes $\left\lceil \frac{n}{2} \right\rceil$

$$\left\lceil \frac{105}{2} \right\rceil = 53$$

End of Solution



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Q.14 The number of edges present in the forest generated by DFS traversal of an undirected graph with 100 vertices is 40.
How many number of connected components?

Ans. (60)

n number of vertices $\Rightarrow 100$

k number of tree edges of DFS traversal $\Rightarrow 40$

\Rightarrow Connected components = $n - k = 60$

End of Solution

Q.15 An array [80, 101, 90, 11, 111, 75, 33, 131, 44, 93]

Heapified first 3 element in heapified array

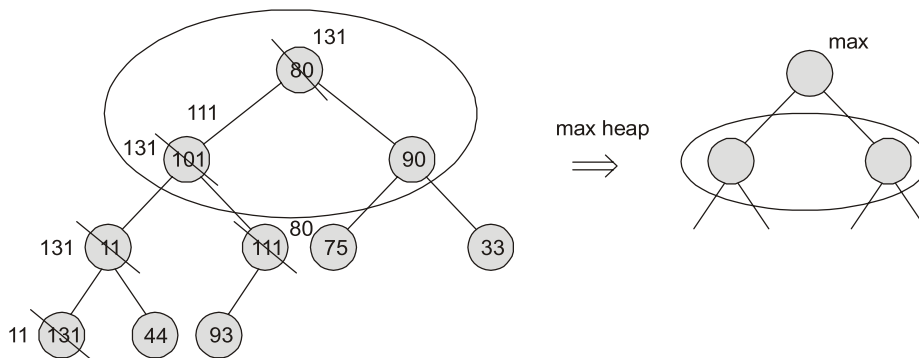
(a) 131, 11, 93

(b) 131, 111, 90

(c) 82, 11, 83

(d) 82, 90, 101

Ans. (b)



End of Solution

Databases

Q.16 Consider given schedule (s):

S:

T_1	T_2	T_3
$r_1(z)$		
$w_1(z)$	$r_2(x)$	$r_3(x)$
	$r_2(y)$	$w_3(y)$
	$w_2(x)$	
	$w_2(y)$	

Which of the following serial schedules is/are conflict equivalent to S?

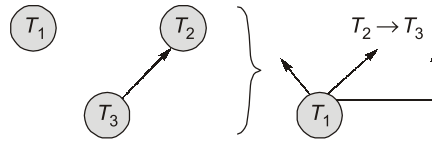
(a) T_1, T_3, T_2

(b) T_1, T_2, T_3

(c) T_3, T_1, T_2

(d) T_3, T_2, T_1

Ans. (a, b, d)



End of Solution

Q.17 Which of the given statements is/are correct? (FD inference rule)

- (a) $\{X \rightarrow Y, Y \rightarrow Z\} \Rightarrow X \rightarrow Z$
- (b) $\{XY \rightarrow Z, W \rightarrow Y\} \Rightarrow XX \rightarrow Z$
- (c) $\{XY \rightarrow ZW\} \Rightarrow XY \rightarrow Z$
- (d) $\{XY \rightarrow ZW\} \Rightarrow X \rightarrow ZW$

Ans. (a, b, c)

End of Solution

Q.18

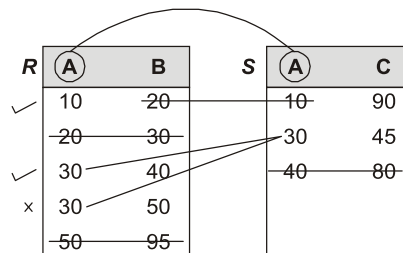
R(AB)	
A	B
10	20
20	30
30	40
30	50
50	95

S(AC)	
A	C
10	90
30	45
40	80

$$(\sigma_{B>C}(R \bowtie_{R.A=S.A} S))$$

How many number of tuples in result of RA query?

Ans. (2)



End of Solution

Compiler Design

- Q.19** Which of the following is/are bottom up parser?
- (a) Predictive parser (b) LR parser
(c) LL (1) parser (d) Shift-Reduce parser

Ans. (b, d)
LR parser and Shift-Reduce parser are bottom up parsers.
Answer is option (b) and (c).

End of Solution

Theory of Computation

- Q.20** Consider the following two regular expressions:
 $R = 0^* + 1^*$ and
 $S = 01^* + 10^*$
How many strings of length less than or equal to 5 which are neither in R nor in S

Ans. (44)
Total number of strings of length less than or equal to 5 is
 $2^0 + 2^1 + 2^2 + 2^3 + 2^4 + 2^5 = 63$
 $R = 0^* + 1^*$
The strings in R of length less than or equal to 5 are i.e.
 $\epsilon, 0, 00, 000, 0000, 00000$ and $\epsilon, 1, 11, 111, 1111, 11111$
Total strings in R of length less than or equal to 5 are $6 + 6 - 1 = 11$
 $S = 01^* + 10^*$
The strings in S of length less than or equal to 5 are
 $0, 01, 011, 0111, 01111$ and $1, 10, 100, 1000, 10000$
Total strings in S are 10
The total number of strings in R and S of length less than or equal to 5 is
 $= 11 + 10 - 2 = 19$
(0 and 1 are common in both R and S)
 \therefore The strings neither in R nor in S is $63 - 19 = 44$

End of Solution

Q.21 Given that L_1, L_2 are regular languages and L_3 is not regular. Which of the following is/are always true?

- (a) $\bar{L}_1 \cup \bar{L}_2$ is regular
(b) \bar{L}_3 is not regular
(c) $L_1 = L_2$ iff $L_1 \cap \bar{L}_2 = \phi$
(d) $L_1 \cup L_3$ is not regular

Ans. (a, b)

(a) $\bar{L}_1 \cup \bar{L}_2$ is regular

$$= \overline{\text{Regular} \cap \text{Regular}}$$

$$= \text{Regular} \cup \text{Regular}$$

$$= \text{Regular}$$

⇒ Option (a) is true

(b) \bar{L}_3 is not regular ⇒ L_3 is also not regular

⇒ Option (b) is true

(c) L_1 and L_2 need not be equal

(d) Let $L_1 = \Sigma^*$ is regular

$L_3 = \{a^n b^n \mid n > 0\}$ is not regular

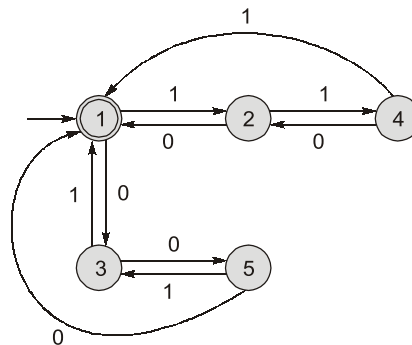
$$L_1 \cup L_3 = \Sigma^* \cup \{a^n b^n\}$$
$$= \Sigma^* \text{ is regular}$$

⇒ Option (d) is false

Option (a) and (b) are true.

End of Solution

Q.22 Consider the following DFA:



Which of the following is/are false statements?

- (a) States 2 and 5 are distinguishable.
(b) If $n_0(w) = n_1(w)$ then w will be accepted by the DFA.
(c) States 2 and 4 are distinguishable.
(d) States 3 and 4 are distinguishable.

Ans. (a, b, d)

If we minimize the DFA we get the states as {1}, {2, 5}, {3, 4}

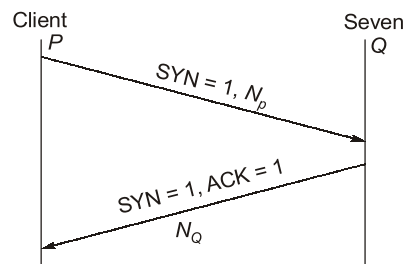
So, (a) and (d) option is true and option (b) is false as we can't construct a DFA for $n_0(w) = n_1(w)$.

Option (a), (b), (d) are false.

End of Solution

Computer Networks

Q.23 TCP client 'P' successfully establish a connection to TCP server Q, let N_p denotes the sequence number in the syn sent from P to Q. Let N_Q denotes the ack no in the syn-ack from Q to P. Which of the following statement is/are correct?



- (a) Sequence number N_p is always 0 for new connection.
- (b) The ack number N_Q is equal to $N_p + 1$.
- (c) The sequence number N_p is chosen randomly by P.
- (d) The ack number N_Q is equal to N_p .

Ans. (b, c)

The acknowledgment number will always be sequence number of the next expected data.

The initial sequence number will always be random number within range of 0 to $2^{32} - 1$.

End of Solution

Q.24 Which of the following field in IPv4 header is/are modified?

- (a) Header checksum
- (b) Source IP
- (c) Destination IP
- (d) Total length

Ans. (a)

End of Solution



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- Q.25** Arrange the data in correct sequence
- (a) http send for index text (b) http send connection request
(c) http send request for images (d) TCP send for connection establishment

Ans. (d, b, a, c)

End of Solution

- Q.26** P wants to send 10^6 bytes data to R. Q is the router with no queuing delay and can send and receive simultaneously. The BW of 10^3 bps on both links. Negligible propagation time. P starts sending at $T = 0$ at what time R will receive all the data.

Ans. (10.08 sec)

End of Solution

- Q.27** A Packet (or a IP address?) goes from internal network to external network passing through NAT (Network Address Translation). Which of the following will be modified?
- (a) Source address (b) Destination address
(c) Checksum (d) Packet length

Ans. (a, c)

End of Solution

- Q.28** IP datagram size = 1420 inclusive 20 bytes header.
Need to forward through 2 networks
First n/w MTU 542 byte second n/w MTU 360 byte
How many fragments does the receiver can receive?

Ans. (6 fragments)

End of Solution

Computer Organization & Architecture

- Q.29** Consider harddisk with 32 surfaces, 4096 sectors/track, 1024 bytes/sectors. Harddisk capacity is 512 GB. Number of cylinders in the harddisk is _____?

Ans. (4096)

$$\begin{aligned} \text{Disk capacity} &= \text{Number of surfaces} \times \text{Number of tracks/surface} \\ &\quad \times \text{Number of sectors/track} \times \text{Number of bytes/sector} \\ 2^{39} \text{ B} &= 2^5 \times x \times 2^{12} \times 2^{10} \text{ B} \\ 2^{39} &= 2^{27} x \\ x &= \frac{2^{39}}{2^{27}} = 2^{12} = 4096 \end{aligned}$$

End of Solution

Q.30 2's complement data

A : 01010

B : 11010

Which one of these creates overflow?

- (a) A + B (b) A - B
(c) B - A (d) 2 * B

Ans. (b)

5 bit 2's complement range : {-16 to +15}

A : 01010 \Rightarrow +10

B : 11010 \Rightarrow -6

- (a) A + B \Rightarrow (+10) + (-6) \Rightarrow 4
(b) A - B \Rightarrow (+10) - (-6) \Rightarrow +16
(c) B - A \Rightarrow (-6) - (10) \Rightarrow -16
(d) 2 * B \Rightarrow 2 - 6 \Rightarrow -12

End of Solution

Digital Logic

Q.31 Consider the Boolean function $f(x, y, z) = \sum m(3, 5, 6, 7)$. Identify the correct option/ options.

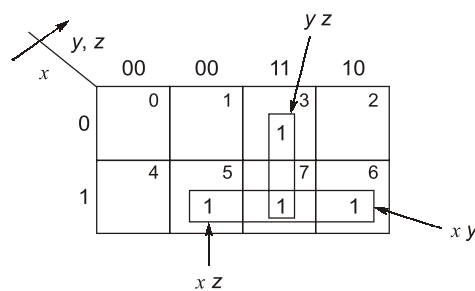
- (a) $f(x, y, z)$ is independent of x
(b) $f(x, y, z) = \pi M(0, 1, 2, 4)$
(c) $f(x, y, z)$ is independent of y
(d) $f(x, y, z) = xy + yz + zx$

Ans. (b, d)

Given function $f(x, y, z) = \sum m(3, 5, 6, 7)$

In terms of max terms function is

$$f(x, y, z) = \pi M(0, 1, 2, 4)$$

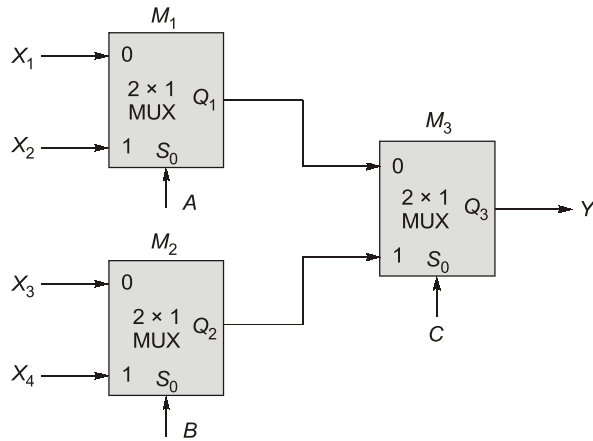


$$f(x, y, z) = xy + yz + zx$$

Answer is option (b) and (d).

End of Solution

Q.32 Consider a digital logic circuit consisting of three 2×1 multiplexers M_1 , M_2 and M_3 as shown. X_1 and X_2 are inputs of M_1 . X_3 and X_4 are inputs of M_2 . A , B and C are select lines of M_1 , M_2 and M_3 respectively. For an instance of inputs $X_1 = 1$, $X_2 = 1$, $X_3 = 0$ and $X_4 = 0$, the number of combination of A , B , C that gives the output $Y = 1$, _____.



Ans. (4)

$$2 : 1 \text{ MUX o/p} = \bar{S}_0 I_0 + S_0 I_1$$

$$\text{MUX } M_1 \text{ o/p} = \bar{A} \cdot 1 + A \cdot 1 = 1$$

$$\text{MUX } M_2 \text{ o/p} = \bar{B} \cdot 0 + B \cdot 0 = 0$$

$$\text{MUX } M_3 \text{ o/p} = \bar{C} \cdot 1 + C \cdot 0 = \bar{C}$$

$$\therefore Y = \bar{C}$$

Whenever $C = 0$, the output $Y = 1$

A and B variables may be with any values.

A	B	C	Y
0	0	0	1
0	1	0	1
1	0	0	1
1	1	0	1

For '4' combinations the output $Y = 1$.

Answer is 4.

End of Solution



Conventional Questions Practice Programme for ESE & State Exams

Commencing from
1st /2nd week of March, 2024

Teaching Hours :
300 to 350 hours

Course Duration :
100 days

**OFFLINE
& ONLINE
COURSE**
Streams :
CE, ME, EE, EC

Key Features

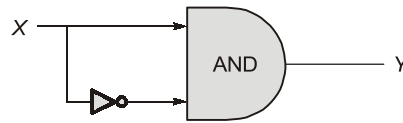
- ✓ In-depth discussion on conventional questions.
- ✓ Beneficial to develop numerical question solving techniques.
- ✓ Helps to improve answer writing and presentation skills.
- ✓ Discussion on probable questions.
- ✓ Updated Mains workbook with wide range of practice questions.
- ✓ ESE Mains test series will be conducted on every Sunday in synchronization with the subjects.

Note : Offline classes will be conducted at Delhi Centre.

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Q.33 Consider the circuit given,



Gates may have propagation delay.

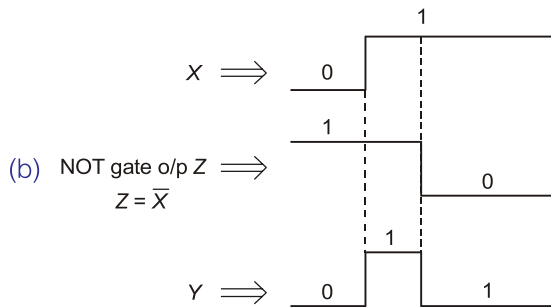
Assume that all signals transitions occur instantaneously and that wires have no delays.

Which of the following about circuit is correct.

- (a) With no propagation, the output Y is always 0.
- (b) Can have a transient logic one, when X transition from logic zero to logic 1.
- (c) Cannot be determined
- (d) None of these

Ans. (a, b)

- (a) If no propagation delay for AND and NOT gates, always one of the input of AND gate is '0', so output is always '0'.



Output Y is logic 1 for small time interval whenever X changes from logic '0' to logic '1', assuming gates are having some delay.

Answer is option (a), (b).

End of Solution

Discrete Mathematics

Q.34 Δ , \square are two binary operations on a set ' A ', $\forall a, b \in A$

$$a \Delta b = a + 2b, a \square b = ab,$$

Which of the following is/are true?

- (a) Δ obeys associative
- (b) Operator \square over Δ obeys distributive law
- (c) Operators Δ over \square obeys distributive law
- (d) Operators \square obeys associative law

Ans. (b, d)

Check with options:

$$\begin{aligned} \text{(a) Consider } a \Delta (b \Delta c) &= a \Delta (b + 2c) \\ &= a + 2(b + 2c) \\ &= a + 2b + 4c \end{aligned}$$

$$\begin{aligned} \text{Consider } (a \Delta b) \Delta c &= (a + 2b) \Delta c \\ &= a + 2b + 2c \end{aligned}$$

$$\therefore (a \Delta b) \Delta c \neq a \Delta (b \Delta c)$$

Option (a) is false.

(b) Distributive law

$$a \square (b \Delta c) = (a \square b) \Delta (a \square c)$$

$$a \square (b \Delta c) = (ab) \Delta (ac)$$

$$a \square (b + 2c) = ab + 2ac$$

$$a(b + 2c) = ab + 2ac$$

\therefore Option (b) is true.

(c) Distributive

$$a \Delta (b \square c) = (a \Delta b) \square (a \Delta c)$$

$$a \Delta (bc) \neq (a + 2b) \square (a + 2c)$$

$$a + 2bc \neq (a + 2b)(a + 2c)$$

$$a(b + 2c) = ab + 2ac$$

(d) Associativity

$$\text{Consider } a \square (b \square c) = a \square (bc) = abc$$

$$\text{and consider } (a \square b) \square c = (ab) \square c$$

$$= abc$$

$\therefore \square$ is associative.

End of Solution

Q.35 If A, B non-empty finite sets, such that

(1). $f: A \rightarrow B$ and condition (2). $f: (A \times B) \rightarrow (A \cup B)$ one-one and onto functions, then find number of possible values of cardinality of $A = \underline{\hspace{2cm}}$?

Ans. (2)

$\therefore f: A \rightarrow B$ is one-one and onto

$$\Rightarrow |A| = |B| = n$$

We check: $f: A \times A \rightarrow A \cup B$

$$n^2 \begin{cases} n, & \text{if } (A = B) \\ 2n, & \text{if } (A \neq B, A \cap B = \phi) \end{cases}$$

$\therefore f$ is one-one

$$|A \times B| = |A \cup B|$$

$$\text{So either } n^2 = n \text{ (or) } n^2 = 2n$$

$$\Downarrow \qquad \qquad \Downarrow$$

$$n = 0, 1 \qquad n = 0, 2$$

$$\therefore n = 1 \text{ or } 2$$

\therefore Number of possible values of cardinality of $A = 2$.

End of Solution

Q.36 Number of spanning trees in a complete graph with 4 labelled vertices a, b, c and d are _____?

Ans. (16)

K_n will have n^{n-2} number of spanning trees
 $4^{4-2} = 4^2 = 16$

End of Solution

Q.37 Let $G = \langle V, E \rangle$ be a graph with $|V| = n$ and the chromatic number of 'G' is k .

Which of the following is true?

(a) G contains complete subgraph with k -vertices

(b) G contains atleast $\frac{k(k-1)}{2}$ edges.

(c) G contains independent set of size atleast $\frac{n}{k}$.

(d) G contains vertex of degree atleast k .

Ans. (b, c)

End of Solution

Engineering Mathematics

Q.38 A bag contains 10 red balls and 15 blue balls are given two balls are drawn randomly without replacement. Given that the first ball drawn is red. Probability that both balls drawn are red is

Ans. $\left(\frac{9}{24}\right)$

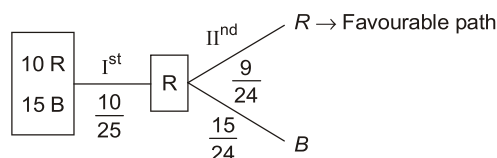
10R
15B

It is given that first ball drawn is red, then remaining balls are

9R
15B

$$P(\text{both ball is red}) \Rightarrow \frac{9}{24}$$

or



$$\text{Prop. (both red ball)} = \frac{\text{Favourable}}{\text{Total}}$$

$$\begin{aligned}
 &= \frac{\frac{10}{25} \times \frac{9}{24}}{\frac{10}{25} \times \frac{9}{24} + \frac{10}{25} \times \frac{15}{24}} \\
 &= \frac{10 \times 9}{10 \times 9 + 10 \times 15} = \frac{9}{24}
 \end{aligned}$$

End of Solution

Q.39 For a given matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ the product of all the eigen value is

- (a) 1 (b) 2
(c) -1 (d) 0

Ans. (d)

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

$$\begin{aligned}
 |A| &= 1(45 - 48) - 2(36 - 42) + 3(32 - 35) \\
 &= -3 + 12 - 9 \\
 &= 0
 \end{aligned}$$

Since the determinant of matrix is zero, so the product of eigen value = 0

End of Solution

Q.40 Let A be any $n \times m$ matrix, where $m > n$, which of the following statements is/are true about the system of linear equations $AX = 0$?

- (a) There exist atleast $m - n$ linearly independent solution of this system.
(b) There exist $m - n$ linearly independent vectors such that every solution in which atleast $m - n$ variables.
(c) There exist a non-zero solution.
(d) There exist a solution in which atleast n variables are non-zero.

Ans. (b)

$$A_{n \times m} X_{m \times n} = 0$$

It is type of underdetermined system which has ∞ solution so option (c) is correct.

Now for option (a), Let $A_{2 \times 4}$ and

(i) $P(A) = 2$ then Nullity = $4 - 2 = 2 = m - n$ LI solution.

(ii) $P(A) = 1$ then Nullity = $4 - 1 = 3 \geq m - n$ LI solution

So option (a) is also correct.

Now for option (b) W.K that

Number of free variables = Number of LI solutions

$$= (m - n)$$

Hence option (b) is also correct.

End of Solution



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Q.41 $P(A) = 0.3, P(B) = 0.5, P(A \cap B) = 0.1$

(a) A, B independent

(b) $P(A^C \cap B^C) = 0.4$

(c) $P(A \cup B) = 0.7$

(d) $P(A \cap B^C) = 0.2$

Ans. (d)

$$P(A) = 0.3, P(B) = 0.3, P(APB) = 0.1$$

$\therefore P(A \cap B) \neq P(A)P(B) \Rightarrow A$ and Base not independent
 $0.1 \neq (0.3)(0.5)$ is option (a) is false

For option (b), $P(\bar{A} \cap \bar{B}) = 1 - P(A \cup B)$

$$= 1 - [P(A) + P(B) - P(A \cap B)]$$

$$= 1 - [0.3 + 0.5 - 0.1] = 0.3$$

i.e. option (b) is also false.

For option (c), $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$= 0.3 + 0.5 - 0.1 = 0.7$$

Hence, (c) is correct.

For option (d), $P(A \cap B) = P(A) - P(A \cap B)$

$$= 0.3 - 0.1 = 0.2$$

Hence, option (d) is also correct.

End of Solution

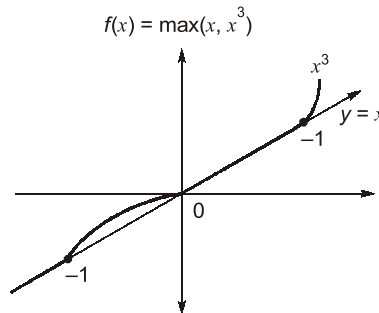
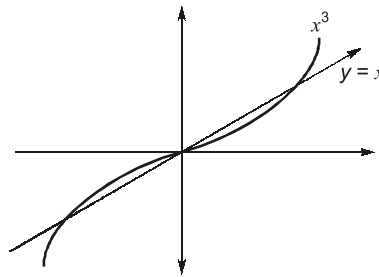
Q.42 If $f(x) = \max \{x, x^3\}$, then find the non differentiable points of $f(x)$

Ans. (3)

Putting $x^3 = x$

$$x(x^2 - 1) = 0$$

$$x = 0, -1, 1$$



So, we have three sharp points at $x = -1, 0, 1$

So, these are non differentiable points

Method II

$$f(x) = \max\{x, x^3\} = \begin{cases} x & ; \quad x < -1 \\ x^3 & ; \quad -1 < x < 0 \\ x & ; \quad 0 < x < 1 \\ x^3 & ; \quad x > 1 \end{cases}$$

$$f'(x) = \begin{cases} 1 & ; \quad x < -1 \\ 3x^3 & ; \quad -1 < x < 0 \\ 1 & ; \quad 0 < x < 1 \\ x^3 & ; \quad x > 1 \end{cases}$$

\therefore At $x = -1, 0$ and 1 , LHD \neq RHD so all three points are non differentiable points.

End of Solution

Operating System

Q.43 Threads, which of the following is/are true?

- (a) Threads belonging to a process are by default not protected by each other.
- (b) Each thread has its own file descriptor.
- (c) Threads can only be implemented in Kernel space.
- (d) All threads belonging to a process has its own stack.

Ans. (a, d)

End of Solution

Q.44 Consider a memory management system page size is 2 KB. The page numbers 0, 1, 2, 3 are stored in frames 1, 3, 2, 0 respectively. What is the physical address is virtual address 2500 _____?

Ans. (6596)

$$\text{P.A.} \rightarrow (1100111000100)_2 \rightarrow (6596)_{10}$$

End of Solution

Q.45 Which of the following is invalid transition?

- (a) Running to ready
- (b) Ready to waiting
- (c) Waiting to running
- (d) Running to exit

Ans. (b, c)

End of Solution



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Q.46 $a = 1, b = 1$

$\frac{T_1}{P_1}$	$\frac{T_2}{P_2}$
{	{
$a = a + 1;$	$b = 2 \times b;$
$b = b + 1;$	$a = a \times 2;$
}	}

Final possible values of a and b

- (a) $(a = 4; b = 4)$ $(a = 4; b = 3)$ $(a = 3; b = 4)$
- (b) $(a = 2; b = 2)$ $(a = 2; b = 3)$ $(a = 3; b = 4)$
- (c) $(a = 4; b = 3)$ $(a = 3; b = 3)$ $(a = 4; b = 3)$
- (d) $(a = 3; b = 3)$ $(a = 4; b = 3)$ $(a = 4; b = 4)$

Ans. (d)

End of Solution

Programming & Data Structures

Q.47 Consider the following code segment:

```
int a = 6, b=0;
while(a < 10)
{
    a = a/12 + 1;
    a+ = b;
    printf("%d", a)
return;
```

- (a) output will be 9
- (b) will be stuck in Infinite loop
- (c) output will be 6
- (d) output will be 10

Ans. (b)

End of Solution

■■■■

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