



Kunal Jha  
 Course: GATE  
 Computer Science Engineering(CS)

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## FULL SYLLABUS TEST-2 (BASIC LEVEL) (GATE - 2021) - REPORTS

OVERALL ANALYSIS    COMPARISON REPORT    **SOLUTION REPORT**

ALL(65)    CORRECT(0)    INCORRECT(0)    SKIPPED(65)

Q. 1

? FAQ    ▶ Solution Video    ⚡ Have any Doubt ?

Out of the following four sentences, select the most suitable sentence with respect to grammar and usages.

- A She has applied for the post of a editor.
- B She has applied for the post of an editor.
- C She has applied for the post of editor.
- D She has applied for the post of the editor.

Correct Option

Solution :

(c)

QUESTION ANALYTICS

Q. 2

? FAQ    ▶ Solution Video    ⚡ Have any Doubt ?

Fill in the blank.  
 The criminal together with his associates \_\_\_\_\_ arrested.

- A are
- B was
- C were
- D have

Correct Option

QUESTION ANALYTICS

Q. 3

? FAQ    ▶ Solution Video    ⚡ Have any Doubt ?

A car is moving along the side of regular hexagon with speed of 30, 50, 60, 90, 150 and 120 respectively. Then the average speed of car during its entire journey is \_\_\_\_\_.

- A 88.33
- B 62.43
- C 10.41
- D None of these

Correct Option

Solution :

(b)

Given regular hexagon, so same distance is covered with different speed.

$$\bar{V} = \frac{\frac{N}{x_1 + x_2 + x_3 + x_4 + x_5 + x_6}}{x_1 + x_2 + x_3 + x_4 + x_5 + x_6}$$

$$\bar{V} = \frac{6}{\frac{1}{30} + \frac{1}{50} + \frac{1}{60} + \frac{1}{90} + \frac{1}{150} + \frac{1}{120}} = 62.43$$

QUESTION ANALYTICS

Q. 4

▶ Solution Video    ⚡ Have any Doubt ?

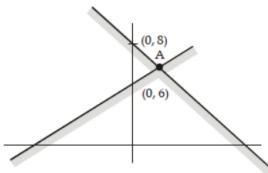
Let  $y = \min\{(x + 6), (8 - x)\}$ . If  $x \in \mathbb{R}$ , what is the maximum value of  $y$ ?

A 8

B 7

Correct Option

**Solution :**  
(b)



∴ Point A is having maximum value of y.

Hence,

$$\begin{aligned}x + 6 &= 8 - x \\x &= 1 \\y &= x + 6 \\y_{\max} &= 7\end{aligned}$$

C 6

D 10

QUESTION ANALYTICS

+

Q. 5

FAQ

Solution Video

Have any Doubt ?

□

If the difference between C.I. and S.I. on a certain sum of money is Rs. 144 at 12 percent per annum for 3 years, then the principal amount is approximately \_\_\_\_\_.

C 3205 [3200 - 3210]

Correct Option

**Solution :**

3205 [3200 - 3210]

$$\begin{aligned}\because (\text{C.I.} - \text{S.I.})_{3 \text{ years}} &= P \left( \frac{R}{100} \right)^3 + 3P \left( \frac{R}{100} \right)^2 \\&\therefore P \left[ \left( \frac{12}{100} \right)^3 + 3 \times \left( \frac{12}{100} \right)^2 \right] = 144 \\P[0.12^3 + 3 \times 0.12^2] &= 144 \\P &= 3205.128 \approx \text{Rs. } 3205\end{aligned}$$

QUESTION ANALYTICS

+

Q. 6

Solution Video

Have any Doubt ?

□

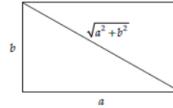
Instead of walking along two adjacent sides of a rectangular field a man took a short cut along the diagonal and saved a distance equal to half of the longer side. Then the ratio of the shorter side to the longer side is \_\_\_\_\_

A  $\frac{1}{2}$ B  $\frac{2}{3}$ C  $\frac{3}{4}$ 

Correct Option

**Solution :**  
(c)  
Given,

$$\begin{aligned}(a+b) - (\sqrt{a^2 + b^2}) &= \frac{a}{2} \\ \frac{a}{2} + b &= \sqrt{a^2 + b^2} \\ \left( \frac{a}{2} + b \right)^2 &= a^2 + b^2 \\ ab - \frac{3a^2}{4} &= 0 \\ a \left( b - \frac{3a}{4} \right) &= 0 \\ a \neq 0, b &= \frac{3a}{4} \\ \Rightarrow b &= \frac{3a}{4} \\ \frac{b}{a} &= \frac{3}{4}\end{aligned}$$

D  $\frac{1}{4}$ 

QUESTION ANALYTICS

+

Q. 7

[▶ Solution Video](#)[Have any Doubt?](#)

Eleven books, consisting of five engineering books, four mathematics books and two physics books are arranged in a shelf at random. What is the probability that the books of each kind are all together?

**A**  $\frac{1}{1155}$

Correct Option

Solution :  
(a)



$$\text{Probability} = \frac{3! \times 5! \times 4! \times 2!}{11!} = \frac{1}{1155}$$

**B**  $\frac{2}{1155}$

**C**  $\frac{3}{1155}$

**D**  $\frac{5}{1155}$

[QUESTION ANALYTICS](#)

Q. 8

[▶ Solution Video](#)[Have any Doubt?](#)

By selling 2 items for Rs. 180 each the shopkeeper gain 20% on one and 20% loses on the other then there will be \_\_\_\_\_.

**A** Loss of Rs. 15

Correct Option

Solution :  
(a)

$$\begin{aligned}\text{Loss will be equal to} &= \frac{2P^2S}{100^2 - P^2} \\ &= \frac{2 \times 20^2 \times 180}{100^2 - 20^2} = 15\end{aligned}$$

**B** Gain of Rs. 15

**C** Loss of Rs. 30

**D** Gain of Rs. 30

[QUESTION ANALYTICS](#)

Q. 9

[▶ Solution Video](#)[Have any Doubt?](#)

'A' completes  $\frac{2}{3}$  of certain job in 6 days. 'B' can complete  $\frac{1}{3}$  of the same job in 8 days and 'C' can complete  $\frac{3}{4}$  of the same job in 12 days. All of them work together for 4 days and then A and C quit. How long will it take for B to complete the remaining work alone?

**A** 3.8 days

**B** 3.33 days

Correct Option

Solution :  
(b)

Suppose A, B and C can complete the entire job in  $a, b, c$  days respectively, then

$$(i) \quad \frac{1}{a} \times 6 = \frac{2}{3} \\ a = 9$$

$$(ii) \quad \frac{1}{b} \times 8 = \frac{1}{3} \\ b = 24$$

$$(iii) \quad \frac{1}{c} \times 12 = \frac{3}{4} \\ c = 16$$

$$\left( \frac{1}{9} + \frac{1}{24} + \frac{1}{16} \right) \times 4 + \frac{1}{24} \times t = 1 \\ t = 3.33 \text{ days}$$

**C** 2.22 days

D 4.3 days

QUESTION ANALYTICS +

Q. 10

Solution Video

Have any Doubt ?



In a test in which 120 students appeared, 90 passed in history, 65 passed in sociology and 75 passed in political science. 30 Students passed in only one subject and 55 students in only two. Five student passed in no subjects. Then

A 85 students passed in atleast two subjects.

Correct Option

B 55 students passed in atleast two subjects.

C 30 students passed in all subjects.

Correct Option

D 55 students passed in all subjects.

YOUR ANSWER - NA

CORRECT ANSWER - a,c

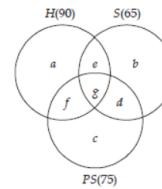
STATUS - SKIPPED

Solution :

(a, c)

So,

$$\begin{aligned} \text{Total student passed} &= 120 - 5 = 115 \\ a + b + c &= 30 \\ d + e + f &= 55 \\ g &= 115 - (30 + 55) = 30 \\ \text{Students who passed in all three subjects} &= 30 \\ \text{Students who passed in atleast two subjects} &= d + e + f + g \\ &= 55 + 30 = 85 \end{aligned}$$



QUESTION ANALYTICS +

Item 1-10 of 65 « previous 1 2 3 4 5 6 7 next »



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**Q. 11**
[FAQ](#)
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Suppose E is the event that a randomly generated bit string of length four begins with a 1 and F is the event that this bit string contains an even number of 1s. if the 16 bit strings of length four are equally likely, which of the following statements is/are correct?

I. E and F are independent events.

II.  $P(E \cap F) = \frac{1}{4}$ .

A Only I

B Only II

C Both I and II

Correct Option

**Solution:**

(c)

E is the event that a randomly generated bit string of length four begins with a 1:

Number of strings that start with 1 = 8

$$P(E) = \frac{8}{16} = \frac{1}{2}$$

F is the event that this bit string contains an even number of 1s :

Number of strings that contain an even number of 1s = 8

$$P(F) = \frac{8}{16} = \frac{1}{2}$$

$$P(E \cap F) = \frac{4}{16} = \frac{1}{4}$$

$$P(E \cap F) = P(E) \cdot P(F)$$

So, option (c) is correct.

D None of these

QUESTION ANALYTICS


**Q. 12**
[FAQ](#)
[Solution Video](#)
[Have any Doubt?](#)


F is a boolean function in four boolean variables  $x, y, z$  and  $w$ .

$$F(x, y, z, w) = \Sigma(0, 1, 4, 11, 12, 13, 15)$$

Then the expression for dual of F is:

A  $xz' + z'w + wx' + x'yz + xy'w'$

B  $xz' + z'w + x'yz + xy'w'$

Correct Option

**Solution:**

(b)

To find minterms of  $F^d$ , we can apply the following method:

1. Find all the terms where F is 0.

2. If F is 0 for term x then  $(2^4 - 1 - x)$  will be a minterm of  $F^d$ .

So, dual of F will have the following minterms: (1, 5, 6, 7, 8, 9, 10, 12, 13).

Now, using K-map, we can find the expression for the dual of F which will be option (b).

Option (a) says that  $F^d$  also has 3 as a minterm.

Option (c) says that  $F^d$  also has 2 as a minterm.

C  $zx' + w'z + x'yz + xy'z'$

D None of these

QUESTION ANALYTICS


**Q. 13**
[FAQ](#)
[Have any Doubt?](#)


A computer has 32 bit instruction and 9 bit address. If there are 400 two address instructions then how many single address instructions can be formulated?

A  $2^{14}$

B  $2^{32} - 200$

C ...

C  $2^{14} - 400$

D  $(2^{14} - 400) \times 2^9$

Correct Option

Solution :

(d)  
Total number of 2 address instructions possible =  $2^{14}$  as we need to use 18 bits for addresses (9 for each)  
Among these, it is said that only 400 are used.  
Therefore remaining 2 address instructions =  $2^{14} - 400$   
Now we need only one address instruction so  
These  $2^{14} - 400$  instructions have 2 addresses and we need only one address thus 9 bits go free.  
So each 2 address instruction can generate  $2^9$  single address instructions.  
Thus  $2^{14} - 400$  instructions can generate  $(2^{14} - 400) \times 2^9$  single address instructions.

QUESTION ANALYTICS



Q. 14

? FAQ

Have any Doubt ?



Let  $L$  be a lattice  $[S, \#]$ , where  $S$  is the base set and  $\#$  is the relation defined on  $S$ . If for every subset  $A$  of  $S$ ,  $[A, \#]$  is also a lattice then  $L$  must be?

A Total order set

Correct Option

Solution :

(a)  
Let  $L$  be a lattice  $[S, \#]$ , where  $S$  is the base set and  $\#$  is the relation defined on  $S$ . If for every subset  $A$  of  $S$ ,  $[A, \#]$  is also a lattice then  $L$  must be a total order.  
We can prove it by contradiction. Assume that  $L$  is Not a total order. Then there must be two different elements  $a, b$  such that  $a$  and  $b$  are not comparable. Now, since it is given that "for every subset  $A$  of  $S$ ,  $[A, \#]$  is also a lattice", so consider the subset  $\{a, b\}$  of  $S$ . This  $\{a, b\}, \#$  clearly is not a lattice. Hence, contradiction.  
So,  $L$  must be total order.

B Complete lattice

C Distributive lattice

D Boolean lattice

QUESTION ANALYTICS



Q. 15

? FAQ

Have any Doubt ?



Let I denote the formula:  $(q \rightarrow p) \rightarrow (p \rightarrow q)$

Let II denote the formula:  $(q \rightarrow p) \wedge q$

Which of the following is true?

A I is not a tautology and II is not satisfiable.

Correct Option

Solution :

(b)  
I is  $(q \rightarrow p) \rightarrow (p \rightarrow q)$ , this is not tautology because  $(q' + p)' + p' + q = qp' + p' + q \neq 1$ .  
II is  $(q \rightarrow p) \wedge q$  which is satisfiable because  $(q' + p)q = pq$  which is neither 0 nor 1 hence it is satisfiable.

C I is a tautology and II is not satisfiable.

D I is a tautology and II is satisfiable.

QUESTION ANALYTICS



Q. 16

Solution Video

Have any Doubt ?



The eigen values of a  $3 \times 3$  matrix  $P$  are 1, 2 and 3 then  $6P^{-1}$  is equal to

A  $P^3 + 6P^2 + 11P + I$

B  $P^2 - 6P + 11I$

Correct Option

Solution :

(b)  
Eigen value (1, 2, 3)  $3 \times 3$  matrix  
 $(\lambda - 1)(\lambda - 2)(\lambda - 3) = 0$   
 $\lambda^3 - 6\lambda^2 + 11\lambda - 6 = 0$   
 $P^3 - 6P^2 + 11P - 6I = 0$   
 $P^2 - 6P + 11 - 6P^{-1} = 0$   
 $6P^{-1} = P^2 - 6P + 11I$

C  $P^2 + 6P - 11I$

**D**  $P^3 - 6P^2 + 11I + I$

QUESTION ANALYTICS



Q. 17

? FAQ Have any Doubt ?



Which of the following problems is/are decidable?

- I. Given a (finite)  $w$ , is  $w$  a prefix of the decimal expansion of  $\pi$ ?
- II. Given a program and an input, is the program's output the decimal expansion of  $\pi$ ?
- III. Given a program that takes as input a prefix of the decimal expansion of  $\pi$ , is the program's output always the same for every prefix?

**A** I only

Correct Option

Solution :

(a)

I is decidable because when we are given a finite string  $w$  of length, say  $m$ , just find the first  $m$  digits of expansion of  $\pi$  and then check whether  $w$  is same as these digits or not.  
 II is undecidable because halting problem of program itself is undecidable.  
 III is undecidable because halting problem of program itself is undecidable.

**B** II only

**C** III only

**D** I and II only

QUESTION ANALYTICS



Q. 18

? FAQ Have any Doubt ?



If G is connected bipartite planar with  $n$  vertices and  $m$  edges, then find the maximum number of edges in G?

**A**  $2n - 4$

Correct Option

Solution :

(a)

In bipartite graph, every region has atleast four edges to form a cycle.  
 • Number of edges =  $m$   
 Number of vertices =  $n$   
 Let number of region =  $r$   
 $4r \leq 2m$   
 $2r \leq m$  ... (i)  
 Euler's theorem:  
 $r = m - n + 2$  ... (ii)  
 Substitute (i) in (ii)  
 $m \leq 2n - 4$   
 Number of edges is atmost  $(2n - 4)$ .

**B**  $3n - 2$

**C**  $n - 2$

**D**  $n$

QUESTION ANALYTICS



Q. 19

? FAQ Have any Doubt ?



Let A = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16} and consider the divides relation on A. Let C denote the length of the maximal chain, M the number of maximal elements, and m the number of minimal elements. Which is true?

**A**  $C = 3, M = 8, m = 6$

Correct Option

Solution :

(a)

The subset {2, 4, 8, 16}, of the poset is maximum chain in the poset. The length of this chain is three (one less than the number of elements in the chain). The longest chain in this poset has length three.  
 Set of maximal elements = {9, 10, 11, 12, 13, 14, 15, 16}  
 Set of minimal elements = {2, 3, 5, 7, 11, 13}

**B**  $C = 4, M = 8, m = 6$

**C**  $C = 3, M = 6, m = 6$

**D**  $C = 4, M = 6, m = 4$

Q. 20

[FAQ](#)[Solution Video](#)[Have any Doubt ?](#)

Consider the recurrence equation:

$$T(1) = 1$$

$$T(n) = n + \max_{\substack{1 \leq j < n \\ 1 \leq i, j < n}} \{T(i) + T(j)\} \quad n > 1$$

Which of the following is correct asymptotic bound for  $T(n)$ ?

A  $O(n \log n)$

B  $O(n^2)$

Correct Option

Solution :

(b)

Show by induction that  $T(n)$  is maximized by choosing  $i = 1, j = n - 1$ . This suggests that the worst case for a divide-and-conquer procedure is the most unbalanced case.

C  $\Theta(n \log n)$

D  $O(n)$



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**Q. 21**
[FAQ](#)
[Have any Doubt ?](#)


Let  $G$  be a group. Let  $g, h, x, y \in G$  be given. It is given that  $x * g = h, y * g = h$ .

- I.  $x = y$
- II.  $x * x * x = y * y * y$
- III.  $x * y * x = y * x * y$

 A Only I

 B Only II

 C Only I and II

 D All of I, II and III

Correct Option

**Solution :**

(d)

Given:

$$\begin{aligned} x * g &= h \\ y * g &= h \end{aligned}$$

...(1)

...(2)

Equate 1 and 2

$$x * g = y * g$$

 Now using cancellation property,  $g$  is cancelled on both sides.

$$\Rightarrow x = y$$

Now II and III can be easily proved using this.


**Q. 22**
[FAQ](#)
[Have any Doubt ?](#)


Consider the following intermediate code segment in 3-address code form:

```

 $x = x * x$ 
 $a = x * x$ 
 $y = y * y$ 
 $b = y * y$ 
 $a = x * y$ 

```

The minimum number of total variables in the static single assignment form of the given code segment to is \_\_\_\_\_.

 7

Correct Option

**Solution :**

7

The SSA form of the given code segment is:

$$\begin{aligned} x_1 &= x_0 * x_0 \\ a_0 &= x_1 * x_1 \\ y_1 &= y_0 * y_0 \\ b_0 &= y_1 * y_1 \\ a_1 &= x_1 * y_1 \end{aligned}$$

Note that SSA requires that every variable is defined before it is used. So when  $x, y$  are used in first and third statement we assume that they were defined earlier.


**Q. 23**
[FAQ](#)
[Solution Video](#)
[Have any Doubt ?](#)


Assume threads  $P_1$  and  $P_2$  executes the codes with the following shared data:

Semaphore	$m = 1, n = 1;$	}
int	$x = 0, y = 0$	

$P_1()$ {	$P_2()$ {
$\text{wait}(m);$ $x++;$ $\text{wait}(n);$ $y++;$ $\text{signal}(n);$ $\text{signal}(m);$	$\text{wait}(n);$ $x++;$ $\text{wait}(m);$ $y++;$ $\text{signal}(m);$ $\text{signal}(n);$
}	}

Which of the following satisfies for the above two concurrent threads?

**B** No deadlock**C** Both race condition and deadlock

Correct Option

Solution :

(c)

- $P_1$  and  $P_2$  can enter the critical section simultaneously and possible to access the data at  $x$ . So, no mutual exclusion called race condition.
- Both can be in deadlock by execution second wait by  $P_1$  and  $P_2$  alternatively.
- Race condition and deadlock can occur by the threads.

**D** Deadlock but no race condition

QUESTION ANALYTICS

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Q. 24

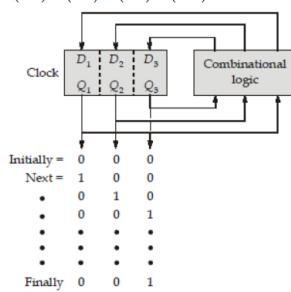
FAQ

Solution Video

Have any Doubt ?

D

The figure below shows a control circuit, consisting of 3-bit register and some combinational logic. This circuit is initially in the state  $Q_1 Q_2 Q_3 = 000$ . On subsequent clock pulses, the circuit is required to generate the control sequence:  
 $(100) \rightarrow (010) \rightarrow (001) \rightarrow (001) \rightarrow \dots$



Which of the following is a correct set of equations to be implemented by the combinational logic?

**A**  $D_1 = \bar{Q}_1 \bar{Q}_2 \bar{Q}_3, D_2 = Q_1, D_3 = Q_2 \vee Q_3$ 

Correct Option

Solution :

(a)

In this question, current state of circuit and next state of circuit are given.

From (000) we go to (100) then we go to (010) then we go to (001) then we stay in this state (001).

Remember that next state of  $D$  flip-flop is same as current value of input  $D$ . So, from next state table, we can find the values of inputs  $D_1, D_2, D_3$  and then we can write them in terms of  $Q_1, Q_2, Q_3$ .

$$\begin{aligned} D_2(Q_1, Q_2, Q_3) &= \Sigma(4) + d(3, 5, 6, 7) \\ D_1(Q_1, Q_2, Q_3) &= \Sigma(0) + d(3, 5, 6, 7) \\ D_3(Q_1, Q_2, Q_3) &= \Sigma(1, 2) + d(3, 5, 6, 7) \end{aligned}$$

"d" represents set of don't cares. Because we are not interested in those values because they cannot occur as output.

	$Q_1$	$Q_2$	$Q_3$	$Q_{1N}$	$Q_{2N}$	$Q_{3N}$	$D_1$	$D_2$	$D_3$
(0)	0	0	0	1	0	0	1	0	0
(4)	1	0	0	0	1	0	0	1	0
(2)	0	1	0	0	0	1	0	0	1
(1)	0	0	1	0	0	1	0	0	1

$D_1:$	$Q_1 Q_2$	$Q_3$	1	X	X		$D_1 = \bar{Q}_1 \bar{Q}_2 \bar{Q}_3$
			X	X	X		

$D_2:$	$Q_1 Q_2$	$Q_3$	X	X	1		$D_2 = Q_1$
			X	X	X		

$D_3:$	$Q_1 Q_2$	$Q_3$	X	1		$D_3 = Q_2 + Q_3$	
			X	X	X		

**B**  $D_1 = \bar{Q}_1 \bar{Q}_2 \bar{Q}_3, D_2 = Q_1 \bar{Q}_2 \bar{Q}_3, D_3 = \bar{Q}_1 Q_2 \bar{Q}_3$ **C**  $D_1 = \bar{Q}_1, D_2 = \bar{Q}_2, D_3 = \bar{Q}_3$ **D**  $D_1 = Q_3, D_2 = Q_1, D_3 = Q_2$ 

QUESTION ANALYTICS

+

Q. 25

FAQ

Have any Doubt ?

D

Consider the following grammar G over the alphabet  $\Sigma = \{a, b, c\}$ :

S' → S  
S → Aa  
S → Bb  
A → Ac  
A → ε  
B → Bc  
B → ε

You want to implement G using an SLR(1) parser (note that we have already added the  $S' \rightarrow S$  production for you). Which of the following is true?

A We have a reduce-reduce conflict in the first state (initial state of the DFA) of the LR(0) machine.

Correct Option

B We have a reduce-reduce conflict in the first state (initial state of the DFA) of the SLR(1) machine.

Correct Option

C We have a shift-reduce conflict in the first state (initial state of the DFA) of the LR(0) machine.

D We have a shift-reduce conflict in the first state (initial state of the DFA) of the SLR(1) machine.

YOUR ANSWER - NA

CORRECT ANSWER - a,b

STATUS - SKIPPED

Solution :

(a, b)

Here is the first state of the LR(0) machine:

S → S  
S → Aa  
S → Bb  
A → Ac  
A → ε  
B → Bc  
B → ε

We have the FOLLOW(A) = {a, c} FOLLOW(B) = {b, c}. We have a reduce-reduce conflict between production 5(A → ε) and production 7(B → ε), so the grammar is not SLR(1).

QUESTION ANALYTICS



Q. 26

? FAQ

Have any Doubt ?



In sliding window protocol, assume a 3 bit sequence number field. Both A and B have 3 bit sequence number. If A send 3 frames then waits for all the three acknowledgements until the timer expires. Which of the following could be sender's window size after the timer expires. Also, assume receiver receives all the three frames correctly but ACK's sent by receivers may be lost.

A 8

Correct Option

B 4

C 6

Correct Option

D 7

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,c,d

STATUS - SKIPPED

Solution :

(a, c, d)

Let's check one by one each options if sender window size is possible for each case.

Note: Sender waits for the acknowledgements before sliding the window.

(a) Window size of 8 is possible as 3 bit sequence is used [0 – 7] initially.

(c) Window size = 6 is possible when 3 frames out of 8 frames has been sent and only acknowledgement of first frame is received. In that case window is slided by 1 frame. Hence window size (8 – 3 + 1 = 6).

(d) Window size = 7, same technique as in (c) when 2 acknowledgements out of 3 frames has been received.

(b) Window size = 4 is not possible in any way.

QUESTION ANALYTICS



Q. 27

? FAQ

Have any Doubt ?



A digital computer has a memory unit with 32 bits per word. The instruction set consists of 110 different operations. All instructions have an operation code part (opcode) and two address fields: one for a memory address and one for a register address. This particular system includes eight general-purpose user-addressable registers. Registers may be loaded directly from memory and memory may be updated directly from the registers. Direct memory-to-memory data movement operations are not supported. Each instruction is stored in one word of memory. If X, Y, Z represent the number of bits that are needed for the opcode, for the register field and bits that are left for the memory address part of the instruction respectively then XY + YZ is \_\_\_\_\_?

87

Correct Option

Solution :

87

X(opcode bits) =  $\lceil \log_2 110 \rceil = 7$  (because the instruction set consists of 110 different operations)

bits for register address(Y) =  $\log 8 = 3$  (because there are 8 registers)

Total size of the instruction = 32 bits

Therefore bits for memory address(Z) =  $32 - 7 - 3 = 22$

$$XY + YZ = 21 + 66 = 87$$

QUESTION ANALYTICS



Q. 28

? FAQ

Have any Doubt ?



T is a min heap of height 9. What is the summation of the largest, smallest number of nodes that T can have? (Height of a tree with a single node is 0)

1535

Correct Option

Solution :

1535

For maximum number of nodes:

If every internal node of T has 2 children then there is one node at the root, 2 at depth 1, 4 at depth 2, 8 at depth 3 and so on,  $2^n$  at depth  $n$ .

So, maximum number of nodes possible in a heap with height  $h$  is:  $2^0 + 2^1 + 2^2 + \dots + 2^h = 2^{h+1} - 1$

For  $h = 9$ , we have, maximum nodes = 1023

For minimum number of nodes :

The first 9 levels (including the root) must be fully filled out, giving a total of 511 nodes. The 10<sup>th</sup> level has 1 node. So the total number of minimum nodes in the heap is  $511 + 1 = 512$

So,  $1023 + 512 = 1535$

QUESTION ANALYTICS



Q. 29

FAQ

Solution Video

Have any Doubt ?



2PL guarantees serializability, but it does not prevent deadlocks. 2PL has two phases growing and shrinking phase. Which of the following rules are used to govern the 2PL protocol?

A Two transactions can not have conflicting locks.

B No unlock operation can precede a lock operation in the same transaction.

C Equal serial schedule based on order of lock points of transaction.

D All of these

Correct Option

Solution :

(d)

2PL protocol is governed by all three rules mentioned in options (a), (b) and (c).

QUESTION ANALYTICS



Q. 30

FAQ

Have any Doubt ?



Which of the following statements is/are true?

A Given two TM's  $A_1$  and  $A_2$ ,  $L_D = \{<A_1> \# <A_2> \mid |L(A_1) \cap L(A_2)| = 2\}$  is undecidable.

Correct Option

B The language  $L_1 = \{a^i b^j c^k \mid j < i, j < k\}$  is not context-free.

Correct Option

C The language of all palindromes over alphabet {a, b} that do not contain the substring aa or bb, is non-regular.

D The language of odd length palindromes over alphabet {a, b} that do not contain the substring aa or bb, is non-regular.

YOUR ANSWER - NA

CORRECT ANSWER - a,b

STATUS - SKIPPED

Solution :

(a, b)

- In option (a) "given two TM's  $A_1$  and  $A_2$ , does  $|L(A_1) \cap L(A_2)| = 2$  That is, are there exactly 2 strings that are accepted by both  $A_1$  and  $A_2$ " It is non-trivial question so TM is undecidable.
- In option (b) we have two comparisons so it is not CFL.
- In option (c) the language of all palindromes over alphabet {a, b} that do not contain the substring aa or bb, is regular because the regular expression is  $(ab)^* a + (ba)^* b + \epsilon$ .

QUESTION ANALYTICS





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OVERALL ANALYSIS

COMPARISON REPORT

SOLUTION REPORT

ALL(65)

CORRECT(0)

INCORRECT(0)

SKIPPED(65)

Q. 31

FAQ

Have any Doubt?



Which of the following statements regarding SSA form (Static Single Assignment form) of an intermediate representation is false?

**A** If a program is in SSA form, then each use of a variable is reached by exactly one definition of that variable.

**B** Flow of control in SSA form remains the same as in the non-SSA form.

**C** Since every variable has exactly one definition in the program text. So there are no loops in SSA form.

Correct Option

**Solution :**

(c)  
SSA form is a property of an intermediate representation (IR), which requires that each variable is assigned exactly once and every variable is defined before it is used. Existing variables in the original IR are split into versions, new variables typically indicated by the original name with a subscript in textbooks, so that every definition gets its own version. In SSA form, use-def chains are explicit and each contains a single element. And flow of control in SSA form remains the same as in the non-SSA form. Every variable has exactly one definition in the program text. This does not mean that there are no loops. This is a static single assignment form and not a dynamic single assignment form. Some computer optimizations perform better on SSA forms conditional constant propagation and global value numbering are faster and more effective on SSA forms.

**D** Some compiler optimizations perform better on SSA forms.

QUESTION ANALYTICS



Q. 32

FAQ

Solution Video

Have any Doubt?



Consider database table R with 8 attributes A, B, C, D, E, F, G, H. What is the largest number of candidate keys that R could simultaneously have, given that ABC is already known to be a candidate key?

66

Correct Option

**Solution :**

66

8 attributes. Maximum number of candidate keys possible =  ${}^8C_4$ .

But ABC is already a key, so we need to remove those keys which have ABC, which is 5.

So, Total =  ${}^8C_4 - {}^5C_1 + 1 = 66$ 

QUESTION ANALYTICS



Q. 33

Solution Video

Have any Doubt?



Consider the following statements:  
 $S_1$  : Round robin scheduling performs poorly compared to FCFS if all the job lengths are less than the time slice length.  
 $S_2$  : The dispatcher is responsible for setting thread priorities.

Which of the above arguments is correct?

**A** Only  $S_1$

**B** Only  $S_2$

**C** Both  $S_1$  and  $S_2$

**D** None of these

Correct Option

**Solution :**

(d)

Round robin scheduling behaves identically to FCFS if the job lengths are no longer than the length of the time slice. Round robin scheduling performs poorly compared to FCFS if the job lengths are all the same and much greater than the time slice length.  $S_2$  is false. The dispatcher is only responsible for switching threads; the scheduler determines the thread priorities, based on the system's scheduling algorithms.

QUESTION ANALYTICS



Q. 34

Have any Doubt?



Of the following sorting algorithms, which has a running time that is LEAST dependent on the initial ordering of the input

**A** Insertion sort

B Quick sort

C Merge sort

Correct Option

Solution :

(c)

Merge sort takes  $O(n\log n)$  time for all permutations of arrays. Remaining algorithms take different times for sorted arrays.

D Bubble sort

QUESTION ANALYTICS



Q. 35

FAQ

Solution Video

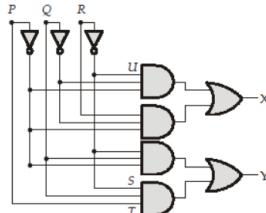
Have any Doubt ?



Consider the following logical functions X, Y and their implementation (possibly faulty).

$$X(P, Q, R) = \Sigma(0, 1)$$

$$Y(P, Q, R) = \Sigma(2, 6)$$



Possibly Faulty Implementation

Which of the following statements is/are true about the circuit shown?

- I. The line labeled S is correct.
- II. The line labeled T is correct.
- III. The line labeled U is correct.

A None of these

B II only

C I only

D I, II, and III

Correct Option

Solution :

(d)

$X = P'Q'R' + P'Q'R$ ; So, Line labeled U is correct.

$Y = P'QR' + PQR'$ ; So, Line labeled S, T are correct. The output of AND gate whose inputs are S, T will be  $PQR'$  where  $T = P$ ,  $S = R'$ .

QUESTION ANALYTICS



Q. 36

FAQ

Have any Doubt ?



Byte addressable main memory having 216 Bytes. 2-way set associative data cache containing 64 lines of 100 byte each. An  $80 \times 80$  2-D array is stored in main memory, starting at 1100H. Assume cache is initially empty and the element size of array is one byte. Total number of misses if array is accessed completely starting from the first element which is at memory location 1100H?

64

Correct Option

Solution :

64

Each block has size 100 bytes and hence 100 elements can be fetched in single transfer.

Now, do some smart work here. Rather than drawing the mapping and analysing think that array is contiguously allocated. Also that the array is starting from 1100, which is the first word of corresponding block. So, whichever line the first element of the array will be mapped to, there will be 1 cache miss for each new block transferred from main memory. Also, since array is accessed only once so no complications of which cache line will be retained in multiple iterations. Hence, number of misses will be equal to number of blocks required to store the array.

$$\frac{80 \times 80}{100} = 64$$

QUESTION ANALYTICS



Q. 37

FAQ

Have any Doubt ?



Let M be a three dimensional array declared as follows:

M : array [5 ... 15] [6 ... 20] [7 ... 10] of integers;

Assuming that each integer takes one memory location, the array is stored in row-major order and the first element of the array is stored at location 200, what is the address of the element A[i][j][k]?

A  $i + 11j + 16k - 1032$

B  $i + 11j + 16k - 1032$

Correct Option

**Solution :**

(b)

When working with 2-D arrays (matrices), row-major vs. column-major are easy to describe. The row-major layout of a matrix puts the first row in contiguous memory, then the second row right after it, then the third and so on. Column-major layout puts the first column in contiguous memory, then the second, etc.

Higher dimensions are a bit more difficult to visualize. When we move to 3-D and beyond, it's best to leave the row/column notation of matrices behind. This is because this notation doesn't easily translate to 3 dimensions due to a common confusion between rows, columns and the Cartesian coordinate system.

So, let's not think of 3-D arrays in terms of Rows/Columns but in terms of dimensions.

In row-major layout of multi-dimensional arrays, the last index is the fastest changing.

This is equivalent in saying that in row-major order, first dimension of a 3-D array represents planes, second dimension represents rows and third dimension represents columns. So, we have the following:

For array  $[p_1 \dots p_3] [r_1 \dots r_2] [c_1 \dots c_2]$ , where each array element takes  $n$  memory locations.

In row major order,

Address of element  $A[i][j][k] = \text{Base address} + [(i - p_1) * (c_2 - c_1 + 1) * (r_2 - r_1 + 1) + (j - r_1)(c_2 - c_1 + 1) + (k - c_1)] * n$

So, for the given question,

Address of element  $A[i][j][k] = 200 + [(i - 5) 60 + (j - 6) * 4 + (k - 7)] * 1 = 60i + 4j + k - 131$ .

**C**  $60i + j + 15k - 211$

**D** None of these

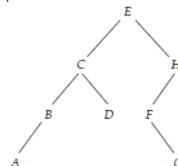
 QUESTION ANALYTICS

+

Q. 38

[Have any Doubt ?](#)


In the binary search tree shown below, finding node *E* requires one comparison, and finding node *A* requires 4 comparisons. What is the expected number of comparisons required to find a node chosen at random? \_\_\_\_\_ (Upto 2 decimal places)



**C** 2.75

Correct Option

**Solution :**  
2.75

Element *E* requires 1 comparison. Elements *C, H* require 2 comparisons each. Elements *B, D, F* require 3 comparisons each. Element *A, G* require 4 comparisons each.

Hence, expected number of comparisons =  $\frac{22}{8} = 2.75$

 QUESTION ANALYTICS

+

Q. 39

[FAQ](#)
[Solution Video](#)
[Have any Doubt ?](#)


Let the process start and end times are give in the below table:

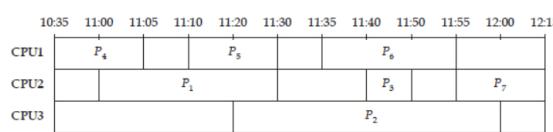
Process	$P_1$	$P_2$	$P_3$	$P_4$	$P_5$	$P_6$	$P_7$
Start	11:00	11:20	11:40	10:35	11:10	11:35	11:55
End	11:30	12:00	11:50	11:05	11:30	11:55	12:15

What is the minimum number of processors required at the station so that the schedule of processes is met?

**C** 3

Correct Option

**Solution :**  
3


 QUESTION ANALYTICS

+

Q. 40

[FAQ](#)
[Solution Video](#)
[Have any Doubt ?](#)


Evaluate  $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x}$

$\lim_{x \rightarrow 0} \frac{\sin^3 x}{x}$   
The value of the above limit is \_\_\_\_\_?

0.5

Correct Option

Solution :  
0.5

$$\begin{aligned}&= \lim_{x \rightarrow 0} \frac{\sin x - \sin x}{\sin^3 x} \\&= \lim_{x \rightarrow 0} \frac{1 - \cos x}{\sin^2 x \cos x} \quad \left[ \frac{0}{0} \right] \text{ form}\end{aligned}$$

By L' Hospital rule

$$\begin{aligned}&= \lim_{x \rightarrow 0} \frac{\sin x}{-\sin^3 x + 2 \sin x \cos^2 x} \\&= \lim_{x \rightarrow 0} \frac{1}{-\sin^2 x + 2 \cos^2 x} \\&= \frac{1}{-0+2} = \frac{1}{2}\end{aligned}$$

QUESTION ANALYTICS



Item 31-40 of 65 [« previous](#) [1](#) [2](#) [3](#) **4** [5](#) [6](#) [7](#) [next »](#)



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ALL(65)    CORRECT(0)    INCORRECT(0)    SKIPPED(65)

Q. 41

Have any Doubt?



In C-programming language, a 2-D array  $A[m][n]$  is stored in the computer's memory one row following another. The address of the first byte of memory is considered as the memory location of the entire 2-D array. Knowing the address of the first byte of memory, the compiler can easily compute to find the memory location of any other array element  $A[i][j]$  in the 2-D array. Which of the following is true? (Assuming each data value of the array requires B bytes of memory)

**A** The number of rows in the array must be known to compute the memory location of any other array element  $A[i][j]$  in the 2-D array.

**B** The number of columns in the array must be known to compute the memory location of any other array element  $A[i][j]$  in the 2-D array.

Correct Option

**Solution :**

(b)

In C-programming language, a 2-D array  $A[m][n]$  is stored in the computer's memory one row following another. The address of the first byte of memory is considered as the memory location of the entire 2-D array. Knowing the address of the first byte of memory, the compiler can easily compute to find the memory location of any other array element  $A[i][j]$  in the 2-D array. If each data value of the array requires B bytes of memory, and if the array has C columns, then the memory location of an element such as  $A[m][n]$  is  $(m * c + n)^* B$  from the address of the first byte. Note that to find the memory location of any element, there is no need to know the total number of rows in the array, i.e. the size of the first dimension. Of course the size of the first dimension is needed to prevent reading or storing data that is out of bounds.

**C** The number of rows and the number of columns in the array must be known to compute the memory location of any other array element  $A[i][j]$  in the 2-D array.

**D** The number of rows or columns in the array need not be known to compute the memory location of any other array element  $A[i][j]$  in the 2-D array.

QUESTION ANALYTICS



Q. 42

FAQ    Have any Doubt?



Let L be a language over an alphabet  $\Sigma$ . The equivalence relation  $\sim_L$  on the set  $\Sigma^*$  is defined by  $u \sim_L v$  if and only if for all  $w \in \Sigma^*$  it is the case that  $uw \in L$  if and only if  $vw \in L$ .

Consider the following statements:

- For a regular language L, the number of  $\sim_L$  equivalence classes is finite.
  - For a non-regular language L, the number of  $\sim_L$  equivalence classes is infinite.
- Which of the above statements is/are correct?

**A** Only I

**B** Only II

**C** Both I and II

Correct Option

**Solution :**

(c)

The given equivalence relation is actually Myhill-Nerode relation. And we know that a language is regular if and only if the number of equivalence classes in the Myhill Nerode relation are finite. So, both statements are true.

**D** None of these

QUESTION ANALYTICS



Q. 43

FAQ    Have any Doubt?



Consider the following expression which calculates one solution of the quadratic equation:

$$ax^2 + bx + c = 0$$

$$x = (-b + \sqrt{b^2 - 4 \times a \times c}) / (2 \times a)$$

Where  $\sqrt{}$  is an unary operator which performs the square root.

The least number of temporary variables required to create a three address code in static single assignment form for the above expression is \_\_\_\_\_?

8

Correct Option

**Solution :**

8

We will need a temporary variable for storing the result of each binary or unary operation as SSA (Static Single Assignment) implies the variable cannot be repeated on LHS of assignment.

$$t_1 = b * b$$

$$t_2 = 4 * a$$

```

 $t_3 = t_2 * c$ 
 $t_4 = t_1 - t_3$ 
 $t_5 = \text{sqrt}(t_4)$ 
 $t_6 = t_5 - b$ 
 $t_7 = 2 * a$ 
 $t_8 = t_7 / t_5$ 
 $x = t_8$ 

```

Here temporary variable = 8

And if it had asked for total variable answer would have been  $8 + 3$  ( $a, b, c$ ) = 11.

#### QUESTION ANALYTICS

Q. 44

Solution Video

Have any Doubt ?



Suppose a program references pages in the following sequence:

A, C, B, D, B, A, E, F, B, F, A, G, E, F, A

Suppose the computer on which this program is running has 4 pages of physical memory. Which of the following is true?

A 7 page faults will occur when we use optimal page replacement-based demand paging.

Correct Option

B 8 page faults will occur when we use optimal page replacement-based demand paging.

C 7 page faults will occur when we use LRU-based demand paging.

D 8 page faults will occur when we use LRU-based demand paging.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,d

STATUS - SKIPPED

Solution :

(a, d)

8 page faults will occur when we use LRU-based demand paging

	A	C	B	D	B	A	E	F	B	F	A	G	E	F	A
1	A														
2		C						E				G			
3			B		+					+			E		
4				D					F		+				+

7 page faults will occur when we use optimal page replacement-based demand paging.

	A	C	B	D	B	A	E	F	B	F	A	G	E	F	A
1	A														
2		C						E					+		
3			B		+					+			G		
4				D					F		+				+

#### QUESTION ANALYTICS

Q. 45

Solution Video

Have any Doubt ?



In the following schedules,  $R_x(Z)$  denotes Trans X Reads item Z.  $W_x(Z)$  denotes Trans X Writes item Z.

Consider the following schedules:

$S_1 : R_1(A), W_1(A), R_2(A), W_2(A), \text{Commit } T_2, R_1(B), W_1(B), \text{Abort } T_1$

$S_2 : R_1(A), R_2(A), W_2(A), \text{Commit } T_2, R_1(A), W_1(A), \text{Commit } T_1$

$S_3 : R_2(A), R_1(A), W_1(A), W_2(A), W_2(B), \text{Commit } T_2, W_1(B), \text{Commit } T_1$

Which of the following statements are true?

A Schedule  $S_1$  has dirty read problem.

Correct Option

B Schedule  $S_2$  has non-repeatable read problem.

Correct Option

C Schedule  $S_3$  has lost update problem.

Correct Option

D Schedule  $S_3$  is conflict serializable.

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c

STATUS - SKIPPED

Solution :

(a, b, c)

The lost update anomaly is said to occur if a transaction  $T_j$  reads a data item X, then another transaction  $T_k$  writes that data item X (possibly based on a previous read), after which  $T_j$  writes the data item X. The update performed by  $T_k$  has been lost, since the update done by  $T_j$  ignored the value written by  $T_k$ .

So,  $S_3$  has lost update problem.  $S_1$  has dirty read because of  $W_1(A), R_2(A)$ .  $S_2$  has non-repeatable read problem.

#### QUESTION ANALYTICS



Q. 46

[FAQ](#)
[Have any Doubt?](#)

Consider the language 'Pal' consisting of all palindromes over alphabet  $\Sigma = \{0, 1\}$ . Which of the following statements is true?

A Pal is non-regular.

Correct Option

B Every infinite subset of pal is non-regular.

C Every infinite superset of pal is non-regular.

D Every finite subset of pal is regular.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,d

STATUS - SKIPPED

**Solution :**

(a, d)

Pal is standard non-regular but CFL language. Consider the infinite subset  $0^*$  of pal, it is regular and consider the infinite superset  $\Sigma^*$  of pal, it is regular. Every finite language is always regular.
 QUESTION ANALYTICS

+

Q. 47

[FAQ](#)
[Have any Doubt?](#)

Which of the following statements about datagrams sent by a node in a network using IPv4 protocol is (are) true?

A Datagrams at the source must be the size of the smallest maximum transmission unit (MTU) of all the links on a path to the destination.

Correct Option

B Datagrams may be fragmented during routing.

Correct Option

C Datagrams are reassembled only at the destination.

Correct Option

D None of these

YOUR ANSWER - NA

CORRECT ANSWER - b,c

STATUS - SKIPPED

**Solution :**

(b, c)

Datagrams may be fragmented during routing. Datagrams are reassembled only at the destination.

 QUESTION ANALYTICS

+

Q. 48

[FAQ](#)
[Have any Doubt?](#)

The Turing machine  $(\{q_0, q_1, q_2\}, \{0, 1\}, \{0, 1, B\}, \delta, q_0, B)$  has the following three transitions and no others:

 $\delta(q_0, 0) = (q_1, 1, R)$ 
 $\delta(q_1, 1) = (q_2, 0, L)$ 
 $\delta(q_2, 1) = (q_0, 1, R)$ 

Which of the following statements is/are true?

A The given TM, on input 0110, will produce output 1110 when TM halts.

Correct Option

B The given TM, on input 0110, will produce output 1010 when TM halts.

C The given TM, on input 0110, will run forever without halting.

D The given TM halts on ALL strings.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,d

STATUS - SKIPPED

**Solution :**

(a, d)

256 KB ( $2^{18}$  bytes) per page. Let's see howAssume page size  $2^t$  B. Total number of entries in the first level (inner most) page table:  $2^{(48-t)}$ Number of pages (page tables) at the first level :  $2^{(48-t)} \times 8B$ Total number of entries in the second level page table:  $2^{(48-2t)} \times 8$ Size of second level page table =  $2^{(48-2t)} \times 8 \times 8B = 2^t B$ 

$$t = 18$$

So, Page size =  $2^{18} B = 256$  KB
 QUESTION ANALYTICS

+

Q. 49

[FAQ](#)
[Have any Doubt?](#)

In the Internet Protocol (IP) suite of protocols, which of the following best describes the purpose of the Address Resolution Protocol?

- A To translate Web addresses to host names.
- B To determine the IP address of a given host name.
- C To determine the hardware address of a given host name.
- D To determine the hardware address of a given IP address.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - d

STATUS - SKIPPED

Solution :

(d) ARP is used to determine the hardware address of a given IP address.

QUESTION ANALYTICS



Q. 50

? FAQ

Have any Doubt ?



You are working for a company that will be using the 192.168.1.0/24 private IP address space for IP addressing inside their organization. They have multiple geographical locations and want to carve up the 192.168.1.0/24 address space into subnets. Their largest subnet will need 15 hosts. What subnet mask should you use to accommodate at least 15 hosts per subnet, while maximizing the number of subnets that can be created?

A 255.255.255.248

B 255.255.255.224

Correct Option

Solution :

(b)

We can determine the maximum number of hosts allowed in a subnet by raising the number 2 to the power of the number of host bits and then subtracting 2. So, the formula looks like this:

Maximum number of hosts per subnet =  $2^h - 2$ , where  $h$  is the number of host bits.

Why are we subtracting two? Well, there are two IP addresses in the subnet that cannot be assigned. These addresses are: (1) the network address, where all of the host bits are set to 0 and (2) the directed broadcast address, where all of the host bits are set to 1.

1. Host Bit:  $2^1 - 2 = 0$
2. Host Bits:  $2^2 - 2 = 2$
3. Host Bits:  $2^3 - 2 = 6$
4. Host Bits:  $2^4 - 2 = 14$
5. Host Bits:  $2^5 - 2 = 30$
6. Host Bits:  $2^6 - 2 = 62$

In this question, we're asked to determine a subnet mask that accommodates at least 15 hosts per subnet. By looking at the reference table we created, we can see that 5 host bits (which support 30 hosts) would work, while 4 host bits (which supports only 14 hosts) would not be enough. So, we need a subnet with 5 host bits, which are enough host bits to meet the design goal, but not more than we need. Using more host bits than we need would violate the requirement to maximize the number of subnets.

A subnet mask with 5 host bits has 27 network bits (i.e.  $32 - 5 = 27$ ) and therefore a 27-bit subnet mask. A 27-bit subnet mask can be written as: 255.255.255.224.

C 255.255.255.252

D 255.255.255.240

QUESTION ANALYTICS



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## FULL SYLLABUS TEST-2 (BASIC LEVEL) (GATE - 2021) - REPORTS

OVERALL ANALYSIS    COMPARISON REPORT    **SOLUTION REPORT**

ALL(65)    CORRECT(0)    INCORRECT(0)    SKIPPED(65)

Q. 51

Have any Doubt ?



We have a binary search tree constructed out of nodes defined as follows:

```
struct node {
    int value;
    struct node* left;
    struct node* right;
};

Consider the following function:
struct node *mystery(struct node* root)
{
    if(root -> right -> right == Null)
        root -> right = root -> right -> left;
    else
        root = mystery(root -> right);
    return root;
}
```

What does this function do if address of root node of a BST is passed as argument, assuming left and right subtree of root node of BST is not Null.

**A** Finds largest node in the BST.

**B** Finds largest node in the BST and delete it.

Correct Option

**Solution :**

(b)  
 The given code finds the largest node in the BST and deletes the largest node And it connects the left child of the largest node *L* to the right side of *L*'s parent.

**C** Finds smallest node in the BST.

**D** Finds smallest node in the BST and deletes it.

QUESTION ANALYTICS



Q. 52

Have any Doubt ?



A stack can be implemented with an array A[0, ..., n - 1], and a variable pos. The push and pop operations are defined by the following code:

```
push (x)
    A[pos] -> x
    pos -> pos - 1
end push
pop ()
    pos -> pos + 1
    return A[pos]
end pop
```

Which of the following will initialize an empty stack with capacity N for this implementation?

**A** pos -> -1

**B** pos -> 0

**C** pos -> N - 1

Correct Option

**Solution :**

(c)  
 The push and pop operations are defined in a manner that stack grows downward. So, initially pos should N - 1 when stack is empty because in push code, we first insert element at pos and then decreases pos.

**D** pos -> N

QUESTION ANALYTICS



Q. 53

Have any Doubt ?



Which of the following is true about persistent HTTP connections?

**A** Persistent HTTP allows a server to track the client's requests through a persistent session.

**B** Only one connection must be opened for a page with no embedded objects served by other servers.

Correct Option

**Solution :**

(b)  
 (a) False, HTTP is still stateless.

- (c) False, persistent HTTP helps best when requesting many small objects.  
 (d) False, The client can close the connection then, or the server can do so after a time out, but the server doesn't know what else the client wants.

**C** Persistent HTTP shows the greatest performance advantage over non persistent with large objects.

**D** When the server has finished sending data for all objects referenced by the initially requested page, the server closes the connection.

### QUESTION ANALYTICS



Q. 54

? FAQ

▶ Solution Video

⌚ Have any Doubt ?



Consider table R with attributes A, B, C, D and E. What is the maximum number of candidate keys that R could have at the same time?

10

Correct Option

**Solution :**

10

We can get max no of candidate keys by combining attributes such the no one should be the subset of others.

So we have 5 possibilities here taking 1 attribute as candidate key i.e.,  ${}^5C_1$  (A, B, C, D, E).

Similarly for 2 attributes and 3 attributes  ${}^5C_2 = {}^5C_3 = 10$

4 attributes  ${}^5C_4 = 5$

5 attributes = 1

So maximum no of candidate keys that R could have at the same time is 10.

### QUESTION ANALYTICS



Q. 55

? FAQ

⌚ Have any Doubt ?



Consider the following characteristics of a disk system:

- 16 GB disk capacity rotates at 12000 rpm.
- Data transfer rate of  $10^6$  bytes/min.
- Average seek time is 6 ms.
- Block size is 64 KB.

The average service time to retrieve a single disk block is \_\_\_\_\_ ms. (Upto 1 decimal places)

3940.6 ( 3940.5 - 3940.7)

Correct Option

**Solution :**

3940.6 ( 3940.5 - 3940.7)

- Rotational latency

$$\begin{array}{rcl} 60 \text{ sec} & \longrightarrow & 12000 \\ \frac{60}{12000} \text{ sec} & \longrightarrow & 1 \end{array}$$

1 rotation requires 5 ms.

$$T_{\text{rotational}} = \frac{1}{2} \times \text{Rotational latency} = \frac{5}{2} = 2.5 \text{ ms}$$

- Data transfer

$$\begin{array}{rcl} 60 \text{ sec} & \longrightarrow & 10^6 \text{ B} \\ ? & \longrightarrow & 64 \text{ KB} \end{array}$$

$$\begin{aligned} T_{\text{transfer}} &= \frac{60}{10^6 \text{ B}} \times 64 \text{ KB} \\ &= 3932.16 \text{ ms} \end{aligned}$$

$$T_{\text{service}} = T_{\text{seek}} + T_{\text{rotational}} + T_{\text{transfer}}$$

$$= 6 + 2.5 + 3932.16 = 3940.66$$

### QUESTION ANALYTICS



Q. 56

? FAQ

⌚ Have any Doubt ?



Given the following piece of code:

```
main(int argc, char ** argv)
{
    forkthem(5)
}
void forkthem(int n)
{
    if(n > 0)
    {
        fork();
        forkthem(n - 1);
    }
}
```

How many processes are created if the above piece of code is run? (Hint: It may be easier to solve this problem by induction/recursion.)

31

Correct Option

**Solution :**

31

To solve this problem, we compute the number of processes that get created by calling the function

`forkthem()`. This can be given by the following equation:

$$n > 0: T(n) = 2T(n - 1) + 1$$

$$n = 0: T(0) = 0$$

where  $T(n)$  is the number of processes created by the function. To see why this is the case, consider what happens when the function is called. The first statement calls the system call `fork()` which creates a child in addition to the caller. Both the caller and the child then execute a recursive call to `forkthem()` with an argument set to  $n - 1$ . Therefore, a call to `forkthem()` creates one process of its own and then is responsible for all the children that will get created by the function with  $n - 1$ . The solution to the recurrence equation is  $2^n - 1$ .

#### QUESTION ANALYTICS

Q. 57

FAQ

Solution Video

Have any Doubt?



Consider the schema  $R(C, D)$ ,  $Q(B, C)$  and  $P(A, B)$ .  $C$  is foreign key in  $Q$  referencing  $R(C)$  on delete cascade.  $B$  is foreign key in  $P$  referencing  $Q(B)$  on delete set null. The tables of  $P$ ,  $Q$  and  $R$  is given below:

P	A	B
a	a	
b	b	

Q	B	C
a	a	
b	a	

R	C	D
a	a	
b	a	

SQL query : Delete \* from  $R$ ,

What are the tuples remained in  $P$  after executing the SQL query?

A (b, b) only

B (a, Null) and (b, Null)

Correct Option

Solution :

(b)

After executing the Query(Delete \* from  $R$ ) table  $Q$  will be empty and table  $P$  contains

P	A	B
a	Null	
b	Null	

C (a, Null) and (b, b)

D P will not be changed

#### QUESTION ANALYTICS

Q. 58

FAQ

Solution Video

Have any Doubt?



Here Address translation mechanism is used for 64-bit processor. Starting with a 48-bit virtual addresses, it uses 4 levels of page table to translate the address to a 52-bit physical address. Each page table entry is 8 bytes long. If the page size is increased, the number of levels of page table can be reduced. How large must pages be in order to translate 48-bit virtual addresses with only 2 levels of page table (Each page table fits exactly into page)?  
How large must pages be, in KB \_\_\_\_\_?

256

Correct Option

Solution :

256

256 KB ( $2^{18}$  bytes) per page. Let's see how

Assume page size  $2^t$  B. Total number of entries in the first level (inner most) page table:  $2^{(48-t)}$

Number of pages (page tables) at the first level :  $2^{(48-t)} \times 8B$

Total number of entries in the second level page table:  $2^{(48-2t)} \times 8$

Size of second level page table =  $2^{(48-2t)} \times 8 \times 8B = 2^t B$

$t = 18$

So, Page size =  $2^{18} B = 256$  KB

#### QUESTION ANALYTICS

Q. 59

FAQ

Have any Doubt?



A mineral collection contains twelve samples of Calomel, seven samples of Magnesite, and N samples of Siderite. Choosing K samples from the collection guarantees that you have six samples of the same type of mineral and K = 15. What is N?

4

Correct Option

Solution :

4

If N = 5 or more then we can not guarantee that you have six samples of the same type of mineral because you can pick 5 of type Calomel, 5 of type Magnesite and 5 of type Siderite. So, we have 15 samples but we do not have 6 samples of same type.  
So, answer will be N = 4.

#### QUESTION ANALYTICS

Suppose we have a node data structure declared as follows:

```
struct Node {  
    int item;  
    Node *next;  
};
```

What value does this function return, assuming that its argument is a properly formed singly linked list with a null pointer in the next field of the last node?

```
int mystery(Node* arg) {  
    if (arg == NULL) {  
        return 0;  
    } else {  
        if (arg->item > 0)  
            return 1 + mystery(arg->next);  
        else  
            return mystery(arg->next);  
    }  
}
```

**A** Returns the sum of the positive numbers in the list.

Correct Option

**B** Returns the number of positive numbers in the list.

**C** Returns the number of negative numbers in the list.

**D** Does not execute correctly because it never reaches a base case.

 QUESTION ANALYTICS

+



C A, B, D, C, E, G, H, F

D A, B, D, C, E, G, F, H

QUESTION ANALYTICS +

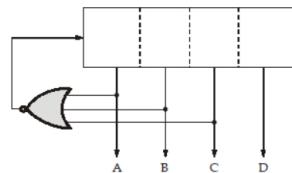
Q. 63

Solution Video

Have any Doubt ?



The figure below shows a 4-bit, right shift register and a NOR gate. If the register outputs {A, B, C, D} at time 0 are 0110, then their values 4 clock pulses later are:



A 0100

Correct Option

Solution :

(a)

A	B	C	D	
0	1	1	0	
0	0	1	1	1 <sup>st</sup>
0	0	0	1	2 <sup>nd</sup>
1	0	0	0	3 <sup>rd</sup>
0	1	0	0	4 <sup>th</sup>

Option (a) is right answer.

B 0110

C 0111

D 1000

QUESTION ANALYTICS +

Q. 64

FAQ

Solution Video

Have any Doubt ?



A network of  $n$  computers is such that we have  $m$  pairs of computers connected using full duplex wired links: a full duplex link is a direct two-way wired connection between two computers. The wired connectivity of a computer is the number of computers it can talk to via any sequence of wired links. What is the efficient time complexity to find a largest subset of existing wired links that could be removed without changing any computer's wired connectivity.

A  $O(m)$

B  $O(n)$

C  $O(mn)$

D  $O(m + n)$

Correct Option

Solution :

(d)

Think of the system as an unweighted undirected graph. Construct a graph on the computers, with an unweighted undirected edge between two computers if they share a wired link. Running DFS on the graph constructs a DFS tree on each connected component of the graph. Each connected component of size  $k$  requires at least  $k - 1$  edges to remain connected, which each DFS tree achieves. So return each wired link not in any DFS tree, since removing it will not affect connectivity. DFS takes  $O(n + m)$  time.

QUESTION ANALYTICS +

Q. 65

FAQ

Have any Doubt ?



Assume that RISC processor contains 10 global registers, 10 local registers, 6 In registers and 6 Out register. It contains 4 register windows what is the size of window and register file of the processor?

A 30 and 74

B 32 and 74

Correct Option

Solution :

(b)

$$\begin{aligned}\text{Window size} &= \text{Local Register} + (\text{In register} + \text{Out register}) + \text{Global register} \\ &= L + 2C + G \\ &= 10 + (2 \times 6) + 10 \\ &= 20 + 12 = 32\end{aligned}$$

$$\begin{aligned}\text{Register file size} &= W(L + C) + G \\ &= 4(10 + 6) + 10\end{aligned}$$

$$\begin{aligned} &= 4(16) + 10 \\ &= 64 + 10 = 74 \end{aligned}$$

**C** 22 and 64

**D** 22 and 70

 QUESTION ANALYTICS



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