



Kunal Jha

Course: GATE  
Computer Science Engineering(CS)

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## FULL SYLLABUS TEST-3 (BASIC LEVEL) (GATE - 2021) - REPORTS

OVERALL ANALYSIS

COMPARISON REPORT

SOLUTION REPORT

ALL(65)

CORRECT(0)

INCORRECT(0)

SKIPPED(65)

Q. 1

Solution Video

Have any Doubt?



Out of the options given below, select whichever word you consider the most appropriate for the blank space.  
Because of his \_\_\_\_ habits, he could not save much money.

 A Extravagant

Correct Option

Solution :

(a)

 B Frugal C Unsavoury D Bad

QUESTION ANALYTICS



Q. 2

FAQ

Solution Video

Have any Doubt?



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

 A Despite of working hard, he could not get even pass marks.

Correct Option

Solution :

(b)

 C Despite work hard, he could not get even pass marks. D Despite working hard, he could not get even passing marks.

QUESTION ANALYTICS



Q. 3

Solution Video

Have any Doubt?



The ratio of cost price and selling price of an article be as 10 : 11, the profit percentage is

 A 10%

Correct Option

Solution :

(a)

$$\frac{CP}{SP} = \frac{10}{11}$$

$$\text{Profit} = \frac{SP - CP}{CP} = \frac{SP}{CP} - 1$$

$$\text{Profit percentage} = \frac{1}{10} \times 100 = 10\%$$

 B 9.99% C 5% D 15%

QUESTION ANALYTICS



Q. 4

Solution Video

Have any Doubt?



The average of all odd numbers upto 100 is

 A 50

Correct Option

**Solution :**  
(a)

$$\begin{aligned}\text{Sum} &= 1 + 3 + 5 + \dots + 99 \\ &= \sum_{n=1}^{50} (2n - 1) = \frac{2 \times 50 \times 51}{2} - 50 \\ \text{Average} &= \frac{50 \times (51 - 1)}{50} = 50\end{aligned}$$

**B** 50.5

**C** 49.5

**D** 49

QUESTION ANALYTICS



**Q. 5**

Solution Video

Have any Doubt ?



A thief is noticed by a police man from a distance of 200 m. The thief start running and the police man start chasing him with speed of 10 km/h and 11 km/h respectively. The distance travelled by thief before being caught is \_\_\_\_\_ meters.

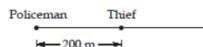
**2000**

Correct Option

**Solution :**  
2000  
Let after  $t$  hour, the thief is caught so,

$$11 \times t - 10 \times t = \frac{200}{1000} = \frac{1}{5}$$

$$t = \frac{1}{5} \text{ hours}$$



$$\text{Distance travelled by thief} = 10 \times \frac{1}{5} = 2 \text{ km} = 2000 \text{ m}$$

QUESTION ANALYTICS



**Q. 6**

Solution Video

Have any Doubt ?



Vivek and Ashok start from a fixed point Vivek moves 3 km north and turns right and then covers 4 km. Ashok moves 4 km west and turn left and walks 3 km. Now, the separation between them is

**A** 6 km

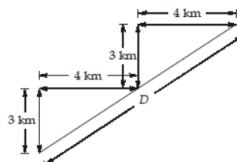
**B**  $7\sqrt{2}$  km

**C** 8 km

**D** 10 km

Correct Option

**Solution :**  
(d)



Separation between them,

$$\begin{aligned}D &= \sqrt{(4+4)^2 + (3+3)^2} \\ &= 10 \text{ km}\end{aligned}$$

QUESTION ANALYTICS



**Q. 7**

Solution Video

Have any Doubt ?



X is 3 times efficient than Y and is able to complete the work in 40 days less than Y. Then the time in which they can complete the work together is

**A** 5 days

**B**  $7\frac{1}{2}$  days

**C** 10 days

**D** 15 days

Correct Option

**Solution :**

(d)  
Let Y can do the work in  $x$  days

X can do the work in  $\frac{x}{3}$  days

$$x - \frac{x}{3} = 40$$

$$\frac{2x}{3} = 40$$
$$x = 60$$

Y can do the work in 60 days and X can do the work in 20 days

Let both can do the work together in  $t_B$  days

Hence,  $\frac{1}{t_B} = \frac{1}{t_Y} + \frac{1}{t_X}$

$$\frac{1}{t_B} = \frac{1}{60} + \frac{1}{20} = \frac{1+3}{60} = \frac{1}{15}$$

Hence,  $t_B = 15$  days

QUESTION ANALYTICS



Q. 8

Solution Video

Have any Doubt ?



A train overtakes two person who are walking at 2 km/h and 4 km/h in the same direction in which train is running in 9 sec and 10 sec respectively. The length of train is

**A** 50 m

Correct Option

**Solution :**

(a)

Let, the speed of train =  $s$  km/h  
the length of train =  $l$  km

$$\frac{l}{s-2} = \frac{9}{3600} \quad \dots(i)$$

$$\frac{l}{s-4} = \frac{10}{3600} \quad \dots(ii)$$

From equation (i) and (ii),

Speed,  $s = 22$  km/h

$$\text{Length, } l = \frac{9}{3600} \times 20 = 0.05 \text{ km} = 50 \text{ m}$$

**B** 125 m

**C** 90 m

**D** 180 m

QUESTION ANALYTICS



Q. 9

Solution Video

Have any Doubt ?



A Jar contains a mixture of two liquids A and B in the ratio 4 : 1. When 10 litre of the mixture is replaced with liquid B, the ratio becomes 2 : 3. The volume of liquid A present in the Jar earlier was

**A** 12 litres

**B** 16 litres

Correct Option

**Solution :**

(b)

Let the volume of A and B are  $4x$  and  $x$  respectively and 10 litre of mixture is removed

$$\text{Volume of A removed} = \frac{4}{5} \times 10 = 8$$

$$\text{Volume of B removed} = \frac{1}{5} \times 10 = 2$$

$$\frac{4x-8}{x-2+10} = \frac{2}{3}$$

$$12x - 24 = 2x + 16$$

$$10x = 40$$

$$x = 4$$

$$\Rightarrow \text{Volume of liquid A} = 4 \times 4 = 16 \text{ litre}$$

**C** 4 litres

**D** 20 litres

Q. 10

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

The traffic lights at three different road crossing changes after 24 seconds, 36 seconds and 54 seconds respectively. If they all change simultaneously at 10:00 AM, then at what time will they again change simultaneously?

A 10 : 16 : 54 AM

B 10 : 18 : 00 AM Correct Option

C 10 : 17 : 02 AM

D 10 : 21 : 36 AM Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - b,d

STATUS - SKIPPED

**Solution :**

(b, d)

LCM of 24, 36, 54 is 216

The light change simultaneously after 216 seconds or multiple of 216 seconds

Option (a),  $16 \times 60 + 54 = 1014$

Option (b),  $18 \times 60 + 00 = 1080$

Option (c),  $17 \times 60 + 02 = 1022$

Option (d),  $21 \times 60 + 36 = 1296$

Only option (b, d) are multiple of 216.



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## FULL SYLLABUS TEST-3 (BASIC LEVEL) (GATE - 2021) - REPORTS

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**Q. 11**
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Consider the following languages:

- I.  $L_1 = \{<G_1, G_2> \mid G_1, G_2 \text{ are CFG and } |G_1| + |G_2| \text{ is prime}\}$  where  $|G_1|$  and  $|G_2|$  represents number of productions in  $G_1$  and  $G_2$  respectively.
- II.  $L_2 = \{<M> \mid M \text{ is a TM and } M \text{ is the only TM which accepts } L(M)\}$

Which of the above languages is/are recursive?

 A Only  $L_1$ 
 B Only  $L_2$ 
 C Both  $L_1$  and  $L_2$ 

Correct Option

**Solution:**

(c)

 For  $L_1$ , we have algorithm to find whether a given number is prime or not. So, decidable, hence recursive.

 For  $L_2$ , we know that for any RE language, there are infinite TM that accepts that language. So, the property that "M is the only TM which accept  $L(M)$  is trivially false".

 D None of these

### QUESTION ANALYTICS


**Q. 12**
[FAQ](#)


Consider the following C like code:

```
int Count(Node root)
{
    if(root == null) return 0;
    else if((root.left != null) || ((root.right != null))
    return(Count(root.left) + Count(root.right));
    else return 1;
}
```

When a Binary tree is passed as input to this code, the above code counts

 A Number of internal nodes in a binary tree.

 B Number of leaf nodes in a binary tree.

Correct Option

**Solution:**

(b)

This code is basically returning 1 for each leaf node and adding the number of leaf nodes in the left tree and in the right subtree. So, it counts number of leaves in the tree.

 C Number of nodes in the binary tree.

 D None of these

### QUESTION ANALYTICS


**Q. 13**
[FAQ](#)
[Solution Video](#)
[FAQ](#)


Consider the following code fragment:

```
void fun(int n)
{
    if(n < 2) return;
    else {
        for(int i = 1; i <= 8; i++)
            fun(n/2);
        for(i = 1; i <= n^3; i++)
            printf("%d", i);
    }
}
```

What is the worst case time complexity of this code fragment? (Choose best answer)

 A  $O(n^3)$ 
 B  $O(n^3 \log n)$ 

Correct Option

**Solution:**

(b)

We can write recurrence relation for this function:

$$T(n) = 8T\left(\frac{n}{2}\right) + O(n^3)$$

Which, by Master's theorem, is  $O(n^3 \log n)$ .

C  $O(n^2)$

D  $O(n^4)$

QUESTION ANALYTICS

Q. 14

? FAQ

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

S<sub>1</sub>: If a program is in SSA form, then each use of a variable is reached by exactly one definition of that variable.

S<sub>2</sub>: Flow of control in SSA form remains the same as in the non-SSA form.

A Only S<sub>1</sub>

B Only S<sub>2</sub>

C Both S<sub>1</sub> and S<sub>2</sub>

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.

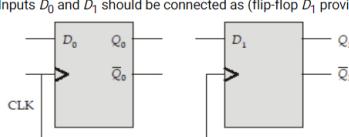
D None of these

QUESTION ANALYTICS

Q. 15

? FAQ

Two D flip-flops are connected as a synchronous counter that goes through following sequence  
 00 → 01 → 11 → 10 → 10  
 Inputs D<sub>0</sub> and D<sub>1</sub> should be connected as (flip-flop D<sub>1</sub> provides the MSB)



A  $\bar{Q}_1$  and  $Q_1 + Q_0$  respectively

Correct Option

Solution :

(a)

In D flip-flop, next state is same as current input value i.e. value of D.

So, from next state table, we can find the values of D<sub>1</sub>, D<sub>0</sub> and then we can write D<sub>1</sub>, D<sub>0</sub> in terms of Q<sub>1</sub>, Q<sub>0</sub>.

Q <sub>1</sub>	Q <sub>0</sub>	Q <sub>1N</sub>	Q <sub>0N</sub>	D <sub>1</sub>	D <sub>0</sub>
0	0	0	1	0	1
0	1	1	1	1	1
1	1	1	0	1	0
1	0	1	0	1	0

$$D_0 = Q'_1$$

$$D_1 = Q_1 + Q_0$$

B  $\bar{Q}_0$  and  $Q_1$  respectively

C  $\bar{Q}_1Q_0$  and  $\bar{Q}_0Q_1$  respectively

D  $\bar{Q}_0\bar{Q}_1$  and  $Q_0Q_1$  respectively

QUESTION ANALYTICS

Q. 16

? FAQ

Consider the following statements:

I. In a relation R, if some set of attributes X is such that closure set of X contains all the attributes of R i.e. X determines every attribute of R then X is a candidate key of R.

II. It is possible for a relation to have no non-trivial functional dependencies.

III. If set of all attributes combined form a candidate key for some relation R then R does not contain any non-trivial FD.

IV. In a relation R, if X is some set of attributes and Y is some prime attribute such that X determines Y is a non-trivial FD. Then R has at least two candidate keys.  
 Which of the above statements is/are false?

A Only I

Correct Option

Solution :

(a)

In statement I, in a relation  $R$ , if some set of attributes  $X$  is such that closure set of  $X$  contains all the attributes of  $R$ i.e.  $X$  determines every attribute of  $R$  then  $X$  is a super key, not necessarily a candidate key of  $R$ . So, I is false. Remaining all are true.

B I and IV only

C III and IV only

D I and II only

QUESTION ANALYTICS



Q. 17

? FAQ

Have any Doubt ?



According to the IEEE standard, a 32-bit, single-precision, floating-point number  $N$  is defined to be  $N = (-1)^S \times 1.F \times 2^{E-127}$  where  $S$  is the sign bit,  $F$  the fractional mantissa, and  $E$  the biased exponent. A floating-point number is stored as  $S:E:F$ , where  $S, E$  and  $F$  are stored in 1 bit, 8 bits, and 23 bits, respectively. What is the decimal value of the floating-point number C1E00000 (hexadecimal notation)?

A -12

B -15

C -26

D -28

Correct Option

Solution :

(d)

$$C1E00000 = 1100\ 0001\ 1110\ 0000.....0000$$

Then we can get:

$$S = 1$$

$$E = 10000011 = 128 + 3 = 131$$

$$F = 0.11000... = \frac{1}{2} + \frac{1}{4} = \frac{3}{4}$$

IEEE 32-bit format, uses a "Normalized Mantissa" which means that the mantissa should always have the form 1.xxxx (i.e. 1 followed by the floating point followed by the fractional part).

The leading 1 is hidden and implicitly understood while the part after the floating point (i.e. "xxxx") is encoded as F.

So you see, the actual Mantissa

$$M = 1 + F;$$

The '.' (dot) in the question (1.F) suggests a floating point and NOT a multiplication.

$$\text{So, } M = 1 + F = 1 + \frac{3}{4} = \frac{7}{4}$$

$$\text{Result} = -1 \times \left(\frac{7}{4}\right) \times 2^{(131-127)} = -\left(\frac{7}{4}\right) \times 16 = -28$$

QUESTION ANALYTICS



Q. 18

Solution Video

Have any Doubt ?



Belady's anomaly: Intuitively, it seems that the more frames the memory has, the fewer page faults a program will get. Surprisingly enough, this is not always true. Belady (1969) discovered an example in which FIFO page replacement causes more faults with four page frames than with three. This strange situation has become known as Belady's anomaly. A program with five virtual pages numbered from 0 to 4 references its pages in the following orders given below. Using FIFO replacement, compute the number of page faults with 3 frames. Repeat for 4 frames.

I. 0 1 2 3 0 1 4 0 1 2 3 4

II. 0 1 2 3 0 1 4 1 0 2 3 4

Which of the above reference strings is an example to show the Belady's anomaly?

A Only I

Correct Option

Solution :

(a)

For I, the number of page faults is 9 with 3 frames, 10 with 4.

For II, The number of page faults is 9 with 3 frames, 6 with 4.

B Only II

C Both I and II

D None of these

QUESTION ANALYTICS



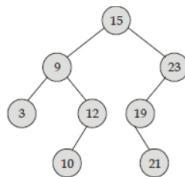
Q. 19

? FAQ

Have any Doubt ?



Consider the following binary search tree.



What is the postorder traversal of the above BST after deleting the node 9? (Assume that we replace the deleted node with its inorder successor).

**A** 10 12 3 21 19 23 15

**B** 3 10 12 21 19 23 15

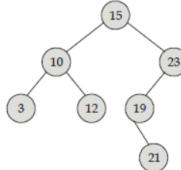
**C** 3 12 10 21 19 23 15

Correct Option

**Solution :**

(c)

After deleting node 9, we get the following tree:



Postorder of this tree is: 3 12 10 21 19 23 15

**D** 10 3 12 21 19 23 15

QUESTION ANALYTICS

+

**Q. 20**

? FAQ

▶ Solution Video

⌚ Have any Doubt ?

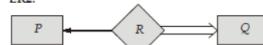
☰

Consider the following two ER diagrams: ER1 and ER2

ER1:



ER2:



The statement that the number of entities in entity set  $P$  must be greater than or equal to the number of entities in entity set  $Q$  holds for

**A** ER1 but not ER2

**B** ER2 but not ER1

Correct Option

**Solution :**

(b)

**C** Both ER1 and ER2

**D** Neither ER1 nor ER2

QUESTION ANALYTICS

+



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

Q. 21

Solution Video

Have any Doubt ?

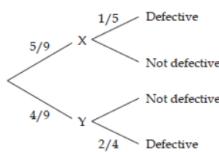


Company X shipped 5 computer chips, 1 of which was defective, and Company Y shipped 4 computer chips, 2 of which were defective. One computer chip is to be chosen uniformly at random from the 9 chips shipped by the companies. If the chosen chip is found to be defective, what is the probability that the chip came from Company Y? \_\_\_\_\_ (Upto 2 decimal places)

0.66 [0.66 - 0.67]

Correct Option

**Solution :**  
 $0.66 [0.66 - 0.67]$



$$P(\text{Company Y} \mid \text{Defective}) = \frac{\frac{4}{9} \times \frac{2}{4}}{\frac{5}{9} \times \frac{1}{5} + \frac{4}{9} \times \frac{2}{4}} = \frac{2}{3}$$

QUESTION ANALYTICS



Q. 22

? FAQ   Have any Doubt ?



The number of relations, on a set of five elements, which are both equivalence relation and partial order relation is \_\_\_\_\_.

1

Correct Option

**Solution :**

1

Equivalence relation is reflexive, symmetric and transitive. Partial order relation is reflexive, anti-symmetric and transitive. So, for a function to be both equivalence relation and partial order relation, it can only be identity relation. So, answer is 1.

QUESTION ANALYTICS



Q. 23

? FAQ   Have any Doubt ?



Consider an array  $A[1 \dots n]$ . It consists of a permutation of numbers  $1 \dots 2n$ . Now compute another array  $B[1 \dots 2n]$  as follows:  $B[A[i]] = 1$  for all  $1 \leq i \leq n$ ; and  $B[i] = 0$  for remaining entries. Consider the following loop:

```
for(i = 1; i ≤ 2n; i++)
    if(B[i] == 1)
        printf("%d\n", i);
```

Which of the following is true for the sequence that is printed by the above loop?

It will be a sorted sequence of elements of array A in increasing order.

Correct Option

**Solution :**

(a)

The given question is an example of how counting sort works. Array B has 1's in the cells indexes corresponding to the elements in array A then we print those indexes that have 1's, so, we'll get a sorted sequence of elements of array A.

It will be a sorted sequence of elements of array A in decreasing order.

It is a sequence of 0's and 1's.

It is not a permutation of elements of array A.

QUESTION ANALYTICS



Q. 24

? FAQ   Have any Doubt ?



Consider the below grammar G:

$S \rightarrow AB$

$A \rightarrow aA$

$A \rightarrow abA$

$A \rightarrow \epsilon$

$b \dots t, b$

$D \rightarrow UD$   
 $B \rightarrow abB$   
 $B \rightarrow \epsilon$

Which of the following statements are true?

A G is ambiguous grammar.

Correct Option

B String 'ab' has multiple leftmost derivations.

Correct Option

C  $L(G)$  is inherently ambiguous language.

D String 'aaaabab' is generated by the given grammar.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,d

STATUS - SKIPPED

Solution :

(a, b, d)

Given grammar generate regular language  $L = (a + ab)^* \cdot (b + ab)^*$ .

• By default the derivations are the leftmost derivations. Here 'ab' has more than 1 derivations so we can say it has multiple leftmost derivations.

• The generated language by G is regular and regular language is never an inherently ambiguous language.

QUESTION ANALYTICS



Q. 25

? FAQ

Have any Doubt ?



Suppose sender window size is 100 then what will be the sequence numbers bits required in sliding window protocol, Go-Back-N and selective repeat protocol.

A 7, 7, 8

Correct Option

Solution :

(a)

For sliding window protocol

$$\text{Window size} = \text{Maximum sequence number} + 1$$

$$W = 2^n - 1 + 1 \Rightarrow 100 = 2^n \text{ then } n \approx 7$$

Go-Back-N

$$W.S = \text{Maximum sequence number}$$

$$100 = 2^n - 1$$

$$101 = 2^n \text{ so } n \approx 7$$

For selective repeat

$$W.S = \frac{\text{Maximum sequence number} + 1}{2}$$

$$200 = 2^n - 1 + 1 \Rightarrow n \approx 8$$

B 8, 8, 8

C 8, 7, 8

D 8, 7, 7

QUESTION ANALYTICS



Q. 26

? FAQ

Solution Video

Have any Doubt ?



In order to create a good solution for the critical section problem for concurrent processes, which of the following conditions must hold?

A No process should have to wait forever to enter its critical region.

Correct Option

B No process running outside of its critical region may block other processes from entering their critical region when critical section is free.

Correct Option

C There should be no assumptions about the speed or number of CPUs.

Correct Option

D Every process should be able to enter inside critical section as soon as it shows interest.

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c

STATUS - SKIPPED

Solution :

(a, b, c)

QUESTION ANALYTICS



Q. 27

Have any Doubt ?



Consider the following grammar:

$S \rightarrow (\$)$

$S \rightarrow x$

Which of the following statements is/are true?

I. The grammar is ambiguous.

- II. The grammar is suitable for top-down parsing.  
 III. The grammar is suitable for bottom-up parsing.

A I only

B II only

C III only

D II and III only

Correct Option

**Solution :**

(d)

Given grammar is unambiguous and is LL(1), so, it is LR(1).

 QUESTION ANALYTICS



Q. 28

 Solution Video

 Have any Doubt?



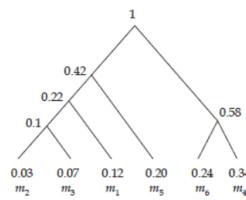
Consider the following set of messages ( $m_1 - m_6$ ) with the following frequencies (0.12, 0.03, 0.07, 0.34, 0.20, 0.24) using Huffman Coding.  
 If a message of 100 characters is encoded using Huffman coding, then the expected length of the encoded message in bits is \_\_\_\_\_.

232

Correct Option

**Solution :**

232



$$\text{Average number of bits/msg} = \sum_{i=1}^n d_i q_i$$

$d_i$  = Distance from visit to  $M_i$

$q_i$  = Frequency/msg

$$= 4 \times 0.03 + 4 \times 0.07 + 3 \times 0.12 + 2 \times 0.24 + 2 \times 0.34 + 2 \times 0.20 = 2.32 \text{ bits/msg}$$

Expand length of 100 character is  $100 \times 2.32 = 232$  bits.

 QUESTION ANALYTICS



Q. 29

  Solution Video

 Have any Doubt?



Consider the following set of processes given with their priorities in the order. (Assume all process arrived at the same time)

Process	Burst time	Priority
$P_1$	10 ms	3
$P_2$	1 ms	1 (highest)
$P_3$	2 ms	4
$P_4$	1 ms	5 (lowest)
$P_5$	5 ms	2

Using priority scheduling algorithm, find the average waiting time (in ms) for the above processes is \_\_\_\_\_. (Upto 1 decimal places)

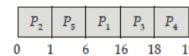
8.2

Correct Option

**Solution :**

8.2

Gantt chart will be



$$\text{Average waiting time} = \frac{1+6+16+18}{5} = \frac{41}{5} = 8.2 \text{ millisecond.}$$

 QUESTION ANALYTICS



Q. 30

 Have any Doubt?



Consider the following CFG:

$S \rightarrow aB \mid bA \mid D \mid E$

$A \rightarrow a \mid aS \mid bAA \mid c$

$B \rightarrow b \mid bS \mid aBB \mid c$

$D \rightarrow dD \mid Dd \mid d$

$E \rightarrow EE \mid EdE$

Which of the following statements is true?

**A** The given grammar generates aabbcc.

Correct Option

**B** The given grammar doesn't generate aabbcc.

**C** The given grammar is ambiguous.

Correct Option

**D** The given grammar is not ambiguous.

YOUR ANSWER - NA

CORRECT ANSWER - a,c

STATUS - SKIPPED

**Solution :**

(a, c)  
 $S \Rightarrow aB \Rightarrow aaBB \Rightarrow aaBc \Rightarrow aabSc \Rightarrow aabbAc \Rightarrow aabbcc$

Yes, the grammar is ambiguous because there are two different leftmost derivations of the string "dd": (i)  $S \Rightarrow D \Rightarrow dD \Rightarrow dd$  and (ii)  $S \Rightarrow DD \Rightarrow Dd \Rightarrow dd$ .

 QUESTION ANALYTICS



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**Q. 31**
[FAQ](#)   [Have any Doubt ?](#)


The Karnaugh map shown above represents a switching function Y(A, B, C, D). The minimized expression for Y is:

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

**A**  $A'C' + B'C + ACD' + BC'D'$ 
**B**  $A'C' + B'C + ABD'$ 

Correct Option

**C**  $A'B' + C'D' + ACD'$ 
**D**  $A'B' + A'C' + AC$ 

YOUR ANSWER - NA

CORRECT ANSWER - b

STATUS - SKIPPED

**Solution :**

(b)  
 Minimized expression is asked. We have two essential prime implicants : (0, 1, 4, 5) and (2, 3, 10, 11). Every EPI is definitely present in every expression. So, after including these two EPIs, we have two 1's remaining to cover. These can be covered by the term  $ABD'$ . Hence, answer is option (b).

QUESTION ANALYTICS


**Q. 32**
[FAQ](#)   [Have any Doubt ?](#)

 An Euler circuit of an undirected graph is a circuit in which each edge of the graph appears exactly once. Which of the following undirected graphs must have an Euler circuit?  
 I. A complete graph with 12 vertices.  
 II. A complete graph with 13 vertices.  
 III. A tree with 13 vertices.

**A** I only

**B** II only

Correct Option

**C** III only

**D** I and II only

YOUR ANSWER - NA

CORRECT ANSWER - b

STATUS - SKIPPED

**Solution :**

(b)  
 A graph has an Euler cycle if and only if it is connected and every vertex has even degree.  $K_{13}$  is 12 - regular (even) so it has Euler cycle.  $K_{12}$  is 11 - regular (odd) so it can not be Euler. Tree is acyclic hence it can not be Euler.

QUESTION ANALYTICS


**Q. 33**
[FAQ](#)   [Have any Doubt ?](#)


An instruction set of a processor has signals which can be divided into groups of mutually exclusive signals as follows:

Group 1: 30 signals, Group 2: 60 signals

If vertical micro-programming is used then the number of bits required to represent control signals?

**A** 11

Correct Option

**B** 7

**C** 90

**D** 6

YOUR ANSWER - NA

CORRECT ANSWER - a

STATUS - SKIPPED

**Solution :**

(a)  
If vertical microprogramming then the number of bits required to represent control signals.  
Group 1: upperbound(log(30)) = 5  
Group 2: upperbound(log(60)) = 6  
Total = 11

**QUESTION ANALYTICS****Q. 34****Solution Video****Have any Doubt ?**

Three squares of chess board are selected at random. The probability of getting 2 squares of one colour and other of a different colour is

**A**  $\frac{16}{21}$

**Correct Option**

**B**  $\frac{8}{21}$

**C**  $\frac{3}{32}$

**D**  $\frac{3}{8}$

**YOUR ANSWER - NA****CORRECT ANSWER - a****STATUS - SKIPPED****Solution :**

(a)  
Total boxes in chess of  $8 \times 8 = 64$ .  
Choosing any 3 squares =  ${}^{64}C_3$ .  
Choosing such that we have 2 of one colour and 1 of other colour.  
So, 2B and 1W or 1B and 2W.

$$P(2B \text{ and } 1W) = \frac{{}^{32}C_2 \times {}^{32}C_1}{{}^{64}C_3} = \frac{8}{21}$$

$$P(1B \text{ and } 2W) = \frac{{}^{32}C_1 \times {}^{32}C_2}{{}^{64}C_3} = \frac{8}{21}$$

$$\text{Required probability} = \frac{8}{21} + \frac{8}{21} = \frac{16}{21}$$

**QUESTION ANALYTICS****Q. 35****FAQ****Have any Doubt ?**

Consider the following code:

```
int x[ ] = {1, 4, 8, 5, 1, 4};
int *ptr, y;
ptr = x + 4;
y = ptr - x;
```

What does y in the sample code above equal?

**A** 3

**Correct Option**

**B** 0

**C** 4

**D** 4 + size of (int)

**YOUR ANSWER - NA****CORRECT ANSWER - c****STATUS - SKIPPED****Solution :**

(c)

**QUESTION ANALYTICS****Q. 36****FAQ****Have any Doubt ?**

Given program below uses 6 temporary variables

$u, v, w, x, y, z$

$u = 1$

$v = 10$

$w = 20$

$x = u + v$

$y = w + x$

```

z = w + y
v = w + y
y = v + z
z = 5 + y
return x + 5

```

Assume that all operation take their operands from registers, what is the minimum number of register needed to execute this program without spilling?

**A** 1

**B** 2

**C** 3

Correct Option

Solution :

(c)		
$R_1 \leftarrow u$	.....	$(u = 1)$
$R_2 \leftarrow v$	.....	$(v = 10)$
$R_3 \leftarrow w$	.....	$(w = 20)$
$R_1 \leftarrow R_1 + R_2$	.....	$(x = u + v)$
$R_1 \leftarrow R_3 + R_1$	.....	$(y = w + x)$
$R_2 \leftarrow R_3 + R_1$	.....	$(z = w + y)$
$R_3 \leftarrow R_3 + R_1$	.....	$(v = w + y)$
$R_1 \leftarrow R_2 + R_3$	.....	$(y = v + z)$
$R_3 \leftarrow 5 + R_1$	.....	$(x = 5 + y)$
return $(R_2 + R_3)$	.....	return $(x + 5)$

hence 3 register needed only.

**D** 4

QUESTION ANALYTICS



Q. 37

? FAQ

Have any Doubt ?



Let L be the set of all propositions generated by P and Q (Where P and Q are two propositions) using at most one of the following logical operations:  
 $\wedge, \vee, \oplus, \rightarrow, \leftrightarrow, \uparrow, \downarrow$  where  $\uparrow, \downarrow$  are NAND and NOR operators respectively.

i.e.,  $L = \{P, Q, P \wedge Q, P \vee Q, P \oplus Q, P \rightarrow Q, P \leftrightarrow Q, P \uparrow Q, P \downarrow Q\}$

A relation R is defined on L such that  $(a, b) \in R$  if and only "a  $\rightarrow$  b" is Tautology. The relation R is

**A** Reflexive

Correct Option

**B** Symmetric

**C** Reflexive, anti-symmetric

Correct Option

**D** Antisymmetric, not transitive

YOUR ANSWER - NA

CORRECT ANSWER - a,c

STATUS - SKIPPED

Solution :

(a, c)

For any proposition variable P we know  $P \rightarrow P$  is always True hence, tautology. So,  $(P, P)$  will always be there in the defined relation, so reflexive.

Antisymmetric because we know that  $P \rightarrow Q$  does not imply that  $Q \rightarrow P$ . And in the given set, no two elements are equivalent. And between non-equivalence elements P, Q if  $P \rightarrow Q$  holds then  $Q \rightarrow P$  can never hold. So, given relation is antisymmetric.

Implication is transitive i.e. If  $P \rightarrow Q$  and  $Q \rightarrow R$  then we know  $P \rightarrow R$ . So, Given relation is transitive.

Hence answer is (a), (c).

QUESTION ANALYTICS



Q. 38

? FAQ

Have any Doubt ?



A computer has a cache, main memory, and a disk. If a referenced word is in the cache, 10 ns are required to access it. If it is in the main memory but not in the cache, 50 ns are required to load it into the cache, and then the reference is started again. If the word is not in the main memory, 10 ms are needed to load it from the disk to main memory, followed by 50 ns to copy it to the cache, and then the reference is started again. The cache hit ratio is 0.8 and the main memory hit ratio is 0.7. What is the average time needed to access a referenced word (in nsec)?

600020

Correct Option

Solution :

600020

This question has explicitly defined what Hierarchical access does.

Cache access time = 10 ns The average time needed to access a referenced word:  $10 \text{ ns} + 0.2 [50 \text{ ns} + (0.30) (10 \text{ ms})]$

Note that for every word we need 10 ns for cache. For 0.2 times, we need some extra time. That extra time is like this: 50 ns is fixed because of memory access time and 0.30 times, we need to access disk.

Answer is asked in nsec so, convert msec into nsec by multiplying with 106.

So, answer is 600020.

QUESTION ANALYTICS



Q. 39

? FAQ

Solution Video

Have any Doubt ?



Consider an undirected graph G. Let T be a depth first search traversal tree. Let u be a vertex and v be the first unvisited vertex after visiting u. Which of the following statement is not always true?

- A**  $(u, v)$  must be an edge in G. Correct Option
- B**  $(u, v)$  must be an edge and  $v$  is a descendant of  $u$  in T. Correct Option
- C** If  $(u, v)$  is not an edge,  $u$  and  $v$  have the same parent. Correct Option
- D** If  $(u, v)$  is not an edge, then  $u$  is a leaf.

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c

STATUS - SKIPPED

Solution :

(a, b, c)  
 $(u, v)$  need not necessarily be an edge.  
If  $(u, v)$  is not an edge, then  $u$  has to be a leaf.  
So here only correct statement is (d).  
Hence (a), (b), (c) are false.

QUESTION ANALYTICS



Q. 40

? FAQ Have any Doubt ?



A class C host address is to be split into subnets with 4 bit subnet number. Calculate the number of hosts/subnet \_\_\_\_\_.

14

Correct Option

Solution :

14  
Number of subnets =  $2^4 = 16$   
Default mask of class C = 255.255.255.0  
As per question SID length in 34 bits.  
 $\Rightarrow 255.255.255.\underline{1111}0000$   
SID  

$$\frac{\text{Number of hosts}}{\text{Subnet}} = 2^4 - 2 = 16 - 2 = 14$$

QUESTION ANALYTICS



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**Q. 41**

Consider the following instance of a Knapsack problem:

 Number of objects  $n = 4$ ; Knapsack capacity  $m = 35$  profit,  $(p_1, p_2, p_3, p_4) = (26, 22, 18, 20)$ ,  $(w_1, w_2, w_3, w_4) = (16, 18, 14, 20)$ . The profit obtained in the optimal solution using greedy approach is \_\_\_\_\_. (Upto 2 decimal places)

50.11 [50.10 - 50.11]

Correct Option

**Solution :**
 $50.11 [50.10 - 50.11]$ 

 Optimal solution is  $\left(1, \frac{5}{18}, 1, 0\right)$  hence profit =  $26 + \left(\frac{5}{18}\right) \times 22 + 18 = 50.11$ .

[QUESTION ANALYTICS](#)

**Q. 42**

Which of following statement is false?

**A** The language  $L\{x \in (a, b)^*: x = a^n b a^m b a^{max(n, m)}\}$  is not regular.

**B**  $L = \{x \in \{a, b\}^*: x \text{ contain exactly two more } b\text{'s than } a\text{'s}\}$  is not regular.

**C**  $L + \{x \in \{a, b\}^*: x \text{ contain twice as many } a\text{'s as } b\text{'s}\}$  is not regular.

**D** If  $L_1$  and  $L_2$  are not regular language then  $L_1 \cup L_2$  is not regular.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - d

STATUS - SKIPPED

**Solution :**
**(d)** Let's check for (d),

$$L_1 = \{a^n b^n \mid n \geq 0\}$$

$$L_2 = \{a^m b^n \mid m \neq n\}$$

 Then,  $L_1 \cup L_2 = \{a^* b^*\}$ 

Hence regular.

[QUESTION ANALYTICS](#)

**Q. 43**
[FAQ](#)
[Solution Video](#)
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 If there are  $N$  jobs, arrived at almost same time in the system, all of the same length (burst time)  $L$ . Round robin algorithm is used by the scheduler. Where  $T$  is the length of the time slice,  $L > T$  and  $L$  is multiple of  $T$ . Then the first job will finish at approximately

**A**  $L$ 
**B**  $N * L$ 
**C**  $N * L - (N - 1)* T$ 

Correct Option

**Solution :**
**(c)**

 If there are  $N$  jobs and all of the same length  $L$ , the first job will finish at approximately  $N * L - (N - 1)* T$ , where  $T$  is the length of the time slice. The smaller that  $T$  becomes, the later the first job finishes. Reducing the time slice increases the average response time. It causes all the jobs to finish closer and closer to the end time.

**D**  $N * L - (N)* T$ 
[QUESTION ANALYTICS](#)

**Q. 44**
[FAQ](#)
[Have any Doubt ?](#)


Suppose you have a stack in which the values 1, 2, 3 must be pushed, in that order, but an item on the stack can be popped at any time. When the item is popped then it will be printed. The number of distinct integer sequences printed through this is \_\_\_\_\_.

5

Correct Option

**Solution :**

5

Possible sequences are : 1, 2, 3; 1, 3, 2; 2, 1, 3; 2, 3, 1; 3, 2, 1

Note that 3, 1, 2 is Not possible because 3 should be popped first then we can't pop 1 because 1 would be on the bottom.

## QUESTION ANALYTICS

**Q. 45**[FAQ](#)[Solution Video](#)[Have any Doubt ?](#)

Suppose a student is answering a test with 5 choices for each question (he can not leave the question without answering). The probability that he knows the answer to any question is  $\frac{1}{3}$ . If he doesn't know the answer then he selects a choice randomly. What is the probability that he knew the answer to the question that he answered correctly?

**A**  $\frac{7}{15}$ **B**  $\frac{5}{7}$ 

Correct Option

**Solution :**

(b)

If he knows answer, (probability =  $\frac{1}{3}$ ) he will answer correctly with probability = 1.If he doesn't know the answer (probability =  $\frac{2}{3}$ ), he will take a guess which can be correct witha probability =  $\frac{1}{5}$ .

$$= \frac{(\text{Know}) (\text{Correct})}{(\text{Know}) (\text{Correct}) + (\text{Not know}) (\text{Correct})}$$

$$= \frac{\left(\frac{1}{3}\right)1}{\left(\frac{1}{3}\right)1 + \left(\frac{2}{3}\right)\left(\frac{1}{5}\right)} = \frac{\frac{1}{3}}{\frac{1}{3} + \frac{2}{15}} = \frac{\frac{1}{3}}{\frac{7}{15}} = \frac{5}{7}$$

**C**  $\frac{1}{15}$ **D**  $\frac{8}{15}$ 

## QUESTION ANALYTICS

**Q. 46**[FAQ](#)[Have any Doubt ?](#)

Email is \_\_\_\_\_

**A** Loss tolerant application**B** Bandwidth sensitive application**C** Elastic application

Correct Option

**Solution :**

(c)

Because Email can work with available throughput so it elastic.

**D** None of these

## QUESTION ANALYTICS

**Q. 47**[FAQ](#)[Solution Video](#)[Have any Doubt ?](#)

Which sorting algorithm is the most suitable for the following cases?

- I. Sorting a large, almost sorted list.
- II. Sorting a very large list that cannot be contained in memory.
- III. Sorting a small list with big record size.

**A** I - Quick sort, II - Heap sort, III - Insertion sort**B** I - Insertion sort, II - Merge sort, III - Selection sort

Correct Option

**Solution :**

(b)

If the file is almost sorted then insertion sort will perform better than quick sort.

External sorting is used if the memory is constraints, one example of external sorting is the external merge sort algorithm, which is a K-way merge algorithm. It sorts chunks that each fit in RAM, then merges the sorted chunks together.

If the swapping is costly operation then form small list selection sort is preferred. ( $O(n)$  swap in worst case).**C** I - Insertion sort, II - Heap sort, III - Merge sort

D I - Quick sort, II - Merge sort, III - Selection sort

QUESTION ANALYTICS

Q. 48

FAQ Solution Video

Have any Doubt?



Consider the following schema:

Student (Sid, Sname)

Teacher (Tid, Tname)

Likes (Sid, Tid) : Student (Sid) likes Teacher (Tid)

$\{t \mid \exists S \in \text{Student} \forall B \in \text{Teacher} \exists L \in \text{Likes}(S.\text{Sid} = L.\text{Sid} \wedge B.\text{Tid} = L.\text{Tid} \wedge t.\text{name} = S.\text{Sname})\}$

What is the output of above tuple relational calculus query?

A It prints names of the students who likes every teacher.

Correct Option

Solution :

(a)

It prints that (those) student names s, who for every teacher t, s likes t.

So, option (a) is answer.

B It prints names of the students if they like some teacher.

C It prints names of the students who do not like some teacher.

D It prints empty set.

QUESTION ANALYTICS

Q. 49

FAQ Solution Video

Have any Doubt?



Consider the following schema:

create table T (

    C integer primary key,

    D integer);

create table S (

    B integer primary key,

    C integer references T(C) on delete cascade);

create table R (

    A integer primary key,

    B integer references S(B) on delete set null);

Suppose the current contents of R, S and T are as follows.

R	
A	B
1	1
2	2

S	
B	C
1	1
2	1

T	
C	D
1	1
2	1

After executing the command:

delete from T;

What tuples will R contain? (By above command, all records in the table T will be deleted!)

A R will not be changed

B (1, NULL) and (2, 2)

C (1, NULL) and (2, NULL)

Correct Option

Solution :

(c)

All records of T will be deleted, so, all records of S will be deleted as well due to on delete cascade. Then tuples of R will have null in the B column because of on delete set null.

D (2, 2) only

QUESTION ANALYTICS

Q. 50

Have any Doubt?



Merge sort works by splitting a list of n numbers in half, sorting each half recursively and merging the two halves.

Which of the following data structures will allow merge sort to work in O(n log n) time?

I. A singly linked list

II. A doubly linked list

III. An array

A None of these

B III only

C II and III only

D

I, II and III

Correct Option

**Solution :**

(d)

Using array we already know that merge sort works in  $n \log n$  time. Using linked list also it will work in  $n \log n$  time. In linked list we will do these things in merge sort:

1. Finding middle of the list ( $O(n)$  time)
2. Sorting both halves  $\left(2T\left(\frac{n}{2}\right)\text{ times}\right)$ .
3. Merging the two sorted halves ( $O(n)$  time)

So, we have

$$T(n) = 2T\left(\frac{n}{2}\right) + O(n) + O(n)$$

$$T(n) = 2T\left(\frac{n}{2}\right) + O(n)$$

So,  $n \log n$ . QUESTION ANALYTICSItem 41-50 of 65 [« previous](#) [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [next »](#)



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**Q. 51**
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The MegaGiga hard disk rotates at 10000 rpm (6 ms/rot) with a seek time given by  $t = 1 + 0.001 t$  msec, where  $t$  is the number of tracks the arm seeks. Assume a block size of 512 bytes, 1024 sector/track, 8192 tracks and 4 platters. The disk controller can DMA read or write data between memory and the disk device at a rate of 100 MB/min. Estimate the worst case delay to read 512 bytes from this disk.

**A** 25 ms

**B** 12.49 ms

Correct Option

**C** 14.9 ms

**D** 26.3 ms

YOUR ANSWER - NA

CORRECT ANSWER - b

STATUS - SKIPPED

**Solution :**

(b)  
 Worst case seek is  $1 + 0.001 \times 8192$  ms = 9.192 ms  
 One rotation time is 6 ms, average rotation time = 3 ms  
 $\text{Read time} = \frac{60 \times 512}{10^3}$  ms = 0.3 ms  
 Total =  $9.192 + 3 + 0.3 = 12.492$  ms

QUESTION ANALYTICS


**Q. 52**
[FAQ](#)   [Solution Video](#)   [Have any Doubt?](#)


Suppose two threads execute the following C code concurrently, assessing shared variables a, b, and c:

**Initialization**

```
int a = 4;
int b = 0;
int c = 0;
```

**Thread 1**

```
if (a < 0)
    c = b - a;
else
    c = b + a;
```

**Thread 2**

```
b = 10;
a = -3;
```

What are the possible values for c after both threads complete? You can assume that reads and writes of the variables are atomic and that the order of statements within each thread is preserved in the code generated by the C compiler. Statement X = Y\* Z reads Y, then reads Z from memory, performs Y\*Z, stores/writes it to memory X.  
 Which of the following values are possible for c after both threads complete?

**A** 4

Correct Option

**B** 7

Correct Option

**C** 14

Correct Option

**D** -3

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,b,c,d

STATUS - SKIPPED

**Solution :**

(a, b, c, d)  
 Values of c that are possible are: 4, 7, 13, 14, -3  
 4 is possible when we run  $T_1$  completely then  $T_2$ .  
 13 is possible when we run  $T_2$  completely then  $T_1$ .  
 14 is possible when we run  $T_2$ 's "b = 10" then run  $T_1$  completely.  
 7 is possible when we run  $T_1$ 's "If (a < 0)" then run  $T_2$  completely then run  $T_1$ 's "c = b + a".  
 -3 is possible when we run  $T_1$ 's "If (a < 0)" then in  $T_1$ 's "c = b + a" we just read b then run  $T_2$  completely then read a and then run  $T_1$ 's "c = b + a".

QUESTION ANALYTICS


**Q. 53**
[FAQ](#)   [Solution Video](#)   [Have any Doubt?](#)


Which of the following is/are true about virtual memory systems that use pages?

**A** The virtual address space can be larger than the amount of physical memory.

Correct Option

**B** Programs must be resident in main memory throughout their execution.

**C** Pages correspond to semantic characteristics of the program.

**D** Secondary memory space can be greater than the amount of virtual memory.

Correct Option

YOUR ANSWER - NA

CORRECT ANSWER - a,d

STATUS - SKIPPED

Solution :

(a, d)

QUESTION ANALYTICS

+

Q. 54

? FAQ ► Solution Video

Have any Doubt ?

Q

Consider a B-tree with order  $P$ , where order  $P$  is defined as usual (maximum number of child pointers a node can have). The maximum levels of index required to store 400 distinct keys in order  $P = 5$  B-tree index \_\_\_\_\_.

5

Correct Option

Solution :

5

(Total maximum number of levels)

Given:

In B-tree,

For Root node: 1 to 4 Keys

For other remaining nodes: 2 to 4 keys.

Since, maximum number of levels has been asked, we will fill each node at each level as less as possible and we will stop at the level when we exceed the total number of keys as 400.

Assume at  $K^{\text{th}}$  level (assuming the level of root as level 1) we strictly exceed 400 then answer will be  $K - 1$  and if at  $K^{\text{th}}$  level, total number of keys = 400 then answer  $K$ .

Hence, at root level: 1 Node, 1 Key, 2 Pointers

At next level (2<sup>nd</sup> level): 2 Nodes, 4 Keys, 6 Pointers

At next level (3<sup>rd</sup> level): 6 Nodes, 12 Keys, 18 Pointers

At next level (4<sup>th</sup> level): 18 Nodes, 36 Keys, 54 Pointers

At next level (5<sup>th</sup> level): 54 Nodes, 108 Keys, 162 Pointers

So far, total number of keys = 160 Keys

At next level (6<sup>th</sup> level): 162 nodes, 324 Keys, 486 Pointers

Now, total number of keys is 484 > 400.

Hence, answer is 5.

QUESTION ANALYTICS

+

Q. 55

? FAQ Have any Doubt ?

Q

Construct the minimal deterministic finite automaton M whose language of accepted strings is equal to the language over the alphabet {a, b, c} generated by the context-free grammar with nonterminals  $q_0$  and  $q_1$ , whose start symbol is  $q_0$  and whose productions are

$q_0 \rightarrow abq_1, q_1 \rightarrow \epsilon, q_1 \rightarrow q_0$  and  $q_1 \rightarrow abc$

The number of states in M is \_\_\_\_\_?

7

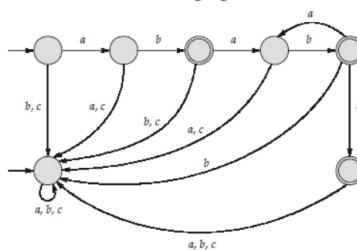
Correct Option

Solution :

7

The language generated by the given grammar is  $(ab)^* + (ab)^* abc$ .

The following is the minimal DFA for this language:



QUESTION ANALYTICS

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Q. 56

? FAQ Have any Doubt ?

Q

Consider the following intermediate program segment in three address code:

$u = v \times w$

$w = u + w$

$x = u / w$

$v = u - x$

The minimum number of total variables required to convert the above code segment to static single assignment form is \_\_\_\_\_?

**Solution :**

6

The SSA form for the given code is as follows:

$$\begin{aligned}w_0 &= v_0 \times w_0 \\w_1 &= u_0 + w_0 \\x_0 &= u_0 / w_1 \\v_1 &= u_0 - x_0\end{aligned}$$

SSA 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.

Straight line sequences of code can be transformed to SSA by simple renaming of variable definitions. The target of the definition is the variable being defined, on the left hand side of the assignment statement. In SSA, each definition target must be a unique variable name. Conversely variable names can be used multiple times on the right hand side of any assignment statements, as source variable for definitions.

**QUESTION ANALYTICS****Q. 57****? FAQ****Have any Doubt ?**

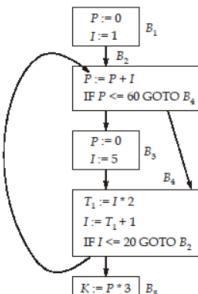
Consider the following 3 Address Intermediate Code:

1.  $P := 0$
2.  $I := 1$
3.  $P := P + 1$
4. IF  $P \leq 60$  GOTO (7)
5.  $P := 0$
6.  $I := 5$
7.  $T_1 := I * 2$
8.  $I := T_1 + 1$
9. IF  $I \leq 20$  GOTO (3)
10.  $K := P * 3$

Let  $x$  be the number of nodes in the Control Flow Graph (Excluding the two special nodes ENTER and EXIT) for the above IR and let  $y$  be the number of edges in the CFG then  $x + y$  is \_\_\_\_\_?

**Solution :**

11



The CFG for the given IR will be as following:

- $B_1 : [(1) P := 0; (2) I := 1]$
- $B_2 : [(3) P := P + I; (4) \text{IF } P \leq 60 \text{ GOTO } B_4]$
- $B_3 : [(5) P := 0; (6) I := 5]$
- $B_4 : [(7) T_1 := I * 2; (8) I := T_1 + 1; (9) \text{IF } I \leq 20 \text{ GOTO } B_2]$
- $B_5 : [(10) K := P * 3]$

**QUESTION ANALYTICS****Q. 58****? FAQ****Have any Doubt ?**

Which of the following languages is undecidable?

**A**  $L_1 = \{\langle M \rangle | M \text{ is a TM and there exists an input on which } M \text{ halts in less than } |M| \text{ steps}\}$ .

**B**  $L_2 = \{\langle M \rangle | M \text{ is a TM and } |L(M)| \leq 3\}$ .

**C**  $L_3 = \{\langle M \rangle | M \text{ is a TM that accepts all even numbers}\}$ .

**D**  $L_4 = \{\langle M \rangle | M \text{ is a TM and } |L(M)| \geq 3\}$ .

YOUR ANSWER - NA

CORRECT ANSWER - b,c,d

STATUS - SKIPPED

**Solution :**

(b, c, d)

R.M\* that decides the languages works as follows on input  $\langle M \rangle$ . If first finds the length of  $\langle M \rangle$  and stores it. Then, it runs M on all inputs of length at most  $|M|$  steps and accepts of M accepts at least one of the strings within the specified number of steps.

You might wonder why we limited the length of the strings. Since we bound the number of steps that M runs on an input, then there is no point on looking at any strings that are longer than that number, since if a TM is allowed to run for at most  $c$  steps, it is not possible for that TM to "process" any input symbol beyond the  $c^{\text{th}}$  symbol!

The number of possible inputs is finite and the number of steps M runs on each input is finite, therefore M is guaranteed to halt and decide the language.

$L_2$  is Not decidable because of non-trivial property of RE languages, using Rice theorem. Property "containing at most 3 strings" is non-trivial property of RE languages.

Using Rice theorem, Both  $L_3$  and  $L_4$  are not decidable.

$L_3$  : "Accepting all even numbers" is non-trivial property of RE languages. Hence, by Rice theorem,  $L_4$  is undecidable. Property "containing at least 3 strings" is non-trivial property of RE languages.

#### QUESTION ANALYTICS



Q. 59

FAQ Solution Video

Have any Doubt?



A binary search tree is constructed by inserting the key values 1, 2, 3, 4, 5, 6, 7 in some order specified by a permutation of 1, ..., 7 into an initially empty tree. How many of these permutations will lead to a complete binary search tree?  
(A complete BST is a BST in which every internal node has two children and all the leaf nodes are at same level)

80

Correct Option

Solution :

80  
First key in any such permutation will have to be 4. Now we have these conditions for desired permutations: 2 must come before 1 and 3, 6 must come before 5 and 7. So, if we count number of permutations with these conditions, we get 80 such permutations.  
So, 4 has to be at first place.  
Now, if 2 is at second place then:  
Case 1 : 6 is at 3<sup>rd</sup> place : 24 ways.  
Case 2 : 6 is at 4<sup>th</sup> place : 12 ways.  
Case 3 : 6 is at 5<sup>th</sup> place : 4 ways.  
So, total permutations = 40 when 2 is at second place.  
Similarly, when 6 is at second place, we have 40 permutations.  
Total 80.

#### QUESTION ANALYTICS



Q. 60

FAQ Have any Doubt?



Define an equivalence relation R on the positive integers A = {2, 3, 4, ..., 20} by mRn if the largest prime divisor of m is the same as the largest prime divisor of n. The number of equivalence classes of R is \_\_\_\_\_.

A 8

Correct Option

Solution :

(a)  
All the prime numbers will have to go to different equivalence classes. Remaining all elements will go to some of these classes. So, total 8 equivalence classes because there are 8 prime numbers below 20.

B 9

C 10

D 11

#### QUESTION ANALYTICS





Kunal Jha  
 Course: GATE  
 Computer Science Engineering(CS)

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## FULL SYLLABUS TEST-3 (BASIC LEVEL) (GATE - 2021) - REPORTS

OVERALL ANALYSIS    COMPARISON REPORT    **SOLUTION REPORT**

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

Q. 61

Have any Doubt?



Total 256 control signals are required for Instruction set of a processor divided into 3 mutually exclusive groups as follows:

Group-1: 120 signals, Group-2: 80 signals, Group-3: 56 signals

How many bits of control word vertical and horizontal micro programming will have respectively?

**A** 20 bits, 256 bits

Correct Option

**Solution :**

(a)

In Horizontal unit, We have one bit for each control signal. So, 256 bits needed.

In vertical unit, we store encoding of control signals. For each group we have a encoding in the control word. So, we need 7 bit for group 1, 7 bits for group 2 and 6 bits for group 3. Total, 20 bits.

**B** 256 bits, 256 bits

**C** 256 bits, 20 bits

**D** 20 bits, 120 bits

QUESTION ANALYTICS



Q. 62

FAQ    Have any Doubt?



An organisation is granted the block 125.238.0.0. The administrator wants to create 512 subnets:  
 Find the number of valid host addresses in each subnet is \_\_\_\_\_.

**A** 32766

Correct Option

**Solution :**

32766

This is a class A address range so that the default mask is /8 we need sufficient bits to produce 512 subnet so  $2^x = 512$  where x is number of bits required, so  $x = 9$ .

So we require mask to be  $8 + 9 = 17$  bits

There will be 15 bits remaining so the number of hosts per subnet is  $32768 - 2 = 32766$  since 2 addresses are not able to be used for hosts (they are reserved addresses).

QUESTION ANALYTICS

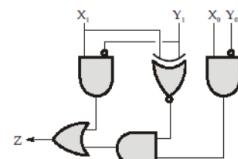


Q. 63

FAQ    Have any Doubt?



The logic circuit above is used to compare two unsigned 2-bit numbers,  $X_1 X_0 = X$  and  $Y_1 Y_0 = Y$ , where  $X_0$  and  $Y_0$  are the least significant bits.  
 (A small circle on any line in a logic diagram indicates logical NOT.)



Which of the following always makes the output Z have the value 1?

**A**  $X > Y$

Correct Option

**Solution :**

(a)

Basically it is the condition of  $X > Y$  in case of 2 bit numbers (either the MSB of X > MSB of Y, or else if both MSBs are same LSB of X > LSB of Y).

**B**  $X < Y$

**C**  $X \neq Y$

**D**  $X \geq Y$

QUESTION ANALYTICS

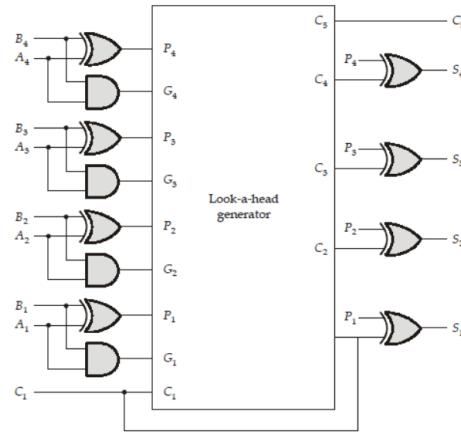


Q. 64

FAQ    Have any Doubt?



Assume that the EXCLUSIVE-OR gate has a propagation delay of 20 ns and that the AND and OR gates have a propagation delay of 10 ns. What is the total propagation delay (in nanosecond) in the four bit adder of the figure given below?



60

Correct Option

Solution :

60  
If you know the structure of carry look-a-head generator then it is easy.  
Propagation delay = Max(20, 10) + 10 + 10 + 20  
= 20 + 10 + 10 + 20 = 60

QUESTION ANALYTICS

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Q. 65

? FAQ Have any Doubt ?

Bookmark

Define a binary relation  $R = \{(0, 1), (1, 2), (2, 3), (3, 2), (2, 0)\}$  on  $A = \{0, 1, 2, 3\}$ . The directed graph (including loops) of the transitive closure of this relation has

A 16 arrows

Correct Option

Solution :

(a)  
Hint: Draw the digraph of R. Definition of transitive closure of  $R = \{(x, y) \mid x \text{ and } y \text{ are connected in the digraph or } R\}$ .  
Now check for every elements of  $A \times A$  one by one in R you will find all the ordered pairs belong to  $R^o$ . So all the 16 arrow are present.

B 12 arrows

C 8 arrows

D 5 arrows

QUESTION ANALYTICS

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