



Ashima Garg

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[ALL\(65\)](#)
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[SKIPPED\(65\)](#)

Q. 1

Which of phrases given below should replace the phrase printed in bold type to make the sentence grammatically correct? By such time you finish that chapter, **I** will write a letter.

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

A

The time when

B

By the time

Correct Option

Solution :

(b)

C

By that time

D

The time

QUESTION ANALYTICS

Q. 2

The words that best fill the blanks in the below sentence are: Although he puts in.....of overtime and takes few holidays, he.....cannot support his family.

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

A

sufficient, however

B

lot, besides

C

much, thus

D

plenty, still

Correct Option

Solution :

(d)

QUESTION ANALYTICS

Q. 3

Select the pair which has the same relationship as the two words
IMPLAUSIBLE : ABSURD ::?



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B
 flamboyant : public

C
 surprising : shocking

Solution :
 (c)

D
 superfluous : truncated

QUESTION ANALYTICS

Correct Option

Q. 4

A jar contains 5 marbles: 3 red and 2 blue. If two marbles are drawn randomly from the jar, what is the probability that they will be of different colours?

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

A
 $\frac{3}{25}$

B
 $\frac{6}{25}$

C
 $\frac{2}{5}$

D
 $\frac{3}{5}$

Correct Option

Solution :
 (d)

Probability of getting 1 red marble is ${}^3C_1 = 3$

Probability of getting 1 blue marble is ${}^2C_1 = 2$

Probability of getting 2 marbles is ${}^5C_2 = 10$

$$\text{Now, } \frac{3 \times 2}{10} = \frac{3}{5}$$

QUESTION ANALYTICS

Q. 5

If in a certain sequence of consecutive multiples of 50, the median is 625, and the greatest term is 950, how many terms that are smaller than 625 are there in the sequence?

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So the list around 625 must go. 600 (625) 650 700 750 800 850 900 950
 Since we know there are 7 numbers greater than 625 then there must be 7 numbers less than

QUESTION ANALYTICS

Q. 6

A cube has a volume of 72 unit³. If it is divided into 8 equal cubes, the ratio of an edge of a smaller cube to an edge of the original cube is

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

A

1 : 2

Correct Option

Solution :

(a)

$$\text{Volume of each small cube} = \frac{72}{8} = 9 \text{ unit}^3$$

$$\text{Edge of each small cube} = 9^{(1/3)}$$

$$\text{Edge of Original cube} = 72^{(1/3)} = (8 \times 9)^{(1/3)} = 2 \times 9^{(1/3)}$$

$$\text{Therefore, ratio} = 1 : 2$$

B

1: 3

C

1 : 3 $\sqrt{2}$

D

2 : 9

QUESTION ANALYTICS

Q. 7

Two bikes, travelling at 5 km/hr and 10 km/hr, head directly towards each other. They begin at a distance of 20 km from each other. How far apart are they (in km) one minute before they collide?

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

A

$$\frac{1}{12}$$

B

$$\frac{1}{6}$$

C

$$\frac{1}{4}$$

Correct Option

Solution :

(c)

$$\text{Bike A} = 5 \text{ km/hour}$$

$$\Rightarrow \frac{5}{60} = \frac{1}{12} \text{ km in 1 minute}$$

$$\text{Bike B} = 10 \text{ km/hour}$$

$$\frac{10}{60} = \frac{1}{6} \text{ km in 1 minute}$$



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D

 $\frac{1}{3}$

QUESTION ANALYTICS

Q. 8

 What is the remainder when $1! + 2! + 3! \dots 100!$ is divided by 18?

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

A

0

B

1

C

5

D

9

Correct Option

Solution :

(d)

Factorial of the positive integers greater than 5 is divisible by 18.

 So, we have to find out the remainder when $1!+2!+3!+4!+5! (= 153)$ is divided by 18. (All other terms yield zero remainder)

So, Remainder = 9.

QUESTION ANALYTICS

Q. 9

Two tracks are parallel. The first track has 6 checkpoints and the second one has 10 checkpoints. In how many ways can the 6 checkpoints of first track be joined with the 10 checkpoints of the second to form a triangle?

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

A

120

B

150

C

200

D

420

Correct Option

Solution :

(d)

To make a triangle, we need 2 checkpoints from one track and 1 from the other. We cannot take all 3 from the same track since then the points will be in a line (assuming straight line of track). We select 2 checkpoints from the first track and one from the second or two from the second and one from the first.



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QUESTION ANALYTICS

Q. 10

The percentage profit earned by selling an article for ₹1920 is equal in the percentage loss incurred by selling the same article for ₹1280. At what price (in ₹) should the article be sold to make 25% profit?

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2000

Correct Option

Solution :

2000

Let Percentage Profit/Loss = x and Cost Price = C Now, $C + xC = 1920$ $C - xC = 1280$ Solving for $C \Rightarrow 2C = 3200 \Rightarrow C = 1600$ Sale Price with 25% profit $\Rightarrow 1.25 \times 1600 = 2000$.

QUESTION ANALYTICS

Q. 11

Consider the following statements regarding grammars:

- If a grammar G has ϵ productions, then ϵ is a member of $L(G)$.
- If a grammar G has no ϵ productions, then ϵ is not a member of $L(G)$.
- If ϵ is not a member of $L(G)$, then G has no ϵ productions.

Which of the above statements are correct?

[Have any Doubt ?](#) |

A

I, II and III

B

II and III only

C

I and II only

D

II only

Correct Option

Solution :

(d)

I is false. For example, take $S \rightarrow aA$; $A \rightarrow \epsilon$. Clearly G has a ϵ production, however ϵ is still a member of $L(G)$, as G only generates the string "a".

III is the contrapositive of I, hence III is also false.

But II is correct. The presence of an ϵ production is obviously a necessary condition for ϵ to be a member of $L(G)$.

QUESTION ANALYTICS

Q. 12

Consider the following statements:

- Any AVL Tree of height $h + 1$ contains strictly more nodes than any AVL Tree of height h .
 - Any Binary Search Tree of height $h + 1$ contains strictly more nodes than any BST of height h .
- Which of the following statements are true?

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 B
 I only

 C
 II only

 D
 None of these

Correct Option

Solution :

(d)

Both are false statements.

Max nodes in an AVL Tree of height 3 = $2^3 + 1 - 1 = 15$ Min nodes in an AVL Tree of height 4 = $7 + 4 + 1 = 12$

So clearly I is false.

II is obviously false. Assuming $h = 4$ is a skew tree, no of nodes = $4 + 1 = 5$.

H = 3 can be a fully filled, complete BST. Therefore no of nodes = 15.

So II is false as well.

QUESTION ANALYTICS**Q. 13**

Consider the following statements:

- There exists a non deterministic context free language whose reversal is DCFL.
- There exists a non regular CSL whose Kleene closure is regular.

Which of the above statements are true?

[Have any Doubt ?](#)
 A
 Both I and II

Correct Option

Solution :

(a)

I is true, for example take $L = \{a^n b^n c\} \cup \{a^n b^{2n} d\}$. Its reversal will be $\{ca^n b^n\} \cup \{da^n b^{2n}\}$ which is DCFL. So I is okay.II is also true. Lets take $L = \{a^p \mid p \text{ is prime}\}$. If we take its kleene closure, then $L^* = \epsilon + aaa^*$. Hence II is also correct.

Therefore (a) is the most appropriate choice.

 B
 Only I

 C
 Only II

 D
 None of these
QUESTION ANALYTICS**Q. 14**

A cache memory system with a capacity of m words and block size of n words needs to be designed. If it is designed as a direct mapped cache and as an 32-way set associative cache, the length of the TAG field is 10 bits and x bits respectively. The value of x is

[Have any Doubt ?](#)

A



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(a)

For the 32-way set associative cache, 5 more bits will be required in the TAG as compared to direct mapping. Hence the length of tag field in an 8-way set associative cache is $10 + 5 = 15$ bits.

B

9

C

7

D

12

QUESTION ANALYTICS

Q. 15

Match the following:

List-I

- A. Kruskal's algorithm for minimum spanning tree
- B. Quick sort
- C. Shortest distance from a node to every other node in graph
- D. Longest common subsequence

List-II

- 1. BFS
- 2. Greedy algorithm
- 3. Divide and Conquer
- 4. Dynamic programming

Codes:

A B C D

- (a) 1 2 3 4
- (b) 2 3 4 1
- (c) 2 4 1 3
- (d) 2 3 1 4

Have any Doubt ?

A

a

B

b

C

c

D

d

Correct Option

Solution :

(d)

- Kruskal's algorithms for minimum cost spanning tree is one of the greedy approach.
- Quick sort using divide and conquer approach.
- Shortest distance from a node to every other node in a graph is calculated by BFS algorithm.
- Longest common subsequence is one of the problem efficiently solved by dynamic programming which takes $O(mn)$ time.

QUESTION ANALYTICS

Q. 16Let Brother (*x, y*) denote - '*x* is a brother of *y*'. Also, Sibling (*x, y*) stands for '*x* and *y* are siblings'. Now



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III. $\forall x \forall y (\text{Sibling}(x, y) \Rightarrow \text{Brother}(x, y))$

Which of the above formulae are valid?

[Have any Doubt ?](#)

A

Only I

B

Only II

C

I, II and III

D

I and II only

Correct Option

Solution :

(d)

I and II are valid, but III is not valid. Because in III, what if x happens to be a sister of y ? In such a case, x and y will surely be siblings, making the left hand side of the implication true, but the right hand side of implication will become false, as x is a sister of y and thereby making $\text{Brother}(x, y)$ false.

I is obviously valid, as x being a brother of y obviously means x and y are siblings. In II, the key point to be noted is that, even though we are using biconditional, II still holds true. Because the relation of siblings happens to be a symmetric relation. So if x is a sibling of y , then y will be a sibling of x . That's it.

QUESTION ANALYTICS

Q. 17

A resource allocation graph contain a cycle, for deadlock to be occur a cycle is

[Have any Doubt ?](#)

A

Necessary but not sufficient condition for system with single instance resource.

B

A necessary but not sufficient condition with system having multi-instance resource.

Correct Option

Solution :

(b)

Every cycle in single instance resource is sufficient and necessary condition for deadlock. Every cycle in multi instance resource is necessary but not sufficient condition for deadlock.

C

A sufficient but not necessary condition, with system having multi instance resource.

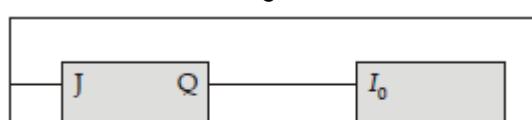
D

Sufficient but not necessary condition for system with single instance resource.

QUESTION ANALYTICS

Q. 18

Consider the below digital circuit.





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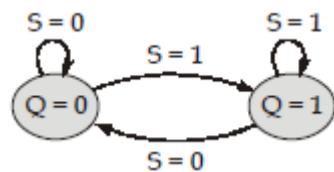
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S₀

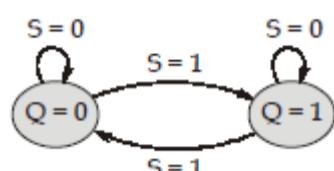
The state transition diagram of the circuit is

[Have any Doubt ?](#)

A



B



Correct Option

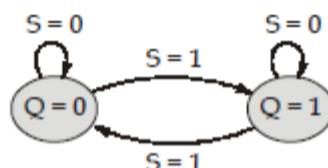
Solution :

(b)

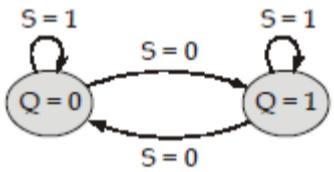
When $S = 0, Y = Q$ $S = 1, Y = \bar{Q}$

The flip-flop is working as T-flip-flop.

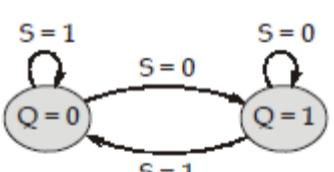
So the transition diagram is



C



D

[QUESTION ANALYTICS](#)**Q. 19**

Which of the following is incorrect?

[Have any Doubt ?](#)

A

RIP uses distance vector routing and OSPF uses link state routing.

B

Distance vector routing requires less bandwidth as compared to link state routing.

C

Link state routing protocol is a loop free protocol.

D

Count to infinity problem can not be removed in distance vector routing.

Correct Option



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QUESTION ANALYTICS

Q. 20

Let x be an integer which can take a value of either 0 or 1. Then the statement $(x = 0) ? x = 1 : x = 0$; Is equivalent to

[Have any Doubt?](#)

A

$$x = 1 + x$$

B

$$x = 1 - x$$

Correct Option

Solution :

(b)

Let's see option (b).

Putting $x = 0$, should make $x = 1$; and putting $x = 1$ should make $x = 0$. Both are satisfied hence option (b) is the answer.

C

$$x = x - 1$$

D

None of these

QUESTION ANALYTICS

Q. 21

If $A = \begin{bmatrix} 2 & 3 \\ 3 & 10 \end{bmatrix}$, and I is identity matrix of order 2, then $(2I - A)(10I - A) = ?$

[Have any Doubt?](#)

A

$$9I$$

Correct Option

Solution :

(a)

$$A = \begin{bmatrix} 2 & 3 \\ 3 & 10 \end{bmatrix}$$

If λ is an eigen value of A ,

$$\begin{bmatrix} 2-\lambda & 3 \\ 3 & 10-\lambda \end{bmatrix} = 0$$

$$(2 - \lambda)(10 - \lambda) - 9 = 0$$

$$(2 - \lambda)(10 - \lambda) = 9$$

Using Cayley Hamilton theorem,

$$\Rightarrow (2I - A)(10I - A) = 9I$$

B

$$7I$$

C

$$6I$$



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QUESTION ANALYTICS

Q. 22

The sum of the divisors of 4800 is equal to

Have any Doubt ?

A
4800B
12778C
8192D
15748

Correct Option

Solution :

(d)

We know, 4800 can be written as $2^6 \times 3 \times 5^2$.

So we need to sum up all the factors, which means the answer will be something like,
 $2^0 3^0 5^0 + 2^0 3^0 5^1 + 2^0 3^0 5^2 + \dots + 2^6 3^1 5^2$

We can argue that this sum will be equal to the result of the following expression, as we can
 every factor like $2^0 3^0 5^0$, $2^2 3^1 5^2$ etc. from the expression below.

$$= (2^0 + 2^1 + 2^2 + 2^3 + 2^4 + 2^5 + 2^6) (3^0 + 3^1) (5^0 + 5^1 + 5^2)$$

So upon solving, this thing works out to 15748.

Hence the correct choice is (d).

QUESTION ANALYTICS

Q. 23

Consider the following statements about a relation R.

S₁ : If a relation R is in 3NF but not BCNF then relation R must consist proper subset of candidate key
 determines proper subset of some other candidate key.

S₂ : If a relation R is in 3NF but not BCNF then relation R must consist atleast two over-lapped candidates
 keys.

Which of the above statements is/are correct?

Have any Doubt ?

A
Both S₁ and S₂

Correct Option

Solution :

(a)

S₁ : If a relation R is in 3NF but not BCNF then relation R must consist proper subset of candidate key
 determines proper subset of candidate key determines proper subset of some other candidate key.

S₂ : R must consist atleast two over-lapped candidates keys.

B
Only S₁C
Only S₂



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QUESTION ANALYTICS

Q. 24

Let L be a lattice. Consider the following statements:

- I. $\forall a \forall b \forall c \in L, a \vee (b \wedge c) \leq (a \vee b) \wedge (a \vee c)$
- II. $\forall a \forall b \forall c \in L, (a \vee b) \wedge (a \vee c) \leq a \vee (b \wedge c)$
- III. $\forall a \forall b \forall c \in L, a \wedge (b \vee c) \leq (a \wedge b) \vee (a \wedge c)$
- IV. $\forall a \forall b \forall c \in L, (a \wedge b) \vee (a \wedge c) \leq a \wedge (b \vee c)$

Which of the given statements always hold true for any lattice L?

A

I and IV only

Correct Option

Solution :

(a)

II and III need not hold for every lattice, but I and IV hold for every lattice out there. The validity of these properties can be easily verified using kite and pentagonal lattices discussed in the course. These are called distributive inequalities; and also if a lattice follows all the four properties, then it is called a distributive lattice.

B

III and IV only

C

I and III only

D

I, II, III, IV

QUESTION ANALYTICS

Q. 25

The maximum number of Boolean expressions that can be formed for the function $f(x, y, z)$ satisfying the relation $f(\bar{x}, y, \bar{z}) = f(x, y, z)$ is

A

8

B

256

C

12

D

16

Correct Option

Solution :

(d)

For every combination of x, y, z the function value remains same for input \bar{x}, y, \bar{z} .

x	y	z	$f(x, y, z) = f(\bar{x}, y, \bar{z})$
0	0	0	either 0 or 1
1	0	1	either 0 or 1



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0 1 1	j
1 1 0	either 0 or 1

Effectively there are only four rows for the truth table of the function $f(x, y, z)$.
 \therefore Total Boolean expressions possible is $2^4 = 16$.

[QUESTION ANALYTICS](#)**Q. 26**

Consider a 2-way set associative cache with 4 blocks. The memory block requests in the order.

4, 6, 3, 8, 5, 6, 0, 15, 6, 17, 20, 15, 0, 8

If LRU is used for block replacement then the memory set 17 will be in the cache block _____.

[Have any Doubt ?](#)

1

[Correct Option](#)**Solution :**

1

2-way set associative cache so $S = 2$, K is cache block

$$K \bmod S = i$$

$$17 \bmod 2 = 1$$

[QUESTION ANALYTICS](#)**Q. 27**

A computer uses CRC method for error checking and uses $x^2 + 1$ as the generator polynomial to generate the check bits. The message 1011 is transmitted as _____. (Message followed by check bits)

[Have any Doubt ?](#)

101101

[Correct Option](#)**Solution :**

101101

$$\begin{aligned} \text{CRC generator} &= x^2 + 1 \\ &= 1.x^2 + 0.x^1 + 1.x^0 \\ &= 101 \end{aligned}$$

Data = 1011

$$\begin{array}{r} 101 \quad 1011\boxed{00} \quad 1001 \\ \underline{\times 101} \\ \hline \quad \quad \quad 001 \\ \quad \quad \quad \underline{\times 001} \\ \hline \quad \quad \quad 000 \\ \quad \quad \quad \underline{\times 010} \\ \hline \quad \quad \quad 000 \\ \quad \quad \quad \underline{\times 100} \\ \hline \quad \quad \quad 101 \\ \underline{\times 01} \\ \hline \quad \quad \quad 01 \end{array}$$

Check bits = 01

So message transferred = 101101

[QUESTION ANALYTICS](#)**Q. 28**

Evaluate $\lim_{x \rightarrow 0^+} \log_{\sin x} \sin 2x$ _____.

[Have any Doubt ?](#)



Correct Option



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Solution :

1

Here,

$$\begin{aligned}
 \lim_{x \rightarrow 0^+} \log_{\sin x} \sin 2x &= \lim_{x \rightarrow 0^+} \frac{\log \sin 2x}{\log \sin x} \quad \left(\frac{-\infty}{-\infty} \text{ from } \right) \\
 &= \lim_{x \rightarrow 0^+} \frac{\frac{2 \cos 2x}{2}}{\frac{\sin 2x}{\sin x}} \quad (\text{Applying L-hospital's rule}) \\
 &= \lim_{x \rightarrow 0^+} \frac{\left(\frac{2x}{\sin 2x} \right) \cos 2x}{\left(\frac{x}{\sin x} \right) \cos x} \quad (\text{Multiply and divide by 'x'}) \\
 &= \lim_{x \rightarrow 0^+} \frac{\cos 2x}{\cos x} = 1
 \end{aligned}$$

QUESTION ANALYTICS

Q. 29

Consider a disk system with 100 cylinder. The requests to access the cylinder occurs in the following sequence.

20, 35, 15, 45, 22, 18, 85

Assuming that the head is currently at cylinder 30, what is the number of move if shortest seek time first policy is used _____.

Have any Doubt ?

115

Correct Option

Solution :

115

$$\begin{aligned}
 \text{Number of moves} &= [(35 - 30) + (45 - 35) + (45 - 22) + (22 - 20) + (20 - 18) + (18 - 15) + (85 - 1) \\
 &= 5 + 10 + 23 + 2 + 2 + 3 + 70 = 115
 \end{aligned}$$

QUESTION ANALYTICS

Q. 30

The number of ways, we can arrange 5 books in 3 shelves _____.

Have any Doubt ?

2520

Correct Option

Solution :

2520

$$n = 3, r = 5$$

$$\text{The answer will be, } {}^{3-1+5}P_5 = {}^7P_5 = 2520$$

QUESTION ANALYTICS

Q. 31

Let X and Y denote the minimum and maximum number of nodes in an AVL Tree of height 7. Then the value of Y - X will be equal to _____.

Have any Doubt ?



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Solution :

201

Max Nodes = Y = 28 - 1 = 255

Min Nodes = X can be found using the following recurrence

$$N(h) = N(h-1) + N(h-2) + 1; N(2) = 4, N(3) = 7$$

So

X = 54

Now

$$Y - X = 255 - 54 = 201$$

QUESTION ANALYTICS

Q. 32

Consider the following relation R(T, U, V, W, X, Y, Z) and functional dependencies:

$$F = \{TU \rightarrow VW, TY \rightarrow W, WX \rightarrow Y, V \rightarrow Z, Y \rightarrow X, Z \rightarrow T\}$$

The number of candidate keys in relation R is _____.

Have any Doubt ?

6

Correct Option

Solution :

6

$$R(T, U, V, W, X, Y, Z)$$

$$F = \{TU \rightarrow VW, TY \rightarrow W, WX \rightarrow Y, V \rightarrow Z, Y \rightarrow X, Z \rightarrow T\}$$

$$(T, U, X)^+ = \{T, U, V, W, Z, X, Y\}$$

$$(Z, U, Y)^+ = \{Z, U, Y, T, V, W, X\}$$

$$(T, U, Y)^+ = \{T, U, V, W, Z, X, Y\}$$

$$(V, U, X)^+ = \{T, U, V, W, X, Y, Z\}$$

$$(V, U, X)^+ = \{T, U, V, W, X, Y, Z\}$$

$$(Z, U, X)^+ = \{T, U, V, W, X, Y, Z\}$$

Total {TUX, ZUY, TUW, VUX, VUY, ZUX} 6 candidate keys.

QUESTION ANALYTICS

Q. 33

Consider the following statements:

S₁: In a compiler, keywords of a language are recognized during parsing of the program.S₂: A recursive descent parser can not use right recursive grammar.S₃: Constant folding can be applied on 3-address code.

The number of the above statements correct are _____.

Have any Doubt ?

1

Correct Option

Solution :

1

S₁: In a compiler, keywords of a language are recognized during lexical analysis.S₂: A recursive descent parser can use right grammar but not left recursive grammar.S₃: Constant folding is possible if expression has constants in value of assignment it can be applied on 3-address code.

QUESTION ANALYTICS

Q. 34



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48

Correct Option

Solution :

48

Property of the output of each pass of quicksort:

I. The pivot element is on its correct position.

II. All the elements on the left of the pivot are smaller than it and elements on the right are greater than it.

If we consider the sorted permutation of the above sequence it will be, 6, 9, 11, 13, 15, 17, 18, 24. Comparing both it can be observed that elements 11, 13 and 19 are on their correct positions. Besides that they are satisfying II property also.

Hence, possible pivots, 11, 13, 24

Sum $11 + 13 + 24 = 48$

QUESTION ANALYTICS

Q. 35

Let A be the most efficient algorithm which checks the presence of cycle in a given linked list having n nodes. It is observed that, when A is ran on input size 256 elements, it takes 32 units of time. Then the time required by the algorithm A if the input size is 512 elements is equal to _____.

Have any Doubt ?

64

Correct Option

Solution :

64

Time complexity of checking presence of cycle in linked list = $O(n) = c.n$ Given, $c(256) = 32$ Therefore, $c = \frac{1}{8}$ So time required by algorithm A if input size is 512 elements is equal to, $\frac{1}{8} \times 512 = 64$ units.

QUESTION ANALYTICS

Q. 36

Consider the following code:

```
void function (int n)
{
    int sum = 0;
    for (int i = 0; i^2 < n; i++)
        for (int j = i; j < log (i); j++)
            sum = sum + 1;
    return sum;
}
```

What is the time complexity of function ()?

Have any Doubt ?

A

 $O(\sqrt{n})$

Correct Option

Solution :

(a)

1st for loop will run $i^2 < n \Rightarrow i = \sqrt{n}$ times.2nd for loop will run 1 time for each i i.e. i is always greater than $\log(i)$.So total time complexity = $O((\sqrt{n}) \times 1)$



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O(logn)

C
O(n)D
O(n logn)

QUESTION ANALYTICS

Q. 37

Match List-I with List-II:

List-I

A. RSA

B. Diffie-Hellman

C. Digital signature

D. Symmetric key cryptography

Codes:

	A	B	C	D
(a)	4	3	1	2
(b)	1	3	1	4
(c)	4	1	3	2
(d)	4	2	3	1

List-II

1. Public and private keys for decryption and encryption respectively
2. $\frac{n(n-1)}{2}$ keys for n people
3. Session key
4. Public key cryptography

Have any Doubt ?

Correct Option

A

a

Solution :

(a)

Symmetric key cryptography, for n people to require $\frac{n(n-1)}{2}$ keys to communicate with other.

Option (a) is correct.

B

b

C

c

D

d

QUESTION ANALYTICS

Q. 38

Consider a relation R on the set C of complex numbers. Recall that complex number is denoted by $z = a + ib$, where a and b are constants and $i = (-1)^{1/2}$. Also, $\arg(z) = \tan^{-1}(b/a)$. The relation R is defined as follows.

$$R = \{(z_1, z_2) \mid \arg(z_1) - \arg(z_2) = 0\}$$

Which of the given statements is true?

Have any Doubt ?

A



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R is reflexive, transitive but not symmetric

C

R is reflexive, symmetric but not transitive

D

R is reflexive, symmetric and transitive

Correct Option

Solution :

(d)

Let's first simplify the given expression.

$$\arg(z_1) = \arg(z_2)$$

So the question is actually, R: $\{(z_1, z_2) \mid \arg(z_1) - \arg(z_2)\}$ Reflexive: $z_1 R z_1$ as $\arg(z_1)$ is always equal to itself.Symmetric: $z_1 R z_2$ implies $z_2 R z_1$ as equality $\arg(z_1) = \arg(z_2)$ is same as $\arg(z_2) = \arg(z_1)$.Transitive: $z_1 R z_2$ and $z_2 R z_3$ implies $z_1 R z_3$, as equivalence is always transitive.

QUESTION ANALYTICS

Q. 39

Consider the following code for classical readers and writers problem:

Semaphore S = 1

Semaphore db = 1

int rc = 0

void reader ()

{

while (1)

{

Wait (S);

rc = rc + 1;

if (rc == 1);

Wait (db);

X₁;

Database

X₂;

rc = rc - 1;

if (rc == 0)

X₃;X₄;

}

}

void write ()

{

while (1)

{

Wait (db);

Database

Signal (db);

The value of X₁, X₂, X₃, X₄ are regarding synchronizing the classical readers and writers?

Have any Doubt ?



A

Signal (S), Wait (db), Signal (db), Signal (S)

B

Signal (S), Wait (S), Signal (db), Signal (S)

Correct Option

Solution :

(b)

Signal (S), Wait (S), Signal (db), Signal (S) is the correct sequence for synchronization.

C

Signal (S), Signal (db), Wait (S), Signal (S)

D

Signal (S). Signal (db). Wait (db). Signal (S)



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Q. 40
 Consider the given query on the relation $P(r, s)$ and $R(s, t)$

- $Q_1 : \pi_r (P \cap (\pi_r (P) \times \pi_s (R)))$
 $Q_2 : \pi_r ((P \times \pi_t (R)) \cap (\pi_s (P) \times R))$
 $Q_3 : \pi_r (P \bowtie R)$

Which of the above query produces same result?

A

 Q_1 and Q_2 only

B

 Q_2 and Q_3 only

C

 Q_1 and Q_3 only

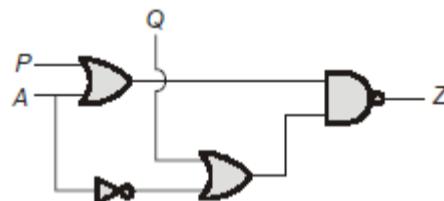
D

All of Q_1 , Q_2 and Q_3 **Correct Option****Solution :**

(d)

All relational algebra query gives same result.

QUESTION ANALYTICS

Q. 41
 The circuit shown below is used to implement the function $z = f(A, B) = \bar{A} + B$. The values of P and Q are


A

 $P = A, Q = B$

B

 $P = B, Q = \bar{A}$

C

 $P = \bar{B}, Q = O$

D

 $P = O, Q = \bar{B}$ **Correct Option****Solution :**

(d)

$$\bar{Z} = (P + A)(Q + \bar{A})$$

$$\bar{Z} = PQ + AQ + \bar{A}P$$

If

$$Z = \bar{A} + B$$

$$\bar{Z} = \overline{\bar{A} + B} = A\bar{B}$$

$$Q = \bar{B}, P = O$$



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Q. 42

A 1 Mbps satellite link connects two ground stations. The altitude of the satellite is 6000 km and speed of the signal is 3×10^8 m/s. What should be the packet size for a channel utilization of 50% for a satellite link using go-back-63 sliding window protocol? Assume that the acknowledgment packets are negligible in size and that there are no errors during communication.

[Have any Doubt ?](#)
 A
 81031 bytes

 B
 83101 bytes

 C
 801301 bytes

 D
 81301 bytes

Correct Option

Solution :

(d)

Efficiency for a sliding window protocol is

$$\eta = \frac{N}{1+2a}$$

where N is the window size.

$$\Rightarrow N = 63 - 1 = 62$$

Utilization is given as 0.50

$$\therefore 0.50 = \frac{62}{1+2a}$$

$$\text{where } a = \frac{t_p}{t_d}$$

$$t_d = \frac{x \text{ bytes}}{1 \text{ Mbps}}$$

$$t_p = \frac{2 \times 6000 \times 10^3}{3 \times 10^8} = 0.4 \text{ sec}$$

$$a = 0.4 \text{ Mbps} / x \text{ byte}$$

$$\therefore 1 + 2(0.4 \text{ Mbps}/x \text{ byte}) = 124$$

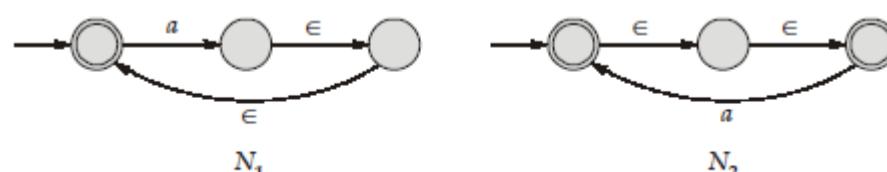
$$2(0.4 \text{ Mbps}/x \text{ byte}) = 123$$

$$\frac{0.8 \text{ Mbps}}{x \text{ byte}} = 123$$

$$x \approx 81301 \text{ byte}$$

QUESTION ANALYTICS

Q. 43

Consider the following NFAs N_1 and N_2 , over $\Sigma = \{a\}$.

Let $L(N_1)$, $L(N_2)$ be the language accepted by N_1 and N_2 respectively. Let be $L(\bar{N}_1)$ be the language generated by interchanging the final and non final states of N_1 . Similarly $L(\bar{N}_2)$ be the language obtained by interchanging the final and non final stages of N_2 . Non consider the following statements:

- I. $L(\bar{N}_1) \subset L(N_2)$



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The correct statements are

[Have any Doubt ?](#)

A

I and II

B

I and III

C

II and III

D

I, II and III

Correct Option

Solution :

(d)

For I:

$$L(N_1) = a^*; \quad L(N_2) = a^* = L(\bar{N}_2)$$

But

$$L(\bar{N}_1) = aa^* \Rightarrow L(\bar{N}_1) \subset L(N_2)$$

Therefore I is true.

For II:

$$L(\bar{N}_1) = aa^*; \quad L(\bar{N}_2) = a^*$$

Again

$$L(\bar{N}_1) \subset L(\bar{N}_2) \Rightarrow \text{II is true}$$

Therefore I is true.

For III:

$$L(N_1) = a^*; \quad L(N_2) = a^*$$

Therefore

$$L(N_1) = L(N_2)$$

⇒

$$L(N_1) \subseteq L(N_2) \text{ and } L(N_2) \subseteq L(N_1)$$

II is also true.

I, II and III are correct.

QUESTION ANALYTICS

Q. 44

Let $G = (V, E)$ be any connected undirected edge-weighted graph. The weights of the edges in E are positive and distinct. Consider the following statements:

S_1 : Minimum spanning tree of G must not contain edge with highest weight.

S_2 : Minimum spanning tree of G need not be unique but cost is unique.

Which of the following is true?

[Have any Doubt ?](#)

A

 S_1 only

B

 S_2 only

C

 S_1 and S_2 only

D

Neither S_1 nor S_2

Correct Option

Solution :

(d)

- When graph contain positive edge weight (distinct) then MST may contain edge with highest weight

i.e., when graph is tree



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Q. 45

Assume that multiplying a matrix G_1 of dimension $p \times q$ with another matrix G_2 of dimension $q \times r$ requires pqr scalar multiplications. Computing the product of n matrices $G_1G_2G_3...G_n$ can be done by parenthesizing in different ways. Define $G_iG_j + 1$ as an explicitly computed pair for a given parenthesization if they are directly multiplied. For example, in the matrix multiplication chain $G_1G_2G_3G_4G_5G_6G_1$ using parenthesization $(G_1(G_2G_2))(G_4(G_5G_5))$, G_2G_3 and G_5G_6 are only explicitly computed pairs. Consider a matrix multiplication chain $F_1F_2F_3F_4F_5$ where matrices F_1, F_2, F_3, F_4 and F_5 are of dimensions $2 \times 25, 25 \times 3, 3 \times 16, 16 \times 1$ and 1×1000 respectively. In the parenthesization of $F_1F_2F_3F_4F_5$ that minimizes the total number of scalar multiplications, the explicitly computed pairs is/are

[Have any Doubt ?](#)

A

 F_1F_2 and F_3F_4 only

B

 F_2F_3 only

C

 F_3F_4 only

Correct Option

Solution :

(c)

Option (c) will be the answer.

D

 F_2F_2 and F_4F_5 only

QUESTION ANALYTICS

Q. 46

Consider the following queries on the relation $P(A, B)$ and $Q(R, S)$

Query 1 : $\pi_A(P) - \pi_A(P \bowtie_{A \leq R} Q)$

Query 2 : Select A FROM P where NOT EXISTS
 (Select * From Q where $P.A \leq Q.R$)

Query 3 : Select A FROM P where $A \leq \text{ALL } (Select R from Q)$

Which of the above queries gives same result?

[Have any Doubt ?](#)

A

Query 1 and Query 2

Correct Option

Solution :

(a)

Query 1 : Give result set of A values which are greater than every value of Q.

Query 2 : Give result same as Query 1.

Query 3 : Give result set of A values.

Which are less than equal to all values of Q.

B

Query 1 and Query 3

C

Query 2 and Query 3



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Q. 47

Consider the following program.

 $\text{MOV } R_1, 3EH \quad [R_1 \rightarrow 3EH]$
 $\text{MOV } R_2, A3H \quad [R_2 \rightarrow A3H]$
 $\text{ADD } R_1, R_2 \quad [R_1 \rightarrow R_1 + R_2]$

What will be status of Auxiliary Carry (AC) and Carry Flag (CY) after executing the above program?

[Have any Doubt ?](#)

A

AC = 0 and CY = 0

B

AC = 0 and CY = 1

C

AC = 1 and CY = 1

D

AC = 1 and CY = 0

Correct Option
Solution :

(d)

$$\begin{array}{r} \textcircled{1} \\ R_1 = 3 \text{ E } H \\ R_2 = \underline{\text{A } 3 \text{ H}} \\ \hline \text{E } 1 \text{ H} \end{array}$$

No carry out of MSB, so CY = 0

AC = 1, because carry out from lower nibble and no carry out from higher nibble.

QUESTION ANALYTICS

Q. 48

Consider the following translation rules for the grammar G:

 $S \rightarrow a\{\text{print "C"}\} A$
 $A \rightarrow b\{\text{print "B"}\} B$
 $C \rightarrow c\{\text{print "R"}\}$
 $A \rightarrow \epsilon\{\text{print "B"}\}$
 $B \rightarrow e\{\text{print "P"}\} A$
 $B \rightarrow \epsilon\{\text{print "A"}\}$

What is the output produced for the input abebebe using the bottom-up parsing with above translation?

[Have any Doubt ?](#)

A

CBBPBPPB

B

CBBPPBB

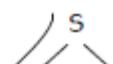
C

CBPBPPB

Correct Option
Solution :

(c)

For the input string abebebe





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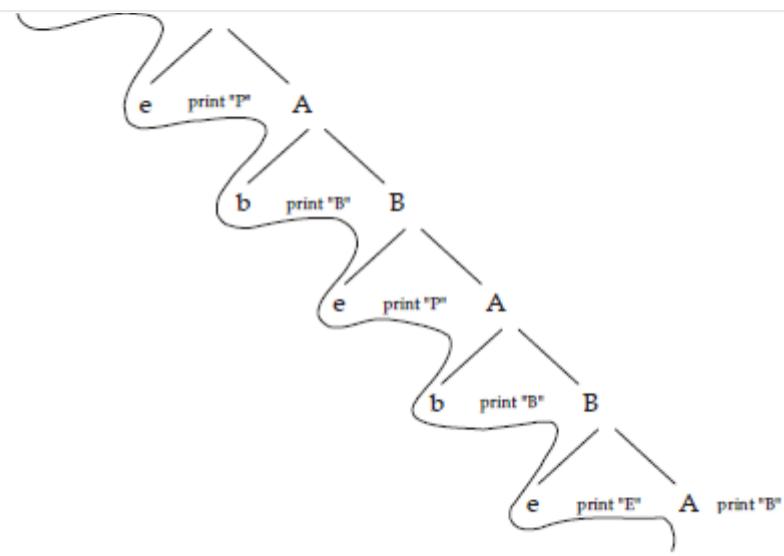
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It will print CBPBPEPB.
 So, option (c) is correct.

D

CBPBBPPB

QUESTION ANALYTICS

Q. 49The eigen values and corresponding eigen vector of a matrix A are given as:
Eigen value **Eigen vector**

$$\lambda_1 = 4 \quad v_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$\lambda_2 = 8 \quad v_2 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

Then the matrix is

Have any Doubt ?

A

$$\begin{bmatrix} 6 & -2 \\ -2 & 6 \end{bmatrix}$$

Correct Option

Solution :

(a)

For a given matrix,

$$\text{Let, } A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

$$|A - \lambda_1 I| \begin{bmatrix} 1 \\ 1 \end{bmatrix} = 0$$

$$\begin{bmatrix} a-4 & b \\ c & d-4 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = 0$$

$$a - 4 + b = 0$$

$$c + d - 4 = 0$$

...(i)

...(ii)

Also,

$$|A - \lambda_2 I| \begin{bmatrix} 1 \\ -1 \end{bmatrix} = 0$$

$$\begin{bmatrix} a-8 & b \\ c & d-8 \end{bmatrix} \begin{bmatrix} 1 \\ -1 \end{bmatrix} = 0$$

$$a - 8 - b = 0$$

$$c - d + 8 = 0$$

...(iii)

...(iv)

After solving (i), (ii), (iii) and (iv)

$$a = 6,$$



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B

$$\begin{bmatrix} 2 & -4 \\ 3 & 10 \end{bmatrix}$$

C

$$\begin{bmatrix} 8 & 0 \\ 2 & 4 \end{bmatrix}$$

D

Data insufficient

QUESTION ANALYTICS

Q. 50

We are given a C function, mystery() as follows.

```
void mystery(int m, int n)
{
    while(m <= n)
    {
        m++;
        n--;
    }
}
```

Let X be the number of times the comparison inside the while loop (i.e. $m \leq n$) is performed, when $\text{mystery}(127, 255)$ is called. Then the value of X is,

Have any Doubt ?



A

128

B

65

Correct Option

Solution :

(b)

Number of times the comparison is performed = Number of times the loop is executed + 1

Let k denote the no of times loop is executed. Therefore,

$$255 - k = 127 + k$$

or,

$$k = 64$$

So required number of times = $64 + 1 = 65$

C

64

D

None of these

QUESTION ANALYTICS

Q. 51

Consider the following languages over the binary alphabet {0, 1}.

 $P = \{1^n 0 1^n \mid n \geq 1\}$ $Q = \{w \mid w \in \{0, 1\}^*; d(w) = 2^n, \text{ where } d(w) \text{ denotes the decimal equivalent of the binary string } w\}$

Which of the above languages are regular?



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 B
 Only P

 C
 Only Q

Correct Option

Solution :

(c)

- P is not regular, because before and after 0 there should be equal number of 1's. So the comparison and which is not allowed in regular language.
- Q is regular because regular expression of Q = 10^* . Hence it is regular.

 D
 None of these

QUESTION ANALYTICS

Q. 52

Consider a 5-stage pipeline. Assume that there is no cycle-time overhead of pipelining. When an application is executing on this 5-stage pipeline, the speedup achieved with respect to non-pipelined execution if 25% of the instruction incur 4 pipeline stall cycles is

[Have any Doubt ?](#)

A

2.5

Correct Option

Solution :

(a)

$$\text{Pipeline depth} = 5$$

$$\text{Speedup factor} = \frac{\text{Pipeline depth}}{1 + \text{Pipeline stall CPI}}$$

$$\text{Pipeline stall CPI} = 0.75 \times 0 + 0.25 \times 4 = 1$$

$$\text{Speedup factor} = \frac{5}{1+1} = 2.5$$

B

2.2

C

2.0

D

2.6

QUESTION ANALYTICS

Q. 53

Which of the following is true?

[Have any Doubt ?](#)

A

If LSP data is less recent than the data stored in database, then the new LSP packet is updated with data stored in database and is flooded to channels.



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Solution :

(b)

If LSP is with less recent data than the data stored in database is received, then new LSP is updated with database data and is sent back only over the link from which the first LSP was received. So, option (a) is incorrect.

C

Both (a) and (b)

D

Neither (a) nor (b)

QUESTION ANALYTICS

Q. 54

Let X and Y be two languages over the alphabet {0, 1} such that,

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

$$Y = \{w \mid w \in \{0, 1\}^{49}; n_0(w) = n_1(w)\}$$

If |X| and |Y| denote the cardinalities of X and Y respectively, then the value of |X| + |Y| is equal to _____.

70

Correct Option

Solution :

70

Indirectly the question is, "Number of bit strings of length n having equal number of 0's and 1's which will be equal to $\binom{n}{n/2}$ if n is even, 0 if n is odd (as it's not possible to set equal 0's and 1's in case of an odd length bit string).

Let's find |X| first.

X consists of binary strings of length 8 having equal 0's and 1's.

Since 8 is even, hence $|X| = 8C4 = 70$.

But |Y| will be 0, because 49 is odd, and it's not possible to have an odd length string with equal number of 0's and 1's.

Hence $|Y| = 0$.

Therefore their sum is equal to 70.

QUESTION ANALYTICS

Q. 55

Consider the following languages:

- $\{a^m b^n c^p d^q \mid m + p = n + q, \text{ where } m, n, p, q \geq 0\}$

- $\{a^m b^n c^p d^q \mid m = n \text{ and } p = q, \text{ where } m, n, p, q \geq 0\}$

- $\{a^m b^n c^p d^q \mid m = n = p \text{ and } p \neq q, \text{ where } m, n, p, q \geq 0\}$

- $\{a^m b^n c^p d^q \mid mn = p + q, \text{ where } m, n, p, q \geq 0\}$

The number of languages that are context free _____.

2

Correct Option

Solution :

2

Both I and II are context free.

QUESTION ANALYTICS



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A transport layer segment with size of 3000 bytes reaches a network whose MTU (maximum transfer unit) is 1505 bytes and assume the IP header size of 20 bytes incorporated in every packet. The fragment offset of the third fragment will be _____.

[Have any Doubt?](#)

370

[Correct Option](#)
Solution :

370

Fragment	Total bytes	Header bytes	Data bytes	MF bit	Fragment offset
1	1500	20	1480	1	0 [0 - 184]
2	1500	20	1480	1	185 [185 - 369]
3	1500	20	1480	1	370 [370 - 554]
4	580	20	560	0	555 [555 - 625]

Third packet offset will be 370.

[QUESTION ANALYTICS](#)**Q. 57**

Consider a single paging hardware with TLB support. If takes 20 milliseconds to search the TLB and 130 milliseconds to access the main memory. If the TLB hit ratio is 0.7, the effective memory access time _____ (milliseconds)

[Have any Doubt?](#)

189

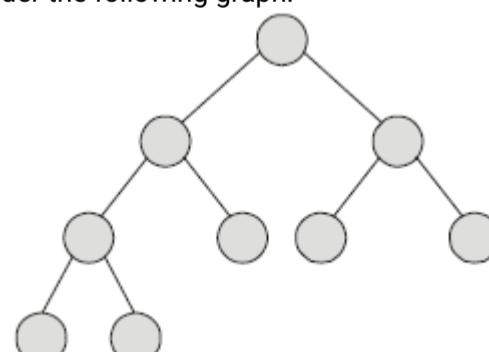
[Correct Option](#)
Solution :

189

$$\begin{aligned}
 \text{Effective Memory Access Time} &= \text{TLB Hit Rate} (\text{TLB Access Time} + \text{Memory Access Time}) + \\
 &\quad \text{Miss Rate} (\text{TLB Access Time} + 2 \times \text{Memory Access Time}) \\
 &= 0.7 (20 + 130) + 0.3 (20 + 260) \\
 &= 0.7 \times 150 + 0.3 \times 280 \\
 &= 105 + 84 \\
 &= 189 \text{ millisecond}
 \end{aligned}$$

[QUESTION ANALYTICS](#)**Q. 58**

Consider the following graph:



Total number of ordering possible with elements 12, 10, 8, 5, 3, 2, 1, 7, 9 such that if node of the above graph is filled with given elements, it satisfied Max-Heap Property _____.

[Have any Doubt?](#)

896

[Correct Option](#)
Solution :

896

Number of ordering such that given tree in Max-Heap tree are:



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Q. 59

Consider the following table:

Process ID	CPU Burst Time	I/O Service Time
P_1	3	3
P_2	3	4
P_3	7	3
P_4	5	1

Assume all process arrived at time $t = 0$. Every process completes its CPU request then get I/O service. If any two process need same amount of CPU time then prefer the process which has less amount of I/O service request. Process are scheduled using SJF for CPU service and I/O scheduling is done using FCFS scheduling, the time at which process P_3 completes both CPU and I/O requests is _____.

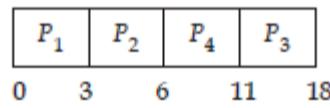
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21

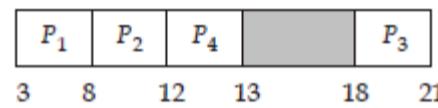
Correct Option

Solution :

21



Gantt chart (for CPU scheduling)



Gantt chart (for I/O scheduling)

At $t = 21$ P_3 will complete its execution.
[QUESTION ANALYTICS](#)
Q. 60

Twelve balls are distributed at random among three boxes. The probability that the first box will contain three balls is _____. (Upto 2 decimal places)

[Have any Doubt ?](#)

0.21 (0.20 - 0.25)

Correct Option

Solution :

0.21 (0.20 - 0.25)

 3^{12} ways in which 12 balls can be placed in three boxes.Number of ways in which 3 ball out of 12 can go to the first box is ${}^{12}C_3$.Now the remaining 9 balls are to be placed in remaining 2 boxes and that can be done in 2^9 ways.
Total number of favorable cases

$$= {}^{12}C_3 \times 2^9$$

$$\therefore \text{Required probability} = \frac{{}^{12}C_3 \times 2^9}{3^{12}} = 0.21$$

[QUESTION ANALYTICS](#)
Q. 61



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1	
2	72
3	53
4	64
5	82
6	76
7	63
8	
9	

The number of different insertion sequences of the key values using the same hash function and linear probing will result in the hash table shown above is _____.

30

Correct Option

Solution :

30

The dependencies are:

82 must come after 72, 53 and 64 have been inserted in any order.

76 must come before 63, and 63 should come last in the insertion sequence.

So we now have to fill in these blanks.

_____ 63 (63 has to be at the last)

72, 53 and 64 can be permuted in $3! = 6$ ways. One of them will be like 72, 53 and 64.

Now 82 will have to come after these 3, so we have 72, 53, 64 and 82.

Now 76 can be placed into any of the 5 gaps created by these 4 numbers i.e. before 72, or between 72 and 53, or between 53 and 64, or between 64 and 82, or after 82. So 5 ways.

Therefore total number of ways = $3! \times 5 = 6 \times 5 = 30$.

QUESTION ANALYTICS

Q. 62Consider the following schedules S with data item x : $S : W_1(x) R_2(x), W_3(x) R_4(x), W_5(x) R_6(x), W_7(x) R_8(x), W_9(x) R_{10}(x)$ The number of serial schedules which are view equal to schedule (S) but not conflict equal to schedule (S) are _____.

23

Correct Option

Solution :

23

 $W_9(x) R_{10}(x)$ must execute last but $[W_1(x) R_2(x)], [W_3(x) R_4(x)], [W_5(x) R_6(x)], [W_7(x) R_8(x)]$

execute in any order.

So total $4! = 24$ view equal serial schedule for S and only one conflict equal serial schedule for S .Total $24 - 1 = 23$ serial schedule which are view equal but not conflict equal.

QUESTION ANALYTICS

Q. 63

Consider the following FSM table:

Present state A	Present state B	Input	Next state A	Next state B	Output
0	0	1	1	0	1
0	1	1	1	1	1



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

If the initial state A = 0, B = 0 what is the minimum length of the input string which will take the machine to A = 1, B = 1 and output 0 is _____.

[Have any Doubt ?](#)

3

[Correct Option](#)**Solution :**

3

Present	State	I/P	N	S	Output
0	0	0	0	1	1
0	1	1	1	1	1
1	1	1	1	1	0

So minimum length to get '0' output is 3.

QUESTION ANALYTICS

Q. 64

Consider the following grammar:

$$S \rightarrow aA \mid bSB \mid a$$

$$B \rightarrow C \mid \epsilon$$

$$A \rightarrow d$$

If the number of states in CLR(1) construction is X and numbers of states in LALR(1) construction is Y then value of (X - Y) _____

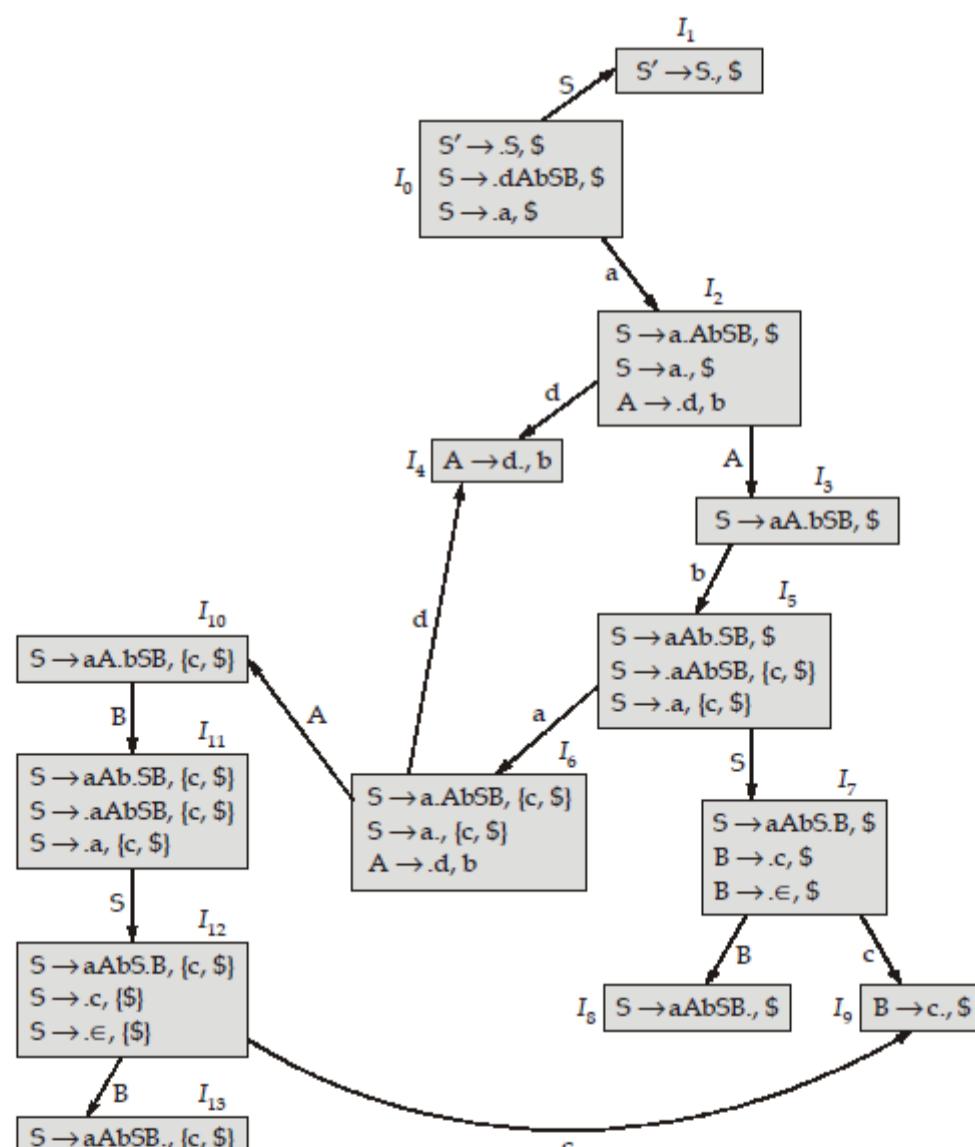
[Have any Doubt ?](#)

5

[Correct Option](#)**Solution :**

5

CLR(1) construction of given grammar



Total 14 states in CLR(1) construction. The terminal items that can be merged



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$$Y = 9$$

$$X - Y = 5$$

QUESTION ANALYTICS

Q. 65

Consider a pipeline processor with 5 stages, Instruction Fetch (IF), Instruction Decode and Operand Fetch (ID), Operation performed (OP), Data memory access (MA) and Write back (WB). The IF, ID, MA and WB stages takes 1 clock cycle each for any instruction. The OP stage takes 1 clock cycle for ADD and SUB instructions and takes 3 clock cycles for MUL instruction. The minimum number of clock cycles are needed to complete following sequence of instruction if operand forwarding is used _____.

Instruction

- I_0 : ADD R_2, R_0, R_1
- I_1 : SUB R_1, R_2, R_1
- I_2 : MUL R_2, R_1, R_0
- I_3 : SUB R_0, R_2, R_0
- I_4 : ADD R_3, R_1, R_0

Meaning of Instruction

- $R_2 \leftarrow R_0 + R_1$
- $R_1 \leftarrow R_2 + R_1$
- $R_2 \leftarrow R_1 + R_0$
- $R_0 \leftarrow R_2 + R_0$
- $R_3 \leftarrow R_1 + R_0$

11

Correct Option

Solution :

11

	Clock cycles											Instruction (operation)			
												SUB			
												ADD			
												MUL			
I_0	IF	ID	OP	MA	WB										
I_1		IF	ID	OP	MA	WB									
I_2			IF	ID	OP	OP	OP	MA	WB						
I_3				IF	ID	ID	ID	OP	MA	WB					
I_4					IF	IF	IF	ID	OP	MA	WB				

Total number of clock cycles needed for given program is 11.

QUESTION ANALYTICS