

Q.1)

which of the following statements are true about the weighted codes?

- I. The weighted codes are self-complementary if the sum of the code is equals to 9.
- II. The invalid codes for all weighted codes are same.

 A Only I B Only II C Both I and II D Neither I nor II

Subject: digital logic systems

Max Marks: 1



Solution: (D)

Solution:

The sum of the weighted code should be 9 is a necessary condition but it is not a sufficient condition. For example, weighted code as 9000 is not not self complementary though, the sum of its code is 9.

The invalid codes of the weighted codes may be different. For example, in 8421, code 1111 is invalid though it is valid in 2421

Correct Option

Q.2)

Consider the following CFG, where the set of terminals is  $\Sigma = \{a, b, \#, \%, !\}$ :

$$\begin{aligned} S &\rightarrow \%aT \mid UI \\ T &\rightarrow aS \mid baT \mid \epsilon \\ U &\rightarrow \#aTU \mid \epsilon \end{aligned}$$

The Follow set for the Non-terminal T is

 A  $\{\$, \#, \epsilon\}$  B  $\{\$, \#, !\}$ 

Solution: (B)

**Explanation:**

$\text{Follow}(T) = \text{Follow}(S)$  and S is the start symbol of the grammar  
 $\Rightarrow \text{Follow}(T) = \{\$\}$   
 $\text{Follow}(T) = \text{First}(U)$   
 $\Rightarrow \text{First}(U) = \{\#, \epsilon\}$   
 Substitute  $\epsilon$  in place of U  
 $\text{Follow}(T) = \text{Follow}(U) = \{!\}$   
 $\text{Follow}(U) = \{!\}$   
 $\Rightarrow \text{Follow}(T) = \{\$, \#, !\}$

Correct Option

 C  $\{\#, !\}$  D  $\{\$, \#\}$ 

Q.3)

Consider the following items with their associated weights and values.

Subject: Algorithms

Max Marks: 1



Item	Weight	Value
1	2	12
2	7	8
3	5	7
4	3	3
5	10	17
6	2	6
7	1	2

If a knapsack of capacity 25 units of weight is available and we are allowed to take either the item completely or leave it the maximum possible profit if we are greedy about the profit is \_\_\_\_\_

Correct Answer

**Solution:** (46)  
Solution 46

If we are greedy about profit and follow the greedy approach then the items are sorted in order of their profits and they are added one by one in decreasing order of the profits

Item 5 is added  
Item 1 is added  
Item 2 is added  
Item 3 is added  
Item 7 is added

The capacity of the knapsack is 25 and no more items can be added further.  
Total profit=17+12+8+7+2=46.

Q.4)

Which of the following statements are correct?

- I. The function  $F(a,b,c) = 1$ , have no maxterms.
- II. The dual of Exclusive-OR (EX-OR) is equivalent to its complement.

A

Only I

B

Only II

C

Both I and II

Subject: digital logic systems

Max Marks: 1

Correct Option

**Solution:** (c)

**Solution:**

- I. The sum of all literals/variables will be equal to 1 only when all the terms are minterms i.e  $\sum(0,1,2,3,4,5,6,7)$  and  $\prod( )$ . Hence, there will be no maxterms
- II. Let  $F = A \text{ XOR } B = A'B + AB'$ . Its dual will be  $(A' + B)(A + B')$ . This is equivalent of writing  $AB + A'B' = F'$ . Hence, it is true.

Thus, both the statements are correct.

D

Neither I nor II

Q.5)

Consider the following c program.

```
#include <stdio.h>
int main()
{
    int i, n=15;
    for (i=3; i< n; i+=3);
        printf("%d",i);
    return 0;
}
```

What will be the output of the code.

A

36912

B

3

C

15

Subject: C Programming

Max Marks: 1

Correct Option

**Solution:** (c)

**Solution:** Ans is 15.

Here, if we go through the code then we can check it.

Start from the main function

```
int main()
{
    int i, n=15; // declaring i and n and initializing n with 15
    for (i=3; i< n; i+=3); // here semicolon is used just after the for loop so it
    will come out of loop when it will be failed.
```

i=3, 3<15 : true i=6	6<15 : true i=9	9<15: true i=12	12<15 : true i=15	15<15 :false
-------------------------	-----------------	-----------------	----------------------	--------------

printf("%d", i); // so here 15 will be printed.

So, the correct answer is 15.

Error

Q.6)

Suppose that T is a full binary tree, If T has 100 internal nodes then the number of leaves in T is \_\_\_\_\_

Subject: Data Structures,C Programming

Max Marks: 1

Correct Answer

Solution: (101)

Solution: 101

**Full Binary Tree Theorem:** The number of leaves in a non-empty full binary tree is one more than the number of internal nodes.

**Proof:** The proof is by **mathematical induction** on  $n$ , the number of internal nodes. This is an example of the style of induction proof where we reduce from an arbitrary instance of size  $n$  to an instance of size  $n - 1$  that meets the induction hypothesis.

i. **Base Cases:** The non-empty tree with zero internal nodes has one leaf node. A full binary tree with one internal node has two leaf nodes. Thus, the base cases for  $n = 0$  and  $n = 1$  conform to the theorem.

ii. **Induction Hypothesis:** Assume that any full binary tree  $T$  containing  $n - 1$  internal nodes has  $n$  leaves.

iii. **Induction Step:** Given tree  $T$  with  $n$  internal nodes, select an internal node  $I$  whose children are both leaf nodes. Remove both of  $I$ 's children, making  $I$  a leaf node. Call the new tree  $T'$ .  $T'$  has  $n - 1$  internal nodes. From the induction hypothesis,  $T'$  has  $n$  leaves. Now, restore  $I$ 's two children. We once again have tree  $T$  with  $n$  internal nodes. How many leaves does  $T$  have? Because  $T'$  has  $n$  leaves, adding the two children yields  $n + 2$ . However, node  $I$  counted as one of the leaves in  $T'$  and has now become an internal node. Thus, tree  $T$  has  $n + 1$  leaf nodes and  $n$  internal nodes.

By mathematical induction the theorem holds for all values of  $n > 0$ .

Q.7)

Consider a k-regular bipartite graph with m and n vertices in the two bipartite sets. Then

Subject: Discrete Mathematics

Max Marks: 1

Correct Option

A m=n

Solution: (A)

Explanation:

Count the number of edges incident on each partite set. The no. of edges incident on the partite set with  $m$  vertices is  $k.m$ . Similarly the no. of edges incident on the partite set with  $n$  vertices is  $k.n$ . Since these are all the edges, they must be the same. Hence  $m = n$ .

B m>n

C m

D None of these

Q.8)

Database file consist 1250 records. A block can hold either 3 records or 10 keys, 11 pointers. The maximum number of levels of index required for sparse B+ tree index for database file are \_\_\_\_\_

Subject: DBMS

Max Marks: 1

Correct Answer

Solution: (4)

Solution: 4

Given that the total number of records = 1250, and each block contains 3 records.

Therefore, the total number of blocks required to allocate all the records are =  $1250/3 = 416.6 = 417$  blocks

Since, it is mentioned that indexing is sparse, therefore, the number of blocks required in index =  $417/10 = 42$ . So, B+ tree will be having 42 blocks at ground level.

As we asked to find the maximum number of levels, therefore, we require a minimum number of pointer in a block =  $\text{ceil}(11/2) = 6$  pointers // in B+ tree internal node can have  $\text{ceil}(P/2)$  to  $P$  pointers.

Next level will have  $42/6 = 7$  blocks

In the next level, it will have  $7/6 = 2$  blocks

In the next level, it will have  $2/6 = 1$  block.

So in total we will have 4 levels.

Q.9)

$$\lim_{x \rightarrow 0} \frac{\cos 5x - \cos 7x}{x^2} =$$

Subject: Engineering-Mathematics

Max Marks: 1

A 1/6

B 1/12

C 12

Correct Option

Solution: (C)

Solution C

Since it is in 0/0 indeterminate form applying L'Hopital's rule

$$\lim_{x \rightarrow 0} \frac{-5 \cdot \sin 5x + 7 \cdot \sin 7x}{2x}$$

$$\lim_{x \rightarrow 0} \frac{-25 * \cos 5x + 49 * \cos 7x}{2}$$

$$= (49 - 25)/2$$

$$= 12$$

D

6

Q.10)

Which of the following is/are true about routers?

Subject: Computer Networks

Max Marks: 1

A

Routers reassemble IP fragments if the next link can handle the full datagram.

B

Routers can arbitrarily drop packets if they want.

Correct Option

Solution: (B)

Explanation:

Routers do not reassemble the packets in between because some fragments may take different paths. Reassembly is done at the destination.

Yes, this is possible because of congestion routers can drop the packets.

Yes, a router can change the values of Packet, it changes header TTL values and mac addresses.

A router is both a collision domain and broadcast domain separator.

C

Routers can not change the IP packets they forward at all.

D

A router is the collision domain but not the broadcast domain separator.

Q.11)

Consider the following C program.

Subject: C Programming

Max Marks: 1

```
#include <stdio.h>
int main()
{
    char x, y, z;
    printf("%d",scanf("%c %c %c", &x,&y,&z));
    return 0;
}
```

If a b c are the inputs for the above code then what will be resulted in

A

Error

B

3

Correct Option

Solution: (B)

Solution: Ans is 3

In the given code, it is just printing the number of inputs which are given in scanf function. Here we are starting from the main() function then  
char x, y, z; // x,y,z are declared as character type.

printf("%d",scanf("%c %c %c", &x,&y,&z)); // here first inside function will be executed so it will ask for input and then a b c is given as input then at the time of printf, this  
printf function will print number of inputs which are taken in scanf function so it will print 3 as we are giving a b c as input.

So, the correct answer is 3.

C

97

D

122

Q.12)

Consider the following C program.

Subject: C Programming

Max Marks: 1

```
#include <stdio.h>
enum t{
    t1,
    t2,
    t3=3,
    t4,
    t5
};
int main()
{
    int x = (t5-t3) + t4 + (t1, t2, t3);
    printf("%d",x);
    return 0;
}
```

Choose the correct option for the above code.

A

5

B

6

C

7

D

9

Correct Option

**Solution:** (D)

**Solution:** Ans is 9

This is question of enumeration. So enum definition is as follows:

Enumeration (or enum) is a user defined data type in C. It is mainly used to assign names to integral constants, the names make a program easy to read and maintain.

```
#include < c header file
```

```
enum t{ // t is declared as enum type and enum is user defined data type in C.
```

```
t1, // it gets value 0
```

```
t2, // it gets value 1
```

```
t3=3, // initialized t3 =3 so we will move 1 from this value
```

```
t4, // after initialization of previous constant, it gets value 4
```

```
t5 // it gets value 5
```

```
};
```

```
int main() // starting body of main function
```

```
{
```

```
int x = (t5-t3) + t4 + (t1, t2, t3); // x = 5-3 + 4 + 3 // as we assignment operator works from right to left. So x = 2+4+3 = 9
```

```
printf("%d",x); // so 9 will be printed here
```

```
return 0;
```

```
}
```

So, the correct output of this is 9.

Q.13)

Number of states in a minimal DFA that accepts the given language

$L = \{w : w \text{ contains at least two } 0\text{s and exactly one } 1\}$  is \_\_\_\_\_

Subject: Theory of Computation, Compiler Design

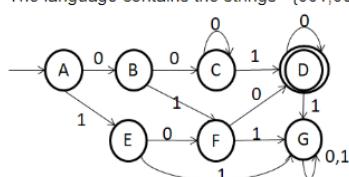
Max Marks: 1

Correct Answer

**Solution:** (7)

**Explanation:**

The language contains the strings = {001, 0010, 1000, 001000, .....}



Q.14)

The number of keys required for the communication of n users in asymmetric key cryptography respectively and the port number

23 used by the application?

Subject: Computer Networks

Max Marks: 1

A

N, FTP

B

4N, TFTP

C

2N, Telnet

Correct Option

**Solution:** (C)

**Explanation:**

In asymmetric key cryptography, each user requires two keys public and the private key. So the total number of keys required for communication is 2N.

Port number 23 is used by the Telnet is an application protocol used on the Internet or local area network to provide a bidirectional interactive text-oriented communication facility using a virtual terminal connection.

D

2(N-1), TFTP

Q.15)

Suppose that a process is executing "counter=counter+1" while another process is executing **concurrently** (without any synchronization) "counter=counter-2", where the counter is a variable shared between the two processes and is only changed in those statements. Given that the value of counter is **five** before execution, which of the following is not a possible value after both processes finish their statement

Subject: operating systems

Max Marks: 1

A

6

4

3

None of these

Correct Option

**Solution:** (D)**Solution:** None of these

each statement can be implemented through three instructions. Thus, the possible values are  $5 + 1 = 6$  (where the counter = counter -2 is overwritten),  $5 - 2 = 3$  (where the counter = counter + 1 is overwritten), or  $5 + 1 - 2 = 4$  (which is correct).

Q.16)

Subject: computer organization

Max Marks: 1

Consider a computer system with 32KB of main memory and 64-byte cache with 8-byte blocks. For a two-way set associative cache the size of the TAG memory is \_\_\_\_\_.(in Bytes)

Correct Answer

**Solution:** (10)**Answer:** 10**Explanation:**Main memory = 32KB  $\Rightarrow 2^{15}$ B

Number of bits in the physical address is 15

Cache size is = 64B

Each cache block contains 8 bytes

Number of cache lines are =  $64B/8B = 8$ 

Offset = 3 bits

Number of sets in the cache =  $8/2 = 4$ 

Set Index = 2

TAG bits =  $15-2-3=10$ Size of the Tag Memory =  $10*8 = 80$  bits = 10B

Q.17)

Subject: computer organization

Max Marks: 1

Consider the main memory of a computer has  $2^m$  blocks while the cache has  $2^n$  blocks. If the cache uses the 4-way set associative mapping scheme, then the block  $k$  of main memory maps to the set:

A

(k mod  $2^m$ )th set of the cache

B

(k mod  $2^n$ )th set of the cache

C

(k mod  $n/4$ )th set of the cache

D

(K mod  $n/2$ )th set of the cache

Correct Option

**Solution:** (D)**Explanation:**

Kth block of main memory has to mapped to

Number of blocks in the cache =  $2^n$ Number of sets in the cache =  $2^n/4 = n/2$ Kth block will map to  $(k \text{ mod } n/2)$  set of the cache.

Q.18)

Subject: Computer Networks

Max Marks: 1

In the TCP's basic timeout algorithm the value of estimated RTT is the average of initial RTT and the new RTT. Determine the value of the smoothing factor?

Correct Answer

**Solution:** (0.5)**Explanation:**

$$\text{ERTT} = \alpha \times \text{IRTT} + (1-\alpha) \times \text{NRTT}$$

$$(\text{IRTT} + \text{NRTT})/2 = \alpha \text{IRTT} + \text{NRTT} - \alpha \text{NRTT}$$

$$\alpha = \frac{1}{2} = 0.5$$

Q.19)

Subject: Algorithms

Max Marks: 1

Which of the following does not represent an array of integers after 2 iterations of Bubble sort?

A

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

B

7, -13, 12, -9, 8, 0, 14, 16

3, 2, 1, 0, 4, 5, 6, -1, 7, 9

2, 4, 15, 0, -10, -8, -12, 12, 16

Correct Option

**Solution:** (D)

In case of bubble sort at the end of ith iteration, the ith largest element reaches its correct position and the elements following it must be already sorted.

By observing the options, option A, B, C have the last two elements in the correct position whereas in the D option element 15 should have been in the second last position but it is not, therefore, D is the correct answer.

Q.20)

Subject: DBMS

Max Marks: 1

Which of the following statements is true?

- I. W1(X), C1, W2(Z), W3(Y), W2(Y), C3, C2; is neither a strict schedule nor cascadeless.  
II. R1(A), R2(A), W2(A), R1(B), W2(B), C2, R1(B), C1; is both conflict serializable and cascadeless schedule.

A Only I

B Only II

C Both I and II

D Neither I nor II

Correct Option

**Solution:** (D)

**Solution:**

This schedule is not a strict schedule due to W-W conflict ( $W3(Y) \rightarrow W2(Y)$ ) but it is cascadeless as there are no dirty reads. Therefore this statement is false.

This schedule is cascadeless as there is no presence of uncommitted read but it is not conflict serializable because there is the presence of cycle in its precedence graph.

Q.21)

Subject: Theory of Computation, Compiler Design

Max Marks: 1

The Left factored grammar for the given grammar is

$E \rightarrow \text{int} \mid \text{int} + E \mid \text{int} - E \mid E - (E)$

A  $E \rightarrow \text{int} E'$   
 $E' \rightarrow + E \mid - E \mid -(E) \mid \epsilon$

B  $E \rightarrow \text{int} E' \mid E - (E)$   
 $E' \rightarrow + E \mid - E \mid -(E) \mid \epsilon$

C  $E \rightarrow \text{int} E' \mid E - (E)$   
 $E' \rightarrow + E \mid - E \mid \epsilon$

Correct Option

**Solution:** (C)

**Explanation:**

$E \rightarrow \text{int} \mid \text{int} + E \mid \text{int} - E \mid E - (E)$

Common factor is int

The left factored grammar for the given grammar is

$E \rightarrow \text{int } E' \mid E - (E)$   
 $E' \rightarrow \epsilon \mid + E \mid - E$

D  $E \rightarrow \text{int} E' \mid E - (E)$   
 $E' \rightarrow + E \mid - E$

Q.22)

Subject: Theory of Computation, Compiler Design

Max Marks: 1

Which of the following is/are decidable

- I.  $A_{\text{NFA}} = \{ \langle B, w \rangle \mid B \text{ is an NFA that accepts string } w \}$ .  
II.  $\text{EQ}_{\text{DFA}} = \{ \langle A, B \rangle \mid A \text{ and } B \text{ are DFAs with } L(A) = L(B) \}$   
III.  $\text{ALL}_{\text{CFG}} = \{ \langle G \rangle \mid G \text{ is a CFG and } L(G) = \Sigma^* \}$ .

A I and II Only

Correct Option

**Solution:** (A)

**Explanation:**

$A_{\text{NFA}} = \{ \langle B, w \rangle \mid B \text{ is an NFA that accepts string } w \}$ . Decidable

$\text{EQ}_{\text{DFA}} = \{ \langle A, B \rangle \mid A \text{ and } B \text{ are DFAs with } L(A) = L(B) \}$  Decidable

$\text{ALL}_{\text{CFG}} = \{ \langle G \rangle \mid G \text{ is a CFG and } L(G) = \Sigma^* \}$ . Undecidable

B II and III Only

C I and III Only

I, II and III

Q.23)

Consider a paging system with the page table stored in memory. If a memory reference takes 150 nanoseconds, and if we add associative registers (a TLB), what percent of page table references need to hit in the TLB to get an effective access rate of 155 nanoseconds? Assume that a TLB lookup has zero overhead.

Subject: operating systems

Max Marks: 1

A 90

B 96

C 96.6

Correct Option

Solution: (c)

Explanation:

Let p=percent of page table references need to hit in the TLB, then

$$155 = p \cdot 150 + (1-p) \cdot 300$$

$$\text{So, } p = 96.6\%$$

D None of these

Q.24)

We have a single stage, non-pipelined machine and a pipelined machine with 5 pipeline stages. The cycle time of the former is 5ns and the latter is 1ns. Given the pipeline stalls 1 cycle for 40% of the instructions, what is the speed up now?

Subject: computer organization

Max Marks: 1

A

Correct Answer

Solution: (3.57)

Explanation:

Pipeline loses 1 cycle 40% of the time. CPI is now 1.4.

$$\text{Speed up} = (1 \text{ CPI} * 5\text{ns}) / (1.4 \text{ CPI} * 1\text{ns}) = 3.57$$

Q.25)

There are 2 bags, Bag A contains 4 white, 3 black balls. Bag B contains 3 white and 5 black balls. One ball is drawn from each bag. The probability that both are black is\_\_\_\_

Subject: Engineering-Mathematics

Max Marks: 1

A 3/14

B 15/56

Correct Option

Solution: (B)

Solution B

Since both of them are independent events

$$P(\text{black from Bag A}) = 3/7$$

$$P(\text{black from Bag B}) = 5/8$$

$$P(\text{black from Bag A and black from bag B}) = (3/7) * (5/8) = 15/56.$$

C 29/56

D 4/5

Q.26)

Consider the following C program.

Subject: C Programming

Max Marks: 2

```
#include <stdio.h>
int main()
{
    char c='a';
    while (c++ <='z')
        putchar(c-1);
    return 0;
}
```

Choose the correct answer for the output of the above code.

A It prints b to z

B It prints b to {

**c** It prints a to z

Correct Option

**Solution:** (c)

**Solution:** Ans is It prints a to z

If we go through the code then we can get that it is simply printing the alphabets from a to z. As we start from main()

char c='a'; // declare c as character type and assigned char 'a' to it.

while (c++ <='z') // compare character 'a' from character 'z' and then incrementing character 'a'. It means after end of this statement c value is incremented by 1 and this condition will be executed until it is not failing. So

c++ <= 'z' : 'a' <= 'z' then c='b'

putchar(c-1); // it works same as printf function so it is decreasing c value and then printing it. As we know that c-1 = b-1 = a

Here, it will print abcdefghijklmnopqrstuvwxyz.

So, the correct output is it prints a to z.

**d**

It prints a to {

Q.27)

Subject: Algorithms

Max Marks: 2

Consider the following functions

$$f_1(n) = n$$

$$f_2(n) = (\log n)^{500}$$

$$f_3(n) = (0.999999999999)^{n^2+100n+1}$$

$$f_4(n) = n^{\log_2(n)}$$

Which of the following orderings arrange the functions in increasing order of growth.

**a**

f<sub>3</sub>, f<sub>1</sub>, f<sub>2</sub>, f<sub>4</sub>

Correct Option

**Solution:** (B)

Comparing the function f<sub>1</sub> and f<sub>2</sub>

n and (500

Taking log on both sides

log n and 500log(log n))

Let us substitute some large value for n say n=22100

log n = 2<sup>100</sup>.

500log(log(n)) = 500 \* 100

Clearly, f<sub>1</sub> grows faster than f<sub>2</sub>.

Among f<sub>1</sub> and f<sub>4</sub> we can easily say that f<sub>4</sub> grows faster than f<sub>1</sub> because the exponent of f<sub>4</sub> grows whereas the exponent of f<sub>1</sub> is constant.

Also, we can clearly say that f<sub>3</sub> grows the slowest because it is in the form of a<sup>n</sup> 0, converges to 0.

Therefore, the correct option is B.

**c**

f<sub>1</sub>, f<sub>2</sub>, f<sub>4</sub>, f<sub>3</sub>

**d**

f<sub>1</sub>, f<sub>3</sub>, f<sub>2</sub>, f<sub>4</sub>

Q.28)

The probability that a teacher will give an unannounced test during any class meeting is 1/5. If a student is absent twice, then the probability that the student will miss at least one test is

Subject: Engineering-Mathematics

Max Marks: 2

A	4/5
B	2/5
C	1/5
D	9/25

**Solution:** (D)  
The probability that one test is held =  $2*(\frac{1}{5})*(\frac{1}{5})=8/25$   
The probability that a test is held on both days =  $\frac{1}{5}*\frac{1}{5}=1/25$   
The Probability that the student misses at least one test =  $8/25+1/25=9/25$ .

**Correct Option**

**Q.29)** Let G be a group. Suppose that the number of elements in G of order 5 is 28. Determine the number of distinct subgroups of G of order 5.

**Solution:** (7)

**Explanation:**  
Let g be an element in G of order 5.  
Then the subgroup  $\langle g \rangle$  generated by g is a cyclic group of order 5.  
That is,  
 $\langle g \rangle = \{e, g, g^2, g^3, g^4\}$ , where e is the identity element in G.  
Note that the order of each non-identity element in  $\langle g \rangle$  is 5.  
Also, if h is another element in G of order 5, then we have either  $\langle g \rangle = \langle h \rangle$  or  
 $\langle g \rangle \cap \langle h \rangle = \{e\}$ .  
This follows from the fact that the intersection  $\langle g \rangle \cap \langle h \rangle$  is a subgroup of the order 5 group  $\langle g \rangle$ , and thus the order of  $\langle g \rangle \cap \langle h \rangle$  is either 5 or 1.  
On the other hand, if H is a subgroup of G of order 5, then every non-identity element in H has order 5.  
These observations imply that each subgroup of order 5 contains exactly 4 elements of order 5 and each element of order 5 appears in exactly one of such subgroups.  
As there are 28 elements of order 5, there are  $28/4=7$  subgroups of order 5.

**Correct Answer**

**Q.30)** Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can't fool all of the people all of the time.

**A**  $\exists x \text{ Politician}(x) \Rightarrow (\exists y \forall t \text{ Person}(y) \wedge \text{Fools}(x, y, t)) \wedge (\exists t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t)) \wedge \neg(\forall t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t))$

**B**  $\forall x \text{ Politician}(x) \Rightarrow (\exists y \forall t \text{ Person}(y) \wedge \text{Fools}(x, y, t)) \wedge (\exists t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t)) \wedge \neg(\forall t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t))$

**Solution:** (B)  
**Explanation:**  
Option A: Some Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can't fool all of the people all of the time.  
Option B: Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can't fool all of the people all of the time.  
Option C: Some Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can fool all of the people all of the time.  
Option D: Some Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can fool all of the people all of the time.  
This is similar to option C.  
Therefore option B is the answer.

**Correct Option**

**C**  $\forall x \text{ Politician}(x) \Rightarrow (\exists y \forall t \text{ Person}(y) \wedge \text{Fools}(x, y, t)) \wedge (\exists t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t)) \wedge (\forall t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t))$

**D**  $\forall x \text{ Politician}(x) \Rightarrow (\exists y \forall t \text{ Person}(y) \wedge \text{Fools}(x, y, t)) \wedge (\exists t \forall y \text{ Person}(y) \Rightarrow \text{Fools}(x, y, t)) \wedge \neg(\forall t \forall y \text{ Person}(y) \Rightarrow \neg \text{Fools}(x, y, t))$

**Q.31)** Consider the following grammar.  
 $S \rightarrow [B$   
 $A \rightarrow \text{int} \mid [B$   
 $B \rightarrow ]] \mid C$   
 $C \rightarrow A] \mid A, C$

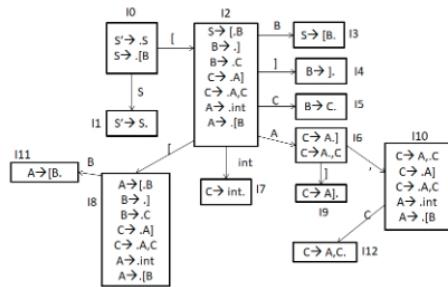
Which of the following is True with respect to SLR(1) Parser.

**A** No conflicts and Grammar is SLR(1)

**Correct Option**

**Solution:** (A)

Explanation:



The given grammar does not contain conflicts. It is SLR(1)

**B**

Not SLR(1) contains S/R Conflict

**C**

Not SLR(1) contains R/R Conflict

**D**

Not SLR(1) contains both S/R and R/R Conflicts

**Q.32**

Subject: computer organization

Max Marks: 2

Consider the following sequence of instructions

lw \$s2, 0(\$s1)  
 lw \$s1, 40(\$s3)  
 sub \$s3, \$s1, \$s2  
 add \$s3, \$s2, \$s2  
 or \$s4, \$s3, \$zero  
 sw \$s3, 50(\$s1)

Assume the 5-stage MIPS pipeline with no forwarding, and each stage takes 1 cycle. Instead of inserting nops, you let the processor stall on hazards. What is the execution time (in cycles) for the whole program?

**A**

Correct Answer

**Solution:** (14)

Explanation:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	-	-	-	-	-	-	-	-	-	-	-	-	-
1		F		D		E		M		W			
2			F		D		E		M		W		
3				F		-		-		D		E	
4							F		D		E		M
5													W
6													

**Q.33**

Subject: Discrete Mathematics

Max Marks: 2

Let G be a simple, undirected, connected graph. G is Eulerian if and only if

**A**

G doesn't have odd cycles

**B**

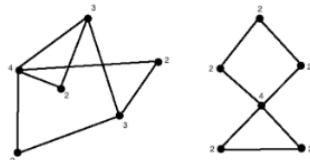
Every vertex in G has even degree.

Correct Option

**Solution:** (B)

Explanation:

A graph with an Eulerian trail is considered Eulerian. Essentially, a graph is considered Eulerian if you can start at a vertex, traverse through every edge only once, and return to the same vertex you started at. For example, let's look at the two graphs below: The graph on the left is not Eulerian.



**C**

Every vertex in G has odd degree.

**D**

G has a cycle of length n, where n is the number of vertices.

Q.34)

Subject: Computer Networks

Max Marks: 2

In a CDMA/CD network with a data rate of 10 Mbps, the maximum distance between any station pair is found to be 2500 m for the correct operation of the collision detection process. What should be the maximum distance in metre if we increase the data rate to 10 Gbps?

Correct Answer

Solution: (2.5)

Ans 2.5

Explanation:

Transmission time = frame size/ data rate

For CSMA/CD

Transmission time = 2 x Propagation time

Frame size/ 10 x 10^6 = 2 x distance /speed

Distance = (Frame size x speed) /2 x data rate

Here frame size and speed are constant

Distance and data rate are inversely proportional

For 10 Mbps = 2500 metre

For 100 Mbps = 250 metre

For 1 Gbps = 25 metre

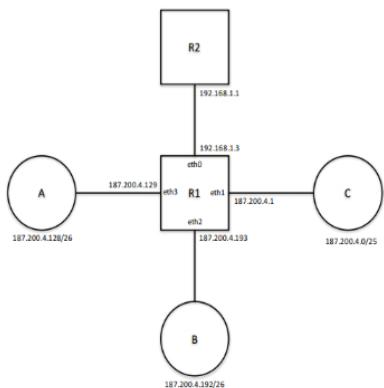
For 10 Gbps= 2.5 metre

Q.35)

Subject: Computer Networks

Max Marks: 2

Consider the network diagram below. Each router (a square in the figure) is labelled with the names of its interfaces (e.g., eth0) and the IP addresses assigned to each. Each network (a circle) is labelled with its network name and prefix length.



The forwarding table at R1 contains the following entries:

Destination	Next Hop	Interface
127.0.0.1/32	127.0.0.1	lo0
Default	192.168.1.1	eth0
192.168.1.0/24		eth0
187.200.4.0/25		eth1
187.200.4.192/26		eth2
187.200.4.128/26		eth3

Suppose the following IP packet arrived at a router R1.

Which entry in the forwarding table would it match and also on which port on R1 must the packet above have arrived respectively? The IP packet contains source IP:187.200.4.165 and destination IP: 187.200.4.83.

A 187.200.4.192/26 eth2, eth3

B 187.200.4.128/26eth3, eth1

C 187.200.4.0/25 eth1, eth3

Correct Option

Solution: (C)

Explanation:

The destination address of the packet is 187.200.4.83

In the forwarding table:

Eth1: 187.200.4.0/25 The range is 187.200.4.0 to 187.200.4.127

Hence the destination address 187.200.4.83 belongs to this range so it will forward to eth1.

The source address of the packet is 187.200.4.165

Eth 3: 187.200.4.128/26 The range is 187.200.4.128 to 187.200.4.191

The source address belongs to Eth3 range so it comes from eth3 to R1

Q.36)

In a demand paging system, consider the following page reference string:

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1

Further assume that there are four frames(a, b, c and d) in the system, where all of them are initially empty. For LRU (least recently used) page replacement algorithm, what are the pages that reside in the memory at the end of all these references.

Note: Sequence is mandatory, choose the options according to the sequence only. Sequence is as follows a, b, c and d.

A 6, 2, 3, 7

B 1, 3, 2, 6

C 1, 2, 3, 7

D None of these

Subject: operating systems

Max Marks: 2



Correct Option

*	1	1	1	1	1	1	1	1	1	1	1	6*	6	6	6
2*	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3*	3	3	3	3	5*	5	5	5	5	3*	3	3	3	3	3
4*	4	4	4	4	6*	6	6	6	6	7*	7	7	7	7	1*
1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2

In the above table we can see that we have started with empty frames and then 1 got in to 'a', 2 got in to 'b', 3 got in to 'c' and 4 got in to 'd', the rest of them is as follows.

\* represents a miss.

Q.37)

Subject: operating systems

Max Marks: 2



Suppose the disk request queue contains a set of references for blocks on tracks 12, 137, 29, 201, 269, and 7 in the order the requests are received. We assume the head is currently at track 100, there is no further request, and the track range is from 0 to 511. Suppose the shortest-seek-time-first algorithm is used then how many total number of head movements in terms of tracks \_\_\_\_\_

Correct Answer

**Solution:** (431)

**Solution:** 431

Here we use the shortest-seek-time-first algorithm. At the beginning the head is 100, the closest request is at track 137 and the head is moved to 137. At 137, 201 is the closest request and the next is 201. The requested are serviced in the following order:

(100)  $\rightarrow$  137  $\rightarrow$  201  $\rightarrow$  269  $\rightarrow$  29  $\rightarrow$  12  $\rightarrow$  7

The total number of head movements is

$$(137-100) + (201-137) + (269-201) + (269-29) + (29-12) + (12-7) = \\ 37 + 64 + 68 + 240 + 17 + 5 = 431$$

Q.38)

Subject: Data Structures,C Programming

Max Marks: 2



Consider the following program

int max( a, b )

    Returns the maximum of a and b;

int fun(int \*arr, int i)

{

    if( $i \leq 1$ )  
        return 0;

    else

        return max(fun(arr + 1, 1 - 1), arr[0] - arr[1]);

}

int main( )

{

    int p[ ] = {10, 11, 12, 13, 14};  
    printf("%d", fun(p, 4));

}

The value printed by this program is

A -1

B 0

Correct Option

**Solution:** (B)

Solution: 0

Let the base address of the array p be 100, arr is pointing to the first element of "p" initially. We keep on moving to the next element and performing the operations of fun().

$$\begin{aligned}
 &= \max(\max(\max(\text{fun}(arr + 1, 1), -1), -1), -1) \\
 &= \max(\max(\max(0, -1), -1), -1) \\
 &= \max(\max(0, -1), -1) \\
 &= \max(0, -1) \\
 &= 0
 \end{aligned}$$

**C**

1

**D**

4

**Q.39)**

A set contains  $(2n + 1)$  elements. The number of subsets of the set which contain more than  $n$  elements is

**A**

$2^n$

**B**

$2^{n+1}$

**C**

$2^{n-1}$

**D**

$2^{2n}$

Correct Option

**Solution:** (D)

The number of subsets containing at most  $n$  elements are

$$\begin{aligned}
 &= C((2n+1), 0) + C((2n+1), 1) + C((2n+1), 2) + \dots + C((2n+1), n) \\
 &= \frac{1}{2}[C((2n+1), 0) + C((2n+1), 1) + C((2n+1), 2) + \dots + C((2n+1), n) + C((2n+1), n+1) + C((2n+1), n+2) + \dots + C((2n+1), (2n+1))] \\
 &\text{Sum of all binomial coefficients} = 2^{2n+1} \\
 &\text{Therefore number of such subsets are} = \frac{1}{2}(2^{2n+1}) = 2^{2n}.
 \end{aligned}$$

**Q.40)**

Which of the following describes the optimal merge pattern for merging 7 files of the following size as given below.

File	File Size in GB
$f_1$	24
$f_2$	19
$f_3$	12
$f_4$	17
$f_5$	13
$f_6$	50
$f_7$	23

**A**

$((((f_3, f_5), (f_2, f_4)), f_6), (f_1, f_7)).$

**B**

$((((f_3, f_5), (f_2, f_4)), ((f_1, f_7), f_6)).$

Correct Option

**Solution:** (B)

To determine the optimal merge pattern we need to actually sort the files in order of their size and keep merging the 2 smallest lists in this process.

- Initially,  $f_3$  and  $f_5$  are merged.
- Then,  $f_2$  and  $f_4$  are merged.
- Then,  $f_1$  and  $f_7$  are merged.
- Then,  $(f_3 + f_5)$  and  $(f_2 + f_4)$  are merged.
- Then,  $f_6$  and  $(f_1 + f_7)$  are merged.
- Now  $(f_6 + f_1 + f_7)$  and  $(f_3 + f_5 + f_2 + f_4)$  are merged.

Option B is the correct option.

C  $((f_2, f_4), (f_3, f_5)), (f_1, f_7)), f_6$ .

D None of the above.

Q.41)

Consider the following schedule:

S: R2(A), R2(B), W3(B), R1(B), W3(A), W2(A), W1(A);

I. The given schedule S is conflict serializable and thus it is also view serializable.

II. The given schedule S is allowed under Thomas Write Rule

The number of statements which are correct are \_\_\_\_\_

Subject: DBMS

Max Marks: 2

**Solution:** ()

**Solution:** 1

I. The schedule S is having cycle in its precedence graph. hence it is not conflict serializable but it is view serializable because:

Initial reads: T2 should be before T1 ( $T_2 \rightarrow T_1$ ) and T3 ( $T_2 \rightarrow T_3$ ).

W-R requests should not be altered ( $W_3(B) \rightarrow R_1(B)$ ). So,  $T_3 \rightarrow T_1$ .

And, final write is done by T1, so, T1 must be executed at last. Hence, the sequence of execution will be  $T_2 \rightarrow T_3 \rightarrow T_1$ .

Hence, it is view serializable but not conflict serializable. Hence, this statement is incorrect.

II. It is allowed in TWR as it will ignore the  $W_2(A)$  (as at  $W_2(A)$  current timestamp will be 1 and  $WTS(A)$  is 2. Since  $2 > 1$ , TWR will ignore this but it will not ignore  $W_3(B)$  and  $R_1(B)$ . Hence, it is not allowed.

Correct Answer | Attempted

Q.42)

Which of the following statements are correct?

I. Boolean expression  $B(DC' + DC) + AB$  could not be represented/reduced to 2 literals.

II. The minimal form of boolean expression  $(A + B)[A'(B' + C')]' + A'B' + A'C'$  contains 0 literals.

A Only I

B Only II

C Both I and II

Correct Option

**Solution:** (c)

**Solution:** (iii)

I.  $B(DC' + DC) + AB$ :

$\Rightarrow B(D(C + C')) + AB$

$\Rightarrow BD + AB$

$\Rightarrow B(D + A)$   $\Rightarrow$  minimal expression

Since, its minimal expression consists of 3 literals. Hence, it could not be reduced to 2 literals and thus, this statement is correct.

II.  $(A + B)[A'(B' + C')]' + A'B' + A'C'$ :

In this expression  $(A + B)[A'(B' + C')]'$  is equivalent to:

$\Rightarrow (A + B)[A + BC]$

$\Rightarrow A.A + A.BC + B.A + B.BC$

$\Rightarrow A + ABC + AB + BC$

$\Rightarrow A(1 + BC) + AB + BC$

$\Rightarrow A + AB + BC // (1 + BC) = 1$

$\Rightarrow A(1 + B) + BC$

$\Rightarrow A + BC$

Now substituting this output in place of  $(A + B)[A'(B' + C')]'$  we will get complete expression as:

$\Rightarrow A + BC + A'B' + A'C'$

$\Rightarrow (A + A')(A + B') + BC + A'C' //$  distributive law over  $A + A'B'$

$\Rightarrow A + B' + BC + A'C' // (A + A') = 1$

$\Rightarrow A + (B' + B)(B' + C) + A'C' //$  distributive law over  $B' + BC$

$\Rightarrow A + B' + C + A'C' // (B + B') = 1$

$\Rightarrow (A + A')(A + C') + B' + C //$  distributive law over  $A + A'C'$

$\Rightarrow A + C' + B' + C // (A + A') = 1$

$\Rightarrow A + B' + 1 // (C + C') = 1$

$\Rightarrow 1 // (\text{any variable} + 1) = 1$

Hence, there are no literals in its minimized expression. This statement is also true.

Hence, the correct option is (iii)

D Neither I and II

Q.43)

Number of onto functions from a set of n elements to itself is

Subject: Discrete Mathematics

Max Marks: 2

A  $n^2$

B  $n^n$

C  $n!$

Correct Option

**Solution:** (c)

**Explanation:**

A function  $f$  is onto in  $f:A \rightarrow A$  if for each element  $x \in A$  there exists  $y \in A$  such that  $f(x)=y$   
 No of onto functions from a given set  $\{1,2,\dots,n\}$  itself is the permutation of  $n$  symbols  $1,2,\dots,n$   
 Total number of maps from  $\{1,2,\dots,n\}$  to itself in permutation of  $n$  symbols which is ' $n!$ '.

D

0

Q.44)

A directed acyclic graph represents one form of intermediate representation. The number of non terminal nodes in Directed Acyclic Graph(DAG) of the expression  $((x+y)-((x+y)*(x-y)) + ((x+y)*(x-y)))$  is:

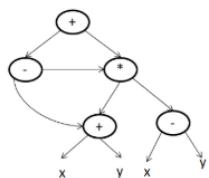
Subject: Theory of Computation, Compiler Design

Max Marks: 2

Correct Answer

**Solution:** (5)**Explanation:**

The DAG for the given expression is



Q.45)

Which of the following languages are CFLs

- $L = \{0^n 1^m 0^n 1^m \mid n \geq 0\}$
- $L = \{ww \mid w \in (0+1)^*\}$

A

I Only

B

II Only

C

I and II Only

D

Neither I nor II Only

Correct Option

**Solution:** (D)**Explanation:**

$$L = \{0^n 1^m 0^n 1^m \mid n \geq 0\}$$

We need to have more than one memory elements or stacks to prove the equality between  $0^n$  and  $0^n$ ,  $1^m$  and  $1^m$ . It is not CFL.

$$L = \{ww \mid w \in (0+1)^*\} \text{ Non CFL}$$

Q.46)

Which of the following statements are not true?

- The number of bits required to represent 31 in signed 2's complement is 6.
- The number of bits required to represent -16 in signed 2's complement is 4 bits.

A

Only I

B

Only II

Subject: digital logic systems

Max Marks: 2

Correct Option

**Solution:** (B)**Solution:**(ii)

- Since, the range of the signed 2's complement numbers are from  $-2^{(n-1)}$  to  $2^{(n-1)} - 1$ , where  $n$  represents the number of bits. Therefore,  
 $\Rightarrow 2^{(n-1)} - 1 \geq 31$   
 $\Rightarrow 2^{(n-1)} \geq 32$   
 $\Rightarrow 2^{(n-1)} \geq 2^5$   
 $\Rightarrow n - 1 = 5$   
 $\Rightarrow n = 6$   
 Hence, this is true.

- Since, the range of the signed 2's complement numbers are from  $-2^{(n-1)}$  to  $2^{(n-1)} - 1$ , where  $n$  represents the number of bits. Therefore,

$\Rightarrow -2^{(n-1)} \leq -16$   
 $\Rightarrow 2^{(n-1)} \geq 16$   
 $\Rightarrow 2^{(n-1)} \geq 2^4$   
 $\Rightarrow n - 1 = 4$   
 $\Rightarrow n = 5$   
 Hence, this is not true

**c** Both I and II

**d** Neither I nor II

**Q.47)**

Consider a message is to be encoded using the following characters which have found to have the following probabilities of appearing in a very large text corpus.

Character	Probability
a	0.05
b	0.09
c	0.12
d	0.13
e	0.26
f	0.35

Using the above probabilities the Huffman code for the following message is encoded then which how many bits required for such an encoding.  
“aabbbccdddeefffa”

Subject: Algorithms

Max Marks: 2



Correct Answer

**Solution:** (43)

### Solution 43

If we draw the Huffman tree it looks like the one drawn below

The encoding for each character is as below

Character	Encoding
F	11
E	10
D	011
C	010
B	001
A	000

Number of characters to encode “aabbbccdddeefffa” required are  $=3*3+3*3+2*3+3*3+2*2+3*2$   
 $=43$ .

**Q.48)**

Two nodes A and B are connected with 10-Mbps link with a single store-and-forward switch in the path. Assume that each section of the link introduces a propagation delay of 10 microseconds and that the switch begins retransmitting immediately after it has finished receiving the packet. A is sending a packet size of 5000 bits to the B. What is an end to end delay between A and B in milli sec? [ Take the floor value if the answer is in decimal]

Subject: Computer Networks

Max Marks: 2



Correct Answer

**Solution:** (1)

**Explanation:**

The transmission time of first link = frame size/ Bandwidth =  $5000/10\text{Mbps} = 0.5\text{ ms}$

Propagation delay A to switch = 10 micro sec = .01 ms

Switch to finish receiving the packet for a total of .51 ms.  
It will take another .51 ms for the switch to send, and then for the destination to receive all of the packets.  
The total delay is:  $2 * 0.51\text{ms} = 1.02\text{ms}$

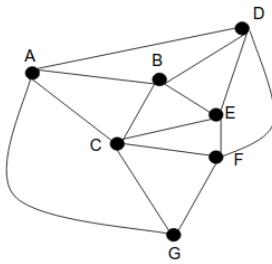
Q.49)

Subject: Algorithms

Max Marks: 2



Which of the following are not BFS traversals of the below graph?



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

Correct Option

Solution: (D)

If we start the BFS traversal from A

1.

The vertices G, C, B and D are one edge away from the A, they are traversed first.

2.

The vertices F, E are one edge away from G, B they are traversed next.

Option A is a valid option.

If we start the BFS traversal from G

1.

The vertices C, F and A are one edge away from the G, they are traversed first.

2.

The vertices B, E, D are one edge away from C and F they are traversed next.

Option B is a valid option.

If we start the BFS traversal from B

1.

The vertices A, D, C and E are one edge away from the B, they are traversed first.

2.

The vertices G and F are one edge away from A and C they are traversed next.

Option C is a valid option.

If we start the BFS traversal from D

1.

The vertices A, B, E and F are one edge away from the D, they should have been traversed first but before F we have C, therefore, option D is an invalid option.

Q.50)

Subject: Theory of Computation, Compiler Design

Max Marks: 2

Consider the following languages over the alphabet  $\Sigma = \{a, b, c\}$   
 Let  $L_1 = \{ab^2c^k \mid i, j, k \geq 0\}$  and  $L_2 = \{a^3b^2c^k \mid i, j, k \geq 0\}$

Then which of the following is/are True

- I.  $L_1 \cup L_2$  is Regular
- II.  $L_1 - L_2$  is Regular

A

I only

B

II only

C

Both I and II

Correct Option

Solution: (C)

Explanation:

Given languages

$L_1 = \{ab^2c^k \mid i, j, k \geq 0\}$  and  $L_2 = \{a^3b^2c^k \mid i, j, k \geq 0\}$

$L_1$  is Regular as there is no direct relation between number of a's, b's and c's.

$L_2$  is also Regular.

From the closure properties of regular languages  $L_1 \cup L_2$  is regular.

$L_1 - L_2 \Rightarrow L_1 \cap L_2^c \Rightarrow$  Regular

$L_2$  is regular,  $L_2^c$  is also regular.

D

Neither I nor II

Q.51)

Subject: operating systems

Max Marks: 2

Consider an operating system with five processes P0.....P4, maximum requirement for instances of resource types each process, allocated instances of the resources for each process and available instances of resources are given below

Process	Allocation	Max
P0	A B C 3 2 2	A B C 5 6 2
P1	0 1 0	2 1 0
P2	1 1 1	5 6 1
P3	3 2 3	9 9 6
P4	2 1 1	3 2 1

Available
A B C
2 0 0

Minimum number of instances of resources required to make the system is in safe state.

A

Requires 1 more instance of resource B

B

Requires 2 More instances of resource B

Correct Option

Solution: (B)

Explanation:

	Allocation	Max	Need	Available
P0	3 2 2	5 6 2	2 4 0	2 0 0
P1	0 1 0	2 1 0	2 0 0	
P2	1 1 1	5 6 1	4 5 0	
P3	3 2 3	9 9 6	6 7 3	
P4	2 1 1	3 2 1	1 1 0	

With the available resources we can finish either P1 or P4.

If we allocate the resources to P1 will complete and release all its existing resources.

Now available is 2 1 0

With 2 1 0 we can finish P4

Now available is 4 2 1

With the resources 4 2 1 we cannot able to finish any of the remaining resources.

We need minimum 2 more resources to complete P1. If we add 2 more instances for resource B then available is 4 4 1

If allocated to P0 then available is 7 6 3

If Allocate to P2 then available is 8 7 4

We left with P3 to finish allocate to P3 will release all the resources

Then available is 11 9 7

Safe sequence after adding two more instances for B is P1 → P4 →

Requires 2 more instances of resource A

Requires one more instance of resource C

Q.52)

Which of the following statements is/are False?

- a. The height of any BST is  $O(\log n)$ .
- b. Consider 2 BSTs(preferably unbalanced) containing n elements, These BSTs can be merged into a single balanced BST in  $O(n)$  time.
- c. At Least  $\log n$  rotations are required to insert into an AVL tree with n nodes.

Note: BST refers to Binary Search Tree

Only a

Only a &amp; c

Correct Option

Solution: (b)

Solution: Only a and c

In the worst case it can go up to  $O(n)$  i.e BST can be left skewed or right skewed.Use in-order traversal of the two BSTs to create two sorted lists of length n in  $O(n)$  time, merge them into a single sorted list of length  $2n$  in  $O(n)$  time, and then create a balanced BST from the sorted lists in  $O(n)$  time, hence TRUE.

False, we may have insertions that require no rotations.

a,b and c

Only b

Q.53)

Consider the two relations below:

Subject: DBMS

Max Marks: 2

Relation Sailors:

SID	SNAME	RATING	AGE
2	A	7	45
9	B	1	33
1	C	8	55
3	D	8	25
5	E	10	35
6	F	7	35
7	G	10	16
4	H	9	35
8	I	3	25
10	J	3	63

Relation Reserves:

SID	BID	DAY
2	101	10/10/98
2	102	10/10/98
2	103	10/8/98
2	104	10/7/98
1	102	11/10/98
1	103	11/6/98
1	104	11/12/98
6	101	9/5/98
6	102	9/8/98
4	103	9/8/98

Relation Boats:

BID	BNAME	COLOR
101	Interlake	Blue
102	Interlake	Red
103	Clipper	Green
104	Marine	Red

An operation on these 2 relations produces the following output:

SNAME
A
C
H

Identify the correct Query in order to get the given output:

 $\prod ((\sigma_{SID>4} \text{Reserves}) \bowtie \text{Sailors})$

**a**  $\prod_{SNAME} ((\sigma_{BID=103} Reserves) \bowtie Sailors \bowtie Boats)$

**c**  $\prod_{SNAME} ((\sigma_{BID=103} Reserves) \bowtie Sailors)$

**d** Both (ii) and (iii)

Correct Option

**Solution:** (d)

**Solution:** (iv)

The first query will select only 1 sid which is 6 due to the condition sid > 4 from reserves. The result of the first query will be:

SNAME
F

The Second and third query will return 3 tuples which are:

SNAME
A
C
H

For query II and III, the result before the projection operation is not the same but after projection, the final result is the same. Hence, both (ii) and (iii) option are correct.

Q.54)

Subject: computer organization

Max Marks: 2

Consider a system employing interrupt-driven I/O for a particular device that transfers data at an average of 8 KB/s on a continuous basis. Now assume that the device has two 16-byte buffers and interrupts the processor when one of the buffers is full. Naturally, interrupt processing takes longer, because the ISR must transfer 16 bytes. While executing the ISR, the processor takes about 8μs for the transfer of each byte. Determine what fraction of processor time is consumed by this I/O device in this case.

Assume that the interrupt processing takes about 100μs (i.e. the time to jump to the interrupt service routine(ISR), execute it, and return to the main program).

Correct Answer

**Solution:** (0.11)

**Answer:** 0.11

**Explanation:**

The device generates  $8 \times 1024 = 8192$  bytes per second or a rate of one byte every 122 μs.

In this case, the time interval between interrupts is  $16 \times 122 = 1952$  μs.

Each interrupt now requires 100 μs for the first byte plus the time for transferring each remaining byte, which adds up to  $8 \times 15 = 120$  μs, for a total of 220 μs.

The fraction of processor time consumed is  $220/1952 = 0.11$

Q.55)

Subject: DBMS

Max Marks: 2

Let t be a B-Tree of order m and height h. If n is the number of key elements in T then the maximum value of n is:

**a**  $(m - 1)^h - 1$

**b**  $(m - 1)^{h-1} + 1$

**c**  $m^{h+1} + 1$

**d**  $m^{h+1} - 1$

Correct Option

**Solution:** (d)

Since, the order of B-Tree is m, therefore, each node can have a maximum of  $(m-1)$  keys.

Hence, the number of keys at height 1 will be  $(m - 1)$ .

Number of keys at height 2 will be  $m * (m - 1)$  // m block pointers of a node at height 1 will give m nodes at height 2

Number of keys at height 3 will be  $m * m * (m - 1) = m^2 * (m - 1)$

Similarly, number of keys at height h will be  $m^{h-1} * (m - 1)$

Therefore, the maximum number of keys, n will be =  $(m-1) + m(m-1) + m^2(m-1) + \dots + m^h(m-1)$

$\Rightarrow n = (m-1)[1 + m + m^2 + \dots + m^{h-1}]$  // Since, it is a GP, therefore, on applying sum of GP

$\Rightarrow n = (m-1)(1 * (m^{h-1} - 1))/(m-1)$

$\Rightarrow n = m^{h+1} - 1$

Q.1

Select an appropriate synonym for Glory

Subject: General Aptitude

Max Marks: 1



Applause



Blame



Grandeur

Correct Option

Solution: (c)

Solution:

Glory means grandeur or honor



Dread

Q.2

'Soft drinks have been shown by scientists to be bad for the teeth. Therefore, the government would be justified in banning all soft

drinks from the Indian market.' Assuming that the factual claim in the above argument is true, what else needs to be assumed for the conclusion to follow?

Subject: General Aptitude

Max Marks: 1



Soft drinks are also bad for gastric health



The government is justified in banning anything that is bad for dental health

Correct Option

Solution: (B)

Solution:

Clearly, option B is the assumption required by the argument. It correlates the fact given in the paragraph with the conclusion reached.



Dental hygiene is a matter of great concern



No further assumptions are necessary

Q.3

Bacon believes that the medical profession should be permitted to ease and quicken death where the end would otherwise only delay for few days and at the cost of great pain.

Choose the correct alternative for the underlined sentence above

Subject: General Aptitude

Max Marks: 1



otherwise only delay for a few days and



be delayed for a few days and



be delayed for a few days and



be otherwise only delayed for a few days and

Correct Option

Solution: (D)

Solution:

In this question, the way it is phrased, the end becomes the doer of the action, which cannot be so. Secondly, the adverbs 'otherwise' and 'only' should be placed closest to the verb they modify, which is 'delayed'. This makes option d the correct answer.

Q.4

In the famous Bhojpuri island, there are four men for every three women and five children for every three men. How many children are there in the island if it has 531 women?

Subject: General Aptitude

Max Marks: 1



454



1180

Correct Option

Solution: (B)

Solution: Women : Men = 3 : 4

Men : Children = 3 : 5

=&gt; Women : Men : Children = 9 : 12 : 20

Women =  $\frac{9}{41} * (\text{Women} + \text{Men} + \text{Children})$ => 531 =  $\frac{9}{41} * (\text{Women} + \text{Men} + \text{Children})$ 

=&gt; Women + Men + Children = 2419

Therefore, Children =  $\frac{20}{41} * 2419 = 1180$ 

1070

Q.5)

Two buckets of equal capacity are full of a mixture of milk and water. In the first, the ratio of milk to water is 1:7 and in the second it is 3:8. Now both mixtures are mixed in a bigger container. What is the resulting ratio of milk to water?

Subject: General Aptitude

Max Marks: 1

A 35:141

Correct Option

Solution: (A)

**Solution:** Assume the capacity of the two containers is 88 litres each. When we mix 88 litres of the first and 88 litres of the second, the amount of milk would be:

$$88 \times \frac{1}{8} + 88 \times \frac{3}{11} = 11 + 24 = 35 \text{ litres.}$$

$$2 \times 88 - 35 = 176 - 35 = 141 \text{ litres. Required Ratio} = 35 : 141$$

B 42:49

C 43:41

D 41:53

Q.6)

The sentences given in the question, when properly sequenced, form a coherent paragraph. Each sentence is labeled with a letter.

Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.

1. Until the MBA arrived on the scene the IIT graduate was king.

(A) A degree from one of five IITs was a passport to a well-paying job, great prospects abroad and for some decent dowry to boot.

(B) From the day he or she cracked the Joint Entrance Examination, the IIT student commanded the awe of neighbors and close relatives.

(C) IIT students had, meanwhile, also developed their own special culture, complete with lingo and attitude, which they passed down.

(D) True, the success stories of IIT graduates are legion and they now constitute the cream of the Indian Diaspora.

6. But not many alumni would agree that the IIT undergraduate mindset merits a serious psychological study, let alone an interactive one.

A BACD

B ABCD

C ABDC

D BADC

Correct Option

Solution: (D)

Solution:

Statement G speaks of a study of IIT graduates' mindset.

Statement C speaks of the culture developed by IIT students.

Therefore, CG is a mandatory pair. D speaks of the success stories of IIT graduates and therefore follows A.

Option d is the right choice.

Q.7)

Given  $A = 2^{65}$  and  $B = (2^{64} + 2^{63} + 2^{62} + \dots + 2^0)$ , which of the following is true?

Subject: General Aptitude

Max Marks: 2

A B is  $2^{64}$  larger than A

B A and B are equal

C B is larger than A by 1

D A is larger than B by 1

Correct Option

Solution: (D)

**Solution:** B is in G.P with  $a = 2^0$ ,  $r = 2$ ,  $n = 65$

$$\text{Therefore, } S_n = \frac{a(r^n - 1)}{r - 1} \\ = \frac{2^0(2^{65} - 1)}{2 - 1}$$

$$\text{Therefore, } B = 2^{65} - 1$$

$$\Rightarrow B = A - 1$$

Therefore, A is larger than B by 1.

Q.8)

Two ghats are located on a riverbank and are 21 km apart. Leaving one of the ghats for the other, a motorboat returns to the first ghat in 270 mins, spending 40 mins of that time in taking the passengers at the second ghat. Find the speed of the boat in still water if the speed of the river flow is 2.5 km/h.

Subject: General Aptitude

Max Marks: 2

A 10.4 km/h

A 12.5 km/h

B 22.5 km/h

C 11.5 km/h

Correct Option

**Solution:** (D)

**Solution:**

Check through the options. Option (d) will give us 14 kmph and 9 kmph as the downstream and upstream speeds. This would mean that the total travel time would be 1.5 hrs and 2.33 hrs downstream and upstream respectively.

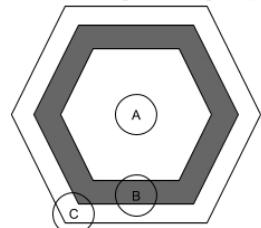
Q.9)

Subject: General Aptitude

Max Marks: 2



Three regular hexagons are drawn such that their diagonals cut each other at the same point and the area  $A : B : C = 1 : 2 : 3$ . Then the ratio of the length of the sides of the regular hexagons (from the smallest to the largest) is:



A  $1 : \sqrt{2} : \sqrt{6}$

B  $1 : \sqrt{2} : \sqrt{3}$

C  $1 : \sqrt{3} : 2\sqrt{2}$

D  $1 : \sqrt{3} : \sqrt{6}$

Correct Option

**Solution:** (D)

**Solution:** If side of the smallest hexagon is ' $a$ ' and the side of the second largest and largest hexagons are  $b$  &  $c$  respectively. Then according to the question:

$$\frac{3\sqrt{3}}{2}a^2 = A$$

$$\frac{3\sqrt{3}}{2}b^2 = A + B = 3A$$

$$\frac{3\sqrt{3}}{2}c^2 = A + B + C = 6A$$

$$a^2 : b^2 : c^2 = 1 : 3 : 6$$

$$a : b : c = 1 : \sqrt{3} : \sqrt{6}$$

Q.10)

Subject: General Aptitude

Max Marks: 2



A restaurant has a pricing policy that allows for the following mark-ups:

Soups - 40%, Starters - 50%, Meals - 25%, Breads - 75% and Sweets - 75%

Mr. Ram with his wife went to the restaurant and got a bill for:

Soups - ₹ 126, Starters - ₹ 180, Meals - ₹ 300, Breads - ₹ 245 and Sweets - ₹ 210

Find the profit for the restaurant (in rupee and percentage to nearest approximation)

A 341, 40%

B 351, 50%

Correct Option

**Solution:** (B)

**Solution:** The original price for the items:

$$\text{Soups} - \frac{126}{140} * 100 = ₹ 90$$

$$\text{Starters} - \frac{180}{130} * 100 = ₹ 120$$

$$\text{Meals} - \frac{300}{125} * 100 = ₹ 240$$

$$\text{Breads} - \frac{245}{175} * 100 = ₹ 140$$

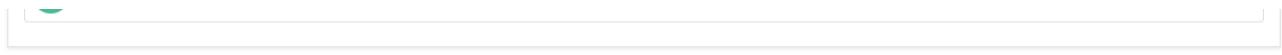
$$\text{Sweets} - \frac{210}{175} * 100 = ₹ 120$$

$$\text{Profit} = (126 + 180 + 300 + 245 + 210) - (90 + 120 + 240 + 140 + 120) \\ = 1060 - 710 = ₹ 351$$

$$\text{Profit (in %)} = \frac{351}{710} * 100 = 49.44\% = 50\% (\text{approx})$$

C 351, 45%

D 341, 55%



close