Q.1) Subject: Theory of Computation,Compiler Design Max Marks: 1

Consider the following ε-NFA
M=({q1, q2, q3}), {a, b}, δ,q1, {q2}), where δ is:
δ (q1, ε) = {q2}
δ (q1, a) = {q3}
δ (q2, a) = {q1}
δ (q3, a) = {q2}
δ (q3, b) = {q2, q3}
The entries for (q1,a) and (q3,b) in the transition table of NFA are

A {q2,q3} {q1,q2,q3}

B {q1,q2,q3} {q2,q3} Correct Option

Solution: (B)

Explanation:

ε-closure(q1) = {q1,q2}
ε-closure(q2) = {q2}
ε-closure(q2) = {q3}
δ (q1,a) = ε-closure (δ (ε-closure(q1),a))
= ε-closure (δ (q1,q2),a))
= ε-closure (q3, q1)
= {q1,q2,q3}
(q3,b) = ε-closure (δ (ε-closure(q3),b))
= ε-closure (δ (q3),b))
= ε-closure (q2,q3)
= {q2,q3}

C {q1,q2} {q2,q3}

D {q1,q2,q3} {q1, q2}

Q.2) Subject: Data Structures Max Marks: 1

Consider A and B be two sets of numbers, represented as Unordered Linked lists. The numbers present in a list are distinct. HeadA and HeadB are head pointers to those two linked lists. What is the best case time complexity to find A = B. (Assume we don't know the lengths of each list and any operation on one or two numbers can be performed in constant time)

A O(max({|A|, |B|}))

B O(min({|A|, |B|})) Correct Option

Solution: (B)
Solution:
First, check that both sets are the same size. If they are not, then they cannot be equal.
To do this check in O(min {|A| , |B|}) time, just iterate over both lists in parallel. That is, advance one step in A and one step in B. If both lists end, the lengths are the same. If one list ends before the other, they have different lengths.
If both lists are the same size, then we want to check whether the elements are the same. We create a hash table of size Θ(|A|) using universal hashing with chaining. We iterate over A, adding each element from A to the hash table. Then we iterate over B. For each element x ∈ B, we check whether x belongs to the hash table (that is, whether it is also in A). If not, then we return that the sets are not identical. If so, then continue iterating over B.
Any sequence of |A| = |B| Insert and Search operations in the table take O(|A|) time in expectation , so the total runtime is O(min {|A| , |B|}) in expectation.

C O(|A|.|B|)

D None of these

Q.3) Subject: digital logic systems Max Marks: 1

The value of radix r for $\sqrt{(764)_r} = (27)_r$ is _____

Correct Answer

Solution: (9)

Solution: 9

For the given equation $\sqrt{(764)_r} = (27)_r$, on converting it into decimal and squaring on both sides, we will get:

$\Rightarrow 7r^2 + 6r + 4 = (2r + 7)^2$

$\Rightarrow 7r^2 + 6r + 4 = 4r^2 + 28r + 49$

$\Rightarrow 3r^2 - 22r - 45 = 0$

$\Rightarrow 3r^2 - 27r + 5r - 45$

$\Rightarrow 3r (r - 9) + 5 (r - 9)$

$\Rightarrow (r - 9) (3r + 5)$

$\Rightarrow r = 9, -5/3$

Since radix r could not be negative and in fraction, therefore, r = 9.

Q.4) Subject: DBMS Max Marks: 1

For any B-tree of minimum degree t <= 2, every node other than root must have at least ____ keys and every node can have at most ____ keys.

A. t - 1, 2t + 1

B. t + 1, 2t + 1

C. t - 1, 2t -1 — Correct Option

Solution: (c)
Solution: (iii)
In B-tree internal node other than root is at least half-full i.e. the number of children of an internal node is in between t and 2t for given order t. which is nothing but
t <= number of children <= 2t equivalent to t-1 <= number of keys/children <= 2t - 1

D. t + 1, 2t - 1

Q.5) Subject: C Programming Max Marks: 1

What will be the output of the following code.

```
#include <stdio.h>
int main()
{
   int a=0, b=1;
   int c = ++a && b-- || (b &&a--);
   printf("%d",++c);
   return 0;
}
```

A. 0

B. 1

C. 2 — Correct Option

Solution: (c)

We need to start the C program from the main function so

int a=0, b=1; // here a and b are declared as integer and defined by 0,1.

int c = ++a && b-- || (b &&a--); // Here c is declared as integer and logical equation is assigned to c. = 1 && 1 || something = 1 || something = 1

Technically C does not work like executing complete statements when it had seen logical and/or. They work like short circuit concepts. example,
if it encounters || if the left-hand side value as TRUE, then without checking the right-hand side it evaluates the result as TRUE. note that associativity for &&/|| is left to right.
same with the logical AND also, if it encounters left-hand side value as FALSE then the result will be FALSE without evaluating right-hand side operand.

printf("%d",++c); // as we get c value 1 and then performing pre-increment upon it so ++1 = 2.
Then 2 is printed.

So, the correct answer is 2.

D. Error

Q.6) Subject: Computer Networks Max Marks: 1

For the two properties of confidentiality and message integrity, which statement is true?

A. They both always hold simultaneously

B. They both can have one without the other — Correct Option

Solution: (B)

Solution:

Yes, you can have one without the other. An encrypted message that is altered in transit may still be con?dential (the attacker cannot determine the original text) but will not have message integrity if the error is undetected. Similarly, a message that is altered in transit (and detected) could have been sent in plaintext and thus would not be con? dential.

C Message integrity cannot have without confidentiality

D None of the above

Q.7) Subject: computer organization Max Marks: 1

Consider the following sequence of instructions.
I1: ADD R1,R2,R1
I2: LW R2,0(R1)
I3: LW R1,4(R1)
I4: OR R3,R1,R2
The sum of (WAR, RAW and WAW) dependencies the given instructions are____

Correct Answer

Solution: (8)
RAW Hazards
(R1) I1 to I2
(R1) I1 to I3
(R2) I2 to I4
(R1) I3 to I4
WAR Hazards
(R2) I1 to I2
(R1) I2 to I3
(R1) I1 to I3
WAW Hazards
(R1) I1 to I3

Q.8) Subject: Theory of Computation,Compiler Design Max Marks: 1

The language generated by the given grammar is
$S \rightarrow aSaa \mid B$
$B \rightarrow bB \mid \varepsilon$

A $L=\{a^nb^na^{2n} \mid n \geq 0\} \cup \{b^n \mid n \geq 0\}$

B $L=\{a^nb^ma^n \mid n, m \geq 0\}$

C $L=\{a^nb^ma^{2n} \mid n, m > 0\}$

D $L=\{a^nb^ma^{2n} \mid n, m \geq 0\}$ Correct Option

Solution: (D)

Explanation:
$S \rightarrow aSaa \mid B$
$B \rightarrow bB \mid \varepsilon$
The strings that are generated by the given grammar is
{b,bb,bbb,abaa,aabaaaa,.....}
For every a there exactly aa will be present in the string and contains any number of b's which separate a's.
The language generated by the given grammar is
$L=\{a^nb^ma^{2n} \mid n, m \geq 0\}$
Option A: $L=\{a^nb^na^{2n} \mid n \geq 0\} \cup \{b^n \mid n \geq 0\}$ False
There is no relation between a's and b's in the given grammar.
Option B:$L=\{a^nb^ma^n \mid n, m \geq 0\}$ False
For every a exactly 2 a's are repeated after b in the grammar.
Option C: $L=\{a^nb^ma^{2n} \mid n, m > 0\}$ False
The given grammar generates epsilon which is not part of the language.

Q.9) Subject: digital logic systems Max Marks: 1

The maximum positive number represented using 8 bits in signed 2's complement is _____

Correct Answer

Solution: (127)

Solution: 127

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, maximum positive number represented by 8 bits will be $2^{(8-1)} - 1 = 2^7-1 = 128-1 = 127$

Q.10) Subject: Theory of Computation,Compiler Design Max Marks: 1

Consider the following regular grammar, which defines a language L:
S → bF
S → aS
F → ε
F → bF
F → aF
The equivalent regular expression for the given regular grammar is

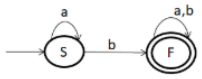
A (a+b)*

B a(a+b)*

C a*b(a+b)*+(a+b)*ba* Correct Option

Solution: (c)

Explanation:
Given Grammar is
S → bF
S → aS
F → ε
F → bF
F → aF
The strings that are generated by the given grammar is = {b,ab, ba, aab,aba,.....}
The equivalent DFA for the grammar is

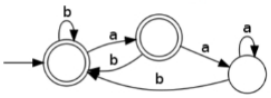


The DFA will accept all the strings contains the substring b.
Option A: (a+b)* ⇒ False generates the strings like a,aa,aaa,.. Which does not contains the string ε
Option B: a(a+b)* ⇒ Every string starts with a mat or may not contain the substring b

D None of these

Q.11) Subject: Theory of Computation,Compiler Design Max Marks: 1

Consider the following DFA.



The language accepted by the given DFA is

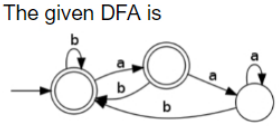
A All strings of a's and b's, such that every string does not end with a.

B All strings of a's and b's, such that every string contains ab as a substring.

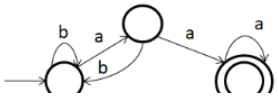
C All strings of a's and b's, such that every string does not end with aa. Correct Option

Solution: (c)

Explanation:
The given DFA is



The Complemented DFA for the given DFA is



DFA accepts all the strings of a's and b's, such that every string ends with aa.
The given DFA accepts all the strings of a's and b's except the strings which are end with aa.
Option A : False the DFA accepts a
Option B : False , DFA accepts bbbb which does not contain ab as a substring.
Option D : False, DFA accepts bbbb which does not contain aab as a substring.

D All strings of a's and b's, such that every string contains aab as a substring.

Q.12) Subject: Discrete Mathematics Max Marks: 1

Consider the following statements for the poset ({2, 4, 6, 9, 12, 18, 27, 36, 48, 60, 72}, |)
S1 : The least upper bound of {2, 9} is 18
S2 : The only minimal element is 2

A S1 is True, S2 is False Correct Option

Solution: (A)
Explanation:
Let S be a subset of A in the poset (A, R). If there exists an element a in A such that sRa for all s in S, then a is called an upper bound.
If a is an upper bound for S which is related to all other upper bounds then it is the least upper bound, denoted lub(S).
All upper bounds of {2, 9} are 18, 36, 72.
And the least upper bound of {2, 9} is 18
In a poset, an element is called minimal if no other elements of the poset is related to it.
The minimal elements are 9,2

B S1 is False, S2 is True

C Both S1 and S2 are False

D None of the above

Q.13) Subject: Data Structures Max Marks: 1

There is one stack s and one queue q and then following operations are performed upon these two.
Push A, enqueue B, push C, pop, pop, enqueue D, push E, dequeue, enqueue F
Then choose the correct option for total number of elements, which are left in the queue and stack in the end.

A 6

B 5

C 4

D 3 Correct Option

Solution: (D)
Solution:
Push A = s:A(top)
Enqueue B = q:B(head)
Push C = s: A C(top)
Pop = top element C is deleted from stack then s:A(top)
Pop = A is deleted from stack then stack will become empty
Enqueue D = q: B(head), D
Push E = s: E(top) → 1
Dequeue = B is deleted from queue then q: D(head)
Enqueue F = q: D(head) F → 2
At last there will be 3 elements left. So answer is 3.
So, the correct answer is 3.

Q.14) Subject: Algorithms Max Marks: 1

The time complexity of an algorithm is given by the following recurrence relation is best described by
T(n)=T(n/2)+ nlogn

A O(n logn) Correct Option

Solution: (A)
Solution:
T(n)=T(n/2)+ nlogn
In the above recurrence relation a=1,b=2, k=1, p=1
Here $a < b^k$
By applying masters theorem we get T(n)=Θ(n logn), as Θ(n logn) is not present in the options, therefore, O(n logn) is the most appropriate option.

B $\Theta(n)$

C $O(n^2)$

D None of the above

Q.15) Subject: computer organization Max Marks: 1

Consider a 32-bit microprocessor, with a 16-bit external data bus, driven by an 8-MHz input clock. Assume that this microprocessor has a bus cycle whose minimum duration equals four input clock cycles. What is the maximum data transfer rate across the bus that this microprocessor can sustain, in Megabytes/s?

Correct Answer

Solution: (4)

Answer:4

Explanation:

Clock cycle = 1/8MHZ = 125ns

Bus Cycle = 4*125ns = 500ns

2-bytes are transferred for every 500ns

$\Rightarrow$ 2B = 500ns

$\Rightarrow$ 2B = 500×10^{-9} Sec

One Sec = $2B/(500 \times 10^{-9})$ = 4MB

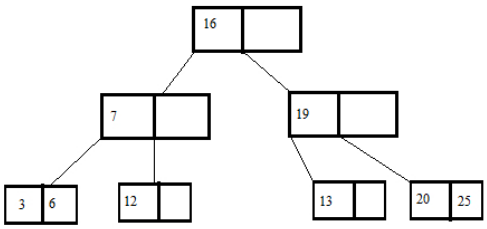
Transfer rate = 4MB/S

Q.16) Subject: DBMS Max Marks: 1

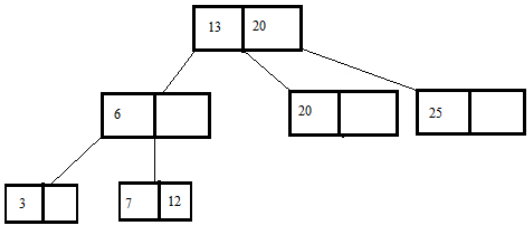
Consider a B-Tree with order as 3. Which of the following will be the correct B-tree for the given key value sequence?

12, 13, 7, 16, 19, 20, 25, 3, 6

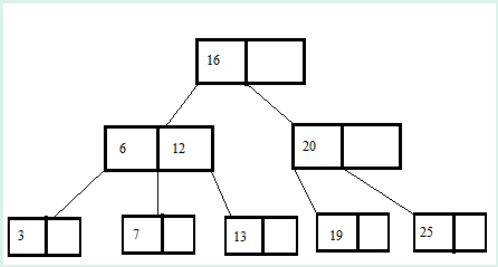
A



B



C Correct Option

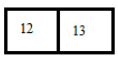


Solution: (C)

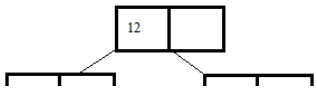
Solution:

Given that, B tree is of order 3, therefore, it can have max 2 keys and 3 children. On inserting keys with the given order, the steps will be as follows:

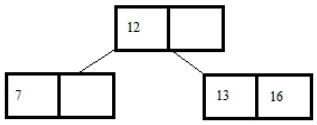
I. On inserting 12 and 13:



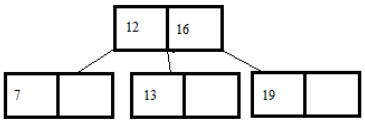
II. On inserting 7, we need to split the node as only 2 keys could get accomodated in a node. Thus, we will split the node from middle which results in:



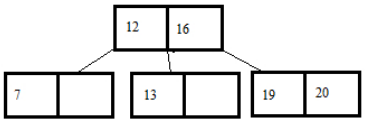
III. On inserting 16:



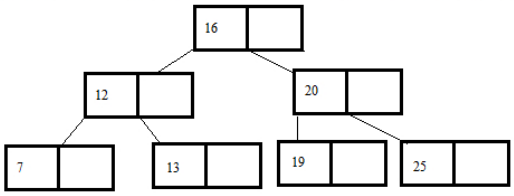
IV. On inserting 19, we need to split the node. The resulting tree will be:



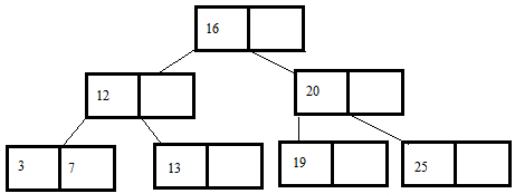
V. On inserting 20:



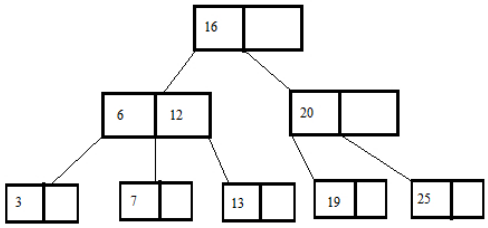
VI. On inserting 25, we need to split two nodes. Thus the resulting tree will be:



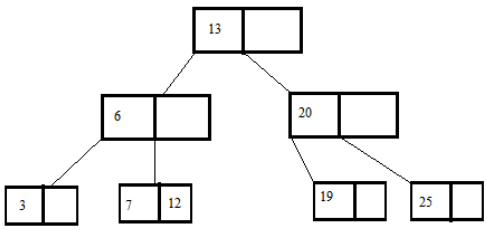
VII. On inserting 3 we will get:



VIII. On inserting 6, we need to split the node. Thus the final tree will be:



D



Q.17)

Subject: Computer Networks | Max Marks: 1

Which of the following statements are true?

A **DNS query can be resolved on the internet both iteratively and recursively** — Correct Option

Solution: (A)

Explanation:

Yes, for resolving DNS query both the methods are possible recursive as well as iterative. In a recursive query, the DNS server will resolve the query by asking the above servers when it does not have the answer. In an iterative query, DNS client has to fetch the individual servers.

DNS uses UDP as the transport layer protocol.

HTTP is stateless while BGP is stateful protocol.

HTTP normally uses TCP for running.

B DNS is a critical infrastructure of the internet and so runs on TCP

C HTTP 1.0 and BGP are examples of stateless protocols

D HTTP is much faster when run over UDP

Q.18) Subject: Algorithms Max Marks: 1

Which of the following has the best execution time in the best case

A Bubble Sort

B Quick Sort

C Merging of two sorted arrays of equal size into one

D Determining the median of a sorted array Correct Option

Solution: (D)

Solution:

In the best case for Bubble Sort when the array is already sorted it occurs when the array is already sorted the time complexity is O(n).

Quicksort best case occurs when the pivot is selected in such a way that it is median of the array the time complexity of such a case is O(nlogn).

If we take the two lists to be of size n then the time complexity to merge two such lists are O(n).

If the array is already sorted and the size if known then the median of the array is the element at the middle index or the average of the elements represented by the two middle elements, this can be determined in O(1) time, therefore, this is the fastest among all the other operations.

Q.19) Subject: computer organization Max Marks: 1

The 5 stages of the processor have the following latencies:

	Fetch	Decode	Execute	Memory	Writeback
a.	300ps	400ps	350ps	500ps	100ps

Assume that when pipelining, each pipeline stage costs 20ps extra for the registers between pipeline stages.
Calculate the difference between the cycle time of a non-pipelined processor to the pipelined processor.

Correct Answer

Solution: (1130)

Explanation:

Non-pipelined Processor Cycle-time: there is no pipelining, so the cycle-time has to allow an instruction to go through all the stages of each cycle. Therefore: a. CT = 1650ps

Pipelined processor Cycle Time: Pipelining to 5 stages reduces the cycle time to the length of the longest stage. Additionally, the cycle time needs to be slightly longer to accommodate the register at the end of the stage. a. CT = 520ps

Difference is 1130PS

Q.20) Subject: Discrete Mathematics Max Marks: 1

Determine whether each of the following relations are reflexive, symmetric and transitive

I. Relation R in the set A = {1, 2, 3...13, 14} defined as

R = {(x, y): 3x – y = 0}

II. Relation R in the set N of natural numbers defined as

R = {(x, y): y = x + 5 and x < 4}

A Both I and II are reflexive, symmetric and transitive

B I is only reflexive and symmetric and not transitive and II is reflexive, symmetric and transitive

C Neither I and II are reflexive, symmetric and transitive

D None of the above Correct Option

Solution: (D)

Explanations:

I. $A = \{1, 2, 3 \ldots 13, 14\}$

$R = \{(x, y): 3x - y = 0\}$

$\therefore R = \{(1, 3), (2, 6), (3, 9), (4, 12)\}$

R is not reflexive since $(1, 1), (2, 2) \ldots (14, 14) \notin R$.

Also, R is not symmetric as $(1, 3) \in R$, but $(3, 1) \notin R$. $[3(3) - 1 \neq 0]$

Also, R is not transitive as (1, 3), (3, 9) ∈R, but (1, 9) ∉ R.

[3(1) − 9 ≠ 0]

Hence, R is neither reflexive, nor symmetric, nor transitive.

(ii) R = {(x, y): y = x + 5 and x < 4} = {(1, 6), (2, 7), (3, 8)}

It is seen that (1, 1) ∉ R.

∴R is not reflexive.

(1, 6) ∈R

But,

(6, 1) ∉ R.

∴R is not symmetric.

A relation is said to be transitive if (a,b)∈R and (b,c)∈R implies (a,c)∈R for all a,b,c. In this relation, it is never the case that (a,b)∈R and (b,c)∈R; hence the condition is vacuously true, and the relation is transitive.

Therefore, R is not reflexive, not symmetric *but transitive.*

Q.21) Subject: C Programming Max Marks: 1

What will be the output of the following code.

```
#include <stdio.h>
 int  main()
 {
 enum Months{JAN =1,FEB,MAR,MAY,JUN,JUL};
 enum Months X,Y;
  X= JAN;
  Y = FEB;
 if((X==1)&&(Y==2))
 {
 printf("Enum values are correct");
 }
 printf("\t%d %d",MAY,JUL);
 return 0;
 }
```

A Errors are given.

B Prints values of MAY and JUL

C Enum values are correct 4 6 — Correct Option

Solution: (C)

Solution: Ans is Enum values are correct 4 6

As we know that enum is the user defined data type. If we declare it like this then values to the content are assigned like this.

enum Months{JAN =1,FEB,MAR,MAY,JUN,JUL}; if we start from 1 then FEB=2, MAR=3, MAY=4, JUN=5, JUL=6

enum Months X,Y; // variable X and Y are declared to this user defined data type.

X = JAN;// value of JAN will be assigned to X

Y = FEB;// value of FEB will be assigned to Y

if((X==1)&&(Y==2)) // condition will be true as X and Y are 1,2.

So it simply prints Enum values are correct 4 6.

So, the correct answer is Enum values are correct 4 6.

D Enum values are correct 5 7

Q.22) Subject: Engineering-Mathematics Max Marks: 1

If X is a Poisson variate such that P (X 2) = 9P (X= 4) + 90 P (X= 6), then mean of X is

A 1 — Correct Option

Solution: (A)

Solution 1:

Explanation:

Given P(X=2) = 9P(X = 4) + 90 P(X= 6)

$\frac{e^{-\lambda}\lambda^2}{2!} = 9.\frac{e^{-\lambda}\lambda^4}{4!} + 90.\frac{e^{-\lambda}\lambda^6}{6!}$

$\frac{1}{2!} = 9.\frac{\lambda^2}{4!} + 90.\frac{\lambda^4}{6!}$

$4=3\lambda^2+\lambda^4$

$(\lambda^2+4)(\lambda^2-1)=0$

Mean = λ = 1.

B 2

C 1/2

D 3/2

Q.23) Subject: operating systems Max Marks: 1

A computer has four page frames. The time of loading, time of last access, and the R and M bits for each page are as shown below (the times are in clock ticks)

Page	Loaded	Last ref.	R	M
0	126	280	1	0
1	230	265	0	1
2	140	270	0	0
3	110	285	1	1

When page fault occurs, NRU removes page number ___

Correct Answer

Solution: (2)

Answer: 2

Explanation

When page fault occurs, the operating system inspects all the pages and divide them into 4 categories based on current values of their R and M bits

- Case 0 : not referenced, not modified
- Case 1 : not referenced, modified
- Case 2 : referenced, not modified
- Case 3 : referenced, modified

The priority order to scan for pages for replacement is :

Case 0 > Case 1 > Case 2 > Case 3

Q.24) Subject: operating systems Max Marks: 1

A system has 4 processes and 5 allocatable resource. The current allocation and maximum needs are as follows:

	Allocated	Maximum	Available
Process A	1 0 2 1 1	1 1 2 1 2	0 0 *x* 1 1
Process B	2 0 1 1 0	2 2 2 1 0	
Process C	1 1 0 1 0	2 1 3 1 0	
Process D	1 1 1 1 0	1 1 2 2 1	

The smallest value of x for which this is a safe state is ____.

Correct Answer

Solution: (1)

Explanation:

If x is 0, we have a deadlock immediately.

If x is 1, process D can run to completion.

When it is finished, the available vector is 1 1 2 2 1.

Now A can run to complete, the available vector then becomes 2 1 4 3 2.

Then C can run and finish, return the available vector as 3 2 4 4 2.

Then B can run to complete. Safe sequence D A C B.

Q.25) Subject: DBMS Max Marks: 1

Consider the following schedule:

R1(a), R2(c), W1(a), W1(c), R2(b), W2(b), R2(a), W2(a), R1(b), C1, C2

Which of the following is false about S?

I. S is not recoverable, and changing the order of commits to C2, C1 does not make the schedule recoverable.

II. S is not recoverable, but changing the order of commits to C2, C1 makes the schedule recoverable.

A Only I

B Only II — Correct Option

Solution: (B)
Solution:
In the transaction T2, R2(a) is after W1(a) and R1(b) is after W1(b), so the schedule will remain non-recoverable even after changing the order of commits. Hence, the second statement is false.

C Both I and II

D None of the above

Q.26) Subject: Computer Networks Max Marks: 1

In a CSMA/CD network the length of the cable is 500 metre and cable capacity is 50 Mbps, the speed at which data transmits is 5 x 10 ^6 m/s. What is the minimum frame size in bytes for the CSMA/CD network?

Correct Answer

Solution: (1250)
Ans 1250
Explanation: For the CSMA/CD network
Transmission time >= 2 Propagation time
For the minimum frame size.
Tt = 2 Tp
Datasize/ BW = 2 x (Length / velocity)
Data size/ 50 x 10^6 = 2 x (500 / 5 x 10^6)
= 10000 bits = 1250 Bytes

Q.27) Subject: Theory of Computation,Compiler Design Max Marks: 2

Which of the following languages are regular

I. $L = \{a^n b^l \mid n \geq 100, l \leq 1000\}$
II. $L = \{a^n b^l c^k \mid n+l+k \geq 5\}$
III. $L = \{a^n b^l \mid |n-l| = 2\}$

A I, II and III

B I and II Only — Correct Option

Solution: (B)

Explanation:
$L = \{a^n b^l \mid n \geq 100, l \leq 1000\}$ is Regular. No relation between a's and b's. We can construct the Finite Automata for the given language.
$L = \{a^n b^l c^k \mid n+l+k \geq 5\}$
Possible strings in the language
={abbcc,abbbc,.....}
is Regular. No relation between a's and b's. We can construct the Finite Automata for the given language.
$L = \{a^n b^l \mid |n-l| = 2\}$Non-Regular
absolute(n-l)=2 ⇒ n=2+L or L= 2+n, We need a memory element to prove that n=2+l or l=2+n

C II and III Only

D II Only

Q.28) Subject: digital logic systems Max Marks: 2

Which of the following is an option is the correct representation for the minterms of the following expression?
Boolean Expression: ABD + A'CD' +AB

A $M_1 + M_3 + M_7 + M_{10} + M_{11} + M_4$

B $M_2 + M_6 + M_{12} + M_1 + M_{13} + M_{14}$

C $M_2 + M_6 + M_{12} + M_{13} + M_{14}$

D $M_2 + M_6 + M_{12} + M_{15} + M_{13} + M_{14}$ — Correct Option

Solution: (D)

Solution:
Given boolean expression, there are 4 variable A, B, C and D. In first term variable C is missing, in second term variable B is missing which in term three, variable C and d both are missing.

From first term: ABD
=> ABD(C + C')
=> ABCD + ABC'D => $M_{15} + M_{13}$
From second term: A'CD'
=> A'CD'(B + B')
=> A'BCD' + A'B'CD' => $M_6 + M_2$
From third term: AB
=> AB(C + C')(D + D')
=> ABCD + ABCD' + ABC'D + ABC'D' => $M_{15} + M_{14} + M_{13} + M_{12}$

Hence, the final minterms will be => ABCD + ABC'D + ABCD' + ABC'D' + A'BCD' + A'B'CD' => $M_{15} + M_{14} + M_{13} + M_{12} + M_6 + M_2$

Q.29) Subject: Data Structures Max Marks: 2

The keys are 25, 27, 33, 38, 35, 58, 67, 83, 12, 50, 18, 103, 260 are inserted into an initially empty hash table of length 9. And hash function is given as h(key)mod 9. Here, collisions are resolved by chaining. Then find the average chain length of hash table. (Assume elements are linked with their base addresses).

A 1.444 Correct Option

Solution: (A)
Explanation:

Here, we are not storing any element in the hash table. In hash table only base addresses are stored.
25 mod 9=7, 27 mod 9 = 0, 33 mod 9 =6, 38 mod 9 = 2, 35 mod 9= 8
58 mod 9 = 4, 67 mod 9 = 4, 83 mod 9 =2, 12 mod 9 =3, 50 mod 9= 5
18 mod 9 = 0, 103 mod 9 = 4, 260 mod 9 = 8

0	→ 27→ 18
1	
2	→ 38 → 83
3	→ 12
4	→ 58→ 67→ 103
5	→ 45
6	→ 33
7	→ 25
8	→ 33 → 260

Average chain length = 2+2+1+3+1+1+1+1+1 /9 =13/9 = 1.444

So, the correct answer is 1.444.

B 0.444

C 1.222

D 1

Q.30) Subject: Computer Networks Max Marks: 2

Which of the following is a valid IP host address given the network ID of 191.254.0.0 while using 11 bits for subnetting?

A 191.254.0.32

B 191.254.0.96

C 191.254.1.65 Correct Option

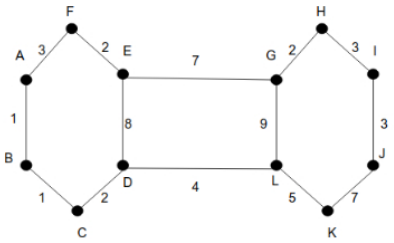
Solution: (C)
Explanation:
191.254.0.0 is network id of class b
Here 16 network bits, 11 subnet bits and 5 host bits
11 bits for subnetting a subnet mask would be 255.255.255.224
We have to consider that the address can be any valid host address from any subnet.
Option a : 191.254.00000000.00100000
Here all host bits are zero not possible for the valid host address.
Option b : 191.254.00000000.01100000
Here all host bits are zero not possible for the valid host address.

Option C: 191.254.00000001.01000001
Here both host, as well as a subnet, is valid

D 191.254.1.64

Q.31) Subject: Algorithms Max Marks: 2

The cost of the MST for the following graph is _____



Correct Answer

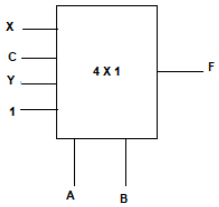
Solution: (33)

Solution: 33
Applying Kruskal's algorithm and then
1. We add the edges AB, BC
2. Then we add the edges FE, CD, GH.
3. Then we add the edges AF, FI, IJ
4. Then we add the edge DL.
5. Then the edge LK is added
6. Then the edge KJ is added.

Now addition of any other edge results in a cycle.
Total cost is =2*1+3*2+3*3+1*4+1*5+1*7=33

Q.32) Subject: digital logic systems Max Marks: 2

Which of the following will be the possible values of X and Y for the function F(A, B, C) = A'B' + A'C + AB + AC'



A X = C', Y = C'

B X = 1, Y = C

C X = C, Y = 1

D None of the above Correct Option

Solution: (D)

Solution:

As we know for a MUX the expression of F is given as:

F = S1'S0' . I0 + S1'S0. I1 + S1S0' . I2 + S1S0 . I3
= A'B' . X + A'B . C + AB' . Y + AB . 1
= A'B'X + A'BC + AB'Y + AB ----------> Equation 1

For the given F, the expression obtained on expanding it will be:
=> A'B' + A'C + AB + AC'
=> A'B'C + A'B'C' + A'BC + A'B'C + ABC + ABC' + ABC' + AB'C'
On aggregating common terms
=> A'B' + A'BC + AB'C' + AB ----------> Equation 2
On comparing Equation 1 and Equation 2 we will get X = 1 and Y = C'
Since there is no such option, therefore, the correct option is (none of the above)

Q.33)

Subject: computer organization | Max Marks: 2

A 5 stage pipelined processor has the following stages:
IF : instruction fetch
ID : instruction decode
EX : execute
MA : memory access
WB : write back
Each stage needs one cycle for all instructions.
I1. Load R5, #200(R2)
I2. Add R3,R5, R6
I3. Subtract R4, R3, R7
I4. Add R7, R3, R5
No. of cycles needed to execute these instructions are_____

Correct Answer

Solution: (12)

Answer:12
Explanation:

	1	2	3	4	5	6	7	8	9	10	11	12	13
I1	IF	ID	EX	MA	WB								
I2		IF	ID	-	-	EX	MA	WB					
I3			IF	-	-	ID	-	-	EX	MA	WB		
I4				IF	-	-	-	-	ID	EX	MA	WB	

Q.34)

Subject: C Programming | Max Marks: 2

What will be the output of the following program.

```
#include<stdio.h>

#include<string.h>

int main()

{

        char str[]= "COURSE";

        char *  ptr;

        ptr=str;

        ptr++;

        ++ *ptr;

        printf("%s", ptr);

        return 0;

}
```

A **COURSE**

B **OURSE**

C **PURSE** — Correct Option

Solution: (C)

Solution:

Let's go with the flow of code for understanding it line by line.

char str[]= "COURSE"; // Here character array is declared and initialized with string "COURSE".

str[0]	str[1]	str[2]	str[3]	str[4]	str[5]
C	O	U	R	S	E

char * ptr; // character pointer ptr is declared

ptr=str; // base address of character array str is assigned to ptr.

ptr++; // post increment to ptr so it will start pointing to str[1] after end of statement

ptr++; // post increment to ptr so it will start pointing to str[1] after end of statement.

++ *ptr; // this is pre-increment to the content of ptr. As we know ptr is pointing to str[1] and content of it is 'o' so increasing it by 1 then it will become 'p'

printf("%s", ptr); // this time ptr is pointing at str[1] so it will start from here only. Also value of str[1] is updated. So it will print PURSE.

So, the correct answer is PURSE.

D URSE

Q.35) Subject: Theory of Computation,Compiler Design Max Marks: 2

Consider the following grammar
R → B R'
R' → '|' R | ε
B → AB'
B' → B | ε
A→ FA''
A' → *A''
A'' → A' | ε
F → a | b | (R)
Follow(F) is

A {*, a, b, (, |,), $} Correct Option

Solution: (A)

Explanation:

Symbol	First
F	a,b,(
A'	*
A''	*,e
A	a,b,(
B	a,b,(
B'	a,b,(,e
R'	|,e
R	a,b,(

Follow(F) = {*, a, b, (, |,), $ }
Follow(F) = First(A'') = { ε } u First(A') = {*}
Substitute { ε } in place of A'' ⇒ Follow(F) = Follow(A)
Follow(A) = First(B') = First(B) u { ε } = First(A)= First(F) ={(, a, b}
Substitute { ε } in place of B'
⇒ Follow(A) = Follow(B)
⇒ Follow(B) = First(R') = {|} U { ε }
Substitute { ε } in place of R'
⇒ Follow(B) = Follow(R) = {$,)}

Finally Follow(F) = {|, a,b, (,), *, $}

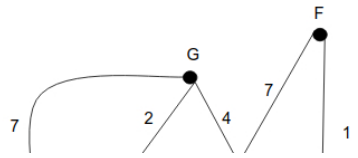
B {*, a, b, (}

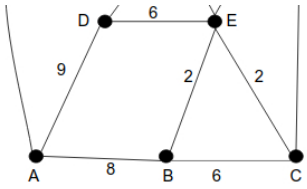
C {*, a, b, (, |, $}

D {*, a, b, (,), $}

Q.36) Subject: Algorithms Max Marks: 2

The sum of the shortest path from A to remaining all the vertices in the below graph is ____





Correct Answer

Solution: (59)
Solution: 59
1. Initially A is removed from the priority queue
G, B, D are relaxed
G.d=7
B.d=8
D.d=9
2. G is removed from the priority queue
E is relaxed
E.d=11.
3. B is removed from the priority queue
C and E are relaxed.
C.d=14
E.d=10
4. D is removed from the priority queue
No vertices are relaxed.
5. E is removed from the priority queue
C and F are relaxed.
C.d=12
F.d=17
6. C is removed from the priority queue
F is relaxed
F.d=13
7. F is finally removed from the priority queue.
Now the sum of the shortest paths for each of the vertices from vertex A is=7+8+9+10+12+13=59

Q.37) Subject: Computer Networks Max Marks: 2

A TCP source starts sending packets using the Slow-Start algorithm, starting with two MSS in the first RTT. Assume that the source sends the packets up to the window size of length N, and that N is sufficiently small so that the source never leaves Slow-Start. Which of the following are true?

A **All of the packets are sent consecutively before the first ACK is received.**

B Assuming a fixed RTT, the time taken to transmit all the packets is approximately RTT × $log_2(N)$ — Correct Option

Solution: (B)
Explanation:
In Slow start every time we double the window and it is mention that we never leave the slow start
Let's assume N= 16
First transmission = 2 MSS
Second transmission= 4 MSS
Third transmission = 8 MSS
Fourth transmission = 16 MSS

So the total number of transmission is equal to the $log_2(N)$ = 4

Time_taken = RTT [fixed] * number of transmission rounds [depends on N]

So, RTT x $log_2(N)$

C **Assuming a fixed RTT, the time taken to transmit all the packets is approximately RTT×N**

D **The window size is increased by one each time a complete window of data is acknowledged.**

Q.38) Subject: Theory of Computation,Compiler Design Max Marks: 2

Consider the following context free grammar
S→ BB
B→ aB | c
Number of states in the canonical collection of LR(0) items.

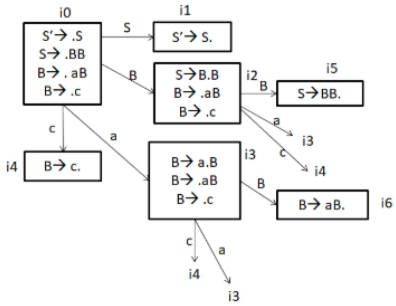
A 5

B 6

C 7 — Correct Option

Solution: (C)

Explanation:



D 8

Q.39) Subject: Engineering-Mathematics Max Marks: 2

The position vector of a point P is r = xi + yj + zk, where x∈N, y∈N, z∈N and a = i+j+ k, where i.j and k are unit vectors in the direction of x, y, z axes respectively. If r.a= 10 then the number of possible positions of P is

A 36 Correct Option

Solution: (A)

Explanation:
The dot product of vectors a and r is given by (x*1)+(y*1)+(z*1)=x+y+z which is given as 10.
We need to find the different values of x,y,z which satisfy the equation x+y+z=10
But here since x,y,z belong to the set of natural numbers N, x,y,z>=1, transforming them to p,q,r such that p=x-1, q=y-1, r=z-1, therefore, we can rewrite the above equation as
p+1+q+1+r+1=10
p+q+r=7
Where p,q,r>=0.
Now the no of solutions to this equation is given by
C(3+7-1,7)=C(9,2)=36.

B 72

C 66

D None of the above

Q.40) Subject: computer organization Max Marks: 2

This problem evaluates the cache performances for different loop orderings. You are asked to consider the following loop, written in C, which calculate the sum of the entries in a 128 by 64 matrix of 32-bit integers:

Loop A

```
sum = 0;
for (i = 0; i < 128; i++)
  for (j = 0; j < 64; j++)
    sum += A[i][j];
```

The matrix A is stored contiguously in memory in row-major order. Row major order means that elements in the same row of the matrix are adjacent in memory as shown in the following memory layout:
A[i][j] resides in memory location [4*(64*i + j)]
Memory Location:

0	4		252	256		4*(64*127+63)
A[0][0]	A[0][1]	...	A[0][63]	A[1][0]	...	A[127][63]

Consider a 4KB direct-mapped data cache with 8-word (32-byte) cache lines. Calculate the number of cache misses that will occur when running Loop A

A 1024 Correct Option

Solution: (A)
Explanation:

Given cache size is 4KB with 8-word (32-byte) cache lines ⇒ NUmber of cache lines are (4KB)/32B ⇒ 128 (Number of cache blocks).
Each element of the matrix can only be mapped to a particular cache location because the cache here is a Direct-mapped data cache.
Matrix A has 64 columns and 128 rows. Since each row of matrix has 64 32-bit integers and each cache line can hold 8 words, each row of the matrix fits exactly into eight (64÷8) cache lines as the following:

0	A[0][0]	A[0][1]	A[0][2]	A[0][3]	A[0][4]	A[0][5]	A[0][6]	A[0][7]
1	A[0][8]	A[0][9]	A[0][10]	A[0][11]	A[0][12]	A[0][13]	A[0][14]	A[0][15]
2	A[0][16]	A[0][17]	A[0][18]	A[0][19]	A[0][20]	A[0][21]	A[0][22]	A[0][23]
3	A[0][24]	A[0][25]	A[0][26]	A[0][27]	A[0][28]	A[0][29]	A[0][30]	A[0][31]
4	A[0][32]	A[0][33]	A[0][34]	A[0][35]	A[0][36]	A[0][37]	A[0][38]	A[0][39]
5	A[0][40]	A[0][41]	A[0][42]	A[0][43]	A[0][44]	A[0][45]	A[0][46]	A[0][47]
6	A[0][48]	A[0][49]	A[0][50]	A[0][51]	A[0][52]	A[0][53]	A[0][54]	A[0][55]
7	A[0][56]	A[0][57]	A[0][58]	A[0][59]	A[0][60]	A[0][61]	A[0][62]	A[0][63]
8	A[1][0]	A[1][1]	A[1][2]	A[1][3]	A[1][4]	A[1][5]	A[1][6]	A[1][7]
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Loop A accesses memory sequentially (each iteration of Loop A sums a row in matrix A), an access to a word that maps to the first word in a cache line will miss but the next seven accesses will hit. Therefore, Loop A will only have compulsory misses ((128×64)÷8 ⇒ 1024 misses).

B 256

C 8192

D None of these

Q.41) Subject: Algorithms Max Marks: 2

Order the following functions in increasing order of asymptotic complexity

1. $f_1(n)=(\log(\log(\log n)))^2$
2. $f_2(n)=(\log n)^3$
3. $f_3(n)=(n^3+2n+3)^{\log n}$
4. $f_4(n)=(3n^2+2n+5)^{100}$

A f_1, f_2, f_3, f_4.

B f_1, f_2, f_4, f_3. Correct Option

Solution: (B)

Solution

To check for growth of any given functions which are complex an easy method is to substitute a very large value for n and then compare the result

Let's substitute $n = 2^{2^{2^{10}}}$

$f_1(n)=(\log(\log(\log\ 2^{2^{2^{10}}})))^2$

$=(\log(\log(\ 2^{2^{10}}\ )))^2$

$=(\log(\ 2^{10}\ ))^2$

$=(10)^2$

$=100.$

$f_2(n)=(\log n)^3$

$=(\ 2^{2^{2^{10}}}\ )^3$

$=(\ 2^{3*2^{2^{10}}}\ )$

$f_3(n)=(n^3+2n+3)^{\log n}$

$=((2^{2^{2^{10}}})^3+2*(2^{2^{2^{10}}})+3)^{2^{2^{10}}}$

$=((2^{3*2^{2^{10}}})+(2^{1+2^{2^{10}}})+3)^{2^{2^{10}}}$

$f_4(n)=(3n^2+2n+5)^{100}$

$=(3*(2^{2^{2^{10}}})^2+2*(2^{2^{2^{10}}})+3)^{100}$

$=(3*(2^{2*2^{2^{10}}})+(2^{1+2^{2^{10}}})+3)^{100}$

By seeing the values for f_3 and f_4 we can clearly say that $f_3 > f_4$ as the exponent of $f_3 > f_4$ also the exponent of f_3 is a function of n (log n which increases with increase in n) whereas the exponent of f_4 is

a constant(100).

By comparing the values of f_1 and f_2 we can say that f_1 grows slower than f_2.

Now comparing f_2 and f_3 we can clearly say that f_2 grows slower than f_3.

Therefore the correct order or growth of these functions is $f_1 < f_2 < f_4 < f_3$.

C f_2, f_1, f_4, f_3.

D f_2, f_1, f_3, f_4.

Q.42) Subject: C Programming Max Marks: 2

Consider the following C program.

```
#include<stdio.h>
int main()
{
  int a;
  char *x;
  x = (char *) &a;
  scanf("%d",&a);
  x[0] = 2;
  x[1] = 3;
  printf("%d",a);
  return 0;
}
```

If character & integer are utilizing 1 byte and 2 bytes memory and values are storing using little endian format in the memory. Then what will be the output of the above code if input is 289.

A 512

B 513

C 770 Correct Option

Solution: (C)

Solution:

As we know that character takes 1 byte while integer takes 4 bytes/ 2bytes it depends on the type of machine. So start with the main()
int main() // starting with main function
int a; // declaring a as integer type
char *x; // declaring x as character pointer
x = (char *) &a; // typecasting a as character and assigning it to x as x is the character pointer.
scanf("%d",&a); // input for a is taken from keyboard as integer so 289 is given to it.
Binary value of 289 = 1, 0010, 0001.
As we have typecasted a as character so first character pointer will point to the first byte of it from LSB so initially

x[0]	0010, 0001
x[1]	0000, 0001

x[0] = 2; // here we are replacing x[0] by binary value of 2 i.e. 0010
x[1] = 3; // here we are replacing x[1] by binary value of 3 i.e. 0011

So, this will look like this:

x[0]	0000, 0010
x[1]	0000, 0011

printf("%d",a); // here we are printing a as integer so it will take all the bytes together then value will be
0000, 0011, 0000, 0010 = 512+256+2 = 770

So, the correct answer is 770.

D 882

Q.43) Subject: Discrete Mathematics Max Marks: 2

Given the following statements:

S1: It possible for a simple connected graph containing a bridge to be Hamiltonian.
S2: Suppose G is a simple graph with degree sequence (3;3;3;3;3;3;6). Let u and v be two non-adjacent vertices with degree 3, so that deg(u)+deg(v) = 6 <= 7. Since the number of vertices is 7, it follows by Ore's Theorem that G is not Hamiltonian.
Which of the following is correct?

A S1 is True and S2 is False

B S1 is False and S2 is True

C None of them is True — Correct Option

Solution: (C)
Explanation :
A bridge is an edge whose removal would disconnect the graph.Clearly, any Hamiltonian cycle in a graph with a bridge would have to include the bridge.But a bridge is not part of any cycle(since if it were,its removal would not disconnect the graph). So any graph with a bridge is not Hamiltonian.
This is an incorrect use of Ore'sTheorem, which states that if G is a simple graph with n3 vertices and deg(u)+deg(v) n for each pair of non-adjacent vertices u and v, then G is Hamiltonian.
The theorem cannot be used to prove that a graph is not Hamiltonian. Indeed, a graph with degree sequence(3;3;3;3;3;3;6) is as shown, and it is easy to see that it is Hamiltonian.

D Both of them is True

Q.44) Subject: Theory of Computation,Compiler Design Max Marks: 2

Which of the following languages is/are CFL

I. $L= \{a^n b^m c^k \mid n=m \text{ or } m \leq k\}$
II. $L= \{a^n b^m c^k \mid k=|n-m|\ \}$
III. $L= \{a^n b^m \mid 2n \leq m \leq 3n\}$

A I and II Only

B II and III Only

C I and III Only

D I, II and III — Correct Option

Solution: (D)

Explanation:

I. $L= \{a^n b^m c^k \mid n=m \text{ or } m \leq k\}$ CFL

We can construct a one stack NPDA where we can check for n=m or $m \leq k$

Case 1: Push all a's in to the stack and pop a for each b and skip all c's

Case 2: Skip all a's and push all b's in to the stack pop b for each c then skip the remaining c's

II. $L= \{a^n b^m c^k \mid k=|n-m|\ \} \Rightarrow L= \{a^n b^m c^k \mid k+n=m \text{ or } k+m=n\}$ CFL

We can construct a NPDA for the language with one stack

III. $L= \{a^n b^m \mid 2n \leq m \leq 3n\}$ CFL

A CFG for L is G = ({S1}, {a, b}, S1, P1) with production P1 as:

$S \rightarrow aSbb|aSbbb|\varepsilon$

Q.45) Subject: operating systems Max Marks: 2

After an interrupt occurs, hardware needs to save its current state (content of registers etc.) before starting the interrupt service routine. One issue is where to save this information.
Here are two suggestions:
I. Put them in some special purpose internal registers which are exclusively used by interrupt service routine.
II. Put them on the stack of the interrupted process.
Which of the above suggestion(s) have issues?

A I only

B II only

C Both I and II — Correct Option

Solution: (C)
Explanation:
I. The problem is that a second interrupt might occur while OS is in the middle of handling the first one. OS must prevent the second interrupt from overwriting the internal registers. This strategy leads to long dead times when interrupts are disabled and possibly lost interrupts and lost data.
II. The stack of the interrupted process might be a user stack. The stack pointer may not be legal which would cause a fatal error when the hardware tried to write some words at it. Also, OS has to be careful to clean up the stack later, to avoid leaking information.

D None of the above

Q.46) Subject: Algorithms Max Marks: 2

Which of the following is not the longest common subsequence in the given pair of strings.

"baadcas"
"bbadsac"

A baac

B bada

C badc

D None of the above — Correct Option

Solution: (D)

Solution:

If the two strings are considered to be x and y then, LCS can be calculated using the below recurrence relation.

$$c[i,j] = \begin{cases} 0 & \text{if } i = 0 \text{ or } j = 0 \\ c[i-1][j-1] + 1 & \text{if } i,j > 0 \text{ and } x_i = y_i \\ max(c[i,j-1], c[i-1,j]) & \text{if } i,j > 0 \text{ and } x_i \neq y_j \end{cases}$$

Following is the Dynamic Programming table.

	0	b	a	a	d	c	s
0	0	0	0	0	0	0	0
b	0	1	1	1	1	1	1
b	0	1	1	1	1	1	1
a	0	1	2	2	2	2	2
d	0	1	2	2	3	3	3
s	0	1	2	2	3	3	4
c	0	1	2	2	3	4	4

The Possible Longest Common Subsequences are

baac
bada
badc
bads

Q.47) Subject: Engineering-Mathematics Max Marks: 2

$$\lim_{x \to 1} \frac{x^2 - 1}{|x - 1|} =$$

A 2

B -2

C ∞

D Does not exist — Correct Option

Solution: (D)

Explanation:

At x=1 the numerator and denominator both tend to 0,

Evaluating the left limit as x->1$^-$, |x-1| is -ve therefore

$\frac{x^2-1}{|x-1|} = \frac{(x-1)(x+1)}{-(x-1)} = -(x+1)$ which comes to -2.

Evaluating the right limit as x->1$^+$, |x-1| is +ve therefore

$\frac{x^2-1}{|x-1|} = \frac{(x-1)(x+1)}{(x-1)} = (x+1)$ which comes to 2.

Left limit≠Right limit, therefore limit does not exist.

Q.48) Subject: DBMS Max Marks: 2

Which of the following is correct decomposition to be in BCNF

Admission(Enroll_id, admission_date, admission_time, staff_no, room_no)
Enroll_id, admission_date -> admission_time, staff_no, room_no
Staff_no, admission_date, admission_time -> Enroll_no, room_no
Staff_no, admission_date -> room_no

A R1(Enroll_no, admission_date, admission_time, room_no), R2(staff_no, admission_date, room_no)

B R1(Enroll_no, admission_date, admission_time, staff_no), R2(admission_date, room_no)

C R1(Enroll_no, admission_date, admission_time, staff_no), R2(staff_no, admission_date, room_no) Correct Option

Solution: (C)
Solution:
The last functional dependency "Staff_no, admission_date -> room_no" violates BCNF rule as LHS is not a super key. To remove this dependency, decompose the relation and set up a relation for the non – key determinant with attributes functionally dependent on it. Hence, one of the relations should be: (staff_no, admission_date, room_no). Hence, we can eliminate option (ii) and (iv). Since possible candidate keys are AB and BCD, therefore, the relations possible in BCNF are:
R1(Enroll_no, admission_date, admission_time, staff_no), and
R2(staff_no, admission_date, room_no).

D R1(Enroll_no, admission_date, admission_time, staff_no), R2(staff_no, room_no)

Q.49) Subject: Discrete Mathematics Max Marks: 2

S1 : Suppose A and B are finite sets with $|A \cup B| < |A|+|B|$. We can say, A and B have an element in common.

S2 : Suppose A and B are finite sets. We can say, $|A \times B| = |A| \times |B|$.

A S1 is True but S2 is False

B S1 is True and S2 is True Correct Option

Solution: (B)
Solution:
S1:
Let A and B do not have an element in common. This would mean that the intersection $A \cap B = \emptyset$ (empty set).
Thus $|A \cap B| = 0$. But then $|A \cup B| = |A|+|B|-|A \cap B| = |A|+|B|$.
This contradicts with $|A \cup B| < |A|+|B|$.
Thus our assumption about A and B not having common element was wrong. So A and B do have a common element.

S2:
By definition of Cartesian product $A \times B = \{(a,b) | a \in A, b \in B\}$
Let set A contain n elements, that is $|A|=n$.
Let set B contain m elements, that is $|B|=m$.
Then, by Product Rule, set of pairs $A \times B$ contains n.m elements.
Thus $|A \times B| = |A| \times |B|$

C S1 is False but S2 is True

D S1 is False and S2 is False

Q.50) Subject: Computer Networks Max Marks: 2

In an IPV4 packet, the value of MF = 1 and the MTU of the network is 500 Bytes. The header size is 20 Bytes. The packet size is big enough so we need to divide in multiple fragments. If the fragment offset of some packet is 180 then what will be the fragment number?

A 1

B 2

C 3

D 4 Correct Option

Solution: (D)
Explanation:
MF= 1 means it is an intermediate fragment. If a fragment is intermediate it means that the fragment size is similar to the previous fragments.
MTU is 500 bytes The maximum allowed size of the packet is 480 + 20 bytes header
First fragment offset number will be = 480/8= 0 - 59
Second fragment offset number will be= 480/8= 60 -119
Third Fragment offset number will be = 480/8 = 120- 179
Fourth fragment offset number will be = 480/8= 180 - 239

Q.51) Subject: operating systems Max Marks: 2

The FastFile file system uses an inode array to organize the files on disk. Each inode consists of a user id (2 bytes), three time stamps (4 bytes each), protection bits (2 bytes), a reference count (2 byte), a file type (2 bytes) and the size (4 bytes). Additionally, the inode contains 13 direct indexes, 1 index to a 1st-level index table, 1 index to a 2nd-level index table, and 1 index to a 3rd level index table. The file system also stores the first 436 bytes of each file in the inode.
Assume a disk sector is 512 bytes, and assume that any auxiliary index table takes up an entire sector, the maximum size for a file in this system is :

A 1 GB Correct Option

Solution: (A)
Explanation:
The first thing we need to determine is the size of an index (2 bytes or 4 bytes). Given that we have a 3-level indexing scheme, we can quickly compute the number of sectors that we can get by 2 byte index and 4 bytes indexes. We will see that the 2-byte indexing does not work. This would give we up to 256 indexes per sector, with a maximum file size of 436 + 13 * 512 + 1 * 256 * 512 + 1 * 256 * 256 * 512 + 1 * 256 * 256 * 256 * 512.
The problem with this analysis is that we have far more disk sector for this scheme to work than can be encoded in 2 bytes. We can use 3 bytes, but this can get ugly.
So, we go with 4-byte indexes, giving us 128 indexes per sector, and the correct answer is: 436 + 13 * 512 + 1 * 128 * 512 + 1 * 128 * 128 * 512 + 1 * 128 * 128 * 128 * 512 = 1082203060, roughly 1GB.

B 2 GB

C 512 MB

D 4 GB

Q.52) Subject: Engineering-Mathematics Max Marks: 2

$\int_0^2 |1-x|dx =$_____

A 0

B 1 Correct Option

Solution: (B)

Explanation:

$\int_0^2 |1-x|dx = \int_0^1 |1-x|dx + \int_1^2 |1-x|dx$

$\int_0^1 (1-x)dx + \int_1^2 -(1-x)dx$

$\left[x - \frac{x^2}{2}\right]_0^1 + \left[x + \frac{x^2}{2}\right]_1^2$

=½+½=1

C 1/2

D 3/2

Q.53) Subject: Discrete Mathematics Max Marks: 2

Suppose predicate formulae are given by S1 and S2. And N1 and N2 denote the truth values False and True respectively.

For the given predicates below:

S1: $\forall z[P(z) \rightarrow (\neg Q(z) \rightarrow P(z))]$
S2: $\exists y[P(y) \wedge (Q(y) \wedge R(y))]$

Which of the following option is correct?

A The negation of S1 is N2 and S2 is N1 respectively.

B The negation of S1 is N1 and S2 is N2 respectively.

C The negation of S2 is N2 but negation of S1 is not N1.

D None of the above. Correct Option

Solution: (D)

Explanation: The negation of S1 is N1 (contradiction) but negation of S2 is contingency.

$\neg\forall z[P(z) \rightarrow (\neg Q(z) \rightarrow P(z))]$
$\equiv \exists z[\neg(P(z) \rightarrow (\neg Q(z) \rightarrow P(z)))]$
$\equiv \exists z[\neg((\neg P(z) \vee (\neg Q(z) \rightarrow P(z))))]$

≡∃z[¬(¬P(z))∧(¬(¬Q(z)→P(z)))]
≡∃z[P(z)∧(¬(¬(¬Q(z))∨P(z)))]
≡∃z[P(z)∧(¬(Q(z)∨P(z)))]
≡∃z[P(z)∧(¬(Q(z))∧¬(P(z)))]
≡∃z[(P(z)∧¬(P(z)))∧(¬Q(z))]
≡False

¬∃y[P(y)∧(Q(y)∧R(y))]
≡∀y[¬(P(y)∧(Q(y)∧R(y)))]
≡∀y[(¬P(y))∨¬(Q(y)∧R(y))]
≡∀y[(¬P(y))∨((¬Q(y))∨(¬R(y))]
≡Contingency (depending on the truth values of P(y), Q(y) and R(y))

Q.54) Subject: DBMS Max Marks: 2

Consider the following oracle relations:
ONE (x, y) = {<1, 1>, <2, 2>, <3 ,2>, <4, 3>}
TWO (x, y) = {<1, 1>, <2, 1>, <3, 2>, <4, 3>, <5, 4>, <6, 5>}
Consider the following SQL queries I and II:
I: SELECT y FROM TWO EXCEPT (SELECT y FROM ONE);
II: SELECT y FROM ONE EXCEPT ALL (SELECT y FROM TWO);
What is the number of tuples returned by the two SQL queries when applied to the instances above?

A **1, 2**

B **2, 2**

C **2, 3**

D **2, 1** Correct Option

Solution: (D)
Solution:
EXCEPT clause returns all records present in the first table and absent in the second one.
But this clause eliminates duplicates and cannot be used as a subject to a DML operation. While EXCEPT ALL returns all records from the first table which are not present in the second table, leaving the duplicates as it is.
The output of the I query will be:

Y
4
5

Since, it will neglect the duplicates and will print only those values of Y which are in TWO but not in ONE.
The output of the II query will be:

Y
2

This contains EXCEPT ALL, therefore, it will not neglect the duplicate values in the tuple and will print the Y value which are in ONE but not in TWO. The value of Y = 2 is repeated in relation ONE while it occurs only one time in relation TWO. Therefore, this duplicate will get print in the given case(EXCEPT ALL).
Hence, the number of tuples(cardinality) returned by I and II are 2, 1 respectively.

Q.55) Subject: operating systems Max Marks: 2

Consider the following statements:
S1: Deadlock avoidance rarely used as a practical solution to the deadlock problem as it requires far too much overhead.
S2: If round-robin schedulers uses small size quantum, it improves the response time.

A **S1 is true, S2 is false**

B **S1 is false, S2 is true**

C **Both S1 and S2 are true** Correct Option

Solution: (C)
Explanation:
Deadlock avoidance requires far too much overhead.
Every time a resource is requested, this complicated algorithm examines multiple scenarios for future use of resources to determine whether or not deadlock could possibly occur if the resource request is granted. Further, it requires that the maximum resource requirement for each process is known in advance, a maximum requirement that may or may not occur depending on which path in the program follows through the code.

A large time quantum will reduce the overhead of context switching since interrupts will be generated with relatively long intervals, hence there will be fewer interrupts. However, a short job will have to wait longer time on the ready queue before it can get to execute on the processor.
With a short time quantum, such a short job will finish quicker and produces the result to the end user faster than with a longer time quantum.

D **None of the above**

Q.1) Subject: General Aptitude Max Marks: 1

FISSION: FUSION

In the above question, a related pair of words or phrases is followed by lettered pairs of words or phrases. Select the lettered pair that best expresses a relationship similar to that expressed in the original pair.

A **Implosion : Explosion**

B **Separation : Combination** Correct Option

Solution: (B)

Solution: The first word of each pair refers to breaking up of something and the second pair refers to joining of something. Hence, option B is the right choice.

C **Intrusion : Extrusion**

D **Enemy : Friend**

Q.2) Subject: General Aptitude Max Marks: 1

$\frac{7}{2} : \frac{4}{3} : \frac{6}{5}$ with this ratio a business started by A,B and C . Investment increase 50% by A after the period of 4 months. What should be the share of B in profit if firm earned ₹ 43200 as a profit?

A **4200**

B **4800**

C **7200**

D **8000** Correct Option

Solution: (D)

Solution: The ration given is $\frac{7}{2} : \frac{4}{3} : \frac{6}{5} = 105 : 40 : 36$

Let us suppose that investment done by A be ₹ $105x$, B be ₹ $40x$ and C be ₹ $36x$

So the ratio of investments would be:

$(105x * 4) + \{(50\% * 105x + 105x) * 8\} : (40x * 12) : (36x * 12)$

$= (420x + 1260x) : 480x : 432x$

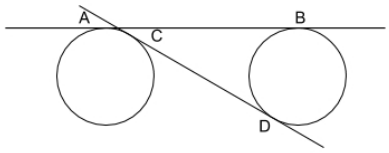
$= 1680x : 480x : 432x$

$= 35 : 10 : 9$

Profit share of B $= 43200 * \frac{10}{54} =$ ₹ 8000

Q.3) Subject: General Aptitude Max Marks: 1

If two equal circles of radius $5\ cm$ have two common tangent AB and CD which touch the circle on A, C and B, D respectively shown in the figure. If CD = $24\ cm$, find the length of AB.



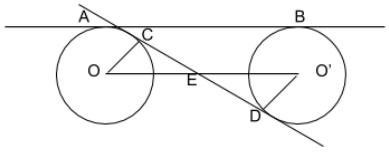
A **27 cm**

B **25 cm**

C **26 cm** Correct Option

Solution: (C)

Solution:



OC = O'D = $5\ cm$ (radius)

CD = $24\ cm$

ΔCOE and $\Delta EO'D$ are similar therefore OE = O'E and CE = ED = $12\ cm$

In $\Delta COE'$; $OE'^2 = CE'^2 + OC'^2$

$= 12^2 + 5^2 = 169$

$OE = 13$

Therefore, $OO' = OE + EO' = 13 + 13 = 26\ cm$

D 30 cm

Q.4) Subject: General Aptitude Max Marks: 1

When the trade was brisk. He worked hard and made his fortune; he believes in making hay while the sun shines.
Choose the option which is closest in meaning to the underlined phrase in the above sentence.

A **Taking advantage of a favorable opportunity** Correct Option

Solution: (A)
Solution: Idiom 'make hay while the sun shines' means: to use favorable opportunities or conditions to our benefit/ to act when the time is right Example: Having being taught make hay while the sun shines, the young employee decided to work hard on the new project and prove himself.

B **Earning money at the cost of others**

C **Taking advantage of the inflationary trends**

D **Earning money through dishonest means**

Q.5) Subject: General Aptitude Max Marks: 2

'Poverty is ... more restrictive and limiting than anything else. If poverty and low standards continue then democracy, for all its fine institutions and ideals, ceases to be a liberating force. It must, therefore, aim continuously at the eradication of poverty and its companion unemployment. In other words, political democracy is not enough. It must develop into economic democracy also' Which of the following is not implied by the above passage?

A **Democracies should aim to eliminate poverty**

B **Democracy has ceased to be a liberating force** Correct Option

Solution: (B)
Solution: Option B is clearly not implied in the paragraph. The paragraph does talk about how it should democracy encompasses economic liberation as well but it never labels democracy as a force that has ceased to have any effect.

C **Poverty and unemployment go hand in hand**

D **Political democracy should develop into economic democracy**

Q.6) Subject: General Aptitude Max Marks: 2

A rectangular swimming pool is 48 m long and 20 m wide. The shallow edge of the pool is 1 m deep. For every 2.6 m that one walks up the inclined base of the swimming pool, one gains an elevation of 1 m. What is the volume of water (in cubic meters), in the swimming pool? Assume that the pool is filled upto the brim.

A **528**

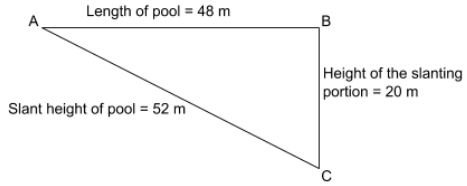
B **960**

C **6790**

D **10560** Correct Option

Solution: (D)

Solution: For every $2.6\ m$ that one walks along the slant part of the pool, there is a height of $1\ m$ that is gained. Also, since the length of the pool os $48\ m$ we get the following dimensions of the pool.



$\frac{AC}{BC} = \frac{2.6}{1}$

$\Rightarrow AC = 2.6 * BC$

In ΔABC

$\Rightarrow (AC)^2 = (AB)^2 + (BC)^2$

$\Rightarrow (2.6 * BC)^2 = (48)^2 + (BC)^2$

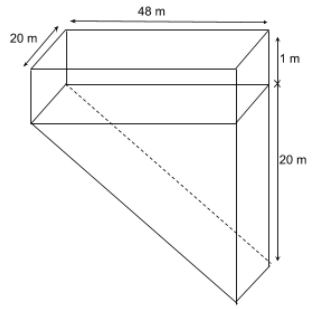
$=> 6.76(BC)^2 - (BC)^2 = 2304$

$=> (BC)^2 = \frac{2304}{5.76} = 400$

$=> BC = 20\ m$

Therefore, $AC = 2.6 * 40 = 52\ m$

The pool would look as given in the figure below:



The volume of water in the pool = volume of the upper part + volume of the standard triangular vessel $= (\frac{1}{2} * 48 * 20) * 20 + (48 * 20 * 1)$

$=> 48 * 20 * 11 = 10560\ m^3$

Q.7) Subject: General Aptitude Max Marks: 2

A sum of 4 is made up of 20 coins that are either 10paise coins or 60 paise coins. Find out how many 10 paise coins are there in the total amount.

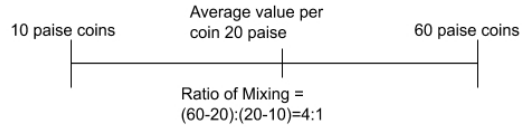
A 10

B 13

C 16 Correct Option

Solution: (C)

Solution: The average value of a coin is 20 paise and there are only 10 paise and 60 paise coins in the sum. Hence, the ratio of the number of 10 paise coins to 60 paise coins would be $4:1$.



Since there are a total of 20 coins, the number of 10 paise coins would be $4 * \frac{20}{5} = 16$ coins.

D 15

Q.8) Subject: General Aptitude Max Marks: 2

Vipin is in the class when Prashant is in the lab.

A. Prashant is in the lab.
B. Vipin is in the park.
C. Prashant is not in the lab.
D. Vipin is in the class.

A CA

B AD Correct Option

Solution: (B)

Solution: B Solution: This conforms to the general case 'When X then Y'. So When Prashant is in the lab, then Vipin is in the class or Vipin is not in the class then Prashant is not in the lab. So AD is correct.

C BC

D BD

Q.9) Subject: General Aptitude Max Marks: 2

P is a natural number of at least 6 digits and its leftmost digit is 7. When this leftmost digit is removed from P, the number thus obtained is found to be 1/21 times of P. What is the product of all the non zero digits of P?

A 126

B 105 Correct Option

Solution: (B)

Solution: Let $P = 7 * 10^{5+n} + k$ where n, k are whole numbers. After removal of the leftmost digit the new number will be k.

According to the question:

$$7 * 10^5 * 10^n + k = 21k$$

$$7 * 10^5 * 10^n = 20k$$

$$\frac{7*10^5*10^n}{20} = k$$

$$k = 35000 * 10^n$$

$$P = 735000 * 10^n$$

The required product $= 7 * 3 * 5 = 105$

C 60

D 72

Q.10) Subject: General Aptitude Max Marks: 2

Three cooks have to make 80 idlis. They are known to make 20 pieces having working together. The first cook began working alone and made 20 pieces having worked for sometime more than three minutes. The remaining part of the work was done by the second and third cook working together. It took a total of 8 minutes to complete the 80 idlis. How many minutes would it take the first cook alone to cook 160 idlis for a marriage party the next day?

A 16 minutes

B 24 minutes

C 32 minutes Correct Option

Solution: (C)

Solution: Let X1 be the number of Idlis cooked by first cook per minute.
Similarly, X2 and X3.
Time required to cook 160 Idlis by first cook be T.
X1 = 160/T
=> Time required for 20 Idlis = 20/(160/T) = T/8 ---------- (1)
X2+X3 = [(80-20)/{8-(T/8)}]
= 480/(64-T)
X1+X2+X3 = 20
(160/T) + (480/(64-T)) = 20
==> (8/T) + (24/(64-T)) = 1
64t-T^2 = 512-8T + 24T
==> 512 -48T + T^2 = 0
On solving, we get,
T =16,32
Given,
T/8 > 3 ==> T>24 (Given 8 Idlis in more than 3 minutes)
So, T =32.

D 40 minutes

close