

Q.1)

Give the first order predicate calculus of the following statement:

"Some fans follow every cricketer"

Subject: Discrete Mathematics

Max Marks: 1



A

 $\forall(x) [\text{cricketer}(x) \rightarrow \exists(y) [\text{fan}(y) \wedge \text{follows}(y,x)]]$

B

 $\forall(x) [\text{cricketer}(x) \wedge \exists(y) [\text{fan}(y) \rightarrow \text{follows}(y,x)]]$

C

 $\forall(x) [\text{cricketer}(x) \rightarrow \exists(y) [\text{fan}(y) \rightarrow \text{follow}(y,x)]]$

D

None of these

Correct Option

Solution: (D)

Explanation:

A - Every cricketer is followed by some fans.

B - Everything is a cricketer, and is either followed by some fan, or something is not a fan.

C - Every cricketer is followed by some fan, or there is something which is not a fan.

Q.2)

Suppose there is a (non-virtual memory) system that has only 200 Mb of main memory and there are two processes that make the following sequence of requests:

Subject: operating systems

Max Marks: 1



P1

P2

...	...
Request 80Mb;	Request 70Mb;
...	...
Request 60Mb;	Request 80Mb;

Consider the following statements:

Statement 1: P1 requests 80 Mb and then P2 requests 70 Mb. This is a deadlock.

Statement 2: There is no possibility of a deadlock.

Which of the above statements are correct?

A

Only Statement 1 is correct

B

Only Statement 2 is correct

C

Neither Statement 1 nor Statement 2 is correct

Correct Option

Solution: (C)

Explanation :

There can be a deadlock.

One way it can occur is if the execution of P1 and P2 is interleaved so that:

- (1) P1 requests 80Mb and it is granted;
- (2) P2 requests 70Mb and it is granted;
- (3) P1 requests 60Mb;
- (4) P2 requests 80Mb.

At that point (and only then) there is a deadlock. Note that the deadlock does not occur until both processes are fatally blocked.

Note that after step (2) the system is in an unsafe state, and future deadlock is unavoidable, but it is not yet deadlocked.

NOTE:Please note that, after 150 Mb has been allotted to P1 and P2, 50 Mb is remaining, the system is in unsafe state. After this, whichever process requests, **deadlock is inevitable. But**

deadlock hasn't occurred yet, thus S1 is false.

Say P1 requests now, i.e., P1 will have a requesting edge on the resource. The resource is not assigned/allocated until the correct amount is available, which is never. Thus there is a deadlock now.

D

Data insufficient

Q.3)

What will be the output of the C program?

```
#include<stdio.h>
int main()
{
    int i, j, k;
    char *a = 0;
    int *b = 0;
    double *c = 0;
    i = (int)(a + 1);
    j = (int)(b + 1);
    k = (int)(c + 1);
    printf("%d %d %d", i, j, k);
    return 0;
}
```

(Assume program runs in 32-bit compiler)

Subject: C Programming

Max Marks: 1



A

Runtime Error

B

0 0 0

C

Compilation Error

D

1 4 8

Correct Option

Solution: (D)

The null pointer is the only integer literal that may be assigned to a pointer. You may NOT assign arbitrary numbers to pointers:

```
int *p = 0; // okay. assignment of null pointer to p
```

Solution:

Initializing pointer variable to zero is possible. Since the initial address of any data type is zero, So its next address will be the size of data type.

Here a pointer variable *a belongs to char data type, thus i = (int) (a + 1); increase its address by 1 as it belongs to char data type. Thus variable i = 1 .

Here a pointer variable *b belongs to int data type, thus j = (int) (b + 1); increase its address by 4 as it belongs to int datatype. Thus variable j = 4 .

Here a pointer variable *c belongs to double data type, thus k = (int) (c + 1); increase its address by 8 as it belongs to double datatype. Thus variable k = 8 .

Q.4)

Subject: Discrete Mathematics

Max Marks: 1



On a given set of n vertices, how many (labelled) graphs contain exactly m edges?

Note : ${}^nC_m C_m$ is to be interpreted as ${}^{(nCm)}C_m$

If x = nCm, then ${}^{(nCm)}C_m = {}^x C_m = x! / [(x-m)! * m!]$

A

${}^nC_m C_m$

B

${}^mC_n C_2$

C

${}^nC_2 C_m$

Correct Option

Solution: (C)

Explanation:

Since there are, nC_2 possible edges on n vertices, and a graph may or may not have each of these edges, we get that there are $2^{{}^nC_2}$ possible graphs on n vertices.

Now, out of the nC_2 possible edges, we want to choose m ones. So, there are

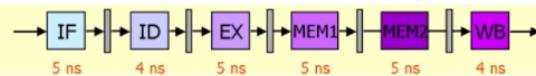
$n^2 C_m$ possible graphs on n vertices having m edges.

D

$m^2 C_n$

Q.5)

Assume that we are going to execute 20000 instructions using the given pipelined system.



The speedup that we can achieve from the pipelined system is _____

A

5

B

5.6

Correct Option

Solution: (B)

Explanation:

Execution time for the Non-pipelined processor is = $28\text{ns} * 20000 = 560 \mu\text{s}$

Execution time for the Non-pipelined processor is = $5\text{ns} * 20000 = 100 \mu\text{s}$

Speedup = $560/100 = 5.6$

C

6

D

4

Q.6)

Which of the following statements is true about the given transaction?

Subject: DBMS

Max Marks: 1

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

Statement I: If the time stamp for T1, T2, T3 is 3, 1, 2 respectively, the schedule is allowed under Timestamp ordering protocol.

Statement II: If the time stamp for T1, T2, T3 is 3, 1, 2 respectively, the schedule is allowed under Thomas Write rule.

A

Only I

B

Only II

Correct Option

Solution: (B)

Solution:

(i) The given schedule S is not allowed under TSP because of W2(A) performed after W3(A). Since the timestamp of WTS(A) = 2 (during the execution of W3(A)) and when we try to perform W2(A) whose current TS is 1 which is lesser than WTS(A) ($1 < 2$). Hence, W2(A) will roll back and, therefore, this schedule S will not be allowed under TSP for given Timestamp order.

(ii) It is allowed in TWR as it will ignore the W2(A) (as at W2(A) current timestamp will be 1 and WTS(A) is 2. Since $2 > 1$, TWR will ignore this. For W1(A), it is according to the given timestamp only. Hence, it will be allowed ($3 > 2$)).

Hence, The given schedule is allowed under TWR but not in TSP.

C

Both I and II

D

Neither I nor II

Q.7)

Assume you have a 2-way set associative cache. There are 1024 blocks in the cache. If you reference a 32-bit physical address.

Each cache block holds 512 bytes. Which set (in decimal) does the data that is brought in go to if the physical address F A B 1 2 3 8 9 (in hex) is supplied to the cache _____

Subject: computer organization

Max Marks: 1

E

Correct Answer

Solution: (145)

Explanation:

Explanation:

We need to determine what the index bits are.

32-bits Physical Address		
TAG	Index	Offset
14 bits	9 bits	9 bits

From above, we know the offset is 9 bits

Index bits are $1024/2 = 512 = 9$ bits given is 2-way set associative memory, so we will need to break up the hex address into binary:

1111 1010 1011 0001 0010 0011 1000 1001

Our offset for this address is: 1 1000 1001

Set Index 01 0010 001 which implies the address maps to the 145th set.

Q.8)

Which of the following can not be the number of nodes possible for an AVL tree of height 6?

Note that root node is at height 0.

Subject: Data Structures

Max Marks: 1

A

31

Correct Option

Solution: (A)

Solution: 31

Maximum number of nodes in AVL tree are 127 (i.e $2^7 - 1$)

Minimum number of nodes possible are $N = 1 + N(h-1) + N(h-2)$

$\Rightarrow N = 33$ from height 6

Therefore 31 nodes cannot be a possible number of nodes in an AVL tree.

B

33

C

127

D

None of these

Q.9)

Consider the following grammar

$S \rightarrow AB \mid CD$

$A \rightarrow aA \mid \epsilon$

$B \rightarrow bBc \mid E \mid cD$

$C \rightarrow aCb \mid E \mid aA$

$D \rightarrow cD \mid \epsilon$

$E \rightarrow bE \mid b$

Then Follow(E) is

A

{b, c}

B

{b, c, \$}

Correct Option

Solution: (B)**Explanation:**

Follow(E) is $\text{Follow}(B) \cup \text{Follow}(C)$

$\Rightarrow \text{Follow}(B) = \{c\} \cup \text{Follow}(S) = \{c, \$\}$

$\text{Follow}(C) = \{b\} \cup \text{First}(D)$

$= \{b\} \cup \{c, \epsilon\}$

Follow does not contain ϵ , substitute ϵ in place of D.

$\text{Follow}(C) = \text{Follow}(S) = \{\$\}$

$\Rightarrow \{b, c, \$\}$

$\Rightarrow \{c, \$\} \cup \{b, c, \$\} = \{b, c, \$\}$

C

{a, b, c, \$}

D

None of these

Q.10)

Consider the following functions

$f_1(n) = n \log(\log(n))$

Subject: Algorithms

Max Marks: 1

$f_2(n) = n \log^2(n)$

$f_3(n) = n^2$

Which of the following is NOT true.

A

$f_1(n) = O(f_2(n))$ and $f_2(n) = O(f_3(n))$

B

$f_2(n) = \Omega(f_1(n))$ and $f_3(n) = \Omega(f_2(n))$

C

$f_1(n) = O(f_2(n))$ and $f_3(n) = O(f_1(n))$

Correct Option

Solution: (C)

Solution:

$f_1(n) = n \log(\log(n))$

$f_2(n) = n \log^2(n)$

$f_3(n) = n^2$

Clearly $f_3(n)$ grows faster than $f_2(n)$ this is because n grows faster than $\log(\log(n))$.

Now we need to compare f_2 and f_3 , f_2 grows faster because $\log(n)$ grows faster than $\log(\log(n))$.

Option C is only the incorrect option because $f_3(n) \neq O(f_1(n))$ as $f_3(n)$ grows faster than $f_1(n)$.

D

$f_1(n) = O(f_2(n))$ and $f_1(n) = O(f_3(n))$

Q.11)

Which of the following option is correct about unicasting of the IPV6 address.

Subject: Computer Networks

Max Marks: 1

A

The local unicast address is ff00::/8

B

The global address starting with 2000::/3 is a unicast address.

Correct Option

Solution: (B)

Explanation:

A: ff00::/8 is not the unicast address it is a multicast address

B: Yes, 2000::/3 is the global unicast address used for unicasting.

C: No there are several kinds of IPV6 addresses like Unicast, Multicast

D: No, there are some other unicast addresses like global unicast, unique local, unspecified which doesn't start from fe80::/10

C

All types of IPV6 addresses are unicast addresses.

D

All the unicast address starts with fe80::/10

Q.12)

In a Compiler, Identifiers in the code can be recognized during

Subject: Theory of Computation, Compiler Design

Max Marks: 1

A

Syntax Analysis

B

Semantic Analysis

C

Intermediate Code Generation

D

Lexical Analysis

Correct Option

Solution: (D)

Explanation:

Lexical Analysis is the first phase of compiler also known as scanner. It converts the High level input program into a sequence of Tokens. During the lexical analysis phase the compiler will identify all the programming constructs keywords, operators, Identifiers etc.

Q.13)

Which of the following is/are decidable

Subject: Theory of Computation, Compiler Design

Max Marks: 1

I.

Given context-free grammars G_1, G_2 , is $L(G_1) = L(G_2)$

II. Given a context-free grammar G and string w , is $w \in L(G)$

III. Given an unrestricted grammar G and string w , is $w \in L(G)$

A

I and II only

B

I only

c II only

Correct Option

Solution: (c)

Explanation:

- Given context-free grammars G_1, G_2 , is $L(G_1) = L(G_2)$
- Equivalence of CFG is undecidable
- Given a context-free grammar G and string w , is $w \in L(G)$
- Membership of CFG is decidable
- Given an unrestricted grammar G and string w , is $w \in L(G)$
- Membership of unrestricted grammars is also undecidable

d II and III only

Q.14)

Which of the following number represented in 2's complement signed binary number results in remainder value as 7 when divided by 11100111.

Subject: digital logic systems

Max Marks: 1

a 110101111

b 1110011100

c 1101001010

Correct Option

Solution: (c)

Explanation:

As we know we can discard all the leading 1's from MSB and leaving at least 1 their (according to the sign bit extension of 2's complement numbers).
 $\Rightarrow (11100111)_2 = (100111)_2 = -32 + 4 + 2 + 1 = -25$. Thus, among all the 4 options, the one which gives the remainder as 7 on division by -25, will be the desired option.

The decimal equivalent value for each of the option will be:

For option (i): $(11010111)_2 = (10101111)_2 = -128 + 32 + 8 + 4 + 2 + 1 = -128 + 47 = -81$. On dividing -81 by -25 we will get remainder as 6

For option (ii): $(1110011100)_2 = (10011100)_2 = -128 + 16 + 8 + 4 = -128 + 28 = -100$. On dividing -100 by -25 we will get 0 as the remainder.

For option (iii): $(1101001010)_2 = (101001010)_2 = -256 + 64 + 8 + 2 = -182$. On dividing -182 by -25, we will get a remainder as 7. Thus this is the correct option.

For option (iv): $(11000001)_2 = (1000001)_2 = -64 + 1 = -63$. On dividing -63 by -25 we will get a remainder as 13.

Hence, the correct option is (iii).

d 11000001

Q.15)

If a direct mapped cache has a hit rate of 95%, a hit time of 4 ns, and a miss penalty of 100 ns, If an L2 cache is added with a hit time of 20 ns and a hit rate of 80%, then the average memory access time is

Subject: computer organization

Max Marks: 1

a 7.5

b 8

c 6

Correct Option

Solution: (c)

Explanation:

$AMAT = \text{Hit Time}_{L1} + \text{Miss Rate}_{L1} \times (\text{Hit Time}_{L2} + \text{Miss Rate}_{L2} \times \text{Miss Penalty}_{L2})$
 $= 4 + 0.05 \times (20 + 0.2 \times 100) = 6 \text{ ns}$

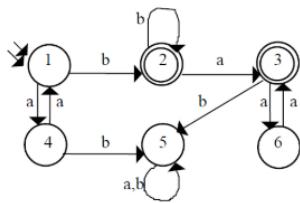
d 7

Q.16)

Subject: Theory of Computation, Compiler Design

Max Marks: 1

The Equivalent regular expression for the given DFA is



A $aa^*bb^* + (aa)^*bb^*a(aa)^*$

B $(aa)^*bb^*a(aa)^*$

C $(aa)^*bb^*(\epsilon + a(aa)^*)$

Correct Option

Solution: (C)

Explanation:

$$1 = \epsilon + 4a \quad \dots \dots \dots (1)$$

$$2 = 1b + 2b \quad \dots \dots \dots (2)$$

$$3 = 2a + 6a \quad \dots \dots \dots (3)$$

$$4 = 1a \quad \dots \dots \dots (4)$$

$$6 = 3a \quad \dots \dots \dots (5)$$

Substitute (4) in (1)

$$1 = \epsilon + 1aa = (aa)^*$$

$$2 = (aa)^*b + 2b = (aa)^*bb^*$$

$$3 = (aa)^*bb^*a + 3aa = (aa)^*bb^*a(aa)^*$$

$$4 = (aa)^*a$$

$$6 = (aa)^*bb^*a(aa)^*a$$

State 2 and 3 are the final states.

The RE for the given DFA is $(aa)^*bb^* + (aa)^*bb^*a(aa)^* = (aa)^*bb^*(\epsilon + a(aa)^*)$

D $aa^*bb^* + aa^*bb^*aaa^*$

Q.17)

Fill the question mark to get "Gate 2020" as an output?

Subject: C Programming

Max Marks: 1

```
#include<stdio.h>
int main()
{
    char *p = "Gate 2020";
    void *vp;
    vp = &p;
    printf("%s", ?);
    return 0;
}
```

A $*(\text{char } **)\text{vp}$

Correct Option

Solution: (A)

Solution:

In this program we used void pointer to display the string stored in another char pointer variable. Thus by using pointer to pointer typecasting $*(\text{char } **)\text{vp}$ we outputted the string "void pointer"

B $(\text{char } **)\text{vp}$

C $*(\text{char } *)\text{vp}$

D $(\text{char })\text{vp}$

Q.18)

What will be the output of the C program ?

Subject: C Programming

Max Marks: 1

```
#include<stdio.h>
```

```
int main()
```

```
{
```

```
    int a = 1, b = 1;
```

```

for(--a && b++ ; a<10; a+=2)
printf("GATE");
return 0;

```

Note: Though our intention is not about ending curly braces of the main function since students got confused about this question as there is a chance of compilation error because of the curly brace mentioned above. We are assigning marks to those who have attempted.

You can check the solution if curly brace present at the end of what can be the answer.

<input checked="" type="radio"/> A	Compilation error
<input type="radio"/> B	Program never ends
<input checked="" type="radio"/> C	GATE GATE GATE GATE GATE
	Correct Option
Solution: (c) Solution: here, for(--a && b++ ; a<10; a+=2) for(0 && 1 ; a<10; a+=2) for(0 ; a<10; a+=2) printf("GATE ") //executes then for loop becomes (a=2 ;a < 10; i++) then printf("GATE ") //executes 4 times totally 5 loops prints	
<input type="radio"/> D	None of these

Q.19)

Which of the following statements is true?

Subject: Computer Networks

Max Marks: 1



<input checked="" type="radio"/> A	For n users to communicate the number of keys required in the symmetric key cryptography is $2n$.
<input type="radio"/> B	SHA is a more secure hash algorithm as compared to MD5.
	Correct Option
Solution: (B) Explanation: <ul style="list-style-type: none"> A. For n users to communicate we need $n(n-1)/2$ keys in symmetric key cryptography. B. SHA is the successor of MD5, SHA is more secure as compared to MD5. There are more secure and better hash functions available now, such as SHA-256, SHA-384, and SHA-512, all of which are practically secure. C. Diffie hellman is prone to the man in the middle attack, RSA is more secure than Diffie hellman. D. For n individuals to communicate, the number of keys required = $2 \times n = 2n$ keys. 	
<input type="radio"/> C	Diffie hellman is more secure than RSA.
<input type="radio"/> D	For n users to communicate we need $4n$ keys in RSA.

Q.20)

If the throughput of slotted aloha is 10 % more than the pure aloha while transmitting the data on the channel. Then what is the value of e^G where G represents the number of stations willing to transmit data?

Subject: Computer Networks

Max Marks: 1



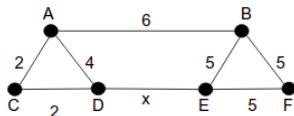
<input checked="" type="radio"/>	Correct Answer
Solution: (1.1) Explanation <p>The throughput equation of pure aloha is $G e^{-2G}$ The throughput equation of slotted aloha is $G e^{-G}$ $G e^{-G} = 0.1 \times G e^{-2G} + G e^{-2G}$ $e^{-G} = 0.1 e^{-2G} + e^{-2G}$ $e^{-G} = 1.1 e^{-2G}$ $e^G = 1.1$ </p>	

Q.21)

Subject: Algorithms

Max Marks: 1

Consider the following graph in which the value of each edge is a positive integral weight. What is the maximum possible value of "x" for which the edge DE is present in every possible Minimal spanning tree of the graph._____.



Correct Answer

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

The edges AB and DE form the cut set of the above graph if x has to be present then it should be the least weight edge in the cut set, the maximum possible value is 1 less than the weight of the edge AB which is $6-1=5$.

Q.22)

Subject: operating systems

Max Marks: 1

S1 : Deadlock can be avoided by using semaphores instead of locks for mutual exclusion.**S2 :** Periodically yielding the processor while spin waiting reduces the amount of wasted time to be proportional to the duration of a context switch.

Which of the above statements are true?

A Only**B** S2 only

Correct Option

Solution: (B)**Explanation:****S1 :** False; if you use a semaphore for mutual exclusion, it has all the same properties as a traditional lock.**S2 :** True; instead of spin-waiting for an entire time slice, the thread will just waste the time for the context switch each time it is scheduled and cannot acquire the lock.**C** Both S1 and S2**D** Neither S1 nor S2

Q.23)

Subject: DBMS

Max Marks: 1

Consider the following statement:

- I. R1(A), R2(A), R1(C), R3(A), R3(B), W1(A), W3(B), R2(B), W2(C), W2(B), C1, C2, C3; is recoverable.
- II. W1(A), R2(B), W2(A), C2, C1; is recoverable and does not have any dirty reads.

Which of the above statement is not true?

A Only I

Correct Option

Solution: (A)**Solution:**

- I. The given schedule is irrecoverable because W3(y) executed before W2(y) which leads to conflicts thus it must be committed before T2 transaction. So the given schedule is unrecoverable.
If C3->C2 is given in schedule then it will become a recoverable schedule. Therefore, this statement is not true.
- II. This schedule is also both recoverable and cascadeless (no dirty reads). Hence, it is true.

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

Q.24)

Subject: digital logic systems

Max Marks: 1

The decimal of 0x416C0000 represented using single precision format of IEEE 754 standard is ?



-14.25



-14.75



14.75

Correct Option

Solution: (c)

Solution:

On expanding the given hexadecimal number 416C0000 H we will get:

0	11011000...0	10000010
<-----sign-bit(1)----->	<-----Mantissa-bit(23)----->	<-----Exponent -bit(8)----->

For single precision the normalised format will be: $(-1)^0 \times (1.M) \times 2^{E-127}$

Here, Exponent is: $100000010 = 130$

$$\Rightarrow (-1)^0 \times (1.1101100...0) \times 2^{130-127}$$

$$\Rightarrow 1.1101100...0 \times 2^3$$

$$\Rightarrow 1110.11$$

$$\Rightarrow 14.75$$



14.25

Q.25)

Subject: Engineering-Mathematics

Max Marks: 1



Considering θ as a constant.

$$\lim_{x \rightarrow 0} x^2 \sin(\pi/x) =$$



0

Correct Option

Solution: (A)

Solution:

Since the value of $\sin(\pi/x)$ will oscillate between [-1, 1] for all values of (π/x) . The value of x^2 tends to 0 therefore the value of the overall limit will be 0.



1



∞



Does not exist

Q.26)

Subject: Engineering-Mathematics

Max Marks: 2



A company knows on the basis of past experience that 2% of its blades are defective.

The probability of having 3 defective blades in a sample of 100 blades (consider $e^{-2} = 0.1353$)



0.1804

Correct Option

Solution: (A)

Solution:

$$\lambda = 100 * \frac{2}{100} = 2.$$

$$P(X=3) = \frac{e^{-2} \lambda^3}{3!} = \frac{e^{-2} 2^3}{6} = 0.1804$$



0.2804



0.4804



None of these

Q.27)

Subject: Computer Networks

Max Marks: 2

Which of the following statements is not true?



The persistence timer used in TCP is used for the solution of deadlock.



The timeout timer is used to resend the lost data for which the sender didn't receive an acknowledgment.



The Keepalive Timer is used in the TCP connection termination where the client sends FIN to the server and waits for the acknowledgment.

Correct Option

Solution: (c)

Explanation:

- True, TCP uses a persistent timer to deal with a zero-widow-size deadlock situation.
- Yes, the timeout timer is used for re-sending the segments which are lost.
- The keepalive timer is used to prevent a long idle connection between two TCPs. If a client opens a TCP connection to a server transfers some data and becomes silent the client will crash. Each time the server hears from the client, it resets the keep-alive timer to 2 hours.
- True, time wait timer used in the connection termination in the TCP, Sender starts the time wait timer after sending the ACK for the second FIN segment



Time wait timer is used in the termination of the TCP connection where the sender starts the time wait timer after sending the ACK to the receiver for the second FIN segment.

Q.28)

Subject: Theory of Computation, Compiler Design

Max Marks: 2

Consider the following grammar

 $S \rightarrow aSa \mid a$ Let n_1, n_2 and n_3 be the number of states in the SLR(1), CLR(1) and LALR(1) respectively. Then n_1, n_2 and n_3 is _____

5, 7 and 5



4, 7 and 7



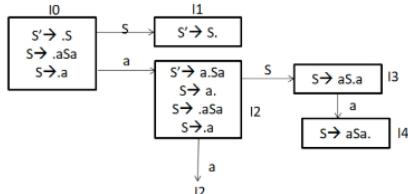
5, 8 and 5

Correct Option

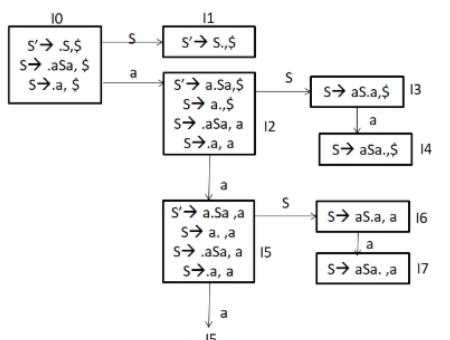
Solution: (c)

Explanation:

Number of States in the SLR(1) Parser = 5



Number of States in the CLR(1) Parser = 8



Number of states in the LALR(1) is the same as the SLR(1) parser.



4, 8 and 8

Q.29)

Subject: operating systems

Max Marks: 2

Given is a set of jobs to be scheduled for execution on a uniprocessor system.

Job	Arrival Time	Burst Time	Priority
J1	0	10	2
J2	2	8	1
J3	3	3	3
J4	10	4	2
J5	12	1	3
J6	15	4	1

Using preemptive priority scheduling, the Completion Time of job J6 is _____ units.

Note : Here the arrival time is used as a tie break mechanism and $1 > 2 > 3$ in terms of priority.

Correct Answer

Solution: (19)

Explanation:

J1	J2	J1	J6	J1	J4	J3	J5	
0	2	10	15	19	22	26	29	30

At time $t = 0$, J1 arrives and gets scheduled for 2 units of time.

Let B.T be the Burst time.

At time $t = 2$, J2 arrives and has higher priority, therefore, it preempts J1 and J2 gets scheduled in the CPU.

Remaining B.T of J1 = $10 - 2 = 8$ units

At time $t = 3$, J3 arrives and has a lower priority compared to J2 and thus, J2 continues to execute on the CPU.

At time $t = 10$, J2 completes execution. At the same time, J4 arrives with priority = 2. Between J1 and J4, J1 gets scheduled because both have the same priority = 2 but J1 arrived before J4.

At time $t = 15$, J6 arrives with priority = 1. Therefore, it preempts J1 and J6 starts executing.

Remaining B.T of J1 = $8 - 5 = 3$

At time $t = 19$, J6 completes and therefore, between J1 and J4, J1 gets scheduled as it has arrived earlier.

Q.30)

Subject: Data Structures

Max Marks: 2

Suppose that you implement a queue using a null-terminated singly-linked list, maintaining a reference to the item least recently added (the front of the list) but not maintaining a reference to the item most recently added (the end of the list). What are the worst case running times for enqueue and dequeue?



constant time for both enqueue and dequeue



constant time for enqueue and linear time for dequeue



linear time for enqueue and constant time for dequeue

Correct Option

Solution: (C)



linear time for both enqueue and dequeue

Q.31)

Which of the following is/are True.

- I. $L = \{a^m b^n c^p d^q : p > m, \text{ and } m, n \geq 1\}$ is CFL

Subject: Theory of Computation,Compiler Design

Max Marks: 2

- II. If L is context free, then L^* must be regular
 III. If L_1 and L_2 are not regular languages, then $L_1 \cup L_2$ is not regular

A I, II and III

B I only

Correct Option

Solution: (B)

Explanation:

- I. $L = \{a^m b^{2n} c^{3n} d^p : p > m, \text{ and } m, n \geq 1\}$ is CFL True
 It is CFL. We can construct a PDA by applying push operation for all a's and b's then start applying pop operation for each c and d for matching between c and b, d and a.
- II. If L is context free, then L^* must be regular False
 Let $L = WW^R$ is CFL,
 $L^* = \{\epsilon, WW^R, WW^R WW^R, \dots\}$ Not Regular
- III. If L_1 and L_2 are not regular languages, then $L_1 \cup L_2$ is not regular
 This statement is False.
 To prove it, we offer a counter example. Let $L_1 = \{a^n b^m : n=m\}$ and let $L_2 = \{a^n b^m : n \neq m\}$. We have shown that both L_1 and L_2 are not regular. However,
 $L_1 \cup L_2 = a^* b^*$, which is regular.

C II and III only

D I and III only

Q.32)

What is the time complexity of the following fragment of code.

```
function(int n)
{
    int i,j,k;
    for (i = 0;i<n-1;i++)
    {
        for (j = i;j<=n-1;j++)
        {
            for (l=1;l<=n;l=l*2)
            {
                printf("Hello World");
            }
        }
    }
}
```

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

B $O(n^2 \log n)$

Correct Option

Solution: (B)

Solution:

For $i=0$ the j loop executes n times
 For $i=1$ the j loop executes $n-1$ times
 For $i=2$ the j loop executes $n-2$ times
 For $i=3$ the j loop executes $n-3$ times
 This process goes on till
 For $i=n-2$ the j loop executes 2 times
 The number of times the inner loop (with j as index) executes is

$$\frac{n(n+1)}{2} - 1 = O(n^2).$$

 The innermost loop (with 'l' as the counter) is going to execute $O(\log n)$ times.
 Therefore, the total number of times the inner most loop will execute is $O(n^2 \log n)$.

C $O(n \log n)$



None of the above

Q.33)

The main memory consists of 256 blocks and the request for memory blocks is in the following order: 0, 255, 1, 4, 3, 8, 133, 159, 216, 129, 63, 8, 48, 32, 73, 92, 155. We are having a 2-way set associative cache with a total 16 cache blocks. Initially the cache is empty. Which one of the following memory block will NOT be in cache if LRU replacement policy is used?

Subject: computer organization

Max Marks: 2



129



155



159



216

Correct Option

Solution: (D)

Explanation:

Given Memory references are

0, 255, 1, 4, 3, 8, 133, 159, 216, 129, 63, 8, 48, 32, 73, 92, 155

2-way set associative.

Number of sets are = $16/2 = 8$

After applying the LRU replacement policy the cache contains 48, 32, 73, 129, 155, 4, 92, 133, 63, 159

216 is not there in the cache.

Set 0	0, 216 , 48
	8, 32
Set1	4 , 73
	129
Set 2	
Set 3	155
Set 4	4
	92
Set 5	133
Set 6	
Set 7	255 , 63
	159

Q.34)

Subject: computer organization

Max Marks: 2

Consider the following MIPS assembly language code:

I1: ADDI \$s0, \$0, 10

I2: ADD \$s0, \$s0, \$s0

I3: SLL \$s0, \$s0, 4

I4: LW \$s1, 4(\$s0)

I5: ADDI \$s2, \$s1, -1

Count the number of clock cycles required on a 5-stage pipeline given as (IF, ID, EX, MEM, WB) assuming that it supports forwarding and pipeline stall.

Correct Answer

Solution: (10)

Explanation:

	1	2	3	4	5	6	7	8	9	10	11
I1	IF	ID	EX	M	WB						
I2		IF	ID	EX	M	WB					
I3			IF	ID	EX	M	WB				
I4				IF	ID	EX	M	WB			
I5					IF	ID	EX	M	WB		

As instruction I4 is a memory reference instruction and I5 must stall till the

Q.35)

If the probabilities of the letters a,b,c,d,e,f are given below then the average length of one character if huffman encoding is used is

Subject: Algorithms

Max Marks: 2



Character	Probability
a	1/2
b	1/4
c	1/8
d	1/16
f	1/16

 A

2.8

 B

1.875

Correct Option

Solution: (B)

Solution:

After drawing the huffman tree we get the following encoding for each character

Character	Encoding
a	1
b	01
c	001
d	0001
f	1111

Now the average length is given by the sum of probability of character * length of encoding of that character.

$$= (0.5*1) + (0.25*2) + (0.125*3) + (0.0625*4) + (0.0625*4)$$

$$= 0.5 + 0.5 + 0.375 + 0.25 + 0.25$$

$$= 1.875$$

 C

4

 D

None of the above

Q.36)

Consider the below given list I and list II for functions of variables A, B and C:

Subject: digital logic systems

Max Marks: 2



List I	List II
a) $A'B' + AC'$	i) $\Sigma(0, 2, 3, 4, 6)$
b) $(B + C')(A' + C')$	ii) $\pi(2, 3, 4, 6)$
c) $A'B' + AC$	iii) $\Sigma(0, 1, 4, 6)$

Which of the following matching is correct?

 A

a-i, b-ii, c-iii

 B

a-iii, b-ii, c-i

 C

a-ii, b-i, c- iii

 D

a-iii, b-i, c-ii

Correct Option

Solution: (D)

Solution:

For (a):

$$\Rightarrow A'B' + AC'$$

$$\Rightarrow A'B'C + A'B'C' + ABC' + AB'C'$$

$$\Rightarrow \Sigma(0, 1, 4, 6) = \pi(2, 3, 5, 7)$$

Therefore, a-iii

For (b):

$$\Rightarrow (B + C')(A' + C')$$

$$\Rightarrow (A + B + C')(A' + B + C')(A' + B' + C')$$

$$\Rightarrow \Sigma(0, 2, 3, 4, 6) = \pi(1, 5, 7)$$

Therefore, b-i

For (c):

$$\Rightarrow A'B' + AC$$

$$\Rightarrow A'B'C + A'B'C' + ABC + AB'C$$

$$\Rightarrow \Sigma(0, 1, 5, 7) = \pi(2, 3, 4, 6)$$

Therefore, c-ii

Hence, option (iv) is correct.

Q.37)

Subject: Computer Networks

Max Marks: 2

We are sending a packet from the source to the destination using a link with the maximum transmission unit (MTU) is X. The fragment offset of the second last fragment is 400 and the last fragment is 600 that reaches the destination. The size of the IP header is 20 bytes. Calculate (X+Y) in bytes where Y is the size of the whole packet including header if all the fragments are of equal size?

Correct Answer

Solution: (8040)

Explanation:

The difference between the offset of last and second last fragment is 600 - 400 = 200

The size of the fragment is = 200 x 8 = 1600 Bytes

Total number of fragments = 600/200 = 3 (0 to 3) = 4 fragments

1st fragment = 0-199

Second fragment= 200-399

Third fragment= 400-599

Fourth fragment= 600-799

Size of the packet = 1600 x 4 + 20 B = 6420 B

The Size of MTU = One fragment size + header size

$$= 1600 + 20$$

$$= 1620 B$$

$$X + Y = 6420 B + 1620 B = 8040 B$$

Q.38)

Subject: Theory of Computation, Compiler Design

Max Marks: 2

Minimum number of states in a DFA that accepts the given language
is _____

$L = \{w \mid w \text{ has an odd number of } a's \text{ and ends with } b\}$

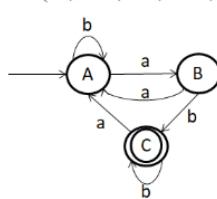
Correct Answer

Solution: (3)

Explanation:

$L = \{w \mid w \text{ has an odd number of } a's \text{ and ends with } b\}$

= {ab, aaab, abb, abbb, aaabb, bab, bbbb...}



Q.39)

Subject: Engineering-Mathematics

Max Marks: 2

The product of eigenvalues of the matrix given below is _____

$$\begin{bmatrix} 7 & 3 & 2 \end{bmatrix}$$

$$A = \begin{vmatrix} 1 & 2 & 1 \\ 4 & 7 & 1 \\ 2 & 1 & 3 \end{vmatrix}$$

Correct Answer

Solution: (90)

Solution: 90

The Product of eigenvalues of any matrix is equal to its determinant.
 $|A|=7(21-1)-3(12-2)+2(4-14)=90.$

Q.40)

Subject: operating systems

Max Marks: 2



Consider page reference string :

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

with 3 page frames. The number of page faults using Belady's *optimal page replacement policy* is _____

Correct Answer

Solution: (9)

Explanation:

Page reference stream:

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

Optimal

Total 9 page faults

Q.41)

Subject: DBMS

Max Marks: 2



Given the relational schema of relation SALES as:

SALES(sale_id, address, zip, date, price, real_price)

What is the correct output of the following SQL query?

SELECT address, COUNT (*) FROM SALES

GROUP BY address

HAVING COUNT (*) > 1 ORDER BY COUNT (*) DESC;

A

Returns the list of addresses of each house that was sold more than once along with the count of the number of sales of those properties. The result of which is ordered by the addresses in decreasing order.

B

Returns the list of addresses of each house that was not sold more than once along with the count of the number of sales of those properties. The result of which is ordered by the number of sales in decreasing order.

C

Returns the list of addresses of each house that was sold more than once along with the count of the number of sales of those properties. The result of which is ordered by the number of sales in decreasing order.

Correct Option

Solution: (c)

Solution:

The query groups the tuples based on their addresses and count(*) will have the number of rows for each address group. Having a clause will put the condition for the result set such that only those group of addresses which have count more one will be present in the result set. The whole data is ordered in descending order based on the count value. Hence, the output of the query will be the list of addresses of each house that was sold more than once along with the count of the number of sales of those properties. The result of which is ordered by the number of sales in decreasing order.

D

None of the above

Q.42)

Subject: Algorithms

Max Marks: 2



Consider the following set of tasks with their associated profits and deadlines, provided that 2 tasks can be completed in a unit time if the optimal schedule is able to get a profit of 128 then the maximum value of x possible is_____.

Task	Profit	Deadline
1	21	5
2	12	4
3	9	1
4	7	4

5	16	3
6	14	2
7	8	5
8	6	x
9	7	2
10	17	7
11	17	1
12	5	2

Correct Answer

Solution: (2)

Solution: 2

In order to get the optimal schedule we need to sort the tasks in decreasing order of profits and schedule them as late as possible, as it is given that 2 tasks can be completed in a given time slot we are scheduling 2 in a time slot, on doing so we will get the following schedule.

Time	1	2	3	4	5	6	7						
Task	T3	T11	T6	T9	T5	T2	T4	T1	T7			T10	
Profit	9	17	14	7	16	12	7	21	8			17	

It is not possible to schedule T12.

If we count the profit of this schedule it

$$is = 9 + 17 + 14 + 7 + 16 + 12 + 7 + 21 + 8 + 17 = 128.$$

This means that T8 is not scheduled, therefore the maximum value of x is 2 because upto time slot 2 all the time slots are full.

Q.43)

A and B are two independent events. If the probability that both A and B occur is $1/20$ and the probability that neither of them occurs is $3/5$, then $P(A), P(B) =$

Subject: Engineering-Mathematics

Max Marks: 2



1/2, 1/3



1/3, 1/4



1/4, 1/5

Correct Option

Solution: (c)

Solution:

Given

$$P(A \cap B) = 1/20$$

$$P(A^c \cap B^c) = 3/5$$

Therefore

$$P((A \cup B)^c) = 3/5 \text{ and } P(A \cup B) = 2/5.$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A) + P(B) = 9/20$$

Also as the events A and B are independent $P(A \cap B) = P(A)P(B) = 1/20$.

$$P(A)(9/20 - P(A)) = 1/20.$$

On Solving we get $P(A) = 1/4, 1/5$.

One is $P(A)$ and the other is $P(B)$.



None of these

Q.44)

Consider a paging system with the page table stored in memory.

Subject: operating systems

Max Marks: 2

Memory access takes 200 nanoseconds. If we add associative registers (a TLB), and 75 percent of all page table references are found in associative registers, then the effective memory reference time is ____ ns

Assume that finding a page-table entry in the TLB takes zero time.

Correct Answer

Solution: (250)

Explanation:

A paged memory reference takes 2 memory accesses: page lookup followed by actual access => $2 \times 200\text{ns} = 400\text{ns}$

$$75\% \times \text{TLB hit-time} + 25\% \times \text{TLB miss-time} = 75\% \times 200\text{ns} + 25\% \times 400\text{ns} = 250\text{ns}$$

Q.45)

Subject: Discrete Mathematics

Max Marks: 2

Here is a partial table for a commutative and associative binary operation * on a set $S = \{a, b, c, d\}$

*	a	b	c	d
a	d	c		
b		d		
c			a	
d				

What is $d * c$?

A

c

Correct Option

Solution: (A)

Explanation:

$$b * a = a * b = c$$

$$b * c = c * b = a$$

$$d * a = (b * b) * a = b * (b * a) = b * c = a$$

$$d * c = (b * b) * c = b * (b * c) = b * a = c$$

B

a

C

d

D

b

Q.46)

Subject: Computer Networks

Max Marks: 2

A company wants to establish the three branches with three subnetworks. If a company needs at least 70 hosts in the first network, 50 hosts in the second network and 40 hosts in the last network and the network mask is 255.255.255.0 then what would be the best possible subnet mask for the company to accommodate these requirements.

A

255.255.255.0 , 255.255.255.0, 255.255.255.0

B

255.255.255.192, 255.255.255.192, 255.255.255.192

C

255.255.255.128, 255.255.255.192, 255.255.255.192

Correct Option

Solution: (C)

Explanation:

The given network mask is 255.255.255.0

We want 70 hosts in the first subnetwork:

For 70 hosts a minimum of 7 bits required.

So the subnet mask for the first subnetwork is 255.255.255.128

For the second subnetwork, we have 50 hosts.

For 50 hosts 6 bits are needed

255.255.255.192

For the third subnetwork, we have 40 hosts.

For 40 hosts 6 bits are needed

255.255.255.192

D

255.255.128, 255.255.192, 255.255.224

Q.47)

Subject: DBMS

Max Marks: 2

The following key values are inserted into a B+ tree, where order of the internal node is 5 and order of leaf node is 4. The order of the internal node is the maximum number of tree pointers in each node and the order of leaf node is the maximum number of data items that can be stored in it. The minimum number of times leaf nodes would get split up as a result if the insertion sequence is: 3, 10, 12, 14, 29, 38, 45, 55, 60, 68

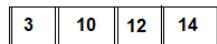
C

Correct Answer

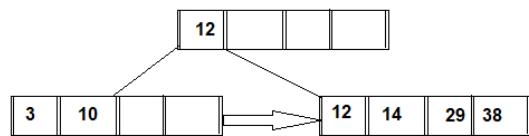
Solution: (2)

Solution:

Step 1: inserting 3 , 10, 12, 14

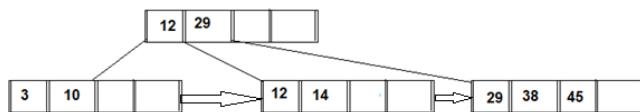


Step 2: inserting 29 and 38



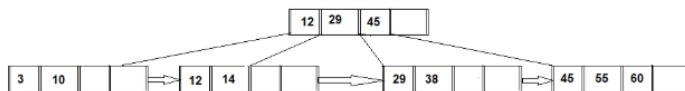
Total number of split till step 2 = 1

Step 3: inserting 45



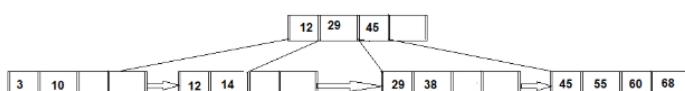
Total number of split till step 3 = 2

Step 4: inserting 55 and 60



Total number of split till step 4 = 3

Step 5: inserting 68



Here, the nodes are getting splitted using right biasing. Therefore, the total number of times the leaf node is getting split is 3, while if we have applied left biasing we will get total splits as 2. Thus, the answer will be 2.

Q.48)

Subject: Data Structures

Max Marks: 2

An inversion in an array GATE is a pair of array indices (i, j) such that $i < j$ but $GATE[i] > GATE[j]$. What is the maximal number of inversions that can be eliminated by the following program fragment?

```
int temp = GATE[5];
GATE[5] = GATE[10];
GATE[10] = temp;
```

Note: Above program may or may not eliminate all the inversions possible in the given GATE array. Number of Inversions may change based on the input elements of the array.

A

6

B

8

C

9

Correct Option

Solution: (c)

Solution: 9

Maximum number of Inversions are possible only when

$GATE[5] > GATE[6]$,
 $GATE[5] > GATE[7]$,
 $GATE[5] > GATE[8]$,
 $GATE[5] > GATE[9]$,
 $GATE[5] > GATE[10]$,

$GATE[10] < GATE[6]$
 $GATE[10] < GATE[7]$
 $GATE[10] < GATE[8]$

GATE[10] < GATE[9]

In this case, the following nine inversions are eliminated:
 (5, 6), (5, 7), (5, 8), (5, 9), (5, 10), (6, 10), (7, 10), (8, 10), and (9, 10).

D

10

Q.49)

Subject: Data Structures

Max Marks: 2

In separate chaining hash tables, array entries are linked lists. Consider a variant, where second-level hash tables are used instead of linked lists. In such a hash table, a first hashing operation returns a hash table on which a second hashing operation is performed in order to retrieve the required answer. You may assume that the second-level hash tables use linear probing. Which one of the following statements about such two-level hash tables is correct?

A

The hash function used in the second level should be the same as the hash function used in the second level.

B

The hash function used in the second level should be different from the hash function used in the first level.

Correct Option

Solution: (B)

Solution:

If the hash function in the second level is the same as the hash function in the first level, then every insertion after the first one into a second-level hash table will lead to a collision; the second-level hash tables would deteriorate to linked list.

C

The hash functions may be the same or different, as long as they both have few collisions.

D

Two-level hash tables are not practically possible, because an array cannot contain arrays as elements.

Q.50)

Subject: digital logic systems

Max Marks: 2

A security system built using basin AND-OR gates consists of a flood light (F), a daylight detector(D), a motion detector for potential criminals (C) and a switch (consisting of 2-bits A and B) with 4 positions marked as 0 ,1, 2, 3. Assume that the system floodlight signals are active high. What will be the expression F of the floodlight system which uses the switch's position to set the system's operating mode as follows:

Switch Position	Operating Mode
0	Floodlight is OFF
1	Floodlight is IN
2	Floodlight is ON if a potential criminal and no daylight
3	Floodlight is ON if there is no daylight

A

$A'B + BD' + ACD'$

Correct Option

Solution: (A)

Solution:

According to the given switch operating mode the function F will be as follows:

Switch Position	Operating Mode	F
0	Floodlight is OFF	$F = 0$
1	Floodlight is IN	$F = 1$
2	Floodlight is ON if a potential criminal and no daylight	$F = CD'$
3	Floodlight is ON if there is no daylight	$F = D'$

Based on the above result the truth table for F will be:

A	B	C	D	F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1

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

The resultant K-map will be:

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

This results in 2 quads and 1 pair: $A'B + BD' + ACD'$

Thus, option (i) is correct.

B $A'B + BD' + AC'D'$

C $A'B' + BD' + ACD$

D None of the above

Q.51)

What is the correct output sequence for the given relation Sequence and the SQL query Q.

Subject: DBMS

Max Marks: 2

Relation Sequence:

X	Y	Z
4	3	4
2	7	2
2	3	6
6	8	5

SQL query Q:

```
SELECT * FROM Sequence s1 WHERE EXISTS ( SELECT * FROM Sequence
s2 WHERE s1.x > s2.x);
```

A=

X	Y	Z
4	3	4
6	8	5

B=

X	Y	Z
6	8	5
4	3	4



C=

X	Y	Z
6	8	5

D

Both A and B are possible order of output.

Correct Option

Solution: (D)

Solution:

The output of the query is $\{(4, 3, 4), (6, 8, 5)\}$. The inner query will compare every value of X with itself. Since we know that EXISTS condition is considered to be met, if the subquery returns at least one row. For $s1.x = 4$, the inner query will result in two rows $\{(2, 7, 2), (2, 3, 6)\}$. Thus, the tuple $(4, 3, 4)$ will be present in the resultant set. For $s1.x = 2$, the inner query will not return any tuple. For $s1.x = 6$, the inner query will return $\{(4, 3, 4), (2, 7, 2), (2, 3, 6)\}$. Thus, the tuple $(6, 8, 5)$ will be present in the resultant set. Hence, the outer query will also return only these 2 rows as resultant set (as outer query selects *). Based on the answer the possible option is either (i) or (ii). But SQL output is implicitly unordered unless order by clause is used. Therefore, Query results are unordered and both (i) and (ii) could be a possible answer. Hence, the correct option is (iv).

Q.52)

Which of the following languages are CFLs

Subject: Theory of Computation, Compiler Design

Max Marks: 2

I. $L_1 = \{0^n 1^m 2^k : n < m \text{ or } m < k\}$ II. $L_2 = \{0^n 1^m 2^{n-m} : n, m \in \mathbb{N}\}$ III. $L_3 = \{0^h 1^i 2^j 3^k : (h \neq i \text{ and } j \neq k) \text{ or } (h \neq k \text{ and } i \neq j)\}$

A

I and II Only

B

II only

C

II and III only

D

I, II and III

Correct Option

Solution: (D)

Explanation: $L_1 = \{0^n 1^m 2^k : n < m \text{ or } m < k\}$ CFL

We can construct a NPDA for the given language for checking the relation between n and m or m and k.

 $L_2 = \{0^n 1^m 2^{n-m} : n, m \in \mathbb{N}\}$ CFL

Apply push operation for all 0's and 1's and apply pop operation for each symbol of 2's.

 $L_3 = \{0^h 1^i 2^j 3^k : (h \neq i \text{ and } j \neq k) \text{ or } (h \neq k \text{ and } i \neq j)\}$ CFL

We can construct a NPDA for the given language

Case 1: ($h \neq i$ and $j \neq k$) $h < i$ and $j < k$ $h > i$ and $j < k$ $h < i$ and $j > k$ $h > i$ and $j > k$ **Case 2: ($h \neq k$ and $i \neq j$)** $h < k$ and $i < j$ $h > k$ and $i < j$ $h < k$ and $i > j$ $h > k$ and $i > j$

Q.53)

If Bubble sort is implemented to sort a collection of numbers on a singly linked list then which of the following statements are TRUE. (Considering the most efficient approach in terms of time and space).

Subject: Algorithms

Max Marks: 2



- Only one additional pointer to the node is required to iterate through the list and comparing the elements

II. Two additional pointers are mandatory, one to the node are required to compare the consecutive elements and after each iteration they have to be incremented.

III. The time complexity for this would remained unchanged i.e. $O(n^2)$.

IV Additional $O(n)$ work needs to be done so the new time complexity is $O(n^3)$.

A	II and IV
B	I and IV
C	I and III
D	II and III

Solution: (C)

Explanation:

I. Only one pointer can be used to iterate the list and compared with the next element using the `->next` operator.

II. Two pointers are not required as one additional pointer is sufficient.

III. The time complexity would remain unchanged as we can pass through the list only in $O(n)$ time and also we can compare and swap them in constant time.

IV. No additional $O(n)$ time is required.

Correct Option

Q.54)

Subject: Discrete Mathematics

Max Marks: 2

The number of relations on the set $A = \{1, 2, 3, 4, 5\}$ that are symmetric and reflexive is :

A	2^{20}
B	2^{10}
C	2^5
D	None of these

Solution: (B)

Explanation:

Reflexivity means that all pairs (x, x) are in R , and symmetry means that (x, y) is in R if and only if (y, x) is in R . Thus, a symmetric and reflexive relation is completely determined by specifying which of the *unordered* pairs $\{x, y\}$ of *distinct* elements of A are in R . Since A has 5 elements, there are $\binom{5}{2}$ such pairs and hence $2^{\binom{5}{2}}$ ways to specify a subset of these pairs.

Therefore, $2^{\binom{5}{2}} = 2^{10}$

Correct Option

Q.55)

Subject: Discrete Mathematics

Max Marks: 2

We know that a group G is called cyclic if there exists $a \in G$ such that $G = \langle a \rangle$. If G is cyclic, any a , such that $G = \langle a \rangle$ is called a generator of G .

So, if $G = \langle a \rangle$ and let $|a| = 16$

Then the following is the set of all the generators of the subgroup of G , of order 8:

A	$\{a^2, a^3, a^5, a^{13}\}$
B	$\{a^2, a^5, a^7, a^{13}\}$
C	$\{a^2, a^6, a^{10}, a^{14}\}$

Solution: (C)

Explanation:

The subgroup of G , of order 8 is: $\langle a^8 \rangle = \langle a^2 \rangle = \{(a^2)^1, (a^2)^2, (a^2)^3, (a^2)^4, (a^2)^5, (a^2)^6, (a^2)^7, (a^2)^8 = e\}$. Since 1, 3, 5, and 7 are relatively prime to 8, the set of generators for this group is $\{(a^2)^1, (a^2)^3, (a^2)^5, (a^2)^7\} = \{a^2, a^6, a^{10}, a^{14}\}$.

Correct Option

D None of these

Q.1)

Select the correct alternative for the underlined sentence below having the same meaning.

It is difficult to have a sensible discussion with her as she flies off at a tangent.

A gets carried away

B starts discussing something irrelevant

Correct Option

Solution: (B)

Solution: The underlined sentence is an idiom and it means that to start saying something which is not related to the topic.

C loses her temper easily

D does not really understand anything

Subject: General Aptitude

Max Marks: 1

Q.2)

Three quantities P, Q, R are such that $PQ=KR$, where K is a constant. When P is kept constant, Q varies directly as R; when Q is kept constant, P varies directly R and when R is kept constant, P varies inversely as Q. Initially P was at 25 and $P:Q:R=1:3:5$. Find the values of P when Q equals 81 at constant R.
 $P = \dots\dots\dots$ [Round to the nearest integer]

Correct Answer

Solution: (23)

Solution: Initial values are:

$$P = 25$$

$$Q = 25 * 3 = 75$$

$$R = 25 * 5 = 125$$

We have $PQ = KR$

$$\Rightarrow 25 * 75 = K * 125$$

$$\Rightarrow K = 15$$

Therefore, $PQ = 15R$

For the problem, keep R constant at 125.

Then, $P * 81 = 15 * 125$

$$\Rightarrow P = \frac{625}{27} = 23.148 \approx 23$$

Q.3)

Since her face was free of (_____) there was no way to (_____) if she appreciated what had happened.

Subject: General Aptitude

Max Marks: 1

A make-up, realise

B expression, ascertain

Correct Option

Solution: (B)

Solution: The second word can help us ascertain the correct option. Only 'ascertain' fits correctly there. All other options, viz.'realize', 'diagnose' and 'understand' are not apt.

C emotion, diagnose

D scars, understand

Q.4)

A sphere-shaped object which is having a radius of 14 cm is given a new shape of a right circular cone which is having a base of radius 17.5 cm by melting the object. What is the height of the cone? (correct up to 2 decimal places)

Subject: General Aptitude

Max Marks: 1

A 34.94 cm

B 11.94 cm

C 35.84 cm

Correct Option

Solution: (C)

Solution: The volume will be equal for both spheres and cones.

$x = 9$
 $y = 4$
Hence, the speed of the stream is 4 km/h.

Q.7)

Ritwik the retailer of pulses sells them by mixing three types of pulses P, Q and R and earns a profit of 25%, when sold at a price of ₹ 40. The price of the type P pulse is ₹ 22 per kg, type Q pulse is ₹ 27 per kg and type R pulse is ₹ 44 per kg. If the type R pulse is 5 kg in the mixture then how much quantity of type Q pulse will be there in the mixture?

Subject: General Aptitude

Max Marks: 2

A

3 kg

B

12 kg

C

6 kg

Correct Option

Solution: (c)

Solution: Cost Price of the mixture of pulses for 1kg = $\frac{40}{125} * 100 = ₹ 32$.

Let the pulse P be x kg and pulse Q be y kg

Then we can say that

$$\frac{(22x)+(27y)+(44*5)}{(x+y+5)} = ₹ 32$$

$$\Rightarrow 22x + 27y + 220 = 32(x + y + 5)$$

$$\Rightarrow 22x + 27y + 220 = 32x + 32y + 160$$

$$\Rightarrow 10x + 5y = 60$$

$$\Rightarrow 2x + y = 12$$

Now we can check with the given options

Option 1: If $y = 3$ kg, then $x = 4.5$ kg

Option 2: If $y = 12$ kg, then $x = 0$ kg [not possible because we have to mix all the three mixtures]

Option 3: If $y = 6$ kg, then $x = 3$ kg

Option 4: If $y = 5$ kg, then $x = 3.5$ kg

Here to find the appropriate answer we need to assume that the quantities of the pulses mixed are considered to be in integer values (i.e., non-decimal number) since the pulse Q and R is in the integer values only, hence the correct option will be c, i.e., 6 kg.

D

5 kg

Q.8)

$$(10)_2 + (12)_3 + (20)_4 + (22)_5 + (30)_6 + (32)_7 + (40)_8 + (42)_9 = (?)_{10}$$

Subject: General Aptitude

Max Marks: 2

Note: Question is INCOMPLETE, hence we are awarding marks to all irrespective of the attempt.

A

68

B

138

Correct Option

Solution: (B)

Solution: $(10)_2 = (1 * 2^1 * 0 * 2^0)_{10} = (2)_{10}$

$$(12)_3 = (1 * 3^1 * 2 * 3^0)_{10} = (5)_{10}$$

$$(20)_4 = (2 * 4^1 * 0 * 4^0)_{10} = (8)_{10}$$

$$(22)_5 = (2 * 5^1 * 2 * 5^0)_{10} = (12)_{10}$$

$$(30)_6 = (3 * 6^1 * 0 * 6^0)_{10} = (18)_{10}$$

$$(32)_7 = (3 * 7^1 * 2 * 7^0)_{10} = (23)_{10}$$

$$(40)_8 = (4 * 8^1 * 0 * 8^0)_{10} = (32)_{10}$$

$$(42)_9 = (4 * 9^1 * 2 * 9^0)_{10} = (38)_{10}$$

$$\text{Sum} = (138)_{10}$$

C

208

D

Cannot be determined

Q.9

Fill in the blanks with the most appropriate words.

Growth under this government has been _____ high and remarkably _____ even during the worst global economic crisis.

Subject: General Aptitude

Max Marks: 2

 A

Impededly, flippant

 B

Relatively, intractable

 C

Obstructedly, rigid

 D

Sustainedly, resilient

Correct Option

Solution: (D)

Solution: Since the given sentence speaks about positive aspects of growth therefore, Sustainedly (uniformly) is best suited, relatively is irrelevant because there is no comparison made in the sentence. the first word of all other choices is illogical/inappropriate.

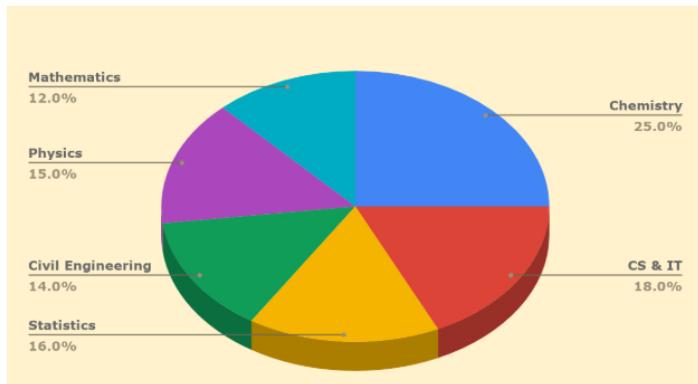
Q.10

Subject: General Aptitude

Max Marks: 2



Below is a Pie Chart showing the distribution of the number of students in the GATE 2019 in the different branches. The total number of students is 8,00,000. The number of boys in Civil Engineering is what percent of the total number of students in CS & IT (in the nearest multiple of 10)?



Branches	Girls (in %)
Chemistry	20
CS & IT	35
Statistics	29
Civil Engineering	40
Physics	57
Mathematics	44

 A

10%

 B

20%

 C

30%

 D

40%

Correct Option

Solution: (D)

Solution: Number of Students in Civil Engineering = $800000 * \frac{14}{100} = 112000$

Number of Girls in Civil Engineering = $112000 * \frac{40}{100} = 44800$

Therefore, the number of boys in Civil Engineering = $112000 - 44800 = 67200$

Number of Students in CS & IT = $800000 * \frac{18}{100} = 144000$

Hence, the required answer = $\frac{67200}{144000} * 100 = 46.66\% \approx 40\%$

close