Q. No. 1 – 25 Carry One Mark Each

1. Suppose X is a set of size n. How many pairs of sets (A,B) exist such that, $A \subseteq B \subseteq X$?

   (A) $2^n + 1$ (B) 2^{2n} (C) 3^n (D) 3^{n+1}

2. $\lim_{x \to 0} \frac{1 - \cos ax}{1 - \cos bx}$ is

   (A) $\frac{a}{b}$ (B) $\frac{a^2}{b^2}$ (C) 1 (D) $\frac{b^2}{a^2}$

3. If $f = \{(1,-2),(2,1),(3,4),(4,7)\}$ is function from A = $\{1,2,3,4\}$ to B = $\{-2,1,4,7\}$ given by the formula, $f(x) = \alpha x + \beta$, then $\alpha - \beta$ is _____

4. A and B want to exchange the key using Diffie – Hellmen protocol. Given that A chooses X_A= 3 and B chooses X_B = 7, where primitive root is 7 and modulus value is 23.The value of symmetric key is_____

5. Let processes are scheduled on a system using round robin scheduling; assume that there is only one process of r time units. Round robin time quantum is q time units and process switch time is s time units. If s < q < r, then process switch over head is

   (A) $\frac{r}{r+s}$ units (B) $\frac{q}{r+s}$ units (C) $(\frac{r}{q} - 1) \times s$ units (D) None of these

6. Consider the following syntax directed definition

   $E \to T$ $\{E_{.val} = T_{.val}\}$

   $T \to TF$ $\{T_{.val} = T_{.val} * 2 + F_{.val}\}$

   $T \to F$ $\{T_{.Val} = F_{.val}\}$

   $F \to 0 / 1$ $\{F_{.val} = 0 / 1\}$

   Which of the following statement(s) is/are true about the above SDT?

   S_1 : It converts the Decimal number to binary

   S_2 : It is an S–attributed grammar

   S_3 : It is an L-attributed grammar

   (A) S_1, S_2 and S_3 (B) S_2 only (C) S_3, only (D) S_2 and S_3

7. Consider the following table and the SQL query :

Targate2011

Test_id	Centre_name	Students_appeared	Test_date
2201	Hyderabad	100	7/11/2010
2202	Bangalore	300	14/11/2010
2203	Chennai	300	21/11/2010
2204	Hyderabad	200	28/11/2010
2205	Pune	150	5/12/2010
2206	Chennai	250	12/12/2010

```
Select Centre_name, SUM (Students_appeared)
From Targate2011
Group by Centre_name
Having Sum (Students_appeared) < 500
```

The number of tuples in the output table if we execute the above SQL query is____

8. Consider the following relational instance:

A	B	D
a_1	b_2	d_2
a_2	b_4	d_1
a_1	b_2	d_3
a_3	b_1	d_4
a_2	b_4	d_1

Which of the following functional dependencies are satisfied by the above instance?

(i) $A \rightarrow B$ (ii) $B \rightarrow A$ (iii) $D \rightarrow A$ (iv) $A \rightarrow D$

(v) $B \rightarrow D$ (vi) $D \rightarrow B$

(A) i, iii, vi only (B) ii, iii, vi only (C) ii, iii, iv only (D) i, ii, iii, vi only

9. If size of a TCP segment is 1KB and header length value is 6, the sequence number = 3500. Given that URG flag = 1 and URG pointer = 45. How many of them are urgent, Give the sequence numbers of urgent data.

(A) 45 bytes of urgent data, sequence no. 3500 – 3544
(B) 45 bytes of urgent data, sequence no. 1024 – 1069
(C) 46 bytes of urgent data, sequence no. 1024 – 1070
(D) 46 bytes of urgent data, sequence no. 3500 – 3545

10. If the initial sequence number is 1 and it increment the counter by 2,56,000 for every 2 sec, how long does it take for the counter to wrap around?

(A) 33,554 seconds (B) 44,554 seconds

(C) 33,455 seconds (D) 44,455 seconds

11. A hardest NP problem 'X' is reducible to problem 'Y' in a polynomial time. All the problems in NP are reduced to problem X, then which of the following statements are true?

S_1 : X is NP complete and Y is NP

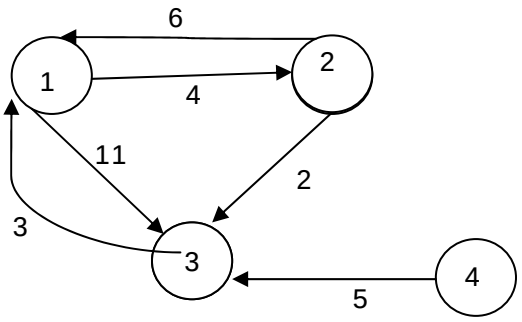
S_2 : X is NP complete and Y is NP hard

S_3 : X and Y are NP complete

S_4 : X and Y are NP hard hence they are NP complete

(A) S_2 & S_3 (B) S_1, S_2 & S_3 (C) S_3 & S_4 (D) S_1, S_2, S_3 & S_4

12. Give all pairs of shortest paths from the following graph:



(A) $\begin{matrix} 0 & 4 & 6 & \infty \\ 5 & 0 & 2 & \infty \\ 3 & \infty & 0 & \infty \\ 8 & 12 & 5 & 0 \end{matrix}$ (B) $\begin{matrix} 0 & 4 & 6 & \infty \\ 6 & 0 & 2 & \infty \\ 3 & 7 & 0 & \infty \\ 8 & 12 & 5 & 0 \end{matrix}$ (C) $\begin{matrix} 0 & 4 & 6 & \infty \\ 5 & 0 & 2 & \infty \\ 3 & 7 & 0 & \infty \\ 8 & 12 & 5 & 0 \end{matrix}$ (D) $\begin{matrix} 0 & 4 & 11 & \infty \\ 5 & 0 & 2 & \infty \\ 3 & 7 & 0 & \infty \\ 8 & 12 & 5 & 0 \end{matrix}$

13. The following is a recursive function used to print the elements of a singly linked list in the reverse order.

```
struct node
{
int data;
 struct node * next;
};
```

```
void fun (struct node *head)
  {
  if (P)
return;
   fun(Q);
  printf("%d", head → data);
   }
```

Then P & Q are

(A) head, head → data (B) !head, head → data

(C) head, head → next (D) !head, head → next

14. Which regular expression doesn't generate the following language?

$\{w$ / the length of w is atmost $4\}$ Where $\Sigma = \{a, b\}$

(A) $(\lambda \cup \Sigma)(\lambda \cup \Sigma \cup \Sigma\Sigma\Sigma)$ (B) $(\lambda \cup \Sigma\Sigma)(\lambda \cup \Sigma \cup \Sigma\Sigma)$

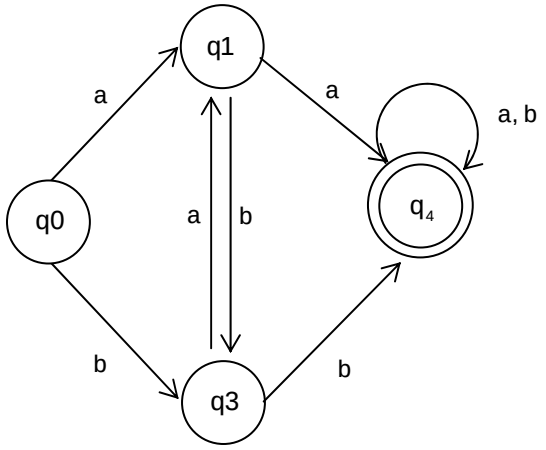
(C) $(\lambda \cup \Sigma)(\lambda \cup \Sigma)(\lambda \cup \Sigma)(\lambda \cup \Sigma)$ (D) $(\lambda \cup \Sigma\Sigma\Sigma)(\lambda \cup \Sigma \cup \Sigma\Sigma)$

15. Consider the adjacency matrix of the undirected graph G as follows:

	p	q	r	s	t	u
p	0	1	1	0	0	0
q	1	0	0	1	0	0
r	1	0	0	1	1	0
s	0	1	1	0	0	0
t	0	0	1	0	0	1
u	0	0	0	0	1	0

The number of bridge(s) of graph G is _____

16. Which of the following statement is true for the automaton below?



(A) All the strings end with either aa or bb

(B) All the strings start with either aa or bb

(C) All the strings containing aa or bb as a substring

(D) All the strings containing aa and bb as a substring

17. Which of the following are regular?

(i) $wxw^R \{w, x \in (0,1)^+\}$

(ii) $wxw \quad \{w, x \in (0,1)^*\}$

(iii) $wxw^R \{x, w \in (0,1)^* \text{ and } |x| = 10\}$

(A) (i) and (ii) only (B) (i) and (iii) only

(C) (i) only (D) None of the given

18. The minimum and maximum number of keys in the internal nodes of B-tree with order 4 is respectively

(A) 1, 3 (B) 2, 4 (C) 1, 4 (D) 2, 3

19. The number of Boolean function possible with 3-boolean variables such that the function contains exactly 2 or 7 min terms in their canonical sum-of-products form is ____

20. Which one of the following is not true about the threads?
(A) Threads in the same process share the same address space
(B) Context switching between threads in the same process is typically same as the context switching between processes
(C) A thread is a flow of control through a program with a single execution point
(D) None of these

21. The address of a terminal connected to a data communication processor consists of two letters of the alphabet or a letter followed by one of 10 numerals. The number of different addresses that can be formulated is _____

22. A ROM is used to store the table for multiplication of two 8 bit unsigned integer, the size of ROM required is
(A) 256×16 (B) $64K \times 16$ (C) $64K \times 8$ (D) 256×8

23. Which of the following statement is a contradiction or absurdity?
$S1 : (p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$
$S2 : (p \vee q) \leftrightarrow (q \vee p)$
$S3 : q \wedge \sim q$
$S4 : (p \rightarrow q) \wedge (p \vee q)$
(A) S3 only (B) S3 and S4 only
(C) S2, S3 and S4 only (D) All of these

24. A 20 KBPS device is connected to the processor. The interrupt overhead is 10 μsec. what is the minimum performance achieved when interrupt initiated data transfer is used instead of programmed I/O?
(A) 15 (B) 5 (C) 50 (D) 2.5

25. Decompose the following table into BCNF:
$R(ABCD)$
$A \rightarrow C$
$C \rightarrow A$
$AB \rightarrow D$
(A) $(AC)(ABD)$ (B) $(AC)(CBD)$ (C) Both (A) & (B) (D) None of these

Q. No. 26 – 51 Carry Two Marks Each

26. A two word instruction is stored in memory at an address designated by symbol W. The address field of the instruction (stored at W+1) is designated by symbol Y. The operand used during the execution of the instruction is stored at an address symbolized by the Z. Which of the following is/are correct if the addressing mode used is the relative addressing mode?
(A) $Z = M[Y] + (Y + 1)$ (B) $Z = (W + 2) + M[Y]$
(C) $Z = M[M[y]] + Y$ (D) Both (A) and (B)

27. When a servlet receives an HTTP GET Request for the first time, what method will be called?

(A) doGET (B) doPOST (C) doHEAD (D) processRequest

28. Mutex is a counting semaphore with initial value of 1. There are 5 active processes A, B, C, D and E. If the events happen in the following order,

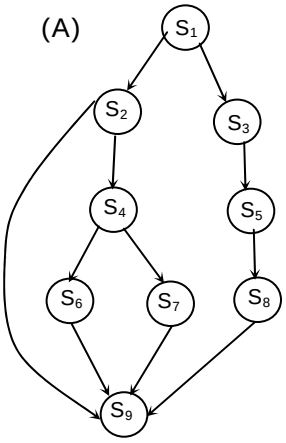
A arrives and executes wait(mutex)
B arrives and executes wait(mutex)
C arrives and executes wait(mutex)
A arrives and executes signal(mutex)
D arrives and executes wait(mutex)
B arrives and executes signal(mutex)
E arrives and executes wait(mutex)

Then the number of processes which will be blocked at the end is ____

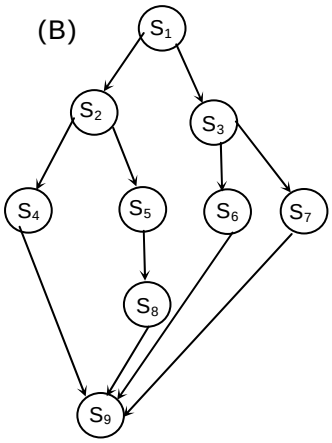
29. The precedence graph for the following fork and join construct is

S_1
Count = 4
Fork L1
S_2
S_4
Fork L2
S_7
Goto L4
L1 : S_3
Fork L3
S_5
Goto L4
L2 : S_8
Goto L4
L3 : S_6
L4 : join count
S_9

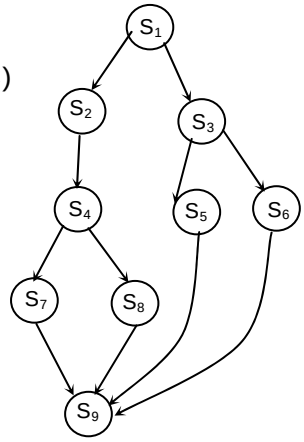
(A)



(B)



(C)

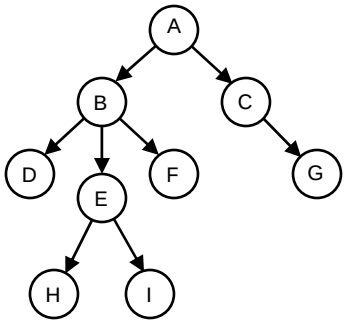


(D) None of these

30. What is the expected number of times 6 appears if a fair die is rolled 10 times?

(A) 5/3 (B) 7/2 (C) 5/2 (D) 7/3

31. Consider the following tree and locking sequences:



I. Lock-X(A), lock-x(B), lock-X(D), unlock (D), lock-X(F), unlock(F), unlock (B), unlock (A)

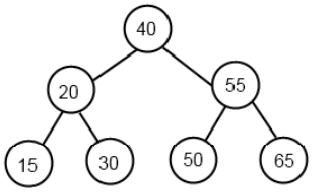
II. Lock-X(A), lock-X(E), lock-X(H), unlock(H), unlock (E), unlock (A)

III. Lock-X(B), lock-X(F), lock-X(E), unlock(F), unlock(E), unlock(B)

Which of the above is the valid locking sequence for tree-based protocol?

(A) II and III only (B) I only (C) I and III only (D) II only

32. Consider the following AVL tree.



The number of rotations performed after inserting 80, 75, 70 and 68 is _____

33. Consider a stack S with elements 1, 0, 2, 4, 5, 7 with top of the stack as 7 and two queues Q_1 and Q_2. Q1 contains elements 3, 6, 7,8,9,0 in that order from front to rear and Q_2 is initially empty. What are the contents of Q_1 & Q_2 if we execute the following code?

```
void foo( )
{
int x,y;
While (! empty (S))
{
x=pop (S);
y=dequeue (Q1);
x = x + y;
enqueue (Q1, x);
enqueue (Q2, y);
}
}
```

(A) Q_1 | | 10 | 11 | 11 | 10 | 9 | 1 |

Q_2 | | 3 | 6 | 7 | 8 | 9 | 0 |

(B) Q_1 | | 10 | 11 | 11 | 10 | 9 | 1 |

Q_2 | | 3 | 6 | 7 | 8 | 9 | 10 |

(C) Q_1 | | 10 | 11 | 10 | 11 | 9 | 1 |

Q_2 | | 3 | 6 | 7 | 8 | 9 | 0 |

(D) None of these

34. What is the output of the following program with dynamic scoping?

```
#include<stdio.h>
int b=5;
int func_1()
{
        int a=b+15;
        return a;
}
int func_2()
{
        int b=10;
        return func_1();
}
void main()
{
        printf("%d", func_1());
        printf("%d", func_2());
}
```

(A) 20, 20 (B) 25, 20 (C) 20, 25 (D) 25, 25

35. If a cache unit with capacity of 4Mbyte is built using $1M \times 1$ bit SRAM chips then the number of SRAM chips needed is _____

36. In a network the maximum lifetime of a segment is 30 sec and link capacity is 500Mbps.The number of bits required to avoid wrap around during this time is _____

37. Determine the efficiency of a token ring with a data rate of 250Mbps, a ring latency of 120 μsec and packet length is 5000 bits. Assume N hosts want to transmit and each host holds the token for a maximum of frame transmission time.

(A) $\frac{N}{7N+6}$ (B) $\frac{N}{6N+7}$ (C) $\frac{10N}{N+6}$ (D) $\frac{N}{N+6}$

38. Consider the following statements:

I. $A_{TM} = \{\langle M, W\rangle | M \text{ is a TM and M accepts W}\}$ is undecidable

II. A language L is decidable if both L and $\bar{L}$ are Turing – recognizable

Which of the above statement(s) is/are true?

(A) only I (B) only II (C) Both I and II (D) None of these

39. If bandwidth of a token ring is 48Mbps and token holding time is 5ms then the maximum payload in bytes is _____

40. Let L be the set of strings on $\sum = (0,1)$ such that

$x \in L$ iff number of 0's in x is divisible by k, $k \geq 2$ and number of 1's in x is odd

What is the number of states in the minimal DFA which accept the language L ?

(A) k+2 (B) 2k (C) $k \log_2 k$ (D) 2^k

41. Consider the following system of linear equations:

2x+y-2z=1

4x+3y-6z=5

x+2y-4z=7

The given system has

(A) no solution (B) infinite solutions

(C) unique solution (D) finite solutions

42. In how many ways you can write the number 5 as the sum of 6 non negative integers?

(A) 210 (B) 720 (C) 120 (D) 252

43. A Number is represented in 2's complement representation as $(FFFF)_H$, the equivalent decimal value is _____

44. Consider the following schedule:

T_1	T_2
	Read(A)
	A = A + 10
	Read (B)
	A = B + 10
	Write(A)
Read (B)	
B = B + 10	
Read (A)	
B = A + 10	
write(B)	
commit	
	Commit

Which of the following transaction problems is present in the given schedule?

(A) Dirty Read (B) Lost update

(C) unrepeatable read (D) Both (A) & (B)

45. CPU has made the following string of the references:

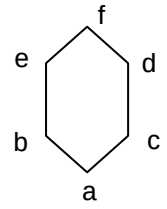
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

Which one of the following is/are the number of free frames which resulted in the same number of page faults for all the FIFO, LRU and optimal page replacement? (Assume that it uses pure demand paging)

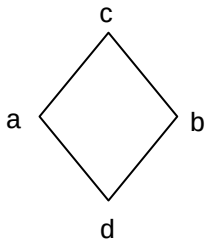
(A) 1 free frame (B) 2 free frames (C) 7 free frames (D) Both (A) and (C)

46. Which of the following is a distributed complemented lattice?

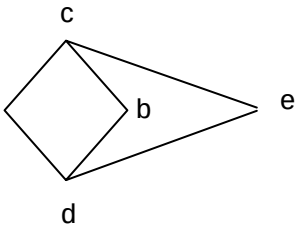
(i)



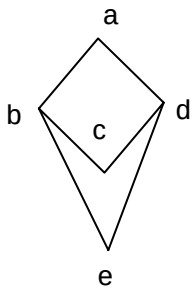
(ii)



(iii)



(iv)



(A) ii only (B) i & ii only (C) ii & iii only (D) ii & iv only

47. How many Equivalence Relations is possible on a set $A = \{1, 2, 3, 4, 5\}$.

(A) 15 (B) 52 (C) 32 (D) 25

Common Data Questions: 48 & 49

Size of the block = 1024 bytes

Size of the record pointer= 10 bytes

Size of the block pointer = 8 bytes

Size of the key = 10 bytes

48. What is the order of internal node and leaf node of B+ tree for the given data respectively?

(A) 58, 51 (B) 57, 50 (C) 57, 51 (D) 58, 50

Size of the Block = 1024 bytes
Size of the Record Pointer= 10 bytes
Size of the Block Pointer = 8 bytes
Size of the Key = 10 bytes.

49. What is the order of B-tree for the given data?
(A) 38 (B) 37 (C) 39 (D) 40

Common Data Questions: 50 & 51

Consider a software project 'A' having three modules each with LOC as given below:
module 1 – 22500 LoC
module 2 – 35000 LoC
module 3 – 12500 LoC

50. Given the system productivity as 1250 Loc/month and the labour rate as $5000 / month, the cost per each line of code (in $) is _____

A software project 'A' having three modules each with LOC as given below.
module 1 – 22500 LoC
module 2 – 35000 LoC
module 3 – 12500 LoC

51. In the above problem, the total cost of the project (in $) is _____

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each

Statement for Linked Answer Questions: 52 & 53

Consider a memory hierarchy system consisting of two levels. The access time of level 1 is 2ns. The miss penalty (The time to get data from level 2, in case of miss) is 100ns.

52. What is the average memory access time if the probability that valid data found in level 1 is 0.97?
(A) 4.5ns (B) 4ns (C) 6ns (D) 5ns

Consider a memory hierarchy system consisting of two levels. The access time of level 1 is 2ns. The miss penalty (The time to get data from level 2, in case of miss) is 100ns.

53. In order to reduce the average access time to 40% of the correct average access time obtained above, what should be the probability that valid data found in level 1?
(A) 100% (B) 98% (C) 97.9% (D) None

Statement for Linked Answer Questions: 54 & 55

Consider a RAM chip of size 128×8 is used to construct a memory.

54. How many chips are required to construct 16kB memory?
(A) 256 (B) 128 (C) 512 (D) 64

Consider a RAM chip of size 128×8 is used to construct a memory.

55. What should be the size of the decoder for constructing above capacity memory?
(A) 7×128 (B) 14×256 (C) 14×128 (D) 7×256

Q. No. 56 – 60 Carry One Mark Each

56. **AESTHETICS : BEAUTY ::**
(A) ethics : etiquette (B) epistemology : knowledge
(C) theology : morals (D) rhetoric : reasoning

Choose the appropriate antonym for the given words given below:

57. **ABOMINATE**
(A) loathe (B) despise (C) adore (D) abhor

Sentence completion

58. According to Maslow's theory of need hierarchy, material is the ---- demand of human beings, in that it provides the founding floor from which the other demands are generated.
(A) essential (B) basic (C) final (D) emotional

59. Choose the sentence that is grammatically correct:
(A) The serving bowl or the plates go on that shelf
(B) The serving bowls or the plate go on that shelf
(C) The serving bowl or the plate go on that shelf
(D) The serving bowls or the plates goes on that shelf

60. 5 red and 12 white balls are to be put in two bags, neither bag being empty. How must the balls be divided so as to give a person who draws one ball from either bag the greatest chance of drawing a red ball?
(A) $\frac{5}{8}$ (B) $\frac{3}{4}$ (C) $\frac{3}{8}$ (D) $\frac{2}{5}$

Q. No. 61 – 65 Carry Two Marks Each

61. The management of the company had cordially invited its staff for the 25th Anniversary function.
Choose the best conclusion:
(A) The company is going to wind-up the next year
(B) It is mandatory for all the staff to attend the function
(C) The management of the company is spend-thrift
(D) The company is well-established

62. A contractor receives a certain sum that he uses for paying wages. His capital, together with the weekly subsidy, would just enable him to pay 42 men for 52 weeks. If he had 60 men at the same wages, his capital together with the weekly subsidy would just suffice for 13 weeks. How many men can be maintained for 26 weeks?
(A) 48 (B) 80 (C) 68 (D) 30

63. 3L water is taken out from a vessel full of water and substituted by pure milk. This process is repeated two more times. Finally the ratio of milk and water in the solution becomes 1728: 27. Find the volume of the original solution.
(A) 4L (B) 6L (C) 8L (D) 2L

64. An apple vendor sells half the number of existing apples plus 1 to the first customer, sells $\frac{1}{3}$rd of the remaining apples plus 1 to the second customer and $\frac{1}{5}$th of the remaining apples plus 1 to the third customer. He then finds that he has 7 apples left. If each apple costs Rs.12, then how much money did he collect while selling apples?
(A) 375 (B) 445 (C) 336 (D) 27

65. Study the following Table:
Expenditure of a company (in lakh rupees) per Annum over given years

Year	Items of Expenditure				
	Salary	Fuel & Transport	Bonus	Interest on loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	74
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

Total expenditure on all these items in 1998 was approximately what % of expenditure in 2002?
(A) 72% (B) 68.5% (C) 69.45% (D) 67 %