Q. No. 1 – 25 Carry One Mark Each

1. Construct a binary search tree inserting 8, 6, 12, 3, 10, 9 one after another. To make the resulting tree as AVL tree, which of the following is required?
   (A) One right rotation only
   (B) One left rotation followed by two right rotations
   (C) One left rotation followed by one right rotation
   (D) The resulting tree itself is AVL

2. In the program given below

```
for{i=0;i<n;i++}
{
        for(j = 0; j < i; j++)
        {
                x → A[i][j] = i + j
        }
}
```

   x gets executed how many times?
   (A) n (B) $\frac{n(n+1)}{2}$ (C) $\frac{n(n-1)}{2}$ (D) n^2

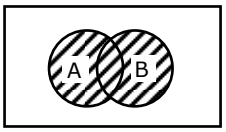
3. The chromatic number of cycle graph with 7 vertices is_____

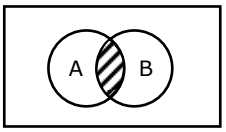
4. The number of elements in the smallest equivalence relation over set A with $|A| = n$ is
   (A) n (B) n^2 (C) $\frac{n^2 - n}{2}$ (D) 2^{n^2}

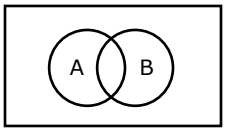
5. If every node in a graph 'G' is adjacent to equal number of nodes, then the graph G is said to be
   (A) Regular (B) Complete
   (C) Finite (D) strongly connected

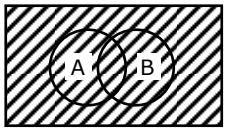
6. Booth's recording pattern for –52 in 8-bit is
   (A) 0-1011-100 (B) 0-1011-101 (C) 0-101-1001 (D) 0-1010-100

7. The Venn diagram representing the Boolean expression $A + (\bar{A}.B)$ is

(A) 

(B) 

(C) 

(D) 

8. Consider the following statements:

S_1 : An arithmetic shift left multiplies a signed binary number by 2.

S_2 : An arithmetic shift – right divides the signed binary number by 2.

S_3 : Arithmetic shift left does not cause any over flow always.

Which of the following is correct?

(A) S_1 is true, S_2 is false, S_3 is false (B) S_1 is true, S_2 is true, S_3 is true

(C) S_1 is true, S_2 is false, S_3 is true (D) S_1 is true, S_2 is true, S_3 is false

9. Consider the following register transfer statement:

$P : R_1 \leftarrow R_1 - 1$

Here P is the control signal and R_1 is the 4-bit register. Which one of the following is correct optimal specification for implementing the above micro operation?

(A) It requires four full adder circuits.

(B) It requires three half adders and one full adder circuits.

(C) It requires four half adder circuits.

(D) It requires three full adders and one half adder circuit.

10. The complete bipartite graph $K_{m,n}$ has vertex covering number X and edge covering number Y. X and Y are respectively

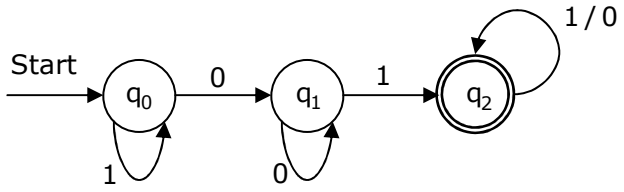
(A) max(m, n), min(m, n) (B) min(m, n), min(m, n)

(C) m+n, mn (D) min(m, n), max(m, n)

11. A table has 7 seats, 4 placed on one side facing towards window and three placed on the opposite side. In how many ways can seven people be seated at the table if 3 people x, y and z have to be seated on the side facing towards window?

(A) 576 (B) 476 (C) 560 (D) 575

12. Consider the following DFA.



What is the language accepted by the above DFA?

(A) Strings over $\sum = \{0,1\}$ contains '01' as a substring.

(B) Strings over $\sum = \{0,1\}$ contains '01' as ending string.

(C) Strings over $\sum\{0,1\}$ contains '01' as starting string.

(D) None of these

13. What is the language accepted by the following productions of the grammar?

$S \rightarrow aA \mid a \mid bS$

$A \rightarrow aA \mid a \mid bS$ where $V=\{S,A\}$; $T=\{a,b\}$

(A) Strings over $\sum = \{a,b\}$ ending with 'a'.

(B) Strings over $\sum = \{a,b\}$ contains even number of a's.

(C) All Strings over $\sum = \{a,b\}$

(D) None of these

14. Consider the grammar:

$E \rightarrow TE^1$

$E^1 \rightarrow +TE^1 \mid \in$

$T \rightarrow FT^1$

$T^1 \rightarrow *FT^1 \mid \in$

$F \rightarrow (E) \mid id$

What is FOLLOW (F)?

(A) {+, *,), $} (B) {+,), $} (C) {*,), $} (D) {+, (,), *}

15. Match the following applications with the corresponding well-known port numbers.

List – I	**List - II**
1. SNMP	a. Port = 20
2. SMTP	b. Port = 21
3. FTP (Control)	c. Port = 161
4. FTP (Data)	d. Port = 25

(A) 1-d, 2-c, 3-b, 4-a (B) 1-c, 2-a, 3-b, 4-d

(C) 1-c, 2-d, 3-a, 4-b (D) 1-c, 2-d, 3-b, 4-a

16. The number of leaf nodes in a rooted tree of '17' nodes, with each node having 0 or 4 children is_____

17. Let $T(n)$ be the function defined by

$T(1) = 1;\ T(n) = 2T(n/2) + \sqrt{n}$ for $n \geq 2$. Which of the following is true?

(A) $T(n) = O(\sqrt{n})$ (B) $T(n) = \Theta(n)$ (C) $T(n) = O(\log n)$ (D) None of these

18. Which of the following is not an in-place sorting algorithm?

(A) Bubble sort (B) Merge sort (C) Insertion sort (D) Heap sort

19. Match the following lists:

List – I		**List – II**	
(a)	Working set model	1.	Deadlocks
(b)	Dual mode operation	2.	Virtual memory
(c)	Wait for graph	3.	Thrashing
(d)	Lazy swapper	4.	Protection

(A) $a-4, b-3, c-2, d-1$ (B) $a-3, b-4, c-1, d-2$

(C) $a-3, b-1, c-4, d-2$ (D) $a-4, b-2, c-3, d-1$

20. There are 25 bits in a physical address. The physical memory is divided into 32 equal partitions. If the total number of entries in the page table is 2^{22}, then the number of bits in the logical address is _____

21. Using 5-bit sequence numbers, what is the maximum size of the sender and receiver windows for selective repeat protocol?

(A) 16, 1 (B) 1, 1 (C) 16, 16 (D) 31, 1

22. A class-c network is assigned with a subnet mask of 255.255.255.248.The total number of hosts possible in all the sub networks together in the above network is_____

23. The following schedule is

$T_1 : R(x)$

$T_2 : R(x)$

$T_2 : W(x)$

$T_1 : W(x)$

T_2 : commit

T_1 : commit

(A) Conflict serializable schedule (B) Not strict

(C) Strict (D) Both (A) & (B)

24. Find out the set of FD's for the relational schema R (ABCD) with primary key AB and under which R is in 2nf but not in 3NF.

(A) $\{AB \to CD,\ A \to C,\ C \to D\}$ (B) $\{AB \to CD,\ B \to C,\ C \to B, A \to D\}$

(C) $\{AB \to CD,\ C \to D,\ DB \to AC\}$ (D) $\{AB \to CD,\ BC \to D\}$

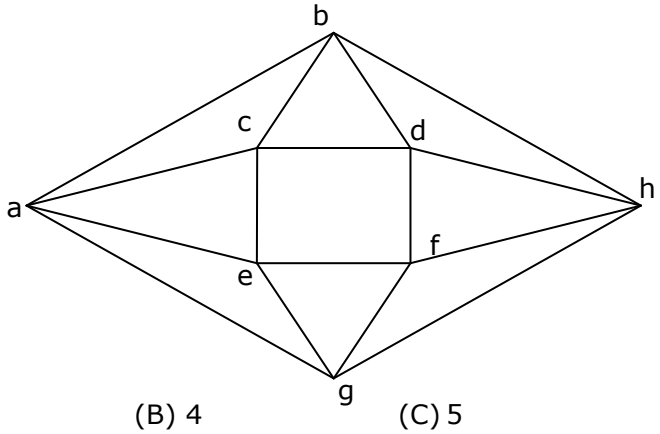
25. Where, in an HTML document, is the correct place to refer to an external style sheet?

(A) At the top of the document (B) At the end of the document

(C) In the <body> section (D) In the <head> section

Q. No. 26 – 51 Carry Two Marks Each

26. What is the chromatic number of the following graph?



(A) 3 (B) 4 (C) 5 (D) 6

27. A die is rolled 10 times. The probability that exactly 7 odd numbers turn up among the 10 outcomes is

(A) $\frac{15}{128}$ (B) $\frac{14}{128}$ (C) $\frac{16}{128}$ (D) none of these

28. Consider a set $A = \{1,2,3,4,5,6,7,8,9,10\}$. A binary relation R on A is defined as aRb, iff $(a-b) \bmod 10 = 0$; then which of the following statements are true?

1. R is reflexive
2. R is anti-symmetric
3. R is symmetric
4. R is transitive

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

29. Number of ways of painting a regular pentagon with 5 different colours is

(A) 5! (B) 12 (C) 1 (D) 4!

30. Find the solution for the following recurrence relation.

$a_n = 5n^2 a_{n-1}$, $a_0 = 5$

(A) $a_n = (n!)^2$ (B) $a_n = 5\,(n!)^2$ (C) $a_n = 5^n\,(n!)^2$ (D) $a_n = 5^{n+1}\,(n!)^2$

31. Consider two hosts with the IP-addresses as follows:

Host 1: 198.5.32.92

Host 2: 198.5.32.40

The subnet mask is 255.255.255.192. Then which one of the following statement is correct?

(A) Both the hosts are in the same sub network

(B) The sub network address of the host 1 is 198.5.32.64

(C) The sub network address of host2 is 198.5.32.44

(D) None of these

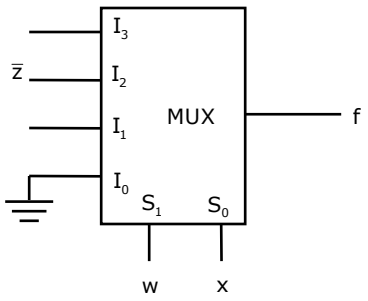
32. 16-bit representation of 2's complement number -108 is

(A) 1111 1111 1001 0100 (B) 0000 0000 1001 0100

(C) 1000 0000 1001 0100 (D) 1000 1111 1001 0100

33. $f(w,x,y,z) = \sum_m (4,5,7,8,10,12,15)$

What will be the input to I_1 and I_3 of the following 4×1 multiplexer?



(A) $y\bar{z},\ \bar{y} + \bar{z}$ (B) $\bar{y} + z,\ y \odot z$ (C) $\bar{y} + z,\ y \oplus z$ (D) $x + \bar{y},\ y \oplus z$

34. A CPU supports 4 interrupts - I_1, I_2, I_3 and I_4. It supports priority of the interrupts. Nested interrupts are allowed if later interrupt is having higher priority than the previous one. During a certain period of time we observe the following sequence of entry into and exit from the interrupt service routine.

I_1 – start …….I_2 - start ….. I_2 end …. I_4 - start ….. I_3 start ….. I_3 end … I_4 end - I_1 end

From the above sequence what we can infer about the priorities interrupt routines?

(A) $I_3 > I_4 > I_2 > I_1$ (B) $I_4 > I_3 > I_2 > I_1$

(C) $I_2 > I_1; I_3 > I_4 > I_1$ (D) $I_1 > I_3 > I_2 > I_4$

35. Assume a stack – oriented processor that includes the stack operations PUSH and POP. Begin with an empty stack, following instructions were executed.

PUSH 4

PUSH 15

PUSH 10

ADD

PUSH 9

SUB

MUL

What is the content of stack after the above instructions are executed?

(A) 64 (B) -64 (C) 136 (D) -136

36. Let the register 'R' contains the value '500'. The index register contains the value '100'. What must be the address field of an indexed addressing mode instruction to make it the same as a register indirect mode instruction?

(A) 400 (B) 600 (C) 300 (D) 800

37. Which of the following statements is not TRUE?

(A) Every regular language is recursive

(B) Recursive language is a subset of recursive enumerable language

(C) A language L and its compliment both are recursive enumerable then L should be recursive

(D) Every recursive enumerable language needs to be context sensitive

38. Consider the following two grammars:

(a) $Z \rightarrow F$
$F \rightarrow D \mid N$
$D \rightarrow D \text{ or } K \mid K$
$N \rightarrow \text{not } F$
$K \rightarrow K \text{ and } A \mid A$
$A \rightarrow (F) \mid id$

(b) $Z \rightarrow S$
$S \rightarrow aA$
$A \rightarrow S$
$A \rightarrow \in$

(A) Both (a) & (b) are LL (1) (B) Neither (a) nor (b) are LL (1)

(C) Only (a) is LL (1) (D) Only (b) is LL (1)

39. Which of the following sequence will result in strict binary search tree? (Each node has either two children or none)

(A) 4,5,2,1,3 (B) 4,6,2,1,3,5 (C) 4,6,5,7,3,2 (D) 4,5,3,2,6

40. The algorithm to calculate the number of nodes in binary tree is

```
int CN(struct node *node)
{
if (node == NULL)
return 0;
return 1+CN(node → left) + CN(node → right);
}
```

What is the complexity of above program assuming there are 'n' nodes in tree?

(A) $O(n)$ (B) $O(\log n)$ (C) $O(n \log n)$ (D) $O(n^2)$

41. Given is a sorted array of 20 elements i.e. a[1.....20] in increasing order. If binary search algorithm is used, then the number of comparisons required in worst case to search an element is_____

42. In a byte addressable system, logical address space of 2^{30} bytes and a page size of 1 K bytes. The total size of the memory required for storing the page table is 2 M bytes. If each page table entry also contains 3 bits for book keeping, then the size of the physical memory in M Bytes is_____

43. Consider the following two lists.

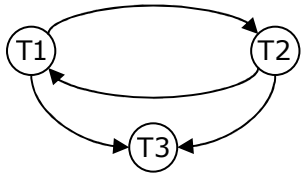
List-I	List – II
P. Presentation layer	1. Resource records
Q. Application layer	2. Encryption
R. Session layer	3. Synchronization
S. Data link layer	4. Encoding

Which one of the following is the correct match for the above two lists?

(A) P-2,Q-1,R-3,S-4 (B) P-1,Q-2,R-3,S-4

(C) P-1,Q-4,R-2,S-3 (D)P-4,Q-3,R-2,S-1

44. The precedence graph of a schedule with three transactions T_1, T_2, T_3 is



The possible schedule for the above graph may be

(A)

T1	T2	T3
read(A)		
	write(A)	
write(A)		
		write(A)

(B)

T1	T2	T3
read(A)		
	write(A)	
		write(A)
write(A)		

(C)

T1	T2	T3
read(A)		
		write(A)
	write(A)	
write(A)		

(D) None of these

45. Consider a relation *R*(*A, B,C,D, E*) with the following FD set F

{

A → BC

CD → E

B →D

E →A

}

The canonical cover of the above FD set is

(A) {A → BC, C → E, B → D, E → A}

(B) {A → BC, CD → E, B → D, E → A}

(C) {A → BC, B → E, B → D, E → A}

(D) {A → B, CD → E, B → D, E → A}

46. Consider the relation schema:
Works (person_name, company_name, salary);
It finds the persons whose salaries are more than salary of every body who work for company xyz. The SQL Query is
(A) Select person_name from Works where salary > ANY(select salary from Works where company_name = 'xyz')
(B) Select person_name from Works where salary
IN (select salary from Works where company_name = 'xyz')
(C) Select person_name from Works where salary > ALL (select salary from Works where company_name = 'xyz')
(D) None of these

47. Which of the following is included in the software requirements specification?
(A) Error handling (B) Functional description
(C) Performance description (D) Maintainability description

Common Data Questions: 48 & 49

Consider the following C-program

```
int f(int num)
{
int result = 0
if(num ≤ 1)
return 1;
else{
for(i=num;i ≥ 1;i--)
{
result+ = f(i / 3);
}
}
return result;
}
```

48. When num = 6 then the return value of the function is _____

Consider the following C-program

```
int f(int num)
{
int result = 0
if (num ≤ 1)
return 1;
else{
for (i=num;i ≥ 1;i--)
{
result+ = f(i / 3);
}
}
return result;
}
```

49. What is the time complexity of the above function?

(A) $O(n)$ (B) $O(n^2)$ (C) $O(n\log_3 n)$ (D) None of these

Common Data Questions: 50 & 51

Assume that the network has a bandwidth of 2M bytes/sec, and the propagation delay of 10ms. Assume that there were no message losses.

50. A node waits for an acknowledgement ACK (100bytes) before transmitting the next packet (10k byte). What is the utilization of the network?

(A) 20% (B) 25% (C) 30% (D) 73%

Assume that the network has a bandwidth of 2M bytes/sec, and the propagation delay of 10ms. Assume that there were no message losses.

51. Size of the packet is 1kbyte, then the latency of packet in ms is _____

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

Statement for Linked Answer Questions: 52 & 53

The Banker's Algorithm for avoiding the Deadlock has got the following data structure, with four processes P_0 ,P_1 ,P_2, P_3 and resource types A, B, C and D

Process	Allocation	Maximum	Available
	A B C D	A B C D	A B C D
P_0	2 1 2 0	4 1 3 2	3 0 1 2
P_1	1 0 0 2	4 1 0 3	
P_2	2 0 2 1	5 4 4 1	
P_3	2 3 4 1	3 3 6 5	

52. What will be the safety sequence of the above processes in order to avoid the dead lock?

(A) P_0, P_3, P_1, P_2 (B) P_0, P_1, P_2, P_3 (C) P_0, P_1, P_3, P_2 (D) P_0, P_2, P_1, P_3

The Banker's Algorithm for avoiding the Deadlock has got the following data structure, with four processes P_0 ,P_1 ,P_2, P_3 and resource types A, B, C and D

Process	Allocation	Maximum	Available
	A B C D	A B C D	A B C D
P_0	2 1 2 0	4 1 3 2	3 0 1 2
P_1	1 0 0 2	4 1 0 3	
P_2	2 0 2 1	5 4 4 1	
P_3	2 3 4 1	3 3 6 5	

53. Assume the processes are arrived into the ready Queue in the correct order above at time t_o. What will be the average waiting time using round Robin scheduling with a time quantum 5 ms? (The CPU Burst requirements of P_0, P_1, P_2, P_3 are 5 ms, 10 ms, 7 ms and 8 ms respectively)

(A) 14.5 ms (B) 13 ms (C) 12.5 ms (D) 15 ms

Statement for Linked Answer Questions: 54 & 55

Given below are two regular languages

$L_1 = \{W / W \text{ in } \{0,1\}^* \text{ and each string starts with '0'.}\}$

$L_2 = \{W / W \text{ in } \{0,1\}^* \text{ and each string ends with '1'}\}$

54. Which one of the following is the intersection of the two languages L_1 and L_2?

(A) $\{W / W \in \{0,1\}^*$ and each string should start and end with either '0' or '1'$\}$

(B) $\{W / W \in \{0,1\}^*$ and each string should start and end with different symbols$\}$

(C) $\{W / W \in \{0,1\}^*$ and each string should start and end with same symbols$\}$

(D) $\{W / W \in \{0,1\}^*$ and each string starts with '0' and ends with '1'$\}$

Given below are two regular languages.

$L_1 = \{W / W \text{ in } \{0,1\}^* \text{ and each string starts with '0'.}\}$

$L_2 = \{W / W \text{ in } \{0,1\}^* \text{ and each string ends with '1'}\}$

55. What is the number of non-final states in the minimized DFA accepting the correct language above?

(A) 2 (B) 3 (C) 4 (D) 5

Q. No. 56 – 60 Carry One Mark Each

56 Before she knew what had happened a man suddenly fell on her **.....** across and stealing her handbag.

(A) lurking (B) lurching (C) limping (D) lunging

57 Construction of the Roman Colosseum, which was officially known as the Flavian Amphitheater, began in A.D.69, during the reign of Vespasian, was completed a decade later, during the reign of Titus, who opened the Colosseum with a one-hundred-day cycle of religious pageants, gladiatorial games, and spectacles.

(A) which was officially known as the Flavian Amphitheater, began in A.D. 69, during the reign of Vespasian,

(B) officially known as the Flavian Amphitheater, begun in A.D. 69, during the reign of Vespasian, and

(C) which was officially known as the Flavian Amphitheater, began in A.D. 69, during the reign of Vespasian, and

(D) officially known as the Flavian Amphitheater and begun in A.D. 69, during the reign of Vespasian it

58 Sedative: Drowsiness

(A) epidemic: contagiousness (B) vaccine: virus

(C) anesthetic: numbness (D) therapy: psychosis

59 Choose opposite word for **"Veneration":**

(A) Derision (B) Avoidance (C) Ostracism (D) Defiance

60 A certain amount becomes 5 times in 3 years at compound interest. In how many years will it be 3125 times of the amount?

(A) 9 (B) 12 (C) 15 (D) 25

Q. No. 61 – 65 Carry Two Marks Each

61. If the sum of n terms of a series in AP is $n^2 + 3n$, find the 6^{th} term of this series ?

(A) 12 (B) 16 (C) 10 (D) 14

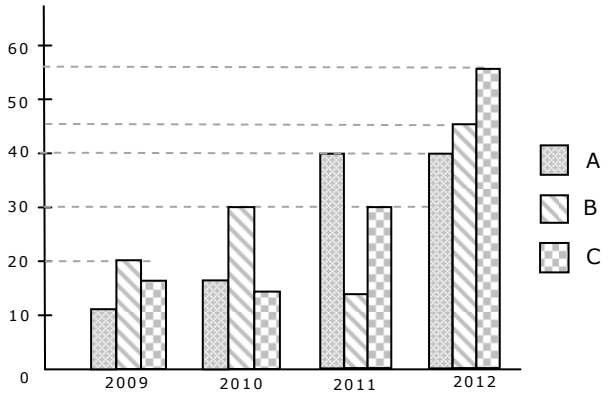
62 Consider a set of numbers $X = \{1, 2, 3, 4, 5, 6, 7, 8\}$. Take every distinct two element subsets of 'X' and write down the number that is greater. For eg. if you take the subset of $\{3,7\}$, you will write down 7. What is the sum of all numbers that you write down ?

(A) 160 (B) 84 (C) 168 (D) 188

63. After striking the floor, the rubber ball rebounds to $\frac{3}{5}$th of the height from which it has fallen. Find the total distance that it travels before coming to rest. If it has been gently dropped from a height of 180 meters ?

(A) 200m (B) 600m (C) 720m (D) 800m

64. Production of sugar (in thousand tons) by three sugar mills over the year



Which of the statement is true ?

i. Ratio between the production of B in 2011 to C in 2012 is 3 :11

ii. Average production of A in four years is 20

iii. Percentage increase in C in 2011 from the previous year is 100%

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

(C) i & iii only (D) i, ii & iii

65 In years past, professional baseball players lifted weights less but were also injured less often during games. Obviously, the more an athlete lifts weights, the higher the likelihood of injury.

The conclusion above presupposes which of the following?

(A) The increase in baseball injuries is due to a factor other than weightlifting.

(B) The activities of baseball players represent those of athletes as a group.

(C) Most baseball injuries today result from too much weight-lifting.

(D) There is no proven correlation between how much athletes lift weights and how likely they are to be affected by injury.