Q. No. 1 – 25 Carry One Mark Each

1. Which of the following properties of variance is true?

   (i) $V(ax) = a^2 V(x)$; if x is random variable and a is constant.

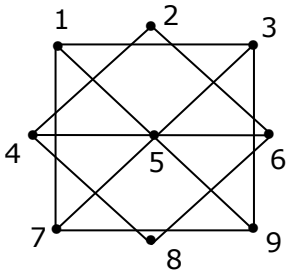
   (ii) $V(x-4) = V(x) - V(4)$; if x and y are independent Random variables

   (iii) $V(ax+b) = a^2 V(x) + b$; if x is a random variable, a and b are constants.

   (A)Only (i) (B) All are true

   (C)(i) & (iii) are true (D) (ii) and (iii) only

2. The chromatic number of graph shown below is _____



3. Consider the following two statements:

   S_1: to apply Simpson's $\frac{1}{3}$ rule, n must be even.

   S_2: to apply Simpson's $\frac{3}{8}$ rule, n must be multiple of 3.

   Where n is number of sub intervals. Which of the following is true?

   (A) Only S_1 (B) Only S_2

   (C) Both (A) & (B) (D) Neither S_1 nor S_2

4. It is observed that the diameter of an electric cable is assumed to be continuous random variable with density function $f(x) = \frac{6x}{5}(1+x),\ 0 \le x \le 1$. Then mean of the electric cable is

   (A) 1 (B) $\frac{10}{7}$ (C) $\frac{7}{10}$ (D) None of these

5. The percentage of page faults by FIFO page replacements for a memory with 4 frames for the page reference string 4 5 1 2 1 3 4 5 4 1 2 5 3, assuming pure demand paging is_____

6. Consider the following context free grammar:

$S \rightarrow SA/B$

$A \rightarrow 0\ B1/A0/0$

$B \rightarrow 1A0/B1/1$

Which of the following strings is accepted by the grammar?

(A) 010110111 (B) 001100100

(C) 101000100 (D) None of the above

7. Which problem among the following is encountered in the given schedule?

(A) Dirty Read

(B) Unrepeatable Read

(C) Blind Write

(D) Phantom Problem

T1	T2
R(A)	
R(B)	
B= A	
W(B)	
	R(A)
	A = A + 10
	W(A)
	Commit
R(A)	
R(C)	
C = A	
W(C)	

8. Given that the block size is 512 bytes, search field is 9 bytes, record pointer is 7 bytes and a block pointer is 6 bytes long, the order of B-tree is _____

9. The minimum size (in meters) of the 18Mbps token ring with 36bit token by assuming velocity of propagation as $1.4 \times 10^8 m/sec$ is _____

10. An IPv4 datagram has arrived in which the offset value is 800, the value of HLEN is 8, and the value of the total length field is 500 and the M bit is 0. What are the sequence numbers of the first and last bytes of the payload and the position of the datagram respectively?

(A) 6400, 6887 and Last fragment (B) 6400, 6867 and First fragment
(C) 6400, 6867 and Last fragment (D) 801, 1268 and First fragment

11. How many distinct spanning trees do exist in an undirected cycle graph of n vertices?

(A) n (B) n-1
(C) n+1 (D) n+2

12. Which of the following statements is/are true?

I. Adjacency list representation is better for sparse graph than adjacency matrix representation.

II. Finding whether there is an edge between any 2 node in a graph is easier in Adjacency list representation.

III. Adding a vertex in adjacency list representation is easier than adjacency Matrix representation.

(A) I only (B) II & III only (C) I & III only (D) I, II & III

13. Degree sequence of a simple graph is the sequences of the degree of the nodes in the graph in descending order. Which of the following sequences can be the degree sequence of simple graph?

I. 5,5,1,1,1,1,1,,1,1,1

II. 6,6,6,5,5,4,3

III. 7, 6,5,5,4,4,3,2

IV.7, 6, 6, 4,4,3,2

(A) I only (B) II & III only (C) I & III only (D) I, II & III only

14. If a program contains 4 "if" statements, 2 "FOR" loops and 3 "Until" loop then the cyclomatic complexity of the program is ____

15. In a given grammar $G = (N, T, P, S)$, if every production in P is of the form $\alpha A\beta \rightarrow \alpha b\beta$, where α, β and $b \in (N \cup T)^*$ and $A \in N$. What is the type of grammar G?

(A) Context Sensitive Grammar (B) Context free Grammar
(C) Regular Grammar (D) Unrestricted Grammar

16. Let G be the grammar with production rules as follows:

$S \rightarrow AX / YC$
$A \rightarrow aA / \in$
$C \rightarrow cC / \in$
$X \rightarrow bXc / \in$
$Y \rightarrow aYb / \in$

Which of the following is true about G?

(i) G is ambiguous (ii) G is unambiguous
(iii) G is left recursive grammar
(iv) G is right recursive grammar

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

17. Consider the following two grammars:

G_1	G_2
$S \rightarrow 0A / \lambda$	$S \rightarrow AS$
$A \rightarrow 1S$	$S \rightarrow \lambda$
	$A \rightarrow BD$
	$B \rightarrow 0$
	$D \rightarrow 1$

Which of the following is correct?

(A) $L_1 \subset L_2$ (B) $L_2 \subset L_1$ (C) $L_1 \neq L_2$ (D) $L_1 = L_2$

18. Assuming a 4 KB page size, what are the page number and offset respectively, for the logical address 4370(provided as decimal numbers)?

(A) Page no= 4 & page offset=272 (B) Page no=1 & page offset=274
(C) Page no=0 & page offset= 370 (D) Page no=1 & page offset=272

19. The number of 1's in the binary representation of $(5 \times 1024 + 3 \times 256 + 128 + 3)$ is _____

20. Consider the regular expression $(a+b)^* a(b+ab)^*$

The number of strings present in the language of the given regular expression whose length less than 4 is _____

21. Assume innermost track has diameter 1cm and outermost track has diameter 10cms. There are 10 tracks in disk and disk is rotating with constant linear velocity. Capacity of innermost track is 1MB. Total capacity of the disk is

(A) 54MB (B) 53MB (C) 55MB (D) 57MB

22. Consider a $2-$way set associative cache memory with 4 sets and total 8 cache blocks $(0-7)$. Main memory has 64 blocks $(0-63)$ .The total number of conflict cache misses for the following sequence of memory block references is _____ (Assume LRU policy is used for replacement and cache is initially empty)

0 5 9 13 7 0 15 25

23. A system uses fixed size partitioning memory allocation technique where 10 partitions are available and each partition size is 100KB.The requests of the processes are in the following order (all in KB):

60, 40, 55, 75, 84, 20

The total amount of internal fragmentation in KB is _____

24. A real $n \times n$ matrix $A=\left[a_{ij}\right]$ is defined as follows $a_{ij} = i^2 j$, if $i = j$ and 0 otherwise. The summation of all n Eigen values of A is

(A) $n(n+1)/2$ (B) $n(n+1)(n+2)/3$

(C) $n(n+1)(2n+1)/6$ (D) $n^2(n+1)^2/4$

25. Suppose an organization A uses non-pipelined system which takes 60 ns to process a task. The same task can be processed in a 6 segment pipeline with clock cycle of 10 ns by the organization B. The speed up ratio of the organization B for the 1000 tasks is _____

Q. No. 26 – 51 Carry Two Marks Each

26. What is the total number of Read after Write (RAW), Write after Read (WAR) and Write after Write (WAW) dependencies, respectively in the following assembly program?

Add R_5, R_0, R_1; $R_5 \leftarrow R_0 + R_1$
Sub R_0, R_2, R_5; $R_0 \leftarrow R_2 - R_5$
MUL R_3, R_2, R_0; $R_3 \leftarrow R_2 * R_0$
OR R_5, R_0, R_4; $R_5 \leftarrow R_0$ or R_4
Store R_6, x; $x \leftarrow R_6$

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

27. Which of the following is false regarding activation tree?

(i) Each node represents an activation of a procedure.

(ii) The root node represents the activation of sub program.

(iii) The node A is parent of node B if A calls B.

(A) (i), (ii) Only (B) (ii), (iii) Only (C) (iii) Only (D) (ii) Only

28. Suppose we have a system with a 32 bit virtual address, page size of 4 KB, and 4 bytes per page table entry. Suppose we use two-level paging and arrange for all page tables to fit into a single page frame. How will the bits of the address be divided up as outer index, inner index and offset?

(A) 12, 8, 12 (B) 8, 12, 12 (C) 10,10,12 (D) 6,14, 12

29. Consider the following statement:

I. Changing Somebody's credit card pin number is the example of both Confidentiality breach and Integrity Breach.

II. Worm is an example of program threat.

III. Access Matrix is one of the models of system security in operating system.

IV. Asymmetric Encryption is preferred for encrypting large amount of data.

Which of the following option is correct?

(A) TTTF (B) TFFT (C) TFFF (D) FTFT

30. Which of the following simple graph is necessarily connected?

(A) A graph $G = (V,E)$ with 6 vertex and 10 edges

(B) A graph $G = (V,E)$ with 7 vertex and 16 edges

(C) A graph $G = (V,E)$ with 8 vertex and 21 edges

(D) A graph $G = (V,E)$ with 9 vertex and 28 edges

31. Consider the table R(a,b,c) and queries given below:

Q1: SELECT DISTINCT a,b FROM R;

Q2: SELECT a,b FROM R GROUP BY a,b;

(A) Q1 and Q2 produce always same result

(B) The output of Q1 is subset of the output of Q2

(C) The output of Q2 is subset of the output of Q1

(D) Q1 and Q2 produce different result

32. Consider an array of elements 6 4 5 3 7 1. The contents of the array after three passes when we apply bubble sort on it is

(A) 3 4 1 5 6 7 (B) 3 4 5 1 6 7

(C) 3 1 4 5 6 7 (D) 3 4 5 6 1 7

33. The output of the following procedure is

```
int foo(int m, int n)
{
    while( m! = n)
    {
       if (m > n)
            m = m – n;
        else
            n = n – m;
    }
  return n;
}
```

(A) m%n (B) $m \div n$

(C) LCM (m,n) (D) GCD(m,n)

34. Express the following recurrence relation in asymptotic notation.

$T(n) = 8T(n/8) + \sqrt{n}$

(A) $\Theta\left(\sqrt{n}\right)$ (B) $\Theta(n)$ (C) $\Theta\left(n^{3/2}\right)$ (D) $\Theta\left(n^2\right)$

35. Consider a word addressable main memory of size 2 million words which is partitioned into blocks where one block is equivalent to 1k words. Cache memory size is 64 kB and Word size is 16 bits. How many tag bits are required for implementing direct mapping?

(A)8 (B)6 (C)11 (D) 14

36. An Internet Service Provider (ISP) is granted a block of addresses starting with 145.75.0.0/16. The ISP needs to distribute these addresses to three groups of customers as follows:

(a) The first group has 128 customers; each needs 256 addresses.

(b) The second group has 128 customers; each needs 64 addresses.

(c) The third group has 64 customers; each needs 128 addresses.

Find the first address of 128^{th} customer of 2^{nd} group and how many addresses are still available with ISP after these allocations.

(A) 145.75.127.128/24, 32768 (B) 145.75.159.192/26, 16384

(C) 145.75.159.192/26, 32768 (D) 145.75.191.128/25, 16384

37. Calculate the effective throughput for transferring a window size of 1000KB file assuming TCP is used. Given the round trip time 100 ms .

(A) 5MBPS (B) 10MBps (C) 1MBPS (D) 1Mbps

38. Which of the following statements is/are true?

(i) A Graph $k_{3,3}$ is traversable.

(ii) Complete Graph of n vertex $(n \geq 3)$ has a Hamiltonian cycle.

(iii) A Graph G has $\frac{(n-1)!}{2}$ Hamiltonian cycle if (G is complete Graph of n vertex (n>2)).

(iv) A line Graph of a clique is also clique.

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

39. Consider the following tables R(A,B) and S(B,C):

Identify the relational algebra expression which is not equivalent to rest of the three.

(A) $\Pi_{A,R.B}(R \times S)$ (B) $R \lhd\rhd \Pi_B(S)$

(C) $R \cap (\Pi_A(R) \times \Pi_B(S))$ (D) $\Pi_{A,B}(R \lhd\rhd S)$

40. Which of the following language is regular?

(A $\{a^{2n}b^m c^n \mid n, m \geq 0\}$ (B) $\{a^n b^{2m} c^k \mid n, m, k \geq 0\}$

(C) $\{b^m c^{2k} a^n \mid n = m, k \geq 0\}$ (D) None of these

41. The relation R (ABCDE) with FD set {AB->CDE, A->C, C->D} is in which of the following normal forms?

(A) 1NF but not in 2NF (B) in both 2NF and 3NF

(C) in 3NF but not in BCNF (D) in BCNF

42. If Eigen values and Eigen vectors of 2×2 matrix are given below

Eigen value	Eigen vector
$\lambda = -1$	$\begin{pmatrix} 1 \\ 1 \end{pmatrix}$
$\lambda = 6$	$\begin{pmatrix} 2 \\ -5 \end{pmatrix}$

Then $A_{2\times 2}$ is _____

(A) $\begin{bmatrix} 1 & 2 \\ 1 & -5 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & 2 \\ -5 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} -1 & 12 \\ -1 & -30 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$

43. The min term corresponding to the boolean function $F(x, y, z) = x'y + z' + xyz$ is

(A) $\sum m(0, 2, 3, 6, 7, 5)$ (B) $\sum m(0, 2, 3, 5, 7)$

(C) $\sum m(0, 2, 3, 5, 6, 7)$ (D) $\sum m(0, 2, 3, 4, 6, 7)$

44. The reliability of two equivalent programs be 0.6 and 0.7. The probability that both programs give wrong result for the same input is

(A) 0.72 (B) 0.6 (C) 0.01 (D) 0.12

45. A problem in mathematics is given to the three students A, B, C given that the chances of solving the problem by A , B are $\frac{1}{2},\frac{3}{4}$ respectively and the chance of not solving problem by C is $\frac{3}{4}$. What is the probability that the problem is solved?

(A) $\frac{29}{32}$ (B) $\frac{3}{32}$ (C) $\frac{3}{8}$ (D) $\frac{1}{2}$

46. Consider the following Program segment for a CPU having three Register R_1, R_2, R_3.

Instruction	Operation	Instruction Size (In words)
MOV R_1, 500	$R_1 \leftarrow [500]$	2
Add R_2, R_1	$R_2 \leftarrow R_2 + R_1$	1
MUL R_3, R_1	$R_3 \leftarrow R_3 * R_1$	1
MOV 500, R_3	$M[500] \leftarrow R_3$	2
HALT	Machine Halts	1

Consider that the memory is byte addressable with word size 16 bits and the program has been loaded starting from memory location 500. If an interrupt occurs while the Add instruction is getting executing by the CPU, then the return address saved onto the stack will be_____

47. Which of the following languages are DCFL?

$L_1 = \{WW^R / W \in \{a,b\}^* \text{ and } w^R \text{ is reverse of } w\}$

$L_2 = \{WW^R x / W, x \in \{0,1\}^*\}$

(A) L_1 only (B) L_2 only

(C) Both L_1 and L_2 (D) Neither of L_1 and L_2

Common Data Questions: 48 & 49

Consider the following K-map of a function $W(A,B,C,D)$

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

48. Which of the following is not a prime implicant ?
(A) A'B' (B) BD (C) A'D (D) ABD

Consider the following K-map of a function $W(A,B,C,D)$

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

49. Which of the following is not an essential prime implicant?
(A) C'D (B) ABC (C) BD (D) A'B'

Common Data Questions: 50 & 51

Consider the frequency table of the characters:-

a	b	c	d	e	f	g
40	11	14	18	9	5	7

We use the variable codeword finding technique using Huffman coding.

50. What will be the code word of f?
(A) 1001 (B) 0110 (C) 1000 (D) 1101

Consider the frequency table of the characters:-

a	b	c	d	e	f	g
40	11	14	18	9	5	7

We use the variable codeword finding technique using Huffman coding.

51. What will be the code word of e?

(A) 1111 (B) 1110 (C) 1001 (D) 1100

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

Statement for Linked Answer Questions: 52 & 53

If x is a Continuous Random Variable, the function $f(x) = k.e^{\frac{-x^2}{2}}$ $-\infty < x < \infty, k > 0.$ then

52. Find the value of K?

(A) $\frac{1}{\sqrt{\pi}}$ (B) $\frac{1}{\sqrt{2\pi}}$ (C) $\frac{2}{\sqrt{\pi}}$ (D) $\frac{1}{2\sqrt{\pi}}$

If x is a Continuous Random Variable, the function $f(x) = k.e^{\frac{-x^2}{2}}$ $-\infty < x < \infty, k > 0.$ then

53. Find the variance of the above question?

(A) $\sqrt{\pi} - 1$ (B) $1 - \sqrt{\pi}$ (C) 1 (D) 0

Statement for Linked Answer Questions: 54 & 55

Consider the following CFG

$S \rightarrow AB$

$A \rightarrow aaA / \in$

$B \rightarrow bB / b$

54. What is the language recognized by the CFG given?

(A) $\{aa^n bb^m / n, m \geq 1\}$ (B) $(aa)^n bb^m / n \geq 0, m \geq 0$

(C) $\{a^n aab^m / n, m \geq 0\}$ (D) $a^n (bb)^m / n, m \geq 0$

54. How many strings are there in the correct language above, whose length is less than 4?

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

Q. No. 56 – 60 Carry One Mark Each

Choose the appropriate antonym for the given words given below

56. Sublimity

(A) erosion (B) baseness (C) insistence (D) noble

Fill in the blanks with appropriate words:

57. My brother is getting _____ his studies quite well.

(A) over (B) at (C) on (D) round

Fill in the blanks with appropriate words:

58. " I wish I knew German". In this sentence the speaker

(A) wants to learn German (B) does not know German

(C) Knows German (D) Knew German in the past

59. Find out the grammatically incorrect sentence.

(A) Ram is angry on Syam

(B) Ram is angry with Syam

(C) Ram is angry at Syam's conduct

(D) Ram is angry with me for my remark

60. 60, 30, 30, 45, 90, __?

(A) 225 (B) 90 (C) 175 (D) 222.5

Q. No. 61 – 65 Carry Two Marks Each

Choose the best inference from the given statements:

61. Statement: If it does not rain throughout this month, most farmers will be in trouble this year.

(A) Most of the farmers are generally dependent on rains.

(B) There is no water in the ponds

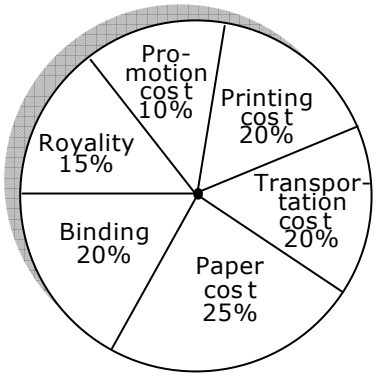
(C) The monsoon Winds are late this year.

(D) Wheat and paddy require water for cultivation.

62. A number 15 is divided into three parts which are in A.P. and the sum of their squares is 83. Find the highest part.

(A) 3 (B) 5 (C) 6 (D) 7

63. Various expenditures (in %) in publishing a Book



Price of Book is marked 20% above CP. If marked price of book is Rs.180, then what is the cost of paper using in singly copy of Book?

(A) 37.5 (B) 36 (C) 40 (D) 42.75

64. A, B, & C working together completed a job in 10 days. However, C only worked for the first three days when $\frac{37}{100}$ of the job was done. Also, the work done by A in 5 days is equal to the work done by B in 4 days. How many days would be required by the fastest worker to complete the entire work?

(A) 30 (B) 28 (C) 20 (D) 45

65. A dishonest dealer marks up the price of his goods by 20% and gives a discount of 10% to the customer. Besides, he also cheats both his supplier and his buyer by 100 grams while buying and selling 1 kilogram. Find the percentage profit earned by the shopkeeper.

(A) 30 (B) 35 (C) 32 (D) 29