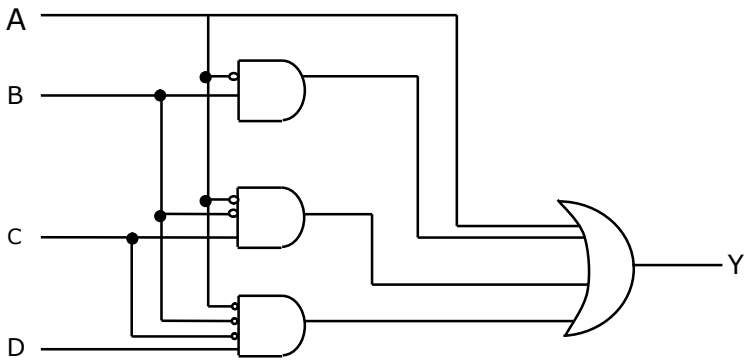
Q. No. 1 – 25 Carry One Mark Each

1. Which of the following logical expression represents the given logic diagram?



(A) $Y = A + B + C + D$ (B) $Y = A + B'C' + C'D + B'D$
(C) $Y = A + B'A + B'C'A + B'C'D'A$ (D) None of these

2. How many prime implicants and essential prime implicants respectively are there in SOP representation of the function: $f(ABCD) = \sum(0,1,2,3,6,7,9,13,14,15)$
(A) 5,1 (B) 5, 2 (C) 6,1 (D) 6,2

3. A full binary tree is one in which every node has 0 or 2 children. If a full binary tree has x+1 leaves, the number of articulation points in such a tree is
(A) 0 (B) 1 (C) x (D) x+1

4. To search a node in a Binary Search Tree (BST), we travel downwards starting from the root node. Suppose we want to search for node with value 370 in some BST. Which of the following is not a valid sequence of nodes we can come across while searching?
(A) 2, 252, 401, 398, 330, 344, 397, 370
(B) 2, 399, 387, 219, 266, 382, 381, 278, 370
(C) 924, 220, 911, 244, 898, 258, 362, 370
(D) 935, 278, 347, 621, 299, 392, 358, 370

5. Which of the following set of vectors are linearly independent?
(A) $[1, -1, 1]$, $[2, 1, 1]$, $[3, 0, 2]$
(B) $[3, 1, -4]$, $[2, 2, -3]$, $[0, -4, 1]$
(C) $[1, 1, -1]$, $[2, -3, 5]$, $[-2, 1, 4]$
(D) None of these

6. In the system of linear equations AX=B, if rank [A] < rank [A:B], then
(Where A is a square matrix, unknown X and B are column vectors and [A:B] is the augmented matrix.)
(A) there is only a trivial solution
(B) there is a unique solution
(C) there are infinitely many solutions
(D) there is no solution

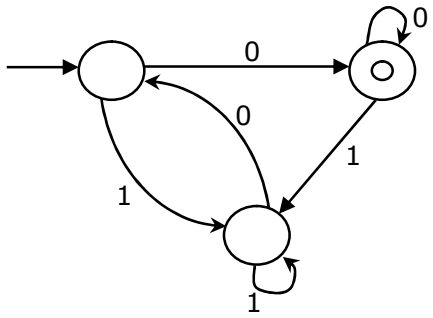
7. In set theory, if (A-B) denotes set of elements in A which are not in B, then $\left(A-\left(A-B\right)\right)-\left(B-A\right)$ is same as

(A) B (B) $A' \cap B$ (C) $A \cap B$ (D) ϕ

8. The set of all 5×5 real symmetric non-singular matrices over matrix multiplication is

(A) a semi-group (B) a monoid
(C) a group (D) an abelian group

9. Which of the following languages is represented by given DFA?



(A) Set of all strings ending with 00.

(B) Set of all binary numbers divisible by 4

(C) Both (A) and (B)

(D) None of these

10. Which of the following statements are false?
i. Deterministic CFL is closed under union
ii. CFL is closed under union

(A) i only (B) i and ii (C) ii only (D) None of these

11. Which of the following are anti-symmetric relations?
1. "$\subset$ (proper subset)" on a collection of sets
2. "$\leq$(less than or equal to)" on set of real numbers
3. "is a factor of" on a set of natural numbers
4. "$\neq$ (not equal to)" on a set of integers

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

12. In an adjacency-list representation of a directed graph with V vertices and E edges, how long does it take to compute out-degree of every vertex?

(A) $0\left(V\right)$ (B) $0\left(V+E\right)$ (C) $0\left(V^2\right)$ (D) $0\left(E\right)$

13. Which of the following is adversely affected by normalization?

(A) UPDATE (B) SELECT (C) INSERT (D) DELETE

14. Consider the table 'employee' having two columns: 'EmpNo and EmpName'.
We run the following transaction on the table.

```
COMMIT;
ALTER TABLE employee
                ADD PhoneNo varchar(10);
ROLLBACK;
```

What are the columns in the table after the above operation?

(A) EmpNo EmpName PhoneNo
(B) EmpNo EmpName
(C) Same as (B) but will given an error indicating failed transaction
(D) None of these

15. Non deterministic grammars are not suitable for making predictive parsers. What operation needs to be performed to make them suitable?
(A) Removing ambiguity
(B) Eliminating left recursion
(C) Left factoring
(D) None of these

16. Match the following:

List I		List II	
1	Quick Sort	a	Divide and Conquer
2	Graph colouring	b	Greedy
3	String editing	c	Dynamic Programming
4	Prim's Algorithm	d	Back tracking

(A) 1-a, 2-c, 3-b, 4-d
(B) 1-b, 2-a, 3-d, 4-c
(C) 1-a, 2-d, 3-c, 4-b
(D) None of these

17. What is the ouput of the following code snippet?

```
void fnSwap(int *P1, int*P2)
{
    int *Temp;
    Temp=P1;
    P1=P2;
    P2=Temp;
}
void main (void)
{
    int N1=10, N2=20;
    printf("Before Swap %d and %d\n", N1++, ++N2);
    fnSwap(&N1, &N2);
    printf("After Swap, %d and %d\n", ++N1, N2++);
}
```

(A) Before Swap, 11 and 21
After Swap, 12 and 22
(B) Before Swap, 10 and 21
After Swap, 21 and 12
(C) Before Swap, 10 and 21
After Swap, 12 and 21
(D) Before Swap, 11 and 21
After Swap, 22 and 12

18. The number of bits required to represent a 57 digit decimal number in a binary number systems is _____

19. A 3 level memory hierarchy uses look-through read architecture. The access time of L1 cache, L2 cache and main memory are 1 ns, 15 ns and 300 ns respectively. The hit rates of L1 and L2 are 0.9 and 0.95. The average access time in ns is _____

20. There are 5 processes which require resource instances of same type in quantities 23, 35, 12, 43, 15 respectively. The minimum number of resource instances required for preventing deadlock is_____

21. A 10 Mbps Ethernet line uses frame length 1542 bytes and is 100 m long. The channel efficiency in percentage is _____

22. A connection oriented communication is said to have occurred if
(A) 3-way handshake is followed
(B) The communication uses ACK packets
(C) Either (A) or (B)
(D) Both (A) and (B)

23. The aspects of program that are not immediately quantifiable are known as
(A) Metrics (B) Direct metrics
(C) Indirect metrics (D) Indicators

24. Which of the following is also called 'Dry Run'?
(A) Path testing (B) Black box testing
(C) Static testing (D) None of these

25. Consider an offline software ABC which has been assigned to a group of software developers. What should be estimated deadline for software using basic COCOMO model if it has 4 modules of sizes as follows:
Data Entry = 0.5 kLOC Query=0.9 kLOC
Data Update=0.6 kLOC Reports=0.8 kLOC
(The coefficients are a=3.2, b=1.05, c=2.5 and d=0.38)
(A) 5-6 months (B) 15-16 months (C) 9-10months (D) 2-4 months

Q. No. 26 – 51 Carry Two Marks Each

26. The following grammar is

$S \rightarrow Aa \mid bAc \mid Bc \mid bBa$

$A \rightarrow d$

$B \rightarrow d$

(A) LR(1) but not LALR(1) (B) LALR(1) but not SLR(1)

(C) SLR(1) but not LR(0) (D) LR(0)

27. Which of the following IP addresses is/are in the same subnet as 172.17.236.149/26?

(A) 172.17.236.118 (B) 172.17.236.130

(C) 172.17.236.189 (D) Both (B) & (C)

28. Gupta and Rashmi attended an interview. The probability that Gupta is selected is $\frac{8}{9}$ and the probability that Rashmi selected is $\frac{5}{8}$. The probability that neither of them is selected is

(A) $\frac{1}{9}$ (B) $\frac{1}{8}$ (C) $\frac{1}{24}$ (D) $\frac{1}{72}$

29. The error (with respect to exact solution) in estimation of the integral $\int_0^1 x^2 dx$ using Simpson's rule is

(A) 0.01 (B) 0.02 (C) 0.03 (D) 0

30. Given below are the processes which arrived simultaneously in given order and their CPU burst time, find average waiting time using Round-Robin algorithm (time quantum=4 ms). Also find maximum time for which a process has to wait at most in this schedule.

Process	CPU time
P1	7
P2	4
P3	3
P4	4

(A) 9.5ms, 10ms (B) 9.5ms, 12 ms (C) 8.5ms, 10ms (D) 8.5ms, 11ms

31. Which of the following statements are not true?
    1. All unsafe states are deadlocks
    2. A deadlock state is unsafe state
    3. A system is in safe state only if there exists a safe sequence
    4. A state is said to be safe if the system can allocate resources to few processes even if all of them suddenly request their maximum number of resources.

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

32. What is the truth value of the following statements if x, y and z represent real numbers?

    (i) $\exists x \forall y (y \neq 0 \rightarrow xy = 1)$ (ii) $\exists x \exists y (x + 2y = 2 \wedge 2x + 4y = 5)$

    (iii) $\forall x \exists y (x + y = 2 \wedge 2x - y = 1)$ (iv) $\forall x \exists y (x = y^2)$

    (A) TTTT (B) FTFT (C) TFTF (D) FFFF

33. We have to calculate a polynomial in X which is in the following form:

    $P(x) = a_0 + a_1X + a_2X^2 + a_3X^3 + ... + a_nX^n$

    How many times it is necessary to perform multiplication to calculate P(X)? Assume there is no function like power (x, k) to compute x^k.

    (A) n times (B) n^2 times

    (C) $n(n+1)/2$ times (D) None of these.

34. A full 3-ary tree is one in which every node has 0 or 3 children. If a full 3-ary tree has 67 nodes, number of leaves in that tree is _____

35. A 16kB cache with line size 64B uses 4-way set associative mapping. Main memory is 8 MB and byte addressable. The size of extra space needed for storing tag information in bytes is _____

36. A DMA module is transferring bytes to memory using cycle stealing mode from a device transmitting at 16 KB/s. The processor is fetching instructions at the rate of 1 MB/s. The percentage by which the processor will be slowed down due to the DMA activity is _____

37. A control unit has control signals which can be divided into 5 mutually exclusive groups of 30, 70, 12, 25 and 23 control signals respectively. The number of bits that are saved using vertical micro-programming over horizontal programming is _____

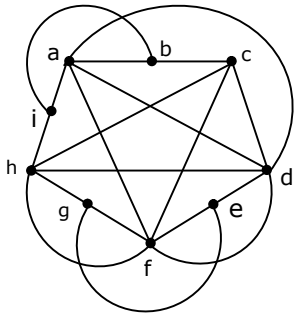
38. The address sequence generated by tracing a particular program, executing in a pure demand paging system with 100 records per page, with 1 free main memory frame is recorded as follows:

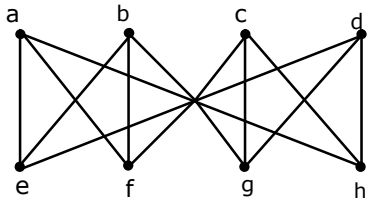
    560, 540, 430, 390, 350, 450, 102, 198, 754, 785

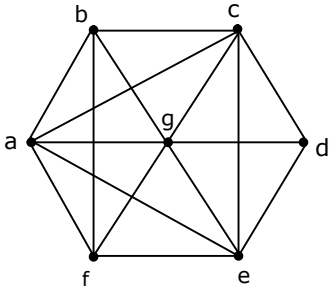
    The page fault rate is _____

39. Which of the following statements are true?
(i) Every totally ordered set is a lattice
(ii) Every lattice has a least element and a greatest element
(iii) All totally ordered posets are also well ordered posets.
(A) (i) only (B) (ii) and (iii)only
(C) (ii) only (D) All of these

40. Which of the following graphs are planar?







(A) 1 only (B) 2 only (C) 2 and 3 only (D)None of these

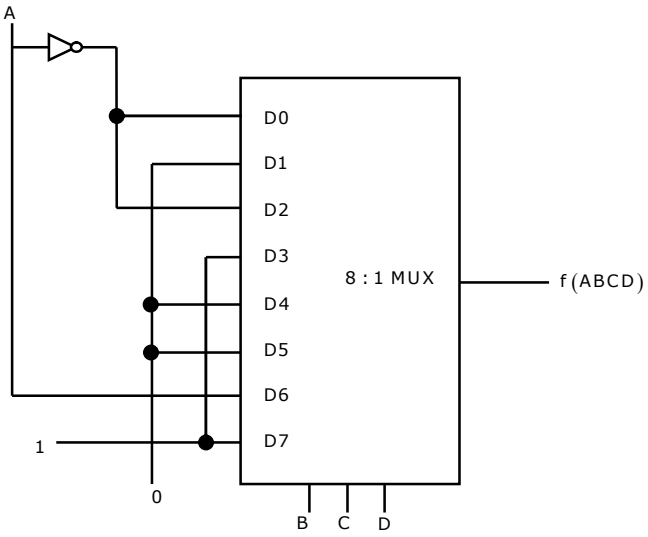
41. Which of the following is the correct SOP operation for the given circuit?

(A) $CD + ABC + A'B'D'$

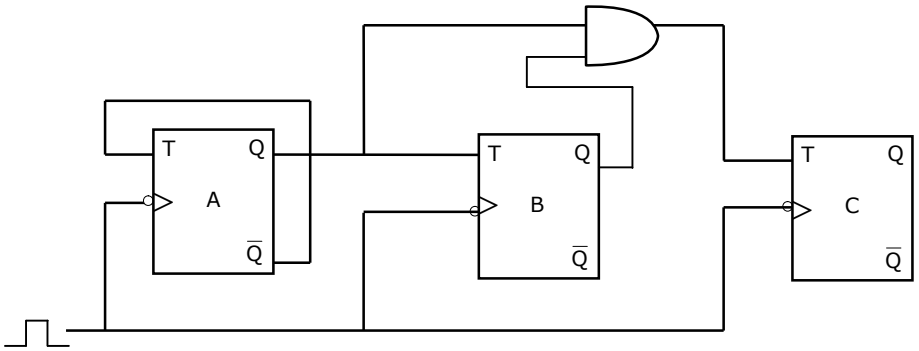
(B) $ABC + B'CD + A'CD$

(C) $A'B'D' + ABC + A'CD$

(D) None of these



42. The initial value of the following 3 bit sequence generator is 0. What is the output value after 3 clock cycles?



(A) 1 (B) 3 (C) 4 (D) 5

43. How many NAND gates are required to realize the following function f given below?

$f = AB + BC + CD + ... + YZ$

(A) 25 (B) 26 (C) 27 (D) None of these

44. Which of the following is the correct regular expression for set containing all strings except 11 and 111?

(A) $\in +1+10+110+101+111(0+1)^{+}+(0+1)^{3}(0+1)^{+}+0(0+1)^{*}$

(B) $\left(0+1\left(0+1\left(0+1(0+1)\right)\right)\right)(0+1)^{*}$

(C) $\left(\in +0+1\left(0+1\left(0+1(0+1)\right)\right)\right)(0+1)^{*}$

(D) None of these

45. Which of the following is a regular language?

(A) L_1 = Set of balanced parenthesis where alphabet $\Sigma = \{(,)\}$

(B) L_2 = Set of all unary strings $(|\Sigma| = 1)$ of lengths equal to Fibonacci numbers greater than 5 (i.e. 8, 13, 21, ...)

(C) L_3 = Kleene closure of the language in option (B)

(D) None of these

46. Which of the following problems are decidable?

i) Whether a Context free language is empty
ii) Whether two context free languages are equal
iii) Whether intersection of two context free languages is empty
iv) Whether a context free language is Σ^{*}

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

47. What is the highest normal form of the relation R(ABCDEF) having functional dependency set F = $\{A \to BC,\ C \to AD,\ E \to ABC,\ F \to CD,\ CD \to BEF,\ AB \to D\}$?

(A) 1NF (B) 2NF (C) 3NF (D) BCNF

Common Data Questions: 48 & 49

In a relational database there are three relations as follows:

- Professor = P(PName),
- Student = S(SName),
- Teaches = T(PName, SName).

48. Which of the following relational algebra expression returns names of students not taught by any professor?

(A) $\pi_{SName}(T)$ (B) $S - T$

(C) $S - \pi_{SName}(T)$ (D) $S - \pi_{SName}((P \times S) - T)$

In a relational data base there are three relations:

- Professor = P(PName),
- Student = S(SName),
- Teaches = T(PName, SName).

49. The following relational algebra expression returns the names of

$$P - \pi_{PName}((P \times S) - T)$$

(A) Professors who teach at least one student
(B) Professor who teaches all the students
(C) Professor who do not teach any student all
(D) None of these

Common Data Questions: 50 & 51

Following keys have to be inserted in exact order into the hash table with 9 slots.

5, 28, 19, 15, 20, 33, 12, 17, 10

The auxiliary hash functions is h(k)=K mod 9.

50. Which of the following represent the contents of the hash table in correct order after insertions are performed using linear probing?

(A) 12,28,19,20,10,5,15,33,17 (B) 10,28,19,20,12,5,15,33,17

(C) 33,28,19,20,12,5,15,10,17 (D) 20,28,19,10,12,5,15,33,17

Following keys have to be inserted in exact order into the hash table with 9 slots.

5, 28, 19, 15, 20, 33, 12, 17, 10

The auxiliary hash functions is h(k)=K mod 9.

51. Which of the following represent the contents of the hash table in correct order If the same keys were inserted using quadratic probing with the given hash function:

$$h'(k) = \{h(k) + 2i + i^2\} \bmod 9 \quad \text{where } i = 0, 1, 2, \ldots.$$

(A) 20,28,19,10,12,5,15,33,17 (B) 12,28,19,20,10,5,15,33,17

(C) 33,28,20,12,19,5,15,10,17 (D) 12,28,19,20,33,5,15,10,17

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

Statement for Linked Answer Questions: 52 & 53

A stop and wait ARQ has maximum size of 1500 bytes. The network cable connects two towns which are 15 km apart. Speed of light is 70% of that in vacuum.

52. What is the round trip time on this setup?

(A) 143μs (B) 155μs

(C) 169μs (D) None of these

A stop and wait ARQ has maximum size of 1500B. The network cable connects two towns which are 15 km apart. Speed of light is 70% of that in vacuum.

53. What is the minimum bandwidth required?

(A) 69.1 Mbps (B) 71.4 Mbps

(C) 83.9 Mbps (D) 92.3 Mbps

Statement for Linked Answer Questions: 54 & 55

Chetan is visiting an old friend Pranitha after a very long time. She told him on phone that she has two school-going kids but she did not say anything about their age or gender. When Chetan reached her house, a boy opened the door and introduced himself as Pranita's son. Chetan was wondering whether the other kid is also a boy or a girl. (Assume they are not twins)

54. What is the probability that the other kid is a girl?

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

Chetan is visiting an old friend Pranitha after a very long time. She told him on phone that she has two school-going kids but she did not say anything about their age or gender. When Chetan reached her house, a boy opened the door and introduced himself as Pranita's son. Chetan was wondering whether the other kid is also a boy or a girl. (Assume they are not twins)

55. Chetan is thinking to gift a cricket kit for the kids, but he still doesn't know anything about the kid other than the boy he met. There is 5/7 chance that a boy likes cricket, while there is a 1/2 chance that a girl likes cricket. What is the probability that all of Pranita's kids like cricket?
(A) 40/49 (B) 20/49 (C) 85/196 (D) None of these

Q. No. 56 – 60 Carry One Mark Each

56. Aluminium: Bauxite:: Iron:
(A) Pyrite (B) Lignite (C) Hematite (D) Steatite

Find out the error part in the given sentences:

57. He advised me/ to think deeply/ about it/ before taking a decision.
(A) (B) (C) (D)

Fill in the blanks with appropriate words:

58. All these problems make me fear_____ my children's future.
(A) For (B) of (C) on (D) about

Find the proper meaning of the word given in bold letters:

59. The business went belly up under the management of new C.E.O.
(A) Improved (B) Failed (C) Civilized (D) Rationalized

60. From a group of 6 men & 5 women, 4 persons are to be selected to form a committee such that at least 2 men are in committee. In how many ways it can be done?
(A) 150 (B) 250 (C) 265 (D) 115

Q. No. 61 – 65 Carry Two Marks Each

Choose the best inference from the given statements:

61. A rabbit was enrolled in a rabbit school. It could hop well but could not swim. The parents were concerned. They said "Forget about hopping, concentrate on swimming". The rabbit went to tuitions on swimming. Finally, it got success in swimming and forgotten how to hop.

Choose the best matching conclusion:

(A) Necessity is the mother of invention.

(B) Slow and steady wins the race.

(C) A rabbit cannot swim.

(D) Strive for excellence in the field we are in

62. Anand can do a certain job in 14 days. Banti is 80% more efficient than Anand. Find the number of days it takes for Banti to do the same piece of work.

(A) $\frac{72}{9}$ (B) $\frac{75}{8}$ (C) $\frac{70}{9}$ (D) $\frac{73}{8}$

63. A jar full of whisky contains 60% alcohol. A part of this whisky is replaced by another containing 22% alcohol and now the percentage of alcohol was found to be 42%. The quantity of whisky replaced is

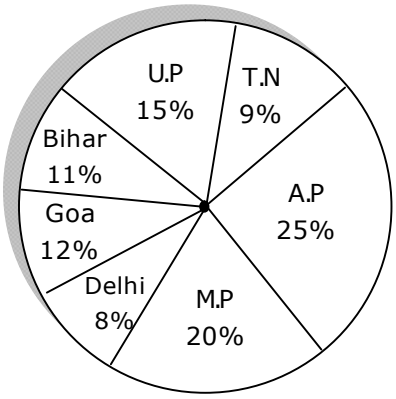
(A) $\frac{10}{9}$ (B) $\frac{9}{10}$ (C) $\frac{9}{19}$ (D) $\frac{10}{19}$

64. What will be remainder when $\left(87^{65} + 87\right)$ is divided by 88?

(A) 86 (B) 87 (C) 1 (D) 0

Information for Q.N. 65

Data of different states regarding population of states in the year 1998:



Total population of given states = 32,76,000

Following table shows that sex & literacy wise population ratio:

States	Sex		Literacy	
	Male	Female	Literate	Illiterate
Andhra Pradesh	5	3	2	7
Madhya Pradesh	3	1	1	4
Delhi	2	3	2	1
Goa	3	5	3	2
Bihar	3	4	4	1
Uttar Pradesh	3	2	7	2
Tamil Nadu	3	4	9	4

65. What will be the total percentage of total number of males in U.P, M.P & Goa together to the total population of all given states ?

(A) 28.5% (B) 18.5% (C) 23% (D) 32%