Name & Signature of the Invigilator

....

....

OMR Answer Sheet No. :

Roll No. :

(in figures as in Hall Ticket)

Roll Number in words : ....

....

Time : 2 Hours]   **No. of Printed Pages : 24**   **[Maximum Marks : 200**

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of **one hundred (100)** multiple choice type of questions. All questions are compulsory.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker seal and do not accept an open booklet.
   (ii) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (iii) After this verification is over, the Test Booklet Number should be entered on the OMR Answer Sheet and the OMR Answer Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
   Example: Ⓐ ⬤ Ⓒ Ⓓ where (B) is the correct response.
5. Your responses to the items are to be indicated on the OMR Answer Sheet under Paper – II only. If you mark your response at any place other than in the oval in the OMR Answer Sheet, it will not be evaluated.
6. Rough Work is to be done in the end of this booklet.
7. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. You have to return the original OMR Answer Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet and duplicate copy of OMR Answer Sheet on conclusion of examination.
9. Use only Blue/Black Ball point pen.
10. Use of any calculator or any electronic devices or log table etc., are prohibited.
11. There shall be no negative marking.

પરીક્ષાર્થીઓ માટે સૂચનાઓ

1. આ પાનાની ટોચ પર દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
2. આ પ્રશ્નપત્રમાં બહુવૈકલ્પિક ઉત્તરો ધરાવતા સો (૧૦૦) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
3. પરીક્ષાની શરૂઆતમાં આપને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ પાંચ (૫) મિનિટ દરમ્યાન તમારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું :
   (i) પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પૃષ્ઠની ધાર પર આપેલ સીલ સ્ટીકર ફાડી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં.
   (ii) કવર પૃષ્ઠ પર છપાયેલ નિર્દેશાનુસાર પ્રશ્નપુસ્તિકાના પ્રશ્નો, પૃષ્ઠો અને સંખ્યાને બરાબર ચકાસી લો. ખામીયુક્ત પ્રશ્નપુસ્તિકા કે જેમાં પ્રશ્નો/ પૃષ્ઠો ઓછાં હોય, બે વાર છપાયા હોય, અનુક્રમમાં અથવા અન્ય કોઈ ફરક હોય અર્થાત્ કોઈપણ સંજોગોમાં ખામીયુક્ત પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં. અને જો ખામીયુક્ત પ્રશ્નપુસ્તિકા મળી હોય તો નિરીક્ષક પાસેથી તુરંત જ બીજી સારી પ્રશ્નપુસ્તિકા મેળવી લેવી. આ માટે ઉમેદવારને પાંચ (૫) મિનિટનો સમયગાળો આપવામાં આવશે. પછીથી, પ્રશ્નપુસ્તિકા બદલવામાં આવશે નહીં કે કોઈ વધારાનો સમયગાળો આપવામાં આવશે નહીં.
   (iii) આ ચકાસણી સમાપ્ત થાય પછી, પ્રશ્નપુસ્તિકાનો નંબર OMR જવાબ પત્રક પર લખવો અને OMR જવાબ પત્રકનો નંબર પ્રશ્નપુસ્તિકા પર લખવો.
4. પ્રત્યેક પ્રશ્ન માટે ચાર જવાબ વિકલ્પ (A), (B), (C) અને (D) આપવામાં આવેલ છે. તમારે સાચા જવાબના ઓવલ (oval) ને નીચે આપેલ ઉદાહરણ મુજબ પેનથી ભરીને સંપૂર્ણ કાળું કરવાનું રહેશે.
   ઉદાહરણ : Ⓐ ⬤ Ⓒ Ⓓ કે જ્યાં (B) સાચો જવાબ છે.
5. આ પ્રશ્નપુસ્તિકાના પ્રશ્નોના જવાબ અલગથી આપવામાં આવેલ OMR જવાબ પત્રકમાં પેપર-IIલખેલ વિભાગમાં જ અંકિત કરવા. જો આપ OMR જવાબ પત્રકમાં આપેલ ઓવલ (oval) સિવાય અન્ય સ્થાને જવાબ અંકિત કરશો તો તે જવાબનું મૂલ્યાંકન કરવામાં આવશે નહીં.
6. કાચું કામ (Rough work) પ્રશ્નપુસ્તિકાના અંતિમ પૃષ્ઠ પર કરવું.
7. જો આપ OMR જવાબ પત્રક નિયત જગ્યા સિવાય અન્ય કોઈપણ સ્થાને, આપનું નામ, રોલ નંબર, ફોન નંબર અથવા એવું કોઈ ચિહ્ન જેનાથી તમારી ઓળખ થઈ શકે, અંકિત કરશો અથવા અબદ્ધ ભાષાનો પ્રયોગ કરો, અથવા અન્ય કોઈ અનુચિત સાધનોનો ઉપયોગ કરો, જેમકે અંકિત કરી દીધેલ જવાબ ભૂંસી નાખવો કે સફેદ શાહીનો ઉપયોગ કરી બદલશો તો આપને પરીક્ષા માટે અયોગ્ય જાહેર કરવામાં આવશે.
8. પરીક્ષા સમય પૂરો થઈ ગયા બાદ ઓરીજીનલ OMR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોંપી દેવું અને કોઈ પણ સંજોગોમાં તે પરીક્ષા ખંડની બહાર લઈ જવું નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર ઓરીજીનલ પ્રશ્નપુસ્તિકા અને OMR જવાબ પત્રકની ડુપ્લિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
9. માત્ર કાળી / ભૂરી બોલ પોઈન્ટ પેન વાપરવી.
10. કેલ્ક્યુલેટર, લોગ ટેબલ અને અન્ય ઈલેક્ટ્રોનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
11. ખોટા જવાબ માટે નકારાત્મક ગુણાંકન પ્રથા નથી.

COMPUTER SCIENCE AND APPLICATIONS
Paper – II

1. If an undirected graph G has an Eulerian path in it but not an Eulerian circuit, then which of the following assertions about G must be true ?

   (A) G is disconnected

   (B) G is a Hamiltonian graph

   (C) G has exactly 2 vertices of odd degree

   (D) The number of edges in G is one less than the number of vertices in it

2. If the planar representation of a simple connected planar graph G with 7 vertices creates three regions in the plane, then what should be the number of edges in G ?

   (A) At most 5   (B) 6   (C) At least 9   (D) 8

3. Consider the universe to be the set of integers and let the predicates E(x) : x is even and P(x) : x is a prime be given. Which of the following is the correct translation of the assertion "2 is the only even prime" in to the language of predicates ?

   (A) $\exists x[E(x) \wedge P(x) \wedge (x = 2)]$

   (B) $\forall x[\{E(x) \wedge P(x)\} \Rightarrow (x = 2)]$

   (C) $\exists x[E(x) \wedge P(x)] \Rightarrow (x = 2)$

   (D) $\forall x[(x = 2) \Rightarrow \{E(x) \wedge P(x)\}]$

4. What is the correct expression in Predicate logic for the assertion "Every student of this class has studied either calculus or logic", using the predicates S(x) : x is a student in this class, C(x) : x has studied calculus, L(x) : x has studied logic. Take the universe to be the set of all persons ?

   (A) $\forall x[S(x) \wedge (C(x) \vee L(x))]$

   (B) $\forall x S(x) \Rightarrow [C(x) \vee L(x)]$

   (C) $\forall x(S(x) \wedge \neg C(x)) \Rightarrow L(x)$

   (D) $\forall x(S(x) \wedge \neg L(x)) \Rightarrow C(x)$

5. In propositional logic with T standing for True and F standing for False, which of the following assertions is False ?

(A) $T \Rightarrow T$ (B) $F \Rightarrow T$

(C) $T \Rightarrow F$ (D) $F \Rightarrow F$

6. If P, Q, R are propositional variables, then which of the following expressions is equivalent to the expression $(P \vee Q) \Rightarrow R$?

(A) $(P \Rightarrow R) \vee (Q \Rightarrow R)$

(B) $(P \Rightarrow R) \wedge (Q \Rightarrow R)$

(C) $\neg R \Rightarrow (P \wedge \neg Q)$

(D) $(P \vee R) \Rightarrow (Q \vee R)$

7. Which of the following statements in the context of graph colouring are true ?

i. A graph is 2-colourable if and only if it is bipartite.

ii. 3-colouring problem is NP-complete.

iii. 4-colouring problem for planar graphs is NP-complete.

(A) ii only   (B) i and ii

(C) i and iii   (D) ii and iii

8. Which of the following statements are true ?

i. All complete graphs are Hamiltonian.

ii. All complete graphs are Eulerian.

iii. There exist graphs that are both Eulerian and Hamiltonian.

(A) i only

(B) ii only

(C) i and iii

(D) ii and iii

9. Consider the set of all functions from a set to itself under the operation of function composition. What is the resulting algebraic system ?

(A) Group   (B) Field

(C) Ring   (D) Semigroup

10. Consider the following Linear Programming Problem :

$$\text{Maximize } 2x_1 + 4x_2$$

Subject to the following constraints :

$$4x_1 + 5x_2 \geq 10$$
$$x_1 + 2x_2 \leq 5$$
$$6x_1 + 7x_2 \leq 3$$
$$x_1, x_2 \geq 0$$

Then which of the following assertions is true regarding the above LPP ?

(A) It has infinitely many optimum feasible solutions

(B) It has an unbounded solution

(C) It has an unique optimum feasible solution

(D) It has no feasible solution

11. What is the maximum number of directly addressable locations in the memory of a machine with a 20-bit address bus ?

(A) 1K   (B) 1M

(C) 1G   (D) 1T

12. A NAND gate is equivalent to a

(A) Bubbled OR gate

(B) Bubbled XOR gate

(C) NOR gate followed by an AND gate

(D) Bubbled AND gate

13. How many flip flops are needed to store the decimal value 8 in binary ?

(A) 1   (B) 3

(C) 4   (D) 9

14. Which is the binary exponent part corresponding to the IEEE single-precision representation C1C00000 (hex) of a floating-point number ?

(A) 1000 0011   (B) 1100 0011

(C) 0000 0011   (D) 1100 0000

15. What is the hexadecimal equivalent number of the octal number 671 ?

(A) DC8   (B) 1B9

(C) DC1   (D) 1B8

16. The address of the instruction to be executed next is stored in a register called

(A) A stack pointer

(B) A base pointer

(C) A program counter

(D) Source index

17. Which addressing scheme specifies the address of a memory word or register that contains the address of the operand ?

(A) Indexing

(B) Direct addressing

(C) Indirect addressing

(D) Immediate addressing

18. After how many clock cycles, the second instruction will complete execution in a seven-stage pipeline machine ?

(A) 1

(B) 6

(C) 7

(D) 8

19. In which of the following machines, a single control unit broadcasts instructions, which are carried out simultaneously by multiple processor/memory elements ?

(A) Multiprocessors

(B) Array Processors

(C) Multicomputers

(D) Pipeline Machines

20. The time required to position read/write head on appropriate track or cylinder is known as

(A) Rotational latency

(B) Seek time

(C) Track time

(D) R/W head latency

21. Consider below statements about Formal Transition model :

I. Formal Transition model describe the syntax and semantics of programming languages.

II. Semantic error does not produce compilation error, but may produce run-time error.

III. BNF is used to describe the semantics of programming languages.

Which of the following is correct regarding the above statements ?

(A) Statements II and III are true

(B) Statements I and III are true

(C) Statement III is false

(D) Statements II and III are false

22. Consider the following C program :

```
#define ab(x, y)     x ## y
#include <stdio.h>
int main ( )
{
   int a = ab(-1,  2);
   printf ("%d", a);
}
```

What do you obtain when you run the above program ?

(A) Compilation error

(B) 12

(C) 1

(D) -12

23. Which of the following statements is FALSE ?

(A) Encapsulation helps in maintaining Data Redundancy.

(B) JavaScript supports inheritance through the "extend" keyword in a more structured way to create a hierarchical relationship between classes, which is similar to classical inheritance.

(C) PHP has features of Object Oriented Programming including inheritance, encapsulation, and polymorphism.

(D) Data hiding is a part of Encapsulation.

24. Consider the following C/C++ program :

```
#include <stdio.h>

int main(void)

{

    int x = 5;

    printf("%d", x <<4);

    printf("%d", x >> 4);

}
```

The output from the above program is

(A) 80, 5

(B) 80, 0

(C) 20, 5

(D) 20, 0

25. Consider x and y are two integer variables. Which of the following pointer operator statements can achieve the purpose of a statement x = y; (i.e. assigning value of y to x) ?

(A) temp = *y; and x = &temp;

(B) temp = &y; and x = *temp;

(C) temp = &y; and x = &temp;

(D) temp = *y; and x = *temp;

26. Consider the following statements regarding the basic data types in C++ :

   I. wchar_t is not one of the data types.

   II. Each basic data type, except void, has various valid modifiers like long, signed, short, etc. preceding them.

   III. If an expression has variables of int, double and float data types then the resultant data type of the expression is double.

   Which of the following statements is False for the above statements ?

   (A) Statements II and III are true

   (B) Statement I is false and III is true

   (C) Statements I and II are false

   (D) Statements I, II and III are true

27. Which of the following statements is true for C++ programming language ?

   (A) An explicit type cast is not required to assign a void *pointer to any other type of pointer.

   (B) The unary operator & can be applied to register storage class.

   (C) A mutable member can be modified by a const member function.

   (D) Method overriding occurs within a class.

28. Which of the following Filling algorithms handles complex polygons with holes ?

   (A) Sutherland-Hodgman

   (B) ScalLinePolygon Fill

   (C) Splitting Concave Polygons

   (D) Weiler-Atherton

29. Which of the following line algorithms is efficient to calculate the pixel positions using integer point values and handle lines with slopes close to a vertical, horizontal, or 45-degree angle ?

   (A) Xiaoliu Wu's line

   (B) DDA line

   (C) Bresenham's line

   (D) Both DDA line and Xiaoliu Wu's

30. Which polygon rendering method is most appropriate for applications in which rendering quality and accuracy are of priority even at the cost of real-time performance ?

(A) Phong shading

(B) Gourand shading

(C) Z-buffering

(D) Flat shading

31. Consider the following tables :

customers (customer_id, first_name, last_name, email)

PRIMARY KEY (customer_id);

Orders (order_id, customer_id, order_date, total_amount)

PRIMARY KEY (order_id),

FOREIGN KEY (customer_id) REFERENCES customers (customer_id);

Which of the following SQL queries will return the customer name, order date, and total amount for all orders placed between January 1, 2023 and February 28, 2023, where the total amount is greater than 1000 ?

(A) SELECT customer_name, order_date, total_amount FROM customers INNER JOIN orders ON customers.customer_id = orders.customer_id WHERE order_date BETWEEN '2023-01-01' AND '2023-02-28' AND total_amount > 1000

(B) SELECT customer_name, order_date, total_amount FROM customers WHERE customer_id IN (SELECT customer_id FROM orders WHERE order_date BETWEEN '2023-01-01' AND '2023-02-28' AND total_amount > 1000);

(C) SELECT customer_name, order_date, total_amount FROM customers INNER JOIN orders ON customers. customer_id = orders.customer_id WHERE order_date BETWEEN '2023-01-01' AND '2023-02-28'; AND total_amount > 1000;

(D) SELECT customer_name, order_date, total_amount FROM orders WHERE order_date BETWEEN '2023-01-01' AND '2023-02-28' AND total_amount > 1000;

32. In a relational database, what does the term "ACID" stands for regarding transaction properties ?
    (A) Aggregated, Committed, Invariant, Distributed
    (B) Atomicity, Concurrency, Isolation, Durability
    (C) Atomicity, Consistency, Isolation, Durability
    (D) Atomicity, Concurrency, Incremental, Distributed

33. With reference to DBMS, when a group of entities is divided into subgroups based on their characteristics, it is known as
    (A) Generalisation
    (B) Specialisation
    (C) Inheritance
    (D) Abstraction

34. What database model is ideal for ensuring seamless data synchronization in mobile environments ?
    (A) Hierarchical Database Model
    (B) NoSQL Database Model
    (C) Replication Database Model
    (D) Object-Relational Database Model

35. Which operator is used for concatenating two strings in SQL ?
    (A) &
    (B) %
    (C) ||
    (D) −

36. Intersection on two relations R1 and R2 can only be computed if R1 and R2 are
    (A) Intersection Compatible
    (B) Union Compatible
    (C) Difference Compatible
    (D) Natural Join Compatible

37. If E1 and E2 are relational algebra expressions, then which of the following is NOT a relational algebra expression ?
    (A) $E1 \cup E2$
    (B) $E1 \div E2$
    (C) $E1 - E2$
    (D) $E1 * E2$

38. Consider the join of a relation R with a relation S. If R has m tuples and S has n tuples, then the maximum and minimum size of the results of the join operation respectively are
    (A) m + n and 0
    (B) m + n and m − n
    (C) m * n and 0
    (D) m * n and m + n

39. Let R be a relation with attributes (A, B, C, D, E, F) and let the following functional dependencies hold :

A → B

A → C

CD → E

CD → F

B → E

Given the above functional dependencies, which of the following functional dependencies does NOT hold ?

(A) A → E   (B) CD → EF   (C) AD → F   (D) B → CD

40. When there are more than two entity sets participating in a relationship, then it is called
(A) Unary Relationship   (B) Binary Relationship
(C) N-ary Relationship   (D) Many-to-many Relationship

41. Peterson's solution is a classic software-based solution to the critical-section problem. What is the maximum number of processes to which it is restricted ?
(A) 2   (B) 3   (C) 4   (D) 5

42. In addition to the signal() operation, which other standard atomic operation can be used to access a semaphore ?
(A) block()   (B) fork()   (C) wait()   (D) exec()

43. Which of the following statements is FALSE in view of the many-to-one multithreading model ?
(A) If a thread makes a blocking system call, the entire process will block.
(B) Multiple threads are unable to run in parallel on multiprocessors.
(C) Creating a user thread requires creating a corresponding kernel thread.
(D) It maps multiple user-level threads to one kernel thread.

44. If only one job of 10 time units is present in a ready queue, and the time quantum is 1 time unit in Round Robin Scheduling, then
(A) 4 context switches will occur   (B) Only 1 context switch will occur
(C) 9 context switches will occur   (D) No context switches will occur

45. Which of the following techniques is useful in solving indefinite blockage of low priority jobs ?

(A) Thrashing   (B) Aging   (C) Starvation   (D) Caching

46. Which one of the following pairs of CPU scheduling algorithms supports preemption ?

(A) SJF and FCFS   (B) FCFS and Priority scheduling

(C) SJF and Priority scheduling   (D) FCFS and RR

47. Consider the following reference string and a memory with three frames :

5, 0, 2, 0, 5, 2, 1

How many page faults will be produced by the LRU page replacement algorithm ?

(A) 3   (B) 4   (C) 5   (D) 7

48. Which is the fourth necessary condition that must hold simultaneously with mutual exclusion, hold and wait, no preemption for a deadlock to occur ?

(A) Linear wait   (B) Spiral wait   (C) Circular wait   (D) Indefinite wait

49. A page fault means

(A) Some I/O error in a page

(B) An error due to difference in size of a page

(C) Reference to address on a page, not present in the memory

(D) Some computational error in a page

50. In which of the following schemes, the logical memory of a program is divided into blocks of the same size called pages and the physical memory is divided into blocks of the same size called frames ?

(A) Fragmentation   (B) Virtual memory

(C) Segmentation   (D) MFT

51. Which of the following software testing techniques does not fall under Black-box testing ?

(A) Path Coverage   (B) State Transition

(C) Equivalence Partitioning   (D) Decision Table

52. A design concept which is an extension of the information hiding and is defined as the strength among elements in a module is

(A) Abstraction   (B) Problem Partitioning

(C) Coupling   (D) Cohesion

53. Which of the following fact-finding techniques allows respondents to answer in their own words ?

(A) Document Review

(B) Observations

(C) Brainstorming

(D) Unstructured Interview

54. A risk-sensitive software is to be developed with high-level of uncertainty in requirements with concurrency in design and development. Which process model from the following is most suitable ?

(A) Agile   (B) Scrum   (C) Spiral   (D) RAD

55. Which of the following is not a direct measure of the software development process ?

(A) Test coverage

(B) Memory size

(C) Maintainability

(D) Lines of code

56. The purpose of having a security component in a software is an example of

(A) Risk Control

(B) Risk Mitigation

(C) Risk Transfer

(D) Risk Avoidance

57. Which of the following is used to represent internal data structures and process details at abstract level ?

(A) Architectural design

(B) Component-level design

(C) Data design

(D) SRS document

58. Which of the following represents a pair of key attributes of software quality ?

(A) Reliability and Performance

(B) Performance and Functionality

(C) Usability and Reliability

(D) Functionality and Usability

59. If the cyclomatic complexity of a source code is nine, then which of the following is indicated ?

(A) There are nine linearly dependent paths in the source code

(B) Nine test cases are to be generated for the purpose of testing the source code

(C) There are nine linearly independent paths in the source code

(D) There are nine connected components in the source code

60. Which of the following is the fundamental goal of the software testing activity ?

(A) To maximize error detection and minimize test cases

(B) To minimize error detection and maximize test cases

(C) To maximize both error detection as well as test cases

(D) To minimize both error detection as well as test cases

61. How much time does extracting the minimum element from a max-heap take ?

(A) O(n)   (B) O(1)   (C) O(n²)   (D) O(n log n)

62. The postorder traversal of a binary tree is DEBFCA. It's preorder traversal is

(A) ABFCDE   (B) ADBFEC   (C) ABDECF   (D) ABDCEF

63. An array of A[1 . . . n], has a sorted subarray A[0 . . . n/2] and another sorted subarray A[n/2 + 1 . . . (n − 1)]. Given an additional empty array B of size n, what is the time complexity of sorting A ?

(A) O(1)   (B) O(log n)   (C) O(n)   (D) O(n log n)

64. When multiple edges with the same minimum weight are available while building an MST using Prim's algorithm, which option ensures a unique MST ?

(A) Select the first edge in the graph's edge list

(B) Randomly choose any of the equally weighted edges

(C) Select the edge connected to the highest degree vertex

(D) Choose the edge with the lowest degree vertex

65. What is the time complexity for computing the Discrete Fourier Transform (DFT) of a sequence of length N ?

(A) O(N)   (B) O(N²)   (C) O(N log N)   (D) O(log N)

66. What is the worst-case complexity of the following C code fragment ?

```
int main ()
{
    ...
    for (i = 0; i < N; i++)
    {   // statements
        }
    for (j = 0; j < N; j++)
    {   // statements
        }
    ...
}
```
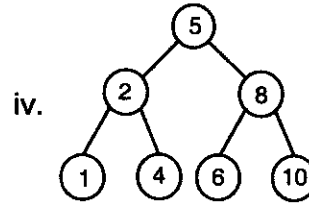
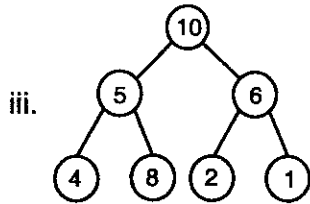(A) O(N)   (B) O(2ᴺ)   (C) O(N²)   (D) O(1)

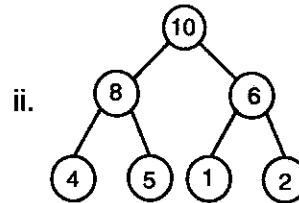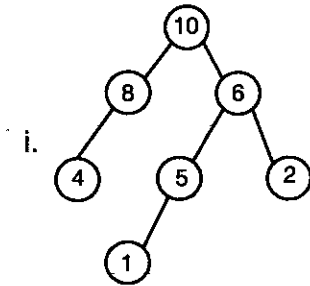**67.** What is the primary purpose of using a circular queue ?
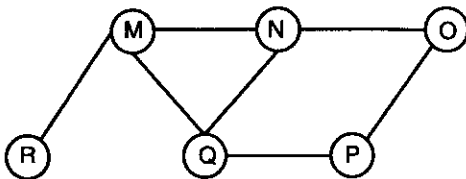
    (A) To minimize memory wastage

    (B) To access the queue based on priority

    (C) To adhere to the FIFO (First-In-First-Out) principle

    (D) To support dynamic resizing of the queue

68. Which of the following is a max-heap ?

    (A) i

    (B) ii

    (C) iii

    (D) iv

69. One possible order of visiting the nodes of the following graph in Breadth First Search implemented using the queue data structure is :

    (A) MNOPQR

    (B) NQMPOR

    (C) QMNPRO

    (D) QMNPOR

70. Which one of the following is not true about a B-tree ?
    (A) All nodes including the root must be at least half full
    (B) All leaf nodes must be at the same level
    (C) All nodes with k keys except the leaves must have (k+1) descendents
    (D) The height of the tree grows whenever the root splits

71. Suppose a problem Y is polynomial-time reducible to problem X. Consider the following statements :
    i. If X cannot be solved in polynomial time, then Y cannot be solved in polynomial time.
    ii. Y can be solved in polynomial time.
    iii. If X can be solved in polynomial time, then Y can be solved in polynomial time.
    (A) Only i is true
    (B) Only iii is true
    (C) ii and iii are true
    (D) i and ii are true

72. Which of the following statement(s) is/are true ?
    i. NP is the set of all problems that cannot be solved in polynomial time.
    ii. P is the set of all problems that can be solved in polynomial time.
    iii. P is the set of all problems whose solutions can be checked in polynomial time.
    (A) i and ii   (B) i and iii   (C) ii and iii   (D) i, ii and iii

73. In the context of automata theory, which of the following statement(s) is/are true ?
    i. Deterministic finite state automata accept regular grammars.
    ii. Non-deterministic finite automata accept non-regular languages.
    iii. Given a language accepted by a deterministic finite state automaton, there exists a unique deterministic finite state automaton with a minimum number of states.
    (A) i   (B) i and ii   (C) i and iii   (D) ii and iii

74. Which of the following is accepted by the following automaton ?
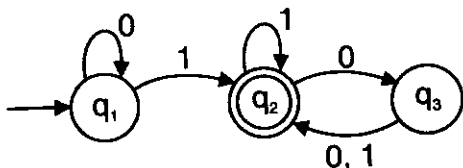
    i. All strings ending with an even number of 0s.
    ii. All strings ending with an even number of 1s.
    iii. All strings beginning with a 0 followed by repeating 01s.
    (A) i, ii   (B) i, iii
    (C) ii, iii   (D) i, ii, iii

75. Consider the following two statements :

i. A pumping lemma can be used to prove that a language is not regular.

ii. A pumping lemma can be used to prove that a language is not context-free.

Which of the following options is correct ?

(A) i and ii are false

(B) i and ii are true

(C) i is false, ii is true

(D) i is true, ii is false

76. Which of the following statement(s) is/are true ?

i. There exist non-deterministic turing machines which cannot be simulated by any deterministic turing machine.

ii. The tape of the turing machine is finite.

iii. A 2-tape turing machine can simulate a 5-tape turing machine.

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

77. A grammar has the following productions :

S → aSSb|a|bSa

Which of the following strings is in the language that is generated by this grammar ?

(A) aabbaabb

(B) bbbaabbaa

(C) bbbaaaa

(D) babbbabba

78. Which of the following grammars are in Greibach Normal Form (GNF) ?

G1 = {S → aAB|bBB, A → aA|a, B → bB|b}

G2 = {S → aAB|aBA, A → aA|ε, B → bB|ε}

G3 = {S → aAB|bBA|ε, A → aA|a, B → bB|b}

(A) G1 only

(B) G2 and G3

(C) G2 only

(D) G1 and G3

79. A language L is such that

i. An algorithm tells in finite time if a string s is in the language.

ii. No algorithm can tell in finite time if a string s is not in the language.

Which of the following is correct ?

(A) L is recursive and recursively enumerable

(B) L is not recursive, and not recursively enumerable

(C) L is not recursive, but is recursively enumerable

(D) L is not recursively enumerable, but recursive

80. The grammar E → E + E|E – E| id is

(A) Left-recursive, but not ambiguous

(B) Left-recursive and ambiguous

(C) LL(1), but not ambiguous

(D) LL(1) and ambiguous

81. Which of the following fields of the IPv6 based header is useful in supporting real-time audio and video applications ?

(A) Hop limit

(B) Traffic class

(C) Flow label

(D) Payload length

82. Which of the following networks requires that all channels in a message transmission path be of the same speed ?

(A) Circuit-switched

(B) Message-switched

(C) Packet-switched

(D) Bus network

83. Which of the following routing algorithms may cause "count to infinity" problem ?

(A) Shortest Path

(B) Distance Vector

(C) Link State

(D) Hierarchical

84. The acknowledgement number field in a TCP segment header specifies the

(A) Last byte correctly received

(B) Next byte expected

(C) Number of bytes expected next

(D) Number of bytes correctly received

85. Consider a subnet with 630 routers. Assuming a three-level hierarchy, how many entries will be required in the routing table of each router, if the subnet is partitioned into 7 clusters, each containing 9 regions of 10 routers ?

(A) 24   (B) 25   (C) 26   (D) 27

86. Which class of IP address uses 1 byte for host address ?

(A) A

(B) B

(C) C

(D) D

87. Consider the IP address 224.102.97.155 expressed in dotted decimal notation. Which class does it belong to ?

(A) A

(B) B

(C) C

(D) D

88. Which layer of the OSI reference model deals with determining a route to be followed by a packet ?

(A) Physical layer

(B) Data link layer

(C) Network layer

(D) Transport layer

89. How many times does the letter n appear in the ciphertext produced by the columnar transposition cipher, if the cipher is keyed by the word MEGA and the plaintext is the following string ?

c o m m u n i c a t i o n

(A) 0

(B) 1

(C) 2

(D) 3

90. What is the size of the fixed part of the IP datagram header ?

(A) 10 bytes

(B) 20 bytes

(C) 30 bytes

(D) 40 bytes

91. Which of the following is NOT a characteristic of a multi-agent system ?

(A) Autonomy

(B) Cooperation

(C) Competition

(D) Centralisation

92. Which of the following is NOT a pragmatic phenomenon ?

(A) Coreference

(B) Ellipsis

(C) Anaphora

(D) Word Sense Disambiguation

93. Which of the following is NOT a type of multi-agent system ?

(A) Distributed Artificial Intelligence (DAI)

(B) Swarm intelligence

(C) Peer-to-Peer (P2P) networks

(D) Agent-Based Modelling and Simulation (ABMS)

94. The A* algorithm is guaranteed to find the optimal solution if the heuristic function is :

(A) Admissible

(B) Consistent

(C) Informative

(D) Monotonic

95. What is the purpose of a dropout layer in an ANN ?

(A) To prevent overfitting by randomly dropping out neurons during training

(B) To improve the efficiency of the ANN by reducing the number of neurons in the network

(C) To improve the accuracy of the ANN by adding more neurons to the network

(D) To make the ANN more robust to noise in the data

96. The learning rate in a SOM is typically

(A) Fixed throughout the training process

(B) Decreases over time

(C) Increases over time

(D) Varies depending on the distance between the input vector and the Best Matching Unit (BMU)

97. If x_1 and x_2 are the binary inputs to the single layer neural network with binary threshold neurons, determine which two-input boolean function is represented by the network ?

$$y = \phi\left(\sum_{i=0}^{2} w_i x_i\right)$$

$$\phi(x) = \begin{cases} 0, & \text{if } x < 0 \\ 1, & \text{otherwise} \end{cases}$$
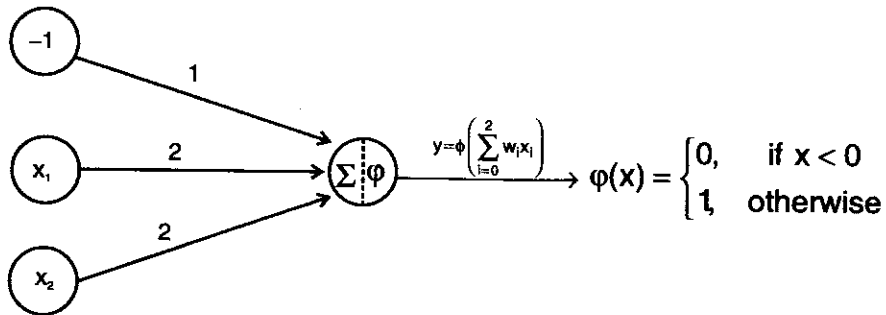
(A) NAND

(B) NOR

(C) OR

(D) AND

98. The most common heuristic used in partial order planning is :

(A) The number of actions that have been executed

(B) The amount of time that has elapsed

(C) The number of violated constraints

(D) The number of remaining goals

99. In reinforcement learning, the value function of a state represents

(A) The expected reward for taking the optimal action in that state

(B) The expected reward for taking any action in that state

(C) The probability of reaching the goal state from that state

(D) The number of times that state has been visited

100. In actor-critic methods, the actor and critic networks are trained to learn

(A) The value function and the model of the environment

(B) The policy and the value function

(C) The policy and the model of the environment

(D) The policy and the reward function

Space for Rough Work

Space for Rough Work