A6-R4: DATA STRUCTURE THROUGH C++

अवधि: 03 घंटे **अधिकतम अंक: 100**

DURATION: 03 Hours **MAXIMUM MARKS: 100**

ओएमआर शीट सं.: **OMR Sheet No.:**						

रोल नं.: **Roll No.:** | | | | | | |

उत्तर-पुस्तिका सं.: **Answer Sheet No.:** | | | | | | |

परीक्षार्थी का नाम: **परीक्षार्थी के हस्ताक्षर**:

Name of Candidate: _____; Signature of candidate: _____

परीक्षार्थियों के लिए निर्देश:	**Instructions for Candidate:**
कृपया प्रश्न-पुस्तिका**,** ओएमआर शीट एवं उत्तर-पुस्तिका में दिये गए निर्देशों को ध्यान पूर्वक पढ़ें।	Carefully read the instructions given on Question Paper, OMR Sheet and Answer Sheet.
प्रश्न-पुस्तिका की भाषा अंग्रेजी है। परीक्षार्थी केवल अंग्रेजी भाषा में ही उत्तर दे सकता है।	Question Paper is in English language. Candidate can answer in English language only.
इस मॉड्यूल/पेपर के **दो भाग** है। **भाग एक** में चार प्रश्न और **भाग दो** में पाँच प्रश्न है।	There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions**.**
भाग एक "वैकल्पिक" प्रकार का है जिसके कुल अंक 40 है तथा **भाग दो**, "व्यक्तिपरक" प्रकार है और इसके कुल अंक 60 है।	**PART ONE** is Objective type and carries 40 Marks. **PART TWO** is subjective type and carries 60 Marks.
भाग एक के उत्तर, इस प्रश्न-पत्र के साथ दी गई **ओएमआर उत्तर-पुस्तिका** पर**,** उसमें दिये गए अनुदेशों के अनुसार ही दिये जाने है। **भाग दो** की उत्तर-पुस्तिका में **भाग एक** के उत्तर **नहीं** दिये जाने चाहिए।	**PART ONE** is to be answered in the **OMR ANSWER SHEET** only, supplied with the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book for **PART TWO**.
भाग एक के लिए अधिकतम समय सीमा **एक घण्टा** निर्धारित की गई है। **भाग दो** की उत्तर-पुस्तिका, **भाग एक** की उत्तर-पुस्तिका जमा कराने के पश्चात दी जाएगी। तथापि, निर्धारित एक घंटे से पहले **भाग एक** पूरा करने वाले परीक्षार्थी **भाग एक** की उत्तर-पुस्तिका निरीक्षक को सौंपने के तुरंत बाद, **भाग दो** की उत्तर-पुस्तिका ले सकते हैं।	Maximum time allotted for **PART ONE** is **ONE HOUR.** Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE.**
परीक्षार्थी, उपस्थिति-पत्रिका पर हस्ताक्षर किए बिना एवं अपनी उत्तर-पुस्तिका, निरीक्षक को सौंपे बिना, परीक्षा हाल नहीं छोड़ सकता हैं। ऐसा नही करने पर, परीक्षार्थी को इस मॉड्यूल/पेपर में अयोग्य घोषित कर दिया जाएगा।	**Candidate cannot leave the examination hall/room without signing on the attendance sheet and handing over his Answer sheet to the invigilator. Failing in doing so, will amount to disqualification of Candidate in this Module/Paper.**
प्रश्न-पुस्तिका को खोलने के निर्देश मिलने के पश्चात एवं उत्तर देने से पहले उम्मीदवार यह जाँच कर यह सुनिश्चित कर ले कि प्रश्न-पुस्तिका प्रत्येक दृष्टि से संपूर्ण है।	After receiving the instruction to open the booklet and before answering the questions, the candidate should ensure that the Question booklet is complete in all respect.

जब तक आपसे कहा न जाए तब तक प्रश्न-पुस्तिका न खोलें।

DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

PART ONE
(Answer all the questions)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one and enter in the "OMR" answer sheet supplied with the question paper, following instructions therein. (1x10)

1.1 What is the best case time taken to find the middle element in a linked list?
A) O (2n) B) O ($\log_2$ n)
C) O (n) D) O (n $\log_2$ n)

1.2 Which of the following is an application of stack?
A) Finding Factorial B) Towers of Hanoi
C) Infix to Postfix D) All of the above

1.3 For an undirected graph with n vertices and e edges, the sum of the degree of each vertex is equal to
A) 2n B) (2n-1)/2
C) 2e D) $e^2/2$

1.4 Which of the following is not the type of queue?
A) Ordinary queue B) Single ended queue
C) Circular queue D) Priority queue

1.5 The initial configuration of the queue is a,b,c,d (a is the front end). To get the configuration d,c,b,a one needs a minimum of?
A) 2 deletions and 3 additions
B) 3 additions and 2 deletions
C) 3 deletions and 3 additions
D) 3 deletions and 4 additions

1.6 The number of possible ordered trees with three nodes A, B, C is?
A) 16 B) 12
C) 6 D) 10

1.7 The most efficient search technique used in an ordered array is
A) Sequential search B) Binary search
C) Interpolation search D) None of the above

1.8 If a node having two children is deleted from a binary search tree, it is replaced by its
A) Inorder predecessor B) Inorder successor
C) Preorder predecessor D) None of the above

1.9 Linked lists are required in
A) Linear Probing B) Quadratic Probing
C) Chaining D) None of these

1.10 Which of the following sorting algorithms does not have a worst case running time of $O(n^2)$?
A) Insertion sort B) Merge sort
C) Quick sort D) Bubble sort

2. Each statement below is either TRUE or FALSE. Choose the most appropriate one and enter your choice in the "OMR" answer sheet supplied with the question paper, following instructions therein. (1x10)

2.1 In strictly binary tree, the out-degree of every node is either 0 or 2.

2.2 A graph is said to be complete if there is an edge between every pair of vertices.

2.3 In a queue, the initial values of front pointer f and rear pointer r should be -1 and 0.

2.4 The number of nodes a null tree can have is 1.

2.5 If the address of A[1][1] and A[2][1] are 1000 and 1010 respectively and each element occupies 2 bytes then the array has been stored in row major order.

2.6 O(N) (linear time) is better than O(1) constant time.

2.7 Operators such as :: cannot be overloaded.

2.8 We can have varying number of arguments for the overloaded form of ( ) operator.

2.9 Number of odd degree vertices in an undirected graph is even.

2.10 If locality is a concern, you can use depth first search to traverse the graph.

ROUGH WORK SPACE:

3. Match words and phrases in column X with the closest related meaning/ word(s)/phrase(s) in column Y. Enter your selection in the "OMR" answer sheet supplied with the question paper, following instructions therein. (1x10)

X		Y	
3.1	The running time and/or storage space requirement of the algorithm in terms of the size n of the input data is called as	**A.**	N-1
3.2	Data structures used in Hierarchical data model is	**B.**	N
3.3	Sorting is not possible by using _____ methods?	**C.**	Trees
3.4	The number of passes required to sort an array of size N using bubble sort is	**D.**	Array
3.5	A do-while loop is guaranteed to loop ____ many times.	**E.**	Deletion
3.6	Complexity of linear Search is	**F.**	Pop
3.7	Data structure permits insertion and removal of nodes at any point in the list in constant time, but do not allow random access.	**G.**	Deque
3.8	The operation for removing an entry from a stack is _____	**H.**	1
3.9	A linear list in which the element can added or removed at either end but not in the middle.	**I.**	Queue
3.10	Data structures used in RDBMS is	**J.**	0
		K.	Linked List
		L.	N^2
		M.	Complexity

4. Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Choose the most appropriate option; enter your choice in the "OMR" answer sheet supplied with the question paper, following instructions therein. (1x10)

A.	Linked	**B.**	Top	**C.**	n!
D.	Inheritance	**E.**	O(logn)	**F.**	147
G.	1	**H.**	Stack	**I.**	47
J.	Polymorphism	**K.**	37	**L.**	n log (n)
M.	7				

4.1 Function overloading is an example of _____.

4.2 The process of building new classes from existing ones is called _____.

4.3 The time complexity of binary search is _____.

4.4 The minimum number of comparisons required to find the minimum and the maximum of 100 numbers is _____.

4.5 Consider a rooted Binary tree represented using pointers. The best upper bound on the time required to determine the number of sub trees having exactly 4 nodes $O(n^a \log n^b)$. Then the value of a + 10b is _____.

4.6 The first element in a stack is called the _____ of the stack.

4.7 A _____ list contains nodes that are joined together by references to other nodes.

4.8 We are given a set of n distinct elements and an unlabeled binary tree with n nodes. In _____ ways can we populate the tree with the given set so that it becomes a binary search tree?

4.9 New Operators allocate memory blocks from the _____.

4.10 If a is an integer variable, a=95/2; will return a value _____.

ROUGH WORK SPACE:

PART TWO
(Answer any FOUR questions)

5.

a) Why do we use a symptotic notation in the study of algorithm? Describe commonly used asymptotic notations and give their significance.

b) A binary tree has 9 nodes. The inorder and preorder traversals of the tree yields the following sequence of nodes:

Inorder : E A C K F H D B G

Preorder: F A E K C D H G B

Draw the tree.

c) Convert the expression A*B+C/D–F to equivalent Prefix and Postfix notations.

(5+5+5)

6.

a) What is a pointer variable? Can we have multiple pointers to a variable? Explain Lvalue and Rvalue expression.

b) Write an algorithm of selection sort.

c) Define adjacency matrix and adjacency list? Illustrate with an example.

(5+7+3)

7.

a) Write an algorithm to search an element in binary search tree.

b) What is operator overloading? Explain its importance with an example.

c) Differentiate between static and dynamic memory allocation.

(5+6+4)

8.

a) With an example explain shell short.

b) Define storage class and its functions. Explain in detail scope, storage allocation and purpose of each storage class.

c) Write a program that will read a positive integer and determine and print its binary equivalent.

(5+5+5)

9.

a) Define & explain graph traversal. Describe in detail various graph traversal strategies with help of example.

b) Sort the following sequence using merge sort and show the results at each step.
12,45, 32, 4, 98, 7, 16, 12, 19, 100, 37, 42, 24,75,1

c) Write an algorithm to count number of nodes in a binary search tree.

(7+4+4)

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ROUGH WORK SPACE:

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