B2.1-R4: DATA STRUCTURE THROUGH C++

अवधि: 03 घंटे	अधिकतम अंक: 100
DURATION: 03 Hours	**MAXIMUM MARKS: 100**

परीक्षार्थियों के लिए निर्देश: / Instructions for Candidates:

कृपया प्रश्न-पुस्तिका, ओएमआर शीट एवं उत्तर–पुस्तिका में दिये गए निर्देशों को ध्यानपूर्वक 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** हैं। **भाग एक** में चार प्रश्न और **भाग दो** में पाँच प्रश्न हैं ।	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 हैं।	**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 हैं। **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 और अपनी उत्तर-पुस्तिका, निरीक्षक को सौंपे बिना, परीक्षा हॉल/कमरा नहीं छोड़ सकते 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 or 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 सुनिश्चित कर लें 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.

SPACE FOR ROUGH WORK

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.**

(1×10=10)

1.1 Which of the following is used to make an abstract class ?

(A) Declaring it abstract using static keyword.

(B) Declaring it abstract using virtual keyword.

(C) Making at least one member function as virtual function.

(D) Making at least one member function as pure virtual function

1.2 Which of the following provides a reuse mechanism ?

(A) Abstraction

(B) Inheritance

(C) Dynamic binding

(D) Encapsulation

1.3 Which of the following is not the member of class ?

(A) Static function

(B) Friend function

(C) Const function

(D) Virtual function

1.4 Which of the following points is/are true about Linked List data structure when it is compared with array ?

(A) Arrays have better cache locality that can make them better in terms of performance.

(B) It is easy to insert and delete elements in Linked List

(C) Random access is not allowed in a typical implementation of Linked Lists

(D) All of the above

1.5 Which of the following pairs of traversals is not sufficient to build a binary tree from the given traversals ?

(A) Preorder and Inorder

(B) Preorder and Postorder

(C) Inorder and Postorder

(D) None of the above

1.6 Which traversal of tree resembles the breadth first search of the graph ?

(A) Preorder   (B) Inorder

(C) Postorder   (D) Level order

1.7 How many undirected graphs (not necessarily connected) can be constructed out of a given set V = {V 1, V 2,...V n} of n vertices ?

(A) n(n–1)/2   (B) 2^n

(C) n!   (D) $2^{(n(n-1)/2)}$

1.8 When inorder traversing a tree resulted E A C K F H D B G; the preorder traversal would return ?

(A) FAEKCDBHG

(B) FAEKCDHGB

(C) EAFKHDCBG

(D) FEAKDCHBG

1.9 Which of the following name does not relate to stacks ?

(A) FIFO lists

(B) LIFO list

(C) Piles

(D) Push-down lists

1.10 A variable P is called pointer if

(A) P contains the address of an element in DATA.

(B) P points to the address of first element in DATA

(C) P can store only memory addresses

(D) P contain the DATA and the address of DATA

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.**

(1×10=10)

2.1 A constructor is called at the time of declaration of an object.

2.2 Class data members are private by default while that of structure are public by default.

2.3 All function calls are resolved at compile-time in OOPS.

2.4 Stack is used for breadth first search.

2.5 Queue is a linear structure which follows the order is Last-In-First-Out (LIFO) to access elements.

2.6 If inorder traversal of a binary tree is sorted, then the binary tree is BST.

2.7 In a max-heap the smallest element resides always at the leaves assuming all elements are distinct.

2.8 A data structure is said to be linear if its elements form a sequence or a linear list. Examples: Array. Linked List, Stacks and Queues.

2.9 In Doubly Linked List two references are associated with each node, One of the reference points to the next node and one to the previous node.

2.10 In a complete binary tree of 'n' levels, there are: 2^n leaves and 2^n-1 non-leaf nodes.

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.** (1×10=10)

	X		Y
3.1	The data structure which allows deletions at both ends of the list but insertion at only one end	(A)	heap
3.2	A graph which has all the vertices with minimum possible number of edges	(B)	binary search
3.3	A special case of balanced binary tree where the root-node key is compared with its children and arranged accordingly	(C)	Encapsulation
3.4	In OOPS, defining a class in terms of another class, which makes it easier to create and maintain an application is known as	(D)	recursion
3.5	In this traversal method, the root node is visited first, then the left subtree and finally the right subtree	(E)	Spanning Tree
3.6	Some computer programming languages allow a function to call itself known as	(F)	Pre-order
3.7	A mechanism of exposing only the interfaces and hiding the implementation details from the user is called	(G)	circular linked list
3.8	In this traversal method, the left subtree is visited first, then the right subtree and finally the root node	(H)	Output restricted dequeue
3.9	The fast search algorithm with run-time complexity of O(log n) is	(I)	Input restricted dequeue
3.10	The data structure in which the first element points to the last element and the last element points to the first element is called	(J)	Post order
		(K)	data abstraction
		(L)	Linear search
		(M)	Inheritance

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.** (1×10=10)

A.	Out-degree	B.	Copy Constructor	C.	multiway search
D.	O(nlogn)	E.	Exception	F.	linear time
G.	O(n^2)	H.	Stack	I.	O(n)
J.	Quick Sort Algorithm	K.	leaf	L.	Queue
M.	Hash				

4.1   The default value of a String type is _____.

4.2   _____ is a mathematical function used to determine the location of a record.

4.3   A tree node that has no children is called a _____ node.

4.4   The B-tree is derived from _____ trees.

4.5   The _____ of a vertex is the number of edges this vertex has that are connected to other vertices.

4.6   _____ works by partitioning the array to be sorted, then recursively sorting each partition.

4.7   A _____ performs the copying for value returns as well as for value parameters.

4.8   The complexity of merge sort algorithm is _____.

4.9   The worst-case time for binary search finding a single item in an array is _____.

4.10   In recursion _____ data structure is used.

PART TWO

(Answer any FOUR Questions.)

5. (a) Write program to reverse a linked list.

(b) Create binary search tree by inserting the integer keys 15, 3, 4, 13, 14, 12, 5, 1, 8, 2, 7, 9, 11, 6, 20 in that order, starting from an empty tree. Now delete the key 4 and show the modified tree.

(7+8=15)

6. (a) The In-order and Post-order traversal of a binary tree are given as below. Draw the tree.

(i) In-order : BEDFCAGHJIK

(ii) Post-order : EFDCBJKIHGA

(b) After two passes of a sorting algorithm, the following array:

47   3   21   32   56   92

has been rearranged as shown below.

3   21   47   32   56   92

Which sorting algorithm is being used ? Also define its average, worst and best case time complexity.   **(7+8=15)**

7. (a) Design a class for complex number and write a program in C++ to overload binary operator + for adding two complex numbers.

(b) What is Encapsulation in OOPS ? Explain with an example. **(7+8=15)**

8. (a) What are circular queues ? Write down routines for inserting and deleting elements from a circular queue implemented using arrays.

(b) What is the advantage of doubly ended queue and priority queue ?

(10+5=15)

9. (a) Draw the B-tree of order 3 created by inserting the following data arriving in the sequences :

24   6   7   11   8   22   4   5   16   19   20   78

(b) Create max heap tree for following data in the sequence :

50   30   40   20   10   25   35   10   5   33   22   8   **(7+8=15)**

SPACE FOR ROUGH WORK