A5-R5 : DATA STRUCTURE THROUGH OBJECT ORIENTED PROGRAMMING LANGUAGE

अवधि : 03 घंटे
DURATION : 03 Hours

अधिकतम अंक : 100
MAXIMUM MARKS : 100

ओएमआर शीट सं. :
OMR Sheet No. :

रोल नं. :
Roll No. :

उत्तर-पुस्तिका सं. :
Answer Sheet No. :

परीक्षार्थी का नाम :
Name of Candidate : _____

परीक्षार्थी के हस्ताक्षर :
;Signature of Candidate : _____

परीक्षार्थियों के लिए निर्देश :
Instructions for Candidate :

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 का 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, **ओएमआर उत्तर-पुस्तिका** पर 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. **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 पश्चात् 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** to the Invigilator.
परीक्षार्थी, उपस्थिति-पत्रिका पर हस्ताक्षर किए बिना और अपनी उत्तर-पुस्तिका, निरीक्षक को सौंपे बिना, परीक्षा हॉल/कमरा नहीं छोड़ सकते हैं। ऐसा नहीं 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/her 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 पश्चात् एवं उत्तर लिखना आरम्भ करने से पहले उम्मीदवार जाँच कर यह सुनिश्चित कर लें कि प्रश्न-पुस्तिका प्रत्येक दृष्टि से संपूर्ण है।	After receiving the instruction to open the booklet and before starting to answer 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 Evaluate the following postfix expression :
231*+9−

(A) −4

(B) −10

(C) 2

(D) −2

1.2 What is the time complexity for finding the height of a binary tree ?

(A) O(loglogn)

(B) O(nlogn)

(C) O(logn)

(D) O(n)

1.3 The inorder traversal of a Binary Search Tree always lends a _____ output.

(A) Strictly Increasing

(B) Strictly Decreasing

(C) Sorted

(D) Random

1.4 What is the maximum number of edges in a bipartite graph of 8 vertices ?

(A) 20

(B) 32

(C) 64

(D) 16

1.5 While inheriting a class in C++, if no access mode is specified then which of the following occurs ?

(A) Inherited Publicly by default

(B) Inherited Privately by default

(C) Cannot be done without access mode specified

(D) Inherited Protected by default

1.6 What does the following code do ?
void show(struct node* head)

```
{
        if(head == "NULL")
        {
                return;
        }
        show(head->next);
        printf("%d", head->data);}
```

(A) Print the data in the linked list in order.

(B) Print the data in the linked list in reverse order.

(C) Simply traverse till the end of the list.

(D) None of the above.

1.7 What is the complexity for searching an element in a circular linked list ?

(A) O(n)

(B) O(logn)

(C) O(1)

(D) O(nlogn)

1.8 Which data structure would be appropriate for the BFS traversal of a graph ?

(A) Tree

(B) Queue

(C) Stack

(D) Array

1.9 What does the following code do ?

```
voidelem(Tree root)
{
        while(root.right()!="NULL")
        {
            elem(root.right());
        }
        cout<<root.data()<<endl;
}
```

(A) Find the least element in a BST.

(B) Find the maximum element in a BST.

(C) Find the value of the root node on the BST.

(D) None of the above.

1.10 Which sorting algorithm can be used to sort a random linked list with least time complexity ?

(A) Insertion Sort

(B) Merge Sort

(C) Quick sort

(D) Heap Sort

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

2.1 Time complexities are added in case of nested 'for' loops.

2.2 In pre-order traversal the root node is visited first.

2.3 We can implement a 'Queue' functionality using the 'Stack' data structure.

2.4 A graph is said to be complete as there is no edge between every pair of vertices.

2.5 Linked-List is an indexed data structure.

2.6 Median-of-three partitioning is the most efficient QuickSort pivoting technique.

2.7 "Abstract" class allows only one object to be created.

2.8 Derived class pointer cannot point to the Base class.

2.9 Linked list nodes are formally stored contiguously in memory.

2.10 Self-referential pointers are necessary for each node in a linked list.

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)

Sl. No.	X		Y
3.1	Destructor Calling	A	Hiding internal object details
3.2	Class	B	To achieve runtime polymorphism
3.3	Data Hiding	C	Hiding the implementation and showing only the features
3.4	Virtual Function	D	Reverse of Constructor Calling
3.5	Keywords	E	Two or more functions having same name but different no. of parameters or type.
3.6	Overloaded function	F	Demonstrates polymorphism
3.7	Abstraction	G	Time complexity of Bubble Sort
3.8	O(n)	H	Resource shared among multiple consumers
3.9	Queue	I	Worst-case Linear Search time complexity
3.10	O(n^2)	J	Reserved words
		K	Operator Overloading
		L	Virtual Constructor
		M	Linear Search

4. Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Enter your choice in the "OMR" answer sheet attached to the question paper, following instructions therein.

(1x10)

A.	parameters	B.	Function calls	C.	same
D.	different	E.	identifier	F.	Divide-and-conquer
G.	ordered	H.	Copy Constructor	I.	unordered
J.	Infix, Postfix	K.	Postfix, Infix	L.	Any
M.	Stack				

4.1 Destructors do not accept _____.

4.2 A stack is a linear list where the addition and the deletions take place at the _____ end.

4.3 In C++, we cannot use a keyword as _____.

4.4 Mergesort uses _____ technique.

4.5 To implement binary search algorithm, one must have an _____ list.

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

4.7 The "+" operator in "V+B" and "VB+" is in _____ and _____ respectively.

4.8 A graph is a _____ data structure.

4.9 _____ is used in a DFS search of a graph.

4.10 Graph vertices can be linked in _____ manner.

PART TWO

(Answer any FOUR questions)

5. (a) Construct a Binary Search tree with the following values inserted in order : 12, 8, 25, 14, 9, 6, 18. Show the preorder, and inorder traversals for the same.

   (b) Mention any 3 important properties of B-trees with an example.

   (c) Write an efficient algorithm to search for a given value "k" in a constructed B-tree. Mention its time complexity. **(5+4+6)**

6. (a) What is inheritance in C++ ? Name the different types of inheritance and explain briefly.

   (b) Differentiate between function overloading and operator overloading, with suitable examples.

   (c) What are the types of polymorphism in C++ ? Distinguish. **(5+7+3)**

7. (a) Define the Breadth First Search (BFS) for a graph using a suitable example.

   (b) What is the data structure we should use for its implementation ? Write a C++ function for BFS.

   (c) How do you perform the address calculation using row major ordering ? Explain. **(5+(2+5)+3)**

8. (a) Write the appropriate C++ functions to implement a singly linked list following these operations :

   INSERT -10, 2, 67, 14, 3, 6

   DELETE -3

   (b) Mention 2 advantages of the doubly linked list over the single one.

   (c) Write the Binary Search algorithm.

   (d) Let the aforementioned values be in an array in an ordered fashion. Illustrate the steps required to search for the value "3" using Binary Search algorithm. **(6+2+3+4)**

9. (a) Define a threaded binary tree, with a diagrammatic example. What type of traversal does a thread binary tree assume ?

   (b) Write the algorithmic steps to insert values in a B-tree. Insert 10, 20, 30, 40, 50, 60, 70, 80, 90 into an initially empty B-tree (assume minimum degree(t) = 3).

   (c) State an important use of B-tree in relation to data. **(3+(5+5)+2)**

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