No. of Printed Pages : **8**

A5-R5 : Data Structure Through Object Oriented Programming Language

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

OMR Sheet No. :						

Roll No. : | | | | | | |

Answer Sheet No. : | | | | | | |

Name of Candidate : _____ **; Signature of Candidate :** _____

INSTRUCTIONS FOR CANDIDATES :

- Carefully read the instructions given on Question Paper, OMR Sheet and Answer Sheet.
- Question Paper is in English language. Candidate has to answer in English language only.
- There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.
- **PART ONE** is Objective type and carries **40** Marks. **PART TWO** is Subjective type and carries **60** Marks.
- **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**.
- 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.
- **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.**
- 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 respects.

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

PART - ONE

(Answer all the questions; each question carries ONE mark)

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 the instructions therein.

(1x10)

1.1 Runtime polymorphism is achieved by :

(A) Friend function

(B) Virtual function

(C) Operator overloading

(D) Function overloading

1.2 Which among the following is an example of stable sort ?

(A) Quick Sort

(B) Merge Sort

(C) Heap Sort

(D) Selection Sort

1.3 Which of the following pair's traversals on a binary tree can build the tree uniquely ?

(A) Post-order and pre-order

(B) Post-order and in-order

(C) Post-order and level-order

(D) Level order and pre-order

1.4 How many undirected graphs (not necessarily connected) can be constructed out of a given set V of n vertices ?

(A) n(n-1)/2

(B) 2^n

(C) n!

(D) 2^(n(n-1)/2)

1.5 The number of non-zero entries in a lower triangular matrix of order nXn :

(A) (n(n+1)/2)

(B) 2n

(C) n^2

(D) None of the above

1.6 Choose the operator which cannot be overloaded.

(A) /

(B) ()

(C) ::

(D) %

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1.7 The result evaluating the postfix expression 10 5 + 60 6 / * 8 - is :

(A) 284

(B) 142

(C) 213

(D) 71

1.8 Which is **not** a member of the class ?

(A) Static function

(B) Friend function

(C) Constant function

(D) Virtual function

1.9 Which of the following concepts of OOPS means exposing only necessary information to client ?

(A) Encapsulation

(B) Abstraction

(C) Data hiding

(D) Data binding

1.10 Complexity in terms of machine cycles of a data structure is measured in terms of :

(A) Time Complexity

(B) Space Complexity

(C) Mean Complexity

(D) Both (A) and (B)

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 the instructions therein. (1x10)

2.1 Function overloading is done at compile time.

2.2 Protected members are accessible to the member of derived class.

2.3. A derived class inherits constructors and destructors.

2.4. A friend function can be called like a normal function.

2.5. Nested class is a derived class.

2.6. One of the techniques of dealing with the hash collision is Chaining.

2.7. B-trees remain balanced after every insertion and deletion.

2.8. Searching is more efficient in Binary Search Trees as compared with B-trees.

2.9. Singly Linked List is a type of linked list where every node stores address of the next node in the list and the last node has the address of the first node.

2.10. In a queue the number of elements is exactly 1 when front = rear = -1

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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 the instructions therein. (1x10)

X		Y	
3.1	Depth of a complete Binary tree	**A**	External sorting
3.2	Merge Sort	**B**	In place Sort
3.3	Insertion Sort	**C**	Queue
3.4	An application of binary tree	**D**	$O(N^2)$
3.5	DFS is implemented using	**E**	Log2n + 1
3.6	Worst case complexity of quick Sort	**F**	Arithmetic expression
3.7	Circular Queue is overflow when	**G**	O(N)
3.8	Best case complexity of Insertion Sort	**H**	$O(N^3)$
3.9	Matrix Multiplication	**I**	Front = Rear-1
3.10	A Very useful data structure in situation when data have to be stored and then retrieved in reverse order	**J**	(Front = -1 and Rear = max-1)
		K	Stack
		L	Link List

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 supplied with the question paper, following the instructions therein. (1x10)

A.	Bubble	**B.**	Searching	**C.**	Linear data structure	**D.**	Insertion
E.	Max-heap	**F.**	Degree	**G.**	Private	**H.**	Stack
I.	Internal	**J.**	External	**K.**	Queue	**L.**	Polymorphism

4.1 The term _____ means the ability to take many forms.

4.2 Stack and queue are _____.

4.3 Hashing is used to speedup _____.

4.4 The _____ of the node is the number of children that branched from it.

4.5 _____ sorting algorithm is frequently used when n is small where n is total number of elements.

4.6 In a _____ the smallest element resides always at the leaves assuming all elements are distinct.

4.7 The _____ member of a class cannot be accessed from outside the class.

4.8 In recursion _____ data structure is used.

4.9 The Non-leaf nodes of a tree are also known as _____ nodes.

4.10. _____ is used to manage Printer Buffer.

PART - TWO

(Answer any FOUR questions)

5. (a) What is the advantage of doubly-ended queue over a priority queue?

(b) Create a binary search tree by inserting the following elements:

13, 3, 4, 12, 14, 10, 5, 1, 8, 2, 7, 9, 11, 6, 18

in that order, starting from an empty tree (show all the steps).

(c) Compare Adjacency Lists and Adjacency Matrices for graph representation.

(5+6+4)

6. (a) Explain the algorithm for insertion sort and give a suitable example. Analyze the algorithm.

(b) Formulate recursive algorithm for binary search with its timing analysis.

(7+8)

7. (a) Define a Queue and all its operations and write an algorithm for the operations on Queue.

(b) What is a Linear List ? Explain all the operations that can be performed on a Linear List.

(c) Differentiate between Arrays and Linked Lists implementation of Linear Lists. **(7+5+3)**

8. (a) Explain the Breadth-First Search (BFS) traversing method with the help of an example. Give its time and space complexity.

(b) What is the structure/building blocks of object-oriented programming ?

(c) What are the principles of an object-oriented programming language ?

(5+5+5)

9. (a) Explain with example the three main parameters related with complexity on which algorithms can be compared.

(b) Distinguish between B tree and B+ Tree. Create a B tree of order 5 by inserting the following elements :
1, 12, 8, 2, 25, 6, 14, 28, 17, 7, 52, 16, 48, 68, 3, 26, 29, 53, 55, 45 and 67

(7+8)

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