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 respect.

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 instructions therein.**

(1x10)

1.1 What should be the value of rear (end) if the queue is full (elements are completely occupied) ?

(A) 1

(B) -1

(C) MAX $+1$

(D) MAX -1

1.2 The complexity of multiplying two matrices of order m*n and n*p is :

(A) mnp

(B) mp

(C) mn

(D) np

1.3 A full binary tree with 2n+1 nodes contains :

(A) n leaf nodes

(B) n non-leaf nodes

(C) $(n-1)$ leaf nodes

(D) $(n-1)$ non-leaf nodes

1.4 Which sorting algorithms have their best and worst case times equal ?

(A) heap and selection sort

(B) insertion sort & merge sort

(C) merge sort and heap sort

(D) none of these

1.5 A graph with n vertices will definitely have a parallel edge or self loop if the total number of edges are :

(A) more than n

(B) more than $n+1$

(C) more than $(n+1)/2$

(D) more than $n(n-1)/2$

1.6 Which of the following is not a type of constructors in C++ ?

(A) Default

(B) Copy

(C) Parameterised

(D) Delete

1.7 In Multipath inheritance, in order to remove duplicate set of constructers in child class, _____.

(A) Write Virtual function in parent classes

(B) Write virtual functions in base class

(C) The child class should virtually inherit the base class.

(D) All of these

1.8 A class can contain objects of other classes and this phenomenon is called _____.

    (A)   Relationship

    (B)   Object Association

    (C)   Containership

    (D)   None of these

1.9 In context of time-complexity, find the odd one out.

    (A)   Deletion of last node from doubly linked list, if last node address is known.

    (B)   Searching in Hash Table

    (C)   Adding edge in Adjacency Matrix

    (D)   Heapify a Binary Heap

1.10 What is the worst case run-time complexity of binary search algorithm ?

    (A) $O(n^2)$

    (B) $O(n\log n)$

    (C) $O(n^3)$

    (D) $O(\log.n)$

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 Array is a dynamic data structure whose size can be changed while stacks are static data structures whose sizes are fixed.

2.2 The time complexity of binary search is $O(\log n)$.

2.3 Destructors in C++ are used to create an object of a class.

2.4 Function overloading and Function overriding both are same.

2.5 A full binary tree has a restricted shape which starts at the root and fills the tree by levels from left to right.

2.6 Big Theta (Θ) indicates that the Upper and Lower bounds of an algorithm are the same.

2.7 In a queue, placing new items in the queue is referred to as a push and taking an item out of the queue is called a pop.

2.8 A preorder traversal visits every node starting at the leaf nodes and working up the tree.

2.9 Arithmetic operators can not be overloaded in C++.

2.10 A linked list implementation relies upon static memory allocation where static refers to the requirement to pre-allocate all of the memory that will be used for the 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)

	X		Y
3.1	Breadth-first search	**A.**	Nondeterministic loop
3.2	Completeness	**B.**	Object
3.3	Space Complexity	**C.**	Stack
3.4	Repeat until	**D.**	i = i + 1
3.5	Class	**E.**	queue
3.6	LIFO	**F.**	O(n)
3.7	++i is equivalent to	**G.**	Lower Bound
3.8	Polymorphism	**H.**	How much memory need to perform the search
3.9	Quick Sort	**I.**	nlog n
3.10	Smallest element of an array (unsorted)	**J.**	The strategy guaranteed to find the solution when there in one.
		K.	Operator Overloading
		L.	Upper Bound
		M.	Tree

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.	Stack	B.	Public	C.	Sorted	D.	Unsorted
E.	FIFO	F.	A traversal	G.	Dynamically allocate	H.	nlog n
I.	Out - degree	J.	External sorting	K.	n^2	L.	Adjacency matrix
M.	Binary Search						

4.1 _____ is the process of visiting every node in a tree atleast once.

4.2 A queue, in other words, is called a _____ list.

4.3 _____ data structure is needed to convert infix notations to postfix notations.

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

4.5 _____ is one of the access specifiers in C++.

4.6 The process of sorting a list stored in a file in secondary memory is known as _____.

4.7 Binary Search is the fasted of all methods for _____ records.

4.8 Function calloc and malloc are used to _____ memory.

4.9 The Worst-case time complexity of Quick Sort _____.

4.10 An _____ representation of a graph cannot contain information of parallel edges.

PART TWO

(Answer any FOUR questions)

5. (a) Sort the following number in ascending order using Bubble sort.

35, 26, 45, 19, 74, 56, 44 and Write the output after each iteration

(b) Translate infix expression into its equivalent postfix expression :

A*(B+D)/E − F*(G+H/K).

(c) What do you meant by Time Space Tradeoff ? Explain all the 3 cases (Best, Average, Worst w.r.t to it.

(5+5+5)

6. (a) Explain the concept of Sparse Matrix.

(b) Write program in C++ to create a singly linked list of 5 nodes with data values/ fields as 10, 20, 30, 40, 50. Further write a search function to search the singly linked list for presence of an element say 40.

(c) For the given 2D array(integer) of order 15X10 whose base address is 1500. Find the address of the location A[12][9] for the row major order and column major order.

(3+8+4)

7. (a) Write an algorithm to evaluate a postfix expression. Execute your algorithm using the following postfix expression as your input : a b + c d +*f ↑.

(b) What is a Stack ? Write an algorithm to perform push and pop operations in array.

(7+8)

8. (a) What is a Binary Search Tree (BST) ? Make a BST for the following sequence of numbers. 45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48
Traverse the tree in Preorder, Inorder and postorder.

(b) What are B-trees ? Construct a B-Tree of order 3 for the following set of Input data: 5, 9, 3, 7, 1, 2, 8, 6, 0, 4.

(7+8)

9. (a) Consider the following specification of a graph G
V(G)={1,2,3,4}
E(G)={(1,2),(1,3),(3,3),(3,4),(4,1)}
(i) Draw an undirected graph.
(ii) Draw its adjacency matrix.

(b) Explain various graph traversal schemes and write their merits and demerits.

(6+9)

- o O o -

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

A5-R5/01-23