

**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 : \_\_\_\_\_;Signature of Candidate : \_\_\_\_\_  
Name 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 हैं तथा भाग दो "व्यक्तिपरक" प्रकार का 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, 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" sheet attached to the question paper, following instructions therein.**

**(1x10)**

**1.1** Which among the below specified condition is applicable if the Queue is non-empty ?

- (A) rear > front
- (B) rear < front
- (C) rear = front
- (D) unpredictable

**1.2** Which linear structure has a provision of Last-In-First-Out (LIFO) mechanism for its elements ?

- (A) Stack
- (B) Queue
- (C) Linked List
- (D) Tree

**1.3** Which data structures find their applications in BFS and DFS Traversal mechanisms on a Tree respectively ?

- (A) Graph & Stack
- (B) Queue & Stack
- (C) Queue & Graph
- (D) Array & Linked List

**1.4** What happens if an expression tree reads the symbol in the form of an Operand ?

- (A) One node tree is created and a pointer is pushed towards it on the stack.
- (B) Pointer is pop to two trees in order to generate a new tree with root as its operator.
- (C) Both (A) and (B)
- (D) None of the above

**1.5** Which one of the following is not a constructor in C++ ?

- (A) Default
- (B) Parameterized
- (C) Copy
- (D) Cut

**1.6** How many edges are present in a Complete Graph with 'N' Vertices ?

- (A) N - 1
- (B) N - 1 / 2
- (C) N(N - 1) / 2
- (D) (N - 1)2

**1.7** Which one of the following is the concept available in C++ ?

- (A) Polymorphism
- (B) Polymer
- (C) Polyester
- (D) Poly

1.8 Which Vertex exhibits its In-degree and Out-degree to be '1' and '0' respectively ?

- (A) Labeled Vertex
- (B) Isolated Vertex
- (C) Cut Vertex
- (D) Pendant Vertex

1.9 Which of the following is the Worst-case time complexity of Quick Sort ?

- (A)  $O(n \log n)$
- (B)  $O(N^2)$
- (C)  $O(\log n)$
- (D)  $O(n^2 / 4)$

1.10 What is the postfix form of the following infix expression ?

$$A+B*C/D-E^F*G$$

- (A)  $ABC*D/+EF^G*-$
- (B)  $ABC*D+EF^G*- /$
- (C)  $AB*CD/+EF^G*-$
- (D)  $ABC*D/+EFG^*-$

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

- 2.1 In C++, runtime memory is allocated by new operator.
- 2.2 When the head pointer points to NULL, it signifies an empty list.
- 2.3 Evaluation of postfix expression is faster than evaluation of same infix expression.
- 2.4 Stack data structure is used for breadth first search.
- 2.5  $O(1)$  Time is required for deleting a node 'x' from a Doubly Linked List having 'n' nodes.
- 2.6 All function calls are resolved at compile-time in OOPS.
- 2.7 Function malloc returns a pointer of type void \* to the memory it allocates.
- 2.8 A tree is an example of a linear data structure.
- 2.9 Atomic data is the data that we choose to consider as a single, non-decomposable entity.
- 2.10 The leaves of an expression tree are operands and all internal nodes are the operators.

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 attached to the question paper, following instructions therein. (1x10)

X		Y	
3.1	Tower of Hanoi	A.	User Defined Type
3.2	Depth first search uses data structure	B.	Selection Sort
3.3	Resource sharing in a computer centre	C.	Recursion
3.4	Structure and union	D.	Merge Sort
3.5	In-place comparison-based algorithm	E.	Stack
3.6	Divide and conquer technique	F.	Queue
3.7	In this traversal method, the root node is visited first, then the left subtree and finally the right subtree	G.	Scope resolution operator
3.8	Syntax to declare a virtual function	H.	In-order Traversal
3.9	Operator cannot be overloaded	I.	Pre-order Traversal
3.10	Displaying only essential information and hiding the details	J.	virtual int func();
		K.	inline virtual func();
		L.	Linear Search
		M.	Abstraction

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.	Zero	B.	$(n*n-n-2*m)/2$	C.	Polymorphism
D.	Linked List	E.	Depth	F.	Queue
G.	Stack	H.	Constructor	I.	$(n*(n-1))/2$
J.	Static	K.	Inheritance	L.	Time Complexity
M.	Binary Search				

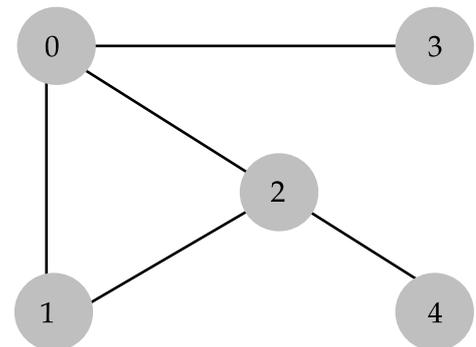
- 4.1 \_\_\_\_\_ Data Structure is used in recursion.
- 4.2 A \_\_\_\_\_ is a member function of a class which initializes objects of a class.
- 4.3 Static methods can only access \_\_\_\_\_ members (data and methods).
- 4.4 \_\_\_\_\_ is a mechanism in which one class acquires the property of another class.
- 4.5 Time taken by an algorithm to solve any given problem is known as \_\_\_\_\_.
- 4.6 In a \_\_\_\_\_ searching technique data required in a sorted order.
- 4.7 A linear collection of data elements where the linear node is given by means of pointer is called \_\_\_\_\_.
- 4.8 A circular queue is implemented using an array of size 10. The array index starts with 0, front is 6, and rear is 9. The insertion of next element takes place at the \_\_\_\_\_ index.
- 4.9 The number of edges from the root to the leaf node is called \_\_\_\_\_ of the tree.
- 4.10 \_\_\_\_\_ number of edges present in a complete graph having n vertices.

**PART TWO**

**(Answer any FOUR questions)**

5. (a) Construct the binary search tree for the given data 50, 70, 60, 20, 90, 10, 40, 100. Also perform in-order, pre-order and post-order traversal of the same tree.
- (b) Write a C++ program to create class named Bank Account with data member like acc\_no and balance, Create two constructor- One without argument and another with argument to initialize the data member. Create showBalance method to display the current balance. Also create withDraw method to withdraw amount from the bank. Create two objects of the class and perform withdraw operation. Display balance for both the accounts before and after withdraw operation. **(10+5)**
6. (a) Convert the given infix expression into postfix notation.  $A+(B*C-(D/E-F)*G)*H$  Also, evaluate the generated postfix expression using given values.  $A=3, B=5, C=3, D=9, E=2, F=6, G=2, H=2$ .
- (b) What is link list ? Explain the advantage and disadvantages of link list in detail. **(8+7)**
7. (a) What is Queue ? Why it is known as FIFO ? Write an algorithm to insert and delete an element from a simple Queue.
- (b) Create a class for singly linked list and write the functions for following operations :
- (i) Write a function to insert a new node at given position.
  - (ii) Write a function to insert a new node at the last position.
- (8+7)**

8. (a) What is Doubly Linked List ? Write an algorithm to insert and delete a node in Doubly Linked List.
- (b) Write the algorithm for merge sort and perform the merge sort on given set of data : 38, 27, 43, 3, 9, 82, 10
- (c) Differentiate between Linear and Non-Linear data structure. **(5+5+5)**
9. (a) What is inheritance in C++ ? List the types of inheritance available. Explain all types of inheritance in brief.
- (b) Perform following operations on stack and display position of top after each operation. Take stack size=3 and initially top = -1. Pop(), Push(1), pop(), push(2), push(3), push(4), push(5), pop()
- (c) Perform DFS search on given graph.



**(5+5+5)**

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SPACE FOR ROUGH WORK

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