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

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

ओएमआर शीट सं. : **OMR Sheet No. :**						

रोल नं. : **Roll No. :** | | | | | | |

उत्तर-पुस्तिका सं. : **Answer Sheet No. :** | | | | | | |

परीक्षार्थी का नाम : **परीक्षार्थी के हस्ताक्षर :**
Name of Candidate : _____ ; **Signature of Candidate :** _____

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 अंग्रेजी भाषा में है। परीक्षार्थी उत्तर लिखने के लिए केवल अंग्रेजी भाषा का ही प्रयोग कर सकते हैं।	Question Paper is in English language. Candidate has to 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, 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 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 यह जाँच कर 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 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 Which of the following data structure is linear type ?

(A) Binary tree

(B) Stack

(C) Graph

(D) Trees

1.2 A _____ is an acyclic digraph, which has only one node with in-degree 0, and other nodes have in-degree 1.

(A) Direction oriented tree

(B) Dis-joint tree

(C) Directed tree

(D) Undirected tree

1.3 Which of the following sorting algorithms can be used to sort a random linked list with minimum time complexity ?

(A) Merge Sort

(B) Quick Sort

(C) Insertion Sort

(D) Heap Sort

1.4 What is the output of following function for start pointing to first node of following linked list ? 1->2->3->4->5->6

```
void fun(struct node* start)
{
if(start == NULL)
return;
printf("%d  ", start->data);
if(start->next != NULL)
fun(start->next->next);
printf("%d  ", start->data);
}
```

(A) 1 3 5 5 3 1

(B) 1 4 6 6 4 1

(C) 1 3 5 1 3 5

(D) 1 2 3 5

1.5 Which of the following properties are obeyed by all three tree - traversals ?

(A) Right subtrees are visited before left subtrees

(B) Root node is visited before left subtree

(C) Left subtrees are visited before right subtrees

(D) Root node is visited before right subtree

1.6 Which of these operators have the highest order of precedence ?

(A) '(' and ')'

(B) '*' and '/'

(C) '~' and '^'

(D) '+' and '-'

1.7 A data structure in which elements can be inserted or deleted at/from both ends but not in the middle is ?

(A) Queue

(B) Circular queue

(C) Priority queue

(D) Dequeue

1.8 Which of the following data structure can't store the non-homogeneous data elements ?

(A) Records

(B) Pointers

(C) Arrays

(D) Stacks

1.9 Which is/are the application(s) of stack ?

(A) Function calls

(B) Large number Arithmetic

(C) Evaluation of arithmetic expressions

(D) All of the above

1.10 What is the average case time complexity for finding the height of the binary tree ?

(A) h = O(log n)

(B) h = O(loglogn)

(C) h = O(n)

(D) h = O(nlogn)

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 Network is a graph that has weights or costs associated with it.

2.2 In strictly binary tree, the out-degree of every node is either 0 or 1.

2.3 Round Robin technique is employed to allocate CPU time to resources which makes use of the circular linked list data structure.

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

2.5 In a full binary tree if number of internal nodes is I, then numbers of leaves L are I+1.

2.6 Data elements in linked list need not be stored in adjacent space in memory.

2.7 Level order traversal of a tree is formed with the help of dijkstra's algorithm.

2.8 Recursive algorithms always terminate without any condition.

2.9 The maximum height of an AVL tree with p nodes is log (p).

2.10 An undirected graph which contains no cycles is called a forest.

SPACE FOR ROUGH WORK

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)

	Column X		Column Y
3.1	Heapsort Complexity	**A.**	Indirect Recursion
3.2	Order notation	**B.**	FIFO
3.3	A calls B and B calls A	**C.**	Sparse Matrix
3.4	Matrix in which many of the entries are zero	**D.**	Queue
3.5	Adjacency Matrix	**E.**	O(n log n)
3.6	Queue	**F.**	Bubble sort
3.7	Data structure used in breadth first search of a graph to hold nodes	**G.**	Merge sort
3.8	Data structures are indexed structures	**H.**	Identity Matrix
3.9	Time complexity of Binary Search	**I.**	Array
3.10	Which is not the internal sort	**J.**	Complexity measurement
		K.	LIFO
		L.	Direct recursion
		M.	O (log n)

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.	Overflow	**B.**	AVL Tree	**C.**	Linear Array	**D.**	Strictly binary tree
E.	Strongly Connected	**F.**	Binary Search	**G.**	Bipartite	**H.**	Queue
I.	Linear Search	**J.**	Depth First	**K.**	Underflow	**L.**	Red black tree
M.	Tightly Connected						

4.1 In the _____ traversal we process all of a vertex's descendants before we move to an adjacent vertex.

4.2 Linked lists are not suitable for the implementation of _____.

4.3 A graph is said to be _____ if the vertices can be split into two sets V1 and V2 such there are no edges between two vertices of V1 vertices of V2.

4.4 In _____, search start at the beginning of the list and check every element in the list.

4.5 A binary search tree whose left subtree and right subtree differ in height by at most 1 unit is called _____.

4.6 The tree where the out-degree of every node is either 0 or 2 is _____.

4.7 The _____condition is checked before insertion in a linked queue.

4.8 A _____ does not keep track of address of every element in the list.

4.9 A directed graph is _____ if there is a path from each vertex to every other vertex in the digraph.

4.10 _____ is very useful in situation when data have to stored and then retrieved in reverse order.

PART TWO

(Answer ANY FOUR questions)

5. (a) What is a sparse matrix. Explain an efficient method of storing a sparse matrix in memory with the help of an example. Why to use a Sparse Matrix instead of simple matrix ?

(b) Define an algorithm. Mention the basic criteria to be satisfied by an algorithm.

(c) What do you mean by performance measurement of an algorithm ? Illustrate with an example.

(5+5+5)

6. (a) Illustrate with the help of an example how an arithmetic expression can be evaluated by using a stack.

(b) Compare and contrast : DFS and BFS (Breadth First Search)

(c) What is a spanning tree ? What do you mean by minimal spanning tree ? Explain with an example.

(5+5+5)

7. (a) What is a binary tree ? Write down different properties of a binary tree.

(b) Show the steps of sorting the following sequence.

25 57 48 37 12 92 86 33

in ascending order using quick sort method.

(7+8)

8. (a) What are the advantages and disadvantages of array representation of stack and queues over linked list representation ?

(b) What is a directed graph ? What is a Hamiltonian path ?

(c) Find the time complexity of the Bubble sort.

(7+4+4)

9. Write short notes on **any three** :

(a) Kruskal 's Algorithm

(b) Hashing Schemes

(c) Binary tree traversal methods

(d) Adjacency matrix and Adjacency lists

(5+5+5)

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SPACE FOR ROUGH WORK

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