A6/B2.1-R4 : DATA STRUCTURES 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 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 सकते हैं।	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, 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 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=10)**

1.1 Write Prefix equivalent of (A + B) * C + D / (E + F * G) - H

(A) /+ * + A B C - D + E * F G H

(B) A B + C * D E F G * + / + H -

(C) A B + C * D E F G * + / + H -

(D) - + * + A B C / D + E * F G H

1.2 Binary search :

(A) is divide and conquer method

(B) is better than linear search in worst case

(C) can be implemented using recursive function

(D) All of the above

1.3 What does the following code segment do ?

```
void fn(n)
{
if (n>1)
return(n*fn(n-1));
else return(1);
}
```

(A) This returns factorial of n for initial value of n greater than 1.

(B) This returns 1 if the initial value of n is less than 1.

(C) This returns 1 if the initial value of n is equal to 1.

(D) All of the above

1.4 How many full binary trees are possible with seven nodes ?

(A) only one

(B) only three

(C) only five

(D) only six

1.5 Evaluate the postfix expression 342^2+* :

(A) 54

(B) 45

(C) 13

(D) 31

1.6 Given the sequence of numbers 13, 52, 95, 26, 38. The sequence after the 3rd iteration of bubble sort is :

(A) 13, 52, 26, 38, 95

(B) 13, 26, 38, 52, 95

(C) 13, 38, 26, 52, 95

(D) 52, 26, 13, 38, 95

1.7 Breadth First Search :

(A) uses STACK as data structure.

(B) uses QUEUE as data structure.

(C) uses Circular QUEUE as data structure.

(D) uses DQUEUE as data structure.

1.8 Using linear probing to resolve collision when applying the hash function (key %10) to the following keys: 11, 115, 175, 181, 165, 132, 220, 119, 256, 123, the order of the storage of entries is :

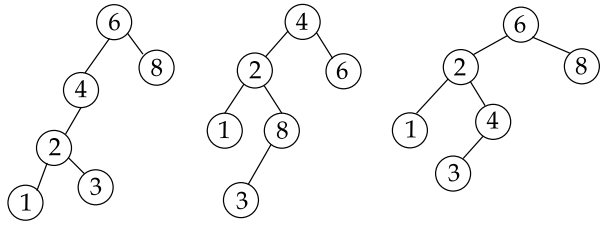
(A) 11, 115, 119, 123, 132, 165, 175, 181, 220, 256

(B) 11, 115, 175, 181, 165, 132, 220, 119, 256, 123

(C) 220, 11, 181, 132, 123, 115, 175, 165, 256, 119

(D) None of the above

1.9 Suppose there is a set of elements 6, 4, 2, 3, 8, 1 and three tree diagrams :



I II III

Which of the given trees corresponds to the BST of the above sequence ?

(A) I

(B) II

(C) III

(D) None of the above

1.10 The program section :

```
int **p;
p = calloc(10, sizeof(int));
for(i=0; i<10; i++)
p[i] = calloc(5, sizeof(int));
```

is equivalent to the declaration :

(A) int p[5][10];

(B) int p[10][5];

(C) int p[5][5];

(D) int p[10][10];

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=10)**

2.1 Hashing techniques search any element in O(1) time.

2.2 Linked list is a non-linear data structure.

2.3 Linked list is not suitable for binary search.

2.4 The maximum number of nodes in a binary tree is 2^h-1 where h is the height of tree.

2.5 Heap sort technique is an application of complete binary tree.

2.6 Prim's spanning tree algorithm uses stack as a data structure.

2.7 Minimum spanning tree traverse every edge of a given graph.

2.8 Preoder traversal of a binary search tree yields ascending order of elements.

2.9 Height balance tree is a binary search tree.

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

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=10)

X		Y	
3.1	A binary tree T has n leaf nodes. The number of nodes of degree two in T is	**A.**	n-1
3.2	Diagonal of an adjacency matrix has all zeros	**B.**	same as its initial condition.
3.3	Empty condition in a circular queue is	**C.**	Graphs has no self loop.
3.4	The number of swapping needed to sort the given sequence 3, 2, 1 in ascending order using Heap sort is	**D.**	3
3.5	Which of these is the Worst-case time complexity of Quick Sort - and cannot be expressed in lower order terms?	**E.**	1
3.6	Which of these is the average case time complexity of Merge Sort - and cannot be expressed in lower order terms ?	**F.**	$O(n^2)$
3.7	Which of these is the time complexity involved in building a heap of *n* elements - and cannot be expressed in lower order terms ?	**G.**	Encapsulation
3.8	Circular Queue is overflow when	**H.**	O(n log n)
3.9	Stack follows the principle of	**I.**	O(n)
3.10	It is an Object Oriented Programming concept that binds together the data and functions that manipulate the data, and that keeps both safe from outside interference and misuse	**J.**	(Front=Rear-1) or (Front=0 and Rear=n-1)
		K.	Inheritance
		L.	Front=Rear-1
		M.	LIFO

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 instructions therein. (1x10=10)

A.	Inorder	**B.**	Postorder	**C.**	Divide and Conquer
D.	Minimum spanning tree	**E.**	Rear-front+1	**F.**	3
G.	Sink	**H.**	Source	**I.**	2
J.	Queue	**K.**	-1	**L.**	1
M.	Stack				

4.1 Merge sort is _____ technique.

4.2 Kruskal's algorithm is used to generate _____.

4.3 In a circular queue, _____ are the number of elements in the queue.

4.4 Two stacks can behave like _____.

4.5 In a directed graph, a vertex with outdegree 0 is called _____ vertex.

4.6 Merging 4 sorted files containing 50, 10, 25 and 15 records will require merge sort algorithm to call by _____ times.

4.7 In left skewed Binary search tree _____ traversal produces ascending order of numbers.

4.8 In right skewed Binary search tree _____ traversal produces descending order of numbers.

4.9 The data structure used in traversing a given graph by Depth first search is _____.

4.10 In a balanced binary tree the height of two sub-trees of every node can not differ by more than _____.

PART TWO

(Answer any FOUR Questions.)

5. (a) What do you mean by Big-O notation ?

(b) Write down generalized algorithm for a two dimensional array in such a way that it has the following relationships between input and output.

Input			output		
2	5	7	0	5	14
3	1	6	3	2	18
2	3	6	4	9	24

(c) Explain quick sort for following data values in an array.

54, 26, 93, 17, 77, 31, 44, 55, 20

Show the results at each step.

(3+5+7=15)

6. (a) Design a class in C++ that will overload the binary operator * and use it to multiply the corresponding elements of 2 arrays into a third array.

(b) What do you mean by inheritance ? Give any example.

(10+5=15)

7. (a) Write an algorithm to simulate the insertion of a node at given position in a linear linked list.

(b) Given the following arithmetic expression in postfix notation as 6 2 3 + - 3 8 2 / + * 2 3 + evaluate it. Show the contents of stack and output at each stage.

(8+7=15)

8. (a) With respect to a binary search tree, explain how to delete a node having two children.

(b) Create five binary trees with 3 nodes which when traversed in post-order gives the sequence 3, 2, 1.

(8+7=15)

9. (a) Apply Prim's algorithm to find the minimum spanning tree of the following graph starting from vertex 1.

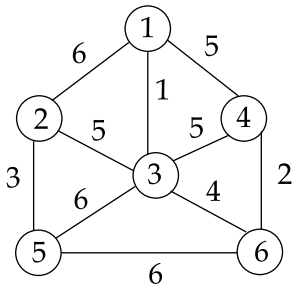


Fig. 1.1

(b) What is an adjacency list ? Design it for the above figure (Fig 1.1).

(c) Apply Depth First Search technique from vertex 1 on the Fig 1.1 while considering the equal weight on all edges.

(6+3+6=15)

SPACE FOR ROUGH WORK

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