

A5-R5 : Data Structure Though Object Oriented Programming Language

अवधि : 03 घंटे
DURATION : 03 Hours

अधिकतम अंक : 100
MAXIMUM MARKS : 100

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

रोल नं. :

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उत्तर-पुस्तिका सं. :

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Answer Sheet No. :

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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 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 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 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. Which of the following is associated with objects ?

- (A) State
- (B) Behaviour
- (C) Identity
- (D) All of the above

1.2. Choose the operator which cannot be overloaded.

- (A) /
- (B) ()
- (C) ::
- (D) %

1.3. What is the output of the following program ?

```
#include<iostream>
using namespace std;
main() {
class student {
int rno = 10;
} v;
cout<<v.rno;
}
```

- (A) 10
- (B) Garbage
- (C) Runtime error
- (D) Compile error

1.4. Which of the following things are necessary to write a C++ program with runtime polymorphism (use of virtual functions) ?

- (A) A base class and a derived class.
- (B) A function with same name in base class and derived class.
- (C) A pointer or reference of base class type pointing or referring to an object of derived class.
- (D) All of these

1.5. What is the time complexity of fun() ?

```
int fun(int n)
{
int count = 0;
for (int i = 0; i < n; i++)
for (int j = i; j > 0; j--)
count = count + 1;
return count;
}
```

- (A) $O(n)$
- (B) $O(n^2)$
- (C) $O(n \cdot \log n)$
- (D) $O(n \log n \log n)$

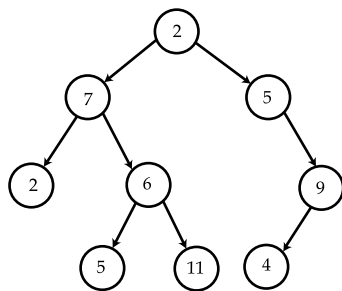
1.6. Which of the following is correct recurrence for worst case of Binary Search ?

- (A) $T(n) = 2T(n/2) + O(1)$
- (B) $T(n) = T(n-1) + O(1)$
- (C) $T(n) = T(n/2) + O(1)$
- (D) $T(n) = T(n-2) + O(1)$

- 1.7 Which one of the following is an application of Stack Data Structure ?
- (A) Managing function calls
 - (B) The stock span problem
 - (C) Arithmetic expression evaluation
 - (D) All of the above

- 1.8 The result evaluating the postfix expression $10\ 5\ +\ 60\ 6\ /\ * 8\ -$ is :
- (A) 284
 - (B) 142
 - (C) 213
 - (D) 71

- 1.9 Postorder traversal of the following binary tree is _____.



- (A) 2 7 5 2 6 9 5 11 4
 - (B) 2 7 5 6 11 2 4 9 5
 - (C) 2 5 11 6 7 4 9 5 2
 - (D) 2 7 2 6 5 11 5 9 4
- 1.10 The worst case running time to search for an element in a binary search tree with n elements is _____.
- (A) $O(n)$
 - (B) $O(n^2)$
 - (C) $O(n \cdot \log n)$
 - (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 Encapsulation allows us to focus on what something does without considering the complexities of how it works.
- 2.2 Function overloading is a dynamic or runtime binding.
- 2.3 A publicly derived class is a subtype of its base class.
- 2.4 Destructors can be private in C++.
- 2.5 There can be more than one destructor in a class.
- 2.6 Every complete binary tree is also a full binary tree.
- 2.7 In a preorder traversal left subtree is always visited before right subtree.
- 2.8 In adjacency list representation, space is saved for sparse graphs.
- 2.9 There are $n * (n - 1) / 2$ maximum number of edges in an acyclic undirected graph with n vertices.
- 2.10 The idea of threaded binary trees is to make inorder traversal faster.

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 | Best Case complexity of Bubble Sort | A. | $O(n)$ |
| 3.2 | Average complexity of Shell Sort | B. | $O(n^2)$ |
| 3.3 | Average complexity of Selection Sort | C. | $O(n \log n)$ |
| 3.4 | Scope | D. | Stack |
| 3.5 | LIFO | E. | Random access |
| 3.6 | Array | F. | :: |
| 3.7 | Linked list | G. | Queue |
| 3.8 | FIFO | H. | C++ |
| 3.9 | Tree | I. | Dynamic data structure |
| 3.10 | Object Oriented Programming | J. | Non linear data structure |
| | | K. | $O(\log n)$ |
| | | L. | C |
| | | M. | Static Data Structure |

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. | Constructor | B. | 2-3 tree | C. | In-Degree | D. | Abstraction |
| E. | Leaf | F. | Binary Search Tree | G. | AVL Tree | H. | Polymorphism |
| I. | Inheritance | J. | Abstract data type | K. | Out-Degree | L. | Threaded binary tree |
| M. | Encapsulation | | | | | | |

- 4.1 _____ allows us to consider complex ideas while ignoring irrelevant detail that would confuse us.
- 4.2 _____ provides for code reuse.
- 4.3 _____ allows the same operation to be carried out differently, depending on the object.
- 4.4 Class function which is called automatically as soon as the object is created is called as _____.
- 4.5 _____ is a self balancing search tree.
- 4.6 _____ is a data type for objects whose behaviour is defined by a set of value and a set of operations.
- 4.7 A tree node that doesn't have any child is known as a _____ node.
- 4.8 In a graph, the _____ of a node refers to the number of arcs incident from the node.
- 4.9 _____ is an ordered binary tree.
- 4.10 _____ is a tree data structure in which every internal node (non-leaf node) has either one data element and two children or two data elements and three children.

PART TWO

(Answer any FOUR questions)

5. (A) Explain the use of friend function in C++ programming.

(B) Write a C++ Program to print the following pattern upto user defined level 'n'.

```
*  
**  
***  
.  
***** ....* ( total n) (7+8)
```

6. (A) Write a C++ code for bubble sort, without using any class and objects declaration.

(B) What is the significance of public, private and protected keywords in a C++ programme ? (7+8)

7. (A) Write a recursive code for inorder traversal of a binary search tree of integers. Supposed the address of root node is stored in variable node* root, where node is the structure declaration for each node or key of binary search tree.

(B) What is the run time complexity of linear search ? Explain. Can we apply binary search on array which is not sorted ? (10+5)

8. (A) What is the concept of operator overloading ? Explain with suitable example.

(B) What is the relationship between graph and tree ? Can we apply DFS and BFS on a tree ? (8+7)

9. (A) Write algorithm to remove an item from a link list of integers.

(B) Write a Programme to implement a single stack using two queues. (10+5)

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SPACE FOR ROUGH WORK

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