C0-R4.B3 : DATA STRUCTURE THROUGH JAVA

DURATION : 03 Hours   **MAXIMUM MARKS : 100**

Roll No. :   **Answer Sheet No. :**

Name of Candidate : _____ ; **Signature of Candidate :** _____

INSTRUCTIONS FOR CANDIDATES :

• Carefully read the instructions given on Question Paper, Answer Sheet.

• Question Paper is in English language. Candidate has to answer in English Language only.

• **Question paper contains Seven questions. The Question No. 1 is compulsory. Attempt any FOUR Questions from Question No. 2 to 7.**

• **Parts of the same question should be answered together and in the same sequence.**

• **Questions are** to be answered in the **ANSWER SHEET** only, supplied with the Question Paper.

• **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 respects.

## DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. (a) In the context of data structures, differentiate between tree and graph.

(b) Briefly discuss the advantages of polymorphism in Java.

(c) What does 'Space Complexity' mean ? Briefly discuss.

(d) Briefly discuss the advantages and disadvantages of priority queue.

(e) The nodes in the complete binary tree are inserted from left to right in one level at a time. If a level is full, the node is inserted in a new level. Construct a complete binary tree by inserting the following elements one by one: 1, 2, 3, 4, 5, 6, 7, 8, and 9. After insertion of all these elements, traverse the constructed complete binary tree using the following traversals: in-order traversal, pre-order traversal, and post-order traversal.

(f) Depth First Search (DFS) is one of the graph traversal schemes. Briefly discuss the advantages and disadvantages of this scheme.

(g) Given a text string with length n and a pattern with length m, implement a brute force algorithm in Java to print all occurrences of pattern in text.

(7x4)

2. (a) The three goals of Object-Oriented Programming are Robustness, Adaptability, and Reusability. Briefly discuss each of the listed goals.

(b) You have been given a pointer to the head node of a singly linked list. It is desired to reverse the linked list by changing the links between nodes. Propose the following approaches to accomplish the desired task :
   i. Reverse the singly linked list by iterative method
   ii. Reverse the singly linked list using recursion
   iii. Reverse the singly linked list by tail recursive method
   iv. Reverse the singly linked list using stack

(9+9)

3. (a) Briefly discuss some common applications of queue data structure. Also, highlight the issues in applications of queue.

(b) Present the iterative algorithm (non-recursive algorithm) to solve the problem of Tower of Hanoi. As an example, consider the number of disks as 3 and discuss the functioning of the iterative algorithm of Tower of Hanoi.

(9+9)

4. (a) AVL Tree is a height balanced binary search tree where balancing during insert operations are performed using rotations. Through examples, discuss different rotations used in the AVL tree to keep itself balanced while inserting elements.

(b) What is Tree data structure? Briefly discuss along with the structure of Tree node. Further, highlighting its advantages, discuss how it is different than hash table.

(9+9)

5. (a) Write a Java program to implement the recursive algorithm of Bubble Sort.
   (b) Briefly discuss the following classification of sorting algorithms :
      (i) Comparison based sorting
      (ii) Non-comparison based sorting
      (iii) Stable sorting
      (iv) Unstable sorting
      Consider the following sorting techniques: bubble sort, selection sort, insertion sort, merge sort, quick sort, heap sort, bucket sort, radix sort, and count sort. Highlighting the best-case, average-case and worst-case time complexities of these sorting techniques, classify them under the classifications mentioned above in (i), (ii), (iii), and (iv). **(9+9)**

6. (a) What is incidence matrix representation of a graph ? Briefly discuss. Further, represent the following directed graph using incidence matrix representation.
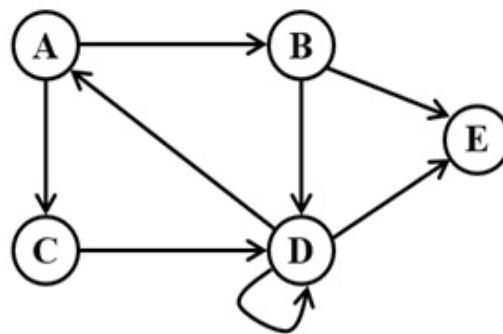
   (b) Discuss some of the applications of Extreme Programming. Also, highlight the advantages of Extreme Programming.
   (c) In the context of Java, explain the following terminologies: subclass, superclass, and final. **(6+6+6)**

7. (a) What do we mean by a logarithmic time algorithm? Briefly discuss.
   (b) There are three cases to analyze an algorithm: Worst-Case Analysis, Best-Case Analysis, and Average-Case Analysis. Briefly discuss each of the listed cases.
   (c) Highlight the major steps of Prim's and Kruskal's approaches to find the Minimum Spanning Tree (MST) in a weighted, connected, and undirected graph. **(6+6+6)**

- o 0 o -

C0-R4.B3/07-25

SPACE FOR ROUGH WORK