C0-R4.B3: DATA STRUCTURE THROUGH JAVA

NOTE:

1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) Explain Abstraction in java with Example.

b) Create binary search tree by inserting the integer keys 13, 3, 4, 12, 14, 10, 5, 1, 8, 2, 7, 9, 11, 6, 18 in that order, starting from an empty tree. Now delete key 4 and show the modified tree.

c) Write a Java code for binary search.

d) Write a Java code to implement insertion sort.

e) Explain three basic access specifiers in Object Oriented Programming with suitable example.

f) Using Stack, convert infix expression ***((A-B)+C*(D+E))-(F+G)*** into prefix expression. Show all the intermediate steps.

g) What are the differences between using recursion to solve a problem versus using iteration? Comment whether one should use recursion or iterations?

(7x4)

2.

a) Describe the algorithm to convert an infix expression to postfix expression.

b) Write Java code to implement Quick Sort.

c) Show the B-tree of order 5 that results after each of the integer keys 1, 12, 8, 2, 25, 6, 14, 28, 17, 7, 52, 16, 48, 68, 3, 26, 29, 53, 55, 45, 67 are inserted in that order, into an initially empty B-tree. Clearly show the tree that result after each insertion.

(6+6+6)

3.

a) What is a heap? How can a heap be used to represent a priority queue? Describe how to perform the operations of item insertion and removal in heap used to represent priority queues?

b) Show the AVL tree that results after each of the integer keys 9, 27, 50, 15, 2, 21, and 36 are inserted, in that order, into an initially empty AVL tree. Clearly show the tree that results after each insertion, and make clear any rotations that must be performed.

c) Show the red-black tree that results after each of the integer keys 21, 32, 64, 75, and 15 are inserted, in that order, into an initially empty red-black tree. Clearly show the tree that results after each insertion (indicating the color of each node), and make clear any rotations that must be performed.

(6+6+6)

4.

a) What is time and space complexity of an algorithm? Write radix sort algorithm and find its time complexity by tracing with an example.

b) Write Java code to implement singly linked list to perform following operations:

i) Insert an element at the beginning

ii) Insert an element at end

iii) Insert an element at any given position

iv) Delete an element from a given position

(10+8)

5.

a) Tower of Hanoi is a well known problem. Write Java code to solve it for 'n' number of disks.

b) The Sierpinski triangle is a fractal and attractive fixed set with the overall shape of an equilateral triangle, subdivided recursively into smaller equilateral triangles as shown below up to fourth level. Write an algorithm to draw it up to n^{th} level.

c) Write a java code for array implementation of a circular queue.

(6+6+6)

6.

a) What is minimum spanning tree/ Write Kruskals algorithm to find minimum spanning tree. Trace the algorithm with an example.

b) Write Brute force pattern matching algorithm. Analyse its time complexity with an example.

(9+9)

7. Write Short notes on the following:

a) Exception handling in java with suitable example.

b) Constructors and destructors in Object Oriented Programming.

c) Compile time and run time polymorphism with suitable example.

d) Importance and principles of modeling

(4+4+6+4)