C0-R4.B3: DATA STRUCTURE THROUGH JAVA

NOTE:

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

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

1.

a) Suppose that a graph has a minimum spanning tree already computed. How quickly can the minimum spanning tree be updated if a new vertex and incident edges are added to Graph?

b) Show how the following polynomial can be represented using a linked list.

$$7x^2y^2 - 4x^2y + 5xy^2 - 2$$

c) What is an AVL tree? Explain how a node can be inserted into an AVL tree.

d) Explain the difference between depth first and breadth first traversing techniques of a graph.

e) Let A[n] be an array of n numbers. Design algorithms to perform the following operations:

Add (i, y): Add the value y to the i^{th} number in the array

Partial-sum(i) : returns the sum of the first i numbers in the array

f) Prove that the number of nodes with degree 2 in any Binary tree is 1 less than the number of leaves.

g) Show a tree (of more than one node) for which the preorder and in-order traversals generate the same sequence. Is this possible for preorder and post order traversals? If it is, show an example.

(7x4)

2.

a) Suppose that a Binary Search Tree is constructed by repeatedly inserting distinct values in to the tree. Prove that the number of nodes examined in searching for a value in the tree is one plus the number of nodes examined when the value was first inserted in to the tree.

b) Suppose a queue is maintained by a circular array QUEUE with N = 12 memory cells. Find the number of elements in QUEUE if

i) Front = 4, Rear =8.

ii) Front = 10, Rear = 3.

iii) Front = 5, Rear = 6 and then two elements are deleted.

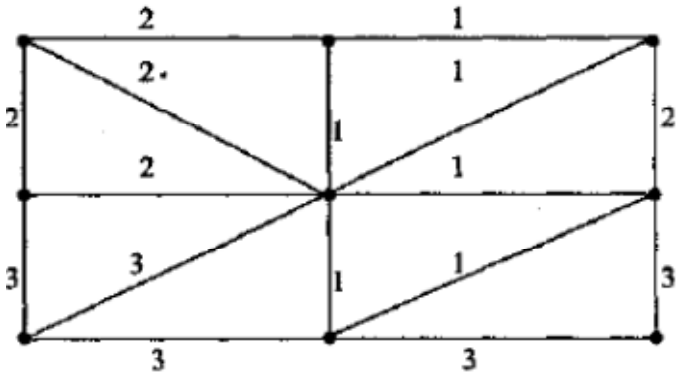
c) Write an O (1) algorithm to delete a node p in a singly linked list. Can we use this algorithm to delete every node? Justify

(6+6+6)

3.

a) Write an algorithm that will split a circularly linked list into two circularly linked Lists.

b) Apply Kruskal's algorithm to find a minimum spanning tree of the following Graph. Display execution of each step of the algorithm.



c) Write an algorithm to insert an element k in double linked list at
   i) Start of linked list
   ii) After a given position P of list
   iii) End of linked list.

(5+7+6)

4.

a) What is Asymptotic Algorithm Analysis? Explain with the help of an example.

b) A binary tree T has 9 nodes. The in-order and preorder traversals of T yield the following sequences of nodes:

   In Order: E A C K F H D B G
   Pre order: F A E K C D H G B

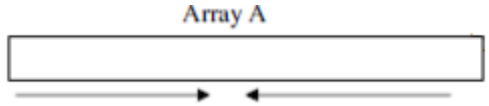
   Draw the tree T.

c) What is quick sort? Sort the following array using quick sort method.
   24 56 47 35 10 90 82 31

(4+6+8)

5.

a) Two stacks S1 and S2 are implemented using an array. What should be the initial values of top for the two stacks S1 and S2? Arrows show the direction of growth of the stack.



Explain how the stacks will grow and indicate the stack overflow condition? Write push and pop programs for such a scenario**.**

b) Work through Binary Search algorithm on an ordered file with the following keys: {1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16}. Determine the number of key Comparisons made while searching for keys 2, 10 and 15.

(9+9)

6.

a) What is an unhandled exception? With an example program explain how it is handled? What is the difference between exception and error in java?

b) What are abstract classes? Give an example with Java program to illustrate the use of abstract classes. Differentiate Abstract classes with interface.

(9+9)

7.

a) What are threaded binary trees? What are the advantages and disadvantages of threaded binary trees over binary search trees?

b) Show all legal B-Trees of minimum degree 3 that represent {1, 2, 3, 4, 5, 6}.

c) Show under what order of input, the insertion sort will have worst-case and best-case situations for sorting the set {142, 543, 123, 65, 453, 879, 572, 434}

(6+6+6)