

# END TERM EXAMINATION

THIRD SEMESTER [B.TECH] JANUARY 2024

Paper Code: CIC209

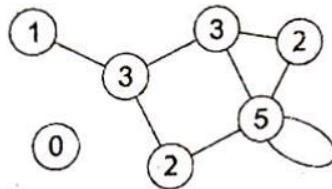
Subject: Data Structures

Time: 3 Hours

Maximum Marks: 75

Note: Attempt five questions including Q.No. 1 which is compulsory. Select One question from each unit. Assume missing data, if any.

- Q1 Attempt the following: (5x3=15)
- What do you understand by underflow and overflow in stack and queue data structures?
  - Why is it required to analyze the time complexity and space complexity of an algorithm?
  - Write short note on Bucket Hashing.
  - Write an algorithm to count the number of nodes of a binary tree.
  - Represent the following graph using Adjacency Matrix and Adjacency List representations:



## UNIT-I

- Q2 a) Convert the following infix expression into postfix expression using Stack: (5)  
 $(A + B) / C * (D - E)^F - G$
- b) Write an algorithm to insert an element in the sorted doubly linked list. (5)
- c) Write short note on double ended queue (deque). Can we implement stack and queue data structures using deque? Comment. (5)
- Q3 a) What are the different classifications of data structures? Explain briefly all types of data structures. (5)
- b) Consider a two-dimensional array or integers A [-11..10, 9..20]. Each element requires 4 bytes of memory storage. If the base address of the Array A is 100. You are required to derive the formula to locate the address of each element then determine the location (i.e. memory address) of A[5][15]. (5)
- c) Explain similarities and dissimilarities between stack and queue data structures. Also list two applications of each. (5)

## UNIT-II

- Q4 a) Step by step construct the binary tree based on the below given traversals of the tree: (5)  
Preorder: A B D C E G F H I  
Inorder: B D A G E C H F I
- b) What is AVL Tree? Explain different types of rotations used in AVL Tree. (5)

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c) Write short note on B-Tree. (5)

Q5 a) Insert the following elements in the Binary Search Tree. Also show the binary search tree after each insertion. (5)

B D A G E C H F I

b) What is sparse matrix? Explain 3-tuple representation of sparse matrix. Give the node structure of linked list based 3-tuple representation of the sparse matrix. (5)

c) Insert the following elements in the max-heap tree. Also show the heap tree after each insertion. (5)

20 40 10 70 50 30 80 60 90

**UNIT-III**

Q6 a) Write an algorithm for merge sort. Sort the following list of numbers using merge sort: (10)

60, 2, 15, 20, 12, 115, 90, 50, 44, 85

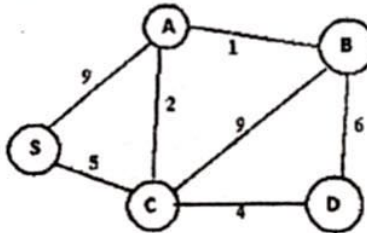
b) Explain various collision resolution techniques used in hashing. (5)

Q7 a) What is hashing? What are the characteristics of a good hashing algorithm? Explain various hashing algorithm with help of examples. (10)

b) Differentiate between list search, sequential search and binary search. Also give an example of each. (5)

**UNIT-IV**

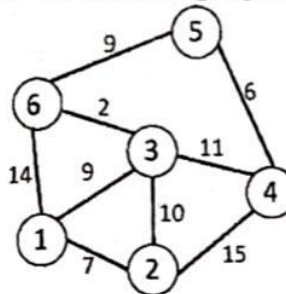
Q8 a) Find out the minimum spanning tree of the following graph using Kruskal's Algorithm. Clearly show every step. Also calculate the total cost of the obtained minimum spanning tree. (5)



b) Write algorithms for DFS and BFS. (5)

c) Explain the following terms with examples: (i) Directed Graph, (ii) Undirected Graph, (iii) Path, (iv) Cycle, and (v) Degree of a vertex. (5)

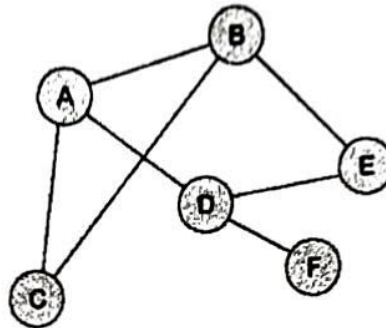
Q9 a) Consider the following graph and find out the shortest path from vertex 1 to all other vertices using Dijkstra's Algorithm. (5)



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- b) Perform DFS and BFS on the following graph considering vertex A as start vertex. Show the resultant spanning trees generated using DFS and BFS. (5)



- c) Write short note on disjoint sets representation. (5)

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