I B. Tech II Semester Regular/Supplementary Examinations, August- 2022
DATA STRUCTURES
(Com. to CSE, IT, CSE-AI&ML, CSE-AI, CSE-DS, CSE-AI&DS, AI&DS)

Time: 3 hours   Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

Unit-I

1	a)	Summarize the classification of Data structures and their real-time applications.	(7M)
	b)	Explain the Linear Search algorithm and derive its Best, Worst and Average time complexities.	(7M)

Or

2	Write the Quick sort algorithm and give its complexity analysis. Also explain the step by step procedure of Quick Sort method for sorting the following unordered list of elements 44,33,23,43,55,12,64,77,75.	(14M)

Unit-II

3	With neat diagrams, explain the following operations in Singly Linked List data structure.
	    i) Insert element at the beginning
	    ii) Insert element at the end
	    iii) Delete the specified element
	    iv) Search the given element
		(14M)

Or

4	a)	How to represent a Polynomial with the Linked List data structure? Explain the algorithm to perform addition on two Linked List representations of Polynomials.	(7M)
	b)	What are the computational advantages and applications of Sparse matrix? Explain its representation in memory with an example.	(7M)

Unit-III

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5	a)	What is DEQUEUE and how it is represented in memory?	(4M)
	b)	Write the algorithm to convert an expression in Infix notation to Postfix notation. And explain the steps to convert the expression A+B*C+D into an equivalent Postfix form.	(10M)

Or

6	a)	Describe the five basic operations which are performed on Stack with example.	(7M)
	b)	Define Priority Queue. What are the real time applications of Priority Queues? Explain the implementation of Priority Queue with an example.	(7M)

Unit-IV

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7	a)	Describe the memory representation of Binary trees using Arrays and Linked lists.	(7M)
	b)	Show step by step process for inserting the elements 1,4, 7, 10, 17, 21, 31, 25, 19, 20, 28, 42 in order to construct a Binary Search Tree.	(7M)

Or

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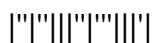
8　a)　Construct a Binary tree for the given Inorder and Postorder traversals by explaining　(7M)
　　　the intermediate steps.
　　　Inorder Traversal　is {4, 8, 2, 5, 1, 6, 3, 7}
　　　Post order Traversal is{8, 4, 5, 2, 6, 7, 3, 1}

　　b)　What is the need of balancing the height of a tree? Why AVL tree is called height　(7M)
　　　balanced tree? Write the properties of AVL trees.

Unit-V

9　a)　Define Graph. Discuss its applications and Adjacency Matrix representation.　(7M)

　　b)　Write the DFS algorithm and derive its complexity. List out the applications of DFS　(7M)
　　　algorithm.

Or

10　a)　Depict the procedure for generating a minimum spanning tree using Prim's　(7M)
　　　algorithm.

　　b)　Explain the steps to find the Transitive closure of a Graph using Warshall's　(7M)
　　　algorithm.
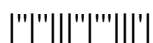
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Unit-I

1 a) Explain the characteristics and applications of Trees and Graphs. (7M)

   b) Write the Binary Search algorithm. What is the necessary condition for Binary search? And give its Complexity analysis. (7M)

Or

2 a) Write the Merge sort algorithm and give its complexity analysis. (10M)

   b) Explain how many passes are required to sort the following list of elements 10, 80, 30, 90, 40, 50, 70 using Merge sort. (4M)

Unit-II

3 What are the advantages and applications of Circular Linked List? Write the Pseudo code to perform all standard operations on Circular Linked List and explain the same with neat diagrams wherever necessary. (14M)

Or

4 a) Explain the implementation of Sparse Matrix data structure using Singly Linked List. (7M)

   b) With neat diagrams, explain the Insert and Delete operations on Doubly Linked List data structure. (7M)

Unit-III

5 a) What is a Queue data structure? What operations can be performed on Queues? Discuss the different ways to implement Queue. (7M)

   b) What are the advantages of Postfix form over the other forms of an expression? Explain the algorithm for evaluating a postfix expression using stack by taking a suitable example. (7M)

Or

6 a) Define Stack data structure and discuss its applications and operations. (7M)

   b) What is the necessity of Priority Queues? Explain its characteristics and memory representation. (7M)

Unit-IV

7 a) Define a Binary Search Tree? Give the properties of Binary Search Tree. Explain the insert, delete and search operations in a Binary Search Tree. (10M)

   b) With a suitable example, Explain the construction of an Expression tree and the procedure to evaluate an expression represented by it. (4M)

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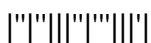
Or

8   Construct an AVL tree by inserting the following sequence of elements   (14M)
10,12,5,4,20,8,7,15,13,77,35,81 starting from an empty tree.

Unit-V

9   a)   Describe various memory representation of Graph data structure with an example.   (7M)

     b)   Which data structure is used in BFS implementation? Explain the step by step   (7M)
procedure to traverse the graph shown in figure 1 using BFS algorithm.
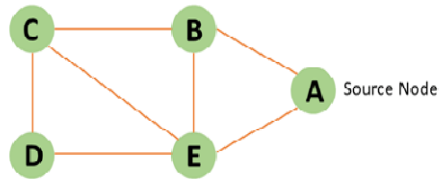
Figure

Or

10 a)   Explain the Kruskal's algorithm for generating a minimum spanning tree.   (7M)

     b)   Write the Dijkstra's shortest path and perform complexity analysis.   (7M)

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Unit-I

1 a) Explain the characteristics and applications of Linear and Non-Linear data structures. (7M)

   b) What does a Time and Space complexity of an algorithm represents? How are they represented and calculated? Explain with an example. (7M)

Or

2 Write the Insertion sort algorithm and explain the step by step procedure of Insertion Sort method for sorting the following unordered list of elements 25,67,56,32,12,96,82,44. Trace the steps to search for the element 82 using Binary search. (14M)

Unit-II

3 Write the algorithm and explain the steps to perform the following operations on Doubly linked list. (14M)
   i) Add an element at the beginning of the list.
   ii) Delete an element at the beginning of the list.
   iii) Add an element after an item of the list.
   iv) Delete an element from the end of the list.
   v) Display the complete list in a backward manner.

Or

4 a) Draw the memory representation of Polynomials using Singly Linked list? Explain the algorithm to perform Polynomial Multiplication. (7M)

   b) Write the Pseudocode to create a Circular Linked list of 'n' nodes and display its contents in reverse order. (7M)

Unit-III

5 a) Discuss the different types of Queues and its applications. (7M)

   b) Why we use postfix/prefix expressions than infix form? Convert the following Infix expression A + B* (C+D) / F + D*E into Postfix form by explaining each and every step. (7M)

Or

6 a) Write an algorithm for Push and Pop operations of stack and list out its applications. (7M)

   b) How to efficiently implement k Queues in a single array? What are the extra arrays that are required to implement it? Derive the time complexity of its operations. (7M)

Unit-IV

7 a) Discuss various Tree traversal techniques with neat diagrams. (7M)

   b) Define Max Heap. Explain the steps involved in building a Max Heap for the following list of elements 5,7,9,1,3,10,8,4 (7M)

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Or

8   What is the balancing condition of an AVL tree height factor? How is rebalancing   (14M)
     done in AVL trees during insertion and deletion of elements? Explain with an
     example.

Unit-V

9   a)   Differentiate tree with binary tree.   (4 M)

     b)   What are the applications of BFS algorithm? Write the BFS algorithm and explain it   (10 M)
     with an example. Also write a short note on its complexity.

Or

10   Explain the principle of Warshall's algorithm. Explain the sequence of steps in   (14M)
     generating Transitive closure for the directed weighted graph given in figure 1.
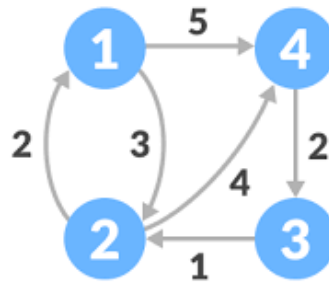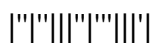

Figure. Directed Graph

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Unit-I

1   a)   What is Data Structure? How Data Structure varies from Data Type? Give examples for each.   (7M)

    b)   Explain the Fibonacci Search algorithm and give its complexity analysis.   (7M)

Or

2   Explain the working of Radix sort algorithm and give its time and space complexities. Demonstrate the process of sorting the unordered list of elements 181, 289, 390, 121, 145, 736, 514, 212 using Radix sort.   (14M)

Unit-II

3   a)   What are the drawbacks of Singly Linked list? Mention the advantages and applications of Doubly Linked List? Give the memory representation of Doubly Linked list.   (4M)

    b)   Write pseudo code and explain all possible types of Insertion and Deletion operations on Doubly Linked list with appropriate diagrams wherever necessary.   (10M)

Or

4   a)   Explain about Input Restricted and Output Restricted DEQUES.   (4M)

    b)   Write an algorithm for evaluating a Postfix expression using Stack data structure and illustrate the same by evaluatinge the following Postfix expression ABC*+D+, where A=2,B=3,C=4, and D=5.   (10M)

Unit-III

5   a)   Define Priority Queue. Discuss its applications, types and operations.   (7M)

    b)   What are the advantages of Linked list over Arrays for implementing Stack data structure? Explain the operations of Linked list implementation of Stack with neat diagrams.   (7M)

Or

6   a)   Explain in detail the list of operations that can be performed on a Circular Queues with appropriate diagrams.   (7M)

    b)   How will you apply stack in converting the infix expression A+ (B*C- (D/E^F)*G)*H into its equivalent postfix notation? Explain each step by tracing the stack contents.   (7M)

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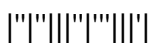
Unit-IV

7 a) Explain various Tree traversal techniques and mention the significant applications of each.　(7M)

   b) Explain the construction of a Binary Search Tree by inserting the elements 13, 3, 4, 12, 14, 10, 5, 1, 8, 2, 7, 9, 11, 6, 18 in that order, starting from an empty tree.　(7M)

Or

8 Why do trees need height balancing? Explain how the AVL tree insertion process makes it balanced through various rotations.　(14M)

Unit-V

9 a) Define Graph. Explain in detail, various representations of Graph data structure.　(7M)

   b) Which data structure is used in DFS implementation? Explain the step by step procedure to traverse the graph shown in figure 1 using DFS algorithm.　(7M)

Or

10 Write the Pseudocode of Dijkstra's shortest path algorithm. Consider the graph given in figure 1. Depict the steps to find the shortest path from node '1' to node '7'.　(14M)
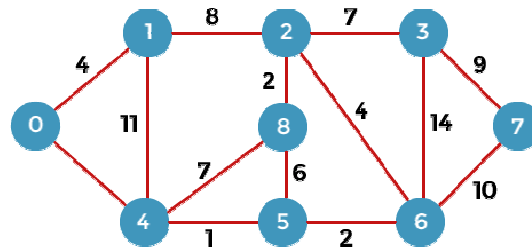

Figure . Graph