

## DATA STRUCTURE

### UNIT I - BASIC CONCEPTS OF ALGORITHM AND DATA STRUCTURE

**Algorithm specification and data abstraction**- Introduction to algorithm, Algorithm specification, Translating a problem into an algorithm, Recursive algorithm, Recursive implementation of binary search, Recursive implementation of Greatest Common Divisor (GCD), Data abstraction, Example of the ADT. **Performance analysis** - Performance analysis, Space complexity, Time complexity. **Asymptotic notation** - Asymptotic notation, Big - Oh notation ( $O$ ), Big - Omega notation, Big - Theta notation. **Abstract data types (ADTs)** - Introduction to data structure, Representation of data structure, Implementation of data structure, Abstract data types (ADT). **Linked list implementation** - Introduction to linked list, Representation of linked list, Implementation using array, Linked list using dynamic variables, Linked implementation of stacks, Advantages and disadvantages. **Singly linked list** - Singly linked list, Operations on singly linked list, Advantages and disadvantages. **Circular linked list** - Circular linked list, Operations in circular linked list, Advantages and disadvantages. **Doubly linked list** - Doubly linked list, Operations in doubly linked list. **Applications of lists** - Applications of linked list, Applications of doubly linked list. **Understand sparse matrix** - Understand sparse matrix. **Representation of sparse matrix** - Representation of sparse matrix, Program for sparse matrix, Transpose of sparse matrix. **List ADT, Array-based implementation** - The list ADT, The array list ADT, Array based implementation, Growable array based array list. **Representation of single, two dimensional arrays** - Representation of single, two dimensional arrays, Representation of one dimensional array, Representation of two dimensional array.

### UNIT II - STACK AND QUEUE

**Stack**- Introduction to stack, Representation of stack using array and linked list, Implementation of stack, Examples and application of stack, Basic operations on stack. **Evaluating arithmetic expressions - other applications** - Balancing symbols, What is an expression?, Conversion of infix to postfix expression, Evaluating postfix expression. **Queue ADT** - Introduction to queue, Queue abstract data types, Example of operation on queue, Array and linked implementation, Routine of array implementation. **Circular queue** - Circular queue, Implementation of circular queue using arrays, Creating and initializing circular queue, Empty circular queue, Full circular queue, Program for circular queue. **Double ended queue** - Double ended queue, Algorithms. **Applications of queue** - Applications of queue.

### UNIT III - TREE AND GRAPH

**General tree** - Introduction, Definition of tree, Tree terminology. **Binary tree** - Introduction to binary tree, Definition of binary tree, Representation of binary tree, Operations on binary tree, Applications of binary tree. **Traversal methods** - Traversing a binary tree, Binary tree traversal, Algorithm - Preorder traversal, Algorithm - Inorder traversal, Algorithm - Postorder traversal, Algorithm - Breadth first tree

traversal. **Expression trees** - Expression trees, Creation of an expression tree. **Array and linked representations** - Array representation, Linked representation, A class for binary tree nodes, Some binary tree operations. **Threaded binary trees, Max Priority Queue ADT** - Threaded binary tree, Types of threaded binary trees, Threaded tree traversal, Threaded tree modification, Max priority queue ADT, Complexity of Insert, Time complexity. **Binary heaps** - Introduction, Priority queues: application, Adding a node to a heap, Removing the top node, Adding a node: same priority, Types of heap, Initializing the max heap, Building a heap, Heap application: heap sort. **Introduction to graphs** - Introduction to graphs. **Directed and undirected graphs** - Directed and undirected graphs. **Representation of Graphs**- Representation of graphs, Adjacency matrix, Adjacency list. **Graph traversals** - Graph traversals, Depth First Search(DFS), Breadth First Search(BFS). **Spanning tree** - Spanning tree, Prim's algorithm, Kruskal's algorithm. **Applications of graphs** - Applications of graphs.

#### **UNIT IV - SEARCHING AND SORTING**

**Searching: Linear search - Binary search** - Introduction to searching, Linear search, Example - linear search, Algorithm for linear search(unsorted array), General requirements for linear search, Introduction to binary search, Binary search algorithm, Binary search - example, Performance of binary search, General requirements for binary search. **Hashing: hash functions**- Introduction to hashing, Hash function, Hash function - examples, Hash function methods. **Separate chaining** - Collision resolution, Separate chaining. **Open addressing** - Open addressing, Linear probing, Quadratic probing, Double hashing. **Rehashing** - Rehashing. **Introduction to sorting** - Introduction to sorting, O notation, Efficiency of sorting. **Insertion sort** - Insertion sort, Program for insertion sort, Complexity analysis of insertion sort. **Selection sort** - Selection sort, Program for selection sort. **Shell sort** - Shell sort, Program for shell sort. **Bubble sort** - Bubble sort, Complexity of bubble sort, Program for bubble sort, Example of bubble sort. **Quick sort** - Quick sort, Techniques in quick sort, Program for quick sort. **Merge sort** - Merge sort, Program for merge sort, Example of merge sort. **Radix sort** - Radix sort, Program for radix sort. **Heap sort** - Heap sort, Program for heap sort, Example for heap sort. **Comparison of sorting methods** - Comparison of sorting methods.

#### **UNIT V - SEARCH TREE AND ALGORITHM**

**Binary search tree** - Definition, Representation of binary search tree, Operations on binary search tree. **AVL search tree** -Introduction, Representation of AVL tree, Insertion, Deletion, Pros and cons of AVL tree. **B-Tree** - Introduction, Definition, Operations on B-Tree, Insertion, Deletion, Applications, advantages and disadvantages. **Red-Black tree** - Introduction to red-black tree, Rotations in red-black tree, Inserting in red-black tree, Algorithm for insertion, Deleting in red-black tree, Algorithm for deletion. **Splay tree** - Introduction to splay tree, Bottom up splay tree, Top-down splay tree, Splay tree operations, Advantages and disadvantages of splay tree, Applications of splay tree. **Comparison of search trees** - AVL tree vs. Red - black tree, Splay tree vs. AVL/RB tree, Treap vs. AVL/RB tree. **Pattern matching algorithm** - Introduction to string algorithms, String - matching, Brute force string matching algorithm, Pattern matching algorithm. **Knuth - morris - pratt algorithm (KMP algorithm)** - Knuth -

morris - pratt algorithm (KMP algorithm), A brief sketch of the boyer - moore algorithm, A brief sketch of bird's algorithm for two - dimensional matching, Tries, Standard tries, Insertion, Deletion, Compressed tries, Suffix tries, Applications of tries.