



CS 201

DATA STRUCTURES USING C++

Course Objectives:

- To introduce the concepts of Abstract data Type, data structure, performance measurement, time and space complexities of algorithms.
- To discuss the implementation linear data structures such as stacks, queues and lists and their applications.
- To discuss the implementation of different non linear data structures such as trees and graphs.
- To introduce various search data structures such as hashing, binary search trees, red black trees, splay trees and b-trees.
- To introduce various internal sorting techniques and analyze their time complexities.

UNIT-I

Algorithm Specification, Performance Analysis and Measurement. **Arrays:** Abstract Data Types and the C++ Class, The Array as an Abstract Data Type, The Polynomial Abstract Data Type, Sparse Matrices, Representation of Arrays, The String Abstract Data Type.

UNIT-II

Stacks and Queues: Templates in C++, The Stack Abstract Data Type, The Queue Abstract Data type, Subtyping and Inheritance in C++, A Mazing Problem, Evaluation of Expressions, Additional Exercises.

UNIT-III

Linked Lists: Singly Linked Lists and Chains, Representing Chains in C++, The Template Class Chain, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials, Equivalence Classes, Sparse Matrices, Doubly Linked Lists, Generalized Lists.

UNIT-IV

Hashing: Static Hashing.

Trees: Introduction, Binary Trees, Binary Tree Traversal and Tree Integrators, Copying Binary Trees, Threaded Binary Trees, Heaps, Binary Search Trees.

Efficient Binary Search Trees: AVL Trees, Red-Black Trees, Splay Trees, m-way Search Trees, B-Trees.

UNIT-V

Sorting: Insertion sort, Quick sort, How Fast Can We Sort, Merge sort, Heap sort, Sorting on Several Keys, List and Table Sorts, Summary of Internal Sorting.

Graphs: The Graph Abstract Data Type, Elementary Graph operations (dfs and bfs), Minimum Cost Spanning Trees (Prim's and Kruskal's Algorithms).

Suggested Reading:

1. Ellis Horowitz, Dinesh Mehta, S. Sahani. *Fundamentals of Data Structures in C++*, Universities Press. 2007.

2. T.H. Cormen, C.E. Leiserson, and R.L. Rivest. *Introduction to Algorithms*, Prentice Hall of India 1996.

3. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, Pearson Education 2006.