

Data Structures in Java

Course Duration: 40 Hours

Course Code : DSJ-201

1. Course Overview

The **Data Structures in Java** course is designed to help learners understand the concepts of data organization, management, and storage using Java programming. This course covers both basic and advanced data structures, equipping participants with the skills to write efficient and optimized code for real-world applications. Through practical examples and hands-on exercises, learners will gain expertise in implementing data structures and solving algorithmic problems using Java.

2. What You'll Learn?

- Understand the fundamentals of data structures and their importance.
- Implement data structures such as arrays, linked lists, stacks, queues, and hash tables.
- Explore tree and graph data structures in Java.
- Learn algorithmic techniques like searching, sorting, and recursion.
- Apply Java collections framework for real-world development.
- Solve coding problems and optimize program efficiency.

3. Target Audience

- Students learning Java programming and preparing for coding interviews.
- Beginners and intermediate programmers looking to strengthen problem-solving skills.
- Professionals aiming to improve algorithmic knowledge and coding efficiency.
- Anyone preparing for competitive exams, technical interviews, or IT placements.

4. Pre-Requisites

- Basic knowledge of **Java programming** (variables, loops, OOP concepts).
- Familiarity with **basic algorithms and problem-solving**.
- No prior knowledge of data structures required (will be taught from basics).

5. Course Content

Module 1: Introduction to Data Structures

- Importance of Data Structures
- Types of Data Structures (Linear & Non-Linear)
- Big-O Notation and Algorithm Complexity

Module 2: Arrays and Strings

- Array operations and applications
- Multi-dimensional arrays
- String manipulation in Java

Module 3: Linked Lists

- Singly Linked List implementation
- Doubly Linked List
- Circular Linked List
- Use cases and performance

Module 4: Stacks and Queues

- Stack operations and applications
- Queue and Priority Queue
- Deque (Double-ended Queue)
- Implementation using Java Collections

Module 5: Searching and Sorting Algorithms

- Linear Search and Binary Search
- Bubble Sort, Selection Sort, Insertion Sort
- Merge Sort and Quick Sort
- Time complexity analysis

Module 6: Trees

- Binary Tree and Binary Search Tree (BST)
- Tree Traversals (Inorder, Preorder, Postorder)
- AVL Trees and Heaps
- Applications of Trees

Module 7: Graphs

- Graph Representation (Adjacency List, Matrix)
- BFS (Breadth First Search) and DFS (Depth First Search)
- Shortest Path Algorithms (Dijkstra, Floyd-Warshall)
- Minimum Spanning Tree (Prim's & Kruskal's Algorithm)

Module 8: Hashing and Hash Tables

- Hash Functions
- Collision handling techniques
- HashMap, HashSet in Java
- Applications in real-world systems

Module 9: Advanced Topics & Problem Solving

- Recursion with Data Structures
- Dynamic Programming basics
- Solving real-world problems using Java data structures
- Coding exercises and interview-based problem-solving

