

Data Structures and Algorithms (DSA) Roadmap

1. Introduction to DSA

- What is DSA and why it's important
- Time and Space Complexity
- Big O Notation

2. Basic Data Structures

- Arrays and Strings
- Linked Lists (Singly and Doubly)
- Stacks and Queues

3. Recursion

- Understanding recursion
- Tail recursion vs Head recursion
- Recursive vs Iterative approaches

4. Searching and Sorting

- Linear and Binary Search
- Bubble, Selection, Insertion Sort
- Merge Sort, Quick Sort, Heap Sort

5. Hashing

- Hash Tables and Hash Maps
- Collision Handling Techniques
- Applications of Hashing

6. Trees

- Binary Trees and Binary Search Trees
- Tree Traversals (Inorder, Preorder, Postorder)

- Balanced Trees (AVL, Red-Black)

7. Graphs

- Graph Representations (Adjacency List/Matrix)
- DFS, BFS Traversals
- Shortest Path Algorithms (Dijkstra, Floyd-Warshall)

8. Dynamic Programming

- Memoization and Tabulation
- Fibonacci, Knapsack, LIS, LCS
- Optimal Substructure and Overlapping Subproblems

9. Greedy Algorithms

- Greedy strategy overview
- Activity Selection, Fractional Knapsack
- Huffman Encoding

10. Backtracking

- N-Queens, Sudoku Solver
- Subset and Permutation generation
- Concept of decision trees

11. Advanced Topics

- Segment Trees and Fenwick Trees
- Tries, Heaps, and Priority Queues
- Disjoint Set Union (DSU), Topological Sort

12. Practice and Optimization

- Participate in coding contests (Codeforces, LeetCode, etc.)
- Analyze and optimize code
- Debugging and edge case handling