Array Manipulation & Searching Algorithms

- Binary Search
- Two Pointer Technique
- Sliding Window Technique
- Kadane's Algorithm (Max Subarray Sum)
- Dutch National Flag Algorithm (3-Way Partitioning)
- String Hashing & Rolling Hash (Rabin-Karp Variant)
- Matrix Rotation

Sorting Algorithms (Optimized)

- Merge Sort
- Quick Sort (Randomized Pivot Selection)
- Heap Sort (Priority Queue Implementation)
- Counting Sort / Radix Sort / Bucket Sort
- Topological Sort (DAG Sorting)

Graph Algorithms

- Breadth-First Search (BFS)
- Depth-First Search (DFS)
- Dijkstra's Algorithm (Single-Source Shortest Path)
- Bellman-Ford Algorithm (Graphs with Negative Weights)
- Floyd-Warshall Algorithm (All-Pairs Shortest Paths)
- Union-Find / Disjoint Set Union (DSU)
- Kruskal's Algorithm (Minimum Spanning Tree)
- Prim's Algorithm (Minimum Spanning Tree)
- Topological Sorting (DAGs)
- Tarjan's Algorithm (Strongly Connected Components)
- A* Algorithm (Heuristic Pathfinding)
- Edmonds-Karp Algorithm (Max Flow - Network Flow)
- Heavy-Light Decomposition
- Articulation Points & Bridges
- Eulerian Path & Circuit
- Johnson's Algorithm
- Hopcroft–Karp Algorithm (Maximum Bipartite Matching)

Dynamic Programming (DP)

- 0/1 Knapsack Problem
- Longest Increasing Subsequence (LIS)
- Edit Distance (Levenshtein Distance)
- Matrix Chain Multiplication
- Subset Sum Problem
- Longest Common Subsequence (LCS)
- Partition Equal Subset Sum
- Rod Cutting Problem
- Fibonacci Series (Memoization/Tabulation)
- Shortest Paths in Graphs (Bellman-Ford, Floyd-Warshall)
- Palindrome Partitioning
- DP on Trees (Maximum Path Sum, Diameter of Tree)
- Min-Cost Path Algorithms (Grids)
- Knuth-Yao Optimization
- Divide and Conquer DP
- Slope Trick Optimization
- Tree Decomposition & DP on Trees
- SOS DP (Sum Over Subsets)

Greedy Algorithms

- Activity Selection Problem
- Huffman Coding (Optimal Data Compression)
- Fractional Knapsack Problem
- Job Sequencing Problem
- Interval Scheduling
- Dijkstra’s Algorithm (Greedy Approach)
- Minimum Spanning Tree (Kruskal’s & Prim’s Algorithms)

Pattern Matching & String Algorithms

- KMP Algorithm (Knuth-Morris-Pratt)
- Rabin-Karp Algorithm (String Matching using Hashing)
- Naive Pattern Matching
- Boyer-Moore Algorithm
- Manacher’s Algorithm (Longest Palindromic Substring)
- Trie Data Structure (Prefix Trees)

- Aho-Corasick Algorithm (Multi-pattern Matching)
- Z Algorithm (Pattern Matching)
- Suffix Arrays & LCP Arrays
- Suffix Trees & Generalized Suffix Trees
- Minimal Perfect Hashing

Important Data Structures

- Hash Tables (Dictionaries, Maps)
- Binary Search Trees (BST)
- AVL Trees / Red-Black Trees (Self-Balancing BST)
- Segment Trees / Fenwick Trees (Range Queries)
- Heaps (Max-Heap, Min-Heap, Priority Queue)
- Tries (Prefix Trees)
- Disjoint Set Union (Union-Find)
- Doubly Linked List (LRU Cache Implementation)
- Skip Lists (Optimized Searching Structures)
- Sparse Tables (Range Queries - Static Arrays)
- Link-Cut Trees
- Wavelet Trees
- Fibonacci Heaps
- Persistent Segment Trees

Linked List Algorithms

- Reverse a Linked List (Iterative & Recursive)
- Detect Cycle in a Linked List (Floyd’s Cycle-Finding Algorithm)
- Merge Two Sorted Lists
- Remove Nth Node from End of List
- Find Intersection Point of Two Linked Lists
- Flattening a Multilevel Doubly Linked List
- LRU Cache Implementation (Using Doubly Linked List + HashMap)
- Palindrome Linked List Check
- Clone a Linked List with Random Pointers
- Add Two Numbers Represented by Linked Lists

Tree Algorithms

- Tree Traversals (Inorder, Preorder, Postorder, Level Order)
- Binary Search Tree Operations (Insertion, Deletion, Search)

- Lowest Common Ancestor (LCA)
- Tree Diameter Calculation
- Tree Serialization & Deserialization
- Binary Tree to Doubly Linked List Conversion
- Morris Traversal (Inorder Traversal Without Recursion/Stack)
- Trie Operations (Insert, Search, Delete)
- Segment Trees / Fenwick Trees
- AVL Tree Operations (Insertion, Deletion, Rotation)

Optimization Techniques

- Backtracking (Sudoku Solver, N-Queens Problem)
- Bit Manipulation (XOR, AND, OR Operations, Masking)
- Memoization & Tabulation (Dynamic Programming Techniques)
- Branch and Bound (NP-Hard Problems - Knapsack, TSP)
- Divide and Conquer (FFT, Merge Sort, Closest Pair Problem)
- Meet in the Middle (Subset Sum Problems)
- Dynamic Connectivity (Handling dynamic graphs)
- Randomization Techniques (Monte Carlo & Las Vegas Algorithms)

Mathematical Algorithms

- Euclidean Algorithm (GCD Calculation)
- Sieve of Eratosthenes (Prime Number Generation)
- Modular Exponentiation (Fast Exponentiation)
- Chinese Remainder Theorem (Solving Systems of Congruences)
- Fast Fourier Transform (FFT)
- Mobius Function
- Totient Function Generalization
- Extended Euclidean Algorithm
- Miller-Rabin Primality Test
- Burnside’s Lemma
- Lucas Theorem

Miscellaneous Algorithms

- Kadane’s Algorithm (Max Subarray Sum)
- Union-Find / Disjoint Set Union (DSU)
- Huffman Coding (Compression Algorithm)
- Sliding Window Technique (Subarray Problems)

- Monotonic Stack / Queue (Histogram, Maximum Rectangle Problems)
- Dancing Links (DLX - Exact Cover Problems)
- Mo’s Algorithm (Efficient Range Queries)