

BASIC OF COMPETATIVE PROGRAMMING

INTRODUCTION TO COMPETITIVE PROGRAMMING

Why Competitive Programming?, How To Approach A Problem In Contest, Various Types Of Errors

BASICS OF RECURSION

Introduction to Recursion, Recursion and PMI, Fibonacci Number, Recursion and Arrays

TIME AND SPACE COMPLEXITY ANALYSIS

Order Complexity Analysis, Theoretical Analysis, Linear Search time complexity, Insertion Sort time complexity, Selection Sort time complexity, Theoretical Analysis - Recursive Algorithms, Merge Sort Time complexity, Fibonacci Time Complexity Analysis, Space Complexity Analysis, Merge Sort Space Complexity Analysis, Fibonacci Space Complexity Analysis, Kadane's Algorithm

LANGUAGE TOOLS

STL - Data Structures, STL - Functions, Hussain Set, Voters List, Permutation & Palindrome

SEARCHING & SORTING APPLICATIONS

Aggressive Cows, Inversion Count

BASIC PROBLEM SOLVING USING CP

TWO POINTERS AND SLIDING WINDOW

Working of two-pointers and sliding window technique, Intuition behind Two Sum Problem Max sum of k consecutive elements and Longest Substring with At Most Two Distinct Characters

GREEDY ALGORITHMS

Introduction to Greedy Algorithms, Greedy Vs DP, Logic building for the problems like Fraction Knapsack and Activity Selection etc.

SORTING

Introduction to Sorting Algorithms, working of Sorting algorithms like Merge Sort, Quick Sort Counting Sort etc and A problem based on Quickselect Algorithm

BINARY SEARCH

Binary Search and its implementation details, problems based on search on answer and problems based on search on input.

APPLICATION OF RECURSION

ADVANCED RECURSION

Generating all subsets and all Permutations using recursion and Logic building of Combination sum Problem

BACKTRACKING

Introduction to Backtracking Algorithms, Recursion vs Backtracking and Logic behind popular problems like Rat in a Maze, N-Queens

BIT MANIPULATION AND NUMBER THEORY

BIT MANIPULATION

All basic bitwise operators like (OR, AND, NOT, XOR, Left Shift and Right Shift) and properties of each of these operators Common operations done using these operators(like Set ith bit, Count Set Bits)

NUMBER THEORY-I

Checking whether a number is prime or not in \sqrt{n} time Sieve algorithm, Segmented Sieve problem's solution, Euclid's algorithm, What are LDEs and how to solve them using Extended and Euclid's algo

NUMBER THEORY-II

Modular Arithmetic Properties, How to find Modular Inverse, How to find number of solutions of LDEs and Euler's Totient Function

NUMBER THEORY-III

Exponentiation and Modular Exponentiation Matrix Exponentiation, How to find Nth term of a recurrence relation using Matrix Exponentiation and How to find Nth term of Fibonacci Series

NUMBER THEORY-IV

Non-Deterministic Primality Tests, Fermat's Theorem, Miller Rabin Test and its Deterministic Version, Wilson's Theorem and Chinese Remainder Theorem

DYNAMIC PROGRAMMING AND DISJOINT SETS

DYNAMIC PROGRAMMING 1

Basics of Dynamic Programming(Introduction, Need) and Memoization vs Tabulation Method Optimization of recurrence relation (overlapping subproblem) into DP- Solution 2-dimensional DP Solution

DYNAMIC PROGRAMMING II

The intuition behind problems like LCS, LIS(How to build logic), Further Optimization of Dynamic Programming Solution using Segment tree or binary search Multidimensional(3D,4D) Dp Solution Conversion of DP-State into DP-Transition and vice-versa

DYNAMIC PROGRAMMING III

Algorithms based on Tree DP including Binary Lifting, Re-rooting(In-Out) DP, Algorithms based on Graph DP and Algorithms based on Digit DP

DISJOINT SET

Introduction to Disjoint Set Data-Structure, need and Applications of DSU, find and Union Operation and union by Rank and Path Compression Technique

TREES

TREE-I

Introduction to Trees(different terminologies related to tree, need of non-linear data structure, applications), various Tree Traversal Techniques, N-ary vs Binary Tree and Concepts based on n-ary tree

TREE-II

Introduction to Euler's Tour, Technique(Construction and Properties), Introduction to Mo's algorithm, Problems based on Tree Queries like Subtree Queries and Path Queries

GRAPHS

GRAPH-I

Introduction and Basic terminologies of Graph, DFS and BFS, Finding Path Between Two Nodes, Detecting Cycle in Graph and Topological Sorting

GRAPH-II

Minimum Spanning Trees, Kruskal Algorithm Prims Algorithm, Explaining Dijkstra Algorithm, Bellman-Ford Algorithm and Floyd Warshall Algorithm

GRAPH-III

Bipartite Graph Test, Introduction & Applications of SCC, Tarjan's Algorithm for SCC and articulation points and Bridges-what are they how to find them

COMBINATORICS

COMBINATORICS-I

Introduction to Combinatorics, revising Permutation and Combination, Combinatorics- nCr , nPr and Binomial coefficient etc

COMBINATORICS-II

Catalan Number, Inclusion-exclusion, PigeonHole Principle and Application of Combinatorics Technique

GEOMETRY

GEOMETRY-I

Introduction to Computational Geometry, Distance of a Point from a Line, Collinear Points, Intersection of Two line segment and Circle line intersection

GEOMETRY-II

Area of Polygon, Convex Hull- Algorithm & Applications

GAME THEORY

Game theory-game states, Nim game and Sprague-Grundy theorem

STRINGS

STRINGS-I

Strings Data Structure and their huge, Importance in CP Pattern Matching basics, Rabin-Karp Algorithm, Longest Prefix Suffix explanation and KMP & Z-Algorithm

STRINGS-II

Manchester Algorithm and Introduction to Suffix Array, LCP Array

TRIES

Introduction to Trie Data Structure, Search, Insert & Deletion using Trie and Applications of Trie Data Structure

RANGE QUERY

RANGE QUERY-I

Introduction to Range Query Data Structure Segment Tree i) Explaining use case ii) Showing implementation range query, point update, range update(Lazy Propagation)

RANGE QUERY-II

Fenwick Tree i) Explaining use case ii) Showing implementation range query, point update, range update Sqrt Decomposition i) Explanation, Implementation Mo's Algorithm i) Online Query ii) Offline Query

BIT MASKING

Introduction to Bit Masking Its Usage(related to Dp) and Representing subsets, DP+Bitmasking Problems