DSA

Searching :

1. Linear Search
2. Binary Search

Sorting :

1. Merge Sort (Recursive and Iterative)
2. Quick Sort (Recursive and Iterative)
3. Insertion Sort (Recursive and Iterative)
4. Selection Sort (Recursive and Iterative)
5. Bubble Sort
6. Counting Sort
7. Heap Sort (Covered later also)

Graphs :

1. Graphs ADT
2. BFS
3. DFS
4. Detect cycle in Graphs
5. Determining if graph is bipartite
6. Topological Sorting
7. Minimum Spanning Tree (2 Algorithms)
8. Maximum Flow Problem / Minimum cut problem
9. Backtracking
10. Dijkstra Algorithm
11. Bellman Ford Algorithm
12. Hard Problems :
    1. Graph Colouring
    2. Travelling Salesman Problem
    3. Hamiltonian Cycle

Arrays and Matrix :

1. Simple Array Rotations
2. Largest Sum Contiguous array
3. Rotate Matrix (Simple and InPlace)
4. Transpose Matrix
5. Clockwise rotation of a Matrix
6. Generating all Subsequence of an array
7. Generating all Subarrays if an array
8. Rearrange positive and negative numbers.
9. Reversing an array
10. Wave form sorting of an array

Linked Lists :

1. Singly linked
2. Doubly linked list
3. Cyclic linked list
4. Finding Cycle in linked list
5. Sorting Linked List
6. Searching for an element in linked list (optimized)

Binary Search Tree : (Also study Simple Binary Trees wherever possible)

1. Binary Tree ADT
2. Traversals (In-order, Pre-Order and Post order)
3. Construction of tree from 2 traversals
4. Maximum height of tree.
5. Maximum width of tree.
6. Determine if two trees are identical.
7. Root to leaf path sum equal to a given number.
8. Checking whether tree is height balanced.

Heap

1. Heap ADT : Min Heap and Max Heap
2. Heap Sort
3. Convert min Heap to max Heap
4. K-ary Heap

Hashing

1. Separate chaining
2. Open addressing

Strings :

1. Maximum occurring character.
2. Smallest window in a String containing characters of other String
3. Second most frequent character.
4. K'th Non repeating character
5. Number of Substrings with exactly K-distinct characters
6. Check if two strings are anagrams of each other or not
7. Check if two strings are K – Anagrams or not
8. Count words in given string.
9. Maximum consecutive repeating character in a String
10. Count of total anagram substrings
11. Anagram Substring search
12. Given a sequence of words , print all anagrams together
13. Given an array if Strings , print all pairs of anagrams

14. Remove minimum number of characters so that two strings become anagrams
15. Check if a String is a palindrome[C++][Python]
16. Check if rotation of a String is a Palindrome
17. Print all palindromes in a given range
18. Check if some arrangement of a string can give palindrome
19. Print all palindromic partitions of a string
20. Check if all bits can be made same by flipping single bit
21. Number of flips to make binary string alternate
22. Calculate 2's complement of a binary string in efficient manner
23. Add two bit strings
24. Pattern Searching : Naive
25. Pattern Searching : KMP
26. Check if two strings ate rotations of each other or not
27. Print all permutations of a given string
28. Divide the string in N equal parts
29. Check if strings are rotations of each other
30. Print all the duplicates in the input string
31. Print all permutations of a string
32. First non-repeating character in a string
33. Check if a given sequence of moves for a robot is circular or not
34. Find the longest substring from k unique characters in a given string
35. Find maximum depth of nested parenthesis in a string.
36. Find if given string can be formed by a substring by iterating substring n times
37. Print all possible strings that can be made by placing spaces
38. Remove recurring digits in a given number
39. Check if edit distance between two strings is one
40. Recursive implementation of atoi()
41. Check if two given strings are isomorphic to each other
42. Print string of odd length in 'X' format
43. Transform one string to another by using minimum number of given operation
44. Print all ways to break a string in bracket form
45. Caeser cipher in Cryptography
46. All combinations of string that can be used to dial number
47. Print concatenation of zig zag string in N rows
48. Given a string find its first non repeating character.
49. Reverse words in a given string
50. Run length encoding
51. Print all permutations with repetition of characters
52. Recursively remove all adjacent duplicates

Backtracking :

1. The Knight's tour problem
2. Rat in a maze
3. N Queen Problem

4. Subset Sum
5. N – Coloring problem
6. Hamiltonian Cycle
7. Sudoku
8. Solving CryptArithmetic Puzzles
9. Remove Invalid Parenthesis
10. Print all possible paths from top left to bottom right of an M×N matrix.

Bitwise Operations

1. Find the element that appears once
2. Add one to a given number
3. Find whether a given number is a power of 4 or not
4. Rotate bits of a number
5. Efficient way to multiply with 7
6. Check whether a number is power of two
7. Binary representation of a given number
8. Find position of the only two bit
9. Add two bit strings
10. Equal Sum and XOR
11. Swap three variables without using temp variable
12. Check if binary representation of a given number and its complement are anagram
13. A Boolean array puzzle
14. Compute the integer absolute value without branching
15. Program to find Parity
16. Generate the N-bits grey code
17. Find Nth magic number
18. Copy set bits in a range
19. Count total set bits in all numbers from 1 to N
20. Compute the parity of a number using XOR and Table look up
21. Find maximum Sub-Array XOR in a given array
22. Bit Masking and Dynamic Programming Set 2
23. Find longest sequence of 1's in binary representation with one flip
24. Pairs of complete strings in two sets of strings
25. Subset sum queries using bitset

Divide and Conquer

1. Write a program to calculate pow(x,n)
2. Closest Pair of Points using Divide and Conquer
3. Strassen's Matrix Multiplication
4. Count Inversions in an array
5. Multiply two polynomials
6. Tiling problem using Divide and Conquer
7. Convex Hull using Divide and Conquer
8. QuickHull algorithm for Convex Hull

9. Median of two sorted arrays of same size
10. Median of two sorted arrays of different size
11. Count number of occurances in a sorted array
12. Find a fixed point (value equal to index) in a given array
13. Find a peak element
14. Find the minimum element in a sorted and rotated array
15. Find the missing number in Arithmetic Progression
16. K-th element of two sorted arrays
17. Largest Rectangular area in a histogram
18. Maximum Subarray Sum using Divide and Conquer algorithm
19. Search in a Row-wise and Column-wise Sorted 2D Array using Divide and Conquer algorithm
20. The SkyLine Problem using Divide and Conquer algorithm
21. Square Root of an Integer
22. Longest Common Prefix using Divide and Conquer algorithm
23. Allocate minimum number of pages
24. Place k elements such that minimum distance is maximized
25. Collect all coins in minimum number of steps

Dynamic Programming

1. Program for Fibonacci numbers
2. Binomial Coefficient
3. Min Cost Path
4. Coin Change
5. Edit Distance
6. Subset Sum Problem
7. Maximum Sum Increasing Subsequence
8. Longest Common Substring
9. Program for Nth Catalan number
10. Permutation Co-efficient
11. Choice of Area
12. Path with maximum average value
13. Maximum Path sum in a triangle
14. Gold Mine Problem
15. Perfect Sum Problem
16. Longest Palindromic Subsequence
17. Egg dropping puzzle
18. Weighted Job Scheduling
19. Floyd Warshall Algorithm
20. Longest Increasing Subsequence
21. Bellman-Ford Algorithm
22. Optimal Binary Search Tree
23. Largest Independent Set Problem
24. Minimum Insertions to form a palindrome
25. Matrix Chain Multiplication

Geometric Algorithms

1. Check if two lines intersect
2. Given N line segments check if any two intersect
3. Klee's Algorithm (Length of Union of given line segments)
4. Clip maximum points on the same line
5. Minimum lines to cover all points
6. Point of intersection of two lines
7. Represent the given set of points by best possible straight line
8. Find the line passing through two points
9. Check whether a given point lies inside the triangle or not
10. Maximum height when coins are arranged in a triangle
11. Check if a right triangle is possible with given area and hypotenuse
12. Find if two rectangles overlap
13. Check if four line segments form a rectangle
14. Check if given four points form a square
15. Pizza Cut Problem
16. Angular Sweep
17. Check if given point lies inside or outside a given polygon
18. Minimum cost polygon triangulation
19. Tangents between two convex polygons
20. Convex hull Graham's Scan
21. Dynamic convex hull
22. Deleting points from convex hull
23. Find simple closed path for given set of points
24. Nth pentagonal number
25. Minimum distance to travel to cover all intervals

Mathematical Algorithms

1. LCM of given array elements
2. GCD of given array elements
3. Euclidean Algorithms (Basic and Extended)
4. GCD of two numbers when one of them is very large
5. Replace every matrix element with maximum of GCD of row or column
6. Efficient program to find all prime factors of a given number
7. Find all divisors of a natural number
8. Prime Factorization using Sieve for multiple Queries
9. K-th Prime factor of a given number
10. Check if a given number is Fibonacci number
11. Matrix Exponentiation
12. Non crossing lines to connect paths in a circle
13. Succinct encoding for a tree
14. Modular Exponentiation
15. Modular multiplicative inverse
16. Modular division
17. Multiplicative order

18. Find Square root under modulo p (Shanks Tonelli Algorithm)
19. Euler's Criterion (Check if square root under modulo p exists)
20. Multiply large integers under large modulo
21. Find sum of modulo K of first N natural numbers
22. How to compute mod of a big number
23. RSA Algorithm in Cryptography
24. Find power of power under mod of a prime
25. Euler’s Totient Function
26. Optimized Euler’s Totient Function for multiple evaluations
27. Primitive root of a prime number n modulo n
28. Compute nCr % p
29. Chinese remainder theorem : Basic
30. CRT : Inverse Modulo based Implementation
31. Cyclic Redundancy Check and Moodulo-2 division
32. Use CRT to combine modular equations
33. Print factorial of a number[C++][Python]
34. Legendre’s Formula
35. Sum of divisors of factorial of a number
36. Count divisors of factorial
37. Compute n! under modulo p
38. Count trailing zeroes in factorial of a number
39. Factorial of a large number
40. Primorial of a number
41. Find first natural number whose factorial is divisible by x
42. Primality test : Basic Method
43. Primality test : Fermat Method
44. Euclid’s Lemma
45. Palindromic primes
46. Mersenne Prime
47. Super Prime
48. Circular primes less than n
49. Almost Prime numbers
50. Sieve of Eratosthenes
51. Sieve of Eratosthenes in O(n) time conplexity
52. Segmented Sieve
53. Check if a large number is divisible by 3 , 11 and 999
54. Smallest number divisible by first N natural numbers
55. Find last digit of a^b for large numbers
56. Divide, Multiply and Subtract two large numbers
57. Removing a number from an array to make it Geometric Progression
58. Nth number with digits in {1,2,3,4,5}
59. Program to check if a number is lucky number (all digits are different)
60. Form the largest number using at most one swap operation.

Greedy Algorithms

1. Activity Selection Problem
2. Job Sequencing Problem
3. Huffman Coding
4. Efficient Huffman Coding for sorted input
5. Reverse Delete Algorithm for MST
6. Prim's MST for Adjacency List Representation
7. Program for First fit algorithm in Memory Management
8. Program for Best Fit algorirthm in Memory Management
9. Program for Worst Fit algorithm in Memory Management
10. Program for Shortest Job First CPU Scheduling (Non-Preemptive)
11. K Centers Problem
12. Shortest Superstring Problem
13. Fractional Knapsack Problem
14. Greedy Algorithm to find Minimum number of coins
15. Find minimum time to finish all jobs with given constraints
16. Minimum sum of two numbers formed from digits of an array
17. Minimum number of Platforms required for a Railway/Bus Station
18. Paper Cut into Minimum number of squares
19. Maximize array sum after K negations (Optimal version)
20. Minimize the maximum difference between the heights

Advanced Data Structures

1. Segment Tree
2. Trie
3. Binary Indexed Tree
4. Suffix Array and Tree
5. AVL Tree
6. K- Dimensional Tree
7. Disjoint Set
8. N-ary Tree