Topics

- Analysis of Algorithms
- Searching and Sorting
- Greedy Algorithms
- Dynamic Programming
- Pattern Searching
- Other String Algorithms
- Backtracking
- Divide and Conquer
- Geometric Algorithms
- Mathematical Algorithms
- Bit Algorithms
- Graph Algorithms
- Randomized Algorithms
- Branch and Bound

Analysis of Algorithms:

1. Asymptotic Analysis
2. Worst, Average and Best Cases
3. Asymptotic Notations
4. Analysis of Loops
5. Solving Recurrences
6. Amortized Analysis
7. What does 'Space Complexity' mean?
8. Pseudo-polynomial Algorithms
9. NP-Completeness Introduction
10. Polynomial Time Approximation Scheme
11. A Time Complexity Question
12. Time Complexity of building a heap
13. Time Complexity where loop variable is incremented by 1, 2, 3, 4 ..
14. Time Complexity of Loop with Powers
15. Performance of loops (A caching question)

Searching and Sorting:

1. Linear Search, Binary Search, Jump Search, Interpolation Search, Exponential Search,Ternary Search
2. Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Heap Sort, QuickSort, Radix Sort, Counting Sort, Bucket Sort, ShellSort, Comb Sort, Pigeonhole Sort, Cycle Sort
3. Interpolation search vs Binary search
4. Stability in sorting algorithms
5. When does the worst case of Quicksort occur?
6. Lower bound for comparison based sorting algorithms
7. Which sorting algorithm makes minimum number of memory writes?
8. Find the Minimum length Unsorted Subarray, sorting which makes the complete array sorted
9. Merge Sort for Linked Lists
10. Sort a nearly sorted (or K sorted) array
11. Iterative Quick Sort
12. QuickSort on Singly Linked List
13. QuickSort on Doubly Linked List
14. Find k closest elements to a given value

15. Sort n numbers in range from 0 to n^2 – 1 in linear time
16. A Problem in Many Binary Search Implementations
17. Search in an almost sorted array
18. Sort an array in wave form
19. Why is Binary Search preferred over Ternary Search?
20. K'th Smallest/Largest Element in Unsorted Array
21. K'th Smallest/Largest Element in Unsorted Array in Expected Linear Time
22. K'th Smallest/Largest Element in Unsorted Array in Worst Case Linear Time
23. Find the closest pair from two sorted arrays
24. Find common elements in three sorted arrays
25. Given a sorted array and a number x, find the pair in array whose sum is closest to x
26. Count 1's in a sorted binary array
27. Binary Insertion Sort
28. Insertion Sort for Singly Linked List
29. Why Quick Sort preferred for Arrays and Merge Sort for Linked Lists?
30. Merge Sort for Doubly Linked List

Greedy Algorithms:

1. Activity Selection Problem
2. Kruskal's Minimum Spanning Tree Algorithm
3. Huffman Coding
4. Efficient Huffman Coding for Sorted Input
5. Prim's Minimum Spanning Tree Algorithm
6. Prim's MST for Adjacency List Representation
7. Dijkstra's Shortest Path Algorithm
8. Dijkstra's Algorithm for Adjacency List Representation
9. Job Sequencing Problem
10. Quiz on Greedy Algorithms
11. Greedy Algorithm to find Minimum number of Coins
12. K Centers Problem
13. Minimum Number of Platforms Required for a Railway/Bus Station

Dynamic Programming:

1. Overlapping Subproblems Property
2. Optimal Substructure Property
3. Longest Increasing Subsequence
4. Longest Common Subsequence
5. Edit Distance
6. Min Cost Path
7. Coin Change
8. Matrix Chain Multiplication
9. Binomial Coefficient
10. 0-1 Knapsack Problem
11. Egg Dropping Puzzle
12. Longest Palindromic Subsequence
13. Cutting a Rod
14. Maximum Sum Increasing Subsequence
15. Longest Bitonic Subsequence
16. Floyd Warshall Algorithm
17. Palindrome Partitioning
18. Partition problem

19. Word Wrap Problem
20. Maximum Length Chain of Pairs
21. Variations of LIS
22. Box Stacking Problem
23. Program for Fibonacci numbers
24. Minimum number of jumps to reach end
25. Maximum size square sub-matrix with all 1s
26. Ugly Numbers
27. Largest Sum Contiguous Subarray
28. Longest Palindromic Substring
29. Bellman–Ford Algorithm for Shortest Paths
30. Optimal Binary Search Tree
31. Largest Independent Set Problem
32. Subset Sum Problem
33. Maximum sum rectangle in a 2D matrix
34. Count number of binary strings without consecutive 1?s
35. Boolean Parenthesization Problem
36. Count ways to reach the n'th stair
37. Minimum Cost Polygon Triangulation
38. Mobile Numeric Keypad Problem
39. Count of n digit numbers whose sum of digits equals to given sum
40. Minimum Initial Points to Reach Destination
41. Total number of non-decreasing numbers with n digits
42. Find length of the longest consecutive path from a given starting character
43. Tiling Problem
44. Minimum number of squares whose sum equals to given number n
45. Find minimum number of coins that make a given value
46. Collect maximum points in a grid using two traversals
47. Shortest Common Supersequence
48. Compute sum of digits in all numbers from 1 to n
49. Count possible ways to construct buildings
50. Maximum profit by buying and selling a share at most twice
51. How to print maximum number of A's using given four keys
52. Find the minimum cost to reach destination using a train
53. Vertex Cover Problem | Set 2 (Dynamic Programming Solution for Tree)
54. Count number of ways to reach a given score in a game
55. Weighted Job Scheduling
56. Longest Even Length Substring such that Sum of First and Second Half is same

Pattern Searching:

1. Naive Pattern Searching
2. KMP Algorithm
3. Rabin-Karp Algorithm
4. A Naive Pattern Searching Question
5. Finite Automata
6. Efficient Construction of Finite Automata
7. Boyer Moore Algorithm – Bad Character Heuristic
8. Suffix Array
9. Anagram Substring Search (Or Search for all permutations)
10. Pattern Searching using a Trie of all Suffixes
11. Aho-Corasick Algorithm for Pattern Searching
12. kasai's Algorithm for Construction of LCP array from Suffix Array
13. Z algorithm (Linear time pattern searching Algorithm)

Other String Algorithms:

1. Manacher's Algorithm – Linear Time Longest Palindromic Substring – Part 1, Part 2, Part 3, Part 4
2. Longest Even Length Substring such that Sum of First and Second Half is same
3. Print all possible strings that can be made by placing spaces

Backtracking:

1. Print all permutations of a given string
2. The Knight's tour problem
3. Rat in a Maze
4. N Queen Problem
5. Subset Sum
6. m Coloring Problem
7. Hamiltonian Cycle
8. Sudoku
9. Tug of War
10. Solving Cryptarithmetic Puzzles

Divide and Conquer:

1. Introduction
2. Write your own pow(x, n) to calculate x*n
3. Median of two sorted arrays
4. Count Inversions
5. Closest Pair of Points
6. Strassen's Matrix Multiplication

Geometric Algorithms:

1. Closest Pair of Points | O(nlogn) Implementation
2. How to check if two given line segments intersect?
3. How to check if a given point lies inside or outside a polygon?
4. Convex Hull | Set 1 (Jarvis's Algorithm or Wrapping)
5. Convex Hull | Set 2 (Graham Scan)
6. Given n line segments, find if any two segments intersect
7. Check whether a given point lies inside a triangle or not
8. How to check if given four points form a square

Mathematical Algorithms:

1. Write an Efficient Method to Check if a Number is Multiple of 3
2. Efficient way to multiply with 7
3. Write a C program to print all permutations of a given string
4. Lucky Numbers
5. Write a program to add two numbers in base 14
6. Babylonian method for square root

7. Multiply two integers without using multiplication, division and bitwise operators, and no loops
8. Print all combinations of points that can compose a given number
9. Write you own Power without using multiplication(*) and division(/) operators
10. Program for Fibonacci numbers
11. Average of a stream of numbers
12. Count numbers that don't contain 3
13. MagicSquare
14. Sieve of Eratosthenes
15. Find day of the week for a given date
16. DFA based division
17. Generate integer from 1 to 7 with equal probability
18. Given a number, find the next smallest palindrome
19. Make a fair coin from a biased coin
20. Check divisibility by 7
21. Find the largest multiple of 3
22. Lexicographic rank of a string
23. Print all permutations in sorted (lexicographic) order
24. Shuffle a given array
25. Space and time efficient Binomial Coefficient
26. Reservoir Sampling
27. Pascal's Triangle
28. Select a random number from stream, with O(1) space
29. Find the largest multiple of 2, 3 and 5
30. Efficient program to calculate e^x
31. Measure one litre using two vessels and infinite water supply
32. Efficient program to print all prime factors of a given number
33. Print all possible combinations of r elements in a given array of size n
34. Random number generator in arbitrary probability distribution fashion
35. How to check if a given number is Fibonacci number?
36. Russian Peasant Multiplication
37. Count all possible groups of size 2 or 3 that have sum as multiple of 3
38. Tower of Hanoi
39. Horner's Method for Polynomial Evaluation
40. Count trailing zeroes in factorial of a number
41. Program for nth Catalan Number
42. Generate one of 3 numbers according to given probabilities
43. Find Excel column name from a given column number
44. Find next greater number with same set of digits
45. Count Possible Decodings of a given Digit Sequence
46. Calculate the angle between hour hand and minute hand
47. Count number of binary strings without consecutive 1?s
48. Find the smallest number whose digits multiply to a given number n
49. Draw a circle without floating point arithmetic
50. How to check if an instance of 8 puzzle is solvable?
51. Birthday Paradox
52. Multiply two polynomials
53. Count Distinct Non-Negative Integer Pairs (x, y) that Satisfy the Inequality x*x + y*y < n
54. Count ways to reach the n'th stair
55. Replace all '0' with '5' in an input Integer
56. Program to add two polynomials
57. Print first k digits of 1/n where n is a positive integer
58. Given a number as a string, find the number of contiguous subsequences which recursively add up to 9
59. Program for Bisection Method

60. Program for Method Of False Position
61. Program for Newton Raphson Method

Bit Algorithms:

1. Find the element that appears once
2. Detect opposite signs
3. Set bits in all numbers from 1 to n
4. Swap bits
5. Add two numbers
6. Smallest of three
7. A Boolean Array Puzzle
8. Set bits in an (big) array
9. Next higher number with same number of set bits
10. Optimization Technique (Modulus)
11. Add 1 to a number
12. Multiply with 3.5
13. Turn off the rightmost set bit
14. Check for Power of 4
15. Absolute value (abs) without branching
16. Modulus division by a power-of-2-number
17. Minimum or Maximum of two integers
18. Rotate bits
19. Find the two non-repeating elements in an array
20. Number Occurring Odd Number of Times
21. Check for Integer Overflow
22. Little and Big Endian
23. Reverse Bits of a Number
24. Count set bits in an integer
25. Number of bits to be flipped to convert A to B
26. Next Power of 2
27. Check if a Number is Multiple of 3
28. Find parity
29. Multiply with 7
30. Find whether a no is power of two
31. Position of rightmost set bit
32. Binary representation of a given number
33. Swap all odd and even bits
34. Find position of the only set bit
35. Karatsuba algorithm for fast multiplication
36. How to swap two numbers without using a temporary variable?
37. Check if a number is multiple of 9 using bitwise operators
38. Swap two nibbles in a byte
39. How to turn off a particular bit in a number?
40. Check if binary representation of a number is palindrome

Graph Algorithms:

Introduction, DFS and BFS:

1. Graph and its representations
2. Breadth First Traversal for a Graph
3. Depth First Traversal for a Graph
4. Applications of Depth First Search
5. Detect Cycle in a Directed Graph
6. Detect Cycle in a an Undirected Graph
7. Detect cycle in an undirected graph
8. Longest Path in a Directed Acyclic Graph
9. Topological Sorting
10. Check whether a given graph is Bipartite or not
11. Snake and Ladder Problem
12. Biconnected Components
13. Check if a given graph is tree or not

Minimum Spanning Tree:

1. Prim's Minimum Spanning Tree (MST))
2. Applications of Minimum Spanning Tree Problem
3. Prim's MST for Adjacency List Representation
4. Kruskal's Minimum Spanning Tree Algorithm
5. Boruvka's algorithm for Minimum Spanning Tree

Shortest Paths:

1. Dijkstra's shortest path algorithm
2. Dijkstra's Algorithm for Adjacency List Representation
3. Bellman–Ford Algorithm
4. Floyd Warshall Algorithm
5. Johnson's algorithm for All-pairs shortest paths
6. Shortest Path in Directed Acyclic Graph
7. Some interesting shortest path questions
8. Shortest path with exactly k edges in a directed and weighted graph

Connectivity:

1. Find if there is a path between two vertices in a directed graph
2. Connectivity in a directed graph
3. Articulation Points (or Cut Vertices) in a Graph
4. Biconnected graph
5. Bridges in a graph
6. Eulerian path and circuit
7. Fleury's Algorithm for printing Eulerian Path or Circuit
8. Strongly Connected Components
9. Transitive closure of a graph
10. Find the number of islands
11. Count all possible walks from a source to a destination with exactly k edges
12. Euler Circuit in a Directed Graph
13. Biconnected Components
14. Tarjan's Algorithm to find Strongly Connected Components

Hard Problems:

1. Graph Coloring (Introduction and Applications)
2. Greedy Algorithm for Graph Coloring
3. Travelling Salesman Problem (Naive and Dynamic Programming)
4. Travelling Salesman Problem (Approximate using MST)
5. Hamiltonian Cycle
6. Vertex Cover Problem (Introduction and Approximate Algorithm)
7. K Centers Problem (Greedy Approximate Algorithm)

Maximum Flow:

1. Ford-Fulkerson Algorithm for Maximum Flow Problem
2. Find maximum number of edge disjoint paths between two vertices
3. Find minimum s-t cut in a flow network
4. Maximum Bipartite Matching
5. Channel Assignment Problem

Misc:

1. Find if the strings can be chained to form a circle
2. Given a sorted dictionary of an alien language, find order of characters
3. Karger's algorithm for Minimum Cut
4. Karger's algorithm for Minimum Cut | Set 2 (Analysis and Applications)
5. Hopcroft–Karp Algorithm for Maximum Matching | Set 1 (Introduction)
6. Hopcroft–Karp Algorithm for Maximum Matching | Set 2 (Implementation)
7. Length of shortest chain to reach a target word
8. Find same contacts in a list of contacts

Randomized Algorithms:

1. Linearity of Expectation
2. Expected Number of Trials until Success
3. Randomized Algorithms | Set 0 (Mathematical Background)
4. Randomized Algorithms | Set 1 (Introduction and Analysis)
5. Randomized Algorithms | Set 2 (Classification and Applications)
6. Randomized Algorithms | Set 3 (1/2 Approximate Median)
7. Karger's algorithm for Minimum Cut
8. K'th Smallest/Largest Element in Unsorted Array | Set 2 (Expected Linear Time)
9. Reservoir Sampling
10. Shuffle a given array
11. Select a Random Node from a Singly Linked List

Branch and Bound:

1. Branch and Bound | Set 1 (Introduction with 0/1 Knapsack)
2. Branch and Bound | Set 2 (Implementation of 0/1 Knapsack)
3. Branch and Bound | Set 3 (8 puzzle Problem)
4. Branch And Bound | Set 4 (Job Assignment Problem)
5. Branch and Bound | Set 5 (N Queen Problem)
6. Branch And Bound | Set 6 (Traveling Salesman Problem)