# 8 weeks DSA course plan

**Week 1:**

**Day 1:** Introduction- Analysis of Algorithms, Asymptotic Notation, Time Complexity, Space Complexity.

**Day 2,3,4:** Mathematics- Prime Numbers and Sieve of Eratosthenes, Multiples and Numbers (GCD, LCM, Factorials), Combinatorics, Modular Arithmetic, Practice Questions.

**Day 5,6:** Bit Manipulation- Bitwise operators, Set Bits, Count Bits, Power of 2 and Power sets, One odd occurring, 2 odd occurring, Practice Questions.

**Day 7:** Recursion- Application, Tail Recursion, Base Conditions, Classic Recursion Problems including Tower of Hanoi and Josephus Problem, Practice Questions.

**Week 2:**

**Day 1:** Continuation of Week 1 Day 7 topics.

**Day 2,3,4:** Arrays- Introduction and simple problems, Shifting and Rotation, Stock buy and sell, Trapping Rainwater, Kadane's Algo, Prefix Sum, Sliding window, Practice Questions.

**Day 5,6:** Searching- Linear, Binary, Ternary Search, Modified Binary Search to find floor, ceil, index of 1$^{st}$ and last occurrence, 2 pointers, median in sorted array, Find Square/Cube root, Search in rotated Sorted Array, Allocate Minimum pages, Practice Questions.

**Day 7:** Sorting- All types of sorting with best, avg, worst time complexity, Problems using merge sort and Quick Sort implementation, Comparator Function in Cpp/Java inbuilt sort function, Practice Questions.

**Week 3:**

**Day 1,2:** Continuation of Week 2 Day 7 topics.

**Day 3,4:** Matrix- Terminologies and Properties, Transpose, Rotation, Spiral, Multiplication of matrices, Search in Sorted matrix, Median in row sorted matrix, Practice Questions.

**Day 5,6:** Hashing- Concept of hashing, Separate chaining and open addressing, implementation of hashing in Cpp/Java, Practice Questions.

**Day 7:** Strings- Introduction and basic questions, String Matching Algorithms, Lexicographic rank of string, Longest substring with distant characters, Practice Questions.

**Week 4:**

**Day 1,2:** Continuation of Week 3 Day 7 topics.

**Day 3,4,5:** Linked List- Types (Single LL, Double LL, XOR LL, Circular LL), Advantages, implementation and operations, Practice questions.

**Day 6,7:** Stacks- Introduction, implementation and operations using array and linked list, Practice Questions.

**Week 5:**

**Day 1:** Continuation of Week 4 Day 7 topics.

**Day 2,3:** Queue and Deque- - Introduction, implementation and operations using array and linked list, few Questions, implement stack using queues and vice versa, Practice Questions.

**Day 4,5,6:** Trees- Introduction and types of trees, Creation, Deletion, Insertion in a tree, Binary trees and Practice Questions.

**Day 7:** Binary Search Trees- Trees- Introduction and properties of BST, Creation, Searching, Deletion, Insertion in a BST, implementation of BST and Practice Questions.

**Week 6:**

**Day 1,:** Continuation of Week 5 Day 7 topics.

**Day 2,3:** Heaps- Introduction to Heap, Creation, Insertion, Deletion, Heapify, Priority Queues and related application in questions. Practice Questions.

**Day 4,5,6,7:** Graphs- Introduction to Graphs, properties, and representations, traverse the graphs using BFS and DFS, detect cycles, find shortest paths, find strongly connected components, etc. in a graph. Practice Questions on BFS, DFS and all given algorithms.

**Week 7:**

**Day 1,2:** Greedy - Practice Questions related to different Greedy approaches given.

**Day 3,4:** Backtracking- Introduction, Rat in a maze, N Queen Problem, Suduko Problem. Practice questions.

**Day 5,6,7:** Dynamic Programming- Introduction to Dynamic Programming, overlapping subproblems, and optimal substructures, Top-down and bottom-up approaches to solving a DP problem, All different types of DP problems and their variations. Practice Questions.

**Week 8:**

**Day 1:** Continuation of Week 7 Day 7 topics.

**Day 2,3:** Tries- Introduction to Tries, insert, search, delete, and updating in Tries, Practice Questions.

**Day 4,5:** Segment Trees (Basic Level)- Introduction to Segment Trees and when to use them, applying segment-trees in questions, Practice Questions.

**Day 6,7:** Disjoint Set- Introduction to DSU, Union by Rank and Path Compression, Kruskal's algorithm, Practice Questions.