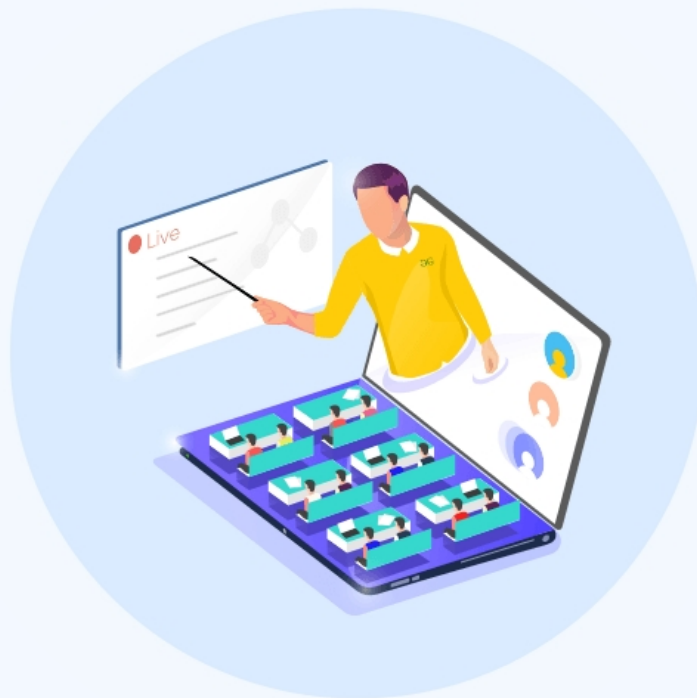


# DSA LIVE

FOR  
WORKING PROFESSIONAL



Detailed  
Course Syllabus

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## Week 01

- Class 1 :**
- **Analysis of Algorithm**
  - **Mathematics**
  - **Bit Manipulation**
  - Asymptotic analysis
  - Time and Space Complexity
  - Master Theorem
  - Bitwise Operators (Bitwise AND, Bitwise OR, Bitwise XOR, Left Shift, Right Shift, etc )

### Practice Problems

GCD and LCM  
Iterative Power  
Computing Power  
Prime factorization  
Prime Numbers (Sieve Algorithms)  
Generate Power Set

- Class 2 :**
- **ARRAYS**
  - Arrays - Introduction and Advantages
  - Types of Arrays
  - Operations of Arrays - Searching, Insertion, Deletion,
  - Sliding Window Technique

### Practice Problems

Largest Element in an Array  
Leaders in an Array problem  
Reverse an Array  
Maximum subarray sum

## Week 02

- Class 1 :**
- **RECURSION**
  - **BACKTRACKING**
  - Introduction to Recursion
  - Writing Base Cases in Recursion
  - Tail Recursion
  - Introduction to Backtracking

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## **Practice Problems**

Print 1 to N Using Recursion  
Sum of Digits Using Recursion  
Rope Cutting Problem  
Generate Subsets  
Tower of Hanoi  
Josephus Problem  
Rat in a Maze Problem

### **Class 2 : - SEARCHING**

- Linear Search
- Binary Search - Iterative and Recursive Approach
- Analysis of Binary Search
- Two Pointer Approach

## **Practice Problems**

Index of first Occurrence in Sorted  
Count 1s in a Sorted Binary Array  
Square root of a number  
Search in an Infinite sized array  
Search in a sorted rotated array  
Triplet in a Sorted Array  
Allocate Minimum Pages (Binary Search)

## **Week 03**

### **Class 1 : - SORTING**

- Overview of sorting algorithm
- Sorting Algorithms like Insertion, Bubble, Selection, Merge and Quick Sort
- Stability of Sorting Algorithms

## **Practice Problems**

Minimum Difference in an Array  
Chocolate Distribution Problem  
Union of two Sorted Arrays  
Kth Smallest Element  
Sort an Array with two/three types of element

# CONTENTS

## Class 2 : - **MATRIX** - **HASHING**

- Multidimensional Array
- Passing 2D arrays as argument
- Hashing Introduction and Application, Time Complexity Analysis
- Collision Handling
- Hashing Function
- Unordered Set and Unordered Map
- HashSet and HashMap

### **Practice Problems**

Transpose of a Matrix  
Matrix in Snake Pattern  
Spiral Traversal of a Matrix  
Count Distinct Elements  
Frequencies of Array Elements  
Intersection and Union of two Array Elements  
Subarray with given Sum  
Count Distinct Elements in Every Window  
More than n/k Occurrence (with  $O(nk)$  solution)

## Week 04

## Class 1 : - **STRINGS**

- Introduction to Strings
- Overview of Pattern Searching Algorithm
- Naive and Improved Naive Pattern Searching
- Rabin Karp Algorithm
- KMP Algorithm (Constructing LPS Array and Complete Algorithms)

### **Practice Problems**

Palindrome Check  
Reverse words in a string  
Check for Anagram  
Check if Strings are Rotations  
Anagram Search  
Lexicographic Rank of a String  
Longest Substring with Distinct Characters  
Check if a String is Subsequence of Other

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## Class 2 : - LINKED LIST

- Introduction to Linked List
- Traversing a Linked List
- Insertion of Node in Singly Linked List
- Reverse a Linked List
- Deletion of Node in Linked List
- Doubly Linked List & Circular Linked List

### Practice Problems

Middle of Linked List

Deleting a node without accessing head pointer of Linked List

Nth Node from end of Linked List

Segregating Even and Odd Nodes of LL

Detect Loop using Floyd Cycle Detection

LRU Cache

## Week 05

## Class 1 : - STACK

- Stack - Introduction and Applications
- Stack Operations (e.g. push, pop, etc)
- Array Implementation of Stack
- Linked List Implementation of Stack

### Practice Problems

Balanced Parenthesis

Next Greater Element

Previous Greater Element

Implement two Stacks in an Array

## Class 2 : - QUEUE - DEQUE

- Queue- Introduction and Application
- Implementation of Queue using Array
- Implementation of Queue using Linked List
- Deque - Introduction and Application

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## **Practice Problems**

Generate numbers with given digits  
First Circular Tour  
Maximums of all subarrays of size k  
Reversing a Queue

## **Week 06**

### **Class 1 : - TREE**

- Tree - Introduction and Application
- Binary Tree
- Tree Traversal - Inorder, Preorder and Postorder with Implementation
- Level Order Traversal
- Set and Map
- TreeSet and TreeMap

## **Practice Problems**

Height of Binary Tree  
Maximum in a Binary Tree  
Check for Balanced Binary Tree  
Diameter of a Binary Tree  
LCA of a Binary Tree  
Serialize and Deserialize a Binary Tree

### **Class 2 : - BINARY SEARCH TREE**

- BST - Introduction and Application
- Search in BST with Implementation
- Insert in BST with Implementation
- Deletion in BST with Implementation
- Self Balancing BST - AVL Tree, Red Black Tree

## **Practice Problems**

Find Kth Smallest in BST  
Check for BST  
Top View of Binary Tree  
Vertical Sum in Binary Tree  
Floor in BST

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## Week 07

### Class 1 : - **GREEDY** - **HEAP**

- Introduction to Greedy Algorithm
- Binary Heap - Introduction
- Binary Heap - Insertion, Heapify and Extract
- Binary Heap - Decrease, Delete and Build Heap
- Heap Sort
- Priority Queue

#### **Practice Problems**

Activity Selection Problem  
Job Sequencing Problem  
Fractional Knapsack Problem  
Sort K Sorted Array  
K Largest Element  
Median of a Stream

### Class 2 : - **GRAPH**

- Introduction to Graph
- Graph Representation (Adjacency List and Matrix)
- Adjacency Matrix and List Comparison
- Breadth First Search - Introduction and Implementation
- Depth First Search - Introduction and Implementation

#### **Practice Problems**

Shortest Path in an Unweighted Graph  
Detect Cycle in Undirected Graph  
Detect Cycle in a Directed Graph  
Strongly Connected Components

## Week 08

### Class 1 : - **Graph - Advanced**

- Prims Algorithm - Introduction and Implementation
- Dijkstra Algorithm - Introduction and Implementation
- Kruskal's Algorithm
- Bellman-Ford Algorithm

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## **Practice Problems**

Find the no. of islands

Articulation Point

Bridges in Graph

## **Class 2 : - Dynamic Programming**

- Introduction to Dynamic Programming

- DP vs Greedy Approach

- How to approach a DP Problem

- Memoization and Tabulation methods

## **Practice Problems**

Coin Change Problem

Longest Common Subsequence

Subset Sum Problem

Longest Increasing Subsequence

0-1 Knapsack Problem