MERN Academy: Data Structures and Algorithms (DSA) Placement Readiness Syllabus

Course Overview

Institution: MERN Academy

Course Name: Data Structures and Algorithms (DSA) Placement Readiness

Duration: 6 Months

Goal: To equip students with essential DSA knowledge and problem-solving skills to excel in technical interviews and secure placements. This syllabus is structured around the highly effective problem categories from the NeetCode, LeetCode, Code Chef, Coding Ninja 150 list, ensuring comprehensive coverage of interview-relevant topics.

Course Structure and Problem Breakdown

The 6-month course will be structured into six major modules, taught By Industry professional IIITians, with each month focusing on a core area of DSA. The topics are categorized based on the problem types outlined in the reference material.

Month	Module	Core Topics	Sample Concepts/Data Structures
1	**Arrays & Hashing**	Introduction to Arrays, Hash Maps, Sets, Frequency Counting	Two Sum, Group Anagrams, Top K Frequent Elements, Valid Sudoku
2	**Two Pointers & Sliding Window**	Two-Pointer Techniques (Opposite/Same Direction), Fixed/Dynamic Sliding Window	Valid Palindrome, Three Sum, Container With Most Water, Longest Substring Without Repeating Characters

Month	Module	Core Topics	Sample Concepts/Data Structures
3	**Stacks & Queues**	Stack Implementation, Queue Implementation, Monotonic Stack	Valid Parentheses, Daily Temperatures, Min Stack, Trapping Rain Water
4	**Binary Search & Trees**	Binary Search (Various Forms), Binary Tree Traversals, DFS, BFS	Search in Rotated Sorted Array, Koko Eating Bananas, Invert Binary Tree, Lowest Common Ancestor
5	**Heaps (Priority Queues) & Graphs**	Min/Max Heap Implementation, Graph Representation (Adjacency List/Matrix), Graph Traversals	K Closest Points to Origin, Find Median from Data Stream, Number of Islands, Clone Graph
6	**Tries, Dynamic Programming (DP) & Advanced Topics**	Trie Structure, DP Fundamentals (Memoization, Tabulation), Backtracking	Implement Trie, Word Break, Climbing Stairs, House Robber, Subsets, Permutations

Monthly Breakdown - Detailed Syllabus

Month 1: Arrays and Hashing

- **Week 1:** Basic Array Operations, Time and Space Complexity Analysis.
- **Week 2:** Hash Maps and Sets: Insertion, Deletion, Lookup.
- **Week 3:** Frequency Counting and Two Sum Problem variations.
- **Week 4:** Advanced Hashing problems (e.g., Longest Consecutive Sequence, Valid Sudoku).

Month 2: Two Pointers and Sliding Window

- **Week 1:** Two Pointers: O(n) solutions for sorted array problems.
- **Week 2:** Sliding Window: Fixed size window problems.
- **Week 3:** Sliding Window: Dynamic size window problems (Max/Min subarray).
- **Week 4:** Combined techniques and complex problems (e.g., Longest Repeating Character Replacement).

Month 3: Stacks and Queues

- **Week 1:** Stack: LIFO principle and basic applications (e.g., Valid Parentheses).

- **Week 2:** Queue: FIFO principle and uses.
- **Week 3:** Monotonic Stack/Queue for optimization (e.g., Daily Temperatures).
- **Week 4:** Hard problems involving Stacks and Arrays (e.g., Largest Rectangle in Histogram).

Month 4: Binary Search and Trees

- **Week 1:** Binary Search: Standard implementation and edge cases.
- **Week 2:** Binary Search Tree (BST) fundamentals.
- **Week 3:** Tree Traversal: DFS (Inorder, Preorder, Postorder) and BFS.
- **Week 4:** Tree properties and advanced problems (e.g., Subtree of Another Tree).

Month 5: Heaps (Priority Queues) and Graphs

- **Week 1:** Heaps: Theory, implementation, and uses in sorting and selection.
- **Week 2:** Graph Representations: Adjacency List/Matrix. Graph Terminology.
- **Week 3:** Graph Traversal: Depth First Search (DFS) and Breadth First Search (BFS) on graphs.
- **Week 4:** Advanced Graph Algorithms: Topological Sort, Disjoint Set Union (DSU) basics.

Month 6: Tries, Dynamic Programming, and Placement Prep

- **Week 1:** Tries: Structure and applications (e.g., prefix searching).
- **Week 2:** Backtracking: Fundamentals and application to search problems (e.g., Subsets, Combinations).
- **Week 3:** Dynamic Programming: 1D DP (e.g., Climbing Stairs, House Robber).
- **Week 4: Placement Readiness:** Mock Interviews, Resume Preparation, Review of the most frequently asked questions.

Assessment and Learning Resources

- **Weekly Assignments:** Problem sets based on the week's topic.
- **Monthly Tests:** Comprehensive exams to assess module mastery.
- **Capstone Project:** An advanced problem or implementation task to be completed by the end of the course.
- **Reference Material:** Access to curated practice problems and video explanations.
- **Office Hours:** Regular doubt-clearing sessions with instructors. Students must schedule their sessions via regular meeting links:

Key Milestones

Milestone	Target Timings	Description
Module 1 Completion	1 month	Mastery of Arrays and Hashing techniques.
Mid-Course Review	2 months	Review of fundamental data structures (Arrays, Linked Lists, Stacks, Queues).
Final Exam	1 month	Comprehensive assessment covering all DSA topics.
Revision & Mock Interviews	2 month	Interview practice with industry professionals (will be held at 📍 IIT Bhilai Gate Number 2: ...).

Contact for Enrollment: Please reach out to Pratik Verma at enrollment@mernacademy.com for registration and fee details.