DSA Patterns

Array

When preparing for Data Structures and Algorithms (DSA)💡 interviews, it's crucial to master certain patterns that frequently arise in array problems📘.

1 Sliding Window
Maximum sum subarray of size K
Longest substring without repeating characters
Count of anagrams in a string

2 Two Pointers
✅ Key Problems:
Pair with a given sum
Merge two sorted arrays
Trapping Rain Water

3 Kadane's Algorithm
✅ Key Problems:
Maximum Sum Subarray
Maximum Circular Subarray Sum

4 Sorting-based Problems
✅ Key Problems:
Find triplets that sum to zero
Minimum platforms required for trains
Largest number formed from an array

5 Binary Search on Arrays
✅ Key Problems:
Search in a rotated sorted array
Find the first and last position of an element
Median of two sorted arrays

6 Prefix Sum & Difference Array
✅ Key Problems:
Subarray sum equals K
Range addition using difference array
Equilibrium index of an array

7 Greedy Techniques
Used when making local optimal choices leads to global optimal solutions.
✅ Key Problems:
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Maximum meetings in one room
Minimum number of platforms required
Candy distribution

8 Matrix Variations (2D Arrays)
2D problems often include pathfinding and dynamic programming.
✅ Key Problems:
Spiral matrix traversal
Rotate a matrix by 90 degrees
Search in a 2D matrix

9 Hashing in Arrays
Involves optimizing searches and pair/group detections.
✅ Key Problems:
Two-sum problem
Longest consecutive subsequence
Count distinct elements in every window

🔟 Advanced Techniques
These are critical for tougher questions often seen in top-tier interviews.
✅ Key Problems:
Maximum product subarray
Subarray with XOR K
Partition array into disjoint intervals

Strings

1. Sliding Window Pattern

- **Key Idea:** Maintain a sliding window to check substrings or character frequencies.
- **Problems:**
    - Longest Substring Without Repeating Characters
    - Minimum Window Substring
    - Longest Substring with At Most K Distinct Characters
    - Check if String Contains All Anagrams of Another String

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2. Two Pointers Pattern

- **Key Idea:** Use two pointers to manipulate string indices.
- **Problems:**

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- Valid Palindrome
- Reverse Words in a String
- Longest Palindromic Substring
- Compare Backspaced Strings

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3. Prefix Sum / Cumulative Frequency

- **Key Idea:** Use prefix sums or hashmaps for cumulative frequency calculations.
- **Problems:**
  - Substring with Equal 0s and 1s (Binary Strings)
  - Longest Substring with Balanced Parentheses

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4. Hashing (Frequency Count)

- **Key Idea:** Use hashmaps to store character frequencies or substrings.
- **Problems:**
  - Group Anagrams
  - First Unique Character in a String
  - Longest Substring with K Unique Characters

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5. Dynamic Programming (DP)

- **Key Idea:** Solve complex problems by breaking them into subproblems.
- **Problems:**
  - Longest Palindromic Subsequence
  - Edit Distance
  - Longest Common Subsequence
  - Wildcard Matching
  - Regular Expression Matching

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6. Backtracking

- **Key Idea:** Explore all possibilities by making choices and backtracking.

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- **Problems:**
    - Generate All Permutations of a String
    - Word Break Problem
    - Palindrome Partitioning

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7. String Searching Algorithms

- **Key Idea:** Efficient algorithms to search substrings or patterns in strings.
- **Problems:**
    - Implement KMP Algorithm (Knuth-Morris-Pratt)
    - Implement Rabin-Karp Algorithm
    - Z-Algorithm for Pattern Searching

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8. Trie (Prefix Tree)

- **Key Idea:** Data structure for efficient prefix searching.
- **Problems:**
    - Longest Word in Dictionary
    - Search Suggestions System
    - Implement Autocomplete

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9. Bit Manipulation for Strings

- **Key Idea:** Use bitmasking for unique character operations.
- **Problems:**
    - Maximum Length of Concatenated String with Unique Characters
    - Subsets with Unique Characters Using Bitmask

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10. Regular Expressions

- **Key Idea:** Use regex-like approaches to handle string pattern matching.
- **Problems:**
    - Regular Expression Matching (DP-based)

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- Wildcard Matching

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11. Mathematical String Problems

- **Key Idea:** Strings that involve numerical computations or encodings.
- **Problems:**
  - Add Binary Strings
  - Multiply Strings
  - Decode Ways

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12. Greedy Algorithms

- **Key Idea:** Solve problems by making optimal choices at every step.
- **Problems:**
  - Rearrange Characters to Avoid Repetition
  - Minimum Swaps to Make Strings Equal

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13. Compression and Encoding

- **Key Idea:** Work with compressing or encoding strings.
- **Problems:**
  - Run-Length Encoding
  - Count and Say Problem
  - Decode String

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14. Miscellaneous Patterns

- **Rotations and Shifts:**
  - Check if Two Strings are Rotations of Each Other
  - Minimum Shifts to Match Strings
- **String Multiplication and Power:**
  - Implement String to Integer Conversion (atoi)
  - Power of Strings (Repeated Substrings)

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2. Stack and Queue

- **Monotonic Stack/Queue**
  - **Next Greater Element**
  - **Largest Rectangle in Histogram**
  - **Sliding Window Maximum**
- **Stack Operations**
  - **Valid Parentheses**
  - **Evaluate Reverse Polish Notation**
- **Queue Operations**
  - **Implement LRU Cache**
  - **Circular Queue**

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3. Linked List

- **Classic Problems**
  - **Reverse a Linked List**
  - **Detect and Remove Cycle in a Linked List**
  - **Merge Two Sorted Lists**
- **Advanced Patterns**
  - **Flatten a Multilevel Doubly Linked List**
  - **Add Two Numbers Represented as Linked Lists**

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4. Binary Search

- **Search Problems**
  - **Search in Rotated Sorted Array**
  - **Median of Two Sorted Arrays**
- **Range Problems**
  - **Kth Smallest/Largest Element in Sorted Matrix**

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    - **Allocate Minimum Pages**

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5. Graph

- **Graph Traversals**
    - **BFS and DFS**
    - **Connected Components**
- **Shortest Path**
    - **Dijkstra's Algorithm**
    - **Bellman-Ford Algorithm**
- **Advanced Graph Problems**
    - **Minimum Spanning Tree (Prim/Kruskal)**
    - **Topological Sorting**

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6. Trees

- **Basic Tree Traversals**
    - **Inorder, Preorder, Postorder**
- **Tree Algorithms**
    - **Lowest Common Ancestor**
    - **Diameter of Binary Tree**
    - **Zigzag Level Order Traversal**
- **Binary Search Trees**
    - **Validate BST**
    - **Kth Smallest Element**

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7. Hashing

- **Frequency Count**
    - **Two Sum**
    - **Longest Substring with K Unique Characters**
- **Subarray Problems**

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    - **Count Subarrays with Sum Divisible by K**

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8. Recursion and Backtracking

- **Classic Problems**
    - **Subset Sum**
    - **N-Queens Problem**
- **String Backtracking**
    - **Word Search**
    - **Generate All Permutations of a String**

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9. Dynamic Programming

- **Knapsack Problems**
    - **0/1 Knapsack**
    - **Subset Sum**
- **String DP**
    - **Longest Common Subsequence**
    - **Edit Distance**
- **Grid-Based DP**
    - **Unique Paths**
    - **Minimum Path Sum**

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10. Greedy Algorithms

- **Interval Problems**
    - **Activity Selection Problem**
    - **Minimum Platforms**
- **Optimization Problems**
    - **Huffman Encoding**
    - **Fractional Knapsack**

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Advanced DSA Patterns

1. Tries

- **Prefix Matching**
  - **Implement Trie**
  - **Longest Word in Dictionary**
- **Pattern Searching**
  - **Word Search II**
  - **Replace Words**

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2. Segment Trees and Fenwick Trees

- **Range Queries**
  - **Range Sum Query**
  - **Range Minimum Query**
- **Lazy Propagation**
  - **Range Updates in Segment Tree**

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3. Heap (Priority Queue)

- **K Problems**
  - **Kth Largest Element in Array**
  - **Merge K Sorted Lists**
- **Advanced Problems**
  - **Top K Frequent Elements**
  - **Sliding Window Median**

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4. Bit Manipulation

- **Single Number Problems**
  - **Find the Single Number (XOR Logic)**
  - **Power of Two**
- **Subsets Using Bitmasking**

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- **Generate All Subsets**

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5. Mathematical Problems

- **Number Theory**
  - **Sieve of Eratosthenes**
  - **Modular Arithmetic**
- **String and Numbers**
  - **Multiply Strings**
  - **Add Binary**

Practice Approach

1. **Solve 250+ curated problems covering these patterns.**
2. **Target platforms like LeetCode, Codeforces, and InterviewBit.**
3. **Focus on company-specific problems, especially from Google, Amazon, Flipkart, etc.**
4. **Analyze problems to identify pattern overlaps (e.g., Sliding Window + Hashing).**

Top DSA Creator on YouTube

1. APNA College(6.23M) - (749) Apna College - YouTube (Baap k Baap)
2. Abdul Bari(1 M)
3. Aditya Verma - Focuses on solving problems step-by-step, with special emphasis on Dynamic Programming (DP).
4. Love Babbar - Covers DSA problems with a practical approach and also has the famous "450 DSA Questions" series.
5. triver (Take U Forward) - Offers playlists on DSA, competitive programming, and system design.
6. CodeWithHarry - Beginner-friendly tutorials on DSA and coding.
7. Pepcoding- Comprehensive coverage of DSA and coding problems.
8. NeetcodeIO - (749) NeetCodeIO - YouTube
9. Neetcode (874 K) - My Brain after 569 Leetcode Problems
10. Gaurav Sen (System Design and Algorithm)(607 k) - (749) Gaurav Sen - YouTube
11. Anuj Bhaiya(507k) - (749) Anuj Bhaiya - YouTube
12. Neso Academy

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Here’s The link:

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