

DSA Patterns – Detailed Explanation

1. Prefix Sum

Used for cumulative frequency/sum queries, range sum, subarray problems. Typical problems: Range sum queries, Subarray sum equals K, Difference arrays.

2. Two Pointers

Used on sorted arrays/strings for pair finding, palindrome checks, shrinking space efficiently.

3. Sliding Window

Used for subarray/substring problems with fixed/variable length. Optimizes $O(n^2)$ to $O(n)$.

4. Fast and Slow Pointer

Used for cycle detection in linked list, middle element, intersection detection.

5. Three Pointers

Used in Dutch National Flag problem, merging sorted arrays, in-place rearrangements.

6. Monotonic Stack

Used for next greater/smaller element, stock span, largest rectangle in histogram.

7. Top K Elements

Used for k-largest/smallest, frequency problems using heap/quickselect.

8. Overlapping Interval

Used in scheduling, merging intervals, detecting conflicts.

9. Modified Binary Search

Used in rotated arrays, first/last position search, peak finding, monotonic conditions.

10. Binary Tree Traversal

Used for inorder, preorder, postorder traversals in BSTs and expression trees.

11. DFS

Used for exploring paths deeply, connected components, cycle detection, islands.

12. BFS

Used for level-order traversal, shortest path in unweighted graphs, multi-source shortest path.

13. Matrix Traversal

Used in grid problems (DFS/BFS in 2D), DP tabulation, spiral/flood fill.

14. Backtracking

Used for exploring all possibilities with pruning: subsets, permutations, N-Queens, Sudoku.

15. Dynamic Programming

Used for problems with overlapping subproblems and optimal substructure.

16. Union Find

Used for connected components, cycle detection, Kruskal's MST, accounts merging.

17. Greedy

Used when local optimal choices lead to global solution: scheduling, jump game, Huffman coding.