**2. Language-Specific Learning**

**Java:**

- **Advantages**:
    - Strong libraries like java.util for data structures.
    - Fast for competitive programming compared to interpreted languages.
- **Key Libraries to Master**:
    - **Collections Framework**:
        - Lists (ArrayList, LinkedList).
        - Maps (HashMap, TreeMap).
        - Sets (HashSet, TreeSet).
    - **Arrays**:
        - Arrays class (Arrays.sort, Arrays.binarySearch).
    - **Math Class**:
        - Math.pow, Math.sqrt, Math.abs, and Math.max/min.
    - **String Manipulation**:
        - Use StringBuilder for efficiency in concatenations.
- **Tips for Java**:
    - Practice fast input/output with BufferedReader and StringTokenizer.
    - Use PriorityQueue for heaps.
    - Get familiar with Comparator and Comparable for custom sorting.

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**JavaScript:**

- **Advantages**:
    - Lightweight and flexible, great for beginners and prototyping.
    - Available everywhere, including browser-based coding platforms.
- **Key Libraries and Features to Master**:
    - **Arrays**:
        - Methods like .map(), .filter(), .reduce(), and .sort().
    - **Objects**:
        - Efficient use of Map and Set for hashing.
    - **Strings**:

        - Functions like .substring(), .charAt(), .split(), and .includes().
    - **Math Object**:
        - Methods like Math.floor(), Math.ceil(), Math.max(), and Math.random().
- **Tips for JavaScript**:
    - Use console.time() and console.timeEnd() to measure performance.
    - Be mindful of Number.MAX_SAFE_INTEGER and precision issues in floating-point calculations.
    - Use BigInt for handling very large numbers.

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**3. Platform-Specific Strategy**

**CodeForces, AtCoder, CodeChef:**

- **Focus**:
    - Time complexity optimization.
    - Competitive problems often require efficient solutions (O(log n), O(n), O(n log n)).
- **Preparation**:
    - Learn fast input/output handling. For JavaScript, use process.stdin for Node.js.
    - Study problems by difficulty level and participate in contests regularly.

**LeetCode:**

- **Focus**:
    - Algorithmic thinking and data structures.
    - Problems designed for interviews; focus on Easy and Medium first.
- **Preparation**:
    - Learn to write clean, modular code.
    - Practice company-specific tags if you're preparing for interviews.

**GeeksforGeeks:**

- **Focus**:
    - Understand theoretical concepts and solve example problems.
    - Great for learning foundational concepts.
- **Preparation**:
    - Use GFG to revisit concepts after solving practical problems.

**Platforms:**

- **Beginner**: GeeksforGeeks, LeetCode Easy.
- **Intermediate**: CodeChef Beginner, LeetCode Medium, AtCoder Beginner Contests.
- **Advanced**: CodeForces Div 2, AtCoder Intermedia

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# Roadmap

**1. Arrays and Strings**

- Basics: Traversing, insertion, deletion.
- Problems: Two-pointer technique, sliding window, prefix sums, Kadane's algorithm.
- Java Focus: ArrayList, StringBuilder.
- JavaScript Focus: splice(), slice(), join().
- Platforms: Start with **LeetCode Easy** and move to **CodeChef Beginner** problems.

**2. Hashing**

- Learn hash tables and hash maps.
- Problems: Count frequencies, check for duplicates, subarray sums.
- Java Focus: HashMap, HashSet.
- JavaScript Focus: Map, Set.

**3. Recursion and Backtracking**

- Basics: Factorial, Fibonacci, subsets.
- Problems: N-Queens, Sudoku Solver, permutations/combinations.
- Platform: LeetCode, GeeksforGeeks.

**4. Sorting and Searching**

- Learn sorting algorithms (merge sort, quick sort, heap sort).
- Binary search and its variations.
- Problems: Search in rotated array, first/last occurrence, closest pair.
- Platforms: CodeForces Div 2 contests.

**5. Linked Lists**

- Basics: Singly, doubly, and circular linked lists.

- Problems: Merge sorted lists, detect a cycle, reverse a list.
- Java Focus: LinkedList class.
- JavaScript Focus: Custom linked list implementation.

**6. Stacks and Queues**

- Problems: Valid parentheses, next greater element, sliding window maximum.
- Java Focus: Stack, Queue, Deque.
- JavaScript Focus: Implement using arrays.

**7. Trees and Graphs**

- Learn traversals (DFS, BFS, in-order, pre-order, post-order).
- Binary trees, binary search trees, and graph representations.
- Problems: Shortest paths (Dijkstra, Bellman-Ford), spanning trees (Kruskal, Prim).
- Platforms: GeeksforGeeks, LeetCode, CodeForces.

**8. Dynamic Programming (DP)**

- Basics: Fibonacci, 0/1 Knapsack, subset sum.
- Intermediate: Longest Increasing Subsequence (LIS), Matrix Chain Multiplication.
- Advanced: DP with bit masking, DP on trees.
- Platforms: LeetCode, CodeChef, AtCoder.

**9. Greedy Algorithms**

- Learn problems like activity selection, Huffman encoding, and coin change.
- Platform: GeeksforGeeks, CodeChef.

**10. Number Theory**

- Basics: GCD, LCM, prime factorization, modular arithmetic.
- Problems: Sieve of Eratosthenes, modular exponentiation.
- Platforms: CodeForces, AtCoder.

**11. Bit Manipulation**

- Basics: AND, OR, XOR, left/right shifts.
- Problems: Count set bits, subsets using bits, single number.
- Platform: LeetCode, GeeksforGeeks.

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**Roadmap to Learning and Solving Problems**

**Step 1: Language Mastery**

- **Week 1–2**:
    - Learn Java syntax: Focus on OOP, Collections Framework (List, Map), and Streams.
    - Learn JavaScript: Master ES6+ features like let/const, arrow functions, async/await, and array/object manipulation.
    - Solve easy language-based problems on **GeeksforGeeks** or **HackerRank**.

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**Step 2: DSA Fundamentals**

- **Week 3–5**:
    - Focus on arrays, strings, and hashing.
    - Practice Easy problems on **LeetCode** (2–3 problems/day).
    - Understand time complexity for basic algorithms.

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**Step 3: Intermediate DSA**

- **Week 6–8**:
    - Cover recursion, backtracking, and sorting algorithms.
    - Solve problems like permutations, combinations, and binary search.
    - Practice **CodeChef Beginner Contests** and **LeetCode Medium**.

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**Step 4: Advanced Topics**

- **Week 9–12**:
    - Learn trees and graphs, dynamic programming, and greedy algorithms.
    - Focus on solving **CodeForces Div 2** contests and **AtCoder Beginner** problems.
    - Practice competitive programming to develop speed and accuracy.

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**Step 5: Competitive Programming**

- **Week 13+**:
    - Participate in contests on **CodeForces**, **AtCoder**, and **CodeChef** regularly.
    - Analyze editorials for problems you couldn't solve during contests.
    - Focus on improving problem-solving speed and handling edge cases.

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