DSA Preparation Plan

🗓️ DSA Preparation Plan

✅ 1 – Core Java + Linear DS

- Java syntax & OOP (encapsulation, inheritance, polymorphism)
- Arrays, Strings, ArrayList, LinkedList
- Stack, Queue, Deque
- 10–15 easy problems on LeetCode or HackerRank

✅ 2 – Non-Linear DS + Recursion

- Binary Tree, BST, Heap
- Recursion basics and tree traversal
- Introduction to Graphs
- Solve problems: DFS, BFS, Tree traversals

✅ 3 – Algorithms

- Sorting (Merge, Quick, Counting)
- Searching (Binary Search, Search in Rotated Array)
- Greedy: Activity Selection, Huffman
- Dynamic Programming: Fibonacci, Knapsack
- Practice 10–12 problems (medium-level)

✅ 4 – Advanced + Patterns

- HashMap, HashSet, Trie, Disjoint Set
- Sliding Window, Two Pointer, Bit Manipulation
- Advanced Graphs: Dijkstra, Union-Find
- Mock interviews, timed contests, and system design basics

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📚 Complete List of Data Structures and Algorithms

🧱 A. Data Structures

🔹 1. Linear Data Structures

Structure	Description
Array	Fixed-size sequential collection of elements
Linked List	Nodes connected by pointers
Stack	LIFO (Last In First Out)
Queue	FIFO (First In First Out)
Deque	Double-ended queue (insert/remove at both ends)
String	Sequence of characters (often treated as DS)

🔹 2. Non-Linear Data Structures

Structure	Description
Tree	Hierarchical DS with root and children
└── Binary Tree	Each node has at most 2 children
└── BST (Search Tree)	Binary Tree with ordering property
└── AVL Tree	Self-balancing BST
└── Red-Black Tree	Balanced BST with coloring rules
└── Segment Tree	Range query optimization
└── Fenwick Tree (Binary Indexed Tree)	Efficient prefix sums
└── Trie (Prefix Tree)	Fast word prefix search

Heap	Complete binary tree with heap property
└── Min Heap / Max Heap	Min/Max value at root
Graph	Set of nodes (vertices) connected by edges
└── Directed / Undirected	Graph types
└── Weighted / Unweighted	Edge weights
└── Adjacency Matrix / List	Representation

🔹 3. **Hashing Structures**

Structure	**Description**
Hash Table / HashMap	Key-value storage with fast lookup
HashSet	Stores unique elements using hashing
Custom Hash Functions	Used in advanced problems

🔹 **4. Other Specialized Data Structures**

Structure	**Description**
Disjoint Set (Union-Find)	Detecting connected components
LRU Cache (LinkedHashMap/Deque)	Least Recently Used caching
Priority Queue	Queue with element priority
Skip List	Fast search using layered linked lists
Bloom Filter	Probabilistic data structure for set membership
Suffix Array / Tree	String pattern searching
K-D Tree / Quad Tree	For multidimensional data (2D/3D)

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🧠 **B. Algorithms**

🔹 1. Sorting Algorithms

Algorithm	Time Complexity (Best/Worst)
Bubble Sort	$O(n) / O(n^2)$
Selection Sort	$O(n^2) / O(n^2)$
Insertion Sort	$O(n) / O(n^2)$
Merge Sort	O(n log n) / O(n log n)
Quick Sort	$O(n \log n) / O(n^2)$
Heap Sort	O(n log n) / O(n log n)
Counting Sort	O(n + k) (for integers)
Radix Sort	O(nk) (non-comparison sort)
Bucket Sort	O(n+k)

🔹 2. Searching Algorithms

Algorithm	Description
Linear Search	O(n) – search element in array
Binary Search	O(log n) – sorted array required
Ternary Search	Division into 3 parts
Exponential Search	For unbounded sorted arrays
Jump Search / Interpolation Search	Faster in some cases

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🔹 3. Recursion & Backtracking

Concept	Usage Example
Basic Recursion	Factorial, Fibonacci
Backtracking	N-Queens, Sudoku, Subset Sum
Memoization	Cache previous results

🔹 4. Divide and Conquer

Algorithm	Description
Merge Sort	Divide into halves
Quick Sort	Divide based on pivot
Binary Search	Repeated halving
Strassen's Matrix Multiplication	Matrix optimization

🔹 5. Greedy Algorithms

Algorithm	Usage
Kruskal’s Algorithm	Minimum Spanning Tree (MST)
Prim’s Algorithm	MST using priority queue
Activity Selection	Scheduling problems
Huffman Coding	Data compression
Fractional Knapsack	Maximize value

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🔹 6. Dynamic Programming (DP)

Problem Type	Technique
0/1 Knapsack	Tabulation, memoization
Fibonacci, LCS, LIS	Overlapping subproblems
Matrix Chain Multiplication	Optimal structure
Coin Change, Rod Cutting	Resource optimization
DP on Trees / Graphs	Complex structures

🔹 7. Graph Algorithms

Algorithm	Purpose
DFS, BFS	Traversal
Dijkstra’s Algorithm	Shortest Path (Non-negative)
Bellman-Ford	Handles negative weights
Floyd-Warshall	All-pairs shortest path
Topological Sort	DAG processing
Kruskal / Prim	Minimum Spanning Tree (MST)
Union-Find	Connected components detection
Tarjan’s Algorithm	SCC / Bridges / Articulation Points

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🔹 8. Advanced Algorithms

Algorithm	Use Case
KMP Algorithm	Pattern matching (strings)
Rabin-Karp	Rolling hash for string match
Manacher’s Algorithm	Longest palindromic substring
*A Search**	Pathfinding in games/AI
Min-Cut/Max-Flow (Ford–Fulkerson)	Network flow
Suffix Arrays / Trees	Fast pattern searching

📦 Common Interview Patterns

Pattern	Use Case
Two Pointers	Sorting, searching, arrays
Sliding Window	Subarrays, strings
Fast & Slow Pointer	Cycles in linked lists
Merge Intervals	Calendar, scheduling
Monotonic Stack/Queue	Stock span, nearest greater/smaller
Bit Manipulation	XOR tricks, toggling bits
Trie	Dictionary matching, autocomplete

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📅 Suggested Learning Schedule

Sr No	Focus	Practice Tool
1	Arrays, Strings, Recursion	LeetCode Easy
2	Linked List, Stack, Queue	GFG/LeetCode
3	Trees, HashMap, Searching/Sorting	Coding Ninjas
4	DP, Graphs, Backtracking	LeetCode Medium/Scaler

📚 GitHub Repositories

- 🔗 The Algorithms - Java: All major DSA implementations
- 🔗 mission-peace/interview: Java-centric DSA explanations and problems

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🚀 Top Platforms to Learn DSA in Java (Free + Paid)

✅ 1. GeeksforGeeks DSA in Java Track

- **Level**: Beginner → Advanced
- **What's Good**: Strong focus on Java-based implementations with quizzes & practice problems.
- **Includes**: Arrays, Strings, Trees, Graphs, DP, Recursion, and more.
- **Price**: Some free content, full course is paid (~₹500–1000).

✅ 2. Coding Ninjas – DSA in Java

- **Level**: Beginner-friendly with mentorship
- **What's Good**: Structured course + assignments + placement prep
- **Java Focus**: Fully Java-focused curriculum
- **Price**: Paid (~₹5000–₹9000); offers EMI and scholarships

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✅ 3. Scaler Academy (by InterviewBit)

- **Level**: Intermediate to Advanced (for serious aspirants)
- **Includes**: Live classes, mock interviews, Java-based system design
- **What's Good**: Top mentors, structured job-driven DSA curriculum
- **Price**: Paid (Premium course, EMI available)

✅ 4. freeCodeCamp YouTube – DSA in Java

- **Level**: Beginner
- **What's Good**: Free, beginner-friendly, well-explained visuals
- **Covers**: Recursion, Sorting, Trees, Graphs with Java code

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✅ 5. LeetCode – Java Tag + Explore Cards

- **Practice-oriented platform**
- Filter problems by Java
- Explore cards for topics like Arrays, Linked List, Binary Search
- Great for **company-specific DSA prep**

✅ 6. Udemy – Master DSA using Java

- **Instructor**: Tim Buchalka (highly rated)
- **Covers**: Core DSA in Java with clean visual explanations
- **Price**: Often discounted to ₹499–₹799

✅ 7. Coursera – Java DSA by UC San Diego

- University-backed course
- Taught in Java
- Includes assignments and certificates

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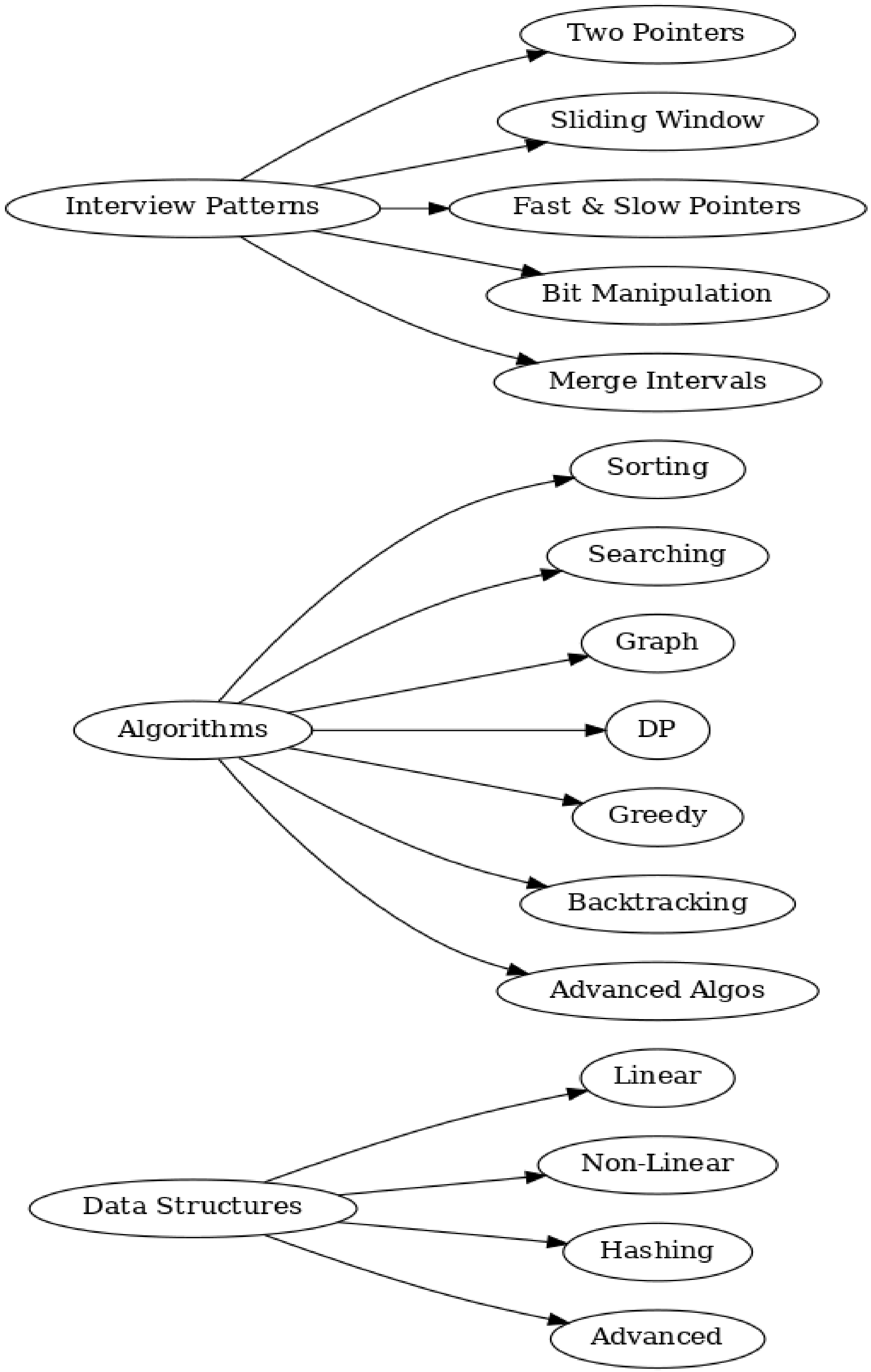

Interview Patterns
Two Pointers
Sliding Window
Fast & Slow Pointers
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Algorithms
Sorting
Searching
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DP
Greedy
Backtracking
Advanced Algos
Data Structures
Linear
Non-Linear
Hashing
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