Intermediate to Advanced Roadmap: Java + Python (OOP, DSA, CSE)

This roadmap is designed for learners who already know Python and Java up to OOP concepts and want to advance into Collections, DSA, and core Computer Science concepts using Java for deep understanding and Python for quick prototyping and project building.

# Phase 1: Master Java Collections & Core APIs (2–3 weeks)

- Java Collections Framework:  
 \* List (ArrayList, LinkedList)  
 \* Set (HashSet, TreeSet, LinkedHashSet)  
 \* Map (HashMap, TreeMap, LinkedHashMap)  
 \* Queue & Deque (PriorityQueue, ArrayDeque)  
- Generics & Wrapper Classes  
- Comparable vs Comparator  
- Practical Task:  
 \* Implement custom LinkedList, Stack, Queue  
 \* Build a Mini To-Do App using Collections

# Phase 2: DSA Deep Dive in Java (6–8 weeks)

Solve in Java first, then implement key ones in Python for reinforcement.  
  
1. Arrays & Strings (Sliding Window, Two Pointers, Kadane’s Algorithm)  
2. Recursion & Backtracking (N-Queens, Sudoku Solver)  
3. Stacks & Queues (Balanced Parentheses, Next Greater Element)  
4. Linked List (Reverse, Detect Cycle, Merge Lists)  
5. Trees & Binary Search Trees (Traversals, LCA, Diameter)  
6. Heaps & Priority Queues (Kth Largest Element, Merge K Lists)  
7. Hashing & Maps (Two Sum, Frequency Counting)  
8. Graphs (BFS, DFS, Dijkstra, Topological Sort)  
9. Dynamic Programming (Knapsack, Coin Change, LCS)  
10. Bit Manipulation (Subsets, Power of Two, XOR problems)  
  
Tools: LeetCode, HackerRank, Codeforces. Maintain a DSA notebook in Java + Python.

# Phase 3: Advanced Core CSE in Java (4–5 weeks)

- Multithreading & Concurrency (Thread, Runnable, Executor Framework, Synchronization)  
- Java I/O & Serialization (File Handling, NIO)  
- Networking & Sockets (Build a Chat Server)  
- JDBC & Databases (MySQL/PostgreSQL)  
- Design Patterns (Singleton, Factory, Observer, Strategy)

# Phase 4: Python for Quick Prototyping (Parallel – 2–3 weeks)

While Java handles deep DSA & CSE, use Python for:  
- Fast Algorithm Testing  
- Small Web Projects (Flask/Django)  
- Automation Scripts  
  
Mini Projects:  
- Movie Search Bot (Flask + MongoDB)  
- Banking App Backend (Flask + MySQL)  
- Data Processing Tool (Pandas + SQL)

# Phase 5: Capstone Projects (Last 4 weeks)

Build real-world systems mixing Java for backend & DSA-heavy logic + Python for APIs/UI:  
1. Library Management System (Java + JDBC + Flask)  
2. Multithreaded Chat Application (Java Sockets + Python GUI)  
3. Stock Market Analyzer (Java Algorithms + Python Visualization)

# Daily/Weekly Schedule

- 2–3 hrs/day: Java (DSA + Advanced CSE)  
- 1 hr/day: Python (projects + automation)  
- Weekends: System Design + Big Project  
- Daily: Solve 2–3 DSA problems (Java)  
- Weekly: Push 1 project/module to GitHub

# Extra Resources

- Books:  
 \* Effective Java by Joshua Bloch  
 \* Introduction to Algorithms (CLRS)  
- Platforms: LeetCode, GeeksforGeeks, HackerRank  
- YouTube: Java Brains (Java), Abdul Bari (DSA & CSE concepts)

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