Java OOP & Collections Practice Roadmap

Step 1 – OOP Basics

Topics:
- Class, Object
- Constructors
- Encapsulation (private fields, getters/setters)
- Inheritance
- Polymorphism (method overriding)

Problems to Practice:
1. Create a BankAccount class with accountNumber, balance, deposit, withdraw.
2. Create a Student class with id, name, marks; input and display methods.
3. Create a Vehicle base class and Car subclass; override methods.
4. Build a library management system with book issuing.
5. Practice encapsulation with private fields and getters/setters.

Resources:
- Java OOP Concepts – https://www.geeksforgeeks.org/object-oriented-programming-in-java/
- Classes & Objects – https://www.programiz.com/java-programming/class-object
- Inheritance – https://www.w3schools.com/java/java_inheritance.asp

Step 2 – List (ArrayList/LinkedList)

Topics:
- Create, add, remove elements
- Sorting and searching
- Iterating using loops and iterators

Problems to Practice:
1. Store and print names in reverse order.
2. Remove duplicates from a list.
3. Sort marks and display top 3.
4. Find even/odd numbers.
5. Merge two lists and remove duplicates.

Resources:
- ArrayList – https://www.geeksforgeeks.org/arraylist-in-java/
- List Interface – https://www.w3schools.com/java/java_arraylist.asp
- LinkedList – https://www.tutorialspoint.com/java/java_linkedlist_class.htm

Step 3 – Set (HashSet/TreeSet)

Topics:
- Unique data storage
- Fast lookup
- Removing duplicates

Problems to Practice:
1. Count unique elements in an array.
2. Find common elements between two arrays.
3. Implement a spell checker with known words.

4. Store numbers in sorted order with TreeSet.
5. Check if a list has duplicates.

Resources:
- Set Interface – https://www.geeksforgeeks.org/set-interface-java-examples/
- HashSet – https://www.java2s.com/Tutorials/Java/Java_Collections/0010__Java_HashSet.htm
- TreeSet – https://www.java2s.com/Tutorials/Java/Java_Collections/0030__Java_TreeSet.htm

Step 4 – Map (HashMap/TreeMap)

Topics:
- Key-value storage
- Counting frequency
- Grouping data

Problems to Practice:
1. Count frequency of words in a sentence.
2. Group students by department.
3. Find first non-repeating character in a string.
4. Create a phonebook app.
5. Store and sort students by name with TreeMap.

Resources:
- HashMap – https://www.geeksforgeeks.org/hashmap-in-java/
- Map Interface – https://www.javatpoint.com/java-map-interface
- TreeMap – https://www.baeldung.com/java-treemap

Step 5 – Queue (LinkedList/PriorityQueue)

Topics:
- FIFO behavior
- Task scheduling
- Priority queues

Problems to Practice:
1. Simulate a customer queue at a bank.
2. Implement a task scheduler.
3. Sort tasks by priority using PriorityQueue.
4. Process events in order of arrival.
5. Check if events are processed correctly.

Resources:
- Queue – https://www.geeksforgeeks.org/queue-interface-java-examples/
- PriorityQueue – https://www.baeldung.com/java-priority-queue
- LinkedList as Queue – https://www.java2s.com/Tutorials/Java/Java_Collections/0120__Java_LinkedList_as_Qu

Bonus Practice Platforms

Platforms:
- LeetCode – https://leetcode.com/problemset/all/?difficulty=All&status=Todo&tags=java
- HackerRank – https://www.hackerrank.com/domains/java
- Codeforces – https://codeforces.com/
- GeeksforGeeks Practice – https://practice.geeksforgeeks.org/explore/?category%5B%5D=Java

Tools:
- IDE: IntelliJ IDEA / Eclipse / VS Code
- Version Control: Git + GitHub
- Documentation: README files for each project