**Exercise 1:**

Explain why data structures and algorithms are essential in handling large inventories

Data structures and algorithms efficiently manage large inventories by organizing data for quick access and updates.  
They help in fast searching, sorting, and retrieval of product information.  
Efficient algorithms reduce time and memory usage during inventory operations.  
This ensures scalability and smooth performance as inventory size grows.

Discuss the types of data structures suitable for this problem.

**ArrayList** – Best for dynamic lists when frequent additions and sequential access are needed

**HashMap** – Useful for quick lookup of products by unique keys like product ID or name.

**LinkedList** – Helpful if frequent insertions/deletions are needed at various positions.

**TreeMap / TreeSet** – Useful when sorted order of products (like by name or price) is required.

Analyze the time complexity of each operation (add, update, delete) in your chosen data structure.

**Add:** O(1)

**Update:** O(n)

**Delete:** O(n)

Discuss how you can optimize these operations.

To optimize the operations in inventory management:

Add: Use a HashMap instead of an ArrayList to allow constant-time insertion using product IDs as keys.

Update: Replace linear search with direct access via HashMap, reducing update time to O(1).

Delete: Optimize deletion by removing items directly from the HashMap using the key, avoiding element shifting.

Search: Maintain additional indices (like a HashMap by name) for quick multi-criteria lookups.

Output:



