**Exercise 1: Inventory Management System**

**Scenario:**

You are developing an inventory management system for a warehouse. Efficient data storage and retrieval are crucial.

**Steps:**

1. **Understand the Problem:**
   * Explain why data structures and algorithms are essential in handling large inventories.

Data structures and algorithms are crucial for efficiently managing large inventories. They enable quick insertion, deletion, and retrieval of data, ensuring optimal performance as the size of the inventory grows. For example, using efficient data structures can reduce the time complexity of operations, making the system responsive even with a large number of products.

* + Discuss the types of data structures suitable for this problem.

Suitable Data Structures:

ArrayList: Provides dynamic resizing and efficient index-based access, but operations like insertion and deletion can be slow if not at the end.

HashMap: Offers constant time complexity for add, update, and delete operations on average, due to hashing.

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

Analysis

Time Complexity:

- HashMap:

Add: O(1)

Update: O(1)

Delete: O(1)

* + Discuss how you can optimize these operations.

I have used a ‘HashMap’ here for fast lookups and updates.

If order matters or frequent iterations are needed, an ‘ArrayList’ with appropriate indexing or a sorted data structure might be preferred.