**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:**

**(i) Explain why data structures and algorithms are essential in handling large inventories.**

**Answer:**

Data structures and algorithms are essential in handling large inventories because they enable efficient storage, retrieval, and manipulation of data. A well-designed data structure can reduce the time complexity of operations, making the system more scalable and responsive.

**(ii) Discuss the types of data structures suitable for this problem.**

**Answer:**

Suitable data structures for this problem include:

* ArrayList:
* HashMap:

**4. Analysis:**

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

**Answer:**

The time complexity of each operation in the Inventory class is:

* **Add product**: O(1) on average, since HashMap provides constant-time insertions.
* **Update product**: O(1) on average, since HashMap provides constant-time updates.
* **Delete product**: O(1) on average, since HashMap provides constant-time deletions.
* **Get product**: O(1) on average, since HashMap provides constant-time lookups.

**(ii) Discuss how you can optimize these operations.**

**Answer:**

To optimize these operations, we can use a more efficient data structure, such as a TreeMap, which provides O(log n) time complexity for insertions, updates, and deletions.