**Inventory Management System**

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

Efficient data structures and algorithms are crucial for handling large inventories in an inventory management system due to the need for fast data storage and retrieval. An optimized system ensures quick access to product information, minimizes the time to update inventory details, and maintains overall performance even as the dataset grows.

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

Here **ArrayList** and **HashMap** both can be used for quick access. But in case of ArrayList, insertion and deletion is slower, especially in the middle of the list. Whereas **HashMap** Offers average constant time complexity for insertion, deletion and search operations due to its hashing mechanism, making it suitable for quick lookups by product ID.

Given the need for efficient retrieval, insertion, and deletion, **HashMap** is used for this problem.

**Time Complexity Analysis:**

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

**Time Complexity** O(1) on average, as HashMap provides constant time complexity for inserting an element.

* + 1. **Update Operation**:

**Time Complexity** O(1) on average for lookup and update, since HashMap provides constant time complexity for accessing and modifying elements.

* + 1. **Delete Operation**:

**Time Complexity** O(1) on average, as HashMap allows for constant time complexity for deletion.

1. **Discuss how you can optimize these operations.**

Using a good hash function and minimizing collisions can maintain O(1) performance.