**Exercise 1: Inventory Management System**

1. Explain why data structures and algorithms are essential in handling large inventories.
   * Efficiency: Data structure and algorithms are the best ways to make operations like searches, add operations, update operations, and delete operations of the products done in an actual effective manner, therefore it reduces the time complexity, hence improving the performance of the system as a whole.
   * Memory Management: Data structures chosen correctly would be able to ensure maximum utilization of memory, therefore preventing wastage. Since data structures conserve memory, the system can handle large blocks of data.
2. Discuss the types of data structures suitable for this problem.
   * ArrayList: Considerably efficient to contain a sorted list of products. Index access is relatively frequent in our example, but costly insertions and deletions can emerge.
   * HashMap: It will be very good in fast retrieval, insertion, and deletion of the product having a unique key. It is very much helpful as in the case of using a unique 'productId.'. The average time complexity it provides for these operations is O(1).
3. Analyze the time complexity of each operation (add, update, delete) in your chosen data structure.
   * Add a Product: O(1)- On an average, this operation would be done while adding the product to the HashMap.
   * Update Product: O(1) - If we need to update a product then the product is fetched from the HashMap(O(1)) and change in the values of the attributes are done which would again be an O(1) operation.
   * Delete Product: O(1) - Deleting the product from the HashMap on an average would be an O(1) operation.
4. Discuss how you can optimize these operations.