**Exercise 1: Inventory Management System**

1. **Understand the problem**
   1. Data Structures and Algorithms are essential in handling large inventories because of the following reasons:
      1. Efficient access and updates: Without a good data structure, a basic linear search could take O(n) time which is not optimal at all. Using the right data structure, (for example, a HashMap), we can reduce it to constant time.
      2. Optimized memory usage: Different data structures utilise memory differently. Hence, choosing the right data structure is necessary to optimise the memory usage.
      3. Scalability: Efficient Data Structure Algorithms work even when the data sets increase in size.
   2. Few suitable data structures for this problem are:
      1. ArrayList
      2. HashMap
      3. TreeMap
      4. LinkedList

(Each have their own advantages and disadvantages)

1. **And 3.** **Setup and Implementation**: Shown in code.

4. **Analysis**:

a. Time Complexity of my program, where I used ArrayList is as follows:

* Add Element: O(1)
* Update Element: O(N) //searches the entire ArrayList if needed.
* Delete Element: O(N) //searches the entire ArrayList if needed.

b. These operations can be optimised if we use implement HashMap instead of ArrayList as HashMap provides faster lookup as compared to ArrayList and we do frequently need to search elements to update and delete.