**Week-I**

**Algorithms & DSA**

**Exercise-:1**

**Understanding Asymptotic Notations:**

* Data structures and algorithms are crucial in handling large inventories because they enable efficient data storage, retrieval, and manipulation.
* The right data structure can optimize the speed of various operations such as searching, inserting, updating, and deleting products.
* Efficient algorithms help in processing the data quickly, which is vital for real-time inventory management where performance and scalability are key.

**Types of Data Structures Suitable:**

* **ArrayList:** Quick access by index is possible but can be slow for insertions and deletions in the middle of the list.
* **HashMap**: Ideal for storing products with unique product IDs. It offers average O(1) time complexity for insertions, updates, and deletions.
* **TreeMap**: Sets elements in a sorted order, TreeMap provides log(n) time complexity for insertions, updates, and deletions.

**Time Complexity Analysis:**

* **Add Operation**: O(1)
* **Update Operation**: O(1)
* **Delete Operation**: O(1)

**Optimization:**

* The hash function for the keys (product IDs) should distribute entries uniformly.
* If the inventory size is expected to grow significantly, consider initializing the HashMap with a larger capacity to reduce rehashing.