Inventory Management System

1. Understanding the Problem:

Why Data Structures and Algorithms are Essential in Handling Large Inventories:

Efficient data storage and retrieval are critical in an inventory management system due to the potential size and complexity of the data. Using appropriate data structures and algorithms ensures that operations like searching, adding, updating, and deleting products are performed quickly and efficiently. This reduces the time complexity and enhances the performance of the system, especially as the inventory grows.

Types of Data Structures Suitable for This Problem:

ArrayList: Useful for a dynamic list of products where the order of insertion is important. It allows for fast random access and iteration.

HashMap (or Dictionary): Ideal for storing key-value pairs, where the product ID can be used as the key. It provides average O(1) time complexity for insertions, deletions, and lookups.

Time Complexity Analysis:

Add Product:

Average Case: O(1) because HashMap allows for constant time insertion.

Worst Case: O(n) in case of hash collisions, but with a good hash function, this is rare.

Update Product:

Average Case: O(1) for the same reason as adding a product.

Worst Case: O(n), again due to potential hash collisions.

Delete Product:

Average Case: O(1) because HashMap allows for constant time deletion.

Worst Case: O(n) due to hash collisions.