Exercise 1: Inventory Management System

1. Understand the Problem:

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

Efficient Data Storage and Retrieval->Using appropriate data structures like hash tables, trees, and graphs allows for efficient storage and quick retrieval of inventory data.

Optimized Data Processing->Sorting Algorithms: Efficient sorting algorithms like Quick Sort and Merge Sort help in organizing inventory data, making it easier to process and analyse..

o Discuss the types of data structures suitable for this problem.

=Arrays/Lists: Useful for simple implementations but their fixed size and linear search times limit their efficiency.

Linked Lists: Dynamic and allow efficient insertions/deletions but searching requires traversing the list.

Hash Tables : Excellent for fast lookups.

4. Analysis:

o Analyze the time complexity of each operation (add, update, delete) in your chosen data structure.

=Time Complexity Analysis:

1. Add: O(1)

2. Search: O(n)

3. Traverse: O(n)

4. Delete: O(n)

Limitations of Arrays:

1. Fixed size: Cannot dynamically resize.

2. Inefficient for insertions and deletions: Requires shifting elements.

3. Not suitable for large datasets if the size is not known in advance.

o Discuss how you can optimize these operations.

When to use Arrays:

1. When the size of the dataset is known and fixed.

2. When fast access to elements is required.