1. Understand the Problem:

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

Ans: Data structures and algorithms are critical in managing large inventories because they provide the foundation for efficient, scalable, and reliable inventory management systems. They enable quick data access, efficient updates, and advanced functionalities, ensuring that the system can handle large volumes of data effectively while maintaining performance and integrity.

Discuss the types of data structures suitable for this problem.

Ans: 1. Arrays

2. LinkedList

3. HashMaps

4. Binary Search Trees

4. Analysis:

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

### Ans: Arrays

* Add :

Best Case: O(1)

Worst Case: O(n)

* Update:

Average Case: O(1)

* Delete:

Best Case: O(1)

Worst Case: O(n)

Linked Lists

* Add :

Best Case: O(1)

Worst Case: O(n)

* Update:

Average Case: O(n)

* Delete:

Best Case: O(1)

Worst Case: O(n)

HashMap

* Add:

Average Case: O(1)

Worst Case: O(n)

* Update:

Average Case: O(1)

Worst Case: O(n)

* Delete:

Average Case: O(1)

Worst Case: O(n)

Binary Search Trees

Add :

Average Case: O(log n)

Worst Case: O(n)

Update:

Average Case: O(log n)

Worst Case: O(n)

Delete:

Average Case: O(log n)

Worst Case: O(n)

Discuss how you can optimize these operations.

1.Batch Processing: To cut down on the overhead of numerous separate activities, think about batch processing for bulk inserts or updates.  
2. Concurrency: If the inventory management system must manage several threads reading and writing at the same time, use concurrent data structures like ConcurrentHashMap.  
3. Indexing: To enable quicker lookups, think about implementing indexing techniques or additional data structures if search operations on non-key attributes (like productName) start to happen frequently.