Q1. Why are Data Structures and Algorithms Essential?

Ans.

* **Efficiency**: Large inventories can involve thousands of products. Efficient algorithms and data structures reduce the time taken to search, update, or add records.
* **Scalability**: Good data structures handle increased data volume without performance degradation.
* **Organization**: Data structures help organize data for faster access.

Q2. Discuss the types of data structures suitable for this problem.

Ans.

* **ArrayList**: Good for ordered collections, easy iteration, but search/update/delete is slow (O(n)).
* **HashMap**: Ideal for key-based access, fast operations (average O(1) for add/update/delete).

Q3. Analyze the time complexity of each operation (add, update, delete) in your chosen data structure.

Ans.

|  |  |  |
| --- | --- | --- |
| **Operation** | **Average Time Complexity** | **Worst-case Time Complexity** |
| Add | O(1) | O(n) |
| Update | O(1) | O(n) |
| Delete | O(1) | O(n) |
| Search/Retrieve | O(1) | O(n) |

Q4. Discuss how you can optimize these operations.

Ans.

* Use **load factor tuning** in HashMap to reduce rehashing.
* Validate inputs before updating/deleting.
* Add **indexes** or use a database for very large datasets (millions of entries).