**3.**

**Exercise 2: E-commerce Platform Search Function**

**Scenario:**

You are working on the search functionality of an e-commerce platform. The search needs to be optimized for fast performance.

**Steps:**

1. **Understand Asymptotic Notation:**
   * Explain Big O notation and how it helps in analyzing algorithms.
   * Describe the best, average, and worst-case scenarios for search operations.
2. **Setup:**
   * Create a class **Product** with attributes for searching, such as **productId, productName**, and **category**.
3. **Implementation:**
   * Implement linear search and binary search algorithms.
   * Store products in an array for linear search and a sorted array for binary search.
4. **Analysis:**
   * Compare the time complexity of linear and binary search algorithms.
   * Discuss which algorithm is more suitable for your platform and why.

**Answer Code :**

### Big O Notation

Big O notation describes the upper bound of an algorithm's time or space complexity in terms of the input size. It helps us analyze how an algorithm's performance scales as the input grows, allowing us to compare different algorithms and choose the most efficient one for a given problem.

### Search Operation Scenarios

****Best-case****: The ideal scenario where the algorithm finds the element immediately (first element checked for linear search, middle element for binary search).

****Average-case****: The expected performance over all possible inputs.

****Worst-case****: The scenario where the algorithm takes the maximum time (element not present or at the end for linear search)

### 4. Analysis

#### ****Time Complexity****

| **Algorithm** | **Best Case** | **Average Case** | **Worst Case** |
| --- | --- | --- | --- |
| ****Linear Search**** | O(1) | O(n) | O(n) |
| ****Binary Search**** | O(1) | O(log n) | O(log n) |

#### ****2. Best for E-Commerce:-****

****Binary Search**** :

* Catalog is **large & sorted**
* **Frequent searches**
* **Sorting overhead is acceptable**

****Linear Search**** :

* Catalog is **small**
* **Frequent updates** (hard to keep sorted)
* **Memory constraints**

#### ****Production Recommendations****

****Conclusion:**** Binary search is better for large, static datasets, while linear works for small or dynamic data.