**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.

**Algorithm Analysis**

* **Time Complexity**:
  + **Linear Search**: O(n) in worst/average cases. Checks each element sequentially.
  + **Binary Search**: O(log n) in worst/average cases. Halves search space each iteration.
* **Suitability for E-commerce Platform**:
  + **Binary Search** is optimal for large catalogs due to logarithmic scalability. For example, searching 1 million products requires only ~20 comparisons vs. 500,000 on average with linear search.
  + **Precondition**: Products must be sorted by productId. This is feasible during data ingestion or updates using efficient sorting algorithms (O(n log n)), which is amortized over many searches.