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:**

**Explain Big O notation and how it helps in analyzing algorithms.**

Big O notation is a mathematical representation used to describe the upper bound of an algorithm's runtime or space requirements in terms of the size of the input. It helps in analyzing and comparing the efficiency of algorithms by providing a high-level understanding of their behavior as the input size grows.

**Describe the best, average, and worst-case scenarios for search operations.**

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| --- | --- | --- |
| **Cases** | **Linear Search** | **Binary Search** |
| **Worst case** | O(n) | O(log n) |
| **Average case** | O(n) | O(log n) |
| **Best case** | O(1) | O(1) |

**Compare the time complexity of linear and binary search algorithms.**

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| --- | --- | --- |
| **Cases** | **Linear Search** | **Binary Search** |
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| **Best case** | O(1) | O(1) |

**Discuss which algorithm is more suitable for your platform and why.**

**Binary Search** is more suitable for the platform if the products array can be kept sorted or if the sorting overhead is manageable because it offers significantly better performance (O(log n)) compared to linear search (O(n)), especially for large datasets.

**Linear Search** can be used if the array is not sorted and the overhead of sorting is too high for the application, or if the array is small and the performance difference is negligible.