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

**1. Understand Asymptotic Notation**

**Big O Notation**

Big O notation is a mathematical representation used to describe the efficiency of an algorithm in terms of the time or space it requires relative to the input size. It provides an upper bound on the time complexity, allowing us to understand the worst-case scenario for the algorithm's performance.

**Best, Average, and Worst-Case Scenarios**

* **Best Case**: The scenario where the algorithm performs the minimum number of operations. For a search, this is often when the target element is at the beginning of the list.
* **Average Case**: The scenario that represents the typical behavior of the algorithm over a range of possible inputs. It averages the time over all possible cases.
* **Worst Case**: The scenario where the algorithm performs the maximum number of operations. For a search, this is often when the target element is not present or at the end of the list.

**4. Analysis**

**Time Complexity Comparison**

* **Linear Search**:
  + Best Case: O(1) (when the target is at the beginning of the array)
  + Average Case: O(n) (where n is the number of elements in the array)
  + Worst Case: O(n) (when the target is not found or at the end of the array)
* **Binary Search**:
  + Best Case: O(1) (when the target is at the middle of the array)
  + Average Case: O(log n) (due to the logarithmic halving of the search space)
  + Worst Case: O(log n) (when the target is not found)

**Suitable Algorithm for the Platform**

* **Binary Search** is more suitable for the platform if the products array is sorted by productId, as it significantly reduces the search time for large datasets due to its logarithmic time complexity.
* **Linear Search** can be used if the products array is unsorted or if the cost of maintaining a sorted array is too high, but it is generally less efficient for large datasets.

Given the typical size of an e-commerce platform's product inventory, binary search is the preferred choice for its superior performance in the average and worst-case scenarios, provided that the initial sorting of the array can be efficiently managed.