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

**1. Understand Asymptotic Notation:**

* **Big O Notation:**
  + Big O notation is used to describe the upper bound of an algorithm's running time in terms of input size.
  + It helps compare algorithm efficiency regardless of hardware or implementation.
  + It provides a standardized way to measure algorithm performance as data size grows.
* **Best, Average, and Worst-Case Scenarios:**
  + **Best Case:** The search finds the item on the first attempt (O(1) for linear search).
  + **Average Case:** The search takes a middle number of steps, usually O(n/2) for linear search and O(log n) for binary search.
  + **Worst Case:** The item is not present or is found after scanning the entire input. For linear search, it is O(n); for binary search, it is O(log n).

**4. Analysis:**

* **Time Complexity Comparison:**
  + **Linear Search:** O(n) in worst case; suitable for unsorted data.
  + **Binary Search:** O(log n) in all cases (except best-case O(1)); requires the data to be sorted.
* **Most Suitable Algorithm:**
  + **Binary Search** is more suitable if the product catalog is sorted by product ID or name.
  + It significantly reduces search time, especially for large datasets.
  + For dynamic and unsorted data, linear search may be used temporarily, but sorting the data and applying binary search or indexing is ideal for scalable platforms.