**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:**

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

**Answer:**

* Big O notation is a mathematical notation that describes the complexity of an algorithm, which is the amount of time or space it requires as the size of the input increases. It's used to classify algorithms according to how their run time or space requirements grow as the input size grows.
* Big O notation helps in analyzing algorithms by providing an upper bound on the number of steps an algorithm takes to complete. This allows us to compare the efficiency of different algorithms and predict how they will perform on large inputs.

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

**Answer:**

**Best-case scenario:** The item is found at the first position in the search space. This is the most optimistic scenario.

**Average-case scenario:** The item is found at a random position in the search space. This is the most realistic scenario.

**Worst-case scenario:** The item is found at the last position in the search space or is not found at all. This is the most pessimistic scenario.

**4. Analysis:**

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

**Answer:**

**Linear Search:** O(n), where n is the number of products. This is because we need to iterate through each product in the worst-case scenario.

**Binary Search:** O(log n), where n is the number of products. This is because we divide the search space in half with each iteration.

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

**Answer:**

Based on the requirements of the e-commerce platform, binary search is more suitable for the following reasons:

* **Large dataset:** The platform is expected to handle a large number of products, making binary search a more efficient choice.
* **Frequent searches:** The platform is expected to handle a high volume of searches, making binary search a more suitable choice due to its faster search time.
* **Sorted dataset:** The platform can maintain a sorted dataset of products, which is a requirement for binary search.