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

1. **Understanding Asymptotic Notation:**

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

**Ans)** Big O notation is a mathematical notation used to describe the upper bound of an algorithm’s running time or space requirements relative to the size of the input. It helps in analyzing and comparing the efficiency of algorithms, particularly in worst-case scenarios with large input sizes.

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

**Ans)**

**Best Case**: The minimum time an algorithm can take to complete, usually under ideal conditions.

**Average Case**: The expected time taken by an algorithm, considering all possible inputs.

**Worst Case**: The maximum execution time taken by an algorithm under the most unfavorable conditions.

1. **Analysis:**

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

**Ans)**

**Linear Search**:

**Best Case**: O(1) – The element is at the first position.

**Average Case**: O(n) – On average, it may need to traverse half the array.

**Worst Case**: O(n) – The element is at the last position or not present at all.

**Binary Search**:

**Best Case**: O(1) – The element is at the middle position.

**Average Case**: O(log n) – The search space halves with each step.

**Worst Case**: O(log n) – The element is at the last possible position or not present at all.

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

**Ans)** Binary search is more suitable for an e-commerce platform if the product list is sorted. Its logarithmic time complexity makes it significantly faster than the linear time complexity of linear search for larger datasets. However, binary search requires the array to be sorted, which incurs additional costs in maintaining the sorted order, especially when frequent additions and deletions occur.