**1. Understanding Asymptotic Notation:**

**Big O Notation (O-notation):**

Big O notation provides a way to express the upper bound (worst-case) of an algorithm’s time complexity.

It abstracts away machine-specific constants and focuses on how the algorithm’s efficiency changes as the input size grows.

For example, if an algorithm has a time complexity of

O(n^2)O(n2) ,it means that its execution time grows quadratically with the input size.

**Best, Average, and Worst-Case Scenarios for Search Operations:**

In search algorithms, we analyze different scenarios:

**Best Case:** The most favorable scenario (e.g., finding the desired item in the first attempt).

**Average Case:** Considering all possible inputs, what performance can we expect on average?

**Worst Case:** The scenario where the algorithm performs the slowest (e.g., linearly searching through the entire list).

For search operations, we aim to optimize the worst-case scenario.

**2. Setting Up:**

* Create a Product class with attributes like productId, productName, and category.
* These attributes will be crucial for efficient searching.

**3. Implementation:**

**Linear Search:**

In linear search:

Start from the beginning of the list.

Compare each item with the target until a match is found or the end of the list is reached.

Time complexity: O(n)O(n)

(linear).

Store products in an array (unsorted) for linear search.

**Binary Search:**

In binary search (requires a sorted list):

Divide the list in half and compare the middle element with the target.

If the middle element matches, we’re done.

Otherwise, narrow down the search to the left or right half.

Repeat until the target is found or the search range becomes empty.

Time complexity: O(log n)O(logn)

(logarithmic).

Store products in a sorted array for binary search.

**4. Analysis:**

**Time Complexity Comparison:**

Linear search:

O(n)O(n)

(slower for large lists).

Binary search:

O(\log n)O(logn)

(much faster due to halving the search space).

**Suitability for Your Platform:**

Choose binary search if your platform has a large inventory (many products).

Linear search is acceptable for smaller inventories.