**Cognizant Deep Nurture 4.0 – Data Structures and Algorithms**  
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**Exercise 2: E-commerce Platform Search Function – Theoretical**

**1. Understanding Asymptotic Notation**

* Big O notation is used to describe the performance of an algorithm in terms of input size n, representing its time or space complexity.
* It provides an upper bound on the running time, helping evaluate scalability and efficiency of code.

**Complexity Case’s for Search Algorithms:**

* **Best Case:** The item is found at the beginning of the dataset.
* **Average Case:** The item is located somewhere in the middle.
* **Worst Case:** The item is not present or is found at the end of the dataset.

**4. Analysis of Search Algorithms**

* **Linear Search:**
  + Searches each element one-by-one.
  + Time Complexity:
    - Best Case: **O(1)**
    - Average/Worst Case: **O(n)**
  + Suitable for **unsorted** datasets or small data dataset.
* **Binary Search:**
  + Operates on **sorted arrays**, repeatedly dividing the dataset using pointers.
  + Time Complexity:
    - Best Case: **O(1)**
    - Average/Worst Case: **O(log n)**
  + Ideal for **large, sorted datasets** where performance is critical.

**Comparison and Recommendation**

* Binary search is significantly faster for larger datasets, but it requires sorting.
* Linear search is more flexible but less efficient as data size increases.
* For an e-commerce platform with frequent product lookups and large inventories, **binary search** is recommended, assuming data is pre-sorted or indexed.