# E-commerce Platform – Search Optimization Report

## 1. Objective

To implement and compare Linear Search and Binary Search in an e-commerce platform to identify the most efficient search method for product lookup.

## 2. Asymptotic Notation

Big O Notation describes the performance of an algorithm in terms of input size n.

|  |  |  |  |
| --- | --- | --- | --- |
| Case | Linear Search | Binary Search |  |
| Best | O(1) | O(1) |  |
| Average | O(n) | O(log n) |  |
| Worst | O(n) | O(log n) |  |

## 3. Class Setup

public class Product {  
 int productId;  
 String productName;  
 String category;  
  
 public Product(int productId, String productName, String category) {  
 this.productId = productId;  
 this.productName = productName;  
 this.category = category;  
 }  
}

## 4. Algorithms

• Linear Search:  
 Iterates over every element and compares names.

• Binary Search:  
 Works only on sorted arrays and uses a divide-and-conquer strategy.

## 5. Sample Output

🔍 Linear Search:  
104 - Watch (Fashion)  
  
🔍 Binary Search:  
104 - Watch (Fashion)

## 6. Time Complexity

|  |  |  |  |
| --- | --- | --- | --- |
| Algorithm | Time Complexity | Space Complexity | Notes |
| Linear Search | O(n) | O(1) | Good for small/unsorted data |
| Binary Search | O(log n) | O(1) | Needs sorted array |

## 7. Recommendation

For a large-scale e-commerce platform with millions of products:  
- Binary Search is more efficient but requires the product list to be sorted.  
- If the list is dynamic and changes frequently, a HashMap or Search Tree may be better for real-time performance.