## Exercise 2: E-commerce Platform Search Function: CODE: Product.java

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;

}

@Override

public String toString() {

return "ID: " + productId + ", Name: " + productName + ", Category: " + category;

}

}

**SearchFunctions.java**

import java.util.Arrays;

import java.util.Comparator;

public class SearchFunctions {

// Linear search by product name

public static Product linearSearch(Product[] products, String name) {

for (Product p : products) {

if (p.productName.equalsIgnoreCase(name)) {

return p;

}

}

return null;

}

// Binary search by product name (requires sorted array)

public static Product binarySearch(Product[] products, String name) {

int left = 0;

int right = products.length - 1;

while (left <= right) {

int mid = (left + right) / 2;

int compare = name.compareToIgnoreCase(products[mid].productName);

if (compare == 0) return products[mid];

else if (compare < 0) right = mid - 1;

else left = mid + 1;

}

return null;

}

// Sort products by name (used before binary search)

public static void sortByName(Product[] products) {

Arrays.sort(products, Comparator.comparing(p -> p.productName.toLowerCase()));

}

}

**Main.java**

public class Main {

public static void main(String[] args) {

Product[] products = {

new Product(101, "Laptop", "Electronics"),

new Product(102, "Shoes", "Fashion"),

new Product(103, "Phone", "Electronics"),

new Product(104, "T-shirt", "Fashion"),

};

// Linear Search

Product result1 = SearchFunctions.linearSearch(products, "Phone");

System.out.println("Linear Search Result: " + (result1 != null ? result1 : "Product not found"));

// Binary Search

SearchFunctions.sortByName(products); // sort first

Product result2 = SearchFunctions.binarySearch(products, "Phone");

System.out.println("Binary Search Result: " + (result2 != null ? result2 : "Product not found"));

}

}

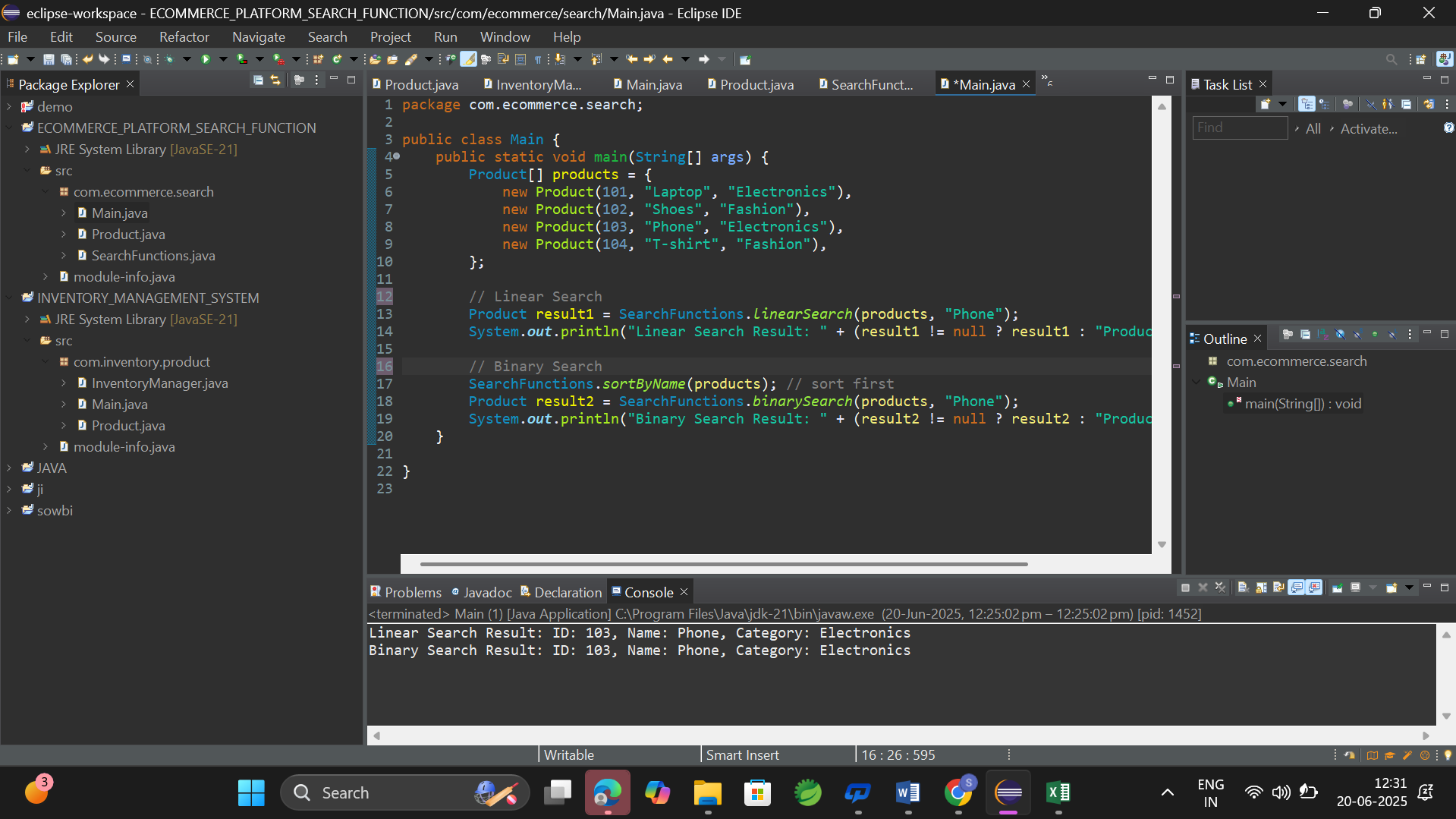
**Analysis:**

**Time Complexity:**

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

**Which is More Suitable for E-Commerce Search?**

* **Binary Search is more suitable** when:
  + Data is **pre-sorted** (or you sort once at load time).
  + **Speed** is important (large product database).
* **Linear Search is simpler** and better for:
  + **Small datasets**.
  + **Unsorted** or dynamically changing arrays.

**OUTPUT:  
**