Exercise 2: E-commerce Platform Search Function

Code:

Product.java

```
public class Product {
   private int productId;
   private String productName;
   private String category;

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

   public int getProductId() {
      return productId;
   }

   public String getProductName() {
      return productName;
   }

   public String getCategory() {
      return category;
   }

   @Override
   public String toString() {
      return "[" + productId + "] " + productName + " (" + category + ")";
   }

}
```

SearchTest.java:

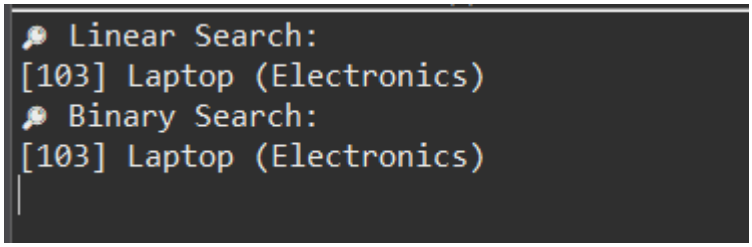
```
public class SearchTest {

  public static void main(String[] args) {
   Product[] products = {
          new Product(101, "Shoes", "Footwear"),
          new Product(102, "T-shirt", "Clothing"),
          new Product(103, "Laptop", "Electronics"),
          new Product(104, "Mobile", "Electronics"),
          new Product(105, "Socks", "Footwear")
       };

       String searchTarget = "Laptop";
       System.out.println(“Linear Search:");
       Product result1 = SearchUtility.linearSearch(products, searchTarget);
```

```
        System.out.println(result1 != null ? result1 : "Product not found.");

        System.out.println("Binary Search:");
        Product result2 = SearchUtility.binarySearch(products, searchTarget);
        System.out.println(result2 != null ? result2 : "Product not found.");

    }

}
```

SearchUtility.java

```
import java.util.*;
public class SearchUtility {
    public static Product linearSearch(Product[] products, String name) {
        for (Product product : products) {
            if (product.getProductName().equalsIgnoreCase(name)) {
                return product;
            }
        }
        return null;
    }

    public static Product binarySearch(Product[] products, String name) {
        Arrays.sort(products, Comparator.comparing(Product::getProductName));
        int low = 0, high = products.length - 1;

        while (low <= high) {
            int mid = (low + high) / 2;
            int comparison = name.compareToIgnoreCase(products[mid].getProductName());

            if (comparison == 0) {
                return products[mid];
            } else if (comparison < 0) {
                high = mid - 1;
            } else {
                low = mid + 1;
            }
        }
        return null;
    }

}
```

OUTPUT:



Exercise 7: Financial Forecasting

Code:

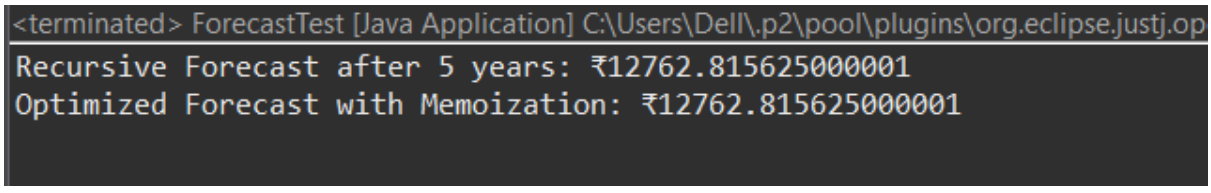
FinancialForecaster.java

```
public class FinancialForecaster {
   public static double forecastRecursive(double presentValue, double growthRate, int years) {
      if (years == 0) return presentValue;
      return (1 + growthRate) * forecastRecursive(presentValue, growthRate, years - 1);
   }

   // Optimized version using memoization
   public static double forecastMemo(double presentValue, double growthRate, int years, Double[]
memo) {
      if (years == 0) return presentValue;
      if (memo[years] != null) return memo[years];

      memo[years] = (1 + growthRate) * forecastMemo(presentValue, growthRate, years - 1, memo);
      return memo[years];
   }

}
```

ForecastTest.java

```
public class ForecastTest {

   public static void main(String[] args) {
      double presentValue = 10000.0;
      double growthRate = 0.05;
      int years = 5;

      double forecast = FinancialForecaster.forecastRecursive(presentValue, growthRate, years);
      System.out.println("Recursive Forecast after " + years + " years: ₹" + forecast);

      Double[] memo = new Double[years + 1];
      double forecastMemoized = FinancialForecaster.forecastMemo(presentValue, growthRate, years,
memo);
      System.out.println("Optimized Forecast with Memoization: ₹" + forecastMemoized);

   }

}
```

OUTPUT:



Exercise 1: Implementing the Singleton Pattern

Code:
SingletonPattern.java

```
public class SingletonPattern {

        public static void main(String[] args) {
                Logger logger1 = Logger.getInstance();
    logger1.display("Message from logger1");

    Logger logger2 = Logger.getInstance();
    logger2.display("Message from logger2");

    if (logger1 == logger2) {
      System.out.println("Same Logger instance used (Singleton verified).");
    } else {
      System.out.println("Different Logger instances (Singleton failed).");
    }

        }

}
```

Logger.java

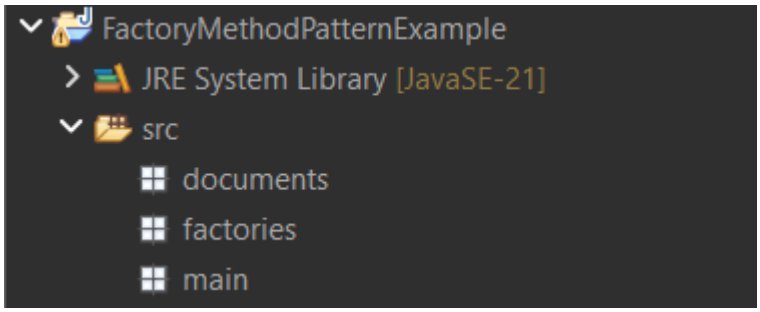
```
public class Logger {
 private static Logger logger=null;
 private Logger() {

 }
 public static Logger getInstance() {
  if(logger==null) {
   logger=new Logger();
  }
  return logger;
 }
 public void display(String str) {
  System.out.println(str);
 }

}
```

OUTPUT:

```
Message from logger1
Message from logger2
Same Logger instance used (Singleton verified).
```

Exercise 2: Implementing the Factory Method Pattern

File Structure:



Code:

Documents Package:

Document.java

```
package documents;

public interface Document {
 public void open();

}
```

ExcelDocument.java

```
package documents;

public class ExcelDocument implements Document  {
   @Override
   public void open() {
      System.out.println("Opening Excel document.");
   }

}
```

PdfDocument.java

```
package documents;

public class PdfDocument implements Document{
  @Override
    public void open() {
       System.out.println("Opening PDF document.");
    }

}
```

WordDocument.java

```
package documents;

public class WordDocument implements Document{
```

```
  @Override
  public void open() {
    System.out.println("Opening Word document.");
  }

}
```

Factories Package:

DocumentFactory.java

```
package factories;

import documents.Document;

public abstract class DocumentFactory {
 public abstract Document createDocument();

}
```

PdfDocumentFactory.java

```
package factories;

import documents.Document;
import documents.PdfDocument;

public class PdfDocumentFactory  extends DocumentFactory{
  @Override
  public Document createDocument() {
    return new PdfDocument();
  }

}
```

ExcelDocumentFactory.java

```
package factories;

import documents.Document;
import documents.ExcelDocument;

public class ExcelDocumentFactory extends DocumentFactory{
  @Override
  public Document createDocument() {
    return new ExcelDocument();
  }

}
```

WordDocumentFactory.java

```
package factories;

import documents.Document;
```

```
import documents.WordDocument;

public class WordDocumentFactory extends DocumentFactory{
  @Override
  public Document createDocument() {
    return new WordDocument();
  }

}
```

Main Package:

FactoryMethodTest.java

```
package main;

import documents.Document;
import factories.DocumentFactory;
import factories.ExcelDocumentFactory;
import factories.PdfDocumentFactory;
import factories.WordDocumentFactory;

public class FactoryMethodTest {

 public static void main(String[] args) {
   DocumentFactory wordFactory = new WordDocumentFactory();
      Document word = wordFactory.createDocument();
      word.open();

      DocumentFactory pdfFactory = new PdfDocumentFactory();
      Document pdf = pdfFactory.createDocument();
      pdf.open();

      DocumentFactory excelFactory = new ExcelDocumentFactory();
      Document excel = excelFactory.createDocument();
      excel.open();
 }

}
```

OUTPUT: