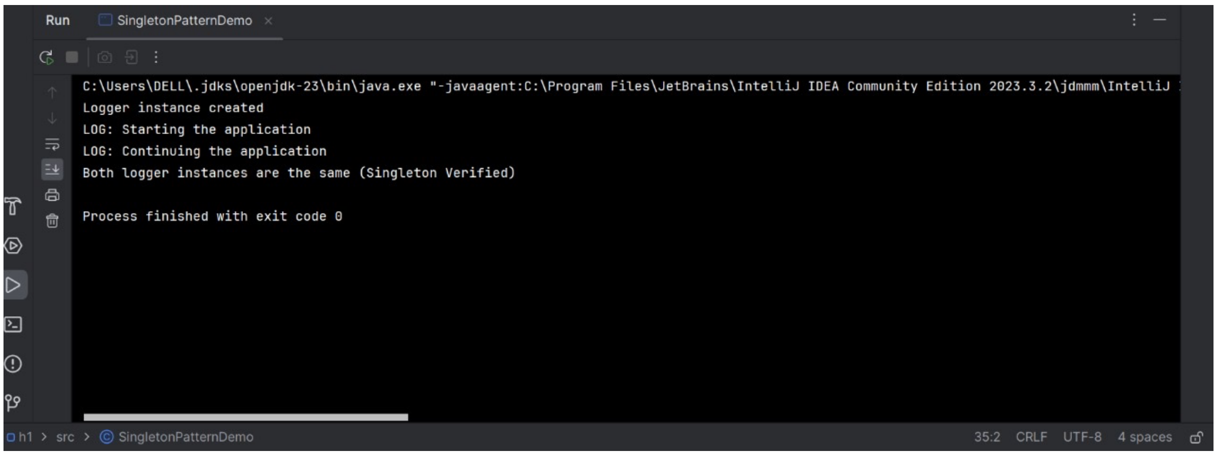
DESIGN PATTERN AND PRINCIPLES

Exercise 1: Implementing the Singleton pattern

```
 public class SingletonPatternExample { static
 class Logger {
    private static Logger instance;

    private Logger() {
        System.out.println("Logger instance created");
    }

        public static Logger getInstance()
        { if (instance == null) {
            instance = new Logger();
        }
        return instance;
    }

        public void log(String message)
        { System.out.println("LOG: " + message);
    }
 }

    public static void main(String[] args)
    { Logger logger1 = Logger.getInstance();
    logger1.log("Starting ");

    Logger logger2 = Logger.getInstance();
    logger2.log("Continuing ");

        if (logger1 == logger2)
        { System.out.println("Singleton Verified ");
    } else {
        System.out.println("Different instances");
    }
 }
}
```

OUTPUT:



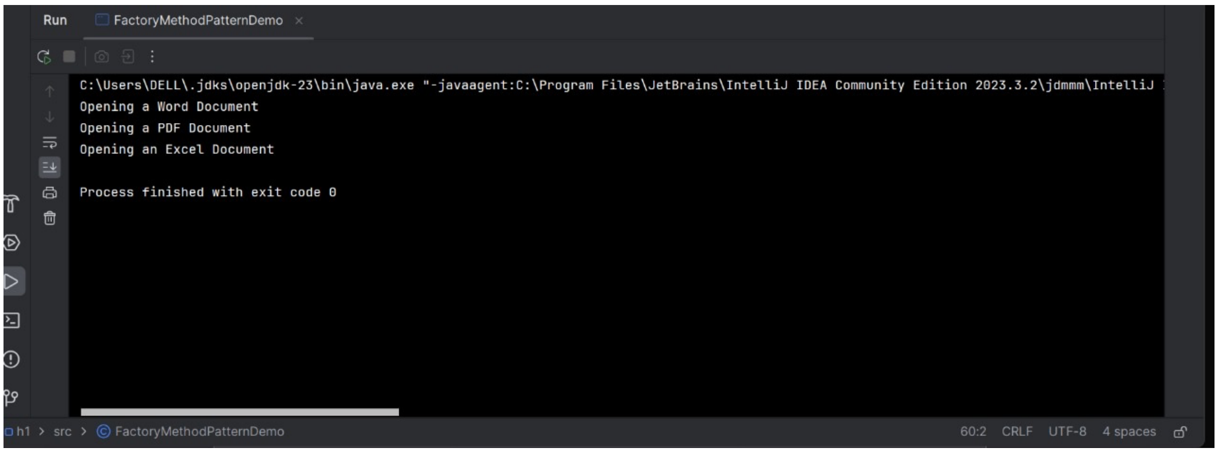
```
C:\Users\DELL\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.2\jdmmm\IntelliJ
Logger instance created
LOG: Starting the application
LOG: Continuing the application
Both logger instances are the same (Singleton Verified)

Process finished with exit code 0
```

Exercise 2: Implementing the Factory Method Pattern:

```
public class FactoryMethodPatternDemo {

      interface Document
      { void open();
   }

      static class WordDocument implements Document
      { public void open() {
         System.out.println("Word Document is being opened” );
      }
   }

      static class PdfDocument implements Document { public
      void open() {
         System.out.println("PDF Document is being opened”);
      }
   }

      static class ExcelDocument implements Document
      { public void open() {
         System.out.println(" Excel Document is being opened”);
      }
   }

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

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

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

      static class ExcelDocumentFactory extends DocumentFactory
      { public Document createDocument() {
         return new ExcelDocument();
      }
   }
```

```
    public static void main(String[] args) {

        DocumentFactory wordFactory = new WordDocumentFactory();
        Document wordDoc = wordFactory.createDocument();
        wordDoc.open();

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

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

OUTPUT:



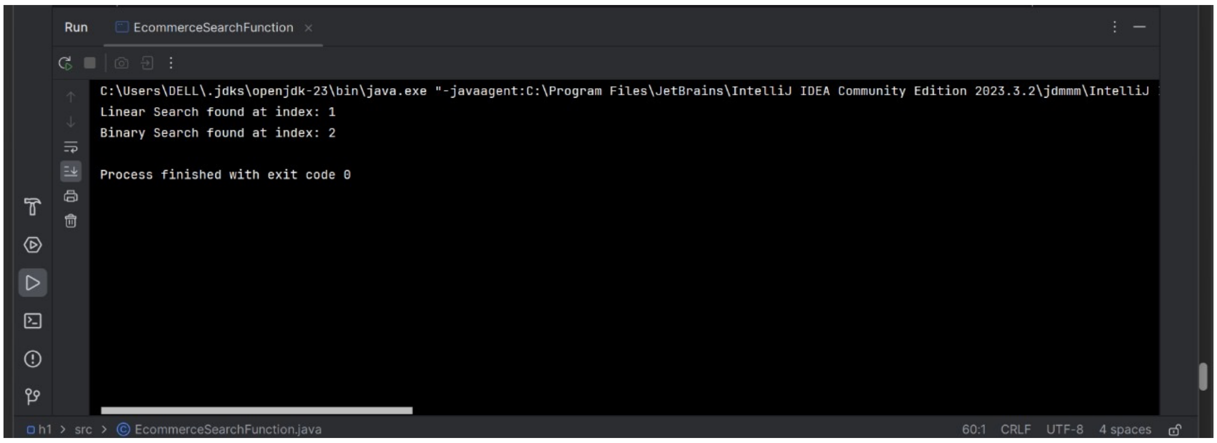
```
C:\Users\DELL\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.2\jdmmm\IntelliJ
Opening a Word Document
Opening a PDF Document
Opening an Excel Document

Process finished with exit code 0
```

DATA STRUCTURES AND ALGORITHMS:

Exercise 2: E-commerce Platform Search Function

```
import java.util.*;
class Product {
    int productId;
    String productName;
    String category;

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


class LinearSearch {
        static int search(Product[] products, String key) { for
        (int i = 0; i < products.length; i++) {
                if (products[i].productName.equalsIgnoreCase(key)) { return
                i;
            }
        }
        return -1;
    }
}

class BinarySearch {
    static int search(Product[] products, String key) {
        Arrays.sort(products, Comparator.comparing(p -> p.productName)); int left
        = 0, right = products.length - 1;
        while (left <= right) {
            int mid = (left + right) / 2;
            int comp = products[mid].productName.compareToIgnoreCase(key); if
            (comp == 0)
            return mid; else if
            (comp < 0)
            left = mid + 1; else
                right = mid - 1;
        }
        return -1;
    }
}

    public class EcommerceSearchFunction
    { public static void main(String[] args) {
        Product[] products = {
            new Product(101, "Laptop", "Electronics"),
            new Product(102, "Phone", "Electronics"),
            new Product(103, "Shoes", "Fashion"), new
            Product(104, "Book", "Stationery")
        };

        int i1 = LinearSearch.search(products, "Phone");
        System.out.println("Linear Search found at index: " + i1);

        int i2 = BinarySearch.search(products, "Phone");
        System.out.println("Binary Search found at index: " + i2);
    }
}
```

OUTPUT:

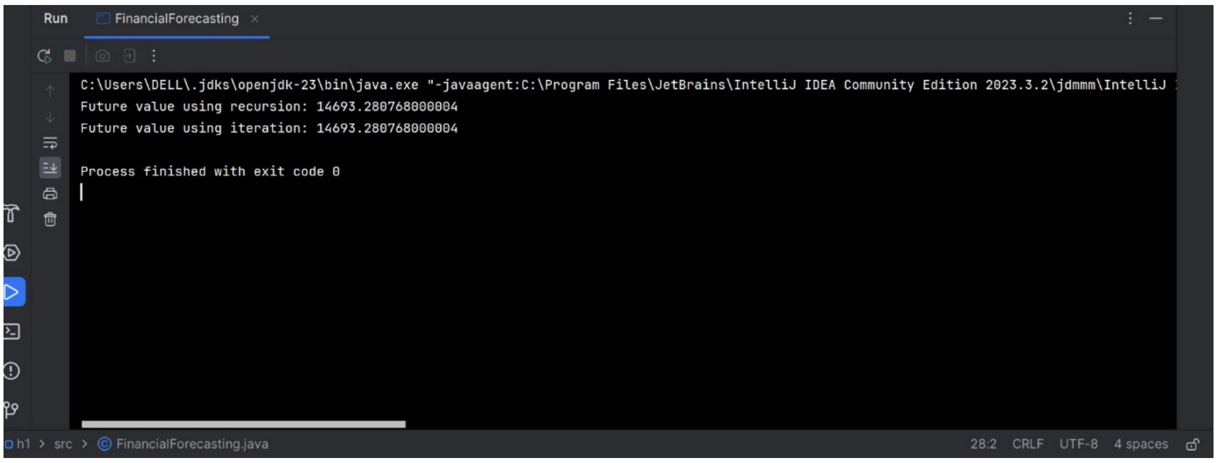


```
C:\Users\DELL\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.2\jdmmm\IntelliJ
Linear Search found at index: 1
Binary Search found at index: 2

Process finished with exit code 0
```

Exercise 7: Financial Forecasting

```
class Forecast {
        static double predictRecursive(double initial, double rate, int years) { if
        (years == 0)
            return initial;
        return predictRecursive(initial, rate, years - 1) * (1 + rate);
    }

        static double predictIterative(double initial, double rate, int years) { for
        (int i = 0; i < years; i++) {
            initial *= (1 + rate);
        }
        return initial;
    }
}

    public class FinancialForecasting
    { public static void main(String[] args) {
        double initialAmount = 10000; double
        annualGrowthRate = 0.08; int years =
        5;

double futureValueRecursive = Forecast.predictRecursive(initialAmount, annualGrowthRate,
years);
double futureValueIterative = Forecast.predictIterative(initialAmount, annualGrowthRate,
years);

        System.out.println("Future value using recursion: " + futureValueRecursive);
        System.out.println("Future value using iteration: " + futureValueIterative);
    }
}
```

OUTPUT:



```
C:\Users\DELL\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.2\jdmmm\IntelliJ
Future value using recursion: 14693.280768000004
Future value using iteration: 14693.280768000004

Process finished with exit code 0
```

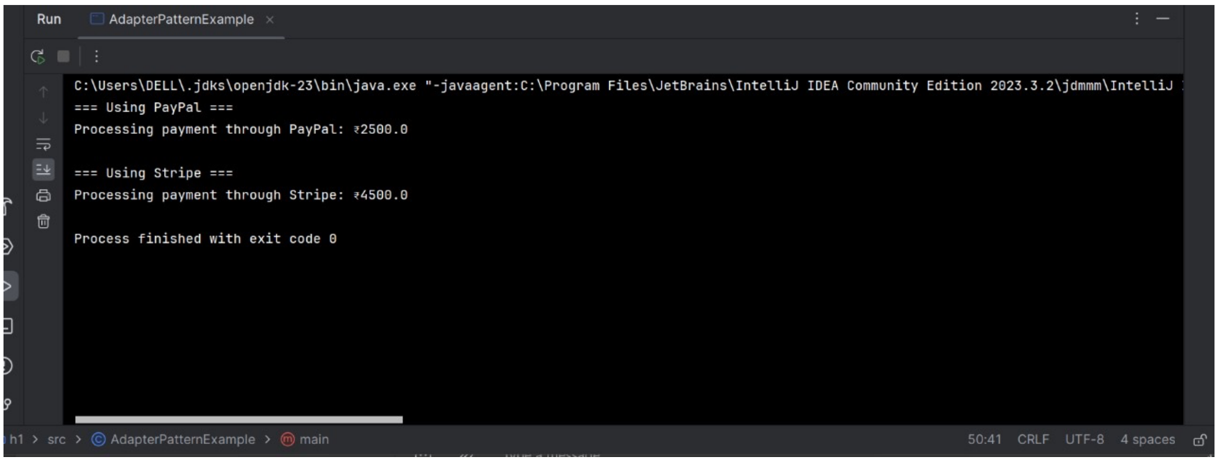
Additional:

Exercise 4: Implementing the Adapter Pattern

```
public class AdapterPatternExample {

    interface PaymentProcessor {
    void processPayment(double amount);
    }

    static class PayPalGateway {
    public void makePayment(double amount) {
    System.out.println("Processing payment through PayPal: ₹" + amount);
    }
    }

    static class StripeGateway {
    public void pay(double amountInINR) {
    System.out.println("Processing payment through Stripe: ₹" + amountInINR);
    }

    }


    static class PayPalAdapter implements PaymentProcessor {
    private PayPalGateway paypal;

    public PayPalAdapter() {
    this.paypal = new PayPalGateway();
    }

    public void processPayment(double amount) {
    paypal.makePayment(amount);
    }
    }
```

```
        static class StripeAdapter implements PaymentProcessor {
        private StripeGateway stripe;

        public StripeAdapter() {
        this.stripe = new StripeGateway();
        }

        public void processPayment(double amount) {
        stripe.pay(amount);
        }
        }
        public static void main(String[] args) {
        PaymentProcessor paypalProcessor = new PayPalAdapter();
        PaymentProcessor stripeProcessor = new StripeAdapter();

        System.out.println("=== Using PayPal ===");
        paypalProcessor.processPayment(2500.00);

        System.out.println("\n=== Using Stripe ===");
        stripeProcessor.processPayment(4500.00);
        }
}
```

OUTPUT:


Run
AdapterPatternExample
h1 > src > AdapterPatternExample > main
50:41 CRLF UTF-8 4 spaces

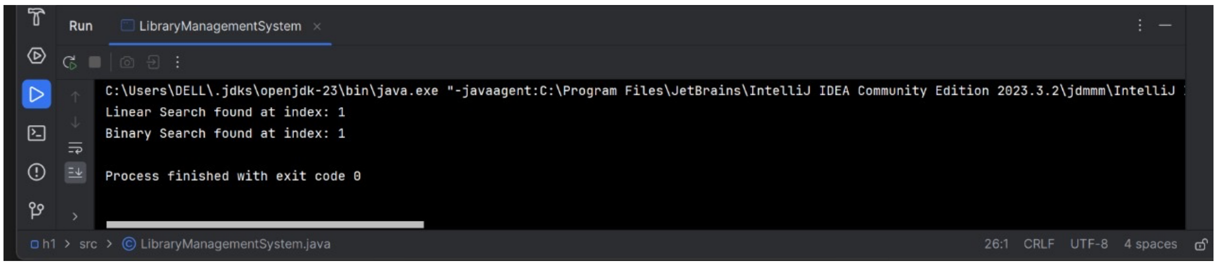
```
C:\Users\DELL\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.2\jdmmm\IntelliJ
=== Using PayPal ===
Processing payment through PayPal: ₹2500.0

=== Using Stripe ===
Processing payment through Stripe: ₹4500.0

Process finished with exit code 0
```

<u>Exercise 6: Library Management System</u>

```
import java.util.Arrays;
import java.util.Comparator;

class Book {

    int bookId;
    String title;
    String author;
```

```
        Book(int bookId, String title, String author)
        { this.bookId = bookId;
        this.title = title;
        this.author = author;
    }
}

class LinearSearch {
        static int search(Book[] books, String key)
        { for (int i = 0; i < books.length; i++) {
                if (books[i].title.equalsIgnoreCase(key))
                { return i;
            }
        }
        return -1;
    }
}

class BinarySearch {
    static int search(Book[] books, String key) {
        Arrays.sort(books, Comparator.comparing(b -> b.title.toLowerCase())); int left
        = 0, right = books.length - 1;
        while (left <= right) {
            int mid = (left + right) / 2;
            int cmp = books[mid].title.compareToIgnoreCase(key); if
            (cmp == 0)
            return mid; else if
            (cmp < 0)
            left = mid + 1; else
                right = mid - 1;
        }
        return -1;
    }
}

    public class LibraryManagementSystem
    { public static void main(String[] args) {
        Book[] books = {
            new Book(1, "The Alchemist", "Paulo Coelho"), new
            Book(2, "Clean Code", "Robert Martin"),


            new Book(3, "1984", "George Orwell"),
            new Book(4, "To Kill a Mockingbird", "Harper Lee")
        };

        int i1 = LinearSearch.search(books, "Clean Code");
        System.out.println("Linear Search found at index: " + i1);

        int i2 = BinarySearch.search(books, "Clean Code");
        System.out.println("Binary Search found at index: " + i2);
    }
}
```

OUTPUT:



```
C:\Users\DELL\.jdks\openjdk-23\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.2\jdmmm\IntelliJ
Linear Search found at index: 1
Binary Search found at index: 1

Process finished with exit code 0
```