LAB RECORD

23CSE111- Object Oriented Programming

Submitted by

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BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

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BONAFIDE CERTIFICATE

This is to certify that the Lab Record work for 23CSE111-Object Oriented Programming Subject submitted by ***CH.SC.U4CSE24015 – S DEEPAK BHARATHWAJ*** in **"Computer Science and Engineering"** is a Bonafide record of the work carried out under my guidance and supervision at Amrita School of Computing, Chennai.

This Lab examination held on / /2025

Internal Examiner 1 Internal Examiner 2

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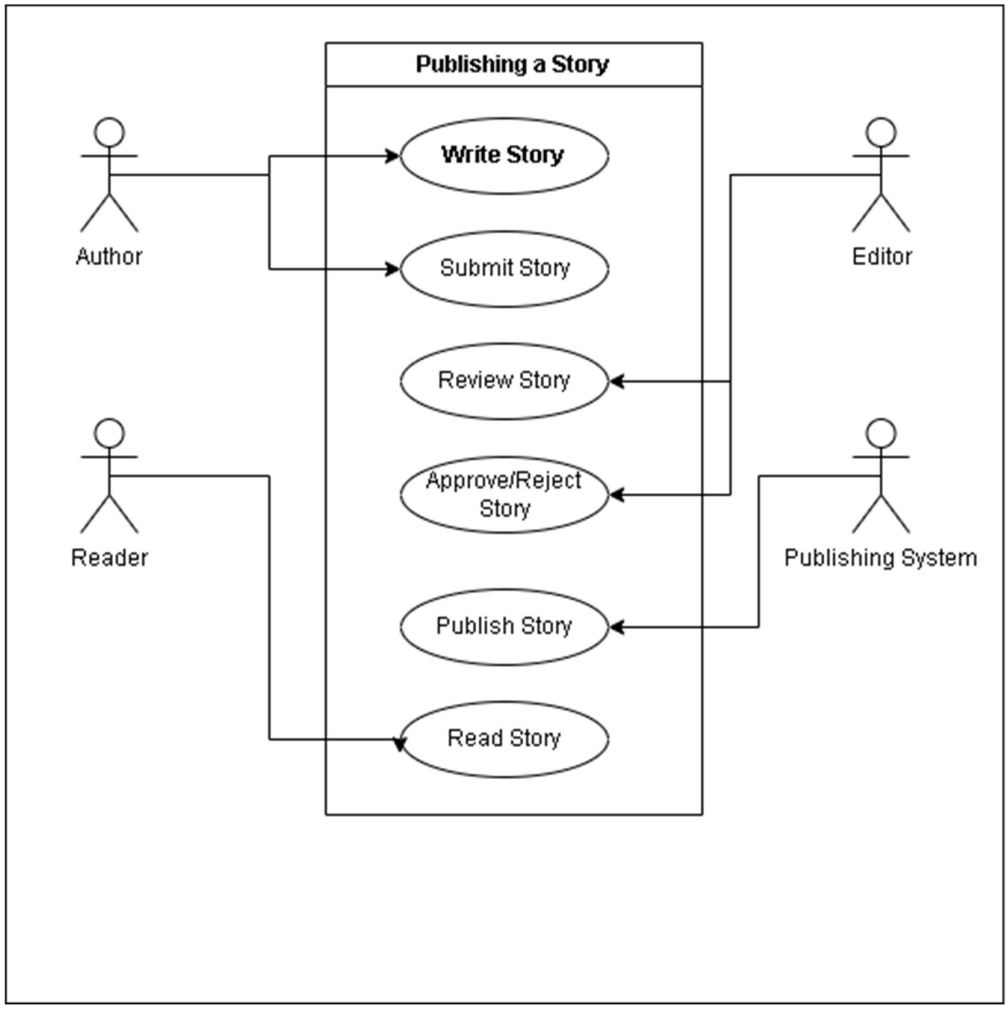
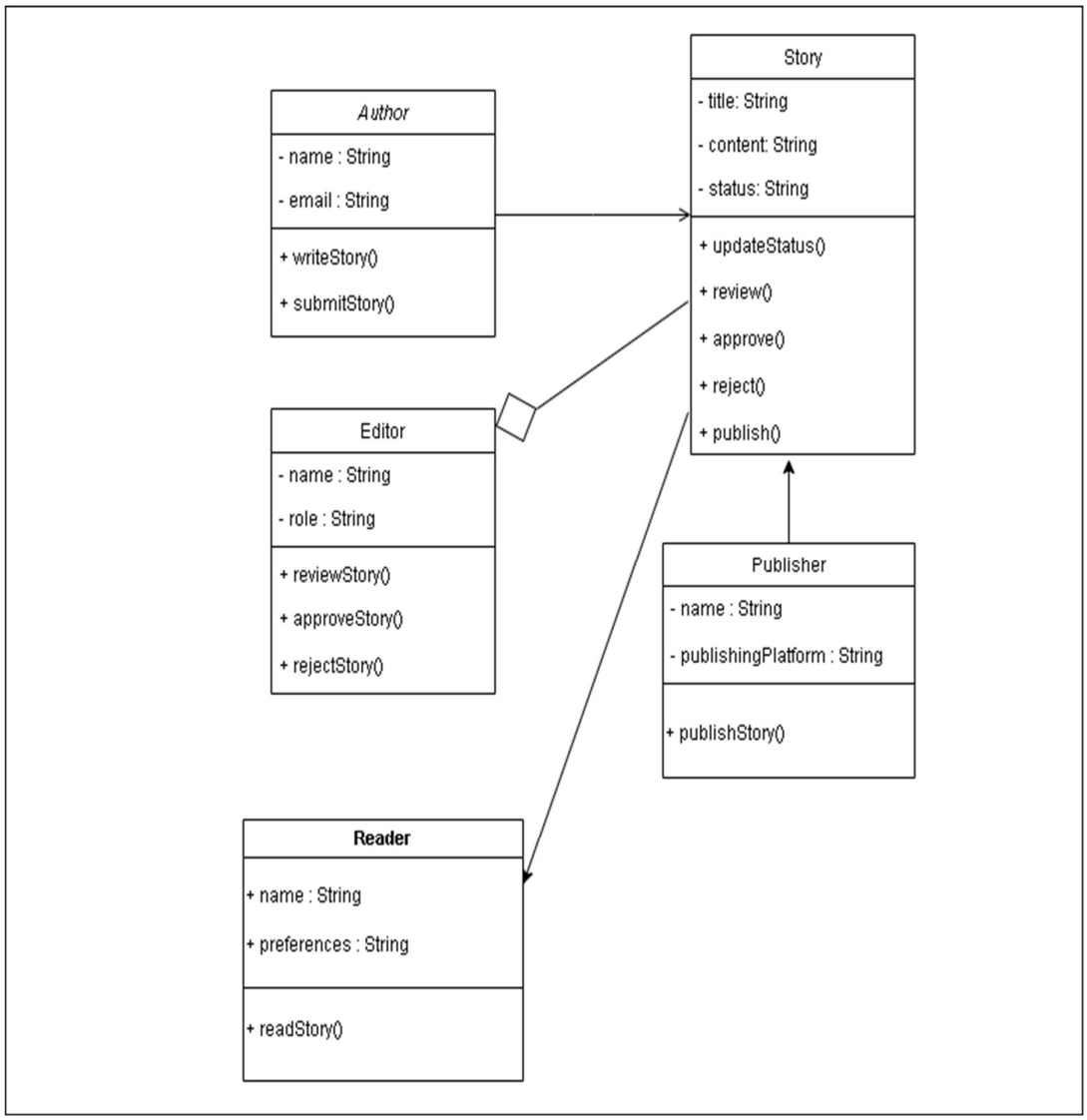
UML Diagrams

1) Publish a Story

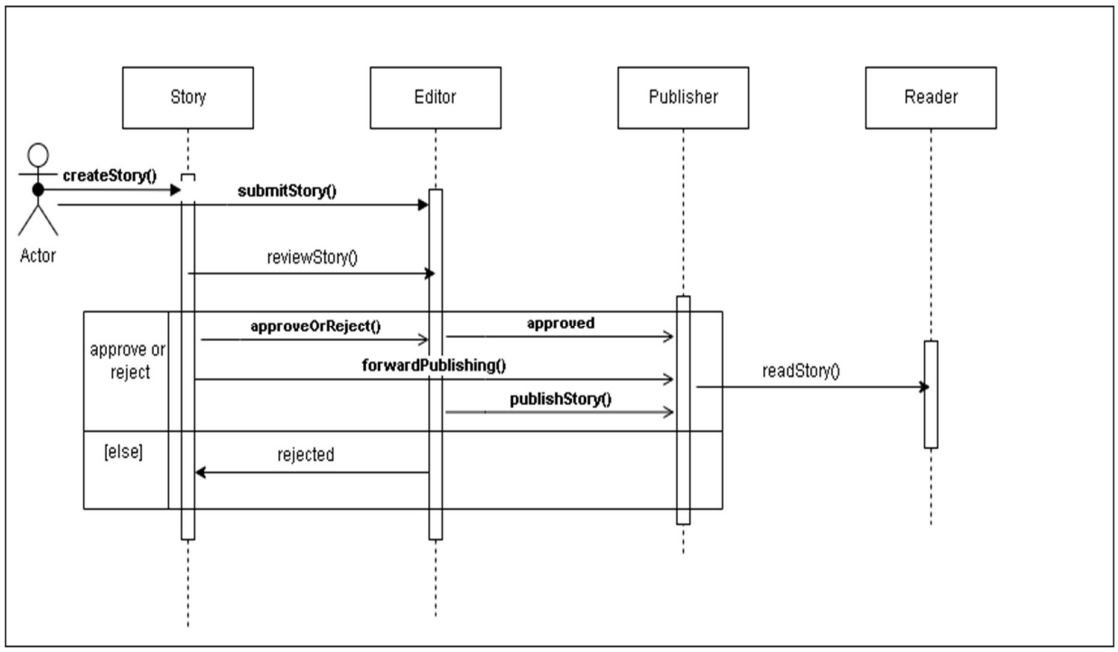
a) Use Case :



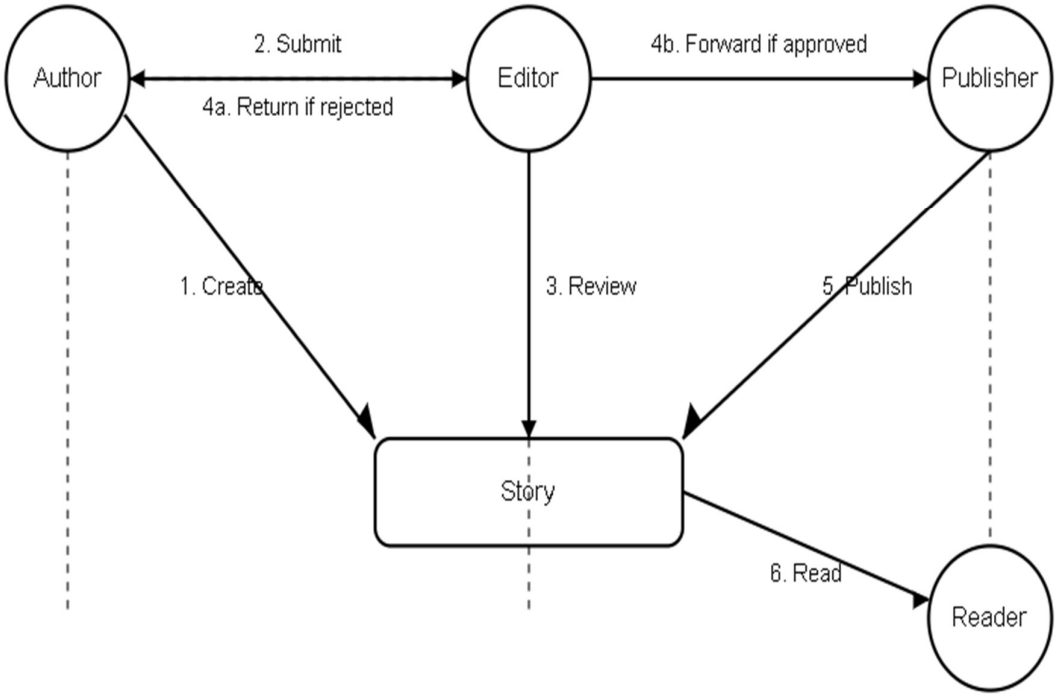
b) Class :


Author
- name : String
- email : String
+ writeStory()
+ submitStory()
Story
- title: String
- content: String
- status: String
+ updateStatus()
+ review()
+ approve()
+ reject()
+ publish()
Editor
- name : String
- role : String
+ reviewStory()
+ approveStory()
+ rejectStory()
Publisher
- name : String
- publishingPlatform : String
+ publishStory()
Reader
+ name : String
+ preferences : String
+ readStory()

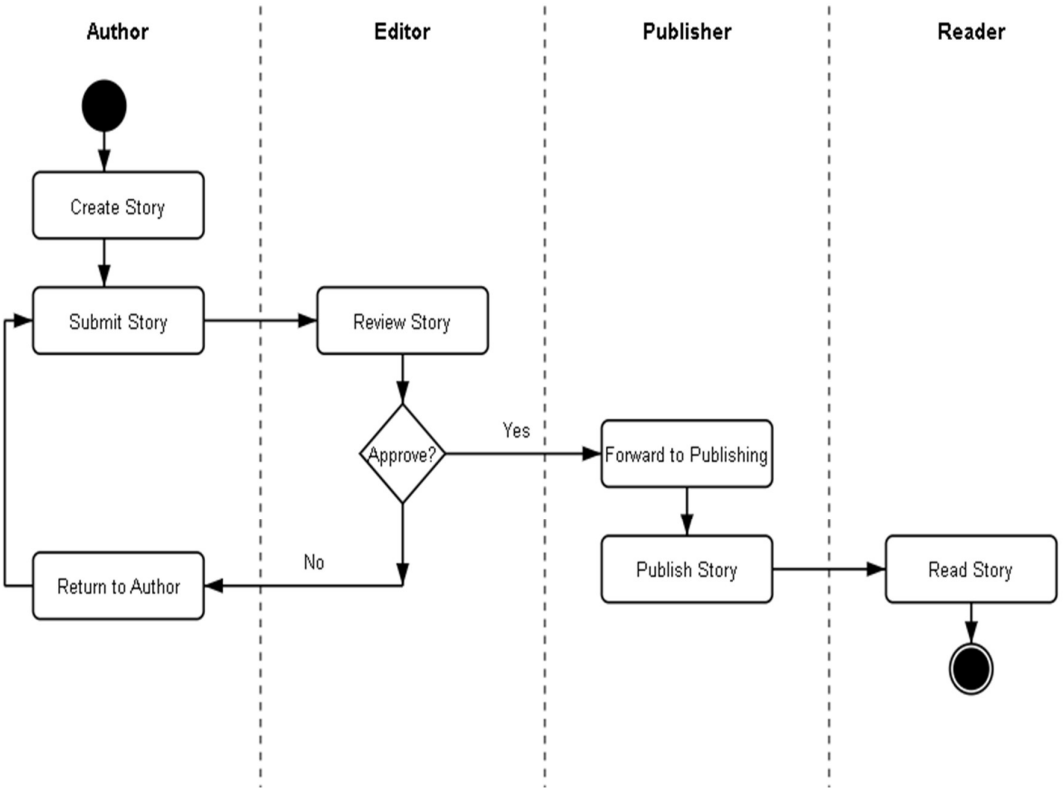
c) Sequence



d) Collaboration :

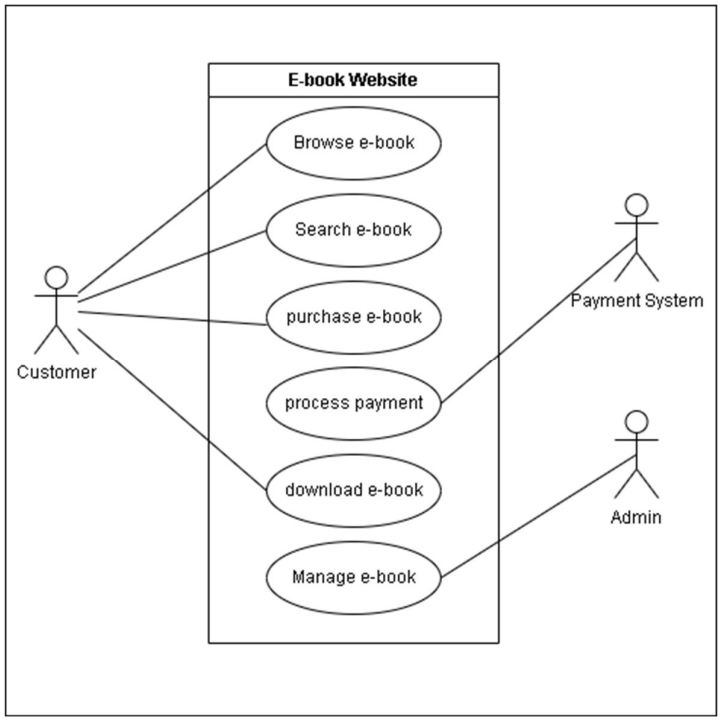


e) Activity :

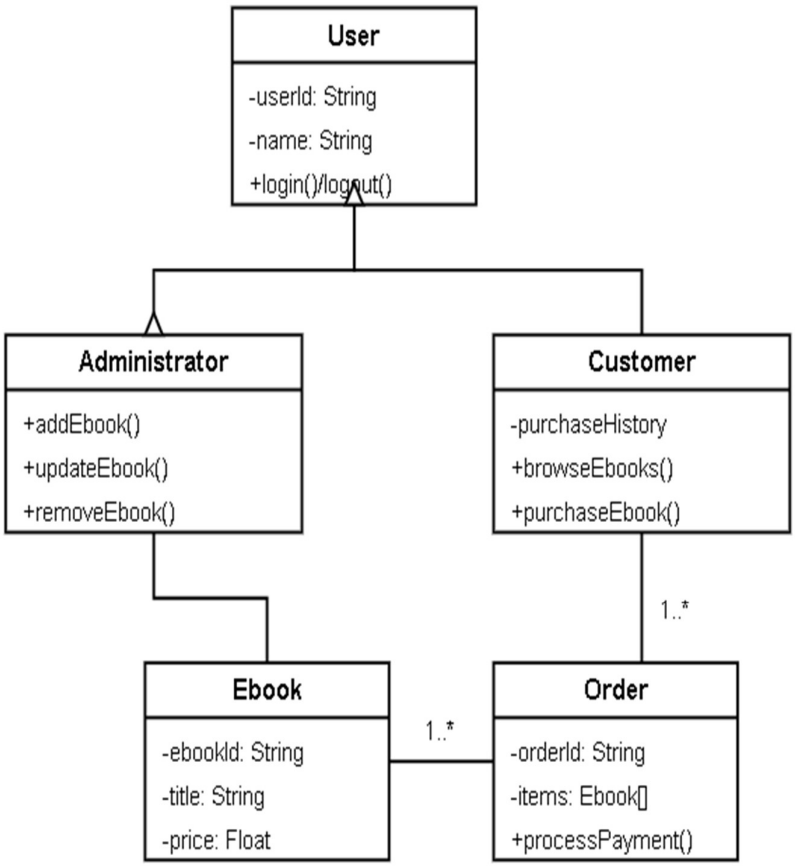


2) Online BookStore

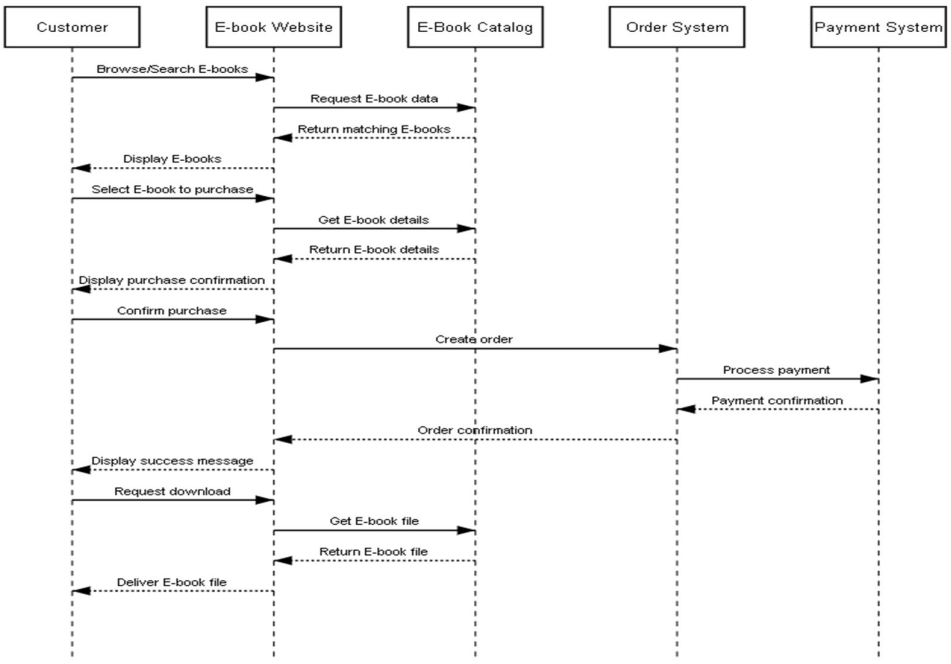
a) Use Case :



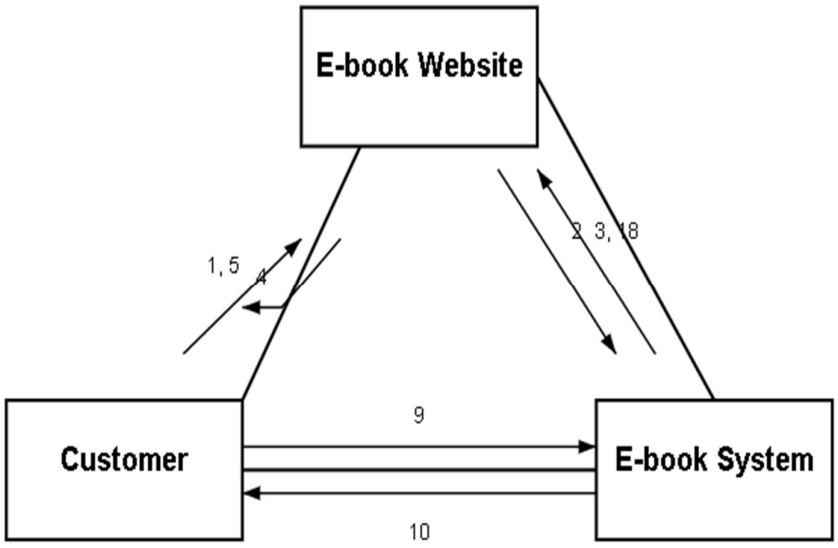
b) Class :



c) Sequence :



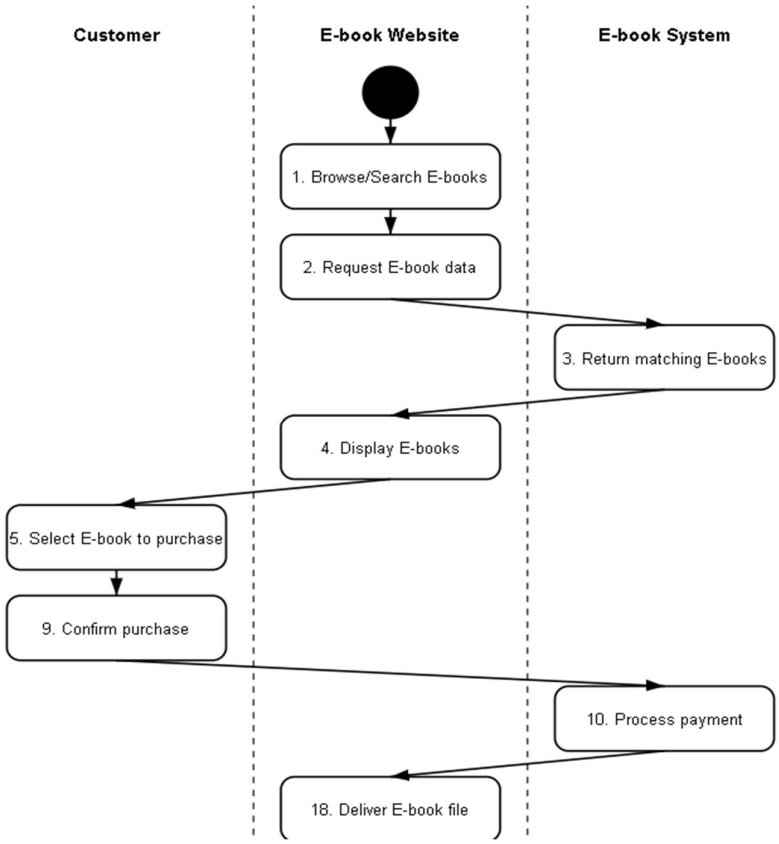
d) Collaboration :



Message Key:

1: Browse/Search E-books
2: Request E-book data
3: Return matching E-books
4: Display E-books
5: Select E-book to purchase
9: Confirm purchase
10: Process payment
18: Deliver E-book file

e) Activity :



3. Basic Java Programs

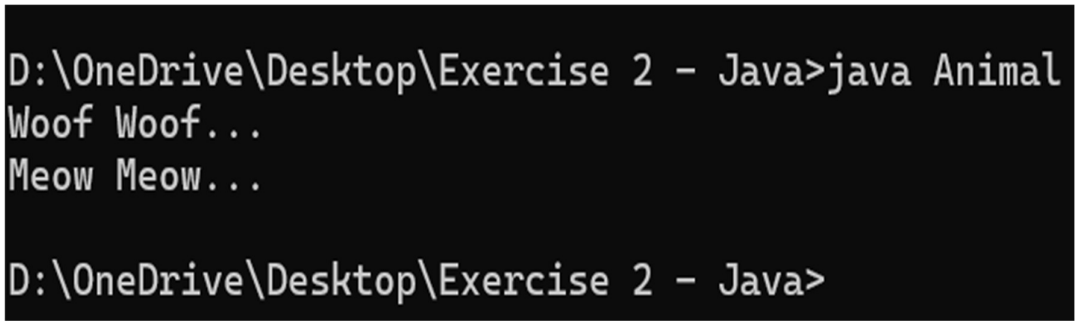
3a) Animal

CODE :

```
class dog extends Animal{
   @Override
   void make_sound(){
      System.out.println("Woof Woof...");
}
}

class cat extends Animal{
   @Override
   void make_sound(){
      System.out.println("Meow Meow...");
   }
```

```
}

public class Animal {

   void make_sound(){
      System.out.println("Sound...");
   }

   public static void main(String[] args) {
      Animal woof = new dog();
      Animal meow = new cat();
      woof.make_sound();
      meow.make_sound();
   }
    }
```

OUTPUT:



3b) Building

CODE :

```
class apartment extends Building{
   int no_of_apartments;
}

class house extends Building{
   int house;
}

public class Building {
    int floor;
```

```
  public static void main(String[] args) {
    house hou = new house();
    Building h = new house();
    apartment a = new apartment();
    System.out.println("number of floors in this floor is : "+(h.floor=10));
    System.out.println("number of apartments is : "+(a.no_of_apartments=10));
    System.out.println("number of houses in these apartments is : "+(hou.house=100));
  }
   }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java Building
number of floors in this floor is : 10
number of apartments is : 10
number of houses in these apartments is : 100

D:\OneDrive\Desktop\Exercise 2 - Java>
```

3c) Palindrome

CODE :

```
    import java.util.Scanner;
class palindrome {
 public static void main(String[] args) {
  Scanner obj = new Scanner(System.in);
  System.out.println("Enter the number :");
  int num = obj.nextInt();

  int temp = num;
  int rev=0;

  while(num>0) {
  int dig=num%10;
  rev=rev*10+dig;
  num=num/10;
  }

  if(temp == rev) {
```

```
   System.out.println("The number "+rev+" is a palindrome!");
   }
   else{
   System.out.println("The number "+rev+" isn't a palindrome!");
   }
 }
   }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java palindrome
Enter the number :
646
The number 646 is a palindrome!

D:\OneDrive\Desktop\Exercise 2 - Java>
```

3d) Vehicle

CODE :

```
class Vehicle{
   void display(){
     System.out.println("Vehicle goes Vroom...");
   }
   void engine(){ // it can be modified
   }
}

class bike extends Vehicle{
   @Override
   void display(){
     System.out.println("Bike goes Vroom...");
   }
   @Override
   void engine(){ // im modifying it
     System.out.println("mehhhhh");
   }
}

class car extends Vehicle{
```

```
    @Override
    void display(){
        System.out.println("Car go meow...");
    }
}
public class Poly {

    public static void main(String[] args) {
        Vehicle v = new Vehicle();
        Vehicle b = new bike();
        Vehicle c = new car();
        b.display();
        c.display();
        v.display();
        b.engine();
    }
     }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java Poly
Bike goes Vroom...
Car go meow...
Vehicle goes Vroom...
mehhhhh

D:\OneDrive\Desktop\Exercise 2 - Java>
```

3e) area

CODE :

```
    import java.util.Scanner;
public class area
{
  public static void main (String args[])
   {
     Scanner obj = new Scanner(System.in);
     Scanner obj2 = new Scanner(System.in);
```

```
    System.out.println("Enter the base : ");
    int b = obj.nextInt();
    System.out.println("Enter the height : ");
    int h = obj2.nextInt();
     int area = ( b*h) / 2 ;
     System.out.println("Area of Triangle is: "+area);
      }}
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java area
Enter the base :
5
Enter the height :
2
Area of Triangle is: 5

D:\OneDrive\Desktop\Exercise 2 - Java>
```

3f) Armstrong

CODE :

```
import java.util.Scanner;
class armstrong {
  public static void main(String[] args) {
    Scanner obj = new Scanner(System.in);
    System.out.println("Enter the number :");
    int num = obj.nextInt();

    int temp = num;
    int sum=0;

    while(temp>0) {
    int dig=temp%10;
    sum+=Math.pow(dig, 3);
    temp=temp/10;
    }
```

```
  if(num == sum) {
  System.out.println("The number "+num+" is a Armstrong number!");
  }
  else{
  System.out.println("The number "+num+" isn't a Armstrong number!");
  }
 }
  }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>javac armstrong.java

D:\OneDrive\Desktop\Exercise 2 - Java>java armstrong
Enter the number :
153
The number 153 is a Armstrong number!

D:\OneDrive\Desktop\Exercise 2 - Java>
```

3g) Fibonacci

CODE :

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

  int n = 10, firstTerm = 0, secondTerm = 1;
  System.out.println("Fibonacci Series till " + n + " terms:");

  for (int i = 1; i <= n; ++i) {
   System.out.print(firstTerm + ", ");

   // compute the next term
   int nextTerm = firstTerm + secondTerm;
   firstTerm = secondTerm;
   secondTerm = nextTerm;
  }
 }
  }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>javac fibonacci.java

D:\OneDrive\Desktop\Exercise 2 - Java>java fibonacci
Fibonacci Series till 10 terms:
0, 1, 1, 2, 3, 5, 8, 13, 21, 34,
D:\OneDrive\Desktop\Exercise 2 - Java>
```

3h) Prime

CODE :

```
import java.util.Scanner;
public class prime{

 public static void main(String[] args) {

  Scanner obj = new Scanner(System.in);
  System.out.println("Enter the number : ");
  int num = obj.nextInt();

  int i = 2;
  boolean flag = false;

  if (num == 0 || num == 1) {
    flag = true;
  }

  while (i <= num / 2) {

   if (num % i == 0) {
    flag = true;
    break;
   }

   ++i;
  }

  if (!flag)
```

```
    System.out.println(num + " is a prime number.");
   else
    System.out.println(num + " is not a prime number.");
 }
   }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java prime
Enter the number :
97
97 is a prime number.

D:\OneDrive\Desktop\Exercise 2 - Java>
```

3i)Factorial

CODE :

```
    import java.util.Scanner;
class factorial{
 public static void main(String args[]){
  Scanner obj = new Scanner(System.in);
  int fact=1;
  System.out.println("Enter the number : ");
  int number = obj.nextInt();

  for(int i=1;i<=number;i++){
    fact=fact*i;
  }
  System.out.println("Factorial of "+number+" is: "+fact);
 }
   }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java factorial
Enter the number :
8
Factorial of 8 is: 40320

D:\OneDrive\Desktop\Exercise 2 - Java>Z
```

3j)Hospital

CODE :

```
 class Person{
String name;
int age;

Person(String name, int age){
   this.name = name;
   this.age = age;
}

void display(){
   System.out.println("Name is : "+name);
   System.out.println("Age is : "+age);
}
}

class Doctor extends Person{
String special;

Doctor(String name,int age,String special){
   super(name,age);
   this.special = special;
}

@Override
void display(){
   super.display();
   System.out.println("Specialazation is : "+special);
}
```

```
}

public class Hospital {

   public static void main(String[] args) {
      Doctor doc = new Doctor("Deepak",18,"Neurologists");
      doc.display();
   }
    }
```

OUTPUT:

```
D:\OneDrive\Desktop\Exercise 2 - Java>java Hospital
Name is : Deepak
Age is : 18
Specialazation is : Neurologists

D:\OneDrive\Desktop\Exercise 2 - Java>
```

4A: SINGLE INHERITANCE 1

CODE:

```
class Book {
   String title;
   int pages;

   void setBook(String title, int pages) {
      this.title = title;
      this.pages = pages;
   }
}

class EBook extends Book {
   double fileSizeMB;

   void setFileSize(double size) {
      fileSizeMB = size;
   }

   void downloadTime(double speedMbps) {
      double time = fileSizeMB / speedMbps;
      System.out.println("Downloading \"" + title + "\"...");
      System.out.println("Estimated time: " + String.format("%.2f", time) + " seconds");
   }
}

public class Single1 {
   public static void main(String[] args) {
      EBook ebook = new EBook();
      ebook.setBook("Java for Beginners", 320);
      ebook.setFileSize(12.5);
      ebook.downloadTime(5);
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Inheritance>java Single1
Downloading "Java for Beginners"...
Estimated time: 2.50 seconds

D:\OneDrive\Desktop\OOPS\assignment\Inheritance>
```

4B:SINGLE INHERITANCE 2

CODE:

```
class Game {
   String name;
   int players;

   void setGame(String name, int players) {
      this.name = name;
      this.players = players;
   }
}

class OnlineGame extends Game {
   int ping;
   void setPing(int ping) {
      this.ping = ping;
   }

   void showPerformance() {
      System.out.println("Game: " + name);
      System.out.println("Players Online: " + players);
      if (ping < 100)
         System.out.println("Ping: " + ping + "ms (Good)");
      else
         System.out.println("Ping: " + ping + "ms (Laggy)");
   }
}

public class Single2 {
   public static void main(String[] args) {
      OnlineGame og = new OnlineGame();
      og.setGame("Valorant", 9000);
      og.setPing(85);
      og.showPerformance();
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Inheritance>java Single2
Game: Valorant
Players Online: 9000
Ping: 85ms (Good)
```

5A: MULTILEVEL INHERITANCE 1

CODE:

```
class Vehicle {
   int speed;
   int fuel;

   Vehicle(int speed, int fuel) {
      this.speed = speed;
      this.fuel = fuel;
   }

   void showStatus() {
      System.out.println("Speed: " + speed + " km/h");
      System.out.println("Fuel Level: " + fuel + "%");
   }

   void accelerate() {
      speed += 10;
      fuel -= 5;
      System.out.println("Vehicle accelerated.");
   }
}

class Car extends Vehicle {
   boolean airConditioningOn;

   Car(int speed, int fuel) {
      super(speed, fuel);
      this.airConditioningOn = false;
   }

   void toggleAC() {
      airConditioningOn = !airConditioningOn;
      System.out.println("AC turned " + (airConditioningOn ? "ON" : "OFF"));
      if (airConditioningOn) fuel -= 2;
   }

   @Override
   void showStatus() {
      super.showStatus();
      System.out.println("Air Conditioning: " + (airConditioningOn ? "ON" : "OFF"));
   }
```

```
}

class SmartCar extends Car {
  String gpsLocation;

  SmartCar(int speed, int fuel, String gpsLocation) {
    super(speed, fuel);
    this.gpsLocation = gpsLocation;
  }

  void updateGPS(String newLocation) {
    gpsLocation = newLocation;
    System.out.println("GPS updated to: " + gpsLocation);
  }

  void showStatus() {
    super.showStatus();
    System.out.println("GPS Location: " + gpsLocation);
  }
}

public class Multi1 {
  public static void main(String[] args) {
    SmartCar myCar = new SmartCar(60, 80, "Downtown");

    System.out.println("--- Initial Status ---");
    myCar.showStatus();

    System.out.println("\n--- After Actions ---");
    myCar.accelerate();
    myCar.toggleAC();
    myCar.updateGPS("Uptown");

    System.out.println("\n--- Updated Status ---");
    myCar.showStatus();
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Multi1>java Multi1
--- Initial Status ---
Speed: 60 km/h
Fuel Level: 80%
Air Conditioning: OFF
GPS Location: Downtown

--- After Actions ---
Vehicle accelerated.
AC turned ON
GPS updated to: Uptown

--- Updated Status ---
Speed: 70 km/h
Fuel Level: 73%
Air Conditioning: ON
GPS Location: Uptown

D:\OneDrive\Desktop\OOPS\assignment\Multi1>
```

5B: MULTILEVEL INHERITANCE 2

CODE:

```
class Item {
   String title;
   String author;

   Item(String title, String author) {
      this.title = title;
      this.author = author;
   }

   void displayBasicInfo() {
      System.out.println("Title: " + title);
      System.out.println("Author: " + author);
   }
}

class Book extends Item {
   int pages;
   String genre;
```

```
    Book(String title, String author, int pages, String genre) {
        super(title, author);
        this.pages = pages;
        this.genre = genre;
    }

    void displayBookInfo() {
        displayBasicInfo();
        System.out.println("Pages: " + pages);
        System.out.println("Genre: " + genre);
    }
}

class DigitalBook extends Book {
    int fileSize;
    String quality;

    DigitalBook(String title, String author, int pages, String genre, int fileSize, String quality) {
        super(title, author, pages, genre);
        this.fileSize = fileSize;
        this.quality = quality;
    }

    void displayDigitalInfo() {
        displayBookInfo();
        System.out.println("File Size: " + fileSize + " MB");
        System.out.println("Quality: " + quality);
        System.out.println("Estimated Download Time: " + calculateDownloadTime() + " seconds");
    }

    int calculateDownloadTime() {
        int speed = 5;
        return fileSize / speed;
    }
}

public class Multi2 {
    public static void main(String[] args) {
        DigitalBook dBook = new DigitalBook("Heaven And Hell", "Deepak", 666, "Fantasy", 50, "High");
        dBook.displayDigitalInfo();
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Multi2>java Multi2
Title: Heaven And Hell
Author: Deepak
Pages: 666
Genre: Fantasy
File Size: 50 MB
Quality: High
Estimated Download Time: 10 seconds
```

6A: HIERARCHICAL INHERITANCE 1

CODE:

```
class Appliance {
  String location;

  void setLocation(String location) {
    this.location = location;
  }
}

class Fan extends Appliance {
  void switchOn() {
    System.out.println("Fan in " + location + " is ON.");
  }
}

class Light extends Appliance {
  void dim(int level) {
    System.out.println("Light in " + location + " dimmed to " + level + "% brightness.");
  }
}

public class Hira1 {
  public static void main(String[] args) {
    Fan fan = new Fan();
    fan.setLocation("Living Room");
    fan.switchOn();

    Light light = new Light();
    light.setLocation("Bedroom");
```

```
        light.dim(40);
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Inheritance\Hierarchical>java Hira1
Fan in Living Room is ON.
Light in Bedroom dimmed to 40% brightness.

D:\OneDrive\Desktop\OOPS\assignment\Inheritance\Hierarchical>
```

6B: HIERARCHICAL INHERITANCE 2

CODE:

```
class Account {
    String accountHolder;

    void setHolder(String name) {
        accountHolder = name;
    }
}

class Paypal extends Account {
    String email;

    void pay(double amount) {
        System.out.println(accountHolder + " paid Rs." + amount + " using PayPal (" + email + ")");
    }
}

class UPI extends Account {
    String upiId;

    void pay(double amount) {
        System.out.println(accountHolder + " paid Rs." + amount + " using UPI (" + upiId + ")");
    }
}

public class Hira2 {
    public static void main(String[] args) {
        Paypal p = new Paypal();
        p.setHolder("Deep");
        p.email = "deep@paypal.com";
```

```
        p.pay(450.75);

        UPI u = new UPI();
        u.setHolder("Deeps");
        u.upiId = "deeps@upi";
        u.pay(230.50);
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Inheritance\Hierarchical>javac Hira2.java

D:\OneDrive\Desktop\OOPS\assignment\Inheritance\Hierarchical>java Hira2
Deep paid Rs.450.75 using PayPal (deep@paypal.com)
Deeps paid Rs.230.5 using UPI (deeps@upi)

D:\OneDrive\Desktop\OOPS\assignment\Inheritance\Hierarchical>
```

7A: HYBRID INHERITANCE 1

CODE:

```
class University {
  void universityDetails() {
    System.out.println("University: Amrita Vishwa Vidyapeetham, Chennai");
  }
}

class Department extends University {
  void departmentDetails() {
    System.out.println("Department: Computer Science");
  }
}

class StudentInfo {
  void studentDetails() {
    System.out.println("Student Name: Deepak");
    System.out.println("Roll No: CH.SC.U4CSE24015");
  }
}

class StudentRecord extends Department {
  StudentInfo info = new StudentInfo();
```

```
    void displayRecord() {
      universityDetails();
      departmentDetails();
      info.studentDetails();
      System.out.println("Result: Passed with Distinction");
    }
  }

  public class Hybrid {
public static void main(String[] args) {
      StudentRecord student = new StudentRecord();
      student.displayRecord();
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment>javac Hybrid.java

D:\OneDrive\Desktop\OOPS\assignment>java Hybrid
University: Amrita Vishwa Vidyapeetham, Chennai
Department: Computer Science
Student Name: Deepak
Roll No: CH.SC.U4CSE24015
Result: Passed with Distinction

D:\OneDrive\Desktop\OOPS\assignment>
```

7B: HYBRID INHERITANCE 2

CODE:

```
class Bank {
  void bankDetails() {
    System.out.println("Bank: City Union Bank");
  }
}

class Branch extends Bank {
  void branchDetails() {
    System.out.println("Branch: Downtown City Branch");
  }
```

```
    }

    class Customer {
      void customerDetails() {
        System.out.println("Customer Name: Poojitha");
        System.out.println("Account Number: 1145780021");
      }
    }

    class Transaction extends Branch {
      Customer customer = new Customer();

      void transactionDetails() {
        bankDetails();
        branchDetails();
        customer.customerDetails();
        System.out.println("Transaction: Deposited Rs.15,000");
      }
    }

    public class Hybrid2 {
      public static void main(String[] args) {
  Transaction txn = new Transaction();
        txn.transactionDetails();
      }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\hybrid2>java Hybrid2
Bank: City Union Bank
Branch: Downtown City Branch
Customer Name: Poojitha
Account Number: 1145780021
Transaction: Deposited Rs.15,000

D:\OneDrive\Desktop\OOPS\assignment\hybrid2>
```

8A: CONSTRUCTOR OVERRIDING PROGRAM

CODE:

```
class Order {
  String customerName;
  String item;

  Order(String name, String item) {
    this.customerName = name;
    this.item = item;
  }

  void showOrder() {
    System.out.println("Customer: " + customerName);
    System.out.println("Item: " + item);
  }
}

class OnlineOrder extends Order {
  String deliveryAddress;

  OnlineOrder(String name, String item, String address) {
    super(name, item);
    this.deliveryAddress = address;
  }

  @Override
  void showOrder() {
    super.showOrder();
    System.out.println("Delivery Address: " + deliveryAddress);
  }
}

public class OR4 {
  public static void main(String[] args) {
    OnlineOrder order = new OnlineOrder("Deepak", "Wireless Keyboard", "Chennai, 600001");
    order.showOrder();
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Polymorphism\OverRiding>java OR4
Customer: Deepak
Item: Wireless Keyboard
Delivery Address: Chennai, 600001

D:\OneDrive\Desktop\OOPS\assignment\Polymorphism\OverRiding>
```

9A: Constructor Overloading Program

CODE:

```
class Polynomial {
   private int[] coefficients;

   public Polynomial(int[] coefficients) {
      this.coefficients = coefficients;
   }

   public void displayPolynomial() {
      for (int i = coefficients.length - 1; i >= 0; i--) {
         if (coefficients[i] != 0) {
            if (i != coefficients.length - 1 && coefficients[i] > 0) {
               System.out.print("+");
            }
            System.out.print(coefficients[i]);
            if (i > 0) {
               System.out.print("x^" + i);
            }
            System.out.print(" ");
         }
      }
      System.out.println();
   }

   public Polynomial add(Polynomial other) {
      int maxLength = Math.max(this.coefficients.length, other.coefficients.length);
      int[] result = new int[maxLength];

      for (int i = 0; i < maxLength; i++) {
         int coef1 = (i < this.coefficients.length) ? this.coefficients[i] : 0;
         int coef2 = (i < other.coefficients.length) ? other.coefficients[i] : 0;
         result[i] = coef1 + coef2;
      }
```

```
    return new Polynomial(result);
        }

          public Polynomial multiply(Polynomial other) {
            int newDegree = this.coefficients.length + other.coefficients.length - 2;
            int[] result = new int[newDegree + 1];

            for (int i = 0; i < this.coefficients.length; i++) {
              for (int j = 0; j < other.coefficients.length; j++) {
                result[i + j] += this.coefficients[i] * other.coefficients[j];
              }
            }

            return new Polynomial(result);
          }
        }

        public class OL3 {
          public static void main(String[] args) {
            int[] poly1 = {1, 2, 3};
            Polynomial p1 = new Polynomial(poly1);
            System.out.print("Polynomial 1: ");
            p1.displayPolynomial();

            int[] poly2 = {5, 0, 3, 4};
            Polynomial p2 = new Polynomial(poly2);
            System.out.print("Polynomial 2: ");
            p2.displayPolynomial();

            Polynomial sum = p1.add(p2);
            System.out.print("Sum of Polynomials: ");
            sum.displayPolynomial();

            Polynomial product = p1.multiply(p2);
            System.out.print("Product of Polynomials: ");
    product.displayPolynomial();
        }
}
```

OUTPUT:

```
C:\Users\ASE Computer Lab\Desktop\java>java Over1
Polynomial 1: 3x^2 +2x^1 +1
Polynomial 2: 4x^3 +3x^2 +5
Sum of Polynomials: 4x^3 +6x^2 +2x^1 +6
Product of Polynomials: 12x^5 +17x^4 +10x^3 +18x^2 +10x^1 +5

C:\Users\ASE Computer Lab\Desktop\java>
```

10A: Method overloading 1

CODE:

```
class Shape {
   public double calculateArea(double radius) {
      return Math.PI * radius * radius;
   }

   public double calculateArea(double length, double breadth) {
      return length * breadth;
   }

   public double calculateArea(double base, double height, boolean isTriangle) {
      return 0.5 * base * height;
   }
}

public class OL1 {
   public static void main(String[] args) {
      Shape shape = new Shape();

      System.out.println("Area of Circle: " + shape.calculateArea(7.0));
      System.out.println("Area of Rectangle: " + shape.calculateArea(5.0, 8.0));
      System.out.println("Area of Triangle: " + shape.calculateArea(6.0, 4.0, true));
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Polymorphism\OverLoading>java OL1
Area of Circle: 153.93804002589985
Area of Rectangle: 40.0
Area of Triangle: 12.0
```

10B: method overloading 2

CODE:

```
class Employee {
      public double calculateSalary(int hoursWorked, double hourlyRate) {
      return hoursWorked * hourlyRate;
   }

   public double calculateSalary(double monthlySalary) {
      return monthlySalary;
   }

   public double calculateSalary(double baseSalary, double bonus) {
      return baseSalary + bonus;
   }
}

public class OL2 {
   public static void main(String[] args) {
      Employee employee = new Employee();

      System.out.println("Hourly Employee Salary: " + employee.calculateSalary(40, 15.5));
      System.out.println("Salaried Employee Salary: " + employee.calculateSalary(3000.0));
      System.out.println("Employee with Bonus Salary: " + employee.calculateSalary(2500.0, 500.0));
   }
}
```

OUTPUT:

```
C:\Users\ASE Computer Lab\Desktop\java>java Over1
Hourly Employee Salary: 620.0
Salaried Employee Salary: 3000.0
Employee with Bonus Salary: 3000.0

C:\Users\ASE Computer Lab\Desktop\java>
```

11A: method overriding 1

CODE:

```
class BankAccount {
   protected String accountNumber;
   protected double balance;

   public BankAccount(String accountNumber, double balance) {
      this.accountNumber = accountNumber;
      this.balance = balance;
   }

   public void deposit(double amount) {
      balance += amount;
      System.out.println("Deposited: $" + amount);
   }

   public void withdraw(double amount) {
      if(amount <= balance) {
         balance -= amount;
         System.out.println("Withdrawn: $" + amount);
      } else {
```

```
            System.out.println("Insufficient funds!");
        }
    }

    public void displayBalance() {
        System.out.println("Current Balance: $" + balance);
    }
}

class SavingsAccount extends BankAccount {
    private double interestRate;

    public SavingsAccount(String accountNumber, double balance, double interestRate) {
        super(accountNumber, balance);
        this.interestRate = interestRate;
    }

    public void addInterest() {
        double interest = balance * interestRate;
        balance += interest;
        System.out.println("Interest added: $" + interest);
    }

    public void displayBalance() {
        System.out.println("Savings Account Balance: $" + balance);
        System.out.println("Interest Rate: " + (interestRate * 100) + "%");
    }
}

class CheckingAccount extends BankAccount {
    private double overdraftLimit;

    public CheckingAccount(String accountNumber, double balance, double overdraftLimit) {
        super(accountNumber, balance);
        this.overdraftLimit = overdraftLimit;
    }

    public void withdraw(double amount) {
        if(amount <= (balance + overdraftLimit)) {
            balance -= amount;
            System.out.println("Withdrawn: $" + amount);
        } else {
            System.out.println("Exceeds overdraft limit!");
        }
    }

    public void displayBalance() {
        System.out.println("Checking Account Balance: $" + balance);
        System.out.println("Overdraft Limit: $" + overdraftLimit);
    }
}

public class OR2 {
    public static void main(String[] args) {
        BankAccount savings = new SavingsAccount("SA001", 1000.0, 0.05);
        BankAccount checking = new CheckingAccount("CA001", 2000.0, 500.0);

        System.out.println("Initial Account Status:");
        System.out.println("----------------------");
        savings.displayBalance();
        System.out.println();
```

```
        checking.displayBalance();

        System.out.println("\nPerforming Transactions:");
        System.out.println("----------------------");
        savings.deposit(500.0);
        checking.withdraw(2300.0);

        ((SavingsAccount)savings).addInterest();

        System.out.println("\nFinal Account Status:");
        System.out.println("--------------------");
        savings.displayBalance();
        System.out.println();
        checking.displayBalance();
    }
}
```

OUTPUT:

```
Initial Account Status:
-----------------------
Savings Account Balance: $1000.0
Interest Rate: 5.0%

Checking Account Balance: $2000.0
Overdraft Limit: $500.0

Performing Transactions:
----------------------
Deposited: $500.0
Withdrawn: $2300.0
Interest added: $75.0

Final Account Status:
--------------------
Savings Account Balance: $1575.0
Interest Rate: 5.0%

Checking Account Balance: $-300.0
Overdraft Limit: $500.0
```

11B: method overriding 2

CODE:

```
class Shape {
   public double getArea() {
      return 0.0;
   }

   public void draw() {
      System.out.println("Drawing a shape");
   }
}

class Circle extends Shape {
   private double radius;

   public Circle(double radius) {
      this.radius = radius;
   }

   @Override
   public double getArea() {
      return Math.PI * radius * radius;
   }

   @Override
   public void draw() {
      System.out.println("Drawing a circle with radius: " + radius);
   }
}

class Rectangle extends Shape {
   private double length;
   private double width;

   public Rectangle(double length, double width) {
      this.length = length;
      this.width = width;
   }

   @Override
   public double getArea() {
      return length * width;
   }

   @Override
   public void draw() {
      System.out.println("Drawing a rectangle with length: " + length + " and width: " + width);
   }
}

public class OR1 {
   public static void main(String[] args) {
      Shape circle = new Circle(5);
      Shape rectangle = new Rectangle(4, 6);

      System.out.println("Shape Areas:");
      System.out.println("Circle area: " + circle.getArea());
      System.out.println("Rectangle area: " + rectangle.getArea());

      System.out.println("\nDrawing Shapes:");
```

```
        circle.draw();
        rectangle.draw();

        Shape[] shapes = {new Circle(3), new Rectangle(2, 5)};

        System.out.println("\nProcessing shapes array:");
        for(Shape shape : shapes) {
            shape.draw();
            System.out.println("Area: " + shape.getArea());
        }
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Polymorphism\OverRiding>java OR1
Shape Areas:
Circle area: 78.53981633974483
Rectangle area: 24.0

Drawing Shapes:
Drawing a circle with radius: 5.0
Drawing a rectangle with length: 4.0 and width: 6.0

Processing shapes array:
Drawing a circle with radius: 3.0
Area: 28.274333882308138
Drawing a rectangle with length: 2.0 and width: 5.0
Area: 10.0
```

12A: interface program 1

CODE:

```
interface Shape {
    double area();
    double perimeter();
}

class Circle implements Shape {
    private double radius;

    public Circle(double radius) {
        this.radius = radius;
    }

    public double area() {
        return Math.PI * radius * radius;
    }

    public double perimeter() {
        return 2 * Math.PI * radius;
    }
}

class Rectangle implements Shape {
    private double length;
    private double width;
```

```
    public Rectangle(double length, double width) {
        this.length = length;
        this.width = width;
    }

    public double area() {
        return length * width;
    }

    public double perimeter() {
        return 2 * (length + width);
    }
}

class Triangle implements Shape {
    private double a, b, c;

    public Triangle(double a, double b, double c) {
        this.a = a;
        this.b = b;
        this.c = c;
    }

    public double area() {
        double s = perimeter() / 2;
        return Math.sqrt(s * (s - a) * (s - b) * (s - c));
    }

    public double perimeter() {
        return a + b + c;
    }
}

public class Inter1 {
    public static void main(String[] args) {
        Shape circle = new Circle(5);
        Shape rectangle = new Rectangle(4, 6);
        Shape triangle = new Triangle(3, 4, 5);

        System.out.println("\nCircle Area: " + circle.area() + ", Perimeter: " + circle.perimeter());
        System.out.println("Rectangle Area: " + rectangle.area() + ", Perimeter: " + rectangle.perimeter());
        System.out.println("Triangle Area: " + triangle.area() + ", Perimeter: " + triangle.perimeter());
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Interface>java Inter1

Circle Area: 78.53981633974483, Perimeter: 31.41592653589793
Rectangle Area: 24.0, Perimeter: 20.0
Triangle Area: 6.0, Perimeter: 12.0
```

12B: interface program 2

CODE:

```
interface PaymentMethod {
   boolean processPayment(double amount);
}

class CreditCard implements PaymentMethod {
   private String cardNumber;

   public CreditCard(String cardNumber) {
      this.cardNumber = cardNumber;
   }

   public boolean processPayment(double amount) {
      System.out.println("Processing credit card payment of Rs : " + amount);
      return true;
   }
}

class GooglePay implements PaymentMethod {
   private String email;

   public GooglePay(String email) {
      this.email = email;
   }

   public boolean processPayment(double amount) {
      System.out.println("Processing GooglePay payment of Rs : " + amount);
      return true;
   }
}

class BankTransfer implements PaymentMethod {
   private String bankAccount;

   public BankTransfer(String bankAccount) {
      this.bankAccount = bankAccount;
}

   public boolean processPayment(double amount) {
      System.out.println("Processing bank transfer of Rs : " + amount);
      return true;
   }
}

public class Inter2 {
   public static void main(String[] args) {
      PaymentMethod paymentMethod1 = new CreditCard("1234-5678-9876-5432");
      PaymentMethod paymentMethod2 = new GooglePay("upi@gmail.com");
      PaymentMethod paymentMethod3 = new BankTransfer("123456789");
            System.out.println();
      paymentMethod1.processPayment(1025.245);
      paymentMethod2.processPayment(986.53);
      paymentMethod3.processPayment(84543.25);
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Interface>java Inter2

Processing credit card payment of Rs : 1025.245
Processing GooglePay payment of Rs : 986.53
Processing bank transfer of Rs : 84543.25

D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Interface>
```

12C: interface program 3

CODE:

```
import java.util.*;

interface LibraryItem {
   String getDetails();
   boolean borrow();
   void returnItem();
}

class Book implements LibraryItem {
   private String title;
   private String author;
   private boolean isBorrowed;

   public Book(String title, String author) {
      this.title = title;
      this.author = author;
      this.isBorrowed = false;
   }

   public String getDetails() {
      return "Book: " + title + " by " + author;
   }

   public boolean borrow() {
      if (!isBorrowed) {
         isBorrowed = true;
         System.out.println("You borrowed the book: " + title);
         return true;
      } else {
         System.out.println("The book is already borrowed.");
         return false;
      }
   }

   public void returnItem() {
      isBorrowed = false;
      System.out.println("You returned the book: " + title);
   }
}

class Library {
   private List<LibraryItem> items = new ArrayList<>();

   public void addItem(LibraryItem item) {
      items.add(item);
   }
```

```
    public void showItems() {
        for (LibraryItem item : items) {
            System.out.println(item.getDetails());
        }
    }

    public LibraryItem getItem(String title) {
        for (LibraryItem item : items) {
            if (item.getDetails().contains(title)) {
                return item;
            }
        }
        return null;
    }
}

public class Inter3 {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        Library library = new Library();

        library.addItem(new Book("Heaven and Hell", "Deepak"));
        library.addItem(new Book("2025", "Vaishnav"));

        while (true) {
            System.out.println("\nLibrary System: ");
            System.out.println("1. View Library Items");
            System.out.println("2. Borrow Book");
            System.out.println("3. Return Book");
            System.out.println("4. Exit");
            System.out.print("Enter your choice: ");
            int choice = scanner.nextInt();
            scanner.nextLine();

            switch (choice) {
                case 1:
                    library.showItems();
                    break;
                case 2:
                    System.out.print("Enter the book title you want to borrow: ");
                    String borrowTitle = scanner.nextLine();
                    LibraryItem itemToBorrow = library.getItem(borrowTitle);
                    if (itemToBorrow != null) {
                        itemToBorrow.borrow();
                    } else {
                        System.out.println("Book not found.");
                    }
                    break;
                case 3:
                    System.out.print("Enter the book title you want to return: ");
                    String returnTitle = scanner.nextLine();
                    LibraryItem itemToReturn = library.getItem(returnTitle);
                    if (itemToReturn != null) {
                        itemToReturn.returnItem();
                    } else {
                        System.out.println("Book not found." );
                    }
                    break;
                case 4:
                    System.out.println("Exiting system...");
```

```
            return;
          default:
            System.out.println("Invalid choice, please try again.");
        }
      }
    }
}
```

OUTPUT:

```
Library System:
1. View Library Items
2. Borrow Book
3. Return Book
4. Exit
Enter your choice: 1
Book: Heaven and Hell by Deepak
Book: 2025 by Vaishnav

Library System:
1. View Library Items
2. Borrow Book
3. Return Book
4. Exit
Enter your choice: 2
Enter the book title you want to borrow: Heaven and Hell
You borrowed the book: Heaven and Hell

Library System:
1. View Library Items
2. Borrow Book
3. Return Book
4. Exit
Enter your choice: 3
Enter the book title you want to return: Heaven and Hell
You returned the book: Heaven and Hell

Library System:
1. View Library Items
2. Borrow Book
3. Return Book
4. Exit
Enter your choice: 4
Exiting system...

D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Interface>
```

12D: interface program 4

CODE:

```
import java.util.*;

interface Task {
   void start();
   void pause();
   void complete();
}

class AppTask implements Task {
   public void start() {
      System.out.println("Started scanning apps.");
   }

   public void pause() {
      System.out.println("Paused scanning apps.");
   }

   public void complete() {
      System.out.println("Completed scanning apps.");
   }
}

class VirusTask implements Task {
   public void start() {
      System.out.println("Started scanning for virus.");
   }

   public void pause() {
      System.out.println("Paused scanning for virus.");
   }

   public void complete() {
      System.out.println("Completed scanning for virus.");
   }
}
class TrojanTask implements Task {
   public void start() {
      System.out.println("Started scanning for trojans");
   }

   public void pause() {
      System.out.println("Paused scanning for trojans.");
   }

   public void complete() {
      System.out.println("Completed scanning for trojans.");
   }
}

public class Inter4 {
   public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      List<Task> tasks = new ArrayList<>();
      tasks.add(new AppTask());
      tasks.add(new VirusTask());
      tasks.add(new TrojanTask());

      while (true) {
```

```
        System.out.println("\nTask Manager:");
        System.out.println("1. Start App Task");
        System.out.println("2. Pause Virus Task");
        System.out.println("3. Complete Trojan Task");
        System.out.println("4. Exit");
        System.out.print("Enter your choice: ");
        int choice = scanner.nextInt();

        switch (choice) {
          case 1:
            tasks.get(0).start();
           break;
          case 2:
            tasks.get(1).pause();
            break;
          case 3:
            tasks.get(2).complete();
            break;
          case 4:
            System.out.println("Exiting Task Manager.");
            return;
          default:
            System.out.println("Invalid choice. Try again.");
        }
      }
    }
}
```

OUTPUT:

```
Task Manager:
1. Start App Task
2. Pause Virus Task
3. Complete Trojan Task
4. Exit
Enter your choice: 1
Started scanning apps.

Task Manager:
1. Start App Task
2. Pause Virus Task
3. Complete Trojan Task
4. Exit
Enter your choice: 2
Paused scanning for virus.

Task Manager:
1. Start App Task
2. Pause Virus Task
3. Complete Trojan Task
4. Exit
Enter your choice: 3
Completed scanning for trojans.

Task Manager:
1. Start App Task
2. Pause Virus Task
3. Complete Trojan Task
4. Exit
Enter your choice: 4
Exiting Task Manager.

D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Interface>
```

13A: abstract program 1

CODE:

```
abstract class Abs1 {
   abstract void Info();
}

class Management extends Abs1 {
   void Info() {
      String name = "Deepak";
      String rollno = "CH.SC.U4CSE24015";
      int age = 18;
      String gender = "Male";

      System.out.println("The name of the student is: " + name);
      System.out.println("The roll number of the student is: " + rollno);
      System.out.println("The age of the student is: " + age);
      System.out.println("The gender of the student is: " + gender);
   }
}

public class Abase1 {
   public static void main(String args[]) {
      Abs1 s = new Management();
      s.Info();
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Abstract>java Abase1
The name of the student is: Deepak
The roll number of the student is: CH.SC.U4CSE24015
The age of the student is: 18
The gender of the student is: Male
```

13B: abstract program 2

CODE:

```
abstract class Subject {
   Subject() {
     System.out.println("Subjects : ");
   }

     abstract void syllabus();

     void Learn(){
        System.out.println("Learning!!!");
   }
}

class College extends Subject {
  void syllabus(){
   System.out.println("Java , HTML , Python");
  }
}

class Abase2 {
   public static void main(String[] args) {
      Subject s = new College();
```

```
        s.syllabus();
        s.Learn();
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Abstract>java Abase2
Subjects :
Java , HTML , Python
Learning!!!

D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Abstract>
```

13C: abstract program 3

CODE:

```
import java.util.Scanner;

abstract class B {
    static abstract class C {
        abstract void myAbstractMethod();
    }
}

class D extends B {
    class E extends C {
        Scanner scan = new Scanner(System.in);

        void myAbstractMethod() {
            System.out.print("Enter your name: ");
            String name = scan.nextLine();

            System.out.print("Enter your roll number: ");
            String rollno = scan.nextLine();

            System.out.print("Enter your age: ");
            int age = scan.nextInt();

            System.out.println("\nYour name is: " + name);
            System.out.println("Your roll number is: " + rollno);
            System.out.println("Your age is: " + age);
        }
    }
}

public class Abase3 {
    public static void main(String[] args) {
        D outer = new D();
        D.E inner = outer.new E();
        inner.myAbstractMethod();
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Abstract>java Abase3
Enter your name: Deepak
Enter your roll number: CH.SC.U4CSE24015
Enter your age: 18

Your name is: Deepak
Your roll number is: CH.SC.U4CSE24015
Your age is: 18
```

13D: abstract program 4

CODE:

```
import java.util.Scanner;

abstract class Movie{
abstract void hero();
abstract void antiHero();
abstract void villain();
}

abstract class character extends Movie{
Scanner scan = new Scanner(System.in);
public void hero(){
System.out.print("Enter a quote for the hero : ");
String hero = scan.nextLine();
System.out.println("Quote of the hero is : "+hero);
}
}

class character2 extends character{
void antiHero(){

System.out.print("Enter a quote for the anti-hero : ");
String antiHero = scan.nextLine();
System.out.println("Quote of the anti-hero is : "+antiHero);
}

void villain(){

System.out.print("Enter a quote for the villain : ");
String villain = scan.nextLine();
System.out.println("Quote of the villain is : "+villain);
}
}

class Abase4 {
public static void main(String[] args) {
character2 c = new character2();
c.hero();
System.out.println("-------------------------------------");
c.antiHero();
System.out.println("-------------------------------------");
c.villain();
System.out.println("-------------------------------------");
}
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Abstraction\Abstract>java Abase4
Enter a quote for the hero : "By the people , for the people , of the people"
Quote of the hero is : "By the people , for the people , of the people"
-----------------------------------
Enter a quote for the anti-hero : "Do what satisfies you no matter its good or bad"
Quote of the anti-hero is : "Do what satisfies you no matter its good or bad"
-----------------------------------
Enter a quote for the villain : "The one who kills others is not a villain but a God who cleans up the trash"
Quote of the villain is : "The one who kills others is not a villain but a God who cleans up the trash"
-----------------------------------
```

14A: encapsulation 1

CODE:

```
class BankAccount {
   private String accountHolder;
   private double balance;

   public BankAccount(String accountHolder, double initialBalance) {
      this.accountHolder = accountHolder;
      this.balance = initialBalance;
   }

   public String getAccountHolder() {
      return accountHolder;
   }

   public double getBalance() {
      return balance;
   }

   public void deposit(double amount) {
      if (amount > 0) {
         balance += amount;
         System.out.println("Deposited: " + amount);
      } else {
         System.out.println("Invalid deposit amount.");
      }
   }

   public void withdraw(double amount) {
      if (amount > 0 && balance >= amount) {
         balance -= amount;
         System.out.println("Withdrawn: " + amount);
      } else {
         System.out.println("Invalid withdrawal amount or insufficient funds.");
      }
   }


   public void displayAccountInfo() {
      System.out.println("Account Holder: " + accountHolder);
      System.out.println("Current Balance: " + balance);
   }
}

public class En1 {
   public static void main(String[] args) {
      BankAccount account = new BankAccount("Ben Dover", 10000);
      account.displayAccountInfo();
      account.deposit(345);
```

```
    account.withdraw(6736);
    account.displayAccountInfo();
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Encapsulation>javac En1.java

D:\OneDrive\Desktop\OOPS\assignment\Encapsulation>java En1
Account Holder: Ben Dover
Current Balance: 10000.0
Deposited: 345.0
Withdrawn: 6736.0
Account Holder: Ben Dover
Current Balance: 3609.0
```

14B: encapsulation 2

CODE:

```
class Employee {
  private String name;
  private String position;
  private double salary;

  public Employee(String name, String position, double salary) {
    this.name = name;
    this.position = position;
    this.salary = salary;
  }

  public String getName() {
    return name;
  }

  public String getPosition() {
    return position;
  }

  public double getSalary() {
    return salary;
  }

  public void giveRaise(double raiseAmount) {
    if (raiseAmount > 0) {
      salary += raiseAmount;
      System.out.println("Salary raised by: " + raiseAmount);
    } else {
      System.out.println("Invalid raise amount.");
    }
  }

  public void displayEmployeeInfo() {
    System.out.println("Employee Name: " + name);
    System.out.println("Position: " + position);
    System.out.println("Salary: " + salary);
  }
}
```

```
public class En2 {
   public static void main(String[] args) {
      Employee emp = new Employee("Vaishnav", "Civil Engineer", 6000);
      emp.displayEmployeeInfo();
      emp.giveRaise(2500);
      emp.displayEmployeeInfo();
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Encapsulation>java En2
Employee Name: Vaishnav
Position: Civil Engineer
Salary: 6000.0
Salary raised by: 2500.0
Employee Name: Vaishnav
Position: Civil Engineer
Salary: 8500.0
```

14C: encapsulation 3

CODE:

```
import java.util.Scanner;

class BankAccount {
   private String accountHolder;
   private double balance;

   public BankAccount(String accountHolder, double initialBalance) {
      this.accountHolder = accountHolder;
      this.balance = initialBalance;
   }

   public String getAccountHolder() {
      return accountHolder;
   }

   public double getBalance() {
      return balance;
   }

   public void deposit(double amount) {
      if (amount > 0) {
         balance += amount;
         System.out.println("Deposited: $" + amount);
      } else {
         System.out.println("Invalid deposit amount.");
      }
   }

   public void withdraw(double amount) {
      if (amount > 0 && balance >= amount) {
         balance -= amount;
         System.out.println("Withdrawn: $" + amount);
      } else {
```

```
            System.out.println("Insufficient funds or invalid amount.");
        }
    }

    public void displayAccountInfo() {
        System.out.println("Account Holder: " + accountHolder);
        System.out.println("Balance: $" + balance);
    }
}

class Book {
    private String title;
    private String author;
    private boolean isAvailable;

    public Book(String title, String author) {
        this.title = title;
        this.author = author;
        this.isAvailable = true;
    }

    public void checkOut() {
        if (isAvailable) {
            isAvailable = false;
            System.out.println("Book '" + title + "' has been checked out.");
        } else {
            System.out.println("Sorry, the book '" + title + "' is not available.");
        }
    }

    public void returnBook() {
        if (!isAvailable) {
            isAvailable = true;
            System.out.println("Book '" + title + "' has been returned.");
        } else {
            System.out.println("This book was not checked out.");
        }
    }

    public void displayBookInfo() {
        System.out.println("Title: " + title);
        System.out.println("Author: " + author);
        System.out.println("Available: " + (isAvailable ? "Yes" : "No"));
    }
}

class Student {
    private String name;
    private double[] grades;
    private int gradeCount;

    public Student(String name, int maxGrades) {
        this.name = name;
        grades = new double[maxGrades];
        gradeCount = 0;
    }

    public void addGrade(double grade) {
        if (gradeCount < grades.length) {
            grades[gradeCount++] = grade;
        } else {
```

```
            System.out.println("Cannot add more grades.");
        }
    }

    public double calculateAverage() {
        double sum = 0;
        for (int i = 0; i < gradeCount; i++) {
            sum += grades[i];
        }
        return (gradeCount > 0) ? sum / gradeCount : 0;
    }

    public void displayStudentInfo() {
        System.out.println("Student: " + name);
        System.out.println("Average Grade: " + calculateAverage());
    }
}

class Employee {
    private String name;
    private String position;
    private double salary;

    public Employee(String name, String position, double salary) {
        this.name = name;
        this.position = position;
        this.salary = salary;
    }

    public void giveRaise(double amount) {
        if (amount > 0) {
            salary += amount;
            System.out.println("Salary raised by: $" + amount);
        } else {
            System.out.println("Invalid raise amount.");
        }
    }

    public void displayEmployeeInfo() {
        System.out.println("Employee: " + name);
        System.out.println("Position: " + position);
        System.out.println("Salary: $" + salary);
    }
}

public class En3 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        BankAccount account = new BankAccount("Ben Dover", 20000);
        Book book = new Book("Heaven and Hell", "Deepak");
        Student student = new Student("Vaishnav", 5);
        Employee employee = new Employee("Sanjay", "Detective", 50000);

        while (true) {
            System.out.println("\nSelect an option:");
            System.out.println("1. Bank Account");
            System.out.println("2. Library System");
            System.out.println("3. Student Grades");
            System.out.println("4. Employee Management");
            System.out.println("5. Exit");
            System.out.print("Choice: ");
```

```
int choice = sc.nextInt();

switch (choice) {
   case 1:
      System.out.println("\nBank Account Operations:");
      System.out.println("1. Deposit");
      System.out.println("2. Withdraw");
      System.out.println("3. Display Info");
      System.out.print("Choice: ");
      int bankChoice = sc.nextInt();
      switch (bankChoice) {
         case 1:
            System.out.print("Enter deposit amount: ");
            double deposit = sc.nextDouble();
            account.deposit(deposit);
            break;
         case 2:
            System.out.print("Enter withdrawal amount: ");
            double withdrawal = sc.nextDouble();
            account.withdraw(withdrawal);
            break;
         case 3:
            account.displayAccountInfo();
            break;
         default:
            System.out.println("Invalid choice.");
      }
      break;

   case 2:
      System.out.println("\nLibrary System Operations:");
      System.out.println("1. Check out Book");
      System.out.println("2. Return Book");
      System.out.println("3. Display Book Info");
      System.out.print("Choice: ");
      int bookChoice = sc.nextInt();
      switch (bookChoice) {
         case 1:
            book.checkOut();
            break;
         case 2:
            book.returnBook();
            break;
         case 3:
            book.displayBookInfo();
            break;
         default:
            System.out.println("Invalid choice.");
      }
      break;

   case 3:
      System.out.println("\nStudent Grades Operations:");
      System.out.println("1. Add Grade");
      System.out.println("2. Display Student Info");
      System.out.print("Choice: ");
      int studentChoice = sc.nextInt();
      switch (studentChoice) {
         case 1:
            System.out.print("Enter grade: ");
            double grade = sc.nextDouble();
```

```
                student.addGrade(grade);
                break;
            case 2:
                student.displayStudentInfo();
                break;
            default:
                System.out.println("Invalid choice.");
            }
            break;

        case 4:
            System.out.println("\nEmployee Management Operations:");
            System.out.println("1. Give Raise");
            System.out.println("2. Display Employee Info");
            System.out.print("Choice: ");
            int empChoice = sc.nextInt();
            switch (empChoice) {
                case 1:
                    System.out.print("Enter raise amount: ");
                    double raise = sc.nextDouble();
                    employee.giveRaise(raise);
                    break;
                case 2:
                    employee.displayEmployeeInfo();
                    break;
                default:
                    System.out.println("Invalid choice.");
            }
            break;

        case 5:
            System.out.println("Exiting...");
            sc.close();
            return;

        default:
            System.out.println("Invalid choice.");
        }
    }
  }
}
```

OUTPUT:

```
Select an option:
1. Bank Account
2. Library System
3. Student Grades
4. Employee Management
5. Exit
Choice: 1

Bank Account Operations:
1. Deposit
2. Withdraw
3. Display Info
Choice: 1
Enter deposit amount: 5000
Deposited: $5000.0

Select an option:
1. Bank Account
2. Library System
3. Student Grades
4. Employee Management
5. Exit
Choice: 2

Library System Operations:
1. Check out Book
2. Return Book
3. Display Book Info
Choice: 1
Book 'Heaven and Hell' has been checked out.

Select an option:
1. Bank Account
2. Library System
3. Student Grades
4. Employee Management
5. Exit
Choice: 4

Employee Management Operations:
1. Give Raise
2. Display Employee Info
Choice: 1
Enter raise amount: 1000
Salary raised by: $1000.0

Select an option:
1. Bank Account
2. Library System
3. Student Grades
4. Employee Management
5. Exit
Choice: 5
Exiting...

D:\OneDrive\Desktop\OOPS\assignment\Encapsulation>
```

14D: encapsulation 4

CODE:

```
abstract class Shape {
   public abstract double area();
}

class Person {
   private String name;
   private int age;

   public Person(String name, int age) {
      this.name = name;
      this.age = age;
   }

   public int getAge() {
      return age;
   }

   public void setAge(int age) {
      if (age > 0) {
         this.age = age;
      } else {
         System.out.println("Age cannot be negative");
      }
   }

   public void introduce() {
      System.out.println("Hi, I am " + name + " and I am " + age + " years old.");
   }
}

class Employee extends Person {
   private String position;

   public Employee(String name, int age, String position) {
      super(name, age);
      this.position = position;
   }

   public void introduce() {
      System.out.println("Hi, I am " + super.getAge() + " years old. I work as a " + position + ".");
   }
}

class Circle extends Shape {
   private double radius;

   public Circle(double radius) {
      this.radius = radius;
   }

   public double area() {
      return 3.14 * radius * radius;
   }
}

class Rectangle extends Shape {
   private double length;
   private double width;
```

```
    public Rectangle(double length, double width) {
        this.length = length;
        this.width = width;
    }

    public double area() {
        return length * width;
    }
}


class Calculator {
    public int add(int a, int b) {
        return a + b;
    }

    public int add(int a, int b, int c) {
        return a + b + c;
    }
}

public class En4 {
    public static void main(String[] args) {
        Person person = new Person("Raj", 29);
        Employee employee = new Employee("Sanjay", 21, "Civil Engineer");

        person.introduce();
        employee.introduce();
        System.out.println("Employee's age is: " + employee.getAge());
        employee.setAge(26);
        System.out.println("Updated Employee's age: " + employee.getAge());

        Shape circle = new Circle(5);
        Shape rectangle = new Rectangle(10, 4);
        System.out.println("Area of circle: " + circle.area());
        System.out.println("Area of rectangle: " + rectangle.area());

        Calculator calculator = new Calculator();
        System.out.println("Sum of 10 and 20: " + calculator.add(10, 20));
        System.out.println("Sum of 10, 20, and 30: " + calculator.add(10, 20, 30));
    }
}
```

OUTPUT:

```
C:\Users\ASE Computer Lab\Desktop\java>java Encap
Hi, I am Raj and I am 29 years old.
Hi, I am 21 years old. I work as a Civil Engineer.
Employee's age is: 21
Updated Employee's age: 26
Area of circle: 78.5
Area of rectangle: 40.0
Sum of 10 and 20: 30
Sum of 10, 20, and 30: 60

C:\Users\ASE Computer Lab\Desktop\java>
```

15A: user-defined package 1

CODE:

```
package pkg;

public class Rectangle {
   private double length;
   private double breadth;

   public Rectangle(double l, double b) {
      length = l;
      breadth = b;
   }

   public double getArea() {
      return length * breadth;
   }

   public double getPerimeter() {
      return 2 * (length + breadth);
   }
}
```

main program :

```
import pkg.Rectangle;

public class Userpk1 {
   public static void main(String[] args) {
      Rectangle r = new Rectangle(10.5, 5.2);
      System.out.println("Area of Rectangle: " + r.getArea());
      System.out.println("Perimeter of Rectangle: " + r.getPerimeter());
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\user package1>java Userpk1
Area of Rectangle: 54.6
Perimeter of Rectangle: 31.4
```

15B: user-defined package 2

CODE:

```
package pkg;

public class BMICalculator {
   private double height;
   private double weight;
   public BMICalculator(double height, double weight) {
      this.height = height;
      this.weight = weight;
   }

   public double calculateBMI() {
      return (weight / (height * height));
   }

   public String getCategory() {
      double bmi = calculateBMI();
```

```
        if (bmi < 18.5) {
            return "Underweight";
        } else if (bmi < 24.9) {
            return "Normal weight";
        } else if (bmi < 29.9) {
            return "Overweight";
        } else {
            return "Obese";
        }
    }
}
```

main program :

```
import pkg.BMICalculator;
import java.util.Scanner;

public class Userpk2 {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter your height in meters: ");
        double height = scanner.nextDouble();

        System.out.print("Enter your weight in kilograms: ");
        double weight = scanner.nextDouble();

        BMICalculator calculator = new BMICalculator(height, weight);
        double bmi = calculator.calculateBMI();
        String category = calculator.getCategory();

        System.out.printf("Your BMI is: %.2f\n", bmi);
        System.out.println("You are classified as: " + category);
    }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\user package1>java Userpk2
Enter your height in meters: 2
Enter your weight in kilograms: 2
Your BMI is: 0.50
You are classified as: Underweight
```

15C: in-built package 3

CODE:

```
import java.io.FileWriter;
import java.io.IOException;
import java.net.InetAddress;
import java.net.UnknownHostException;
import java.time.LocalDateTime;
import java.time.format.DateTimeFormatter;
import java.util.Scanner;

public class Package1 {
   public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      System.out.println("Enter website (e.g., www.example.com):");
      String website = scanner.nextLine();

      try {
         InetAddress inet = InetAddress.getByName(website);
         String ip = inet.getHostAddress();

         LocalDateTime timestamp = LocalDateTime.now();
         DateTimeFormatter formatter = DateTimeFormatter.ofPattern("yyyy-MM-dd HH:mm:ss");

         String log = "Website: " + website + "\nIP Address: " + ip +
                  "\nTimestamp: " + timestamp.format(formatter) + "\n\n";

         FileWriter writer = new FileWriter("log.txt", true);
         writer.write(log);
         writer.close();

         System.out.println("Website info logged successfully!");
      } catch (UnknownHostException e) {
         System.out.println("Website not found!");
      } catch (IOException e) {
         System.out.println("Error writing to file.");
      }
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment>javac Package1.java

D:\OneDrive\Desktop\OOPS\assignment>java Package1
Enter website (e.g., www.example.com):
www.google.com
Website info logged successfully!

D:\OneDrive\Desktop\OOPS\assignment>
```

15D: in-built package 4

CODE:

```
import java.io.FileWriter;
import java.io.IOException;
import java.net.InetAddress;
import java.time.LocalDateTime;
import java.time.format.DateTimeFormatter;

class Attendance {
   private String studentName;
   private String ipAddress;
   private String loginTime;

   public void setStudentName(String name) {
      this.studentName = name;
   }

   public String getStudentName() {
      return studentName;
   }

   public void setIpAddress(String ip) {
      this.ipAddress = ip;
   }

   public String getIpAddress() {
      return ipAddress;
   }

   public void setLoginTime(String time) {
      this.loginTime = time;
   }

   public String getLoginTime() {
      return loginTime;
   }

   public String getFormattedRecord() {
      return "Name: " + studentName + ", IP: " + ipAddress + ", Login Time: " + loginTime + "\n";
   }
}

public class Package2 {
   public static void main(String[] args) {
      Attendance a = new Attendance();
      a.setStudentName("Rahul Sharma");

      try {
         InetAddress inet = InetAddress.getLocalHost();
         a.setIpAddress(inet.getHostAddress());

         LocalDateTime now = LocalDateTime.now();
         DateTimeFormatter dtf = DateTimeFormatter.ofPattern("yyyy-MM-dd HH:mm:ss");
         a.setLoginTime(dtf.format(now));

         FileWriter writer = new FileWriter("attendance_log.txt", true);
         writer.write(a.getFormattedRecord());
         writer.close();

         System.out.println("Attendance logged successfully.");
```

```
    } catch (IOException e) {
      System.out.println("Error: " + e.getMessage());
    }
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\Package2>javac Package2.java

D:\OneDrive\Desktop\OOPS\assignment\Package2>java Package2
Attendance logged successfully.

D:\OneDrive\Desktop\OOPS\assignment\Package2>
```

16A: exception handling 1

CODE:

```
public class Excp1 {
  public static void main(String[] args) {
    String s = "abc";
    try {
      int num = Integer.parseInt(s);
      System.out.println("Number: " + num);
    } catch (NumberFormatException e) {
      System.out.println("Invalid number format!");
    }
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment>javac Excp1.java

D:\OneDrive\Desktop\OOPS\assignment>java Excp1
Invalid number format!

D:\OneDrive\Desktop\OOPS\assignment>
```

16B: exception handling 2

CODE:

```
import java.util.Scanner;

public class Excp2 {
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    String correctUsername = "admin";
    String correctPassword = "1234";

    try {
      System.out.print("Enter username: ");
      String username = sc.nextLine();

      System.out.print("Enter password: ");
      String password = sc.nextLine();
```

```
        if (!username.equals(correctUsername) || !password.equals(correctPassword)) {
            throw new Exception("Invalid username or password.");
        }

        System.out.println("Login Successful!");

    } catch (Exception e) {
        System.out.println("Login failed: " + e.getMessage());
    }
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment>java Excp2
Enter username: deepak
Enter password: 123
Login failed: Invalid username or password.

D:\OneDrive\Desktop\OOPS\assignment>java Excp2
Enter username: admin
Enter password: 1234
Login Successful!
```

16C: exception handling 3

CODE:

```
import java.io.*;

public class Excp3 {
  public static void main(String[] args) {
    BufferedReader reader = null;

    try {
      reader = new BufferedReader(new FileReader("sample.txt"));
      String line;

      while ((line = reader.readLine()) != null) {
        System.out.println(line);
      }

    } catch (FileNotFoundException e) {
      System.out.println("File not found.");
    } catch (IOException e) {
      System.out.println("Error reading file.");
    } finally {
      try {
        if (reader != null) reader.close();
      } catch (IOException e) {
        System.out.println("Error closing the file.");
      }
```

```
    }
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment>javac Excp3.java

D:\OneDrive\Desktop\OOPS\assignment>java Excp3
File not found.
```

16D: exception handling 4

CODE:

```
import java.util.Scanner;

public class Excp4 {
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);

    try {
      System.out.print("Enter first number: ");
      int a = sc.nextInt();

      System.out.print("Enter second number: ");
      int b = sc.nextInt();

      System.out.println("Choose operation (+, -, *, /): ");
      char op = sc.next().charAt(0);

      double result;

      switch (op) {
        case '+': result = a + b; break;
        case '-': result = a - b; break;
        case '*': result = a * b; break;
        case '/':
          if (b == 0) throw new ArithmeticException("Cannot divide by zero.");
          result = (double) a / b; break;
        default:
          throw new Exception("Invalid operator.");
      }

      System.out.println("Result: " + result);

    } catch (Exception e) {
      System.out.println("Error: " + e.getMessage());
    }
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment>java Excp4
Enter first number: 10
Enter second number: 10
Choose operation (+, -, *, /):
/
Result: 1.0

D:\OneDrive\Desktop\OOPS\assignment>java Excp4
Enter first number: 10
Enter second number: 0
Choose operation (+, -, *, /):
/
Error: Cannot divide by zero.
```

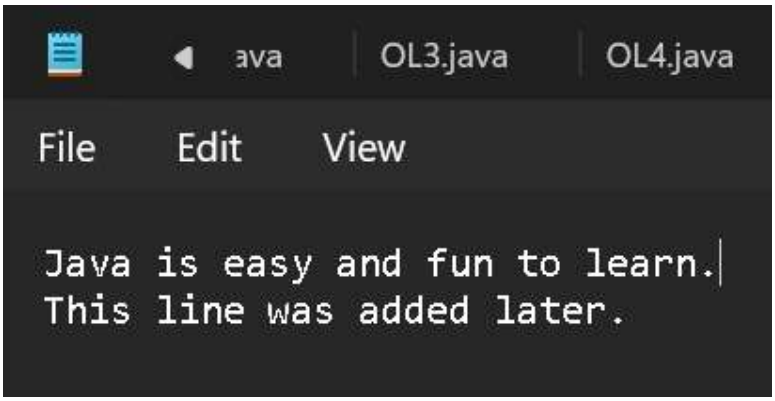
17A: file handling 1

CODE:

```
import java.io.FileWriter;
import java.io.IOException;

public class File1 {
   public static void main(String[] args) {
      try {
         FileWriter writer = new FileWriter("sample.txt", true);
         writer.write("\nThis line was added later.");
         writer.close();
         System.out.println("Appended successfully.");
      } catch (IOException e) {
         System.out.println("An error occurred.");
         e.printStackTrace();
      }
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\files>java File1
Appended successfully.

D:\OneDrive\Desktop\OOPS\assignment\files>
```



17B: file handling 2

CODE:

```
import java.io.*;
import java.util.*;

public class File2 {
   static final String FILE_NAME = "sample.txt";

   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      int choice;

      do {
         System.out.println("\n1. Add Person");
         System.out.println("2. View All Person");
         System.out.println("3. Search Person by Name");
         System.out.println("4. Exit");
         System.out.print("Choose: ");
         choice = sc.nextInt();
         sc.nextLine();

         switch (choice) {
            case 1 -> addPerson(sc);
            case 2 -> viewPerson();
            case 3 -> searchPerson(sc);
            case 4 -> System.out.println("Goodbye!");
            default -> System.out.println("Invalid choice.");
         }
      } while (choice != 4);
   }

   static void addPerson(Scanner sc) {
      try (FileWriter fw = new FileWriter(FILE_NAME, true)) {
         System.out.print("Enter name: ");
         String name = sc.nextLine();
         System.out.print("Enter age: ");
         int age = sc.nextInt();
         sc.nextLine();
         fw.write(name + "," + age + "\n");
         System.out.println("Person added.");
      } catch (IOException e) {
         e.printStackTrace();
      }
   }
```

```
  static void viewPerson() {
    try (Scanner fileScanner = new Scanner(new File(FILE_NAME))) {
      System.out.println("All Student Records:");
      while (fileScanner.hasNextLine()) {
        String[] data = fileScanner.nextLine().split(",");
        System.out.println("Name: " + data[0] + ", Age: " + data[1]);
      }
    } catch (FileNotFoundException e) {
      System.out.println("No person records found.");
    }
  }

  static void searchPerson(Scanner sc) {
    System.out.print("Enter name to search: ");
    String searchName = sc.nextLine();
    boolean found = false;

    try (Scanner fileScanner = new Scanner(new File(FILE_NAME))) {
      while (fileScanner.hasNextLine()) {
        String line = fileScanner.nextLine();
        String[] data = line.split(",");
        if (data[0].equalsIgnoreCase(searchName)) {
          System.out.println("Found: Name: " + data[0] + ", Age: " + data[1]);
          found = true;
        }
      }
    } catch (FileNotFoundException e) {
      System.out.println("File not found.");
    }

    if (!found) {
      System.out.println("Person not found.");
    }
  }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\files>java File2

1. Add Person
2. View All Person
3. Search Person by Name
4. Exit
Choose: 1
Enter name: Deepak
Enter age: 18
Person added.

1. Add Person
2. View All Person
3. Search Person by Name
4. Exit
Choose: 3
Enter name to search: Deepak
Found: Name: Deepak, Age: 18

1. Add Person
2. View All Person
3. Search Person by Name
4. Exit
Choose: 4
Goodbye!

D:\OneDrive\Desktop\OOPS\assignment\files>
```

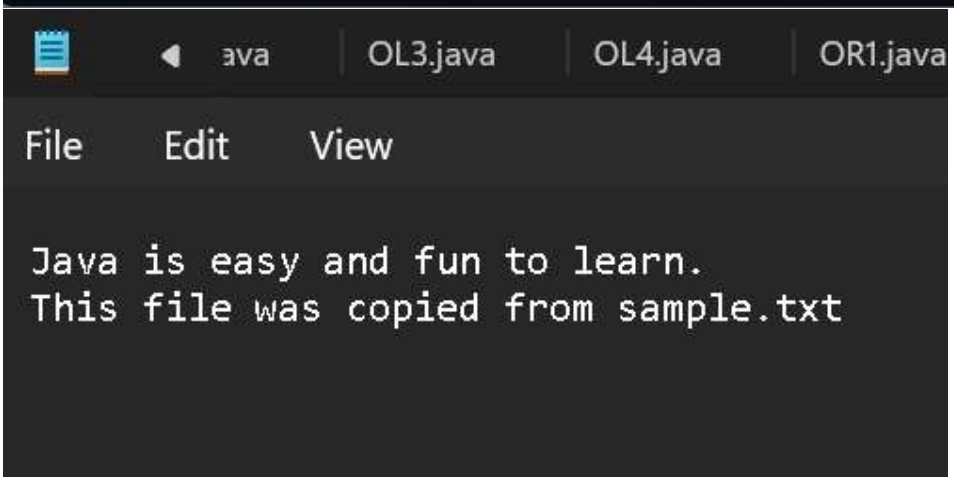
17C: file handling 3

CODE:

```
import java.io.*;

public class File3 {
   public static void main(String[] args) {
      try (BufferedReader reader = new BufferedReader(new FileReader("sample.txt"));
          BufferedWriter writer = new BufferedWriter(new FileWriter("destination.txt"))) {

         String line;
         while ((line = reader.readLine()) != null) {
            writer.write(line);
            writer.newLine();
         }

         System.out.println("File copied successfully.");

      } catch (IOException e) {
         e.printStackTrace();
      }
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\files>javac File3.java

D:\OneDrive\Desktop\OOPS\assignment\files>java File3
File copied successfully.

D:\OneDrive\Desktop\OOPS\assignment\files>
```



17D: file handling 4

CODE:

```
import java.io.*;
import java.util.*;

public class File4 {
   static final String FILE_NAME = "sample.txt";

   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      System.out.print("Enter product name: ");
      String name = sc.nextLine();
      System.out.print("Enter price: ");
      double price = sc.nextDouble();
      System.out.print("Enter quantity: ");
      int quantity = sc.nextInt();

      try (FileWriter fw = new FileWriter(FILE_NAME, true)) {
         fw.write(name + "," + price + "," + quantity + "\n");
         System.out.println("Product saved.");
      } catch (IOException e) {
         e.printStackTrace();
      }
   }
}
```

OUTPUT:

```
D:\OneDrive\Desktop\OOPS\assignment\files>java File4
Enter product name: Laptop
Enter price: 80000
Enter quantity: 1
Product saved.

D:\OneDrive\Desktop\OOPS\assignment\files>
```