LAB RECORD

23CSE111 – Object Oriented Programming

Submitted by

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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.U4CSE24108 –Chepoori Sai Vivek*** 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 in 2nd Semester

Internal Examiner 1 Internal Examiner 2

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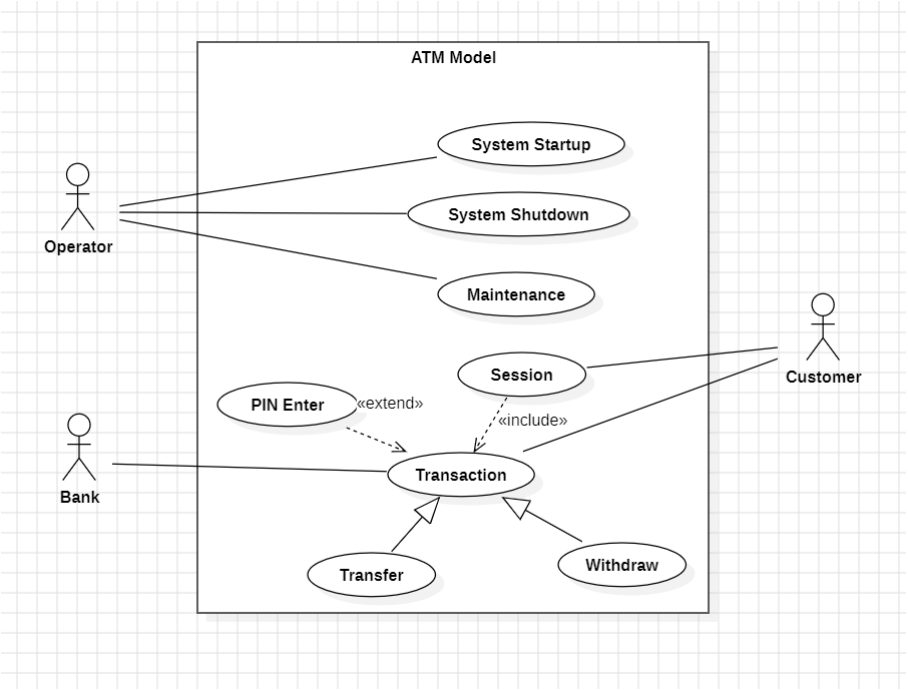
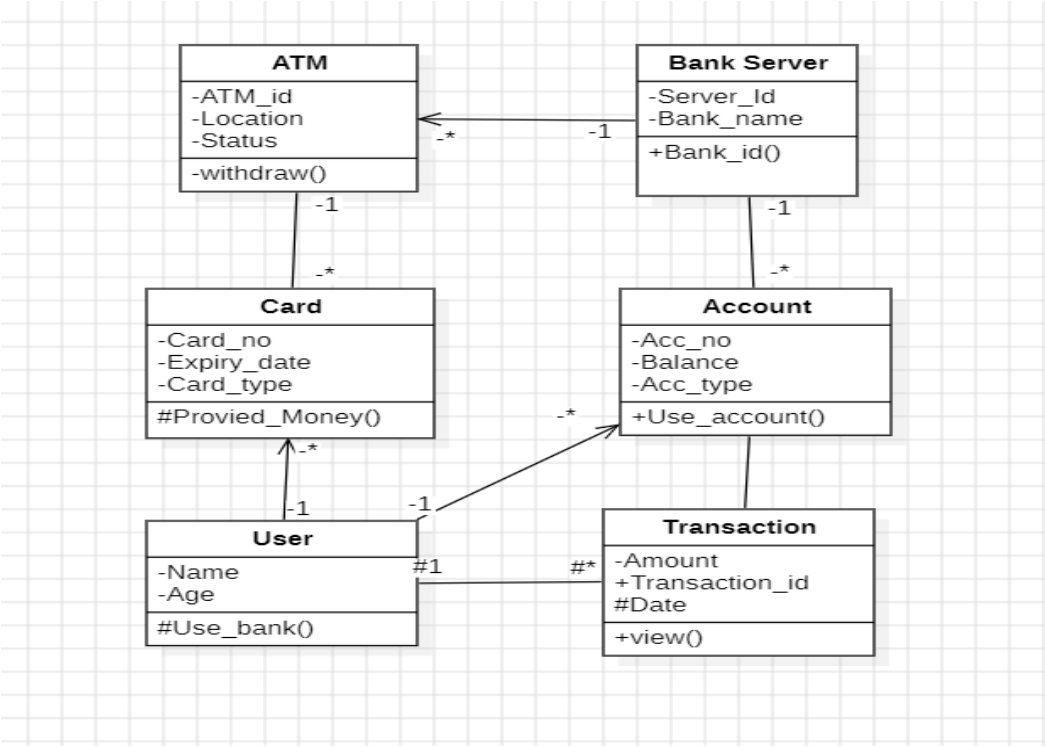
1. UML Diagrams

Problem 1 – ATM Management System

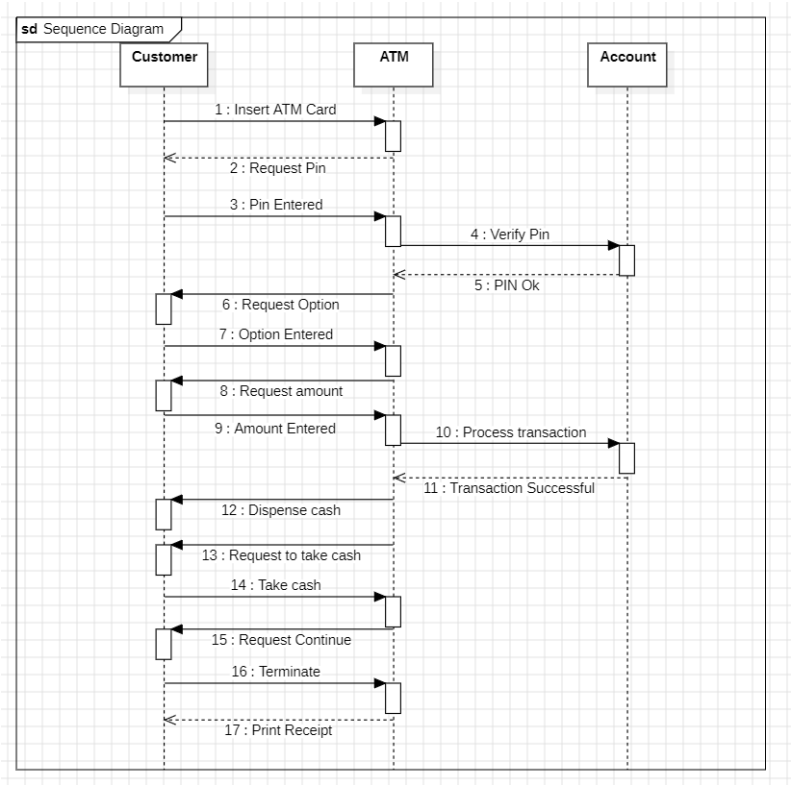
a. Use Case Diagram



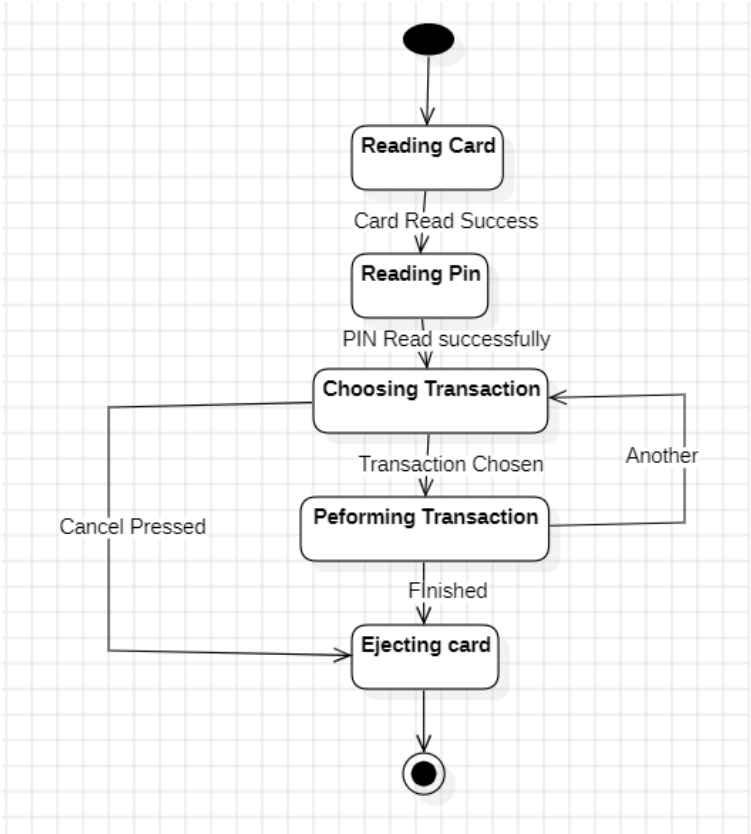
b. Class Diagram



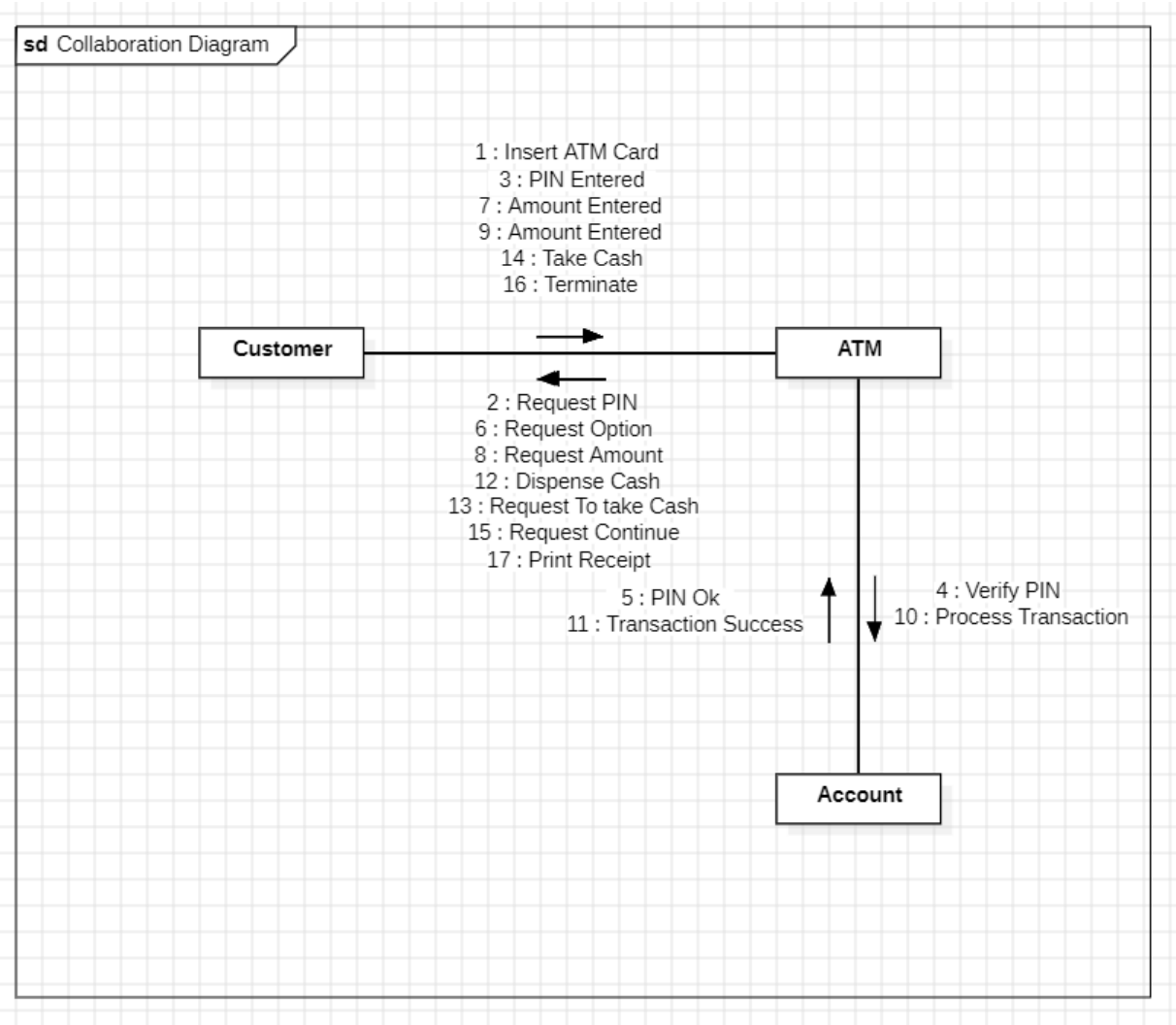
c. Sequence Diagram



d. State Diagram

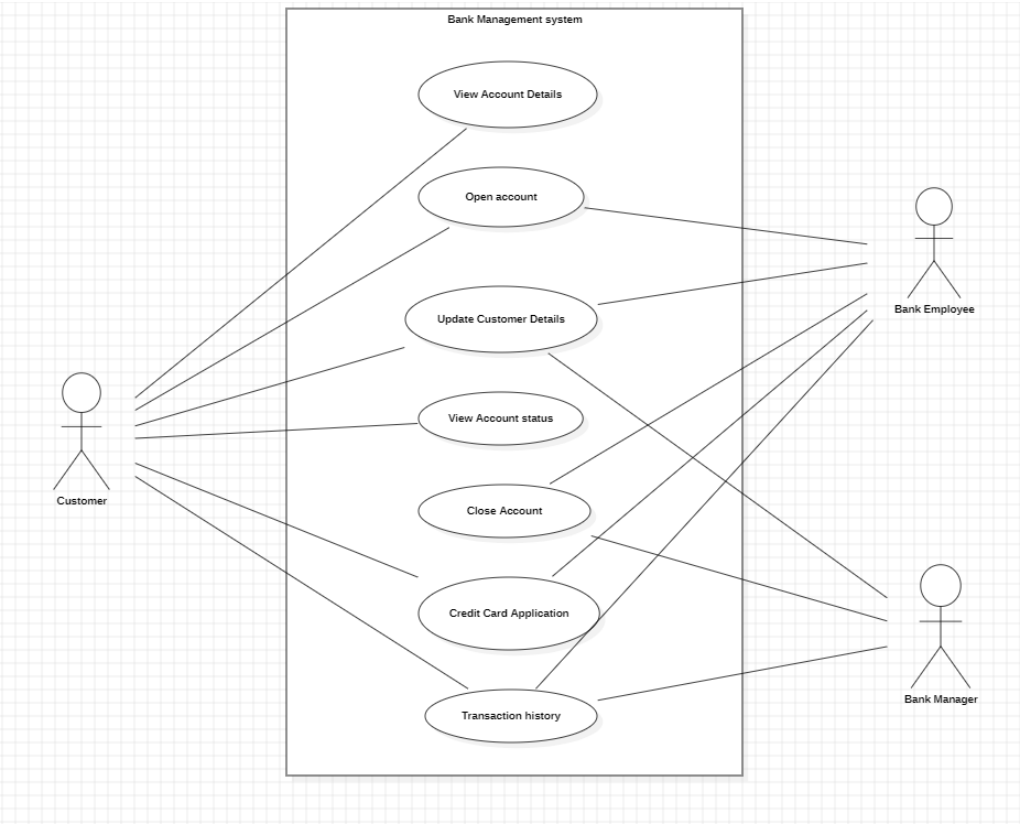


e. Collaboration Diagram

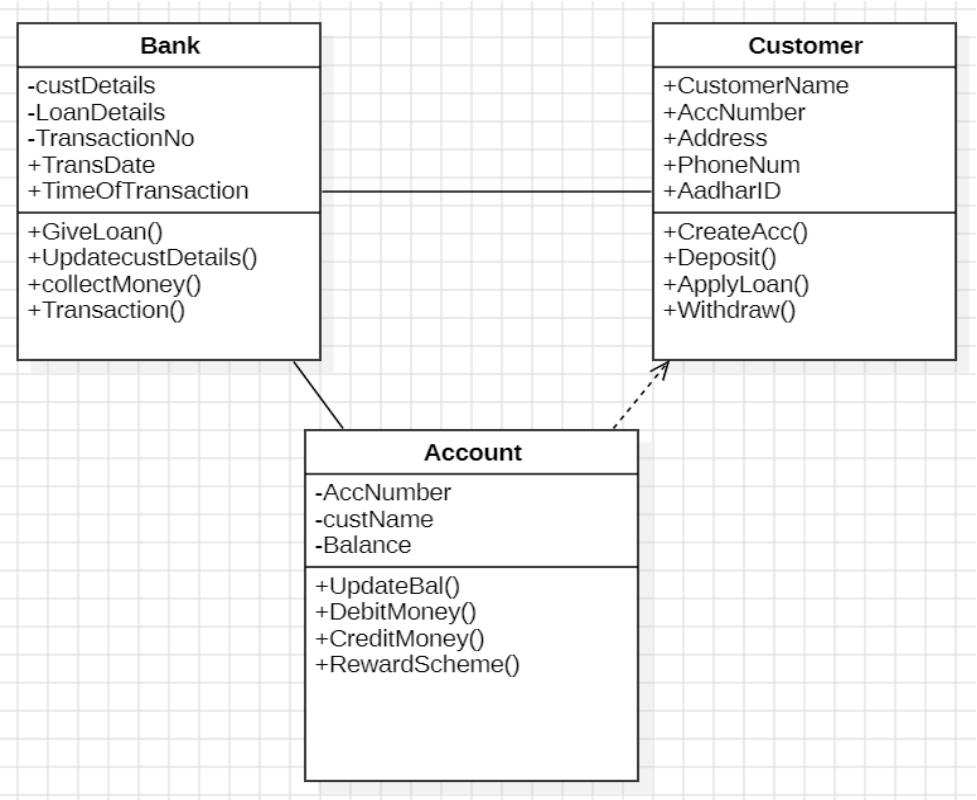


Problem 2 – Bank Management System

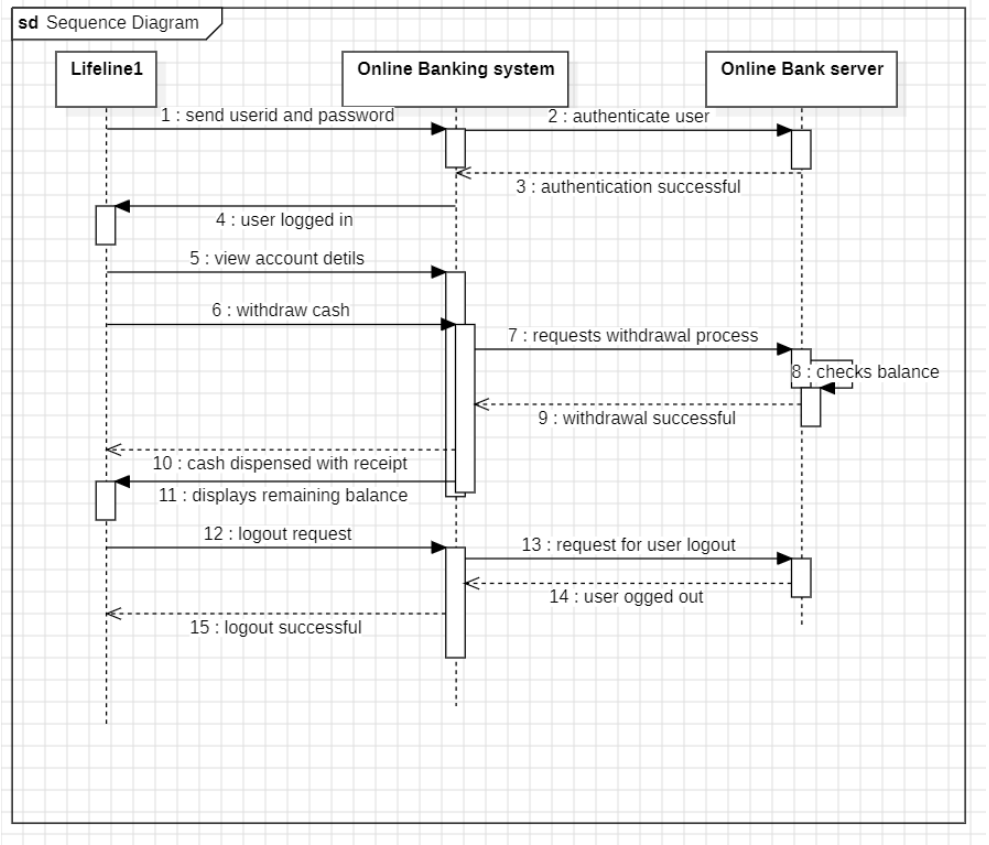
a. Use Case Diagram



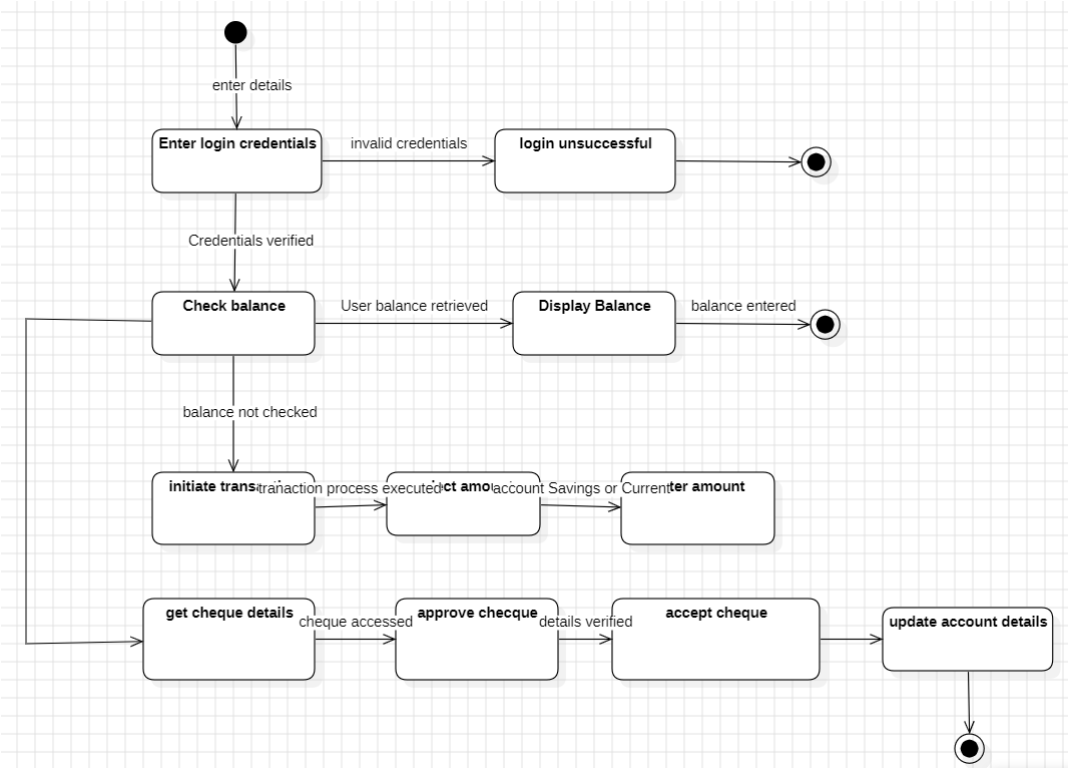
b. Class Diagram



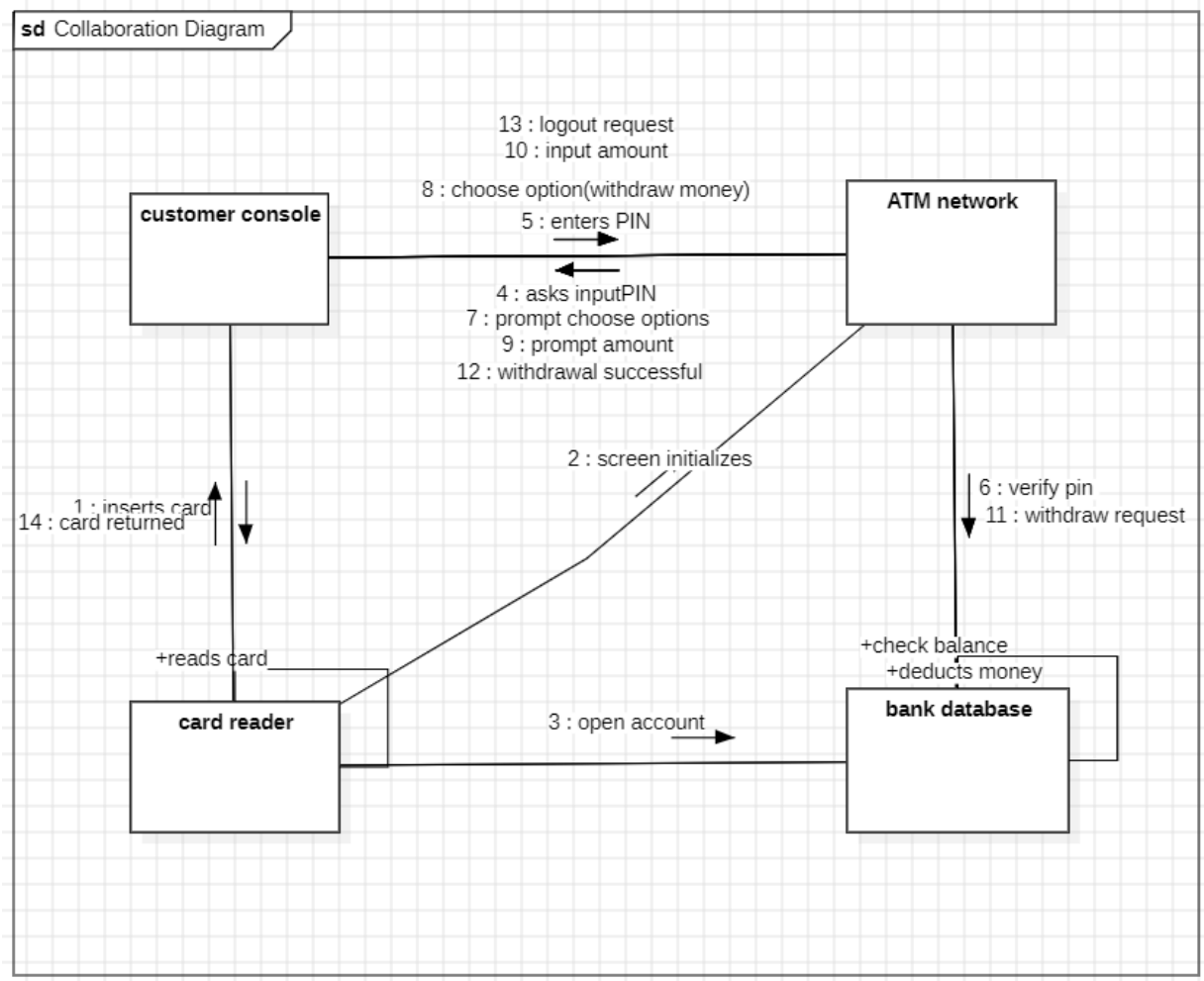
c. Sequence Diagram



d. State Diagram



e. Collaboration Diagram



Java Basic Programs

1. BMI Calculator program in java

Program:

```
import java.util.Scanner;
public class BMICalculator {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter weight in kilograms: ");
        double weight = scanner.nextDouble();
        System.out.print("Enter height in meters: ");
        double height = scanner.nextDouble();
        double bmi = weight / (height * height);
        System.out.printf("Your BMI is: %.2f\n", bmi);
        if (bmi < 18.5) {
            System.out.println("Category: Underweight");
        } else if (bmi < 24.9) {
            System.out.println("Category: Normal weight");
        } else if (bmi < 29.9) {
            System.out.println("Category: Overweight");
        } else {
            System.out.println("Category: Obese");
        }
        scanner.close();
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac BMICalculator.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java BMICalculator
Enter weight in kilograms: 60
Enter height in meters: 2
Your BMI is: 15.00
Category: Underweight
```

2. Reverse multiplication program in java

Program:

```
import java.util.Scanner;

public class ReverseMultiplicationTable {

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter a number: ");

        int num = scanner.nextInt();

        System.out.print("Enter the range: ");

        int range = scanner.nextInt();

        System.out.println("Multiplication Table of " + num + " in Reverse Order:");

        for (int i = range; i >= 1; i--) {

            System.out.println(num + " x " + i + " = " + (num * i));

        }

        scanner.close();

    }

}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac ReverseMultiplicationTable.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java ReverseMultiplicationTable
Enter a number: 10
Enter the range: 10
Multiplication Table of 10 in Reverse Order:
10 x 10 = 100
10 x 9 = 90
10 x 8 = 80
10 x 7 = 70
10 x 6 = 60
10 x 5 = 50
10 x 4 = 40
10 x 3 = 30
10 x 2 = 20
10 x 1 = 10
```

3. Sum of four-digited program in java

Program:

```
import java.util.Scanner;

public class SumOfDigits {

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter a four-digit number: ");

        int number = scanner.nextInt();

        if (number < 1000 || number > 9999) {

            System.out.println("Please enter a valid four-digit number.");

        } else {

            int sum = 0;

            int temp = number;

            while (temp > 0) {

                sum += temp % 10;

                temp /= 10;

            }

            System.out.println("Sum of digits: " + sum);

        }

        scanner.close();

    }

}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac SumOfDigits.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java SumOfDigits
Enter a four-digit number: 1845
Sum of digits: 18
```

4. Java Program to check if two numbers are equal.

Program:

```
import java.util.Scanner;
public class Equal_Integer
{
    public static void main(String[] args)
    {
        int m, n;
        Scanner s = new Scanner(System.in);
        System.out.print("Enter the first number:");
        m = s.nextInt();
        System.out.print("Enter the second number:");
        n = s.nextInt();
        if(m == n)
        {
            System.out.println(m+" and "+n+" are equal ");
        }
        else
        {
            System.out.println(m+" and "+n+" are not equal ");
        }
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Equal_Integer.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Equal_Integer
Enter the first number: 18
Enter the second number: 18
18 and 18 are equal
```

5. Java Program to reverse a number.

Program:

```
import java.util.Scanner;

public class Reverse_Number

{

    public static void main(String args[])

    {

        int m, n, sum = 0;

        Scanner s = new Scanner(System.in);

        System.out.print("Enter the number:");

        m = s.nextInt();

        while(m > 0)

        {

            n = m % 10;

            sum = sum * 10 + n;

            m = m / 10;

        }

        System.out.println("Reverse of a Number is "+sum);

    }

}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Reverse_Number.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Reverse_Number
Enter the number: 1845
Reverse of a Number is 5481
```

6. Java Program to find sum of first n natural numbers.

Program:

```
import java.util.Scanner;

public class Sum_Numbers

{

    int sum = 0, j = 0;

    public static void main(String[] args)

    {

        int n;

        Scanner s = new Scanner(System.in);

        System.out.print("Enter the no. of elements you want:");

        n = s.nextInt();

        int a[] = new int[n];

        System.out.print("Enter all the elements you want:");

        for(int i = 0; i < n; i++)

        {

            a[i] = s.nextInt();

        }

        Sum_Numbers obj = new Sum_Numbers();

        int x = obj.add(a, a.length, 0);

        System.out.println("Sum:"+x);
```

```
    }
    int add(int a[], int n, int i)
    {
        if(i < n)
        {
            return a[i] + add(a, n, ++i);
        }
        else
        {
            return 0;
        }
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Sum_Numbers.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Sum_Numbers
Enter the number of elements: 3
Enter all the elements: 1
7
5
Sum: 13
```

7. Java Program to find whether number is positive or negative.

Program:

```
import java.util.Scanner;
public class Postive_Negative
{
    public static void main(String[] args)
    {
```

```
        int n;
        Scanner s = new Scanner(System.in);
        System.out.print("Enter the number you want to check:");
        n = s.nextInt();
        if(n > 0)
        {
            System.out.println("The given number "+n+" is Positive");
        }
        else if(n < 0)
        {
            System.out.println("The given number "+n+" is Negative");
        }
        else
        {
            System.out.println("The given number "+n+" is neither Positive nor Negative ");
        }
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Positive_Negative.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Positive_Negative
Enter a number: 2
2 is Positive
```

8. Java Program to find the largest among three numbers.

Program:

```
import java.util.Scanner;

public class Biggest_Number

{

    public static void main(String[] args)

    {

        int x, y, z;

        Scanner s = new Scanner(System.in);

        System.out.print("Enter the first number:");
```

```
        x = s.nextInt();
        System.out.print("Enter the second number:");
        y = s.nextInt();
        System.out.print("Enter the third number:");
        z = s.nextInt();
        if(x > y && x > z)
        {
            System.out.println("Largest number is:"+x);
        }
        else if(y > z)
        {
            System.out.println("Largest number is:"+y);
        }
        else
        {
            System.out.println("Largest number is:"+z);
        }

    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Biggest_Number.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Biggest_Number
Enter three numbers: 7
10
18
Largest number is: 18
```

9. Java Program to find the largest element in an array.

Program:

```
import java.util.Scanner;
public class Largest_Number
{
    public static void main(String[] args)
    {
        int n, max;
        Scanner s = new Scanner(System.in);
        System.out.print("Enter number of elements in the array:");
        n = s.nextInt();
        int a[] = new int[n];
        System.out.println("Enter elements of array:");
        for(int i = 0; i < n; i++)
        {
            a[i] = s.nextInt();
        }
        max = a[0];
        for(int i = 0; i < n; i++)
        {
            if(max < a[i])
            {
                max = a[i];
            }
        }
        System.out.println("Maximum value:"+max);
    }
}
```

Output:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Largest_Number.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Largest_Number
Enter number of elements: 3
Enter elements:
7
10
18
Maximum value: 18
```

10. Java Program to print Pascal's Triangle.

Program:

```
public class PascalTriangle
{
    public static void main(String[] args)
    {
        int rows = 5;
        for (int i = 0; i < rows; i++)
        {
            int number = 1;
            for (int j = 0; j < rows - i; j++)
            {
                System.out.print(" ");
            }
            for (int j = 0; j <= i; j++)
            {
                System.out.print(number + " ");
                number = number * (i - j) / (j + 1);
            }
            System.out.println();
        }
```

```
    }
  }
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac PascalTriangle.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java PascalTriangle
     1
    1 1
   1 2 1
  1 3 3 1
 1 4 6 4 1
```

Inheritance

Single Inheritance problems

1. Write a Java program using inheritance to calculate the area of a rectangle based on user input.

Code:

```
import java.util.Scanner;

class Shape {
    public void calculateArea() {
        System.out.println("The area has been calculating");
    }
}

class Rectangle extends Shape {
    int length, breadth;

    Rectangle(int length, int breadth) {
        this.length = length;
        this.breadth = breadth;
    }

    public void getArea() {
        System.out.println("The area of rectangle is :" + (length
* breadth));
    }
}

public class Main {
    public static void main(String[] args) {
        Scanner obj = new Scanner(System.in);
        System.out.println("Enter length :");
        int length = obj.nextInt();
        System.out.println("Enter breadth :");
        int breadth = obj.nextInt();
```

```
        Shape myShape = new Shape();
        myShape.calculateArea();

        Rectangle myObj = new Rectangle(length, breadth);
        myObj.getArea();
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Main.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Main
Enter length :
12
Enter breadth :
23
The area has been calculating
The area of rectangle is :276
```

2. Write a Java program using inheritance to display a restaurant menu and generate a bill based on user-selected items.

Code:

```
import java.util.Scanner;

class RestrauntMenu {
    public void defaultMenu() {
        System.out.println("-----------####----------");
        System.out.println("Here is our menu card");
        System.out.println("Biryani");
        System.out.println("Kadhai Paneer");
        System.out.println("Butter Chicken");
        System.out.println("Nans");
        System.out.println("Sweets");
        System.out.println("Juices");
        System.out.println("Ice Creams");
        System.out.println("-------------------------");
    }
}

class PaymentBill extends RestrauntMenu {
```

```
    String Biryani, curry, icecreams;

    PaymentBill(String Biryani, String curry, String icecreams)
{
        this.Biryani = Biryani;
        this.curry = curry;
        this.icecreams = icecreams;
    }

    public void yourBill() {
        System.out.println("-----------####----------");
        System.out.println("Here is our bill card");
        System.out.println(Biryani);
        System.out.println(curry);
        System.out.println(icecreams);
        System.out.println("--------------------------");
    }
}

public class Restraunt {
    public static void main(String[] args) {
        Scanner obj = new Scanner(System.in);
        System.out.println("Enter any Biryani:");
        String Biryani = obj.nextLine();
        System.out.println("Enter any Curry:");
        String curry = obj.nextLine();
        System.out.println("Enter any Ice Creams:");
        String icecreams = obj.nextLine();

        RestrauntMenu myRes = new RestrauntMenu();
        myRes.defaultMenu();

        PaymentBill myobj = new PaymentBill(Biryani, curry,
icecreams);
        myobj.yourBill();
    }
```

}

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Restraunt.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Restraunt
Enter any Biryani:
Prawns
Enter any Curry:
chicken
Enter any Ice Creams:
vanilla
-----------####----------
Here is our menu card
Biryani
Kadhai Paneer
Butter Chicken
Nans
Sweets
Juices
Ice Creams
--------------------------
-----------####----------
Here is our bill card
Prawns
chicken
vanilla
--------------------------
```

Multilevel Inheritance

1. Write a Java program demonstrating multilevel inheritance with different types of pens and their behaviors.

Code:

```
class Pen {
    String color;
    String inkType;

    public Pen(String color, String inkType) {
        this.color = color;
        this.inkType = inkType;
    }

    public void write() {
        System.out.println("Writing with a " + color + " pen using " + inkType + "
ink.");
    }
}

class FountainPen extends Pen {
    String nibSize;
```

```
    public FountainPen(String color, String inkType, String nibSize) {
        super(color, inkType);
        this.nibSize = nibSize;
    }

    public void write() {
        System.out.println("Writing with a " + color + " fountain pen using " +
inkType + " ink with a " + nibSize + " nib.");
    }

    public void refill() {
        System.out.println("Refilling the " + color + " fountain pen.");
    }
}

class UseAndThrowPen extends FountainPen {
    public UseAndThrowPen(String color, String inkType, String nibSize) {
        super(color, inkType, nibSize);
    }

    public void write() {
        System.out.println("Writing with a " + color + " use-and-throw pen using "
+ inkType + " ink with a " + nibSize + " nib.");
    }

    public void dispose() {
        System.out.println("Disposing of the " + color + " use-and-throw pen.");
    }
}

public class PenTest {
    public static void main(String[] args) {
        Pen pen = new Pen("Blue", "gel");
        pen.write();

        FountainPen fountainPen = new FountainPen("Black", "liquid", "fine");
        fountainPen.write();
        fountainPen.refill();

        UseAndThrowPen useAndThrowPen = new UseAndThrowPen("Red",
"ballpoint", "medium");
        useAndThrowPen.write();
        useAndThrowPen.dispose();
    }
}
```

Output:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac PenTest.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java PenTest
Writing with a Blue pen using gel ink.
Writing with a Black fountain pen using liquid ink with a fine nib.
Refilling the Black fountain pen.
Writing with a Red use-and-throw pen using ballpoint ink with a medium nib.
Disposing of the Red use-and-throw pen.
```

2. Write a Java program using inheritance to display a categorized restaurant menu including starters, main items, desserts, and drinks.

Code:

```
class RestaurantItem {
    String name;
    double price;

    public RestaurantItem(String name, double price) {
        this.name = name;
        this.price = price;
    }

    public void display() {
        System.out.println("Item: " + name + ", Price: ₹" + price);
    }
}

class Starters extends RestaurantItem {
    public Starters(String name, double price) {
        super(name, price);
    }

    public void display() {
        System.out.println("----------###----------");
        System.out.println("Starter: " + name + ", Price: ₹" + price);
        System.out.println("----------------------");
    }

    public static void displayStarters() {
        Starters starter1 = new Starters("Garlic Bread", 120);
        Starters starter2 = new Starters("Bruschetta", 100);
        Starters starter3 = new Starters("Stuffed Mushrooms", 70);
        Starters starter4 = new Starters("Spring Rolls", 90);
        starter1.display();
        starter2.display();
        starter3.display();
        starter4.display();
    }
```

```
}

class MainItems extends RestaurantItem {
    public MainItems(String name, double price) {
        super(name, price);
    }

    public void display() {
        System.out.println("----------###----------");
        System.out.println("Main Item: " + name + ", Price: ₹" + price);
        System.out.println("---------------------");
    }

    public static void displayMainItems() {
        MainItems mainItem1 = new MainItems("Grilled Chicken", 140);
        MainItems mainItem2 = new MainItems("Pasta Primavera", 210);
        MainItems mainItem3 = new MainItems("Beef Steak", 349);
        MainItems mainItem4 = new MainItems("Vegetable Curry", 100);
        mainItem1.display();
        mainItem2.display();
        mainItem3.display();
        mainItem4.display();
    }
}

class Desserts extends RestaurantItem {
    public Desserts(String name, double price) {
        super(name, price);
    }

    public void display() {
        System.out.println("----------###----------");
        System.out.println("Dessert: " + name + ", Price: ₹" + price);
        System.out.println("---------------------");
    }

    public static void displayDesserts() {
        Desserts dessert1 = new Desserts("Chocolate Cake", 60);
        Desserts dessert2 = new Desserts("Ice Cream Sundae", 80);
        Desserts dessert3 = new Desserts("Fruit Tart", 30);
        Desserts dessert4 = new Desserts("Cheesecake", 60);
        dessert1.display();
        dessert2.display();
        dessert3.display();
        dessert4.display();
    }
```

```
}

class Drinks extends RestaurantItem {
    public Drinks(String name, double price) {
        super(name, price);
    }

    public void display() {
        System.out.println("----------###----------");
        System.out.println("Drink: " + name + ", Price: ₹" + price);
        System.out.println("----------------------");
    }

    public static void displayDrinks() {
        Drinks drink1 = new Drinks("Coke", 76);
        Drinks drink2 = new Drinks("Lemonade", 89);
        Drinks drink3 = new Drinks("Iced Tea", 200);
        Drinks drink4 = new Drinks("Water", 20);
        drink1.display();
        drink2.display();
        drink3.display();
        drink4.display();
    }
}

public class RestaurantMenu {
    public static void main(String[] args) {
        Starters.displayStarters();
        MainItems.displayMainItems();
        Desserts.displayDesserts();
        Drinks.displayDrinks();
    }
}
```

Output:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java RestaurantMenu
----------###----------
Starter: Garlic Bread, Price: ?120.0
------------------------
----------###----------
Starter: Bruschetta, Price: ?100.0
------------------------
----------###----------
Starter: Stuffed Mushrooms, Price: ?70.0
------------------------
----------###----------
Starter: Spring Rolls, Price: ?90.0
------------------------
----------###----------
Main Item: Grilled Chicken, Price: ?140.0
------------------------
----------###----------
Main Item: Pasta Primavera, Price: ?210.0
------------------------
----------###----------
Main Item: Beef Steak, Price: ?349.0
------------------------
----------###----------
Main Item: Vegetable Curry, Price: ?100.0
------------------------
----------###----------
Dessert: Chocolate Cake, Price: ?60.0
------------------------
----------###----------
Dessert: Ice Cream Sundae, Price: ?80.0
------------------------
----------###----------
Dessert: Fruit Tart, Price: ?30.0
------------------------
----------###----------
Dessert: Cheesecake, Price: ?60.0
------------------------
----------###----------
Drink: Coke, Price: ?76.0
------------------------
----------###----------
Drink: Lemonade, Price: ?89.0
------------------------
----------###----------
Drink: Iced Tea, Price: ?200.0
------------------------
----------###----------
Drink: Water, Price: ?20.0
------------------------
```

HERIECHIAL INHERITANCE

1. Write a Java program using inheritance to model vehicles and calculate their efficiency based on speed and distance.

Code:

```
import java.util.Scanner;

class Vehicle {
   String make;
   int model, year, distance, maxspeed, efficiency;

   public Vehicle(String make, int model, int year, int distance, int maxspeed)
{
      this.make = make;
      this.model = model;
      this.year = year;
      this.distance = distance;
      this.maxspeed = maxspeed;
   }
```

```
    public void special() {
        if (maxspeed != 0) {
            efficiency = (distance / maxspeed) * 100;
        } else {
            efficiency = 0;
        }
    }
}

class Truck extends Vehicle {
    public Truck(String make, int model, int year, int distance, int maxspeed) {
        super(make, model, year, distance, maxspeed);
        special();
    }

    public void displayTruckInfo() {
        System.out.println("--------@@@@---------");
        System.out.println("Make: " + make);
        System.out.println("Year: " + year);
        System.out.println("Model: " + model);
        System.out.println("The Speed of the Truck is: " + maxspeed);
        System.out.println("The distance travelled by truck is: " + distance);
        System.out.println("The efficiency is: " + efficiency + "%");
        System.out.println("----------------------");
    }
}

class Car extends Vehicle {

    public Car(String make, int model, int year, int distance, int maxspeed) {
        super(make, model, year, distance, maxspeed);
        special();
    }

    public void displayCarInfo() {
        System.out.println("--------@@@@---------");
        System.out.println("Make: " + make);
        System.out.println("Year: " + year);
        System.out.println("Model: " + model);
        System.out.println("The Speed of the Car is: " + maxspeed);
        System.out.println("The distance travelled by Car is: " + distance);
        System.out.println("The efficiency is: " + efficiency + "%");
        System.out.println("----------------------");
    }
}
```

```
public class Details {
   public static void main(String[] args) {
      Scanner obj = new Scanner(System.in);

      System.out.println("Enter the make of Truck:");
      String make = obj.nextLine();

      System.out.println("Enter the model of Truck:");
      int model = obj.nextInt();

      System.out.println("Enter the Year of Truck:");
      int year = obj.nextInt();

      System.out.println("Enter the maxspeed of Truck:");
      int maxspeed = obj.nextInt();

      System.out.println("Enter the distance travelled by Truck:");
      int distance = obj.nextInt();

      Truck obj1 = new Truck(make, model, year, distance, maxspeed);
      obj1.displayTruckInfo();

      Car obj2 = new Car(make, model, year, distance, maxspeed);
      obj2.displayCarInfo();
   }
}
```

Output:

```
Enter the make of Truck:
toyato
Enter the model of Truck:
6
Enter the Year of Truck:
2006
Enter the maxspeed of Truck:
46
Enter the distance travelled by Truck:
654
--------@@@@---------
Make: toyato
Year: 2006
Model: 6
The Speed of the Truck is: 46
The distance travelled by truck is: 654
The efficiency is: 1400%
----------------------
--------@@@@---------
Make: toyato
Year: 2006
Model: 6
The Speed of the Car is: 46
The distance travelled by Car is: 654
The efficiency is: 1400%
----------------------
```

2. Write a Java program using inheritance to calculate the area and perimeter of different shapes like Circle and Square.

Code:

```
class Shape {

    double area;

    double perimeter;



    public Shape() {

        this.area = 0.0;
```

```
        this.perimeter = 0.0;
    }

    public void calculateArea() {
        System.out.println("The area is: " + area);
    }

    public void calculatePerimeter() {
        System.out.println("The perimeter is: " + perimeter);
    }
}

class Circle extends Shape {
    int radius;

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

    public void calculateArea() {
        area = Math.PI * radius * radius;
        System.out.println("The area of Circle is: " + area);
    }

    public void calculatePerimeter() {
```

```
        perimeter = 2 * Math.PI * radius;

        System.out.println("The perimeter of Circle is: " + perimeter);

    }

}


class Square extends Shape {

    int length;


    public Square(int length) {

        this.length = length;

    }


    public void calculateArea() {

        area = length * length;

        System.out.println("The area of Square is: " + area);

    }


    public void calculatePerimeter() {

        perimeter = 4 * length;

        System.out.println("The perimeter of Square is: " + perimeter);

    }

}


public class Main {

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

```
        Circle circle = new Circle(7);

        circle.calculateArea();

        circle.calculatePerimeter();



        Square square = new Square(4);

        square.calculateArea();

        square.calculatePerimeter();

    }

}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java Main
The area of Circle is: 153.93804002589985
The perimeter of Circle is: 43.982297150257104
The area of Square is: 16.0
The perimeter of Square is: 16.0

C:\Users\yogir\OneDrive\Documents\Desktop\practice>
```

HYBRID INHERITANCE

1. Write a Java program using Hybrid inheritance to model different bank accounts like savings, current, and loan.

Code:

```
class Bank {
    String bankName;

    public Bank(String bankName) {
        this.bankName = bankName;
    }

    public void displayBankInfo() {
        System.out.println("Bank Name: " + bankName);
    }
}
```

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
class SavingsAccount extends Bank {
   double interestRate;

   public SavingsAccount(String bankName, double interestRate) {
      super(bankName);

      this.interestRate = interestRate;
   }

   public void displaySavingsInfo() {
      System.out.println("Savings Account at " + bankName + " with Interest
Rate: " + interestRate + "%");
   }
}

class CurrentAccount extends Bank {
   double overdraftLimit;

   public CurrentAccount(String bankName, double overdraftLimit) {
      super(bankName);
      this.overdraftLimit = overdraftLimit;
   }

   public void displayCurrentInfo() {
      System.out.println("Current Account at " + bankName + " with Overdraft
Limit: ₹" + overdraftLimit);
   }
}

class LoanAccount extends SavingsAccount {
   double loanAmount;

   public LoanAccount(String bankName, double interestRate, double
loanAmount) {
      super(bankName, interestRate);
      this.loanAmount = loanAmount;
   }

   public void displayLoanInfo() {
      System.out.println("Loan Account at " + bankName + " with Loan
Amount: ₹" + loanAmount +
            " and Interest Rate: " + interestRate + "%");
   }
}

public class BankTest {
```

```
    public static void main(String[] args) {
        SavingsAccount savings = new SavingsAccount("SBI Bank", 4.5);
        savings.displayBankInfo();
        savings.displaySavingsInfo();

        CurrentAccount current = new CurrentAccount("HDFC Bank", 5000);
        current.displayBankInfo();
        current.displayCurrentInfo();


        LoanAccount loan = new LoanAccount("ICICI Bank", 5.0, 200000);
        loan.displayBankInfo();
        loan.displaySavingsInfo();
        loan.displayLoanInfo();
    }
}
```

Output:

```
C:\path\to\your\java\files> java BankTest
Bank Name: SBI
Savings Account at SBI with Interest Rate: 4.5%
Bank Name: HDFC
Current Account at HDFC with Overdraft Limit: ₹5000.0
Bank Name: ICICI
Savings Account at ICICI with Interest Rate: 5.0%
Loan Account at ICICI with Loan Amount: ₹200000.0 and Interest
```

2. Write a Java program using multilevel and hierarchical inheritance to manage a ticketing system for different types of transport like trains and buses.

Code:

```
class Ticket {
    protected double price;

    public Ticket(double price) {
        this.price = price;
    }

    public double getPrice() {
        return price;
    }

    public void displayTicketInfo() {
```

```
        System.out.println("Ticket Price: $" + price);
    }
}

class TrainTicket extends Ticket {
    private String trainNumber;

    public TrainTicket(double price, String trainNumber) {
        super(price);
        this.trainNumber = trainNumber;
    }

    public void displayTicketInfo() {
        super.displayTicketInfo();
        System.out.println("Train Number: " + trainNumber);
    }
}

class BusTicket extends Ticket {
    private String busNumber;

    public BusTicket(double price, String busNumber) {
        super(price);
        this.busNumber = busNumber;
    }

    public void displayTicketInfo() {
        super.displayTicketInfo();
        System.out.println("Bus Number: " + busNumber);
    }
}

class ACTicket extends TrainTicket {
    public ACTicket(double price, String trainNumber) {
        super(price, trainNumber);
    }

    public void displayTicketInfo() {
        System.out.println("AC Train Ticket:");
        super.displayTicketInfo();
    }
}

class SleeperTicket extends TrainTicket {
    public SleeperTicket(double price, String trainNumber) {
        super(price, trainNumber);
```

```
    }

    public void displayTicketInfo() {
        System.out.println("Sleeper Train Ticket:");
        super.displayTicketInfo();
    }
}

class ACBusTicket extends BusTicket {
    public ACBusTicket(double price, String busNumber) {
        super(price, busNumber);
    }

    public void displayTicketInfo() {
        System.out.println("AC Bus Ticket:");
        super.displayTicketInfo();
    }
}

class SleeperBusTicket extends BusTicket {
    public SleeperBusTicket(double price, String busNumber) {
        super(price, busNumber);
    }

    public void displayTicketInfo() {
        System.out.println("Sleeper Bus Ticket:");
        super.displayTicketInfo();
    }
}

public class TicketingSystem {
    public static void main(String[] args) {
        Ticket trainTicket = new TrainTicket(50.0, "12345");
        Ticket busTicket = new BusTicket(30.0, "54321");
        Ticket acTrainTicket = new ACTicket(80.0, "12345");
        Ticket sleeperTrainTicket = new SleeperTicket(60.0, "12345");
        Ticket acBusTicket = new ACBusTicket(40.0, "54321");
        Ticket sleeperBusTicket = new SleeperBusTicket(35.0, "54321");

        trainTicket.displayTicketInfo();
        System.out.println();

        busTicket.displayTicketInfo();
        System.out.println();

        acTrainTicket.displayTicketInfo();
```

```
        System.out.println();

        sleeperTrainTicket.displayTicketInfo();
        System.out.println();

        acBusTicket.displayTicketInfo();
        System.out.println();

        sleeperBusTicket.displayTicketInfo();
    }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java TicketingSystem
Ticket Price: $50.0
Train Number: 12345

Ticket Price: $30.0
Bus Number: 54321

AC Train Ticket:
Ticket Price: $80.0
Train Number: 12345

Sleeper Train Ticket:
Ticket Price: $60.0
Train Number: 12345

AC Bus Ticket:
Ticket Price: $40.0
Bus Number: 54321

Sleeper Bus Ticket:
Ticket Price: $35.0
Bus Number: 54321
```

POLYMORPHISM

Constructor programs

1. Demonstrate constructor chaining and encapsulation with `Shape` as base class and `Circle`, `Rectangle` as derived classes showing area and color.

Code:

```
class Shape {
    private String color;

    public Shape(String color) {
        this.color = color;
        System.out.println("A shape of color " + color + " has been created.");
    }

    public void displayColor() {
```

```
        System.out.println("Color: " + color);
    }
}

class Circle extends Shape {
    private double radius;

    public Circle(String color, double radius) {
        super(color);
        this.radius = radius;
        System.out.println("Circle created with radius: " + radius);
    }

    public void area() {
        double area = Math.PI * radius * radius;
        System.out.println("Area of Circle: " + area);
    }
}

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

    public Rectangle(String color, double length, double width) {
        super(color);
        this.length = length;
        this.width = width;
        System.out.println("Rectangle created with length: " + length + " and
width: " + width);
    }

    public void area() {
        double area = length * width;
        System.out.println("Area of Rectangle: " + area);
    }
}

public class ShapeTest {
    public static void main(String[] args) {
        Circle circle = new Circle("Red", 5.0);
        circle.area();
        circle.displayColor();

        System.out.println();

        Rectangle rectangle = new Rectangle("Blue", 4.0, 6.0);
```

```
        rectangle.area();
        rectangle.displayColor();
    }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java ShapeTest
A shape of color Red has been created.
Circle created with radius: 5.0
Area of Circle: 78.53981633974483
Color: Red
A shape of color Blue has been created.
Rectangle created with length: 4.0 and width: 6.0
Area of Rectangle: 24.0
Color: Blue
```

CONSTRUCTOR OVERLOADING

1. How can constructor overloading be used to handle different types of payment details in a class?

Code:

```
class Payment {
    private String paymentId;
    private double amount;
    private String paymentMethod;
    private String currency;

    public Payment(String paymentId, double amount, String paymentMethod) {
        this.paymentId = paymentId;
        this.amount = amount;
        this.paymentMethod = paymentMethod;
        this.currency = "USD";
    }

    public Payment(String paymentId, double amount, String paymentMethod,
String currency) {
        this.paymentId = paymentId;
        this.amount = amount;
        this.paymentMethod = paymentMethod;
        this.currency = currency;
    }

    public Payment(String paymentId, double amount) {
        this.paymentId = paymentId;
        this.amount = amount;
        this.paymentMethod = "Cash";
```

```
        this.currency = "USD";
    }

    public void displayPaymentDetails() {
        System.out.println("Payment ID: " + paymentId);
        System.out.println("Amount: " + amount);
        System.out.println("Payment Method: " + paymentMethod);
        System.out.println("Currency: " + currency);
        System.out.println("--------------------------");
    }
}

public class OnlinePaymentSystem {
    public static void main(String[] args) {
        Payment creditCardPayment = new Payment("CC123", 150.00, "Credit
Card");
        creditCardPayment.displayPaymentDetails();


        Payment bankTransferPayment = new Payment("BT456", 200.00, "Bank
Transfer", "EUR");
        bankTransferPayment.displayPaymentDetails();

        Payment cashPayment = new Payment("C789", 50.00);
        cashPayment.displayPaymentDetails();
    }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java OnlinePaymentSystem
Payment ID: CC123
Amount: 150.0
Payment Method: Credit Card
Currency: USD
--------------------------
Payment ID: BT456
Amount: 200.0
Payment Method: Bank Transfer
Currency: EUR
--------------------------
Payment ID: C789
Amount: 50.0
Payment Method: Cash
Currency: USD
--------------------------
```

Method Overloading

1. How does method overloading help calculate total price with varying conditions in a shop system?

Code:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
class Shop {
   public void calculateTotalPrice(double price, int quantity) {
      double total = price * quantity;
      System.out.println("Total Price (without discount): " + total);
   }

   public void calculateTotalPrice(double price, int quantity, double discount)
{
      double total = price * quantity;
      total = total - (total * discount / 100);
      System.out.println("Total Price (with discount): " + total);
   }

   public void calculateTotalPrice(double price, int quantity, double discount,
double tax) {
      double total = price * quantity;
      total = total - (total * discount / 100);
      total = total + (total * tax / 100);
      System.out.println("Total Price (with discount and tax): " + total);
   }
}

public class ShopLite {
   public static void main(String[] args) {
      Shop shop = new Shop();
      double price1 = 100.0;
      int quantity1 = 2;
      double discount1 = 10.0;
      double tax1 = 5.0;

      shop.calculateTotalPrice(price1, quantity1);
      shop.calculateTotalPrice(price1, quantity1, discount1);
      shop.calculateTotalPrice(price1, quantity1, discount1, tax1);
   }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java ShopLite
Total Price (without discount): 200.0
Total Price (with discount): 180.0
Total Price (with discount and tax): 189.0
```

2. How is method overloading implemented to perform multiplication of different numbers of integers?

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

Code:

```
class Multiplier {
    public void multiply(int a, int b) {
        int result = a * b;
        System.out.println("Multiplication of two numbers: " + result);
    }

    public void multiply(int a, int b, int c) {
        int result = a * b * c;
        System.out.println("Multiplication of three numbers: " + result);
    }

    public void multiply(int a, int b, int c, int d) {
        int result = a * b * c * d;
        System.out.println("Multiplication of four numbers: " + result);
    }
}

public class MultiplierExample {
    public static void main(String[] args) {
        Multiplier multiplier = new Multiplier();
        multiplier.multiply(2, 3);
        multiplier.multiply(2, 3, 4);
        multiplier.multiply(2, 3, 4, 5);
    }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java MultiplierExample
Multiplication of two numbers: 6
Multiplication of three numbers: 24
Multiplication of four numbers: 120
```

METHOD OVERIDING

1. How is method overriding used in different subclasses to customize the behavior of a base class method?

Code:

```
class Home {
    public void display() {
        System.out.println("We are in the home");
    }
}

class Apartment extends Home {
    public void display() {
```

```
        System.out.println("We are in the apartment");
    }
}

class Company extends Home {
    public void display() {
        System.out.println("We are in the Company");
    }
}

public class Room {
    public static void main(String[] args) {
        Home myHome = new Home();
        Home myApartment = new Apartment();
        Company myObj = new Company();

        myHome.display();
        myApartment.display();
        myObj.display();
    }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java Room
We are in the home
We are in the apartment
We are in the Company
```

2. How does method overriding help in calculating different delivery item prices using inheritance?

Code:

```
class DeliveryItem {
    private double basePrice;

    public void setBasePrice(double basePrice) {
        this.basePrice = basePrice;
    }

    public double getBasePrice() {
        return basePrice;
    }
```

```
    public void calculatePrice() {
        System.out.println("Price of Regular Delivery Item: " + basePrice);
    }
}

class ExpressDeliveryItem extends DeliveryItem {
    private double expressFee;

    public void setExpressFee(double expressFee) {
        this.expressFee = expressFee;
    }

    @Override
    public void calculatePrice() {
        double totalPrice = getBasePrice() + expressFee;
        System.out.println("Price of Express Delivery Item: " + totalPrice);
    }
}

public class Delivery {
    public static void main(String[] args) {
        DeliveryItem regularItem = new DeliveryItem();
        regularItem.setBasePrice(100.0);

        ExpressDeliveryItem expressItem = new ExpressDeliveryItem();
        expressItem.setBasePrice(100.0);
        expressItem.setExpressFee(20.0);

        regularItem.calculatePrice();
        expressItem.calculatePrice();
    }
}
```

Output:

```
C:\Users\yogir\OneDrive\Documents\Desktop\practice>java Delivery
Price of Regular Delivery Item: 100.0
Price of Express Delivery Item: 120.0
```

ABSTRACTION

INTERFACE PROGRAMS

1. How does Java use interfaces to enable polymorphic behavior in flying vehicles?

Code:

```
interface Flyable {
```

```
    void fly_obj();
}

class Jet implements Flyable {
    public void fly_obj() {
        System.out.println("The Jet is flying at a speed of 1500 km/h.");
    }
}

class Plane implements Flyable {
    public void fly_obj() {
        System.out.println("The Plane is flying at a speed of 900 km/h.");
    }
}

class Chopper implements Flyable {
    public void fly_obj() {
        System.out.println("The Chopper is flying at a speed of 300 km/h.");
    }
}

public class FlyableTest {
    public static void main(String[] args) {
        Flyable jet = new Jet();
        Flyable plane = new Plane();
        Flyable chopper = new Chopper();

        jet.fly_obj();
        plane.fly_obj();

        chopper.fly_obj();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>javac FlyableTest.java

C:\Users\DELL\OneDrive\Desktop\rohan>java FlyableTest
The Jet is flying at a speed of 1500 km/h.
The Plane is flying at a speed of 900 km/h.
The Chopper is flying at a speed of 300 km/h.
```

2. How is the `Resizable` interface implemented to modify the dimensions of a rectangle in Java?

Code:

```
interface Resizable {
```

```
    void resizeWidth(int width);
    void resizeHeight(int height);
}

class Rectangle implements Resizable {
    private int width;
    private int height;

    public Rectangle(int width, int height) {
        this.width = width;
        this.height = height;
    }

    public void resizeWidth(int width) {
        if (width > 0) {
            this.width = width;
            System.out.println("Width resized to: " + this.width);
        } else {
            System.out.println("Invalid width value");
        }
    }

    public void resizeHeight(int height) {
        if (height > 0) {
            this.height = height;
            System.out.println("Height resized to: " + this.height);
        } else {
            System.out.println("Invalid height value");
        }
    }

    public void display() {
        System.out.println("Rectangle Dimensions: Width = " + width + ", Height
= " + height);
    }

    public static void main(String[] args) {
        Rectangle rect = new Rectangle(10, 20);
        rect.display();
        rect.resizeWidth(30);
        rect.resizeHeight(40);
        rect.display();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Rectangle
Rectangle Dimensions: Width = 10, Height = 20
Width resized to: 30
Height resized to: 40
Rectangle Dimensions: Width = 30, Height = 40
```

3. How is the `Playable` interface used to demonstrate polymorphism in different sports games in Java?

Code:

```
interface Playable {
   void play();
}

class Football implements Playable {
   public void play() {
      System.out.println("Playing Football");
   }
}

class Volleyball implements Playable {
   public void play() {
      System.out.println("Playing Volleyball");
   }
}

class Basketball implements Playable {
   public void play() {
      System.out.println("Playing Basketball");
   }
}

public class Main {

   public static void main(String[] args) {
      Playable football = new Football();
      Playable volleyball = new Volleyball();
      Playable basketball = new Basketball();

      football.play();
      volleyball.play();
      basketball.play();
   }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Playing Football
Playing Volleyball
Playing Basketball
```

4. How is the concept of interface implementation demonstrated through the `Playable` interface in Java?

Code:

```
interface CarOrder {
   void placeOrder();
   void trackOrder();
   void cancelOrder();
}

class Car implements CarOrder {
   public void placeOrder() {
      System.out.println("Car order placed.");
   }
   public void trackOrder() {
      System.out.println("Tracking car order.");
   }
   public void cancelOrder() {
      System.out.println("Car order canceled.");
   }
}

public class Main {
   public static void main(String[] args) {
      Car myCar = new Car();
      myCar.placeOrder();
      myCar.trackOrder();
      myCar.cancelOrder();
   }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Car order placed.
Tracking car order.
Car order canceled.
```

ABSTRACT CLASSES PROGRAMS

1. How does the `BankAccount` abstract class enforce method implementation in its subclasses?

Code:

```
abstract class BankAccount {
    double balance;

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

    abstract void deposit(double amount);
    abstract void withdraw(double amount);

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

class SavingsAccount extends BankAccount {
    private static final double MIN_BALANCE = 500;

    public SavingsAccount(double balance) {
        super(balance);
    }

    public void deposit(double amount) {
        balance += amount;
        System.out.println("Deposited " + amount + " in Savings Account.");
    }

    public void withdraw(double amount) {
        if (balance - amount >= MIN_BALANCE) {
            balance -= amount;
            System.out.println("Withdrew " + amount + " from Savings Account.");
        } else {
            System.out.println("Insufficient balance. Minimum balance must be
maintained.");
        }
    }
}

class CurrentAccount extends BankAccount {
    private static final double OVERDRAFT_LIMIT = 1000;

    public CurrentAccount(double balance) {
        super(balance);
    }
```

```
    public void deposit(double amount) {
        balance += amount;
        System.out.println("Deposited " + amount + " in Current Account.");
    }

    public void withdraw(double amount) {
        if (balance - amount >= -OVERDRAFT_LIMIT) {
            balance -= amount;
            System.out.println("Withdrew " + amount + " from Current Account.");
        } else {
            System.out.println("Overdraft limit exceeded. Cannot withdraw.");
        }
    }
}

public class Main {
    public static void main(String[] args) {
        BankAccount savings = new SavingsAccount(1000);
        savings.deposit(500);
        savings.withdraw(800);
        savings.displayBalance();

        BankAccount current = new CurrentAccount(500);
        current.deposit(1000);
        current.withdraw(1800);
        current.displayBalance();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Deposited 500.0 in Savings Account.
Withdrew 800.0 from Savings Account.
Current balance: 700.0
Deposited 1000.0 in Current Account.
Withdrew 1800.0 from Current Account.
Current balance: -300.0
```

2. How does the `Animal` abstract class enforce method overriding in its subclasses?

Code:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
abstract class Animal {
   abstract void sound();
}

class Lion extends Animal {
   public void sound() {
      System.out.println("Lion roars");
   }
}

class Tiger extends Animal {
   public void sound() {
      System.out.println("Tiger growls");
   }
}

public class Main {
   public static void main(String[] args) {
      Animal lion = new Lion();
      Animal tiger = new Tiger();
      lion.sound();
      tiger.sound();
   }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Lion roars
Tiger growls
```

3. How does the code demonstrate abstraction and method overriding using `Animal` **and** `RapidoBooking` **classes?**

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

Code:

```
abstract class Animal {
   abstract void sound();
}

class Lion extends Animal {
   public void sound() {
      System.out.println("Lion roars");
   }
}

class Tiger extends Animal {
   public void sound() {
      System.out.println("Tiger growls");
   }
}

abstract class RapidoBooking {
   String pickupLocation;
   String dropLocation;

   public RapidoBooking(String pickupLocation, String dropLocation) {
      this.pickupLocation = pickupLocation;
      this.dropLocation = dropLocation;
   }

   abstract void bookRide();
}

class BikeRide extends RapidoBooking {
   public BikeRide(String pickupLocation, String dropLocation) {
      super(pickupLocation, dropLocation);
   }

   public void bookRide() {
      System.out.println("Bike ride booked from " + pickupLocation + " to " +
dropLocation);
   }
}

public class Main {
   public static void main(String[] args) {
      Animal lion = new Lion();
      Animal tiger = new Tiger();
      lion.sound();
```

```
        tiger.sound();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Lion roars
Tiger growls
```

4. How does the code implement abstraction and polymorphism in calculating area and perimeter of different shapes?

Code:

```
abstract class GeometricShape {
    abstract void area();
    abstract void perimeter();
}

class Triangle extends GeometricShape {
    private double base, height, side1, side2, side3;

    public Triangle(double base, double height, double side1, double side2,
double side3) {
        this.base = base;
        this.height = height;
        this.side1 = side1;
        this.side2 = side2;
        this.side3 = side3;
    }

    public void area() {
        System.out.println("Triangle Area: " + (0.5 * base * height));
    }

    public void perimeter() {
        System.out.println("Triangle Perimeter: " + (side1 + side2 + side3));
    }
}

class Square extends GeometricShape {
    private double side;

    public Square(double side) {
        this.side = side;
    }
```

```
    public void area() {
        System.out.println("Square Area: " + (side * side));
    }

    public void perimeter() {
        System.out.println("Square Perimeter: " + (4 * side));
    }
}

public class Main {
    public static void main(String[] args) {
        GeometricShape triangle = new Triangle(5, 4, 3, 4, 5);
        GeometricShape square = new Square(4);

        triangle.area();
        triangle.perimeter();
        square.area();
        square.perimeter();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Triangle Area: 10.0
Triangle Perimeter: 12.0
Square Area: 16.0
Square Perimeter: 16.0

C:\Users\DELL\OneDrive\Desktop\rohan>
```

ENCAPSULATION

ENCAPSULATION PROGRAMS

1. How is encapsulation implemented using getter and setter methods in this Java program?

Code:

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

    public void getName() {
        System.out.println("Name: " + name);
    }

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

    public void getAge() {
        System.out.println("Age: " + age);
    }

    public void setAge(int age) {
        this.age = age;
    }

    public void getCountry() {
        System.out.println("Country: " + country);
    }

    public void setCountry(String country) {
        this.country = country;
    }
}

public class Main {
    public static void main(String[] args) {
        Person person = new Person();
        person.setName("John");
        person.setAge(30);
        person.setCountry("USA");
        person.getName();
        person.getAge();
```

```
        person.getCountry();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Name: John
Age: 30
Country: USA

C:\Users\DELL\OneDrive\Desktop\rohan>
```

2. How does the Rectangle class use encapsulation to manage user input for dimensions?

Code:

```
import java.util.Scanner;

class Rectangle {
    private double length;
    private double width;

    public void setLength(double length) {
        this.length = length;
    }

    public void setWidth(double width) {
        this.width = width;
    }

    public void getLength() {
        System.out.println("Length: " + length);
    }

    public void getWidth() {
        System.out.println("Width: " + width);
    }
}

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

        System.out.print("Enter length: ");
        double length = sc.nextDouble();
        rectangle.setLength(length);
```

```
        System.out.print("Enter width: ");
        double width = sc.nextDouble();
        rectangle.setWidth(width);

        rectangle.getLength();
        rectangle.getWidth();

        sc.close();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>javac Main

C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Enter length: 20
Enter width: 40
Length: 20.0
Width: 40.0
```

3. How does the `House` class calculate the total price based on its area and price per square meter?

Code:

```
class House {
    private String address;
    private int numberOfRooms;
    private double area;

    public House(String address, int numberOfRooms, double area) {
        this.address = address;
        this.numberOfRooms = numberOfRooms;
        this.area = area;
    }

    public String getAddress() {
        return address;
    }

    public void setAddress(String address) {
        this.address = address;
    }
```

```
    public int getNumberOfRooms() {
        return numberOfRooms;
    }

    public void setNumberOfRooms(int numberOfRooms) {
        this.numberOfRooms = numberOfRooms;
    }

    public double getArea() {
        return area;
    }

    public void setArea(double area) {
        this.area = area;
    }

    public double calculatePrice(double pricePerSquareMeter) {
        return area * pricePerSquareMeter;
    }
}

public class Main {
    public static void main(String[] args) {
        House house = new House("123 Main St", 3, 150.0);
        System.out.println("Address: " + house.getAddress());
        System.out.println("Number of Rooms: " + house.getNumberOfRooms());
        System.out.println("Area: " + house.getArea() + " sq. meters");

        double pricePerSquareMeter = 2000.0;
        double price = house.calculatePrice(pricePerSquareMeter);
        System.out.println("Price of the house: $" + price);
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Address: 123 Main St
Number of Rooms: 3
Area: 150.0 sq. meters
Price of the house: $300000.0
```

4. How does the `CricketPlayer` class store and display information about a player's name, runs, and wickets?

Code:

```
class CricketPlayer {
```

```
    private String name;
    private int runs;
    private int wickets;

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

    public void setRuns(int runs) {
        this.runs = runs;
    }

    public void setWickets(int wickets) {
        this.wickets = wickets;
    }

    public void getName() {
        System.out.println("Player Name: " + name);
    }

    public void getRuns() {
        System.out.println("Total Runs: " + runs);
    }

    public void getWickets() {
        System.out.println("Total Wickets: " + wickets);
    }
}

public class Main {
    public static void main(String[] args) {
        CricketPlayer player = new CricketPlayer();
        player.setName("Virat Kohli");
        player.setRuns(12000);
        player.setWickets(4);
        player.getName();
        player.getRuns();
        player.getWickets();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Player Name: Virat Kohli
Total Runs: 12000
Total Wickets: 4
```

5. Create a `BankAccount` class that hides balance and allows secure deposit and withdrawal operations.

Code:

```
class BankAccount {
    private double balance;

    public BankAccount(double initialBalance) {
        balance = initialBalance;
    }

    public void deposit(double amount) {
        if (amount > 0)
            balance += amount;
    }

    public void withdraw(double amount) {
        if (amount > 0 && amount <= balance)
            balance -= amount;
        else
            System.out.println("Insufficient balance!");
    }

    public double getBalance() {
        return balance;
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac BankAccount.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java BankAccount
Deposited: ?500.0
Withdrawn: ?200.0
Insufficient balance! Available: ?1300.0
Deposit amount must be positive.
Final Balance: ?1300.0
```

6. Create a `Student` class that encapsulates marks with validation between 0 and 100.

Code:

```
class Student {
    private String name;
    private int marks;

    public Student(String name) {
        this.name = name;
```

```
    }

    public void setMarks(int marks) {
        if (marks >= 0 && marks <= 100)
            this.marks = marks;
        else
            System.out.println("Invalid marks entered!");
    }

    public int getMarks() {
        return marks;
    }

    public String getName() {
        return name;
    }

    public static void main(String[] args) {
        Student s = new Student("Vivek");
        s.setMarks(85);
        System.out.println(s.getName() + "'s Marks: " + s.getMarks());
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Student.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Student
Vivek's Marks: 85
PS C:\Users\user\OneDrive\Documents\Java Programs>
```

7. Design a `Car` class that controls speed with a max limit using encapsulation.

Code:

```
class Car {
    private int speed = 0;
    private final int MAX_SPEED = 200;

    public void accelerate(int increment) {
        if (speed + increment <= MAX_SPEED)
            speed += increment;
        else
            System.out.println("Speed limit exceeded!");
    }

    public void brake(int decrement) {
        if (speed - decrement >= 0)
            speed -= decrement;
```

```
        else
            speed = 0;
    }

    public int getSpeed() {
        return speed;
    }

    public static void main(String[] args) {
        Car c = new Car();
        c.accelerate(50);
        c.brake(20);
        System.out.println("Current Speed: " + c.getSpeed() + " km/h");
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac ^C
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Car.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Car
Current Speed: 30 km/h
PS C:\Users\user\OneDrive\Documents\Java Programs>
```

8. Implement a `Patient` class that securely manages age and temperature with range checks.

Code:

```
class Patient {
    private int age;
    private double temperature;

    public void setAge(int age) {
        if (age >= 0)
            this.age = age;
        else
            System.out.println("Invalid age!");
    }

    public void setTemperature(double temperature) {
        if (temperature >= 95 && temperature <= 108)
            this.temperature = temperature;
        else
            System.out.println("Temperature out of range!");
    }

    public int getAge() {
```

```
        return age;
    }

    public double getTemperature() {
        return temperature;
    }

    public static void main(String[] args) {
        Patient p = new Patient();
        p.setAge(25);
        p.setTemperature(98.6);
        System.out.println("Age: " + p.getAge() + ", Temperature: " +
p.getTemperature() + "°F");
    }
}
```

Output:

```
PS C:\Users\user\OneDrive\Documents\Java Programs> javac Patient.java
PS C:\Users\user\OneDrive\Documents\Java Programs> java Patient
Age: 25, Temperature: 98.6°F
PS C:\Users\user\OneDrive\Documents\Java Programs>
```

PACKAGES PROGRAMS

1. How does the program use an `ArrayList` to store and print a list of names?

Code:

```
import java.util.ArrayList;

public class Main {
    public static void main(String[] args) {
        ArrayList<String> names = new ArrayList<>();
        names.add("Alice");
        names.add("Bob");
        names.add("Charlie");

        System.out.println("Names in the list:");
        for (String name : names) {
            System.out.println(name);
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Names in the list:
Alice
Bob
Charlie
```

2. How does the program create a TCP client to send a message to a server and receive a response?

Code:

```
import java.io.*;
import java.net.*;

public class Main {
    public static void main(String[] args) {
        String hostname = "localhost";
        int port = 12345;

        try (
            Socket socket = new Socket(hostname, port);
            PrintWriter out = new PrintWriter(socket.getOutputStream(), true);
            BufferedReader in = new BufferedReader(new
InputStreamReader(socket.getInputStream()))
        ) {
            out.println("Hello Server!");
            String response = in.readLine();
            System.out.println("Server response: " + response);
        } catch (IOException e) {
            e.printStackTrace();
        }
    }
}
```

Output:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
java.net.ConnectException: Connection refused: connect
        at java.base/sun.nio.ch.Net.connect0(Native Method)
        at java.base/sun.nio.ch.Net.connect(Net.java:589)
        at java.base/sun.nio.ch.Net.connect(Net.java:578)
        at java.base/sun.nio.ch.NioSocketImpl.connect(NioSocketImpl.java:583)
        at java.base/java.net.SocksSocketImpl.connect(SocksSocketImpl.java:327)
        at java.base/java.net.Socket.connect(Socket.java:760)
        at java.base/java.net.Socket.connect(Socket.java:695)
        at java.base/java.net.Socket.<init>(Socket.java:564)
        at java.base/java.net.Socket.<init>(Socket.java:328)
        at Main.main(Main.java:9)
```

3. How does the program demonstrate working with current date, time, formatting, time zones, and calculating date differences using the Java `time` API?

Code:

```
import java.time.*;
import java.time.format.DateTimeFormatter;

public class Main {
   public static void main(String[] args) {
      LocalDate currentDate = LocalDate.now();
      LocalTime currentTime = LocalTime.now();
      LocalDateTime currentDateTime = LocalDateTime.now();

      DateTimeFormatter formatter = DateTimeFormatter.ofPattern("yyyy-MM-
dd HH:mm:ss");
      String formattedDateTime = currentDateTime.format(formatter);

      ZonedDateTime zonedDateTime =
ZonedDateTime.now(ZoneId.of("America/New_York"));

      LocalDate pastDate = LocalDate.of(2020, Month.JANUARY, 1);
      Period period = Period.between(pastDate, currentDate);

      System.out.printf("Current Date: %s%n", currentDate);
      System.out.printf("Current Time: %s%n", currentTime);
      System.out.printf("Formatted DateTime: %s%n", formattedDateTime);
      System.out.printf("Zoned DateTime (New York): %s%n",
zonedDateTime);
      System.out.printf("Period from 2020-01-01 to now: %d years, %d months,
%d days%n",
            period.getYears(), period.getMonths(), period.getDays());
   }
}
```

Output:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
C:\Users\DELL\OneDrive\Desktop\rohan>javac Main.java

C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Current Date: 2025-04-03
Current Time: 23:11:12.310761500
Formatted DateTime: 2025-04-03 23:11:12
Zoned DateTime (New York): 2025-04-03T13:41:12.319745500-04:00[America/New_York]
Period from 2020-01-01 to now: 5 years, 3 months, 2 days
```

4. How does this program take user input for name and age and display a personalized greeting?

Code:

```
import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter your name: ");
        String name = scanner.nextLine();
        System.out.print("Enter your age: ");
        int age = scanner.nextInt();
        System.out.println("Hello, " + name + "! You are " + age + " years old.");
        scanner.close();
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Enter your name: VIRAT KOHLI
Enter your age: 37
Hello, VIRAT KOHLI! You are 37 years old.
```

EXCEPTION HANDLING

1. How does this program use a custom exception to handle even number inputs?

Code:

```
class EvenNumberException extends Exception {
    public EvenNumberException(String message) {
        super(message);
    }
}

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

```
        try {
            checkNumber(4); // Change this number to test different cases
        } catch (EvenNumberException e) {
            System.out.println("Exception caught: " + e.getMessage());
        }
    }

    public static void checkNumber(int number) throws EvenNumberException
{
        if (number % 2 == 0) {
            throw new EvenNumberException("The number " + number + " is
divisible by 2.");
        } else {
            System.out.println("The number " + number + " is not divisible by 2.");
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Exception caught: The number 4 is divisible by 2.
```

2. How does this program use a custom exception to detect negative numbers from a file?

Code:

```
import java.io.IOException;
import java.nio.file.Files;
import java.nio.file.Path;
import java.nio.file.Paths;
import java.util.List;

class NegativeNumberException extends Exception {
    public NegativeNumberException(String message) {
        super(message);
    }
}

public class Main {
    public static void main(String[] args) {
        String filePath = "numbers.txt"; // Change this to the path of your file
        try {
            checkNumbers(filePath);
            System.out.println("All numbers are non-negative.");
        } catch (NegativeNumberException e) {
            System.out.println("Exception caught: " + e.getMessage());
```

```
        } catch (IOException e) {
            System.out.println("An error occurred while reading the file: " +
e.getMessage());
        }
    }

    public static void checkNumbers(String filePath) throws
NegativeNumberException, IOException {
        Path path = Paths.get(filePath);
        if (Files.notExists(path)) {
            throw new IOException("File does not exist.");
        }
        List<String> lines = Files.readAllLines(path);
        for (String line : lines) {
            try {
                int number = Integer.parseInt(line.trim());
                if (number < 0) {
                    throw new NegativeNumberException("Negative number found: "
+ number);
                }
            } catch (NumberFormatException e) {
                System.out.println("Invalid number format: " + line);
            }
        }
    }
}
```

Output:

```
:\Users\DELL\OneDrive\Desktop\rohan>java Main
n error occurred while reading the file: File does not exist.
```

3. How does this program handle odd numbers using a user-defined exception in Java?

Code:

```
class OddNumberException extends Exception {
    public OddNumberException(String message) {
        super(message);
    }
}

public class Main {
    public static void main(String[] args) {
        try {
            checkNumber(5); // Change this number to test different cases
```

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

    public static void checkNumber(int number) throws OddNumberException {
        if (number % 2 != 0) {
            throw new OddNumberException("The number " + number + " is
odd.");
        } else {
            System.out.println("The number " + number + " is even.");
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Exception caught: The number 5 is odd.
```

4. How does this Java program use a custom exception to validate if a given string is a palindrome?

Code:

```
class InvalidInputException extends Exception {
    public InvalidInputException(String message) {
        super(message);
    }
}

public class Main {
    public static void main(String[] args) {
        String input = "madam";
        try {
            checkPalindrome(input);
            System.out.println(input + " is a palindrome.");
        } catch (InvalidInputException e) {
            System.out.println("Exception caught: " + e.getMessage());
        }
    }

    public static void checkPalindrome(String str) throws
InvalidInputException {
        if (str == null || str.isEmpty()) {
            throw new InvalidInputException("Input string is null or empty.");
        }
```

```
        String reversedStr = new StringBuilder(str).reverse().toString();
        if (!str.equals(reversedStr)) {
            throw new InvalidInputException(str + " is not a palindrome.");
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
madam is a palindrome.

C:\Users\DELL\OneDrive\Desktop\rohan>
```

FILE HANDLING

1. How does this Java program create and write content to a file using `FileWriter` with exception handling?

Code:

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

public class Main {
    public static void main(String[] args) {
        try (FileWriter writer = new FileWriter("example.txt")) {
            writer.write("Hello, this is a sample file.\n");
            writer.write("Java File Handling Example.\n");
            System.out.println("File created and written successfully.");
        } catch (IOException e) {
            System.out.println("An error occurred.");
            e.printStackTrace();
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
File created and written successfully.

C:\Users\DELL\OneDrive\Desktop\rohan>
```

2. How does this Java program read and display the contents of a file using `Scanner` and handle file-not-found exceptions?

Code:

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

```
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        try {
            File file = new File("example.txt");
            Scanner reader = new Scanner(file);
            while (reader.hasNextLine()) {
                System.out.println(reader.nextLine());
            }
            reader.close();
        } catch (FileNotFoundException e) {
            System.out.println("File not found.");
            e.printStackTrace();
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Hello, this is a sample file.
Java File Handling Example.
```

3. How does this Java program count the total number of words in a file using `Scanner` and string splitting?

Code:

```
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        try {
            File file = new File("example.txt");
            Scanner reader = new Scanner(file);
            int wordCount = 0;
            while (reader.hasNextLine()) {
                String line = reader.nextLine();
                String[] words = line.split("\\s+");
                wordCount += words.length;
            }
            reader.close();
```

```
            System.out.println("Total words in file: " + wordCount);
        } catch (FileNotFoundException e) {
            System.out.println("File not found.");
            e.printStackTrace();
        }
    }
}
```

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>javac Main.java

C:\Users\DELL\OneDrive\Desktop\rohan>java Main
Total words in file: 10
```

4. How does this Java program copy the contents of one file to another using `FileReader` and `FileWriter`?

Code:

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

public class Main {
    public static void main(String[] args) {
        String sourceFile = "example.txt";
        String destinationFile = "copy_example.txt";
        try {
            FileReader reader = new FileReader(sourceFile);
            FileWriter writer = new FileWriter(destinationFile);
            int ch;
            while ((ch = reader.read()) != -1) {
                writer.write(ch);
            }
            reader.close();
            writer.close();
            System.out.println("File copied successfully.");
        } catch (IOException e) {
            System.out.println("An error occurred.");
            e.printStackTrace();
        }
    }
}
```

(Chepoori Sai Vivek – CH.SC.U4CSE24108)

Output:

```
C:\Users\DELL\OneDrive\Desktop\rohan>javac Main.java

C:\Users\DELL\OneDrive\Desktop\rohan>java Main
File copied successfully.
```

****