SCHOOL OF COMPUTING

LAB RECORD

OBJECT ORIENTED PROGRAMMING

(23CSE111)

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SECTION: B

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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.U4CSE24141 – ROHITH SUBRAMANIAN NITHYADEVI*** 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 :08/04/2025

Internal Examiner 1 Internal Examiner 2

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UML DIAGRAMS

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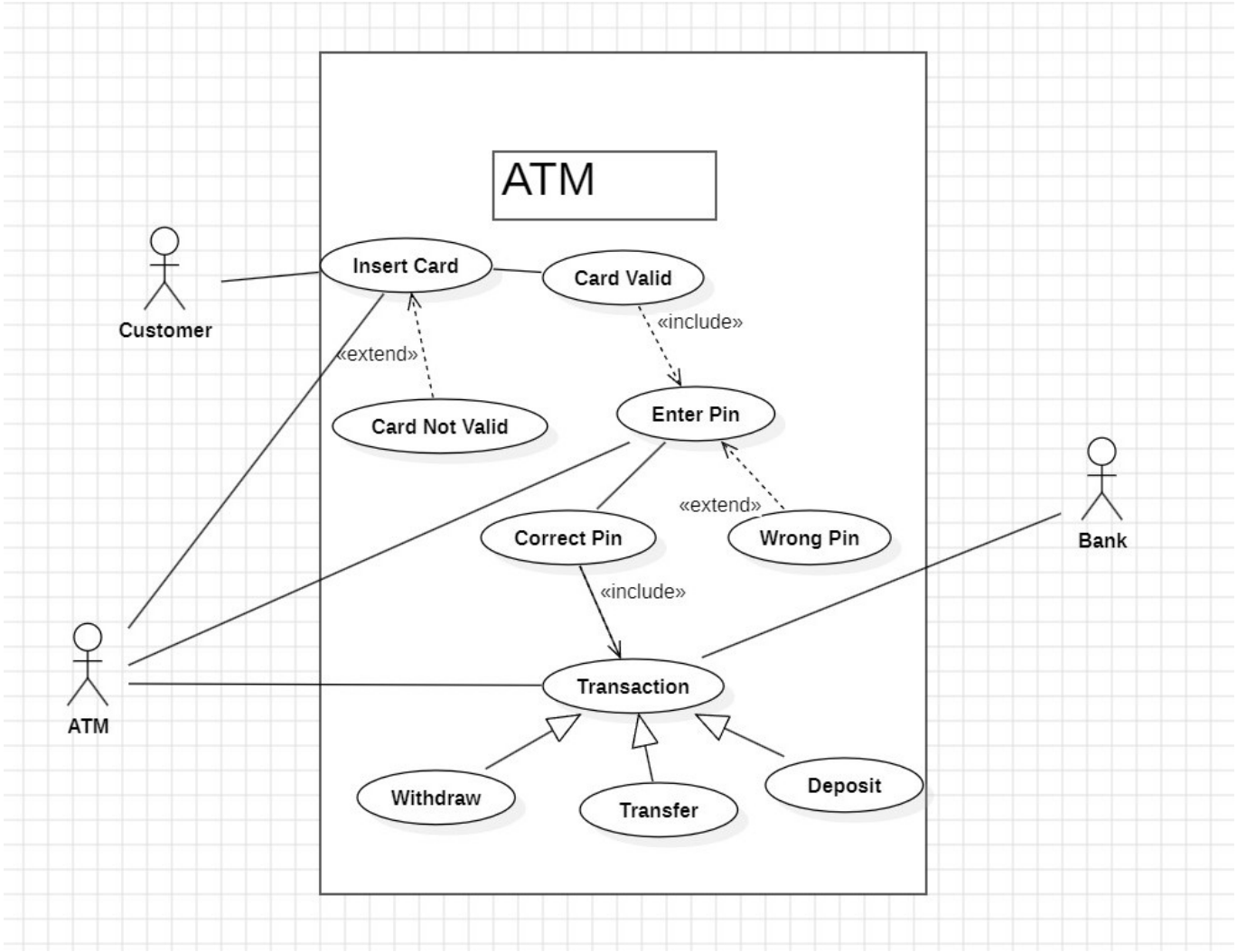
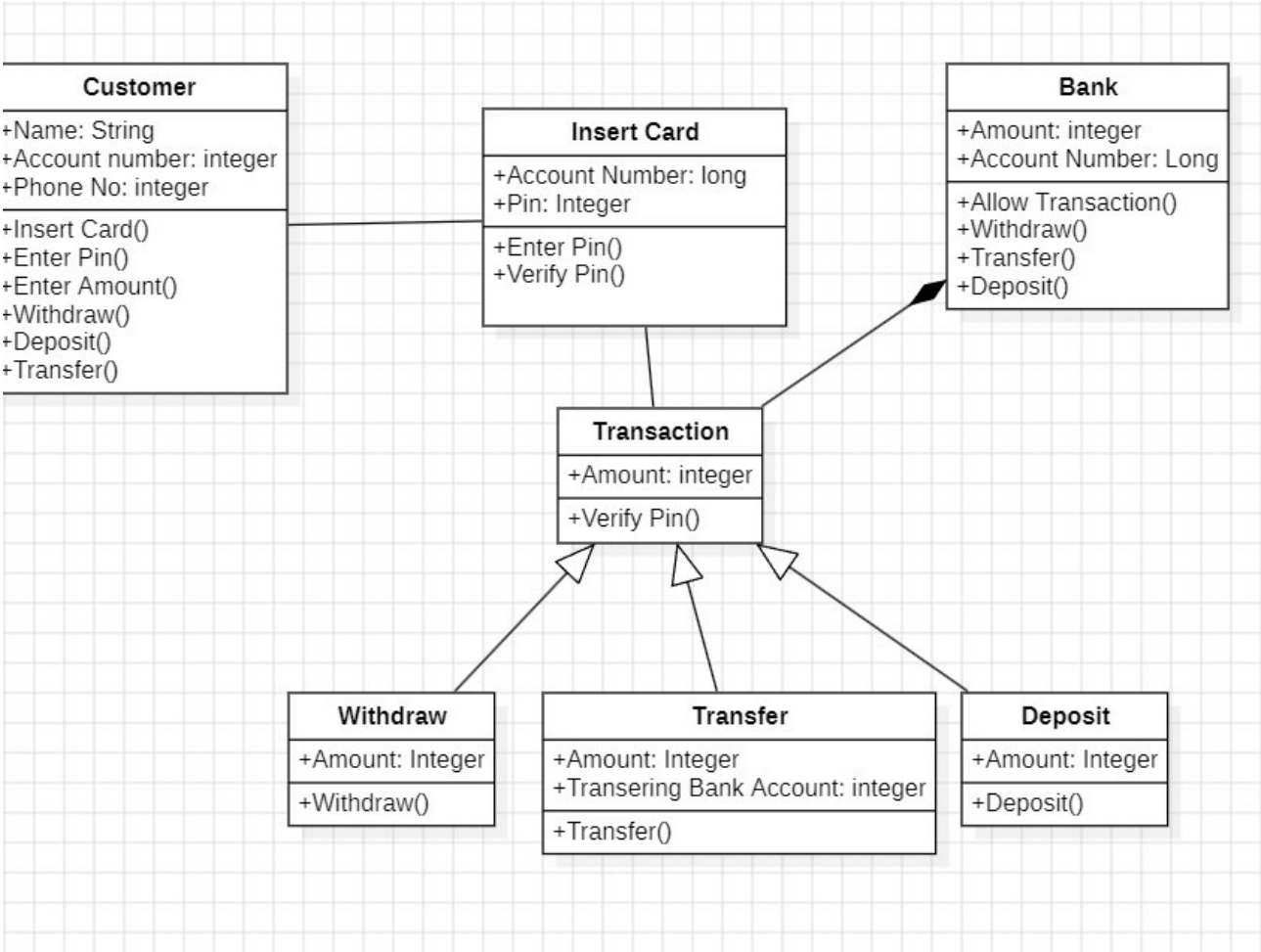


1. b) Class Diagram:



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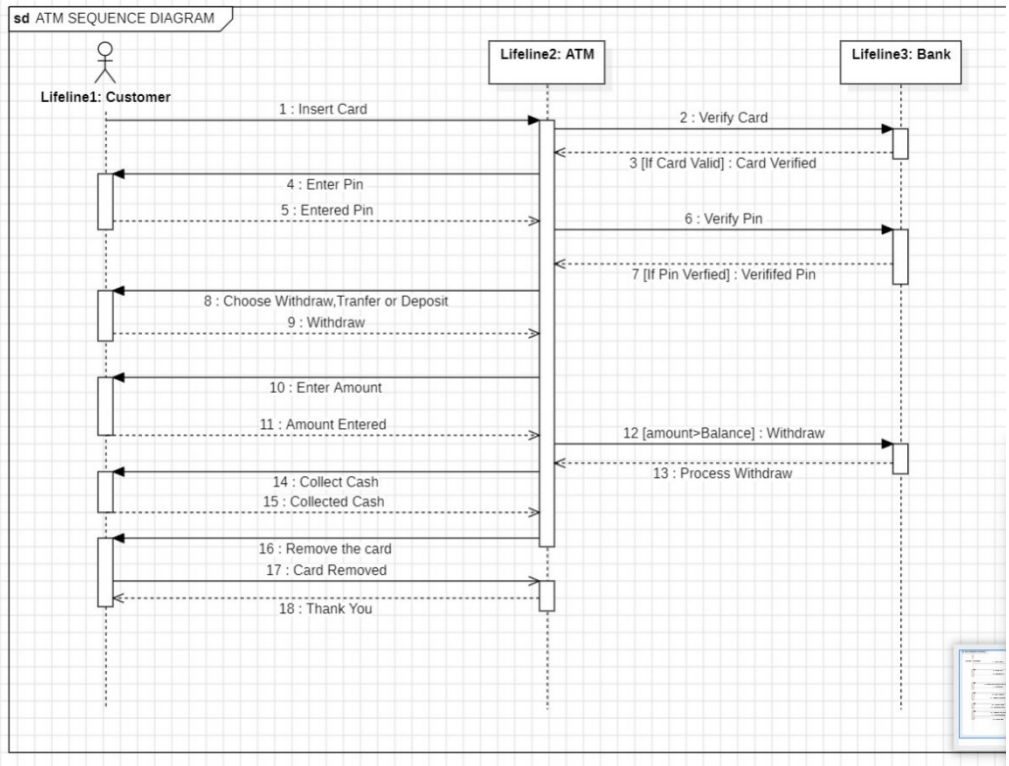

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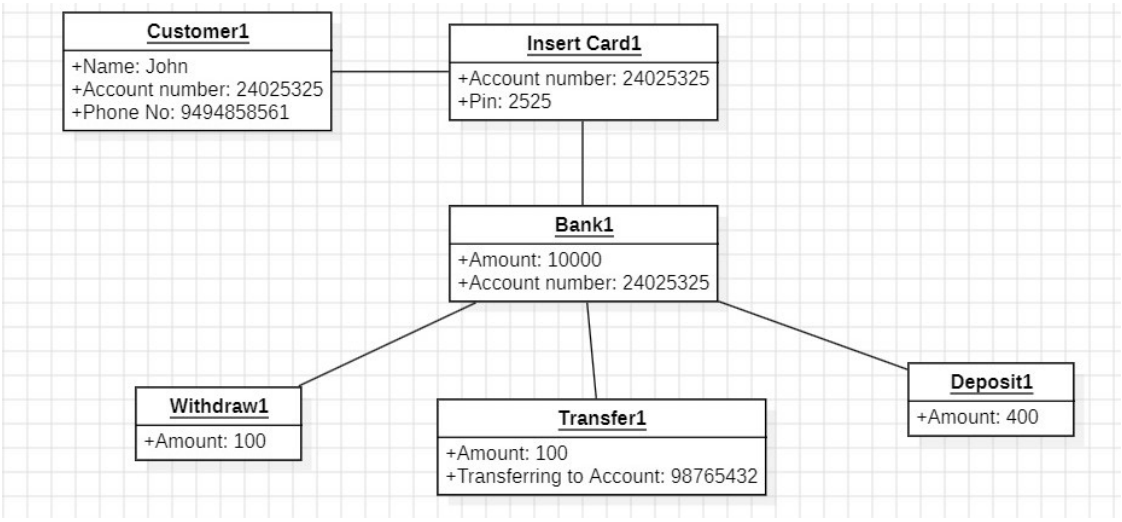

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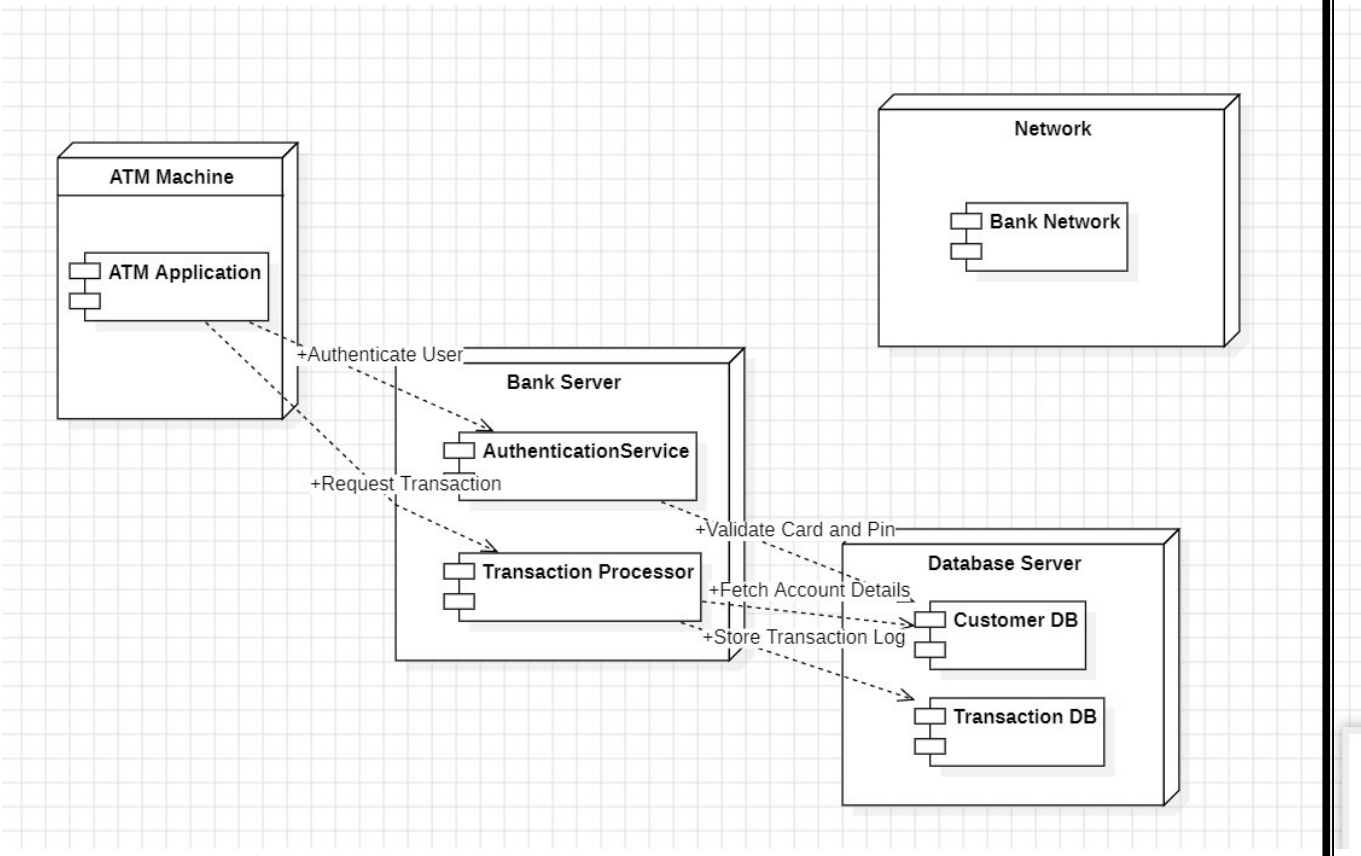
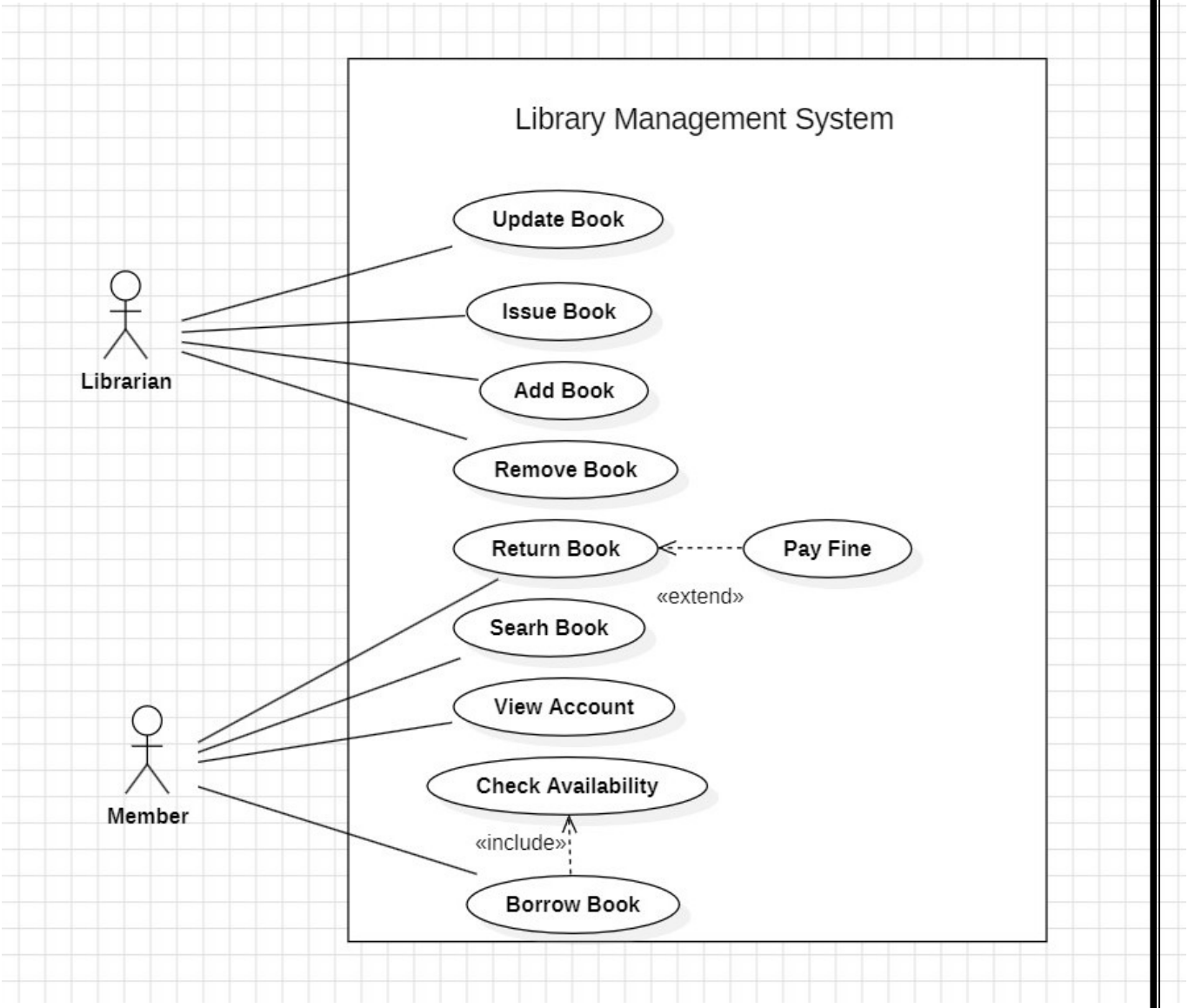


2. LIBRARY MANAGEMENT SYSTEM

2.a) Use Case Diagram:



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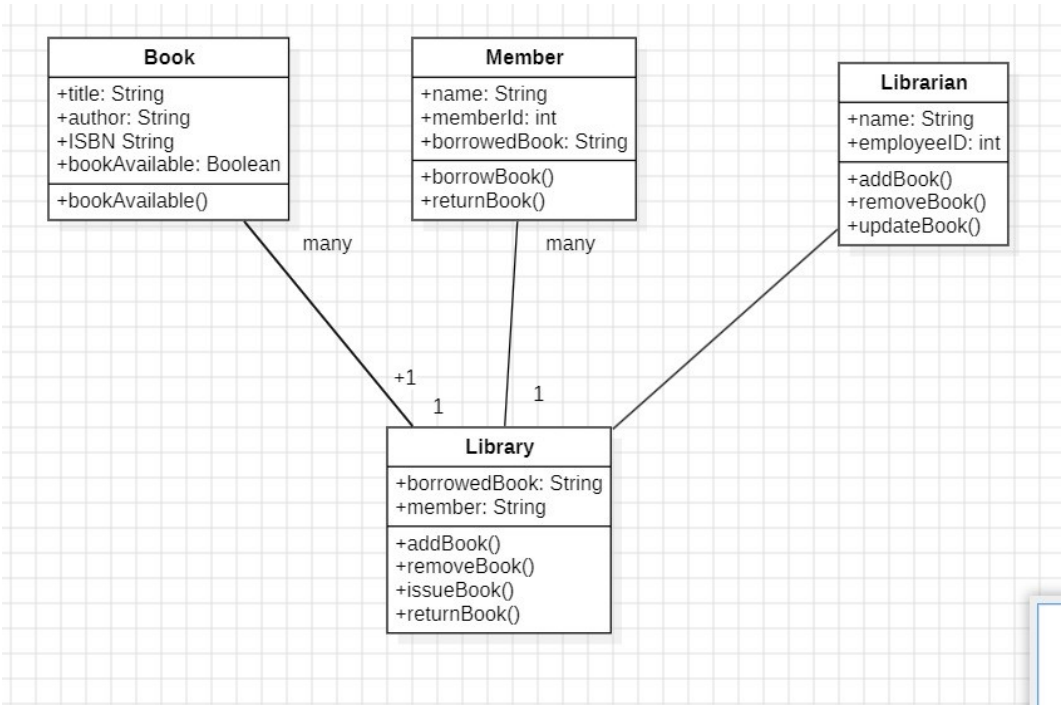
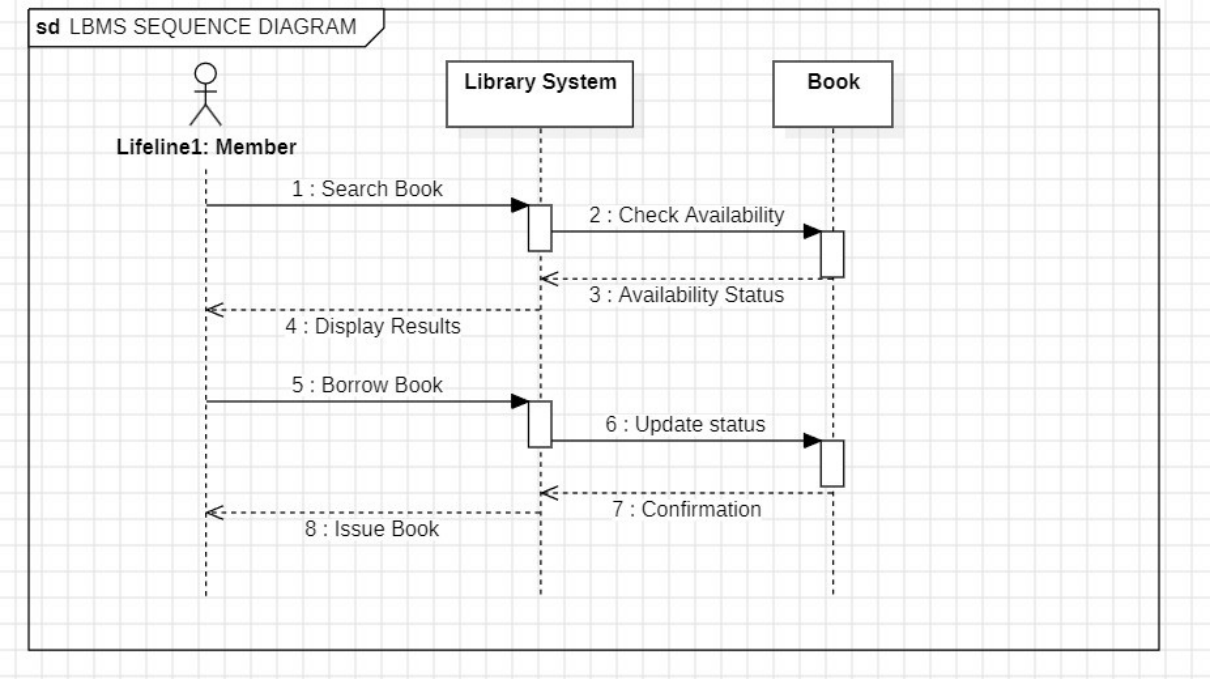
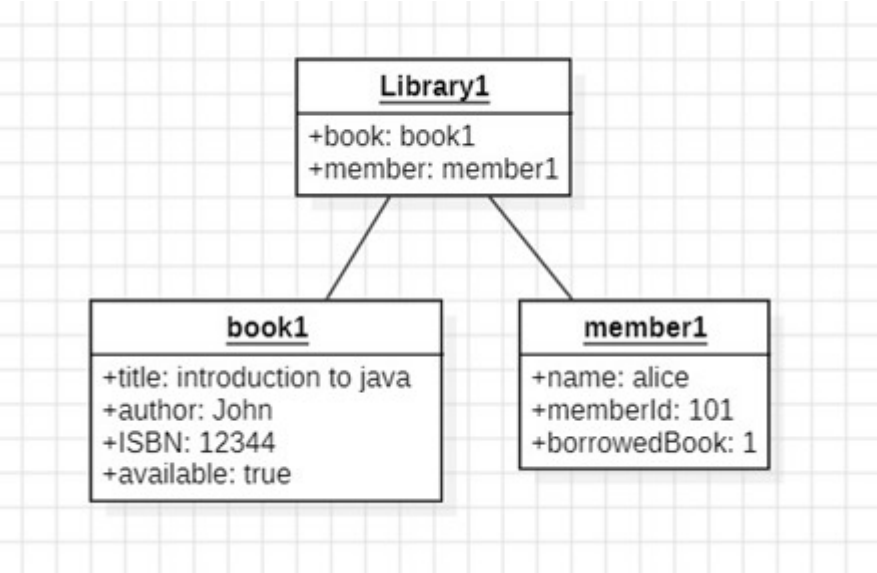


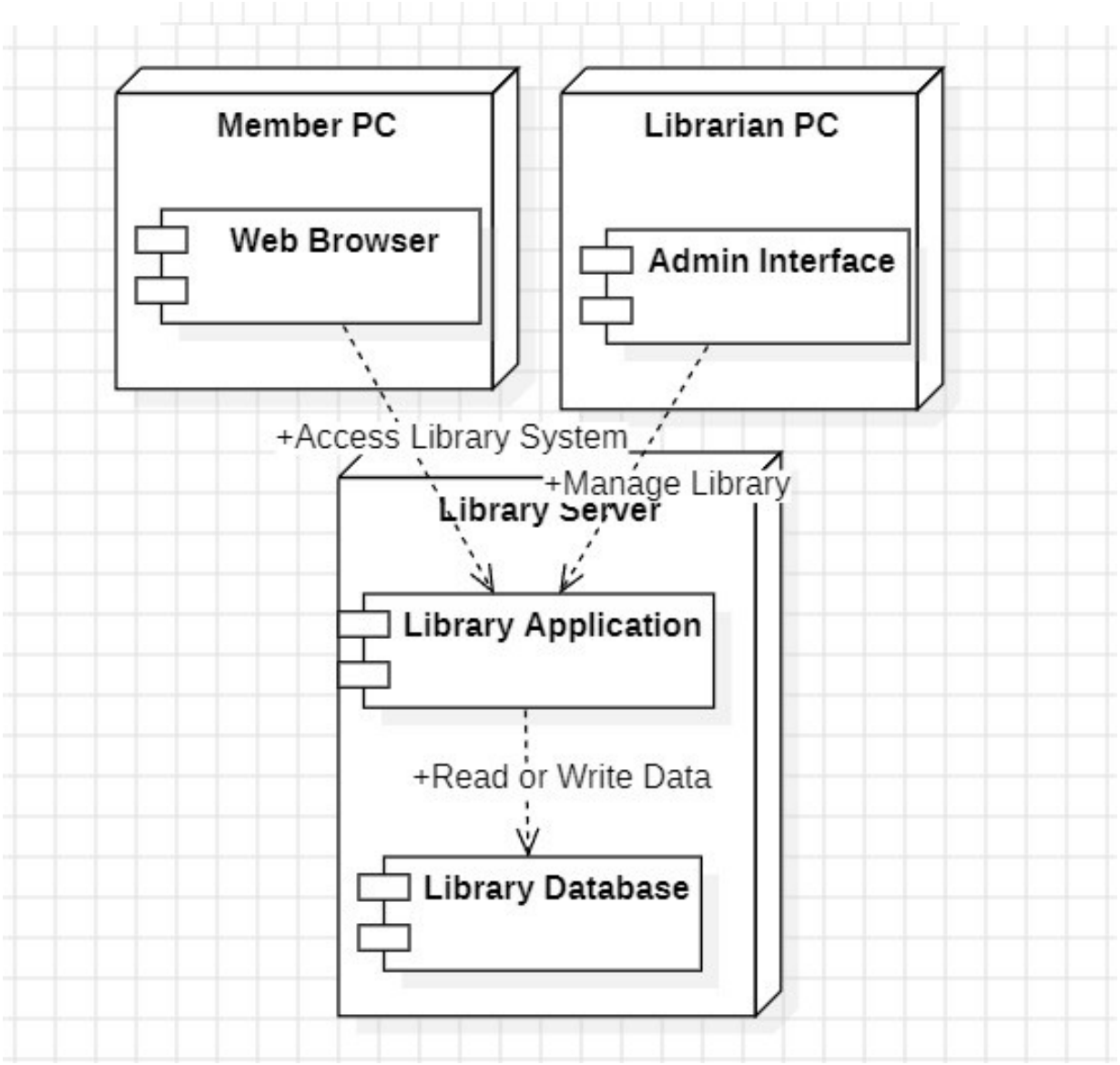
2.c) Sequence Diagram:



2. d) Object Diagram:



2.e)Deployment Diagram:



JAVA PROGRAMS

3.Basic Java Programs

3.a) Palindrome Word:

Code:

```
import java.util.Scanner;

public class PalindromeWord {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a string: ");
        String str = scanner.nextLine();
        String reversed = new StringBuilder(str).reverse().toString();

        if (str.equals(reversed)) {
            System.out.println("Palindrome");
        } else {
            System.out.println("Not a Palindrome");
        }
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac PalindromeWord.java

C:\Users\rohit\Desktop\Java>java PalindromeWord
Enter a string: malayalam
Palindrome
```

3.b) Even or Odd:

Code:

```
import java.util.Scanner;

public class EvenOdd {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();

        if (num % 2 == 0) {
            System.out.println(num + " is Even");
        } else {
            System.out.println(num + " is Odd");
        }
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac EvenOdd.java

C:\Users\rohit\Desktop\Java>java EvenOdd
Enter a number: 2
2 is Even

C:\Users\rohit\Desktop\Java>
```

3.c) Factorial:

Code:

```
import java.util.Scanner;

public class Factorial {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();
        int factorial = 1;
        for (int i = 1; i <= num; i++) {
            factorial *= i;
        }
        System.out.println("Factorial of " + num + " is: " + factorial);
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac Factorial.java

C:\Users\rohit\Desktop\Java>java Factorial
Enter a number: 4
Factorial of 4 is: 24
```

3.d) Fibonacci Series:

Code:

```
import java.util.Scanner;

public class Fibonacci{
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the number of terms: ");
        int n = scanner.nextInt();
        int firstTerm = 0, secondTerm = 1;
        System.out.println("Fibonacci Series:");
        for (int i = 1; i <= n; i++) {
            System.out.print(firstTerm + " ");
            int nextTerm = firstTerm + secondTerm;
            firstTerm = secondTerm;
            secondTerm = nextTerm;
        }
        scanner.close();
    }
}
```

Output;

```
C:\Users\rohit\Desktop\Java>java Fibonacci
Enter the number of terms: 3
Fibonacci Series:
0 1 1
```

3.e) Leap Year:

Code:

```
import java.util.Scanner;

public class LeapYear {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a year: ");
        int year = scanner.nextInt();
        if ((year % 4 == 0 && year % 100 != 0) || (year % 400 == 0)) {
            System.out.println(year + " is a leap year.");
        } else {
            System.out.println(year + " is not a leap year.");
        }
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac LeapYear.java

C:\Users\rohit\Desktop\Java>java LeapYear
Enter a year: 2016
2016 is a leap year.
```

3.f) Multiplication Table:

Code:

```
import java.util.Scanner;

public class MultiplicationTable {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();
        for (int i = 1; i <= 10; i++) {
            System.out.println(num + " x " + i + " = " + (num * i));
        }
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac MultiplicationTable.java

C:\Users\rohit\Desktop\Java>java MultiplicationTable
Enter a number: 5
5 x 1 = 5
5 x 2 = 10
5 x 3 = 15
5 x 4 = 20
5 x 5 = 25
5 x 6 = 30
5 x 7 = 35
5 x 8 = 40
5 x 9 = 45
5 x 10 = 50
```

3.g) Palindrome No:

Code:

```
import java.util.Scanner;

public class PalindromeNo{
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();
        int reversed = 0, original = num;
        while (num != 0) {
            int digit = num % 10;
            reversed = reversed * 10 + digit;
            num /= 10;
        }
        if (original == reversed) {
            System.out.println(original + " is a palindrome.");
        } else {
            System.out.println(original + " is not a palindrome.");
        }
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac PalindromeNo.java

C:\Users\rohit\Desktop\Java>java PalindromeNo
Enter a number: 5
5 is a palindrome.
```

3.h) Prime No:

Code:

```
import java.util.Scanner;

public class PrimeNo{
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();
        boolean isPrime = true;
        for (int i = 2; i <= num / 2; i++) {
            if (num % i == 0) {
                isPrime = false;
                break;
            }
        }
        if (isPrime) {
            System.out.println(num + " is a prime number.");
        } else {
            System.out.println(num + " is not a prime number.");
        }
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac PrimeNo.java

C:\Users\rohit\Desktop\Java>java PrimeNo
Enter a number: 6
6 is not a prime number.
```

3.i) Sum of Digits:

Code:

```
import java.util.Scanner;

public class SumOfDigits{
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();
        int sum = 0;
        while (num != 0) {
            sum += num % 10;
            num /= 10;
        }
        System.out.println("Sum of digits: " + sum);
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac SumOfDigits.java

C:\Users\rohit\Desktop\Java>java SumOfDigits
Enter a number: 61
Sum of digits: 7
```

3.j) Sum Two Numbers:

Code:

```
import java.util.Scanner;

public class SumTwoNumbers {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter first number: ");
        int num1 = scanner.nextInt();
        System.out.print("Enter second number: ");
        int num2 = scanner.nextInt();
        int sum = num1 + num2;
        System.out.println("Sum: " + sum);
        scanner.close();
    }
}
```

Output:

```
C:\Users\rohit\Desktop\Java>javac SumTwoNumbers.java

C:\Users\rohit\Desktop\Java>java SumTwoNumbers
Enter first number: 23
Enter second number: 23
Sum: 46

C:\Users\rohit\Desktop\Java>
```

INHERITANCE

4. SINGLE INHERITANCE PROGRAMS

4.a)Library System

CODE:

```
import java.util.Scanner;
class Book {
   String title, author;
   int bookId;
   void getBookDetails() {
      Scanner obj = new Scanner(System.in);
      System.out.print("Enter Book Title: ");
      title = obj.nextLine();
      System.out.print("Enter Author Name: ");
      author = obj.nextLine();
      System.out.print("Enter Book ID: ");
      bookId = obj.nextInt();
   }
   void displayBookDetails() {
      System.out.println("Book Title: " + title);
      System.out.println("Author: " + author);
      System.out.println("Book ID: " + bookId);
   }
}
class Library extends Book {
   String issueDate, returnDate;
   void getIssueDetails() {
      Scanner obj = new Scanner(System.in);
      System.out.print("Enter Issue Date: ");
```

```
        issueDate = obj.nextLine();
        System.out.print("Enter Return Date: ");
        returnDate = obj.nextLine();
    }
    void displayIssueDetails() {
        System.out.println("Issue Date: " + issueDate);
        System.out.println("Return Date: " + returnDate);
    }
}
public class LibrarySystem {
    public static void main(String[] args) {
        Library book = new Library();
        book.getBookDetails();
        book.getIssueDetails();
        book.displayBookDetails();
        book.displayIssueDetails();
    }
}
```

OUTPUT:

```
Microsoft Windows [Version 10.0.27802.1000]
(c) Microsoft Corporation. All rights reserved.

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Singl
e Inheritance>javac LibrarySystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Singl
e Inheritance>java LibrarySystem.java
Enter Book Title: KIng
Enter Author Name: Queen
Enter Book ID: 2882
Enter Issue Date: 22/01/22
Enter Return Date: 25/01/22
Book Title: KIng
Author: Queen
Book ID: 2882
Issue Date: 22/01/22
Return Date: 25/01/22
```

4.b)Student Grade System

CODE:

```
import java.util.Scanner;
class Student {
   String name;
   int rollNo;
   void getStudentInfo() {
      Scanner obj=new Scanner(System.in);
      System.out.print("Enter Student Name: ");
      name=obj.nextLine();
      System.out.print("Enter Roll No: ");
      rollNo=obj.nextInt();
   }
   void displayStudentInfo() {
      System.out.println("Name: "+name);
      System.out.println("Roll No: "+rollNo);
   }
}
class GradeCalculator extends Student {
   int marks1, marks2, marks3;
   double avg;
   void getMarks() {
      Scanner obj=new Scanner(System.in);
      System.out.print("Enter Marks in Subject 1: ");
      marks1=obj.nextInt();
      System.out.print("Enter Marks in Subject 2: ");
      marks2=obj.nextInt();
      System.out.print("Enter Marks in Subject 3: ");
      marks3=obj.nextInt();
```

```
    }
    void calculateGrade() {
        avg=(marks1+marks2+marks3)/3.0;
        System.out.print("Grade: ");
        if (avg >= 90){
                    System.out.println("A");
            }
        else if (avg >= 80){
                   System.out.println("B");
            }
        else if (avg >= 70){
                    System.out.println("C");
            }
        else if (avg >= 60){
                    System.out.println("D");
            }
        else{
                    System.out.println("F");
            }
    }
}
public class StudentGradeSystem {
    public static void main(String[] args) {
        GradeCalculator student = new GradeCalculator();
        student.getStudentInfo();
        student.getMarks();
        student.displayStudentInfo();
        student.calculateGrade();
    }
```

```
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Singl
e Inheritance>javac StudentGradeSystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Singl
e Inheritance>java StudentGradeSystem
Enter Student Name: Rohith
Enter Roll No: 24141
Enter Marks in Subject 1: 90
Enter Marks in Subject 2: 99
Enter Marks in Subject 3: 95
Name: Rohith
Roll No: 24141
Grade: A
```

5. MULTILEVEL INHERITANCE PROGRAMS

5.a)Banking System

CODE:

```
import java.util.Scanner;
class Account {
   String accHolder;
   void getAccHolder() {
      Scanner obj = new Scanner(System.in);
      System.out.print("Enter Account Holder: ");
      accHolder = obj.nextLine();
   }
   void displayAccHolder() {
      System.out.println("Account Holder: " + accHolder);
   }
}
class SavingsAccount extends Account {
   double balance;
   void getBalance() {
      Scanner obj = new Scanner(System.in);
      System.out.print("Enter Balance: ");
      balance = obj.nextDouble();
   }
```

```
    void displayBalance() {
        System.out.println("Balance: " + balance);
    }
}
class PremiumSavingsAccount extends SavingsAccount {
    double bonusInterest;
    void calculateBonusInterest() {
        bonusInterest = balance * 0.1;
        System.out.println("Bonus Interest: " + bonusInterest);
    }
}
public class BankingSystem {
    public static void main(String[] args) {
        PremiumSavingsAccount acc = new PremiumSavingsAccount();
        acc.getAccHolder();
        acc.getBalance();
        acc.displayAccHolder();
        acc.displayBalance();
        acc.calculateBonusInterest();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Multi
Level Inheritence>javac BankingSystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Multi
Level Inheritence>java BankingSystem
Enter Account Holder: Rohith
Enter Balance: 2000000
Account Holder: Rohith
Balance: 2000000.0
Bonus Interest: 200000.0
```

5.b)ECommerce System

CODE:

```
import java.util.Scanner;
class Product {
```

```
    String productName;
    void getProductName() {
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter Product Name: ");
        productName = obj.nextLine();
    }
    void displayProductName() {
        System.out.println("Product: " + productName);
    }
}
class Electronics extends Product {
    String brand;
    void getBrand() {
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter Brand: ");
        brand = obj.nextLine();
    }
    void displayBrand() {
        System.out.println("Brand: " + brand);
    }
}
class Smartphone extends Electronics {
    int ram;
    void getRAM() {
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter RAM (GB): ");
        ram = obj.nextInt();
    }
    void displayRAM() {
```

```
        System.out.println("RAM: " + ram + "GB");
    }
}
public class ECommerceSystem {
    public static void main(String[] args) {
        Smartphone phone = new Smartphone();
        phone.getProductName();
        phone.getBrand();
        phone.getRAM();
        phone.displayProductName();
        phone.displayBrand();
        phone.displayRAM();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Multi
Level Inheritence>javac ECommerceSystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Multi
Level Inheritence>java ECommerceSystem
Enter Product Name: Legion
Enter Brand: Lenovo
Enter RAM (GB): 26
Product: Legion
Brand: Lenovo
RAM: 26GB
```

6. HIERARCHICAL INHERITANCE PROGRAMS

6.a)Employee System

CODE:

```
import java.util.Scanner;
class Employee {
    String name;
    int empId;
    void getBasicDetails() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter employee name: ");
        name=obj.nextLine();
```

```
        System.out.print("Enter employee ID: ");
        empId=obj.nextInt();
    }
}
class FullTimeEmployee extends Employee {
    double monthlySalary;
    void getSalaryDetails() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter monthly salary: ");
        monthlySalary=obj.nextDouble();
    }
    void displaySalary() {
        System.out.println("Annual Salary: "+(monthlySalary*12));
    }
}
class PartTimeEmployee extends Employee {
    double hourlyRate;
    void getRateDetails() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter hourly rate: ");
        hourlyRate=obj.nextDouble();
    }
    void calculateWeeklyPay(int hours) {
        System.out.println("Weekly Pay: "+(hourlyRate*hours));
    }
}
public class EmployeeSystem {
    public static void main(String[] args) {
        FullTimeEmployee ft=new FullTimeEmployee();
```

```
        PartTimeEmployee pt=new PartTimeEmployee();
        System.out.println("Full-time Employee:");
        ft.getBasicDetails();
        ft.getSalaryDetails();
        ft.displaySalary();
        System.out.println("Part-time Employee:");
        pt.getBasicDetails();
        pt.getRateDetails();
        pt.calculateWeeklyPay(20);
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Heira
rchial Inheritance>javac EmployeeSystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Heira
rchial Inheritance>java EmployeeSystem
Full-time Employee:
Enter employee name: Rohith
Enter employee ID: 234
Enter monthly salary: 2300000
Annual Salary: 2.76E7
Part-time Employee:
Enter employee name: Rohith1
Enter employee ID: 3232
Enter hourly rate: 989
Weekly Pay: 19780.0
```

6.b)Shape Area Calculator

CODE:

```
import java.util.Scanner;
class Shape {
    double dimension1,dimension2;
    void getDimensions() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter dimension1: ");
        dimension1=obj.nextDouble();
        System.out.print("Enter dimension2: ");
        dimension2=obj.nextDouble();
    }
```

```
}
class Rectangle extends Shape {
   void calculateArea() {
      System.out.println("Rectangle Area: "+(dimension1*dimension2));
   }
}
class Triangle extends Shape {
   void calculateArea() {
      System.out.println("Triangle Area: "+(0.5*dimension1*dimension2));
   }
}
public class ShapeCalculator {
   public static void main(String[] args) {
      Rectangle rect=new Rectangle();
      Triangle tri=new Triangle();
      System.out.println("Rectangle:");
      rect.getDimensions();
      rect.calculateArea();
      System.out.println("Triangle:");
      tri.getDimensions();
      tri.calculateArea();
   }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Heira
rchial Inheritance>javac ShapeCalculator.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Heira
rchial Inheritance>java ShapeCalculator
Rectangle:
Enter dimension1: 2
Enter dimension2: 4
Rectangle Area: 8.0
Triangle:
Enter dimension1: 3
Enter dimension2: 3
Triangle Area: 4.5
```

7. HYBRID INHERITANCE PROGRAMS

7.a)University System

CODE:

```
import java.util.Scanner;
class Person {
   String name;
   void getName() {
      Scanner obj=new Scanner(System.in);
      System.out.print("Enter name: ");
      name=obj.nextLine();
   }
}
class Student extends Person {
   int rollNo;
   void getRollNo() {
      Scanner obj=new Scanner(System.in);
      System.out.print("Enter roll number: ");
      rollNo=obj.nextInt();
   }
}
class Faculty extends Person {
   String department;
   void getDepartment() {
      Scanner obj=new Scanner(System.in);
      System.out.print("Enter department: ");
      department=obj.nextLine();
   }
}
class ResearchAssistant extends Student {
   String researchTopic;
```

```
    void getResearchTopic() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter research topic: ");
        researchTopic=obj.nextLine();
    }
}
public class UniversitySystem {
    public static void main(String[] args) {
        ResearchAssistant ra=new ResearchAssistant();
        Faculty prof=new Faculty();
        ra.getName();
        ra.getRollNo();
        ra.getResearchTopic();
        prof.getName();
        prof.getDepartment();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Hybri
d Inheritance>javac UniversitySystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Hybri
d Inheritance>java UniversitySystem
Enter name: Rohith
Enter roll number: 234
Enter research topic: Quantum
Enter name: Rahul
Enter department: CSE
```

7.b)Vehicle System

CODE:

```
import java.util.Scanner;
class Vehicle {
    String model;
    void getModel() {
        Scanner obj=new Scanner(System.in);
```

```
        System.out.print("Enter model: ");
        model=obj.nextLine();
    }
}
class Engine {
    String engineType;
    void getEngineType() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter engine type: ");
        engineType=obj.nextLine();
    }
}
class Car extends Vehicle {
    int seatingCapacity;
    void getSeatingCapacity() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter seating capacity: ");
        seatingCapacity=obj.nextInt();
    }
}
class ElectricCar extends Car {
    int batteryCapacity;
    void getBatteryCapacity() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter battery capacity: ");
        batteryCapacity=obj.nextInt();
    }
}
public class VehicleSystem {
```

```
    public static void main(String[] args) {
        ElectricCar ec=new ElectricCar();
        ec.getModel();
        ec.getSeatingCapacity();
        ec.getBatteryCapacity();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Hybrid Inheritance>javac VehicleSystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Inheritance\Hybrid Inheritance>java VehicleSystem
Enter model: M5
Enter seating capacity: 5
Enter battery capacity: 30000
```

POLYMORPHISM

8. CONSTRUCTOR PROGRAMS

8.a)Traffic System

CODE:

```
import java.util.Scanner;
class TrafficSignal {
    String location;
    int defaultGreenTime;
    TrafficSignal() {
        Scanner obj=new Scanner(System.in);
        System.out.print("Enter signal location: ");
        location=obj.nextLine();
        System.out.print("Enter default green time (sec): ");
        defaultGreenTime=obj.nextInt();
    }
    void adjustTiming(int trafficDensity) {
```

```
        System.out.println("Adjusted timing: "+(defaultGreenTime+(trafficDensity*2))+" sec");
    }
}
public class TrafficSystem {
    public static void main(String[] args) {
        TrafficSignal signal1=new TrafficSignal();
        signal1.adjustTiming(5);
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Cons
tructor Program>javac TrafficSystem.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Cons
tructor Program>java TrafficSystem
Enter signal location: Madhavaram
Enter default green time (sec): 30
Adjusted timing: 40 sec
```

9.CONSTRUCTOR OVERLOADING PROGRAMS

9.a)Printer Managment

CODE:

```
import java.util.Scanner;
class PrintJob {
    String jobId;
    String material;
    double volume;
    int estimatedHours;

    PrintJob() {
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter job ID: ");
        jobId = obj.nextLine();
        System.out.print("Enter material (PLA/ABS): ");
        material = obj.nextLine();
```

```
        System.out.print("Enter volume (cm³): ");
        volume = obj.nextDouble();
        estimatedHours = (int)(volume * 0.5);
    }

    PrintJob(String id, String mat) {
        jobId = id;
        material = mat;
        volume = 50.0;
        estimatedHours = (int)(volume * (mat.equals("ABS") ? 0.6 : 0.5));
    }

    PrintJob(String id, String mat, double vol) {
        jobId = id;
        material = mat;
        volume = vol;
        estimatedHours = (int)(vol * (mat.equals("ABS") ? 0.6 : 0.5));
    }

    void displayJobDetails() {
        System.out.println("Job "+jobId+": "+volume+"cm³ of "+material+
                    " (Est. "+estimatedHours+" hours)");
    }

    void calculateCost() {
        double rate = material.equals("ABS") ? 0.15 : 0.10;
        System.out.println("Estimated cost: $"+String.format("%.2f", volume*rate));
    }
}
```

```
public class PrinterManagement {
    public static void main(String[] args) {
        PrintJob defaultJob = new PrintJob();
        PrintJob absJob = new PrintJob("JOB-002", "ABS");
        PrintJob largeJob = new PrintJob("JOB-003", "PLA", 120.5);

        defaultJob.displayJobDetails();
        defaultJob.calculateCost();

        absJob.displayJobDetails();
        absJob.calculateCost();

        largeJob.displayJobDetails();
        largeJob.calculateCost();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Cons
tructor Overloading Program>javac PrinterManagement.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Cons
tructor Overloading Program>java PrinterManagement
Enter job ID: 2345
Enter material (PLA/ABS): pla
Enter volume (cm?): 50
Job 2345: 50.0cm? of pla (Est. 25 hours)
Estimated cost: $5.00
Job JOB-002: 50.0cm? of ABS (Est. 30 hours)
Estimated cost: $7.50
Job JOB-003: 120.5cm? of PLA (Est. 60 hours)
Estimated cost: $12.05
```

10. METHOD OVERLOADING PROGRAMS

10.a)Greeting Generation

CODE:

```
import java.util.Scanner;
class Greeting {
    Scanner obj=new Scanner(System.in);
    void sayHello() {
```

```
        System.out.println("Hello!");
    }
    void sayHello(String name) {
        System.out.print("Enter your name: ");
        name=obj.nextLine();
        System.out.println("Hello, "+name+"!");
    }
    void sayHello(String name,String time) {
        System.out.print("Enter time of day: ");
        time=obj.nextLine();
        System.out.println("Good "+time+", "+name+"!");
    }
}
public class GreetingApp {
    public static void main(String[] args) {
        Greeting greet=new Greeting();
        greet.sayHello();
        greet.sayHello("");
        greet.sayHello("Alice","");
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Ovverloading Program>javac GreetingApp.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Ovverloading Program>java GreetingApp
Hello!
Enter your name: Rohith
Hello, Rohith!
Enter time of day: 8:30
Good 8:30, Alice!
```

10.b)Online Store

CODE:

```
import java.util.Scanner;
```

```
class ShoppingCart {
   Scanner obj=new Scanner(System.in);
   void addItem() {
      System.out.print("Enter item name: ");
      String item=obj.nextLine();
      System.out.println("Added "+item+" to cart");
   }
   void addItem(String item) {
      System.out.print("Enter quantity: ");
      int quantity=obj.nextInt();
      System.out.println("Added "+quantity+" "+item+"(s) to cart");
   }
   void addItem(String item,int quantity) {
      System.out.print("Enter price: ");
      double price=obj.nextDouble();
      System.out.println("Added "+quantity+" "+item+"(s) at $"+price+" each");
   }
}
public class OnlineStore {
   public static void main(String[] args) {
      ShoppingCart cart=new ShoppingCart();
      cart.addItem();
      cart.obj.nextLine();
      cart.addItem("Shirt");
      cart.addItem("Pants",2);
   }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Ovverloading Program>javac OnlineStore.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Ovverloading Program>java OnlineStore
Enter item name: Shirt
Added Shirt to cart
```

11. METHOD OVERRIDING PROGRAMS

11.a)Light Control

CODE:

```
import java.util.Scanner;
class Light {
   void turnOn() {
      System.out.println("Standard light turned on");
   }
}
class SmartLight extends Light {
   void turnOn() {
      System.out.println("Smart light activated with voice control");
   }
}
public class LightControl {
   public static void main(String[] args) {
      Scanner obj = new Scanner(System.in);
      System.out.print("Use smart light? (y/n): ");
      String choice = obj.next();
      Light light = choice.equals("y") ? new SmartLight() : new Light();
      light.turnOn();
   }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Overriding Program>javac LightControl.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Overriding Program>java LightControl
Use smart light? (y/n): y
Smart light activated with voice control
```

11.b)Transfer App

CODE:

```
import java.util.Scanner;

class Payment {
    void processPayment() {
        System.out.println("Processing cash payment");
    }
}
class MobilePayment extends Payment {
    void processPayment() {
        System.out.println("Processing mobile wallet payment");
    }
}
public class TransferApp {
    public static void main(String[] args) {
        Scanner obj = new Scanner(System.in);
        System.out.print("Pay with mobile? (y/n): ");
        String choice = obj.next();
        Payment payment = choice.equals("y") ? new MobilePayment() : new Payment();
        payment.processPayment();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Overriding Program>javac TransferApp.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Polymorphism\Meth
od Overriding Program>java TransferApp
Pay with mobile? (y/n): y
Processing mobile wallet payment
```

ABSTRACTION

12. INTERFACE PROGRAMS

12.a)File Encryptor

CODE:

```
import java.util.Scanner;


interface Encryptor {
   String encrypt(String text);
   String decrypt(String text);
}


class CaesarCipher implements Encryptor {
   private int shift = 3;
   public String encrypt(String text) {
      StringBuilder result = new StringBuilder();
      for (char c : text.toCharArray())
         result.append((char)(c + shift));
      return result.toString();
   }
   public String decrypt(String text) {
      StringBuilder result = new StringBuilder();
      for (char c : text.toCharArray())
         result.append((char)(c - shift));
      return result.toString();
   }
}


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

```
        Scanner sc = new Scanner(System.in);
        Encryptor encryptor = new CaesarCipher();

        System.out.println("Enter text: ");
        String text = sc.nextLine();

        System.out.println("1-Encrypt, 2-Decrypt: ");
        int choice = sc.nextInt();

        if (choice == 1) System.out.println("Encrypted: " + encryptor.encrypt(text));
        else System.out.println("Decrypted: " + encryptor.decrypt(text));

        sc.close();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>javac FileEncryptor.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>java FileEncryptor
Enter text:
HI
1-Encrypt, 2-Decrypt:
1
Encrypted: KL
```

12.b)Fitness App

CODE:

```
import java.util.Scanner;

interface FitnessTracker {
    void trackSteps(int steps);
    void trackCalories(int calories);
    void trackDistance(double km);
}
```

```
class BasicTracker implements FitnessTracker {
   public void trackSteps(int steps) { System.out.println("Steps: " + steps); }
   public void trackCalories(int calories) { System.out.println("Calories: " + calories); }
   public void trackDistance(double km) { System.out.println("Distance: " + km + " km"); }
}

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

      System.out.println("Enter steps: ");
      tracker.trackSteps(sc.nextInt());

      System.out.println("Enter calories burned: ");
      tracker.trackCalories(sc.nextInt());

      System.out.println("Enter distance (km): ");
      tracker.trackDistance(sc.nextDouble());

      sc.close();
   }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>javac FitnessApp.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>java FitnessApp
Enter steps:
1
Steps: 1
Enter calories burned:
230
Calories: 230
Enter distance (km):
5
Distance: 5.0 km
```

12.c)Payment Gateway

CODE:

```
import java.util.Scanner;


interface PaymentMethod {
   void pay(double amount);
}


class CreditCard implements PaymentMethod {
   public void pay(double amount) {
      System.out.println("Paid " + amount + " via Credit Card.");
   }
}


class UPI implements PaymentMethod {
   public void pay(double amount) {
      System.out.println("Paid " + amount + " via UPI.");
   }
}


public class PaymentGateway {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      System.out.println("Enter amount: ");
```

```
        double amt = sc.nextDouble();

        System.out.println("Choose payment (1-Credit Card, 2-UPI): ");
        int choice = sc.nextInt();

        PaymentMethod payment;
        if (choice == 1) payment = new CreditCard();
        else payment = new UPI();

        payment.pay(amt);
        sc.close();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>javac PaymentGateway.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>java  PaymentGateway
Enter amount:
2300
Choose payment (1-Credit Card, 2-UPI):
1
Paid 2300.0 via Credit Card.
```

12.d)Temperature Conversion

CODE:

```
import java.util.Scanner;

interface TempConverter {
    double convert(double temp);
}

class CelsiusToFahrenheit implements TempConverter {
    public double convert(double temp) { return (temp * 9/5) + 32; }
}
```

```
class FahrenheitToCelsius implements TempConverter {
   public double convert(double temp) { return (temp - 32) * 5/9; }
}

public class TempConversion {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      System.out.println("Enter temperature: ");
      double temp = sc.nextDouble();

      System.out.println("Convert to (1-Celsius→Fahrenheit, 2-Fahrenheit→Celsius): ");
      int choice = sc.nextInt();

      TempConverter converter;
      if (choice == 1) converter = new CelsiusToFahrenheit();
      else converter = new FahrenheitToCelsius();

      System.out.println("Converted Temp: " + converter.convert(temp));
      sc.close();
   }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>javac TempConversion.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Inter
face Program>java TempConversion
Enter temperature:
23
Convert to (1-Celsius?Fahrenheit, 2-Fahrenheit?Celsius):
2
Converted Temp: -5.0
```

13. ABSTRACT CLASS PROGRAMS

13.a)Bank Demo

CODE:

```
import java.util.Scanner;

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

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

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

class SavingsAccount extends BankAccount {
    private double interestRate;

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


    void deposit(double amount) {
        balance += amount;
        System.out.println(amount + " deposited.");
    }
```

```
    void withdraw(double amount) {
        if (balance >= amount) {
            balance -= amount;
            System.out.println(amount + " withdrawn.");
        } else {
            System.out.println("Insufficient balance.");
        }
    }

    void displayBalance() {
        System.out.println("Account Number: " + accountNumber);
        System.out.println("Balance: " + balance);
        System.out.println("Interest Rate: " + interestRate + "%");
    }

    void calculateInterest() {
        double interest = balance * interestRate / 100;
        System.out.println("Interest: " + interest);
    }
}

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

        System.out.println("Enter account number:");
        String accNum = sc.next();
```

```
        System.out.println("Enter initial balance:");
        double balance = sc.nextDouble();

        System.out.println("Enter interest rate:");
        double rate = sc.nextDouble();

        SavingsAccount account = new SavingsAccount(accNum, balance, rate);

        while (true) {
            System.out.println("\n1. Deposit\n2. Withdraw\n3. Display Balance\n4. Calculate Interest\n5. Exit");
            int choice = sc.nextInt();

            switch (choice) {
                case 1:
                    System.out.println("Enter amount to deposit:");
                    account.deposit(sc.nextDouble());
                    break;
                case 2:
                    System.out.println("Enter amount to withdraw:");
                    account.withdraw(sc.nextDouble());
                    break;
                case 3:
                    account.displayBalance();
                    break;
                case 4:
                    account.calculateInterest();
                    break;
                case 5:
                    sc.close();
```

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

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Abstr
act Class Program>javac BankDemo.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Abstr
act Class Program>java BankDemo
Enter account number:
201010
Enter initial balance:
100
Enter interest rate:
202

1. Deposit
2. Withdraw
3. Display Balance
4. Calculate Interest
5. Exit
1
Enter amount to deposit:
2
2.0 deposited.

1. Deposit
2. Withdraw
3. Display Balance
4. Calculate Interest
5. Exit
5
```

13.b)Employee Demo

CODE:

```
import java.util.Scanner;


abstract class Employee {
   protected String name;
   protected int id;

   Employee(String name, int id) {
      this.name = name;
      this.id = id;
   }
```

```
    abstract double calculateSalary();
    abstract void displayDetails();
}

class FullTimeEmployee extends Employee {
    private double monthlySalary;

    FullTimeEmployee(String name, int id, double monthlySalary) {
        super(name, id);
        this.monthlySalary = monthlySalary;
    }

    double calculateSalary() {
        return monthlySalary;
    }

    void displayDetails() {
        System.out.println("Full-time Employee:");
        System.out.println("ID: " + id);
        System.out.println("Name: " + name);
        System.out.println("Monthly Salary: " + monthlySalary);
    }
}

class PartTimeEmployee extends Employee {
    private double hourlyRate;
    private int hoursWorked;
```

```
    PartTimeEmployee(String name, int id, double hourlyRate, int hoursWorked) {
        super(name, id);
        this.hourlyRate = hourlyRate;
        this.hoursWorked = hoursWorked;
    }

    double calculateSalary() {
        return hourlyRate * hoursWorked;
    }

    void displayDetails() {
        System.out.println("Part-time Employee:");
        System.out.println("ID: " + id);
        System.out.println("Name: " + name);
        System.out.println("Hourly Rate: " + hourlyRate);
        System.out.println("Hours Worked: " + hoursWorked);
        System.out.println("Total Salary: " + calculateSalary());
    }
}

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

        System.out.println("Enter employee type (fulltime/parttime):");
        String type = sc.next();

        System.out.println("Enter name:");
        String name = sc.next();
```

```
        System.out.println("Enter ID:");
        int id = sc.nextInt();

        Employee emp;

        if (type.equalsIgnoreCase("fulltime")) {
            System.out.println("Enter monthly salary:");
            double salary = sc.nextDouble();
            emp = new FullTimeEmployee(name, id, salary);
        } else {
            System.out.println("Enter hourly rate:");
            double rate = sc.nextDouble();
            System.out.println("Enter hours worked:");
            int hours = sc.nextInt();
            emp = new PartTimeEmployee(name, id, rate, hours);
        }

        emp.displayDetails();
        System.out.println("Calculated Salary: " + emp.calculateSalary());
        sc.close();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Abstr
act Class Program>javac EmployeeDemo.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Abstr
act Class Program>java EmployeeDemo
Enter employee type (fulltime/parttime):
fulltime
Enter name:
Rohith
Enter ID:
3445
Enter monthly salary:
2300000
Full-time Employee:
ID: 3445
Name: Rohith
Monthly Salary: 2300000.0
Calculated Salary: 2300000.0
```

13.c)Media Demo

CODE:

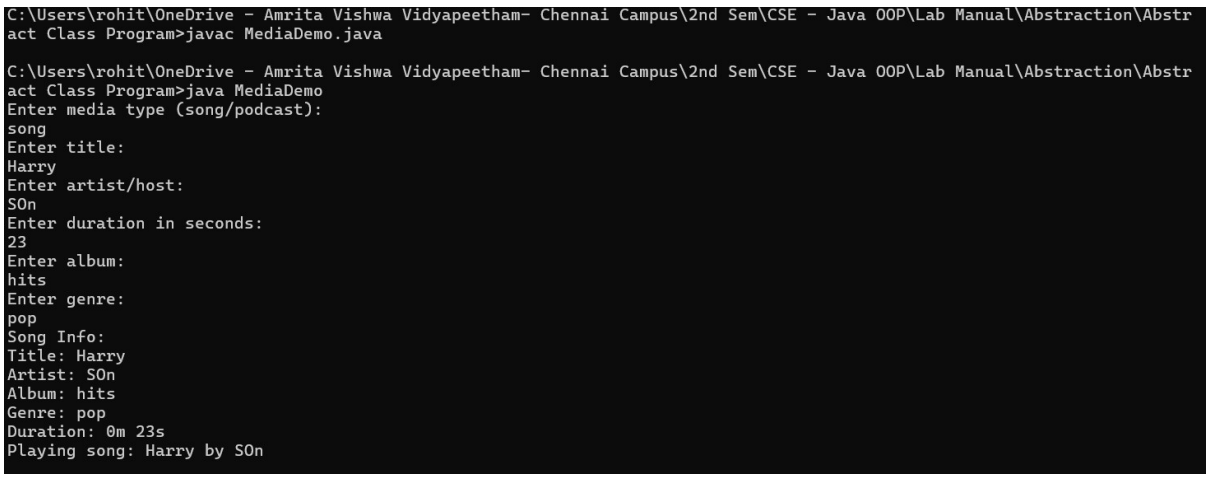
```
import java.util.Scanner;


abstract class Media {
    protected String title;
    protected String artist;
    protected int duration;

    Media(String title, String artist, int duration) {
        this.title = title;
        this.artist = artist;
        this.duration = duration;
    }

    abstract void play();
    abstract void displayInfo();
}

class Song extends Media {
    private String album;
    private String genre;

    Song(String title, String artist, int duration, String album, String genre) {
```

```
        super(title, artist, duration);
        this.album = album;
        this.genre = genre;
    }

    void play() {
        System.out.println("Playing song: " + title + " by " + artist);
    }

    void displayInfo() {
        System.out.println("Song Info:");
        System.out.println("Title: " + title);
        System.out.println("Artist: " + artist);
        System.out.println("Album: " + album);
        System.out.println("Genre: " + genre);
        System.out.println("Duration: " + duration/60 + "m " + duration%60 + "s");
    }
}

class Podcast extends Media {
    private String host;
    private String topic;

    Podcast(String title, String artist, int duration, String host, String topic) {
        super(title, artist, duration);
        this.host = host;
        this.topic = topic;
    }
```

```
    void play() {
        System.out.println("Playing podcast: " + title + " hosted by " + host);
    }

    void displayInfo() {
        System.out.println("Podcast Info:");
        System.out.println("Title: " + title);
        System.out.println("Host: " + host);
        System.out.println("Topic: " + topic);
        System.out.println("Duration: " + duration/60 + "m " + duration%60 + "s");
    }
}

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

        System.out.println("Enter media type (song/podcast):");
        String type = sc.next();

        System.out.println("Enter title:");
        String title = sc.next();

        System.out.println("Enter artist/host:");
        String artist = sc.next();

        System.out.println("Enter duration in seconds:");
        int duration = sc.nextInt();
```

```
        Media media;

        if (type.equalsIgnoreCase("song")) {
            System.out.println("Enter album:");
            String album = sc.next();
            System.out.println("Enter genre:");
            String genre = sc.next();
            media = new Song(title, artist, duration, album, genre);
        } else {
            System.out.println("Enter topic:");
            String topic = sc.next();
            media = new Podcast(title, artist, duration, artist, topic);
        }

        media.displayInfo();
        media.play();
        sc.close();
    }
}
```

OUTPUT:



13.d)University Demo

CODE:

```
import java.util.Scanner;

abstract class UniversityMember {
   protected String name;
   protected int id;

   UniversityMember(String name, int id) {
      this.name = name;
      this.id = id;
   }

   abstract void displayRole();
   abstract void displayDetails();
}

class Student extends UniversityMember {
   private String major;
   private int semester;

   Student(String name, int id, String major, int semester) {
      super(name, id);
      this.major = major;
      this.semester = semester;
   }

   void displayRole() {
      System.out.println("Role: Student");
```

```
    }

    void displayDetails() {
        System.out.println("Student Details:");
        System.out.println("Name: " + name);
        System.out.println("ID: " + id);
        System.out.println("Major: " + major);
        System.out.println("Semester: " + semester);
    }
}

class Professor extends UniversityMember {
    private String department;
    private String specialization;

    Professor(String name, int id, String department, String specialization) {
        super(name, id);
        this.department = department;
        this.specialization = specialization;
    }

    void displayRole() {
        System.out.println("Role: Professor");
    }

    void displayDetails() {
        System.out.println("Professor Details:");
        System.out.println("Name: " + name);
        System.out.println("ID: " + id);
```

```
        System.out.println("Department: " + department);
        System.out.println("Specialization: " + specialization);
    }
}

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

        System.out.println("Enter member type (student/professor):");
        String type = sc.next();

        System.out.println("Enter name:");
        String name = sc.next();

        System.out.println("Enter ID:");
        int id = sc.nextInt();

        UniversityMember member;

        if (type.equalsIgnoreCase("student")) {
            System.out.println("Enter major:");
            String major = sc.next();
            System.out.println("Enter semester:");
            int semester = sc.nextInt();
            member = new Student(name, id, major, semester);
        } else {
            System.out.println("Enter department:");
            String dept = sc.next();
```

```
            System.out.println("Enter specialization:");
            String spec = sc.next();
            member = new Professor(name, id, dept, spec);
        }

        member.displayRole();
        member.displayDetails();
        sc.close();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Abst
act Class Program>javac UniversityDemo.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Abstraction\Abst
act Class Program>java UniversityDemo
Enter member type (student/professor):
student
Enter name:
ROhith
Enter ID:
12
Enter major:
CSE
Enter semester:
2
Role: Student
Student Details:
Name: ROhith
ID: 12
Major: CSE
Semester: 2
```

ENCAPSULATION

14. ENCAPSULATION PROGRAMS

14.a)Employee Salary

CODE:

```
import java.util.Scanner;
class Employee {
    private String name;
    private double baseSalary;
    private double bonus;
    public void setName(String name) { this.name = name; }
```

```
    public void setBaseSalary(double baseSalary) { this.baseSalary = baseSalary; }
    public void setBonus(double bonus) { this.bonus = bonus; }
    public double calculateTotalSalary() { return baseSalary + bonus; }
    public String getName() { return name; }
}
public class Main {
    public static void main(String[] args) {
        Scanner obj = new Scanner(System.in);
        Employee emp = new Employee();
        System.out.print("Enter employee name: ");
        emp.setName(obj.nextLine());
        System.out.print("Enter base salary: ");
        emp.setBaseSalary(obj.nextDouble());
        System.out.print("Enter bonus: ");
        emp.setBonus(obj.nextDouble());
        System.out.println(emp.getName() + "'s total salary: " + emp.calculateTotalSalary());
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Emp
loyee Salary>javac Main.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Emp
loyee Salary>java Main
Enter employee name: RObith
Enter base salary: 20000000
Enter bonus: 2000
RObith's total salary: 2.0002E7
```

14.b)Library Book Management System

CODE:

```
import java.util.Scanner;
class Book {
    private String title;
    private String author;
    private boolean isAvailable;
```

```
    public void setTitle(String title) { this.title = title; }
    public void setAuthor(String author) { this.author = author; }
    public void setAvailability(boolean isAvailable) { this.isAvailable = isAvailable; }
    public String getStatus() { return isAvailable ? "Available" : "Not Available"; }
    public String getTitle() { return title; }
}
public class Main {
    public static void main(String[] args) {
        Scanner obj = new Scanner(System.in);
        Book book = new Book();
        System.out.print("Enter book title: ");
        book.setTitle(obj.nextLine());
        System.out.print("Enter author: ");
        book.setAuthor(obj.nextLine());
        System.out.print("Is the book available? (true/false): ");
        book.setAvailability(obj.nextBoolean());
        System.out.println(book.getTitle() + " status: " + book.getStatus());
    }
}
```

OUTPUT:

```
(c) Microsoft Corporation. All rights reserved.

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Lib
rary Book Managment System>javac Main.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Lib
rary Book Managment System>java Main
Enter book title: Harry
Enter author: Stephe
Is the book available? (true/false): true
Harry status: Available
```

14.c)Student Grade Analyzer

CODE:

```
import java.util.Scanner;
class Student {
    private String name;
```

```
    private int[] marks;
    public void setName(String name) { this.name = name; }
    public void setMarks(int[] marks) { this.marks = marks; }
    public double calculateAverage() {
        double sum = 0;
        for(int mark : marks) sum += mark;
        return sum / marks.length;
    }
    public String getName() { return name; }
}
public class Main {
    public static void main(String[] args) {
        Scanner obj = new Scanner(System.in);
        Student stu = new Student();
        System.out.print("Enter student name: ");
        stu.setName(obj.nextLine());
        System.out.print("Enter number of subjects: ");
        int n = obj.nextInt();
        int[] marks = new int[n];
        System.out.println("Enter marks:");
        for(int i=0;i<n;i++) marks[i] = obj.nextInt();
        stu.setMarks(marks);
        System.out.println(stu.getName() + "'s average: " + stu.calculateAverage());
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Stu
dent Grade Analyzer>javac Main.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Stu
dent Grade Analyzer>java Main
Enter student name: Rohith
Enter number of subjects: 2
Enter marks:
23
23
Rohith's average: 23.0
```

14.d)Thermostat

CODE:

```
import java.util.Scanner;


class Thermostat {
    private double currentTemp;
    private boolean isEnergySaving;


    public void setTemperature(double temp) {
        if (temp < 10 || temp > 35) {
            System.out.println("Invalid temperature! Setting to nearest safe value (10°C-35°C).");
            this.currentTemp = (temp < 10) ? 10 : 35;
            this.isEnergySaving = true;
        } else {
            this.currentTemp = temp;
            this.isEnergySaving = (temp >= 30 || temp <= 15);
        }
    }


    public double getTemperature() {
        return currentTemp;
    }


    public String getStatus() {
        return "Current: " + currentTemp + "°C | Energy Saving: " + (isEnergySaving ? "ON" :
"OFF");
```

```
    }
}

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

        System.out.print("Enter desired temperature (°C): ");
        thermo.setTemperature(obj.nextDouble());

        System.out.println(thermo.getStatus());
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Thermostat>javac Main.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Encapsulation\Thermostat>java Main
Enter desired temperature (°C): 23
Current: 23.0°C | Energy Saving: OFF
```

15.PACKAGES PROGRAMS

15.a)Student Grade Analyzer

CODE:

StudentGradeAnalyzer.java

```
package edu.grades.analysis;

import java.util.Scanner;

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

```
        System.out.print("Enter number of students: ");
        int numStudents = scanner.nextInt();

        int[] grades = new int[numStudents];

        for (int i = 0; i < numStudents; i++) {
            System.out.print("Enter grade for student " + (i+1) + ": ");
            grades[i] = scanner.nextInt();
        }

        GradeStatistics stats = new GradeStatistics(grades);
        stats.displayResults();

        scanner.close();
    }
}
```

GradeStatistics.java

```
package edu.grades.analysis;

public class GradeStatistics {
    private int[] grades;
    private int highest;
    private int lowest;
    private double average;

    public GradeStatistics(int[] grades) {
        this.grades = grades;
        calculateStatistics();
```

```
    }

    private void calculateStatistics() {
        if (grades.length == 0) return;

        highest = grades[0];
        lowest = grades[0];
        double sum = 0;

        for (int grade : grades) {
            if (grade > highest) highest = grade;
            if (grade < lowest) lowest = grade;
            sum += grade;
        }

        average = sum / grades.length;
    }

    public void displayResults() {
        System.out.println("\nGrade Analysis Results:");
        System.out.println("Highest Grade: " + highest);
        System.out.println("Lowest Grade: " + lowest);
        System.out.printf("Average Grade: %.2f\n", average);
        System.out.println("Grade Distribution:");

        int[] frequency = new int[11];
        for (int grade : grades) {
            int index = grade / 10;
            if (index > 10) index = 10;
```

```
            frequency[index]++;
        }

        for (int i = 0; i < frequency.length; i++) {
            int lower = i * 10;
            int upper = (i == 10) ? 100 : lower + 9;
            System.out.printf("%3d-%3d: %s\n", lower, upper, "*".repeat(frequency[i]));
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\Downloads\Lab Manual\Packages Program\Built In Packages\User Defined Packages\Stu
dent Grade Analyzer>javac edu/grades/analysis/StudentGradeAnalyzer.java

C:\Users\rohit\Downloads\Lab Manual\Packages Program\Built In Packages\User Defined Packages\Stu
dent Grade Analyzer>java edu.grades.analysis.StudentGradeAnalyzer
Enter number of students: 5
Enter grade for student 1: 85
Enter grade for student 2: 92
Enter grade for student 3: 78
Enter grade for student 4: 65
Enter grade for student 5: 90

Grade Analysis Results:
Highest Grade: 92
Lowest Grade: 65
Average Grade: 82.00
Grade Distribution:
  0-  9:
 10- 19:
 20- 29:
 30- 39:
 40- 49:
 50- 59:
 60- 69: *
 70- 79: *
 80- 89: **
 90-100: **
```

15.b)Scientific Calculator

CODE:

ScientificCalculator.java

```
package sci.calculator.advanced;

import java.util.Scanner;

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

      System.out.println("Scientific Calculator");
      System.out.println("1. Factorial");
      System.out.println("2. Power");
      System.out.println("3. Square Root");
      System.out.println("4. Logarithm (base 10)");
      System.out.println("5. Trigonometric Function");
      System.out.print("Enter your choice: ");

      int choice = scanner.nextInt();
      double result = 0;
      boolean valid = true;

      switch (choice) {
         case 1:
            System.out.print("Enter a positive integer: ");
            int num = scanner.nextInt();
            result = math.factorial(num);
            break;
```

```
        case 2:
            System.out.print("Enter base: ");
            double base = scanner.nextDouble();
            System.out.print("Enter exponent: ");
            double exponent = scanner.nextDouble();
            result = math.power(base, exponent);
            break;
        case 3:
            System.out.print("Enter a number: ");
            double sqrtNum = scanner.nextDouble();
            result = math.squareRoot(sqrtNum);
            break;
        case 4:
            System.out.print("Enter a positive number: ");
            double logNum = scanner.nextDouble();
            result = math.logarithm(logNum);
            break;
        case 5:
            System.out.println("1. Sine");
            System.out.println("2. Cosine");
            System.out.println("3. Tangent");
            System.out.print("Choose trigonometric function: ");
            int trigChoice = scanner.nextInt();
            System.out.print("Enter angle in degrees: ");
            double angle = scanner.nextDouble();

            switch (trigChoice) {
                case 1: result = math.sine(angle); break;
                case 2: result = math.cosine(angle); break;
```

```
                case 3: result = math.tangent(angle); break;
                default: valid = false;
            }
            break;
        default:
            valid = false;
    }

    if (valid) {
        System.out.println("Result: " + result);
    } else {
        System.out.println("Invalid choice!");
    }

    scanner.close();
  }
}
```

AdvancedMathOperations.java

```
package sci.calculator.advanced;

public class AdvancedMathOperations {
  public double factorial(int n) {
    if (n < 0) throw new IllegalArgumentException("Factorial of negative number is not defined");
    if (n == 0 || n == 1) return 1;

    double result = 1;
    for (int i = 2; i <= n; i++) {
        result *= i;
    }
```

```
        return result;
    }

    public double power(double base, double exponent) {
        return Math.pow(base, exponent);
    }

    public double squareRoot(double num) {
        if (num < 0) throw new IllegalArgumentException("Square root of negative number is not real");
        return Math.sqrt(num);
    }

    public double logarithm(double num) {
        if (num <= 0) throw new IllegalArgumentException("Logarithm of non-positive number is not defined");
        return Math.log10(num);
    }

    public double sine(double angleDegrees) {
        return Math.sin(Math.toRadians(angleDegrees));
    }

    public double cosine(double angleDegrees) {
        return Math.cos(Math.toRadians(angleDegrees));
    }

    public double tangent(double angleDegrees) {
        return Math.tan(Math.toRadians(angleDegrees));
    }
```

```
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab
Manual\Packages Program\User Defined Packages\Scientific Calculator>javac sci/calculator/advance
d/ScientificCalculator.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab
Manual\Packages Program\User Defined Packages\Scientific Calculator>java sci.calculator.advance
d.ScientificCalculator
Scientific Calculator
1. Factorial
2. Power
3. Square Root
4. Logarithm (base 10)
5. Trigonometric Function
Enter your choice: 1
Enter a positive integer: 5
Result: 120.0

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab
Manual\Packages Program\User Defined Packages\Scientific Calculator>java sci.calculator.advance
d.ScientificCalculator
Scientific Calculator
1. Factorial
2. Power
3. Square Root
4. Logarithm (base 10)
5. Trigonometric Function
Enter your choice: 2
Enter base: 2
Enter exponent: 8
Result: 256.0
```

15.c)File Size Analyzer

CODE:

```
import java.util.Scanner;

import java.io.File;

import java.text.NumberFormat;


public class FileSizeAnalyzer {

   public static void main(String[] args) {

      Scanner scanner = new Scanner(System.in);

      NumberFormat nf = NumberFormat.getInstance();
```

```
        System.out.println("File Size Analyzer");
        System.out.println("------------------");

        System.out.print("Enter file or directory path: ");
        String path = scanner.nextLine();

        File file = new File(path);

        if (!file.exists()) {
            System.out.println("Error: File or directory does not exist!");
            scanner.close();
            return;
        }

        analyzeFile(file, nf);

        scanner.close();
    }

    private static void analyzeFile(File file, NumberFormat nf) {
        if (file.isFile()) {
            System.out.println("\nFile: " + file.getName());
            System.out.println("Size: " + formatSize(file.length()));
            System.out.println("Last Modified: " + new java.util.Date(file.lastModified()));
        } else if (file.isDirectory()) {
            System.out.println("\nDirectory: " + file.getName());

            File[] files = file.listFiles();
```

```
        if (files == null || files.length == 0) {
            System.out.println("Directory is empty");
            return;
        }

        long totalSize = 0;
        int fileCount = 0;
        int dirCount = 0;

        for (File f : files) {
            if (f.isFile()) {
                totalSize += f.length();
                fileCount++;
            } else if (f.isDirectory()) {
                dirCount++;
            }
        }

        System.out.println("Contains: " + nf.format(fileCount) + " files and " +
                           nf.format(dirCount) + " subdirectories");
        System.out.println("Total Size: " + formatSize(totalSize));

        if (fileCount > 0) {
            File largest = null;
            File smallest = null;
            long maxSize = Long.MIN_VALUE;
            long minSize = Long.MAX_VALUE;

            for (File f : files) {
```

```
            if (f.isFile()) {
                long size = f.length();
                if (size > maxSize) {
                    maxSize = size;
                    largest = f;
                }
                if (size < minSize) {
                    minSize = size;
                    smallest = f;
                }
            }
        }

        System.out.println("\nLargest File: " + largest.getName() +
                " (" + formatSize(largest.length()) + ")");
        System.out.println("Smallest File: " + smallest.getName() +
                " (" + formatSize(smallest.length()) + ")");
    }
  }
}

  private static String formatSize(long size) {
    if (size < 1024) {
      return size + " B";
    } else if (size < 1024 * 1024) {
      return String.format("%.2f KB", size / 1024.0);
    } else if (size < 1024 * 1024 * 1024) {
      return String.format("%.2f MB", size / (1024.0 * 1024.0));
    } else {
```

```
            return String.format("%.2f GB", size / (1024.0 * 1024.0 * 1024.0));
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Packages Program\
Built In Packages>javac FileSizeAnalyzer.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Packages Program\
Built In Packages>java FileSizeAnalyzer
File Size Analyzer
------------------
Enter file or directory path: C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OO
P\Lab Manual\Packages Program\Built In Packages\FileSizeAnalyzer.java

File: FileSizeAnalyzer.java
Size: 3.64 KB
Last Modified: Sat Apr 05 11:52:12 IST 2025
```

15.d)Finance Tracker

CODE:

```
import java.util.Scanner;
import java.text.DecimalFormat;
import java.time.LocalDate;


public class FinanceTracker {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        DecimalFormat df = new DecimalFormat("₹#,##0.00");

        System.out.println("Personal Finance Tracker");
        System.out.println("------------------------");

        System.out.print("Enter your monthly income: ");
        double income = scanner.nextDouble();

        System.out.print("Enter number of expense categories: ");
        int categories = scanner.nextInt();
```

```
        double totalExpenses = 0;
        for (int i = 1; i <= categories; i++) {
            System.out.print("Enter expense category " + i + " name: ");
            String category = scanner.next();

            System.out.print("Enter amount spent on " + category + ": ");
            double amount = scanner.nextDouble();
            totalExpenses += amount;
        }

        double savings = income - totalExpenses;
        LocalDate today = LocalDate.now();

        System.out.println("\nFinancial Summary for " + today.getMonth() + " " +
today.getYear());
        System.out.println("Total Income: " + df.format(income));
        System.out.println("Total Expenses: " + df.format(totalExpenses));
        System.out.println("Net Savings: " + df.format(savings));

        if (savings < 0) {
            System.out.println("Warning: You're spending more than you earn!");
        } else if (savings < income * 0.2) {
            System.out.println("Advice: Try to save at least 20% of your income.");
        } else {
            System.out.println("Great job with your savings!");
        }

        scanner.close();
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Packages Program\Built In Packages>javac FinanceTrack
er.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Packages Program\Built In Packages>java FinanceTracke
r
Personal Finance Tracker
-------------------------
Enter your monthly income: 2000000
Enter number of expense categories: 2
Enter expense category 1 name: 200
Enter amount spent on 200: 20000
Enter expense category 2 name: 29
Enter amount spent on 29: 20000

Financial Summary for APRIL 2025
Total Income: ?2,000,000.00
Total Expenses: ?40,000.00
Net Savings: ?1,960,000.00
Great job with your savings!
```

16. EXCEPTION HANDLING PROGRAMS

16.a)Password Checker

CODE:

```
import java.util.Scanner;


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


public class PasswordChecker {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      try {
         System.out.print("Create a password (min 8 chars, with special char): ");
         String password = sc.nextLine();


         if(password.length() < 8)
            throw new WeakPasswordException("Password too short!");
         if(!password.matches(".*[!@#$%^&*()].*"))
            throw new WeakPasswordException("Password needs a special character!");
```

```
            System.out.println("Password is strong!");
        } catch (WeakPasswordException e) {
            System.out.println("Weak Password: " + e.getMessage());
        } finally {
            sc.close();
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handl
ing Program>javac PasswordChecker.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handl
ing Program>java PasswordChecker
Create a password (min 8 chars, with special char): Welcome@01
Password is strong!
```

16.b)Temperature Converter

CODE:

```
import java.util.Scanner;


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


public class TemperatureConverter {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        try {
            System.out.print("Enter temperature in Celsius: ");
            double celsius = Double.parseDouble(sc.nextLine());
```

```
            if(celsius < -273.15)
                throw new InvalidTemperatureException("Temperature cannot be below absolute zero (-273.15°C)");

            double fahrenheit = (celsius * 9/5) + 32;
            System.out.printf("%.2f°C = %.2f°F\n", celsius, fahrenheit);

        } catch (NumberFormatException e) {
            System.out.println("Error: Please enter a valid number!");
        } catch (InvalidTemperatureException e) {
            System.out.println("Error: " + e.getMessage());
        } finally {
            sc.close();
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handling Program>javac TemperatureConverter.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handling Program>java TemperatureConverter
Enter temperature in Celsius: 23
23.00°C = 73.40°F
```

16.c)Math Operations

CODE:

```
import java.util.Scanner;

public class MathOperations {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        try {
            System.out.print("Enter first number: ");
            double num1 = Double.parseDouble(sc.nextLine());
```

```
            System.out.print("Enter second number: ");
            double num2 = Double.parseDouble(sc.nextLine());

            System.out.print("Enter operation (+, -, *, /): ");
            char op = sc.nextLine().charAt(0);

            switch(op) {
                case '+': System.out.println("Result: " + (num1+num2)); break;
                case '-': System.out.println("Result: " + (num1-num2)); break;
                case '*': System.out.println("Result: " + (num1*num2)); break;
                case '/':
                    if(num2 == 0) throw new ArithmeticException("Division by zero!");
                    System.out.println("Result: " + (num1/num2));
                    break;
                default: throw new IllegalArgumentException("Invalid operation!");
            }
        } catch (NumberFormatException e) {
            System.out.println("Error: Invalid number format!");
        } catch (ArithmeticException | IllegalArgumentException e) {
            System.out.println("Error: " + e.getMessage());
        } finally {
            sc.close();
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handl
ing Program>javac MathOperations.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handl
ing Program>java MathOperations
Enter first number: 23
Enter second number: 23
Enter operation (+, -, *, /): -
Result: 0.0
```

16.d)Grade Calculator

CODE:

```
import java.util.Scanner;


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


public class GradeCalculator {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      try {
         System.out.print("Enter marks obtained (out of 100): ");
         double marks = Double.parseDouble(sc.nextLine());


         if(marks < 0 || marks > 100)
            throw new InvalidGradeException("Marks must be between 0 and 100");


         String grade;
         if(marks >= 90) grade = "A";
         else if(marks >= 80) grade = "B";
         else if(marks >= 70) grade = "C";
         else if(marks >= 60) grade = "D";
         else grade = "F";
```

```
            System.out.println("Grade: " + grade);
        } catch (NumberFormatException e) {
            System.out.println("Error: Please enter a valid number!");
        } catch (InvalidGradeException e) {
            System.out.println("Error: " + e.getMessage());
        } finally {
            sc.close();
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handl
ing Program>javac GradeCalculator.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\Exceptional Handl
ing Program>java GradeCalculator
Enter marks obtained (out of 100): 50
Grade: F
```

17. FILE HANDLING PROGRAMS

17.a)Word Counter

CODE:

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


public class WordCounter {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the file path to count words:");
        String filePath = sc.nextLine();


        int wordCount = 0;
        try (BufferedReader br = new BufferedReader(new FileReader(filePath))) {
```

```
            String line;
            while ((line = br.readLine()) != null) {
                String[] words = line.split("\\s+");
                wordCount += words.length;
            }
            System.out.println("Total words: " + wordCount);
        } catch (IOException e) {
            System.out.println("Error: File not found!");
        }
    }
}
```

OUTPUT:

```
C:\Users\rohit\Downloads\Lab Programs\File Handling Programs>javac WordCounter.java

C:\Users\rohit\Downloads\Lab Programs\File Handling Programs>java WordCounter
Enter the file path to count words:
C:\Users\rohit\Downloads\Lab Programs\File Handling Programs\WordCounter.java
Total words: 93
```

17.b)Grade Tracker

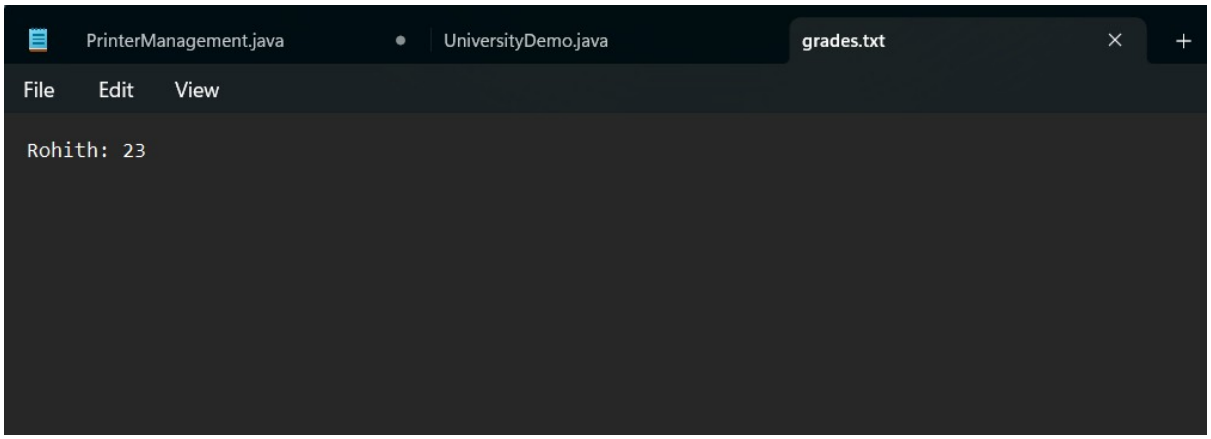
CODE:

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


public class GradeTracker {
    public static void main(String[] args) throws IOException {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter student name:");
        String name = sc.nextLine();
        System.out.println("Enter marks for 5 subjects (space separated):");
        String[] marks = sc.nextLine().split(" ");


        try (PrintWriter pw = new PrintWriter(new FileWriter("grades.txt", true))) {
```

```
            pw.println(name + ": " + String.join(", ", marks));
        }

        System.out.println("Grade saved successfully!");
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\File Handling Pro
grams>javac GradeTracker.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\File Handling Pro
grams>java GradeTracker
Enter student name:
Rohith
Enter marks for 5 subjects (space separated):
23
Grade saved successfully!
```



17.c)Configuration Generator

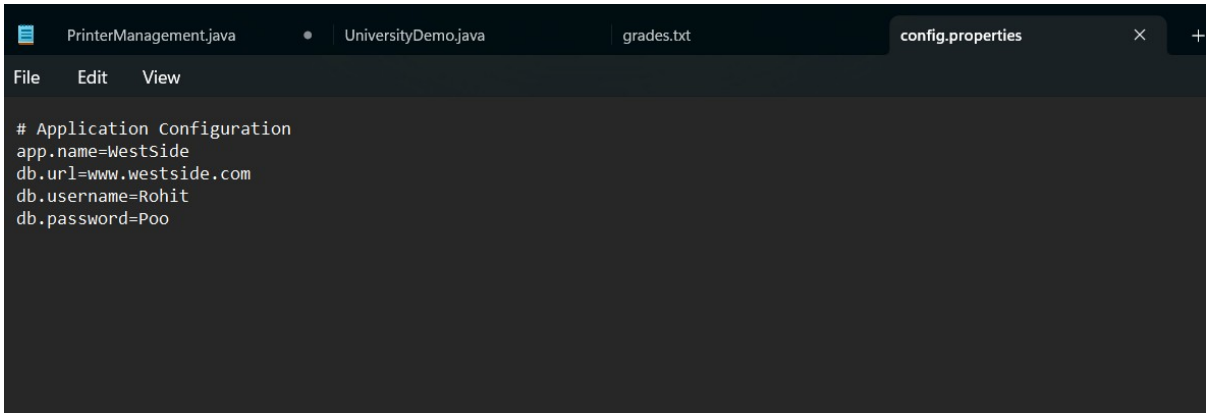
CODE:

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


public class ConfigGenerator {
    public static void main(String[] args) throws IOException {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter application name:");
        String appName = sc.nextLine();
```

```
        System.out.println("Enter database URL:");
        String dbUrl = sc.nextLine();

        System.out.println("Enter username:");
        String username = sc.nextLine();

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

        try (PrintWriter pw = new PrintWriter(new FileWriter("config.properties"))) {
            pw.println("# Application Configuration");
            pw.println("app.name=" + appName);
            pw.println("db.url=" + dbUrl);
            pw.println("db.username=" + username);
            pw.println("db.password=" + password);
        }

        System.out.println("Configuration file created successfully!");
    }
}
```

OUTPUT:

```
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\File Handling Pro
grams>javac ConfigGenerator.java

C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\File Handling Pro
grams>java ConfigGenerator
Enter application name:
WestSide
Enter database URL:
www.westside.com
Enter username:
Rohit
Enter password:
Poo
Configuration file created successfully!
```



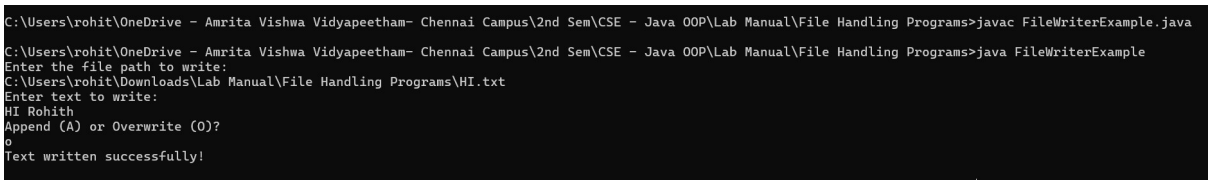
17.d)File Writer

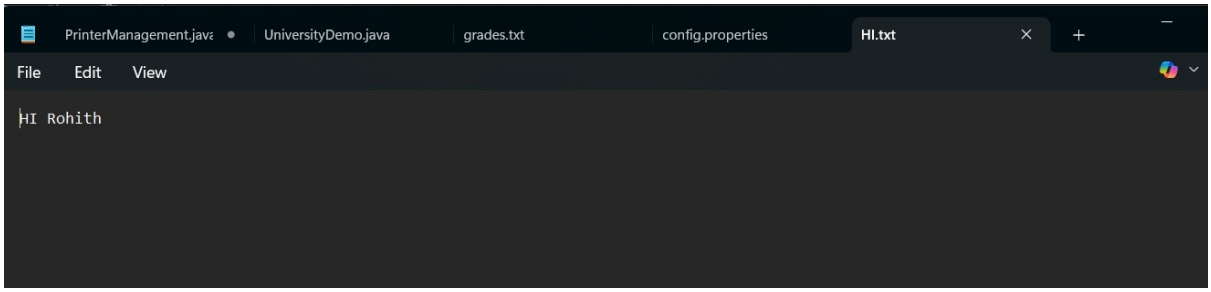
CODE:

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


public class FileWriterExample {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      System.out.println("Enter the file path to write:");
      String filePath = sc.nextLine();


      System.out.println("Enter text to write:");
      String text = sc.nextLine();


      System.out.println("Append (A) or Overwrite (O)?");
      char choice = sc.next().charAt(0);


      try (FileWriter fw = new FileWriter(filePath, choice == 'A' || choice == 'a')) {
         fw.write(text + "\n");
         System.out.println("Text written successfully!");
      } catch (IOException e) {
         System.out.println("Error: Unable to write to file!");
```

```
    }
  }
}
```

OUTPUT:


C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\File Handling Programs>javac FileWriterExample.java
C:\Users\rohit\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\2nd Sem\CSE - Java OOP\Lab Manual\File Handling Programs>java FileWriterExample
Enter the file path to write:
C:\Users\rohit\Downloads\Lab Manual\File Handling Programs\HI.txt
Enter text to write:
HI Rohith
Append (A) or Overwrite (O)?
o
Text written successfully!


PrinterManagement.java
UniversityDemo.java
grades.txt
config.properties
HI.txt
File
Edit
View
HI Rohith