DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B M S COLLEGE OF ENGINEERING (AUTONOMOUS COLLEGE UNDER VTU, BELGAUM)

BANGALORE – 560019 2023-24

LAB REPORT OF OBJECT-ORIENTED JAVA PROGRAMMING (23CS3PCOOJ)

LAB REPORT

BY

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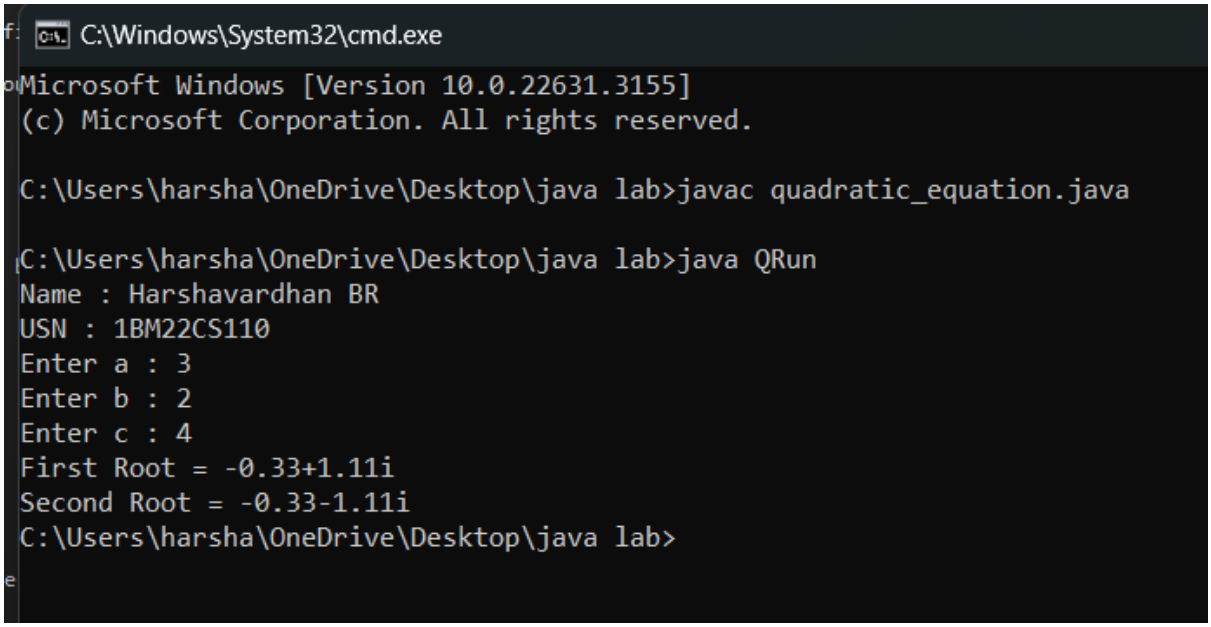
LAB PROGRAM 1:

Develop a Java program that prints all real solutions to the quadratic equation $ax^2+bx+c = 0$. Read in a, b, c and use the quadratic formula. If the discriminate b^2 -4ac is negative, display a message stating that there are no real solutions.

CODE:

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

class Quad {
    double a, b, c, firstroot, secondroot;

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

    void Eval() {
        double det = b * b - 4 * a * c;

    if (det > 0) {

                            firstroot = (-b + Math.sqrt(det)) / (2 * a);
                            secondroot = (-b - Math.sqrt(det)) / (2 * a);

                            System.out.format(
                                     "First Root = %.2f and Second Root = %.2f",
                                     firstroot, secondroot);
                    }

                    else if (det == 0) {

                             firstroot = secondroot = -b / (2 * a);

                             System.out.format(
                                     "First Root = Second Root = %.2f;",
                                     firstroot);
                    }

                    else {

                             double real = -b / (2 * a);

                             double img = Math.sqrt(-det) / (2 * a);

                             System.out.printf("First Root = %.2f+%.2fi",
                                                      real, img);
                             System.out.printf("\nSecond Root = %.2f-%.2fi",
                                                      real, img);
                    }
    }

}


class QRun {
         public static void main(String[] args) {
                  System.out.println("Name : Harshavardhan BR");
                  System.out.println("USN : 1BM22CS110       ");
                  double a, b, c;
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter a : ");
        a = sc.nextDouble();
        System.out.print("Enter b : ");
        b = sc.nextDouble();
        System.out.print("Enter c : ");
        c = sc.nextDouble();

        Quad q = new Quad(a, b, c);
        q.Eval();
         }
}
```

OUTPUT:


C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.
C:\Users\harsha\OneDrive\Desktop\java lab>javac quadratic_equation.java
C:\Users\harsha\OneDrive\Desktop\java lab>java QRun
Name : Harshavardhan BR
USN : 1BM22CS110
Enter a : 3
Enter b : 2
Enter c : 4
First Root = -0.33+1.11i
Second Root = -0.33-1.11i
C:\Users\harsha\OneDrive\Desktop\java lab>

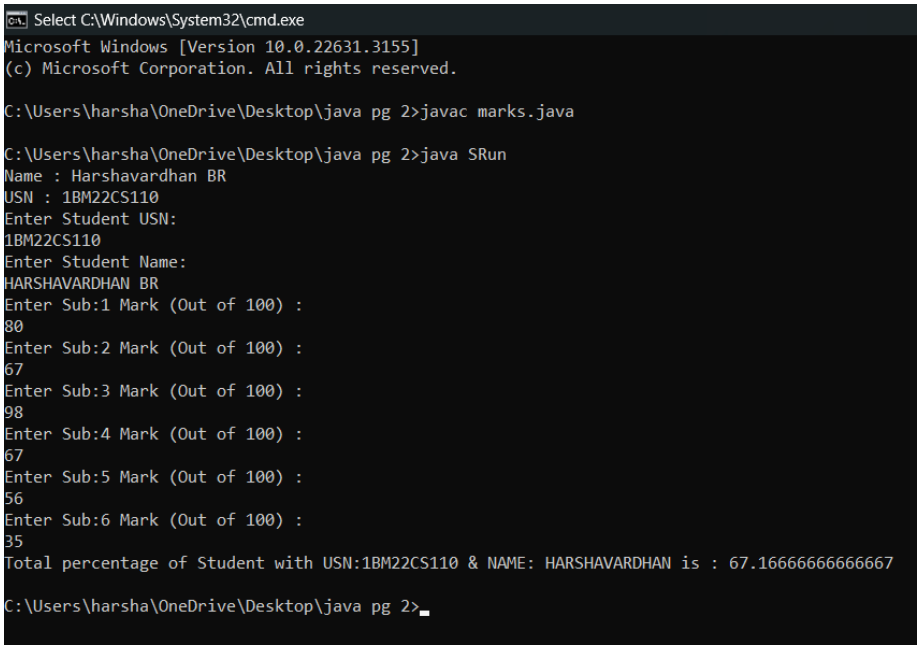
LAB PROGRAM 2:

Develop a Java program to create a class Student with members usn, name, an array of credits and an array of marks. Include methods to accept and display details and a method to calculate SGPA of a student.

CODE:

```
import java.util.Scanner;

class Student {
    String USN, Name;
    double mark, sum;

    Scanner sc = new Scanner(System.in);
    double marks[] = new double[6];
    Student(String USN, String Name) {
        this.USN = USN;
        this.Name = Name;
    }

    void getMarks() {
        for (int i = 0; i < 6; i++) {
            System.out.println("Enter Sub:" + (i + 1) + " Mark (Out of 100) : ");
            mark = sc.nextDouble();
            marks[i] = mark;
        }
    }
    double totalMarks_percent() {
        for (int i = 0; i < 6; i++) {
            sum = sum + marks[i];
        }
        return (sum/6);
    }
}


class SRun {
    public static void main(String[] args) {
        System.out.println("Name : Harshavardhan BR");
            System.out.println("USN : 1BM22CS110");
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter Student USN: ");
        String USN = sc.next();
        System.out.println("Enter Student Name: ");
        String name = sc.next();

        Student s1 = new Student(USN, name);
        s1.getMarks();
        double percentage = s1.totalMarks_percent();

        System.out.println("Total percentage of Student with USN:" + s1.USN + " & NAME: " + s1.Name +" is : " + percentage);

    }
}
```

OUTPUT:


Select C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.
C:\Users\harsha\OneDrive\Desktop\java pg 2>javac marks.java
C:\Users\harsha\OneDrive\Desktop\java pg 2>java SRun
Name : Harshavardhan BR
USN : 1BM22CS110
Enter Student USN:
1BM22CS110
Enter Student Name:
HARSHAVARDHAN BR
Enter Sub:1 Mark (Out of 100) :
80
Enter Sub:2 Mark (Out of 100) :
67
Enter Sub:3 Mark (Out of 100) :
98
Enter Sub:4 Mark (Out of 100) :
67
Enter Sub:5 Mark (Out of 100) :
56
Enter Sub:6 Mark (Out of 100) :
35
Total percentage of Student with USN:1BM22CS110 & NAME: HARSHAVARDHAN is : 67.16666666666667
C:\Users\harsha\OneDrive\Desktop\java pg 2>

LAB PROGRAM 3:

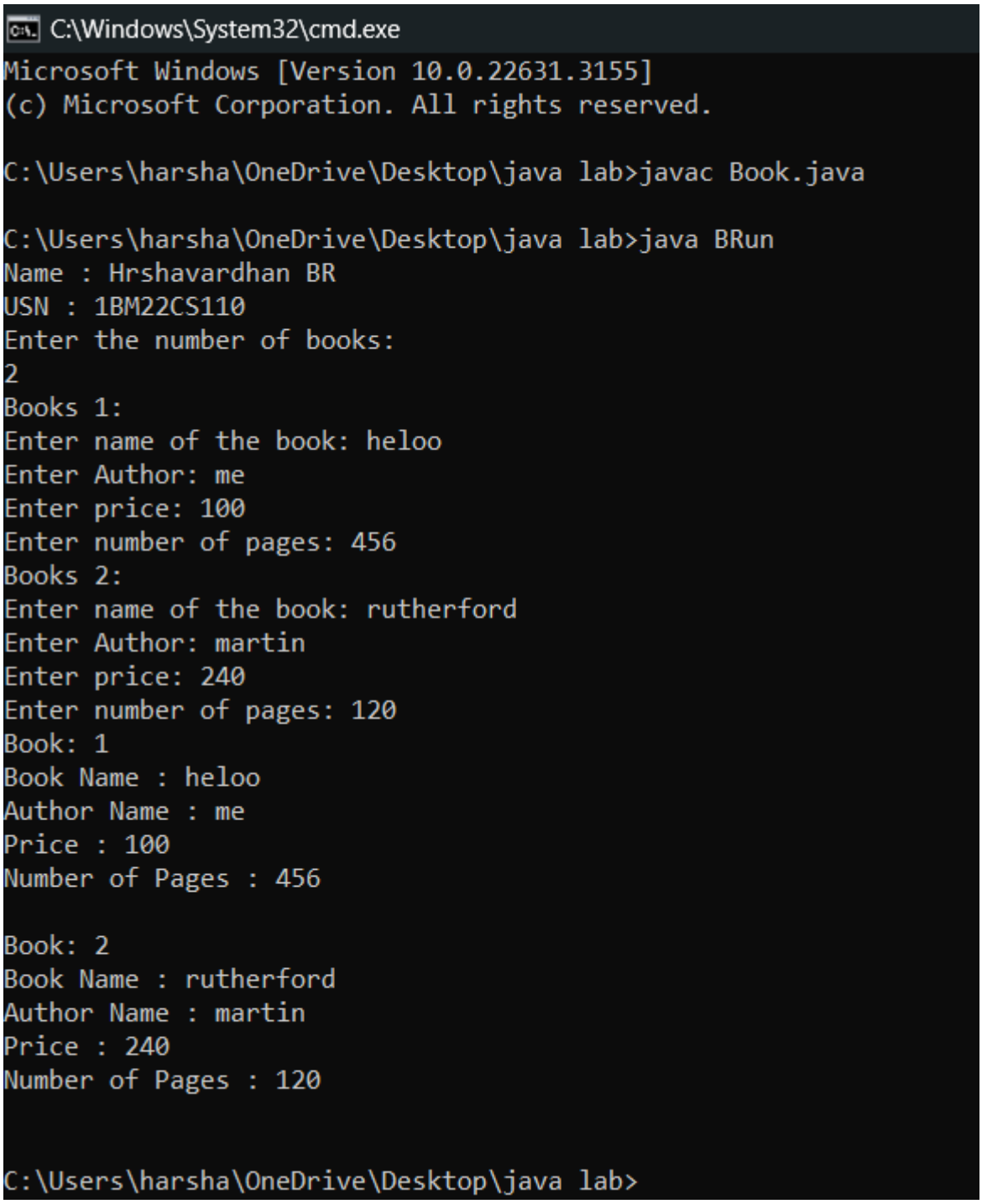
Create a class Book which contains four members: name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects. Include a toString( ) method that could display the complete details of the book. Develop a Java program to create n book objects.

CODE:

```
import java.util.Scanner;

class Books {
    String name;
    String author;
    int price;
    int numPages;

    Books() {};
    Books(String name, String author, int price, int numPages) {
        this.name = name;
        this.author = author;
        this.price = price;
        this.numPages = numPages;
    }

    public String toString() {
        String name, author, price, numPages;
        name = "Book Name : " + this.name + "\n";
        author = "Author Name : " + this.author + "\n";
        price = "Price : " + this.price + "\n";
        numPages = "Number of Pages : " + this.numPages + "\n";

        return name + author + price + numPages;
    }
}


class BRun{
    public static void main(String[] args) {
        System.out.println("Name : Hrshavardhan BR");
          System.out.println("USN : 1BM22CS110");
        Scanner sc = new Scanner(System.in);
        int n;
        String name, author;
        int price, numPages;

        System.out.println("Enter the number of books: ");
        n = sc.nextInt();
```

```
class BRun{
    public static void main(String[] args) {
        System.out.println("Name : Hrshavardhan BR");
          System.out.println("USN : 1BM22CS110");
        Scanner sc = new Scanner(System.in);
        int n;
        String name, author;
        int price, numPages;

        System.out.println("Enter the number of books: ");
        n = sc.nextInt();

        Books b[];
        b = new Books[n];

        for(int i = 0; i < n; i++) {
            System.out.println("Books " + (i + 1) + ": ");
            System.out.print("Enter name of the book: ");
            name = sc.next();
            System.out.print("Enter Author: ");
            author = sc.next();
            System.out.print("Enter price: ");
            price = sc.nextInt();
            sc.nextLine();
            System.out.print("Enter number of pages: ");
            numPages = sc.nextInt();
            sc.nextLine();
            b[i] = new Books(name, author, price, numPages);
        }

        for (int i = 0; i < n; i++) {
            System.out.println("Book: " + (i + 1) + "\n" + b[i
        }
    }
}
```

OUTPUT:


C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.
C:\Users\harsha\OneDrive\Desktop\java lab>javac Book.java
C:\Users\harsha\OneDrive\Desktop\java lab>java BRun
Name : Hrshavardhan BR
USN : 1BM22CS110
Enter the number of books:
2
Books 1:
Enter name of the book: heloo
Enter Author: me
Enter price: 100
Enter number of pages: 456
Books 2:
Enter name of the book: rutherford
Enter Author: martin
Enter price: 240
Enter number of pages: 120
Book: 1
Book Name : heloo
Author Name : me
Price : 100
Number of Pages : 456
Book: 2
Book Name : rutherford
Author Name : martin
Price : 240
Number of Pages : 120
C:\Users\harsha\OneDrive\Desktop\java lab>

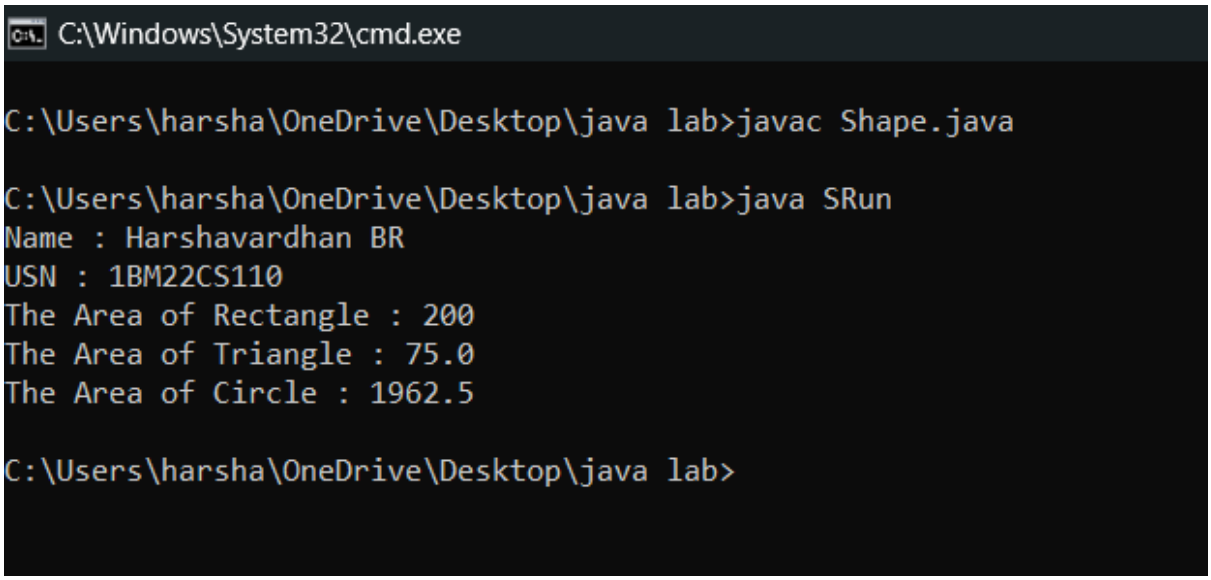
LAB PROGRAM 4:

Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea( ). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.

CODE:

```
abstract class Shape {
    public int side1, side2;
    abstract void printArea();
}


class Rectangle extends Shape {
    Rectangle(int length, int breadth) {
        this.side1 = length;
        this.side2 = breadth;
    }
    void printArea() {
        System.out.println("The Area of Rectangle : " + (side1 * side2));
    }
}

class Triangle extends Shape {
    Triangle(int base, int height) {
        this.side1 = base;
        this.side2 = height;
    }
    void printArea() {
        System.out.println("The Area of Triangle : " + (0.5 * side1 * side2));
    }
}

class Circle extends Shape {
    Circle(int rad) {
        this.side1 = this.side2 = rad;
    }
    void printArea() {
        System.out.println("The Area of Circle : " + (3.14 * side1 * side2));
    }
}


class SRun{
    public static void main(String[] args) {
        System.out.println("Name : Harshavardhan BR");
            System.out.println("USN : 1BM22CS110");
        Rectangle r = new Rectangle(20, 10);
        Triangle t = new Triangle(15, 10);
        Circle c = new Circle(25);

        r.printArea();
        t.printArea();
        c.printArea();
    }
}
```

OUTPUT:


C:\Windows\System32\cmd.exe
C:\Users\harsha\OneDrive\Desktop\java lab>javac Shape.java
C:\Users\harsha\OneDrive\Desktop\java lab>java SRun
Name : Harshavardhan BR
USN : 1BM22CS110
The Area of Rectangle : 200
The Area of Triangle : 75.0
The Area of Circle : 1962.5
C:\Users\harsha\OneDrive\Desktop\java lab>

LAB PROGRAM 5:

Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks:

a) Accept deposit from customer and update the balance.

b) Display the balance.

c) Compute and deposit interest

d) Permit withdrawal and update the balance

Check for the minimum balance, impose penalty if necessary and update the balance.

CODE:

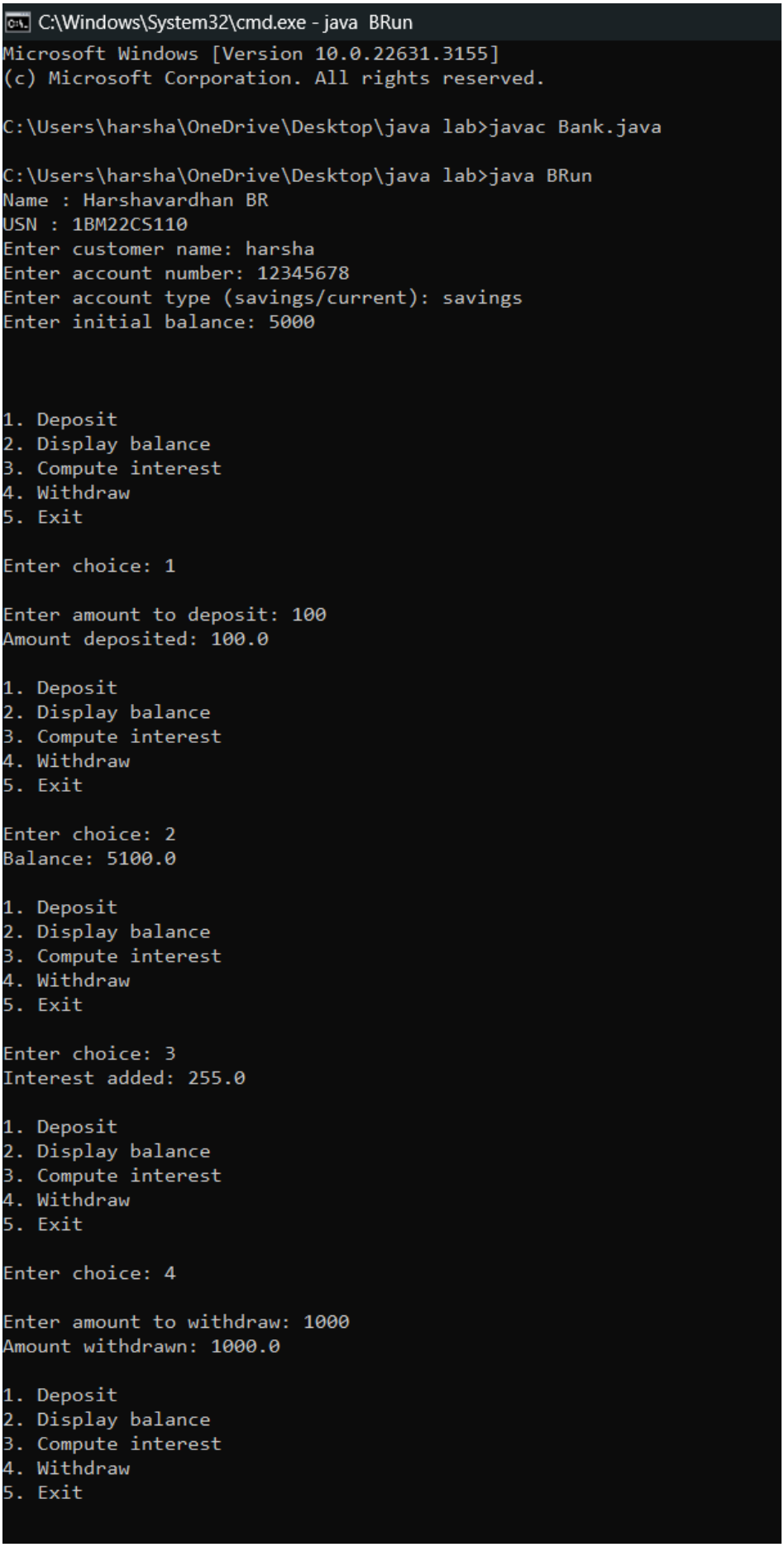
```
import java.util.Scanner;

abstract class Account {
    String customerName;
    int accountNumber;
    String accountType;
    double balance;

    Account(String customerName, int accountNumber, String accountType, double balance) {
        this.customerName = customerName;
        this.accountNumber = accountNumber;
        this.accountType = accountType;
        this.balance = balance;
    }

    abstract void deposit(double amount);

    abstract void displayBalance();

    abstract void computeInterest();

    abstract void withdraw(double amount);
}

class SavingsAccount extends Account {
    SavingsAccount(String customerName, int accountNumber, String accountType, double balance) {
        super(customerName, accountNumber, accountType, balance);
    }

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

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

    void computeInterest() {
        double interestRate = 0.05;
        double interest = balance * interestRate;
        balance += interest;
        System.out.println("Interest added: " + interest);
    }

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

```
class CurrentAccount extends Account {
    double minimumBalance = 1000;
    double serviceCharge = 50;

    CurrentAccount(String customerName, int accountNumber, String accountType, double balance)
        super(customerName, accountNumber, accountType, balance);
    }

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

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

    void computeInterest() {
        System.out.println("Current account does not earn interest");
    }

    void withdraw(double amount) {
        if (balance - amount < minimumBalance) {
            System.out.println("Insufficient balance");
            balance -= serviceCharge;
            System.out.println("Service charge: " + serviceCharge);
        } else {
            balance -= amount;
            System.out.println("Amount withdrawn: " + amount);
        }
    }
}

class BRun {
    public static void main(String[] args) {
        System.out.println("Name : Harshavardhan BR");
               System.out.println("USN : 1BM22CS110");
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter customer name: ");
        String customerName = sc.nextLine();

        System.out.print("Enter account number: ");
        int accountNumber = sc.nextInt();

        System.out.print("Enter account type (savings/current): ");
        String accountType = sc.next();

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

        System.out.println("\n");

        Account account;
        if (accountType.equals("savings")) {
            account = new SavingsAccount(customerName, accountNumber, accountType, balance);
        } else {
            account = new CurrentAccount(customerName, accountNumber, accountType, balance);
        }
```

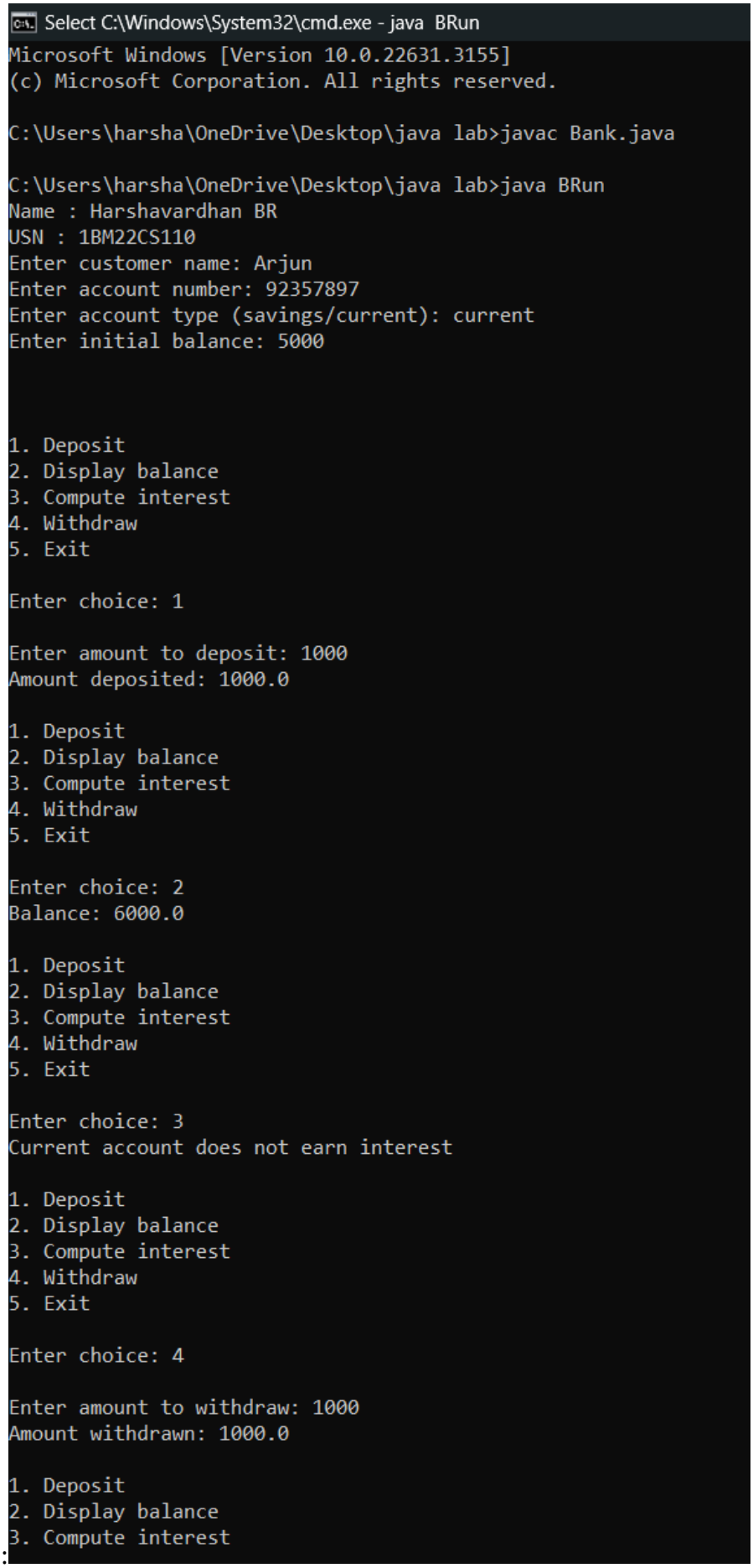
```
        while (true) {
            System.out.println("\n1. Deposit");
            System.out.println("2. Display balance");
            System.out.println("3. Compute interest");
            System.out.println("4. Withdraw");
            System.out.println("5. Exit\n");

            System.out.print("Enter choice: ");
            int choice = sc.nextInt();

            switch (choice) {
                case 1:
                    System.out.print("\nEnter amount to deposit: ");
                    double amount = sc.nextDouble();
                    account.deposit(amount);
                    break;
                case 2:
                    account.displayBalance();
                    break;
                case 3:
                    account.computeInterest();
                    break;
                case 4:
                    System.out.print("\nEnter amount to withdraw: ");
                    amount = sc.nextDouble();
                    account.withdraw(amount);
                    break;
                case 5:
                    sc.close();
                    System.exit(0);
                    break;
                default:
                    System.out.println("\nInvalid choice");
            }
        }
    }
}
```

Ln 29, Col 1

OUTPUT1:


C:\Windows\System32\cmd.exe - java BRun
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.
C:\Users\harsha\OneDrive\Desktop\java lab>javac Bank.java
C:\Users\harsha\OneDrive\Desktop\java lab>java BRun
Name : Harshavardhan BR
USN : 1BM22CS110
Enter customer name: harsha
Enter account number: 12345678
Enter account type (savings/current): savings
Enter initial balance: 5000
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 1
Enter amount to deposit: 100
Amount deposited: 100.0
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 2
Balance: 5100.0
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 3
Interest added: 255.0
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 4
Enter amount to withdraw: 1000
Amount withdrawn: 1000.0
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit

OUTPUT2:

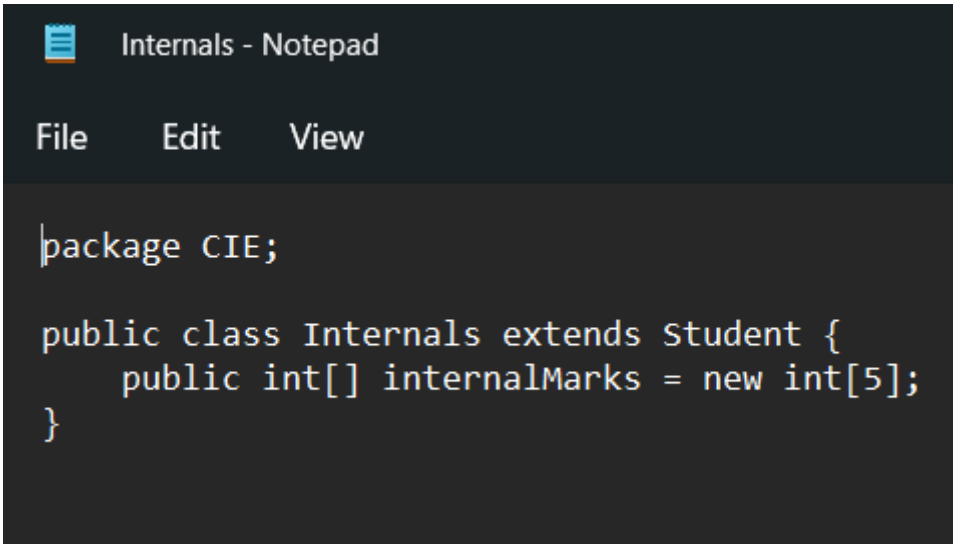

Select C:\Windows\System32\cmd.exe - java BRun
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.
C:\Users\harsha\OneDrive\Desktop\java lab>javac Bank.java
C:\Users\harsha\OneDrive\Desktop\java lab>java BRun
Name : Harshavardhan BR
USN : 1BM22CS110
Enter customer name: Arjun
Enter account number: 92357897
Enter account type (savings/current): current
Enter initial balance: 5000
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 1
Enter amount to deposit: 1000
Amount deposited: 1000.0
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 2
Balance: 6000.0
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 3
Current account does not earn interest
1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
Enter choice: 4
Enter amount to withdraw: 1000
Amount withdrawn: 1000.0
1. Deposit
2. Display balance
3. Compute interest

LAB PROGRAM 6:

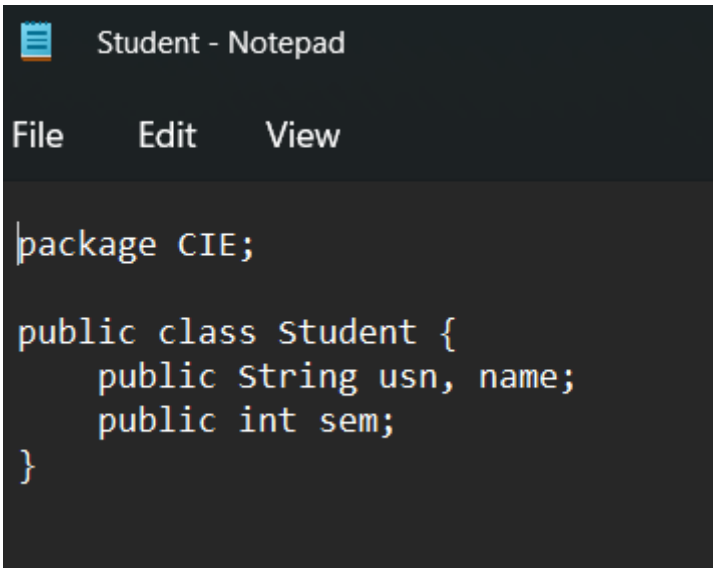
Create a package CIE which has two classes- Student and Internals. The class Personal has members like usn, name, sem. The class internals has an array that stores the internal marks scored in five courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Student. This class has an array that stores the SEE marks scored in five courses of the current semester of the student. Import the two packages in a file that declares the final marks of n students in all five courses.

CODES:

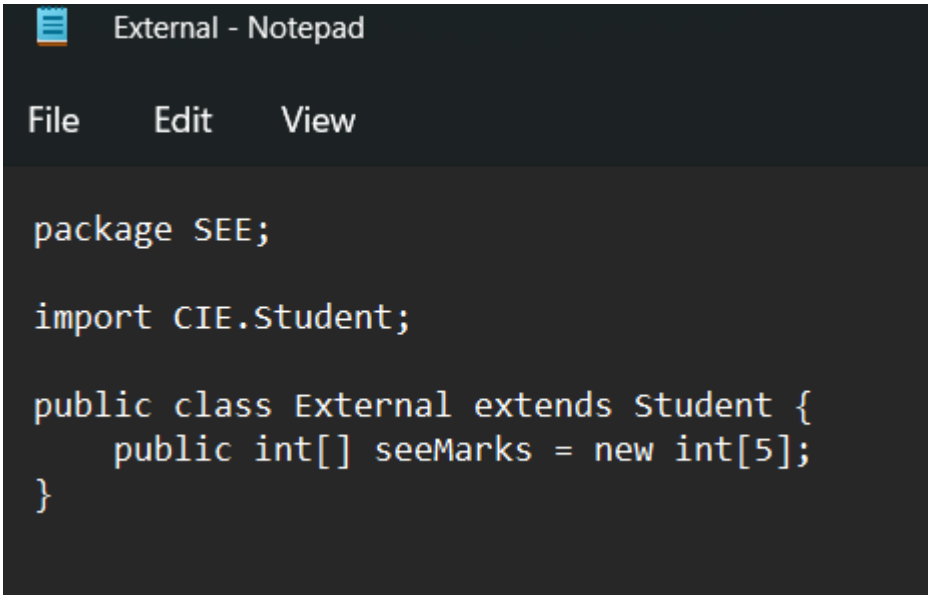
CODE1:



CODE2:



CODE3:


External - Notepad
File
Edit
View
package SEE;
import CIE.Student;
public class External extends Student {
public int[] seeMarks = new int[5];
}

CODE4 :

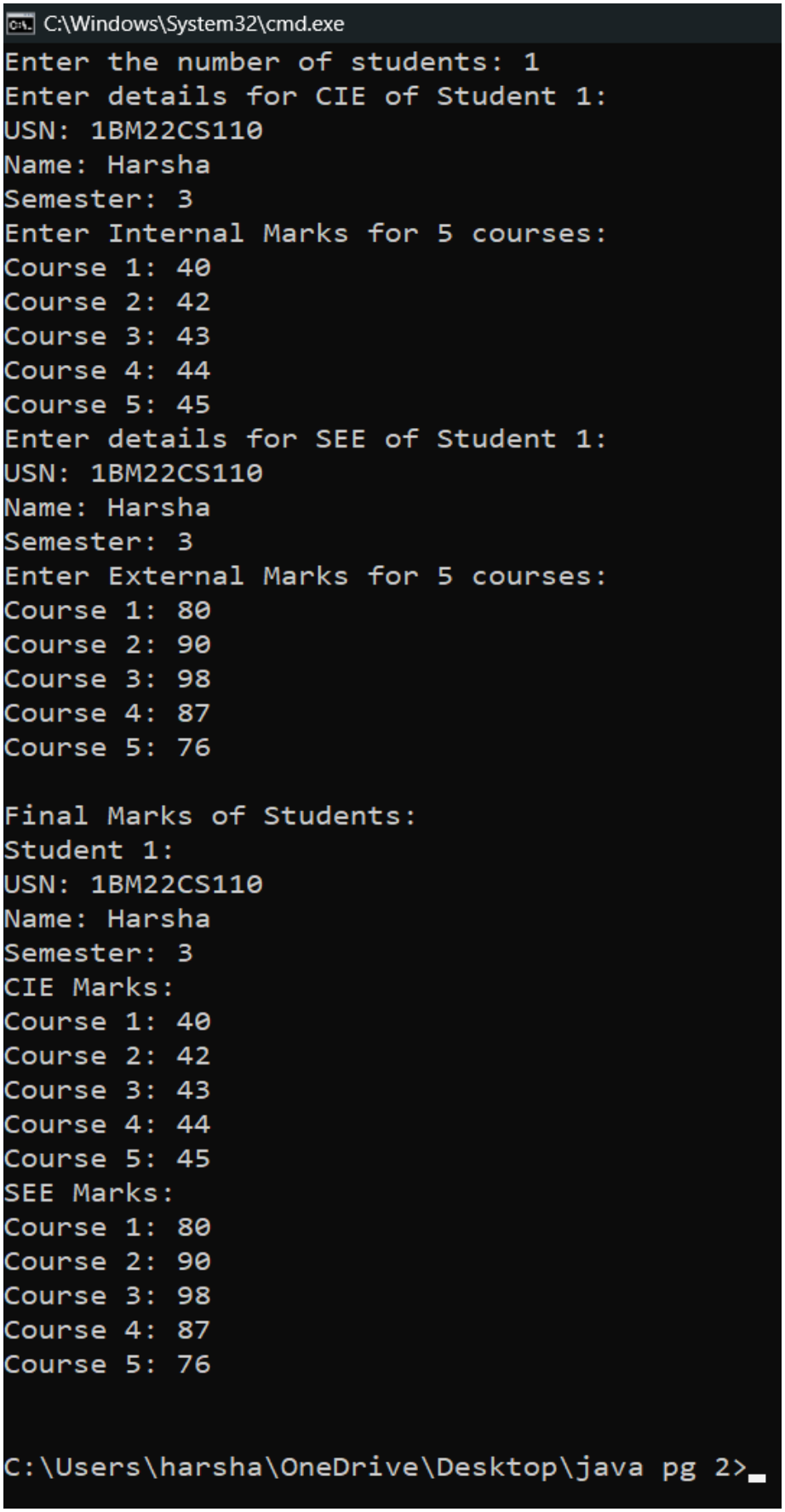
Main - Notepad

File Edit View

```
import CIE.Internals;
import SEE.External;
import java.util.Scanner;

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

        System.out.println("Name :Harshavardhan BR");
            System.out.println("USN : 1BM22CS110");

        Scanner scanner = new Scanner(System.in);

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

        Internals[] cieStudents = new Internals[n];
        External[] seeStudents = new External[n];
        for (int i = 0; i < n; i++) {
            cieStudents[i] = new Internals();
            System.out.println("Enter details for CIE of Student " + (i + 1) + ":");
            System.out.print("USN: ");
            cieStudents[i].usn = scanner.next();
            System.out.print("Name: ");
            cieStudents[i].name = scanner.next();
            System.out.print("Semester: ");
            cieStudents[i].sem = scanner.nextInt();
            scanner.nextLine();

            System.out.println("Enter Internal Marks for 5 courses:");
            for (int j = 0; j < 5; j++) {
                System.out.print("Course " + (j + 1) + ": ");
                cieStudents[i].internalMarks[j] = scanner.nextInt();
            }
        }

        // Input SEE marks
        for (int i = 0; i < n; i++) {
            seeStudents[i] = new External();
            System.out.println("Enter details for SEE of Student " + (i + 1) + ":");
            System.out.print("USN: ");
            seeStudents[i].usn = scanner.next();
            System.out.print("Name: ");
            seeStudents[i].name = scanner.next();
            System.out.print("Semester: ");
            seeStudents[i].sem = scanner.nextInt();

            System.out.println("Enter External Marks for 5 courses:");
            for (int j = 0; j < 5; j++) {
                System.out.print("Course " + (j + 1) + ": ");
                seeStudents[i].seeMarks[j] = scanner.nextInt();
            }
        }
```

```
        // Display final marks
        System.out.println("\nFinal Marks of Students:");
        for (int i = 0; i < n; i++) {
            System.out.println("Student " + (i + 1) + ":");
            System.out.println("USN: " + cieStudents[i].usn);
            System.out.println("Name: " + cieStudents[i].name);
            System.out.println("Semester: " + cieStudents[i].sem);

            System.out.println("CIE Marks:");
            for (int j = 0; j < 5; j++) {
                System.out.println("Course " + (j + 1) + ": " + cieStudents[i].internalMarks[j]);
            }

            System.out.println("SEE Marks:");
            for (int j = 0; j < 5; j++) {
                System.out.println("Course " + (j + 1) + ": " + seeStudents[i].seeMarks[j]);
            }

            System.out.println();
        }
        scanner.close();
    }
}
```

OUTPUT:


C:\Windows\System32\cmd.exe
Enter the number of students: 1
Enter details for CIE of Student 1:
USN: 1BM22CS110
Name: Harsha
Semester: 3
Enter Internal Marks for 5 courses:
Course 1: 40
Course 2: 42
Course 3: 43
Course 4: 44
Course 5: 45
Enter details for SEE of Student 1:
USN: 1BM22CS110
Name: Harsha
Semester: 3
Enter External Marks for 5 courses:
Course 1: 80
Course 2: 90
Course 3: 98
Course 4: 87
Course 5: 76
Final Marks of Students:
Student 1:
USN: 1BM22CS110
Name: Harsha
Semester: 3
CIE Marks:
Course 1: 40
Course 2: 42
Course 3: 43
Course 4: 44
Course 5: 45
SEE Marks:
Course 1: 80
Course 2: 90
Course 3: 98
Course 4: 87
Course 5: 76
C:\Users\harsha\OneDrive\Desktop\java pg 2>

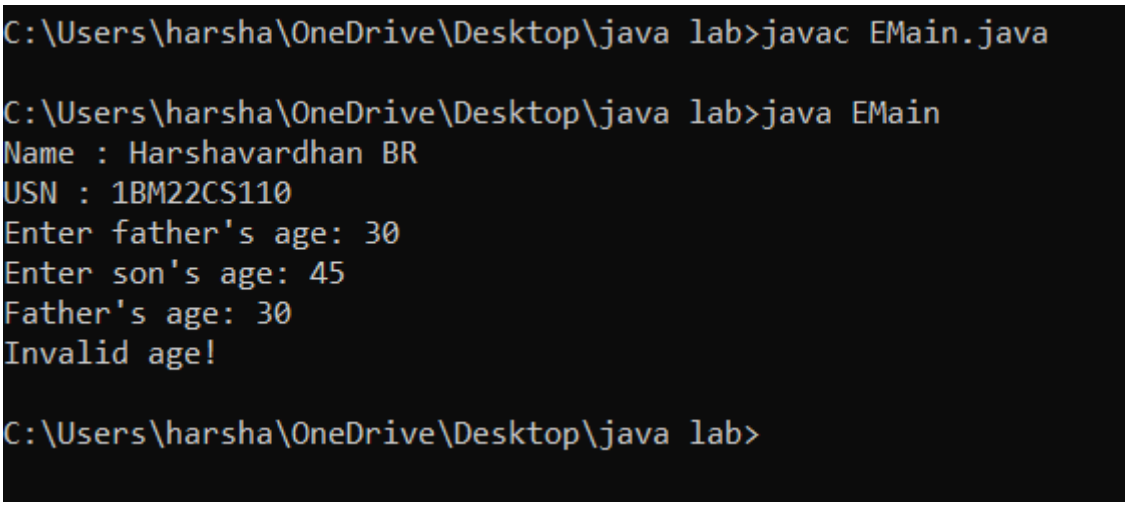
LAB PROGRAM 7:

Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called “Father” and derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge( ) when the input age < 0. In Son class, implement a constructor that cases both father and son’s age and throws an exception if son’s age is >= father’s age.

CODE:

```java
import java.util.Scanner;

class WrongAge extends Exception {
    public WrongAge() {
        super("Invalid age!");
    }
}

class Father {
    private int age;

    public Father(int age) throws WrongAge {
        if (age < 0) {
            throw new WrongAge();
        }
        this.age = age;
    }

    public int getAge() {
        return age;
    }
}

class Son extends Father {
    private int sonAge;

    public Son(int fatherAge, int sonAge) throws WrongAge {
        super(fatherAge);

        if (sonAge >= fatherAge) {
            throw new WrongAge();
        }
        this.sonAge = sonAge;
    }

    public int getSonAge() {
        return sonAge;
    }
}

public class EMain{
    public static void main(String[] args) {
        System.out.println("Name : Mithun G");
                System.out.println("USN : 1BM22CS096");
        Scanner scanner = new Scanner(System.in);

        try {
            System.out.print("Enter father's age: ");
            int fatherAge = scanner.nextInt();

            System.out.print("Enter son's age: ");
            int sonAge = scanner.nextInt();

            Father father = new Father(fatherAge);
            System.out.println("Father's age: " + father.getAge());

            Son son = new Son(fatherAge, sonAge);
            System.out.println("Son's age: " + son.getSonAge());
        } catch (WrongAge e) {
            System.out.println(e.getMessage());
        } catch (Exception e) {
            System.out.println("Invalid input.");
        } finally {
            scanner.close();
        }
    }
}
```

OUTPUT:


C:\Users\harsha\OneDrive\Desktop\java lab>javac EMain.java
C:\Users\harsha\OneDrive\Desktop\java lab>java EMain
Name : Harshavardhan BR
USN : 1BM22CS110
Enter father's age: 30
Enter son's age: 45
Father's age: 30
Invalid age!
C:\Users\harsha\OneDrive\Desktop\java lab>

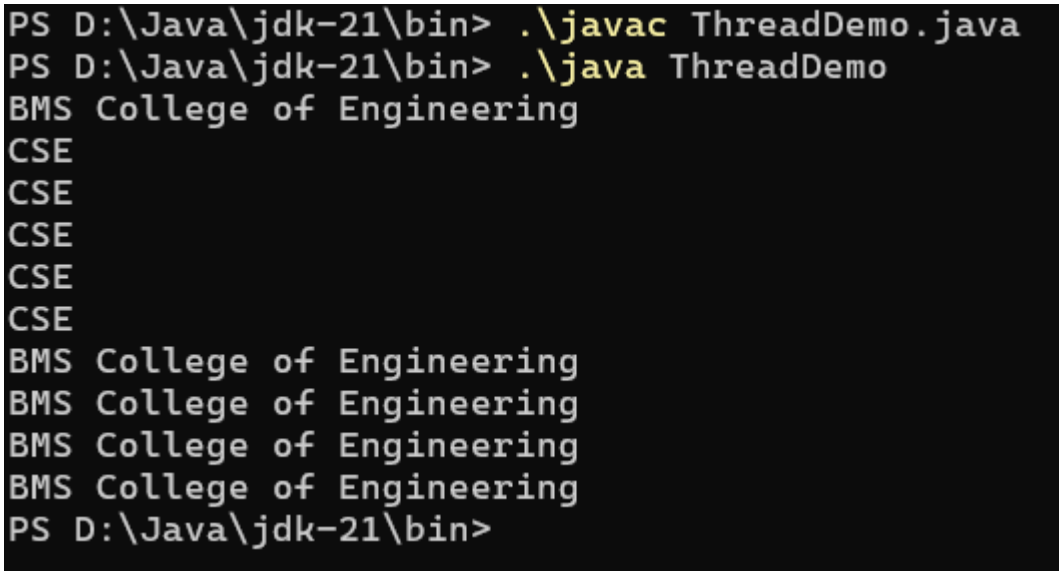
LAB PROGRAM 8:

Write a program which creates two threads, one thread displaying “BMS College of Engineering” once every ten seconds and another displaying “CSE” once every two seconds.

CODE:

```
class DisplayThread extends Thread {
    private String message;
    private int interval;

    public DisplayThread(String message, int interval) {
        this.message = message;
        this.interval = interval;
    }

    public void run() {
        try {
            for(int i = 0; i < 5; i++) {
                System.out.println(message);
                Thread.sleep(interval * 1000);
            }
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
    }
}

class ThreadDemo {
    public static void main(String[] args) {
        DisplayThread thread1 = new DisplayThread("BMS College of Engineering", 10);
        thread1.start();

        DisplayThread thread2 = new DisplayThread("CSE", 2);
        thread2.start();
    }
}
```

OUTPUT:


PS D:\Java\jdk-21\bin> .\javac ThreadDemo.java
PS D:\Java\jdk-21\bin> .\java ThreadDemo
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
PS D:\Java\jdk-21\bin>