B.M.S. College of Engineering

(Autonomous College Affiliated to Visvesvaraya Technological University, Belgaum) Bull Temple
Road, Basavanagudi, Bengaluru – 560019

Department of

Computer Science & Engineering (CSE)

Lab Programs Report

Course Title: Object Oriented Java Programming Course Code: 23CS3PCOOJ

BY

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CERTIFICATE

This is to certify that the report on “**Java Lab Programs**” has been carried out by **Gayatri Vikas Yatagiri** bearing USN **1BM22CS102** as a part of AAT for the course **Object Oriented Java Programming** with course code **23CS3PCOOJ**, Computer Science and Engineering from Visvesvaraya Technological University, Belgaum during the year 2023–24. It is certified that all corrections/suggestions indicated for Internal Assessments have been incorporated in the report.

Gayatri Vikas Yatagiri 1BM22CS102	**Shravya AR** Assistant Professor Department of CSE BMSCE, Bengaluru-19

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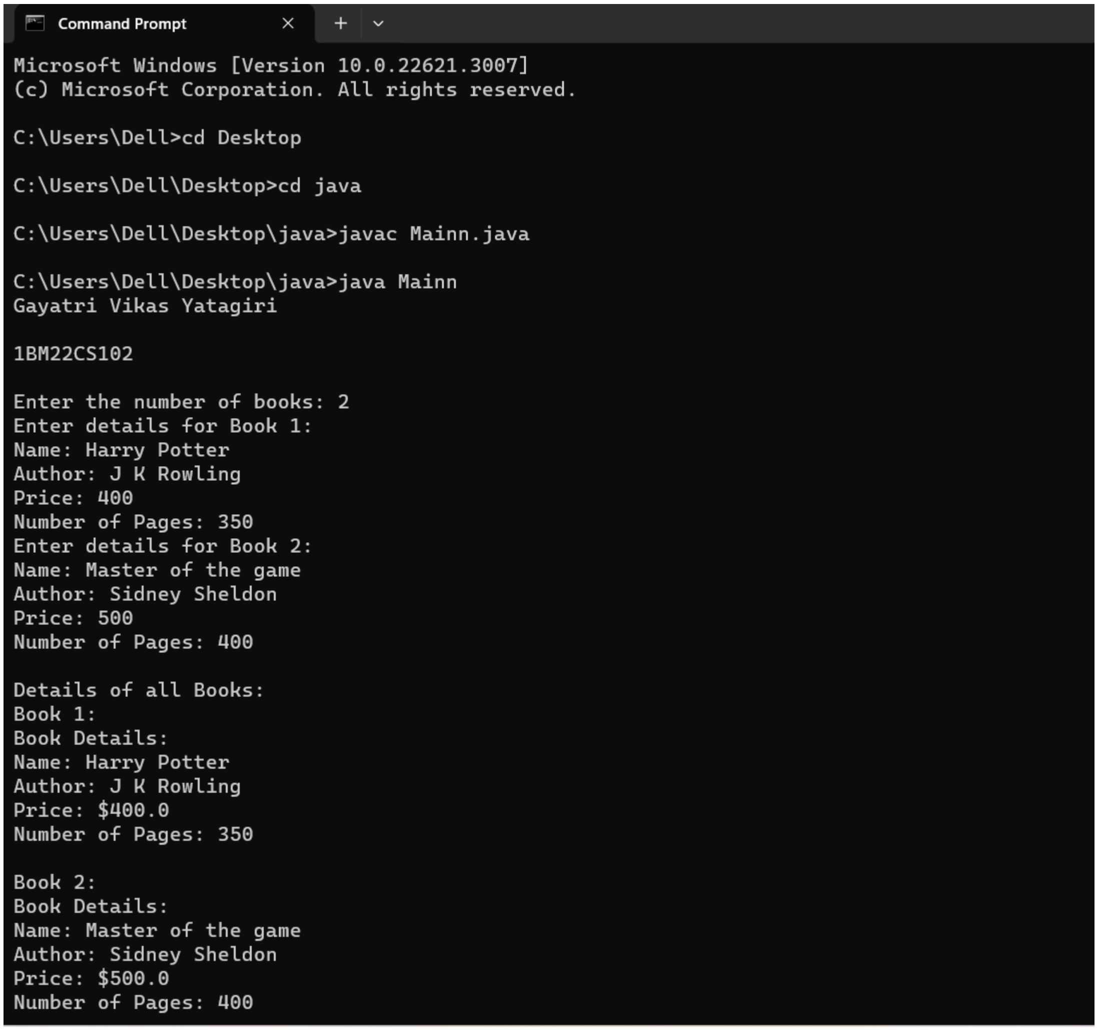
1) Create a class Book that contains 4 members name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects. Include a toString() method that could display the complete details of the book. Develop a java program to create n book objects

JAVA CODE

```
import java.util.Scanner;

public class Mainn {
    public static void main(String[] args) {
        System.out.println("Gayatri Vikas Yatagiri\n");
        System.out.println("1BM22CS102\n");

        Scanner scanner = new Scanner(System.in);

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


        Book[] books = new Book[n];


        for (int i = 0; i < n; i++) {
            System.out.println("Enter details for Book " + (i + 1) + ":");
            scanner.nextLine(); // Consume newline
            System.out.print("Name: ");
            String name = scanner.nextLine();
            System.out.print("Author: ");
            String author = scanner.nextLine();
            System.out.print("Price: ");
            double price = scanner.nextDouble();
            System.out.print("Number of Pages: ");
            int numPages = scanner.nextInt();


            books[i] = new Book(name, author, price, numPages);
        }
        System.out.println("\nDetails of all Books:");
        for (int i = 0; i < n; i++) {
            System.out.println("Book " + (i + 1) + ":");
            System.out.println(books[i]);
            System.out.println();
        }

        scanner.close();
    }
}

public class Book {
    private String name;
    private String author;
    private double price;
    private int numPages;

    // Constructor to set the values for the members
    public Book(String name, String author, double price, int numPages) {
        this.name = name;
        this.author = author;
        this.price = price;
        this.numPages = numPages;
    }

    // Methods to set and get the details of the objects
    public void setName(String name) {
        this.name = name;
    }

    public String getName() {
        return name;
    }

    public void setAuthor(String author) {
        this.author = author;
    }

    public String getAuthor() {
        return author;
    }

    public void setPrice(double price) {
        this.price = price;
    }

    public double getPrice() {
        return price;
    }

    public void setNumPages(int numPages) {
        this.numPages = numPages;
    }

    public int getNumPages() {
        return numPages;
    }


    public String toString() {
        return "Book Details: \nName: " + name + "\nAuthor: " + author + "\nPrice: $" + price +
"\nNumber of Pages: " + numPages;
    }
}
```

OUTPUT



```
Microsoft Windows [Version 10.0.22621.3007]
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C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac Mainn.java

C:\Users\Dell\Desktop\java>java Mainn
Gayatri Vikas Yatagiri

1BM22CS102

Enter the number of books: 2
Enter details for Book 1:
Name: Harry Potter
Author: J K Rowling
Price: 400
Number of Pages: 350
Enter details for Book 2:
Name: Master of the game
Author: Sidney Sheldon
Price: 500
Number of Pages: 400

Details of all Books:
Book 1:
Book Details:
Name: Harry Potter
Author: J K Rowling
Price: $400.0
Number of Pages: 350

Book 2:
Book Details:
Name: Master of the game
Author: Sidney Sheldon
Price: $500.0
Number of Pages: 400
```
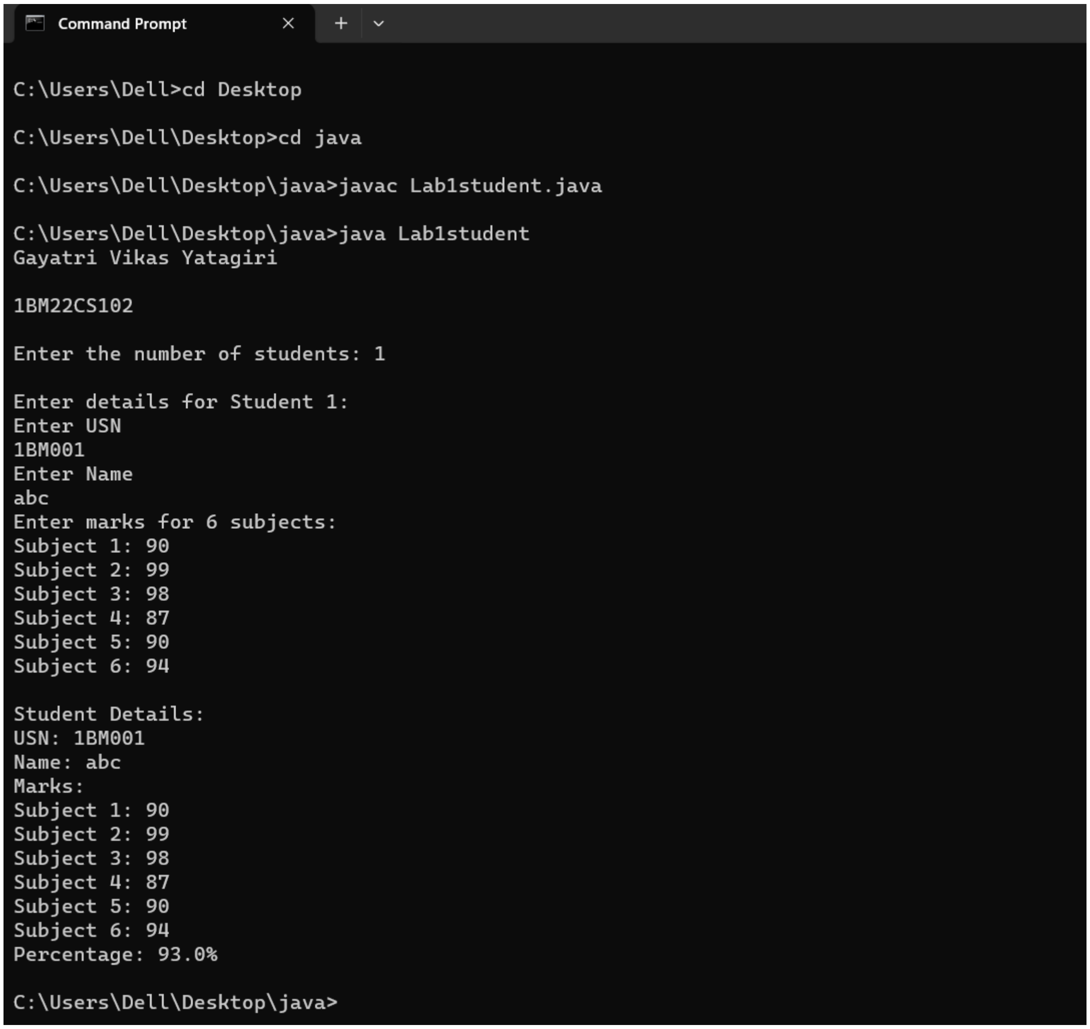

2) Write a java program to create a class Student with members USN, name, marks(6 subjects). Include methods to accept student details and marks. Also include a method to calculate the percentage and display appropriate details.

<u>JAVA CODE</u>

```
import java.util.Scanner;
class Student{
  String usn;
  String name;
  int marks[]= new int[6];

  void Details()
  {
Scanner s=new Scanner(System.in);
System.out.println("Enter USN");
usn=s.next();
System.out.println("Enter Name");
```

```
name=s.next();
System.out.println("Enter marks for 6 subjects:");
for(int i = 0; i < 6; i++)
{
System.out.print("Subject " + (i + 1) + ": ");
marks[i]=s.nextInt();
}
  }
  double percentage()
  {
int total=0;
for(int i=0;i<6;i++)
{
total+=marks[i];
}
double p=total/6;
return p;
  }
  void display()
  {
System.out.println("\nStudent Details:");
      System.out.println("USN: " + usn);
      System.out.println("Name: " + name);
      System.out.println("Marks:");
      for(int i = 0; i < 6; i++)
      {
System.out.println("Subject " + (i + 1) + ": " + marks[i]);
      }
      System.out.println("Percentage: "+ percentage() + "%");
  }
}
class Lab1student
{
public static void main(String args[]){
System.out.println("Gayatri Vikas Yatagiri\n");
System.out.println("1BM22CS102\n");

Scanner s = new Scanner(System.in);
System.out.print("Enter the number of students: ");
int n = s.nextInt();
Student[] students = new Student[n];
for (int i = 0; i < n; i++)
{
students[i] = new Student();
System.out.println("\nEnter details for Student " + (i + 1) + ":");
students[i].Details();
}
for (Student student : students)
{
student.display();
}
}
}
```

OUTPUT



```
C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac Lab1student.java

C:\Users\Dell\Desktop\java>java Lab1student
Gayatri Vikas Yatagiri

1BM22CS102

Enter the number of students: 1

Enter details for Student 1:
Enter USN
1BM001
Enter Name
abc
Enter marks for 6 subjects:
Subject 1: 90
Subject 2: 99
Subject 3: 98
Subject 4: 87
Subject 5: 90
Subject 6: 94

Student Details:
USN: 1BM001
Name: abc
Marks:
Subject 1: 90
Subject 2: 99
Subject 3: 98
Subject 4: 87
Subject 5: 90
Subject 6: 94
Percentage: 93.0%

C:\Users\Dell\Desktop\java>
```

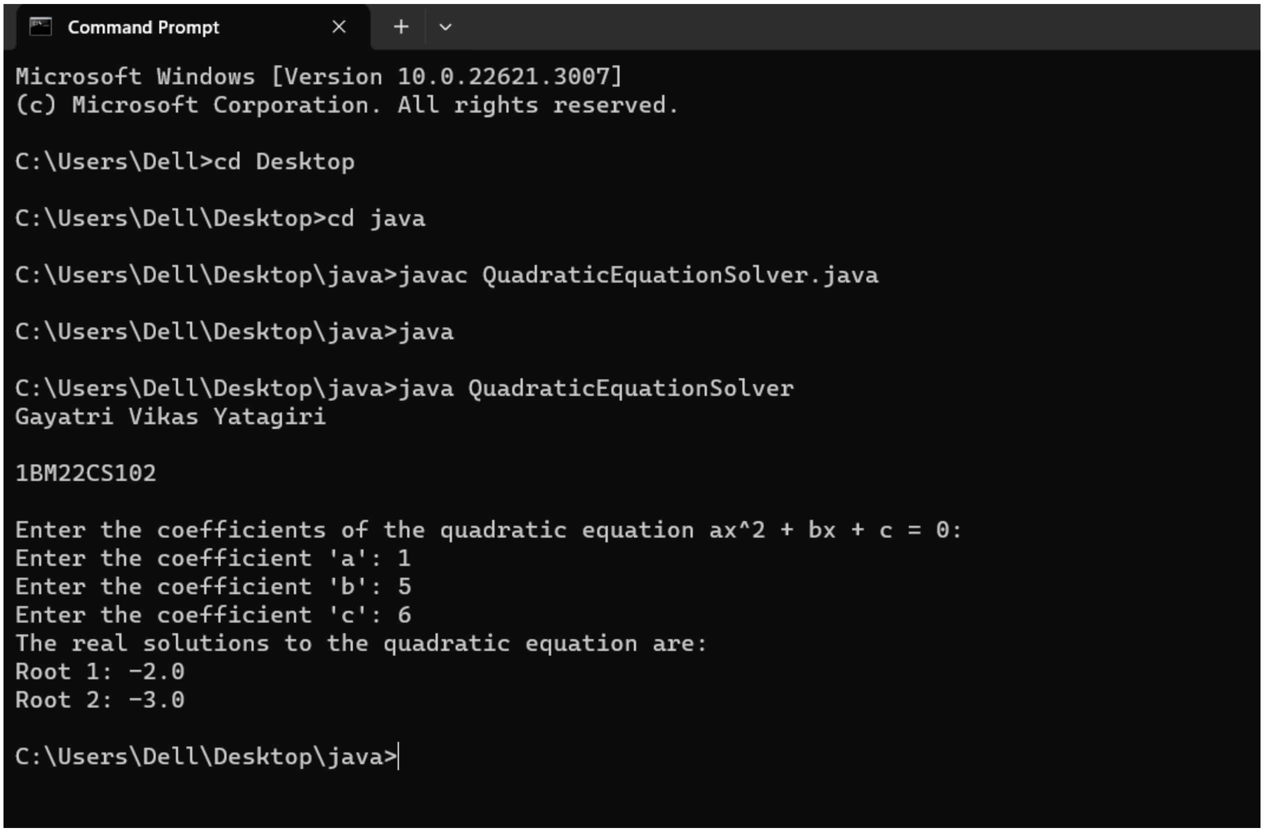
3) Develop a Java program that prints all real solutions to the quadratic equation

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.

JAVA CODE

```
import java.util.Scanner;

public class QuadraticEquationSolver {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Gayatri Vikas Yatagiri\n");
        System.out.println("1BM22CS102\n");


        System.out.println("Enter the coefficients of the quadratic equation ax^2 + bx + c = 0:");

        System.out.print("Enter the coefficient 'a': ");
        double a = scanner.nextDouble();

        System.out.print("Enter the coefficient 'b': ");
        double b = scanner.nextDouble();

        System.out.print("Enter the coefficient 'c': ");
        double c = scanner.nextDouble();


        double discriminant = b * b - 4 * a * c;


        if (discriminant < 0) {
            System.out.println("The quadratic equation has no real solutions.");
        } else {
            // Calculate real solutions
            double root1 = (-b + Math.sqrt(discriminant)) / (2 * a);
            double root2 = (-b - Math.sqrt(discriminant)) / (2 * a);

            System.out.println("The real solutions to the quadratic equation are:");
            System.out.println("Root 1: " + root1);
            System.out.println("Root 2: " + root2);
        }

        scanner.close();
    }
}
```

OUTPUT



```
Microsoft Windows [Version 10.0.22621.3007]
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C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac QuadraticEquationSolver.java

C:\Users\Dell\Desktop\java>java

C:\Users\Dell\Desktop\java>java QuadraticEquationSolver
Gayatri Vikas Yatagiri

1BM22CS102

Enter the coefficients of the quadratic equation ax^2 + bx + c = 0:
Enter the coefficient 'a': 1
Enter the coefficient 'b': 5
Enter the coefficient 'c': 6
The real solutions to the quadratic equation are:
Root 1: -2.0
Root 2: -3.0

C:\Users\Dell\Desktop\java>
```

4) 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

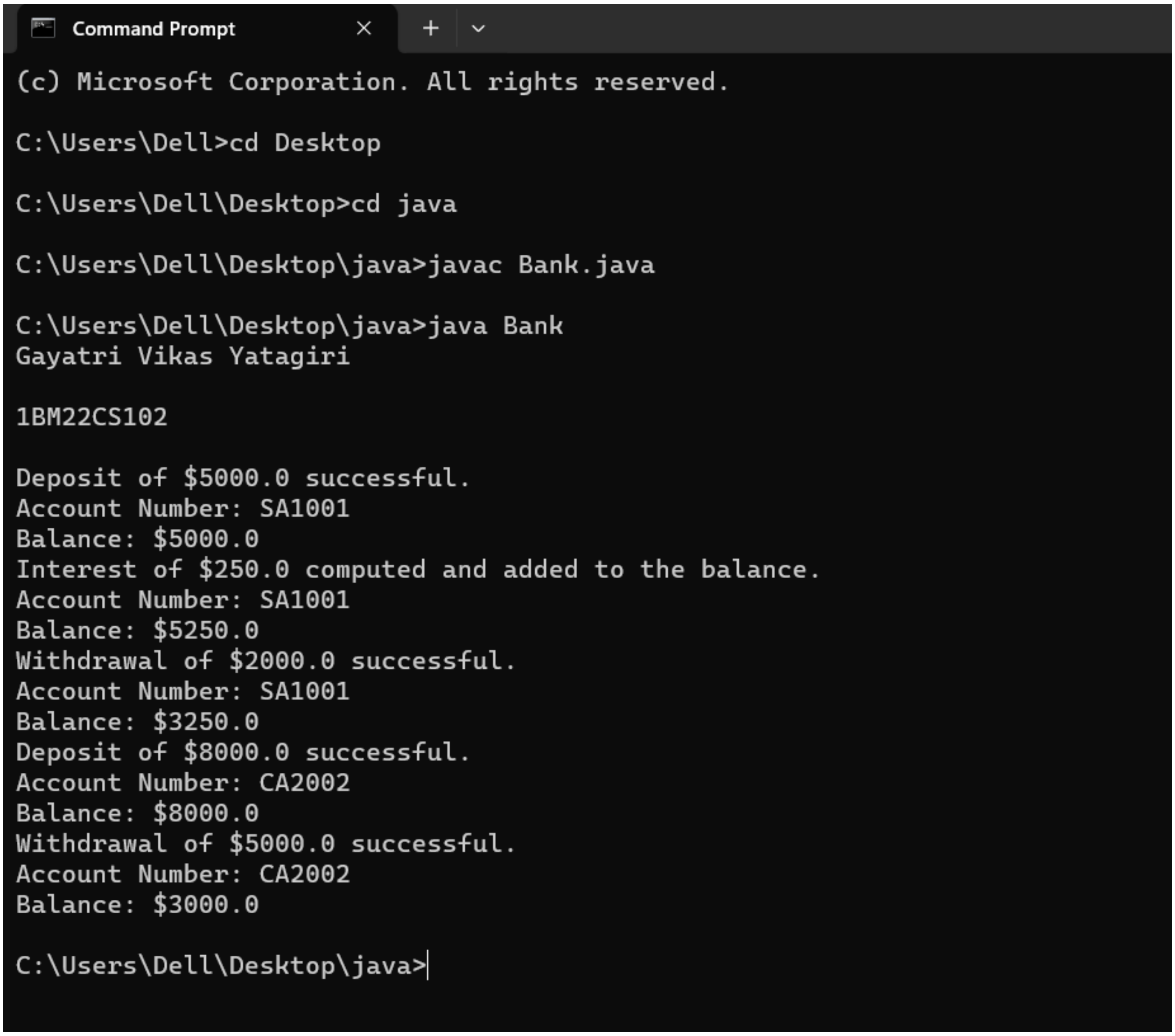
d) Permit withdrawal and update the balance

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

JAVA CODE

```
class Bank {
    public static void main(String[] args) {
      System.out.println("Gayatri Vikas Yatagiri\n");
      System.out.println("1BM22CS102\n");

        SavingsAccount savingsAccount = new SavingsAccount("John Doe", "SA1001");
        CurrentAccount currentAccount = new CurrentAccount("Jane Smith", "CA2002");
savingsAccount.deposit(5000);
        savingsAccount.displayBalance();
        savingsAccount.computeInterest();
        savingsAccount.displayBalance();
        savingsAccount.withdraw(2000);
        savingsAccount.displayBalance();
        // Perform operations on current account
        currentAccount.deposit(8000);
        currentAccount.displayBalance();
        currentAccount.withdraw(5000);
        currentAccount.displayBalance();
    }
}

class Account {
    protected String customerName;
    protected String accountNumber;
    protected double balance;

    public Account(String customerName, String accountNumber) {
        this.customerName = customerName;
        this.accountNumber = accountNumber;
        this.balance = 0;
    }

    public void deposit(double amount) {
        balance += amount;
        System.out.println("Deposit of $" + amount + " successful.");
    }

    public void displayBalance() {
        System.out.println("Account Number: " + accountNumber + "\nBalance: $" + balance);
    }
}

class SavingsAccount extends Account {
    public SavingsAccount(String customerName, String accountNumber) {
        super(customerName, accountNumber);
    }

    public void computeInterest() {
        double interestRate = 0.05; // Assuming a 5% interest rate
        double interest = balance * interestRate;
        balance += interest;
        System.out.println("Interest of $" + interest + " computed and added to the balance.");
    }

    public void withdraw(double amount) {
        if (balance >= amount) {
            balance -= amount;
            System.out.println("Withdrawal of $" + amount + " successful.");
        } else {
            System.out.println("Insufficient funds for withdrawal.");
        }
    }
}

class CurrentAccount extends Account {
    private double minimumBalance = 1000;

    public CurrentAccount(String customerName, String accountNumber) {
        super(customerName, accountNumber);
    }

    public void withdraw(double amount) {
        if (balance - amount >= minimumBalance) {
            balance -= amount;
            System.out.println("Withdrawal of $" + amount + " successful.");
        } else {
            System.out.println("Insufficient funds. Service charge applied.");
            imposeServiceCharge();
        }
    }

    private void imposeServiceCharge() {
        double serviceCharge = 20; // Assuming a service charge of $20
        balance -= serviceCharge;
        System.out.println("Service charge of $" + serviceCharge + " imposed.");
    }
}
```

OUTPUT



```
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C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac Bank.java

C:\Users\Dell\Desktop\java>java Bank
Gayatri Vikas Yatagiri

1BM22CS102

Deposit of $5000.0 successful.
Account Number: SA1001
Balance: $5000.0
Interest of $250.0 computed and added to the balance.
Account Number: SA1001
Balance: $5250.0
Withdrawal of $2000.0 successful.
Account Number: SA1001
Balance: $3250.0
Deposit of $8000.0 successful.
Account Number: CA2002
Balance: $8000.0
Withdrawal of $5000.0 successful.
Account Number: CA2002
Balance: $3000.0

C:\Users\Dell\Desktop\java>
```
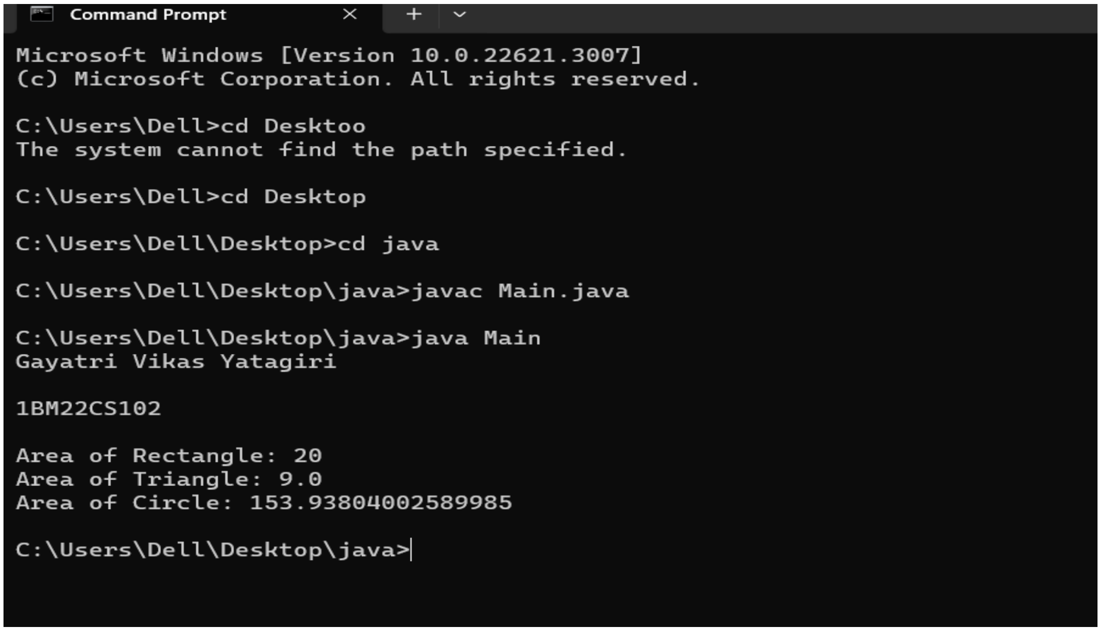

5) Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle,

Circle such that each one of the classes extends the class Shape. Each one of the classes contain the method printArea() that prints the area of a given shape.

JAVA CODE

```
import java.util.Scanner;

abstract class Shape {
    protected int dimension1;
    protected int dimension2;

    public Shape(int dimension1, int dimension2) {
        this.dimension1 = dimension1;
        this.dimension2 = dimension2;
    }

    public abstract void printArea();
}

class Rectangle extends Shape {
    public Rectangle(int length, int width) {
        super(length, width);
    }

    public void printArea() {
        int area = dimension1 * dimension2;
        System.out.println("Area of Rectangle: " + area);
    }
}

class Triangle extends Shape {
    public Triangle(int base, int height) {
        super(base, height);
    }

    public void printArea() {
        double area = 0.5 * dimension1 * dimension2;
        System.out.println("Area of Triangle: " + area);
    }
}

class Circle extends Shape {
    public Circle(int radius) {
        super(radius, 0);
    }
    public void printArea() {
        double area = Math.PI * dimension1 * dimension1;
        System.out.println("Area of Circle: " + area);
    }
}

public class Main {
    public static void main(String[] args) {
       System.out.println("Gayatri Vikas Yatagiri\n");
       System.out.println("1BM22CS102\n");

        Rectangle rectangle = new Rectangle(4, 5);
        rectangle.printArea();

        Triangle triangle = new Triangle(3, 6);
        triangle.printArea();

        Circle circle = new Circle(7);
        circle.printArea();
    }
}
```

OUTPUT



```
Microsoft Windows [Version 10.0.22621.3007]
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C:\Users\Dell>cd Desktoo
The system cannot find the path specified.

C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac Main.java

C:\Users\Dell\Desktop\java>java Main
Gayatri Vikas Yatagiri

1BM22CS102

Area of Rectangle: 20
Area of Triangle: 9.0
Area of Circle: 153.93804002589985

C:\Users\Dell\Desktop\java>
```

6) Create a package CIE which has two classes- Student and Internals. The class Student has members like usn, name, sem. The class internals derived from student 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.

1. Create a folder CIE and save the programs Student.java and Internals.java within it.
2. Create a folder SEE and save the program External.java within it.
3. Save the Main program outside these two folders.
4. Compile Main.java and Execute the Main.class

JAVA CODE

```
package CIE;

public class Student{
public String usn;
public String name;
protected int sem;
public Student(String usn, String name, int sem)
{
this.usn=usn;
this.usn=usn;
this.usn=usn;
}
}

package CIE;

public class Internals extends Student{
public int[] internalMarks=new int[5];
public Internals(String usn, String name, int sem, int[] internalMarks){
super(usn,name,sem);
this.internalMarks=internalMarks;
}
}


package SEE;

import CIE.Student;

public class External extends Student {
   public int[] seeMarks;
```

```
    public External(String usn, String name, int sem, int[] seeMarks) {
        super(usn, name, sem);
        this.seeMarks = seeMarks;
    }
}
```

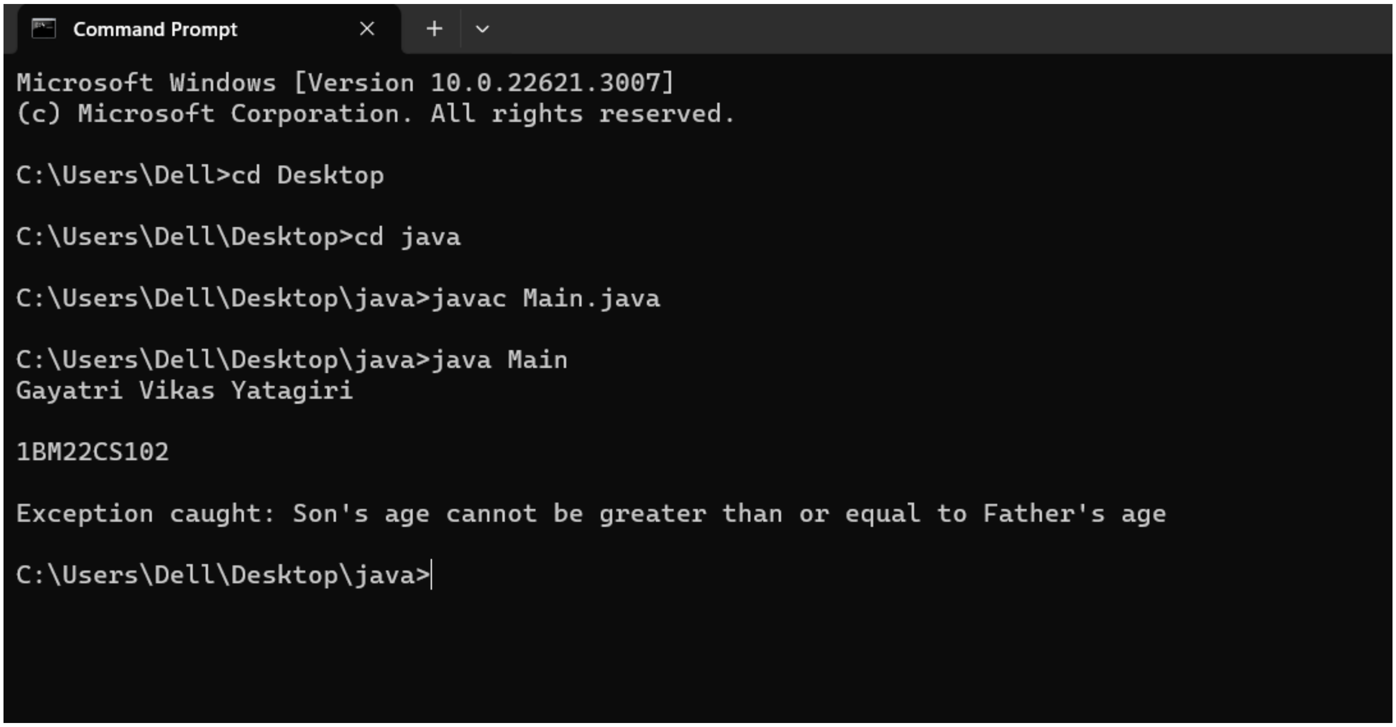
```
import CIE.Internals;
import SEE.External;

public class Main {
    public static void main(String[] args) {
        int[] internalMarks1 = {80, 75, 90, 85, 88};
        Internals student1 = new Internals("1ABC123", "John Doe", 3, internalMarks1);

        int[] seeMarks1 = {70, 85, 78, 92, 88};
        External student2 = new External("2XYZ456", "Jane Smith", 3, seeMarks1);

        int[] finalMarks1 = new int[5];
        for (int i = 0; i < 5; i++) {
            finalMarks1[i] = student1.internalMarks[i] + student2.seeMarks[i];
        }

        System.out.println("Final Marks for " + student1.name + " (USN: " + student1.usn + ")");
        for (int i = 0; i < 5; i++) {
            System.out.println("Course " + (i + 1) + ": " + finalMarks1[i]);
        }
    }
}
```

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.

JAVA CODE

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

class Father {
    int age;

    public Father(int age) throws WrongAgeException {
        if (age < 0) {
            throw new WrongAgeException("Age cannot be negative");
        }
        this.age = age;
    }
}

class Son extends Father {
    int sonAge;

    public Son(int fatherAge, int sonAge) throws WrongAgeException {
        super(fatherAge);
        if (sonAge >= fatherAge) {
            throw new WrongAgeException("Son's age cannot be greater than or equal to Father's
age");
        }
        this.sonAge = sonAge;
    }
}

public class Main {
    public static void main(String[] args) {
        try {
            System.out.println("Gayatri Vikas Yatagiri\n");
            System.out.println("1BM22CS102\n");

            int fatherAge = 40;
            int sonAge = 20;
            Son son = new Son(fatherAge, sonAge);
            System.out.println("Father's age: " + fatherAge);
            System.out.println("Son's age: " + son.sonAge);
        } catch (WrongAgeException e) {
            System.out.println("Exception caught: " + e.getMessage());
        }
    }
}
```

OUTPUT



```
Microsoft Windows [Version 10.0.22621.3007]
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C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac Main.java

C:\Users\Dell\Desktop\java>java Main
Gayatri Vikas Yatagiri

1BM22CS102

Exception caught: Son's age cannot be greater than or equal to Father's age

C:\Users\Dell\Desktop\java>
```
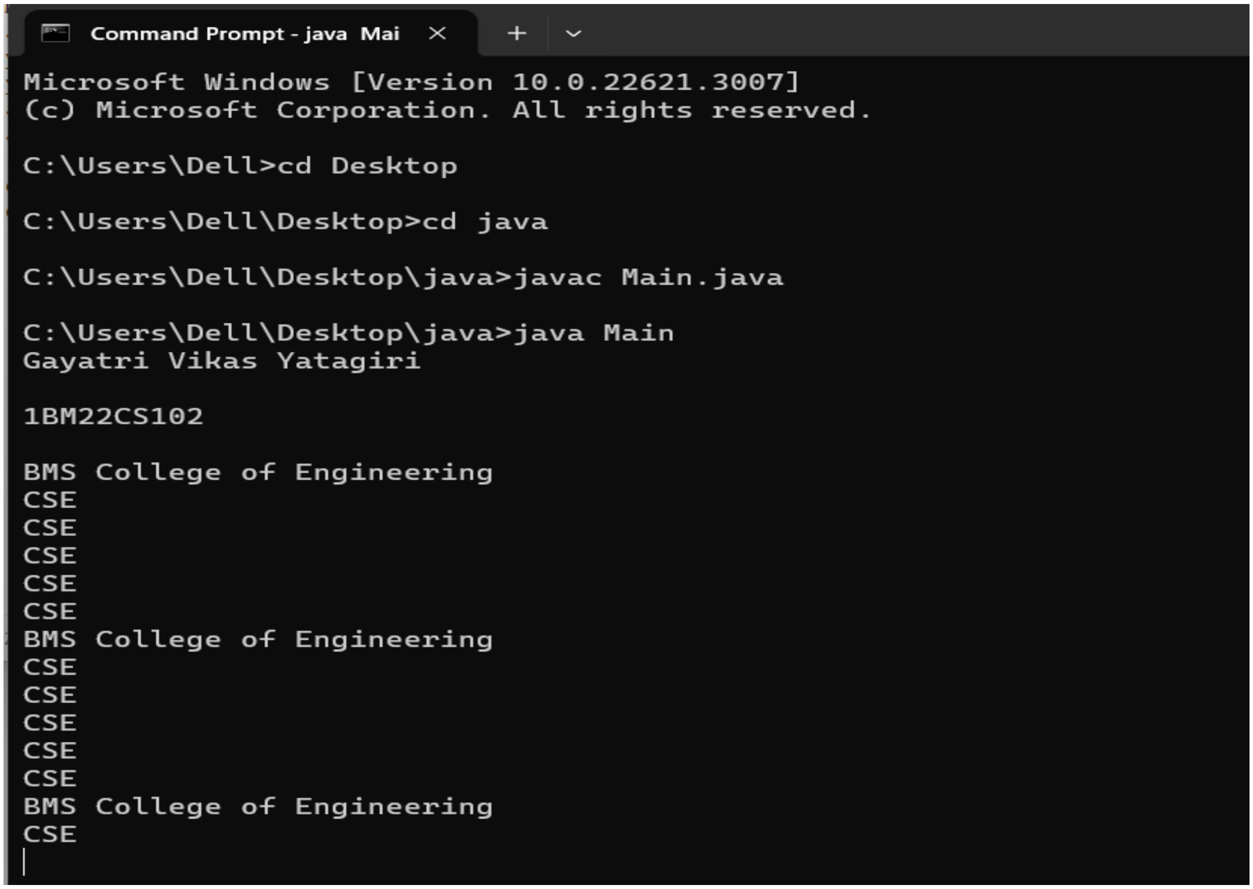

8) Write a program which creates two threads, one thread displaying “BMS College of Engineering” once every ten seconds and another displaying “CSE” once every two seconds.

JAVA 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() {
        while (true) {
            try {
                System.out.println(message);
                Thread.sleep(interval);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}

public class Main {
    public static void main(String[] args) {
        System.out.println("Gayatri Vikas Yatagiri\n");
        System.out.println("1BM22CS102\n");

        DisplayThread thread1 = new DisplayThread("BMS College of Engineering", 10000); // 10
seconds
        DisplayThread thread2 = new DisplayThread("CSE", 2000); // 2 seconds

        thread1.start();
        thread2.start();
    }
}
```

OUTPUT



```
Microsoft Windows [Version 10.0.22621.3007]
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C:\Users\Dell>cd Desktop

C:\Users\Dell\Desktop>cd java

C:\Users\Dell\Desktop\java>javac Main.java

C:\Users\Dell\Desktop\java>java Main
Gayatri Vikas Yatagiri

1BM22CS102

BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
```