Develop a Java program that prints all real solutions to the quadratic equation ax2 +bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac isnegative, display a message stating that there are no real solutions.

```
import java.io.*;
import java.util.*;
import java.lang.*;
public class quadratic
{
 private static double a;
 private static double b;
 private static double c;
 public static void read()
 {
 Scanner sc=new Scanner(System.in);
 System.out.println("Enter the Co-Effcient a");
 a=sc.nextDouble();
 System.out.println("Enter the Co-Effcient b");
 b=sc.nextDouble();
 System.out.println("Enter the Co-Effcient c");
 c=sc.nextDouble();
 System.out.println("THANK YOU FOR ENTERRING THE CO-EFFCIENTS");
 }
 public static void calc()
 {
 read();
 double d=b*b-4*a*c;
 if(d>0)
 {
 System.out.println("ROOTS ARE REAL AND DISTINCT");
 System.out.println("FIRST ROOT IS " + (-b+Math.sqrt(d))/(2*a));
 System.out.println("FIRST ROOT IS " + (-b-Math.sqrt(d))/(2*a));
 }
 else if(d==0)
 {
 System.out.println("Roots are equal");
 System.out.println("ROOTS ARE " + (-b)/(2*a));
 }
 else
 {
 System.out.println("ROOTS ARE IMAGINARY");
 System.out.println("ROOTS ARE " + -b/(2*a) + "+" +"i" + (Math.sqrt(-d))/(2*a));
 System.out.println("ROOTS ARE " + -b/(2*a) + "-" +"i" + (Math.sqrt(-d))/(2*a));
```

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

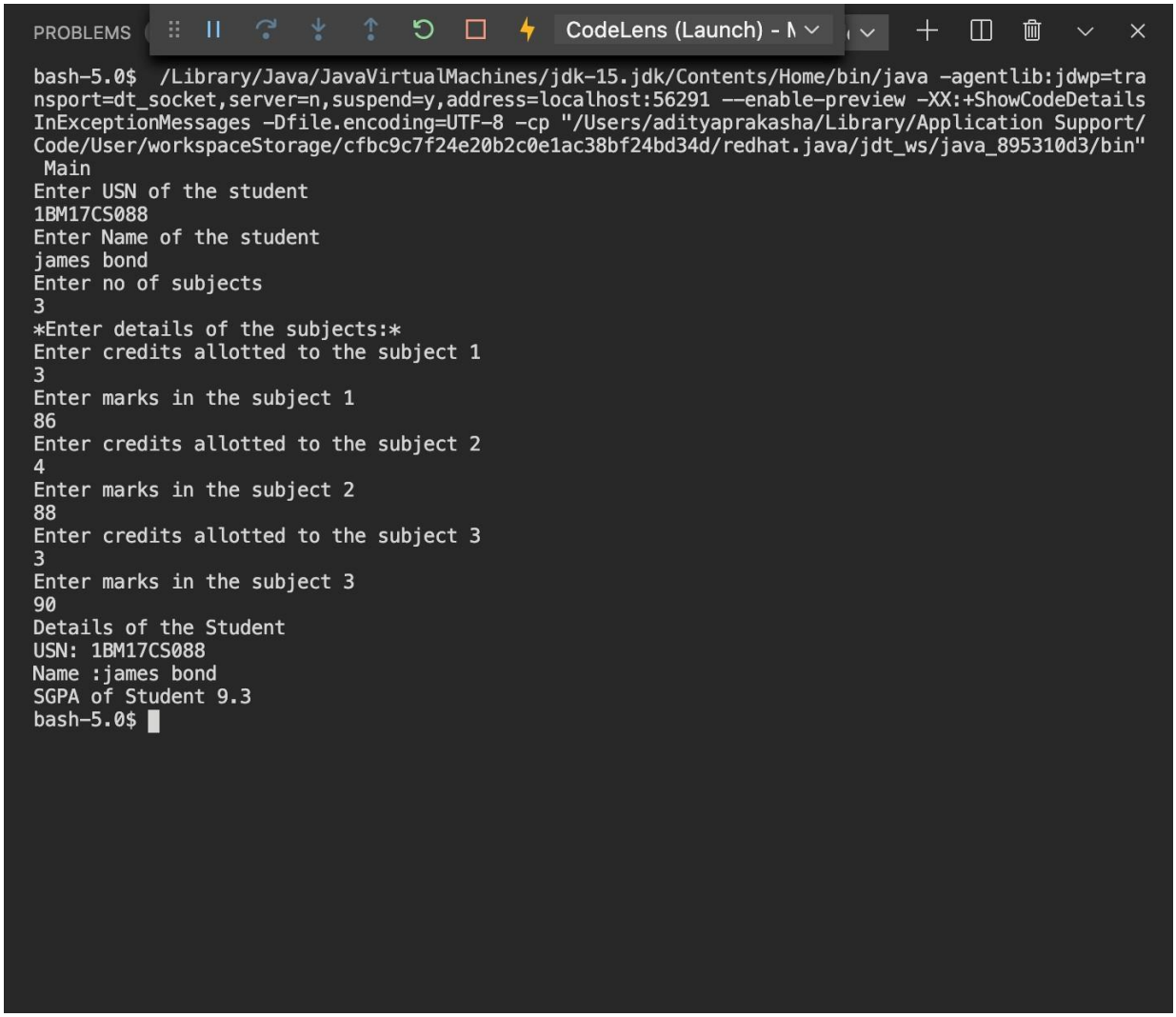
output:

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

```
import java.util.Scanner;
class Student
{
    private String USN;
    private String name;
    private int n;
    private double SGPA = 0;
    private int totalCredits = 0;
  private int credits[];
  private double marks[];
    Scanner ss = new Scanner(System.in);

    void Details()
    {
    System.out.println("Enter USN of the student");
    USN = ss.nextLine();
    System.out.println("Enter Name of the student");
    name = ss.nextLine();
    System.out.println("Enter no of subjects");
    n = ss.nextInt();
    credits = new int[n];
    marks = new double[n];
    System.out.println("*Enter details of the subjects:*");
    for(int i=0;i<n;i++)
    {
        System.out.println("Enter credits allotted to the subject "+(i+1));
        credits[i] = ss.nextInt();
        System.out.println("Enter marks in the subject "+(i+1));
        marks[i] = ss.nextInt();
        Calculate(credits[i],marks[i],i);
    }
    }
    void Calculate(int credit,double mark,int j)
    {
        totalCredits = totalCredits + credit;
        if(mark>=90&&mark<=100)
            SGPA = SGPA + (10*credit);
        else if(mark>=80 && mark<=89)
```

```
            SGPA = SGPA + (9*credit);
        else if(mark>=70&&mark<=79)
            SGPA = SGPA + (8*credit);
        else if(mark>=60&&mark<=69)
            SGPA = SGPA + (7*credit);
        else if(mark>=50 && mark<=59)
            SGPA = SGPA + (6*credit);
        else if(mark>=40&&mark<=49)
            SGPA = SGPA + (5*credit);
        else
            System.out.println("Failed in Subject "+(j+1));
    }
    void Display()
    {
        System.out.println("Details of the Student");
    System.out.println("USN: "+USN);
    System.out.println("Name :"+name);
        System.out.println("SGPA of Student "+(SGPA/totalCredits));
    }
}
class Main
{
    public static void main(String args[])
    {
        Student s1 = new Student();
        s1.Details();
        s1.Display();
    }
}
```

output:


PROBLEMS
CodeLens (Launch) - M
bash-5.0$ /Library/Java/JavaVirtualMachines/jdk-15.jdk/Contents/Home/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:56291 --enable-preview -XX:+ShowCodeDetailsInExceptionMessages -Dfile.encoding=UTF-8 -cp "/Users/adityaprakasha/Library/Application Support/Code/User/workspaceStorage/cfbc9c7f24e20b2c0e1ac38bf24bd34d/redhat.java/jdt_ws/java_895310d3/bin" Main
Enter USN of the student
1BM17CS088
Enter Name of the student
james bond
Enter no of subjects
3
Enter details of the subjects:
Enter credits allotted to the subject 1
3
Enter marks in the subject 1
86
Enter credits allotted to the subject 2
4
Enter marks in the subject 2
88
Enter credits allotted to the subject 3
3
Enter marks in the subject 3
90
Details of the Student
USN: 1BM17CS088
Name :james bond
SGPA of Student 9.3
bash-5.0$

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 containonly the method printArea( ) that prints the area of the given shape.

```
import java.util.*;
import java.lang.Math.*;

abstract class shape{
        public int a;
        public int b;
        abstract public void printArea();
        Scanner s=new Scanner(System.in);
}

class rectangle extends shape{
        public void printArea(){
                System.out.print("Please enter length and breadth of rectangle: ");
                float a=s.nextFloat();
                float b=s.nextFloat();
                float area=a*b;
                System.out.println("Area="+area+"sq.units");
        }
}

class  triangle  extends  shape{
        public void printArea(){
                System.out.print("Please enter three sides of triangle: ");
                float a=s.nextFloat();
                float  b=s.nextFloat();
                float  c=s.nextFloat();
                float d=(a+b+c)/2;
                double   area=Math.sqrt(d*(d-a)*(d-b)*(d-c));
                System.out.println("Area="+area+"sq.units");
        }
}

class circle extends shape{
        public void printArea(){
                System.out.print("Please enter radius of circle: ");
                float a=s.nextFloat();
                float area=22/7*a*a;
                System.out.println("Area="+area+"sq.units");
        }
}
```

```
class Shapedemo{
        public static void main(String args[]){
                shape r=new rectangle();
                shape t=new triangle();
                shape c=new circle();
                for(int i=0;i<100;i++){
                System.out.println("\n1)Triangle\n2)Rectangle\n3)Circle\n");
                System.out.println("Enter your choice: ");
                Scanner s=new Scanner(System.in);
                int ch=s.nextInt();
                switch(ch){
                        case 1: t.printArea();
                                break;
                        case 2: r.printArea();
                                break;
                        case 3: c.printArea();
                                break;
                                default:
                        System.out.println("Invalid choice");
                        }
                }
        }
}
```

output:

```
bash-5.0$  /Library/Java/JavaVirtualMachines/jdk-15.jdk/Contents/Home/bin/java -agentlib:jdwp=tra
nsport=dt_socket,server=n,suspend=y,address=localhost:61892 --enable-preview -XX:+ShowCodeDetails
InExceptionMessages -Dfile.encoding=UTF-8 -cp "/Users/adityaprakasha/Library/Application Support/
Code/User/workspaceStorage/cfbc9c7f24e20b2c0e1ac38bf24bd34d/redhat.java/jdt_ws/java_895310d3/bin"
 Shapedemo

1)Triangle
2)Rectangle
3)Circle

Enter your choice:
1
Please enter three sides of triangle: 3
4
5
Area=6.0sq.units

1)Triangle
2)Rectangle
3)Circle

Enter your choice:
2
Please enter length and breadth of rectangle: 2
3
Area=6.0sq.units

1)Triangle
2)Rectangle
3)Circle

Enter your choice:
4
Invalid choice

1)Triangle
2)Rectangle
3)Circle

Enter your choice:
3
Please enter radius of circle: 4
Area=48.0sq.units

1)Triangle
2)Rectangle
3)Circle

Enter your choice:
```

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 andget 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.

```
import java.util.*;
class book
{
   String booktitle;
   String author;
   int no_of_pages;
   double price;
   Scanner sc = new Scanner(System.in);
   book()
   {
      System.out.print("Enter book title: ");
      booktitle = sc.nextLine();
      System.out.print("Enter the author name: ");
      author  = sc.nextLine();
      System.out.print("Enter the price: ");
      price  = sc.nextDouble();
      System.out.print("Enter the pages: ");
      no_of_pages = sc.nextInt();
   }
   public String toString()
   {
      return(" Book name = "+booktitle+" Author = "+author+" Price = "
      +price+" Pages = "+no_of_pages);
   }
}
class Books
{
   public static void main(String[] args)
   {
      int n,i;
      Scanner in = new Scanner(System.in);
      System.out.print("Enter number of books: ");
      n = in.nextInt();
      book[] b = new book[n];
      for(i=0;i<n;i++)
      {
         System.out.println("Enter details of Book: "+(i+1));
         b[i] = new book();
      }
      for(i=0;i<n;i++)
      {
         System.out.println(b[i]);
```

```
    }
  }
}
```

output:

```
bash-5.0$  /Library/Java/JavaVirtualMachines/jdk-15.jdk/Contents/Home/bin/java -agentlib:jdwp=tra
nsport=dt_socket,server=n,suspend=y,address=localhost:52179 --enable-preview -XX:+ShowCodeDetails
InExceptionMessages -Dfile.encoding=UTF-8 -cp "/Users/adityaprakasha/Library/Application Support/
Code/User/workspaceStorage/cec6510638e2882570735580372d9ec6/redhat.java/jdt_ws/jdt.ls-java-projec
t/bin" Books
Enter number of books: 2
Enter details of Book: 1
Enter book title: invisible man
Enter the author name: raplh ellison
Enter the price: 300
Enter the pages: 400
Enter details of Book: 2
Enter book title: native son
Enter the author name: richard wright
Enter the price: 350
Enter the pages: 500
 Book name = invisible man Author = raplh ellison Price = 300.0 Pages = 400
 Book name = native son Author = richard wright Price = 350.0 Pages = 500
bash-5.0$
```

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 Curr-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks: • Accept deposit from customer and update the balance. • Display the balance. • Compute and deposit interest • Permit withdrawal and update the balance • Check for the minimum balance, impose penalty if necessary and update the balance

```
import java.util.*;

class Account{
  Scanner in=new Scanner(System.in);
  String cusName,accType;
  long  accNumber;
  double balance=9876.5;
  void Accept(){
    System.out.println("Enter name ");
    cusName=in.nextLine();
    System.out.println("Enter Account number");
    accNumber=in.nextLong();
  }
  void deposit(){
    int dep;
    System.out.println("Enter the amount to be deposited");
    dep=in.nextInt();
    balance+=dep;
    System.out.println("Balance = "+balance);
  }
  void withdrawal(){
    int witdr;
    System.out.println("Enter the amount you want to withdraw");
    witdr=in.nextInt();
    balance-=witdr;
    System.out.println("Balance = "+balance);
  }
}
class CurrAct extends Account{
  void penalty(){
  if(balance<2000){
    balance-=400;
    System.out.println("400 penalty for maintainin less than minimum balance");
    System.out.println("Balance = "+balance);
```

```
  }
}
}
class SavAct extends Account{
  void interest(){
    double i;
    i=balance*0.05;
    balance+=i;
    System.out.println("Interest = "+i);
    System.out.println("Total Balance = "+balance);
  }
}
class Bank{
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.println("Enter your choice\n1. Savings Account \n2.Current Account");
    int choice=sc.nextInt();

    CurrAct c= new CurrAct();
    SavAct s= new SavAct();

    if(choice==2){
      c.Accept();

      System.out.println("Enter your choice\n1. Deposit\n2. Withdraw");
      int n= sc.nextInt();

      switch (n) {
        case 1:{
          c.deposit();
          break;
        }
        case 2:{
          c.withdrawal();
          c.penalty();
          break;
        }
        default:System.out.println("Wrong choice!");
      }
    }
    if(choice==1){
      s.Accept();

      System.out.println("Enter your choice\n1. Deposit\n2. Withdraw");
      int n=sc.nextInt();

      switch (n) {
        case 1:{
```

```
          s.deposit();
          s.interest();
          break;
        }
        case 2:{
          s.withdrawal();

          break;
        }
        default:System.out.println("Wrong choice!");
      }
    }
  }
}
```

output:

```
PROBLEMS 23  OUTPUT  DEBUG CONSOLE  TERMINAL  2: Java Debug Console

bash-5.0$  /Library/Java/JavaVirtualMachines/jdk-15.jdk/Contents/Home/bin/java -agentlib:jdwp=tra
nsport=dt_socket,server=n,suspend=y,address=localhost:61844 --enable-preview -XX:+ShowCodeDetails
InExceptionMessages -Dfile.encoding=UTF-8 -cp "/Users/adityaprakasha/Library/Application Support/
Code/User/workspaceStorage/cfbc9c7f24e20b2c0e1ac38bf24bd34d/redhat.java/jdt_ws/java_895310d3/bin"
 Bank
Enter your choice
1. Savings Account
2.Current Account
1
Enter name
rahul
Enter Account number
758595858
Enter your choice
1. Deposit
2. Withdraw
1
Enter the amount to be deposited
1000000
Balance = 1009876.5
Interest = 50493.825000000004
Total Balance = 1060370.325
bash-5.0$
```

Create a package CIE which has two classes- Student and Internals. The class Student 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.

CIE Package:

Student:

```
package CIE;

import java.util.*;


public class Student{
	public String name;
	public String usn;
	public int sem;

	public void display(){
		Scanner sc = new Scanner(System.in);
		System.out.println("Name:");
		name = sc.next();
		System.out.println("USN:");
		usn = sc.next();
		System.out.println("Sem:");
		sem = sc.nextInt();
	}

}
```

Internals:

```
package CIE;
import java.util.*;

public class Internals extends Student{
	public double ciem[];

	public void display(){
		ciem = new double[5];
		Scanner c = new Scanner(System.in);
		System.out.println("Eneter cie marks out of 50:");
		for(int i=0;i<5;i++){
			ciem[i] = c.nextDouble();
		}
	}
}
```

SEE Package:

Externals:

```
package SEE;
import CIE.*;
import java.util.*;

public class Externals extends CIE.Student{
	public double seem[];

	public void display(){
		seem = new double[5];
		Scanner s = new Scanner(System.in);
		System.out.println("SEE marks for 5 subjects out of 100:");
		for(int i=0;i<5;i++){
			seem[i]=s.nextDouble();
```

```
        }
    }
}
```

Main Class:

```
import CIE.*;
import SEE.*;
import java.util.*;

public class Main{
    public static void main(String[] args){
        int n;
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter no. of students:");
        n = sc.nextInt();
        CIE.Student st[] = new CIE.Student[n];
        CIE.Internals in[] = new CIE.Internals[n];
        SEE.Externals ex[] = new SEE.Externals[n];

        for(int i=0;i<n;i++){
            st[i] = new CIE.Student();
            in[i] = new CIE.Internals();
            ex[i] = new SEE.Externals();

            st[i].display();
            in[i].display();
            ex[i].display();
            System.out.println("Total Marks of "+st[i].name+"\n");
            for(int j=0;j<5;j++){
                System.out.println(in[i].ciem[j]+ex[i].seem[j]/2);
            }
        }
```

```
        }
}
```

Output:

```
Enter no. of students:
2
Name:
A
USN:
1BM17CS005
Sem:
2
Eneter cie marks out of 50:
48
47
46
48
44
SEE marks for 5 subjects out of 100:
84
88
86
82
80
Total Marks of A

90.0
91.0
89.0
89.0
84.0
Name:
B
USN:
1BM19CS192
Sem:
5
Eneter cie marks out of 50:
43
41
39
37
45
SEE marks for 5 subjects out of 100:
78
80
84
86
82
Total Marks of B

82.0
81.0
81.0
80.0
86.0
```

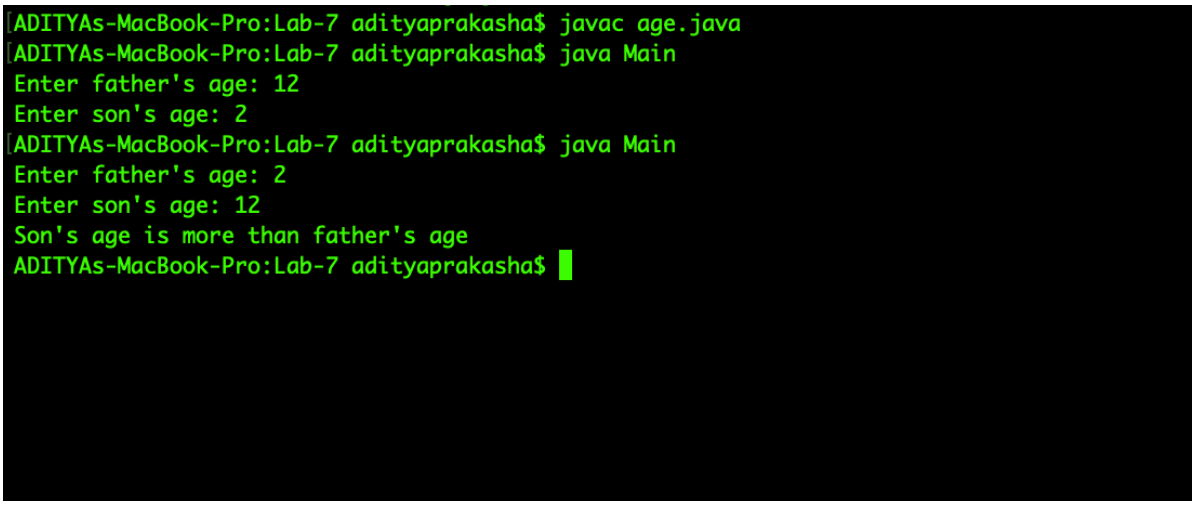
Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called “Father” and derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge( ) when the input age=father’s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

Code:

```
import java.util.Scanner;

class WrongAge extends Exception

{

	public WrongAge(String message)

	{

		super(message);

	}

}

class Father

{

	Int fatherAge;

	public Father(int fatherAge) throws WrongAge

	{

		if (fatherAge < 0)

		{

			throw new WrongAge("Age cannot be negative");

		}

	this.fatherAge = fatherAge;

	}

}

class Son extends Father

{

	int sonAge;

	public Son(int fatherAge, int sonAge) throws WrongAge

	{

		super(fatherAge);

		if (sonAge >= fatherAge)
```

```
                {
                        throw new WrongAge("Son's age must be less than Father's age");
                }
        this.sonAge = sonAge;
        }
}
public class fatherson
{
        public static void main(String[] args)
        {
                Scanner sc = new Scanner(System.in);
                System.out.println("Enter father's age and son's age: ");
                int fa=sc.nextInt();
                int sa=sc.nextInt();
                try
                {
                        Son s = new Son(fa, sa);
                        23 System.out.println("Father's age: " + s.fatherAge);
                        System.out.println("Son's age: " + s.sonAge);
                }
        catch (WrongAge e)
        {
                System.out.println("Error: " + e.getMessage());
        }
        }
}
```

OUTPUT:


ADITYAs-MacBook-Pro:Lab-7 adityaprakasha$ javac age.java
ADITYAs-MacBook-Pro:Lab-7 adityaprakasha$ java Main
Enter father's age: 12
Enter son's age: 2
ADITYAs-MacBook-Pro:Lab-7 adityaprakasha$ java Main
Enter father's age: 2
Enter son's age: 12
Son's age is more than father's age
ADITYAs-MacBook-Pro:Lab-7 adityaprakasha$

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.

```
class bms implements Runnable{
  Thread t1;
  bms(){
    t1 = new Thread(this,"bms");
  }
  public void run(){
    try{
      for(int i=5; i>0; i--){
        System.out.println("BMS College of Engineering");
        Thread.sleep(10000);
      }
    }
    catch(InterruptedException e){
      System.out.println("BMS interrupted\n");
    }
    System.out.println("Exiting: "+t1);
  }
}

class cse implements Runnable{
  Thread t2;
  cse(){
    t2 = new Thread(this,"cse");
  }
  public void run(){
    try{
      for(int i=5; i>0; i--){
        System.out.println("CSE");
        Thread.sleep(2000);
      }
    }
    catch(InterruptedException e){
        System.out.println("CSE interrupted\n");
    }
    System.out.println("Exiting: "+t2);
  }
}

class threadprg{
  public static void main(String args[]){
    bms obj1 = new bms();
```

```
    cse obj2 = new cse();
    obj1.t1.start();
    obj2.t2.start();
  }
}
```

output:

```
bash-5.0$  cd /Users/adityaprakasha/Developer ; /Library/Java/JavaVirtualMachines/jdk-11.0.8.jdk/Contents/Hom
e/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:51471 -Dfile.encoding=UTF-
8 -cp "/Users/adityaprakasha/Library/Application Support/Code/User/workspaceStorage/cec6510638e28825707355803
72d9ec6/redhat.java/jdt_ws/Developer_877bb0be/bin" threadprg
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
Exiting: Thread[cse,5,main]
BMS College of Engineering
```

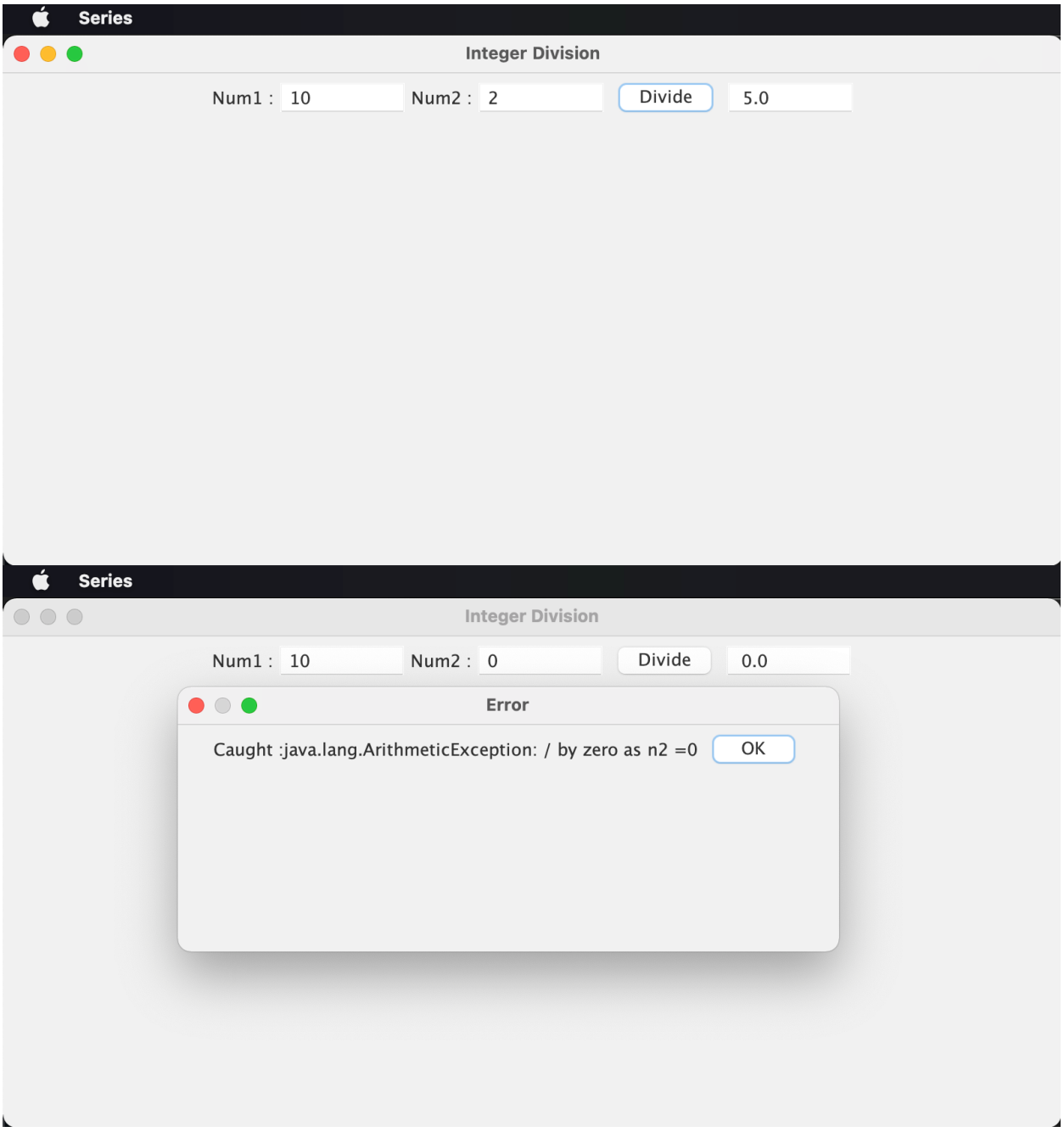
Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2.The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the programwould throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

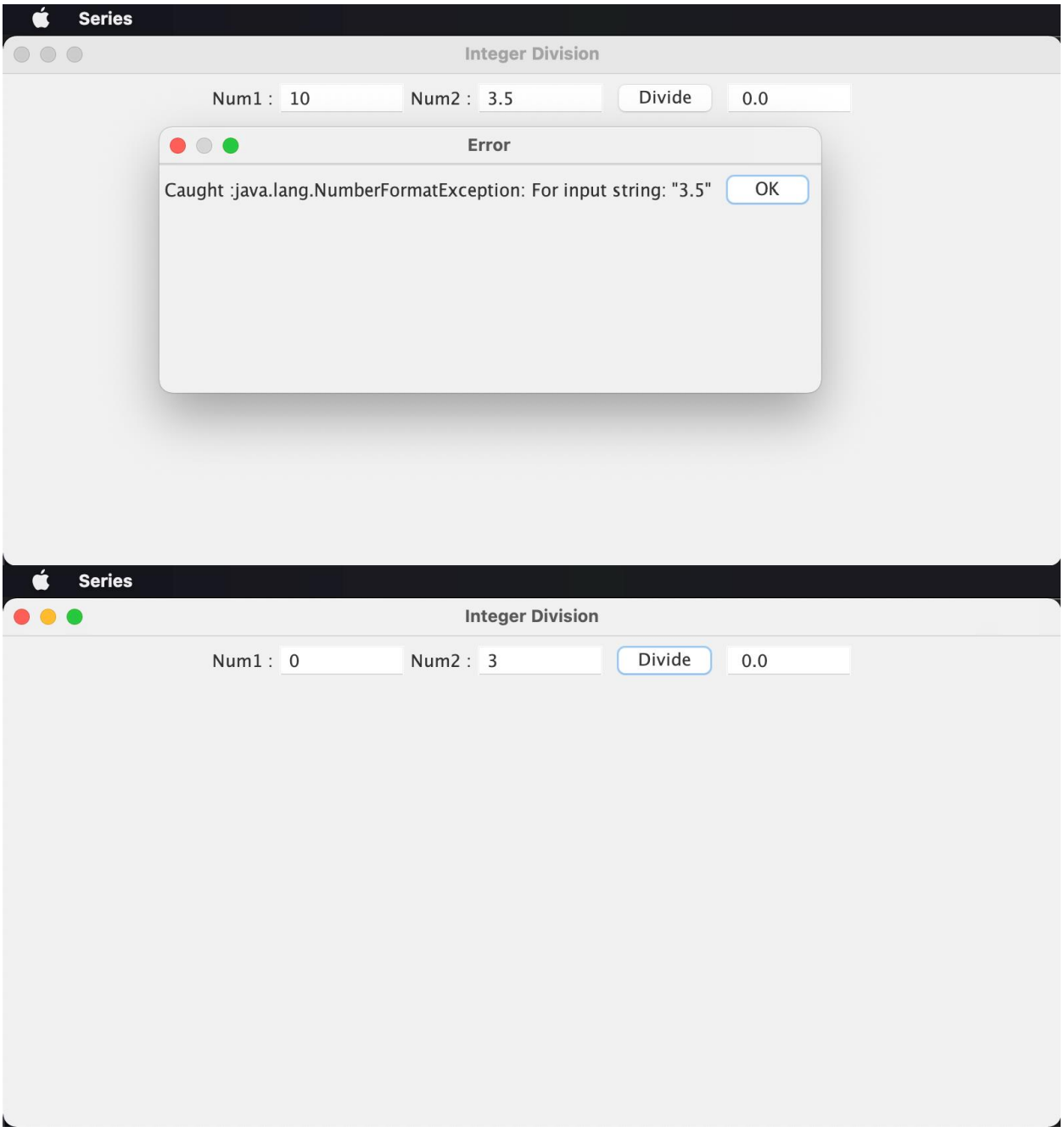
```
import java.awt.*;
import java.awt.event.*;
class div extends Dialog implements ActionListener{
  Series d;
  div(Frame parent, String title){
    super(parent,title,false);
    d=(Series)parent;
    setLayout(new FlowLayout());
    setSize(500,200);
    add(new Label(d.er));
    Button b;
    add(b=new Button("OK"));
    b.addActionListener(this);
  }
  public void actionPerformed(ActionEvent ae){
    dispose();
  }
}
public class Series extends Frame implements ActionListener{
  TextField n1,n2,r;
  Button Divide;
  String er="";
  public Series()
  {
    setLayout(new FlowLayout());
    Divide = new Button("Divide");
    Label n1p = new Label("Num1 :",Label.RIGHT);
```

```
  Label n2p = new Label("Num2 :",Label.RIGHT);
  n1 = new TextField(10);
  n2 = new TextField(10);
  r = new TextField(10);
  add(n1p);
  add(n1);
  add(n2p);
  add(n2);
  add(Divide);
  add(r);
  Divide.addActionListener(this);
  addWindowListener(new WindowAdapter(){
  public void windowClosing(WindowEvent we)
    {
      System.exit(0);
    }
  });
}
 public void actionPerformed(ActionEvent ae)
 {
  int a=0,b=0,c=0,d=0;
  double re=0;
  try{
    a = Integer.parseInt(n1.getText());
    b = Integer.parseInt(n2.getText());
  }
  catch(NumberFormatException e1){
    er="Caught :"+e1;
    div dv = new div(this,"Error");
    dv.setVisible(true);
  }
  try{
    c = Integer.parseInt(n1.getText());
    d = Integer.parseInt(n2.getText());
    re=c/d;
  }
  catch(ArithmeticException e2){
```

```
      er="Caught :"+e2+" as n2 ="+ n2.getText();
      div di = new div(this,"Error");
      di.setVisible(true);
    }
    r.setText(" "+re);
  }
  public static void main(String args[]){
    Series appwin = new Series();
    appwin.setSize(new Dimension(800,400));
    appwin.setTitle("Integer Division");
    appwin.setVisible(true);
  }
}
```

Output:


Series
Integer Division
Num1 : 10
Num2 : 2
Divide
5.0
Series
Integer Division
Num1 : 10
Num2 : 0
Divide
0.0
Error
Caught :java.lang.ArithmeticException: / by zero as n2 =0
OK


Series
Integer Division
Num1 : 10
Num2 : 3.5
Divide
0.0
Error
Caught :java.lang.NumberFormatException: For input string: "3.5"
OK
Series
Integer Division
Num1 : 0
Num2 : 3
Divide
0.0