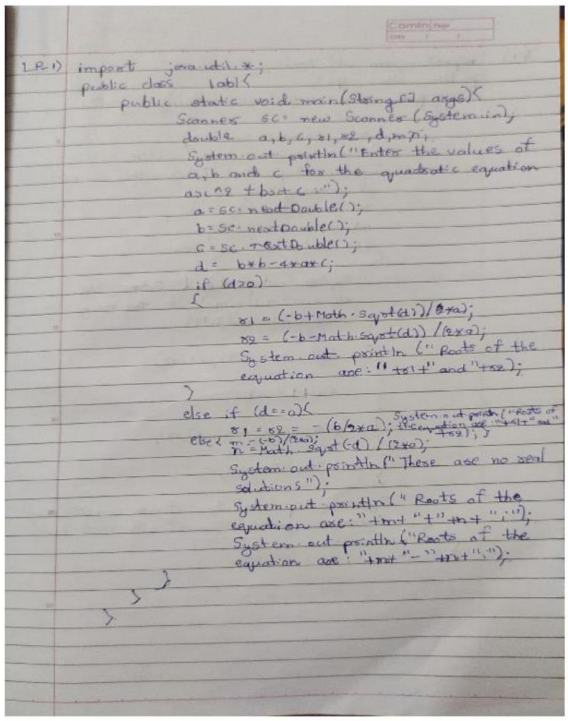
1) Develop a Java program that prints all real solutions to the quadratic equation ax2 +bx+c = 0.Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions.



```
LAB 1)  import java.util.*;
public class lab1{
    public static void main(String[] args){
        Scanner sc= new Scanner(System.in);
        double a,b,c,x1,x2,d,m,n;
        System.out.println("Enter the values of
        a,b and c for the quadratic equation
        ax^2 +bx+c :");
        a=sc.nextDouble();
        b=sc.nextDouble();
        c=sc.nextDouble();
        d= b*b-4*a*c;
        if (d>0)
        {
            x1 = (-b+Math.sqrt(d))/(2*a);
            x2 = (-b-Math.sqrt(d))/(2*a);
            System.out.println("Roots of the
            equation are:"+x1+" and "+x2);
        }
        else if (d==0){
            x1 = x2 = -(b/2*a); System.out.println("Roots of
            m=(-b)/(2*a);
            n=Math.sqrt(-d)/(2*a);
            System.out.println("These are no real
            solutions");
            System.out.println("Roots of the
            equation are:"+m+"+"+n+"i");
            System.out.println("Roots of the
            equation are:"+m+"-"+n+"i");
        }
    }
}
```

```
Microsoft Windows [Version 10.0.18362.1082]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\HP-PC>cd Desktop

C:\Users\HP-PC\Desktop>cd JAVA_PROGRAMS

C:\Users\HP-PC\Desktop\JAVA_PROGRAMS>javac lab1.java

C:\Users\HP-PC\Desktop\JAVA_PROGRAMS>java lab1
Enter the values of a,b and c for the quadratic equation ax^2+bx+c:
1
5
6
Roots of the equation are:-2.0 and -3.0

C:\Users\HP-PC\Desktop\JAVA_PROGRAMS>
```

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

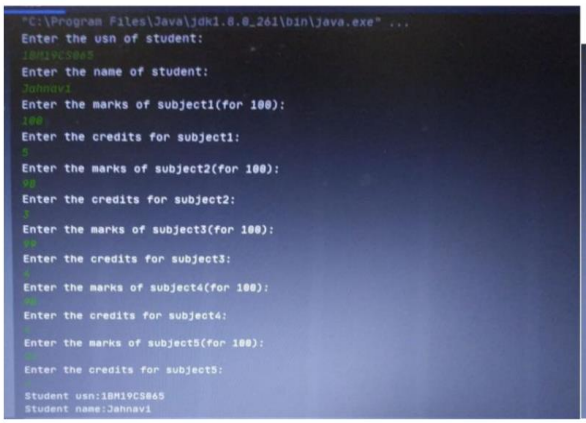
```
1b2) import java.util.Scanner;
class Student {
    private String usn;
    private String name;
    private int[] credits = new int[5];
    private double[] marks = new double[5];
    private int n=0;
    private int total_credits=0;
    private float total=0f;
    private float sgpa=0f;
    private int[] pf = new int[5];
    Scanner s = new Scanner(System.in);
```

```
Student(){
    usn = " ";
    name=" ";
}
Student(String eusn, String ename, double[]marks,
int[] credit)
{
    usn = eusn;
    name=ename;
    marks=emarks;
    credit=ecredits;
}
```

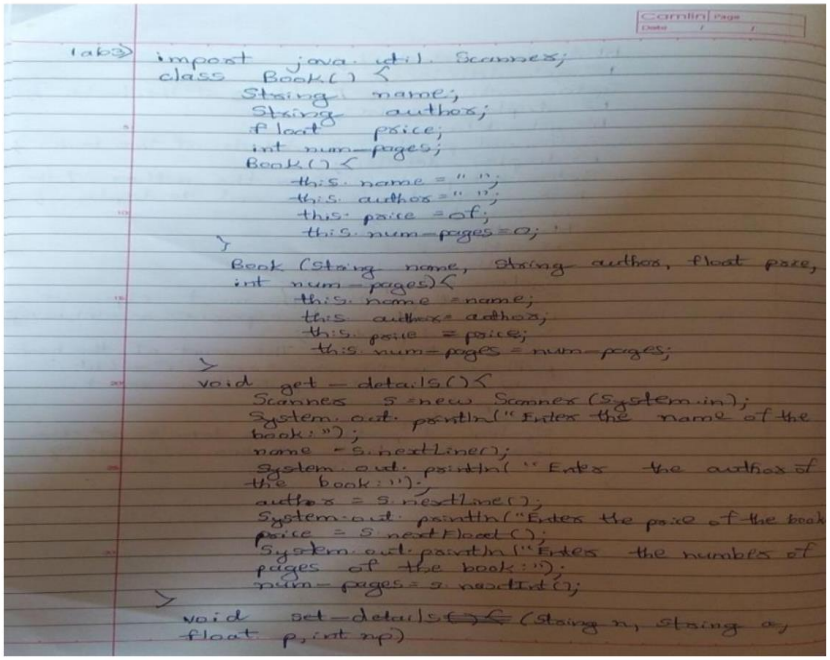
```
public void get_details()
{
    System.out.println("Enter the usn of
    student:");
    usn = S.next();
    System.out.println("Enter the name of
    Student:");
    name = S.next();
    System.out.println("Enter the numbes of
    subjects:");
    n = S.nextInt();
    marks = new double[n];
    credit = new int[n];
    for (int i=0 ; i<5 ; i++)
    {
        System.out.println("Enter the marks
        of subject"+(i+1)+"(out of 100):");
        marks[i] = S.nextDouble();
        System.out.println("Enter the credits
        for subject"+(i+1)+":");
        credit[i] = S.nextInt();
    }
}
```

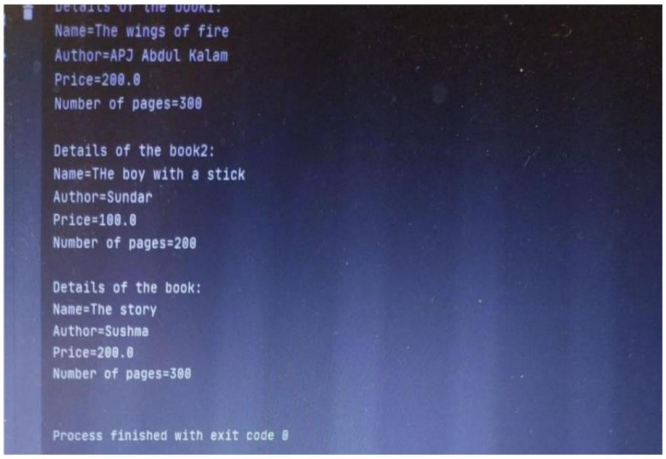
```
public float compute_sgpa()
{
    p = new int[n];
    for (int i=0; i<5; i++)
    {
        total = credits + credit[i];
    }
    for (int i=0; i<5; i++)
    {
        if (marks[i] >=90)
            p[i]=10;
        else if (marks[i]>=80)
            p[i]=9;
        else if (marks[i]>=70)
            p[i]=8;
        else if (marks[i]>=60)
            p[i]=7;
        else if (marks[i]>=50)
            p[i]=6;
        else if (marks[i]>=40)
            p[i]=5;
        else
            p[i]=0;
    }
    for (int i=0; i<5; i++)
    {
        total = p[i]*credit[i];
    }
    sgpa = total/total_credits;
    return sgpa;
}
public void display_details()
{
    sgpa = compute_sgpa();
    System.out.println("Student
    Details:");
    System.out.println("Student usn :"+usn);
    System.out.println("Student name :"+name);
```

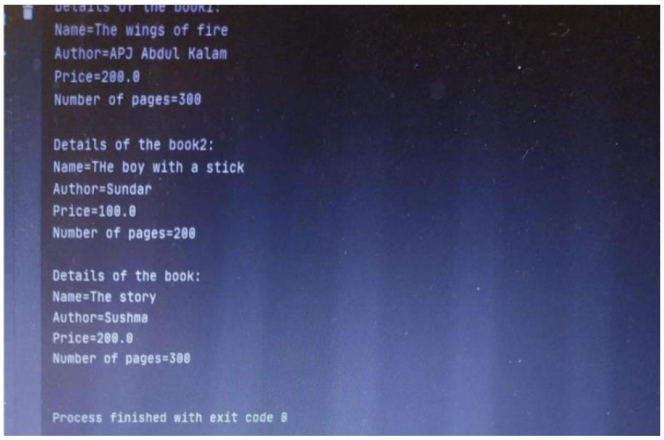
```
    System.out.println("Marks    Credits");
    for (int i=0; i<n; i++)
    {
        System.out.println(marks[i]+"  "+credit[i]);
    }
    System.out.println("Student sgpa :"+sgpa);
}
}
public class lab2{
    public static void main(String args[])
    {
        double[] marks = {100,100,98,100,100};
        int[] credit = {4,4,3,3,4};
        Student s1 = new Student();
        s1.get_details();
        s1.display_details();
        Student s2 = new Student("1BM14CS004","Adithi",marks,
                                 credit);
        s2.display_details();
    }
}
```



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 objects.







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.

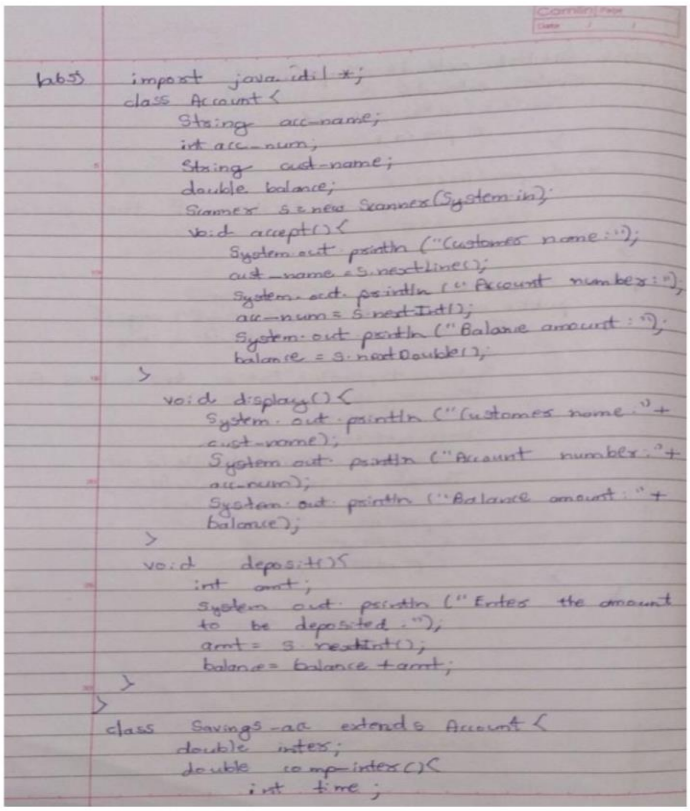
lab4)

```
import java.util.Scanner;
abstract class Shape{
    int a,b;
    Shape(a,b);
    Shape(int a, int b){
        this.a=a;
        this.b=b;
    }
    abstract void printArea();
}
class Rectangle extends Shape{
    Rectangle(int a, int b){
        super(a,b);
    }
    void printArea(){
        System.out.println("Area of the rectangle="
        +(a*b));
    }
}
class Triangle extends Shape{
    Triangle(int a, int b){
        super(a,b);
    }
    void printArea(){
        System.out.println("Area of the triangle
        +(float)(a*b)/2);
    }
}
```

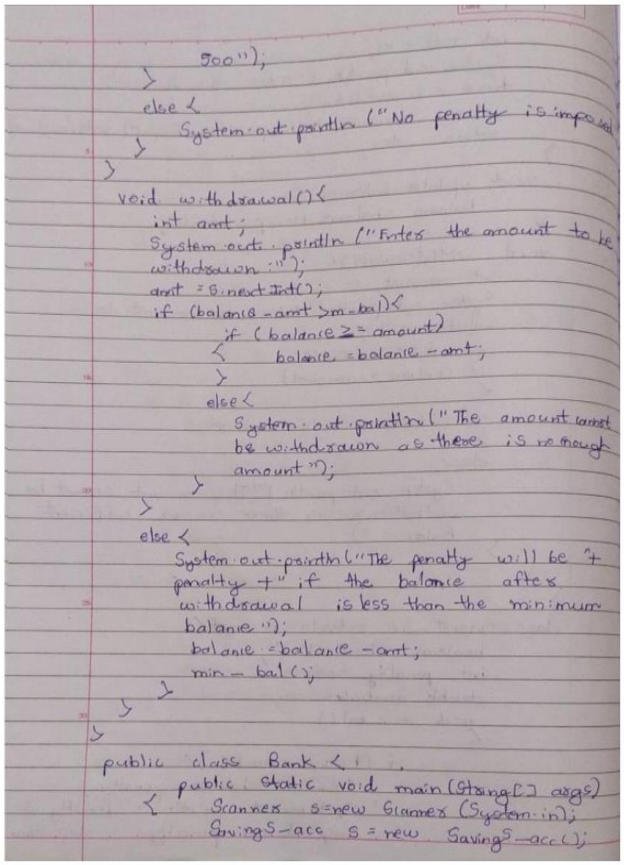
```
class Circle1 extends Shape{
    Circle1(int a, int b){
        super(a,b);
    }
    void printArea(){
        System.out.println("Area of the circle="+
        (3.14*a));
    }
}
public class Week_8_lab_4{
    public static void main(String[] args){
        Scanner s=new Scanner(System.in);
        int a,b;
        System.out.println("Enter the values for
        the integers a and b:");
        a=s.nextInt();
        b=s.nextInt();
        Rectangle x=new Rectangle(a,b);
        Triangle t=new Triangle(a,b);
        Circle1 c=new Circle1(a,b);
        x.printArea();
        t.printArea();
        c.printArea();
    }
}
```

```
"C:\Program Files\Java\jdk1.8.0_261\bin\java.exe" ...
Enter the values for the integers a and b:
4
5
Area of the rectangle=20
Area of the triangle=10.0
Area of the circle=25.12

Process finished with exit code 0
```

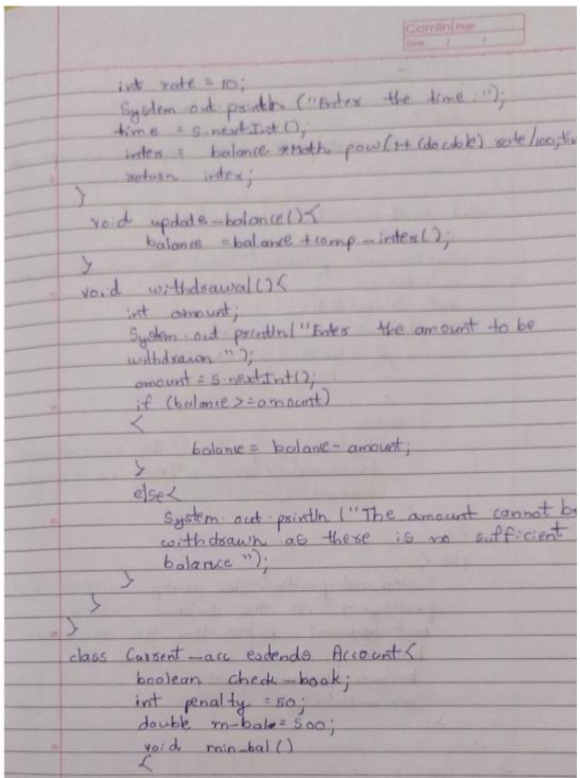
5)Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book 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 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



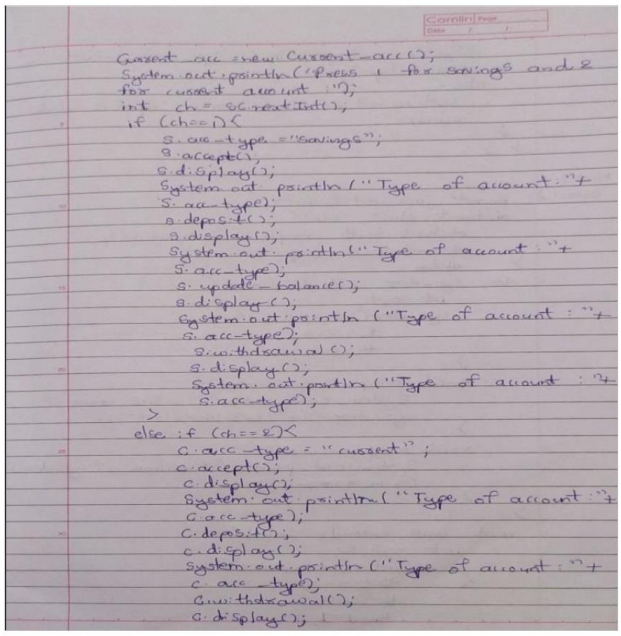
```
lab5
import java.util.*;
class Account{
    String acc_name;
    int acc_num;
    String cust_name;
    double balance;
    Scanner S=new Scanner(System.in);
    void accept(){
        System.out.println("Customer name:");
        cust_name=S.nextLine();
        System.out.println("Account number:");
        acc_num=S.nextInt();
        System.out.println("Balance amount:");
        balance=S.nextDouble();
    }
    void display(){
        System.out.println("Customer name:"+
        cust_name);
        System.out.println("Account number:"+
        acc_num);
        System.out.println("Balance amount:"+
        balance);
    }
    void deposit(){
        int amt;
        System.out.println("Enter the amount
        to be deposited:");
        amt=S.nextInt();
        balance=balance+amt;
    }
}
class Savings_ac extends Account{
    double intes;
    double comp_inter(){
        int time;
```



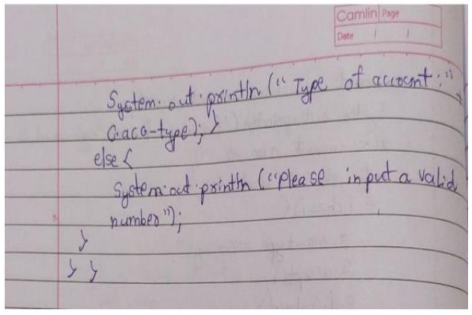
```
        500");
    }
    else{
        System.out.println("No penalty is imposed");
    }
}
void withdrawal(){
    int amt;
    System.out.println("Enter the amount to be
    withdrawn:");
    amt = s.nextInt();
    if (balance - amt >= m-bal){
        if (balance >= amount)
        {
            balance = balance - amt;
        }
        else{
            System.out.println("The amount cannot
            be withdrawn as there is no enough
            amount");
        }
    }
    else{
        System.out.println("The penalty will be "+
        penalty +" if the balance after
        withdrawal is less than the minimum
        balance");
        balance = balance - amt;
        min_bal();
    }
}
public class Bank {
    public static void main(String[] args)
    {   Scanner s=new Scanner(System.in);
        SavingS_acc s = new SavingS_acc();
```



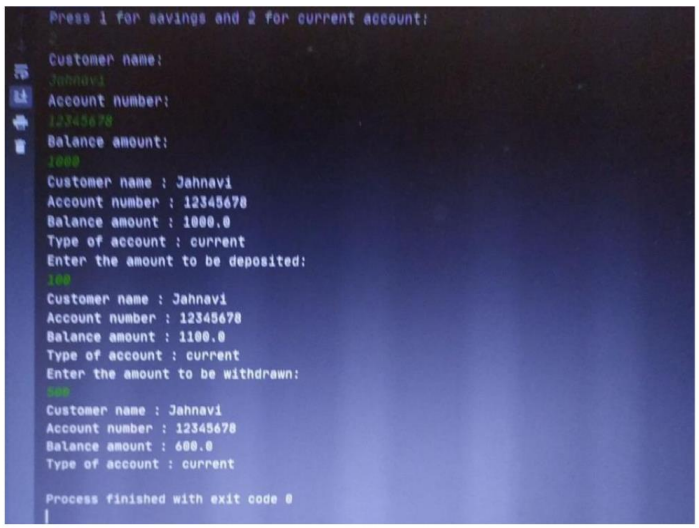
```
    int rate = 10;
    System.out.println("Enter the time:");
    time = s.nextInt();
    inter = balance * Math.pow(1+(double) rate/100,ti
    return inter;
}
void update_balance(){
    balance = balance + comp_inter();
}
void withdrawal(){
    int amount;
    System.out.println("Enter the amount to be
    withdrawn");
    amount = s.nextInt();
    if (balance >= amount)
    {
        balance = balance - amount;
    }
    else{
        System.out.println("The amount cannot be
        withdrawn as there is no sufficient
        balance");
    }
}
}
class Current_acc extends Account{
    boolean check_book;
    int penalty = 50;
    double m-bale = 500;
    void min_bal()
    {
```



```
Current acc = new Current_acc();
System.out.println("Press 1 for savings and 2
for current account :");
int ch = sc.nextInt();
if (ch==1){
    S.acc_type = "Savings";
    S.accept();
    S.display();
    System.out.println("Type of account :"+
    S.acc_type);
    S.deposit();
    S.display();
    System.out.println("Type of account :"+
    S.acc_type);
    S.update_balance();
    S.display();
    System.out.println("Type of account :"+
    S.acc_type);
     S.withdrawal();
    S.display();
    System.out.println("Type of account :"+
     S.acc_type);
  }
else if (ch==2){
    C.acc_type = "current";
    C.accept();
    C.display();
    System.out.println("Type of account :"+
    C.acc_type);
    C.deposit();
    C.display();
    System.out.println("Type of account :"+
    C.acc_type);
    C.withdrawal();
    C.display();
```

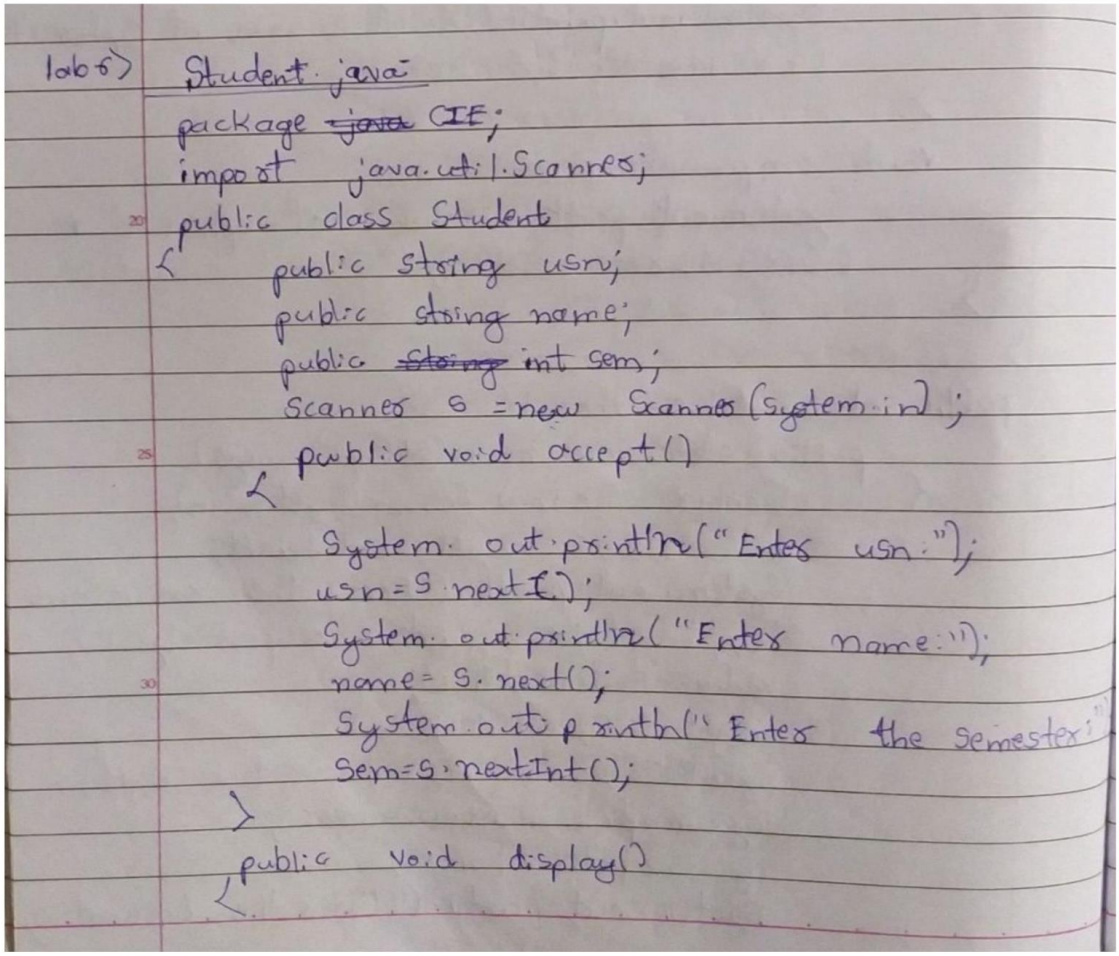


```
System.out.println("Type of account:"
C.acc_type);}
else{
System.out.println("please input a valid
number");
}
}}
```



```
Press 1 for savings and 2 for current account:
2
Customer name:
Jahnavi
Account number:
12345678
Balance amount:
1000
Customer name : Jahnavi
Account number : 12345678
Balance amount : 1000.0
Type of account : current
Enter the amount to be deposited:
100
Customer name : Jahnavi
Account number : 12345678
Balance amount : 1100.0
Type of account : current
Enter the amount to be withdrawn:
500
Customer name : Jahnavi
Account number : 12345678
Balance amount : 600.0
Type of account : current

Process finished with exit code 0
```

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.



lab 6) Student.java

```
package CIE;
import java.util.Scanner;
public class Student
{
    public string usn;
    public string name;
    public int sem;
    Scanner s = new Scanner(System.in);
    public void accept()
    {
        System.out.println("Enter usn:");
        usn=s.next();
        System.out.println("Enter name:");
        name= s.next();
        System.out.println("Enter the semester:");
        sem=s.nextInt();
    }
    public void display()
    {
```

```
        System.out.println("Usn :" +usn);
        System.out.println("Name :" +name);
        System.out.println("Semester :" +sem);
    }
}
```

Internals.java-

```
package CIE;
import java.util.Scanner;
public class Internals extends Student
{
    Scanner s=new Scanner(System.in);
    public int[] cie_marks = new int[5];
    public int i;
    public void accept_cies()
    {
        System.out.println("Enter the cie marks for five subjects");
        for(i=0;i<5;i++)
        {
            cie_marks[i]=s.nextInt();
        }
    }
}
```

External.java-

```
package SEE;
import CIE.*;
import java.util.Scanner;
public class External extends CIE.Student
{
    public int[] see_marks = new int[5];
    public int i;
    Scanner S=new Scanner(System.in);
    public void accept_see()
    {
        System.out.println("Enter the see marks for five subjects:");
        for(i=0;i<5;i++)
```

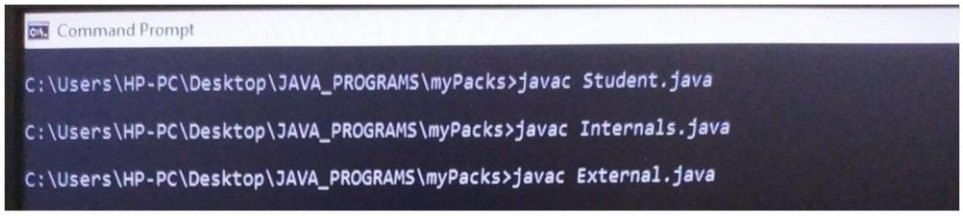
```
        {   see_marks[i] = s.nextInt();
        }
    }
}
```

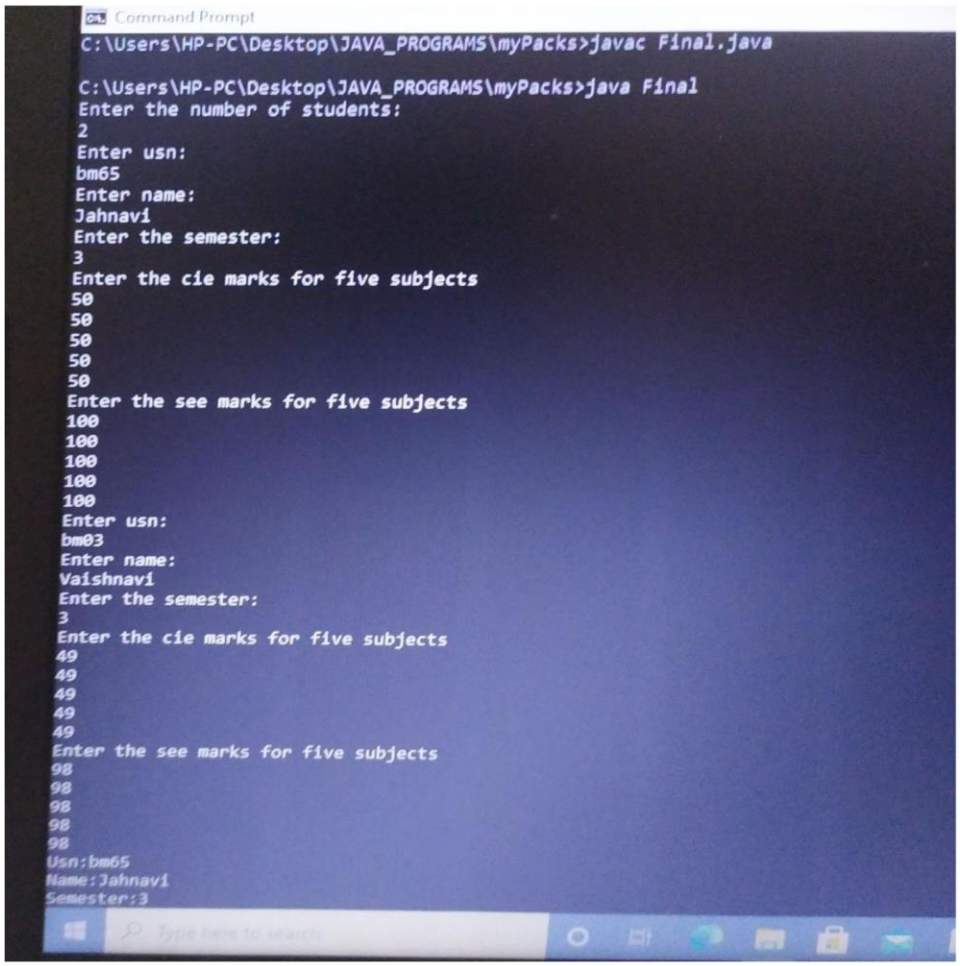
Final.java -

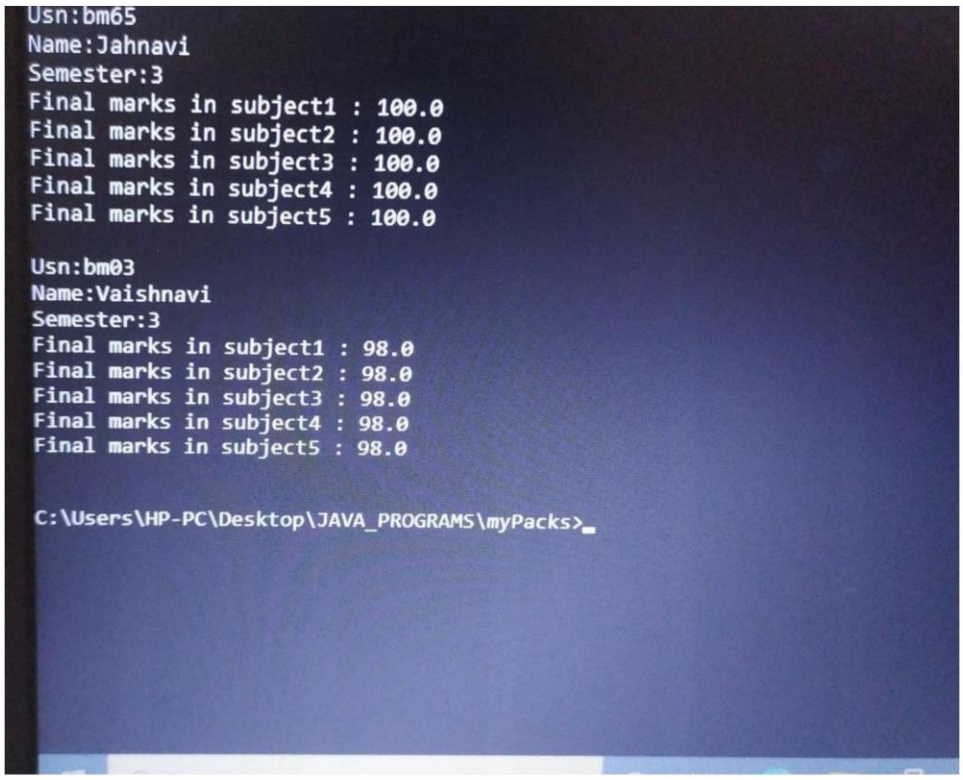
```
import CIE.*;
import SEE.*;
import java.util.Scanner;
public class Final
{
    public static void main(String[] args)
    {   Scanner s = new Scanner(System.in);
        int i,j;
        System.out.println("Enter the number of
        students:");
        n = s.nextInt();
        CIE.Internals[] in = new CIE.Internals[n];
        SEE.~~Ext~~External[] ex = new SEE.External[n];
        for (i=0; i<n;i++)
        {
            in[i] = new CIE.Internals();
            ex[i] = new SEE.External();
            in[i].accept();
            in[i].accept_cie();
            ex[i].accept_see();
        }

        for (i=0;i<n;i++)
        {
            in[i].display();
            for (j=0;j<5;j++)
            {   System.out.println("Final marks in
                Subject "+(j+1)+" : "+(in[i].cie_
                marks[j]+(ex[i].see_marks[j])/2.0
            }System.out.println();
    }}}
```

→ Procedure-

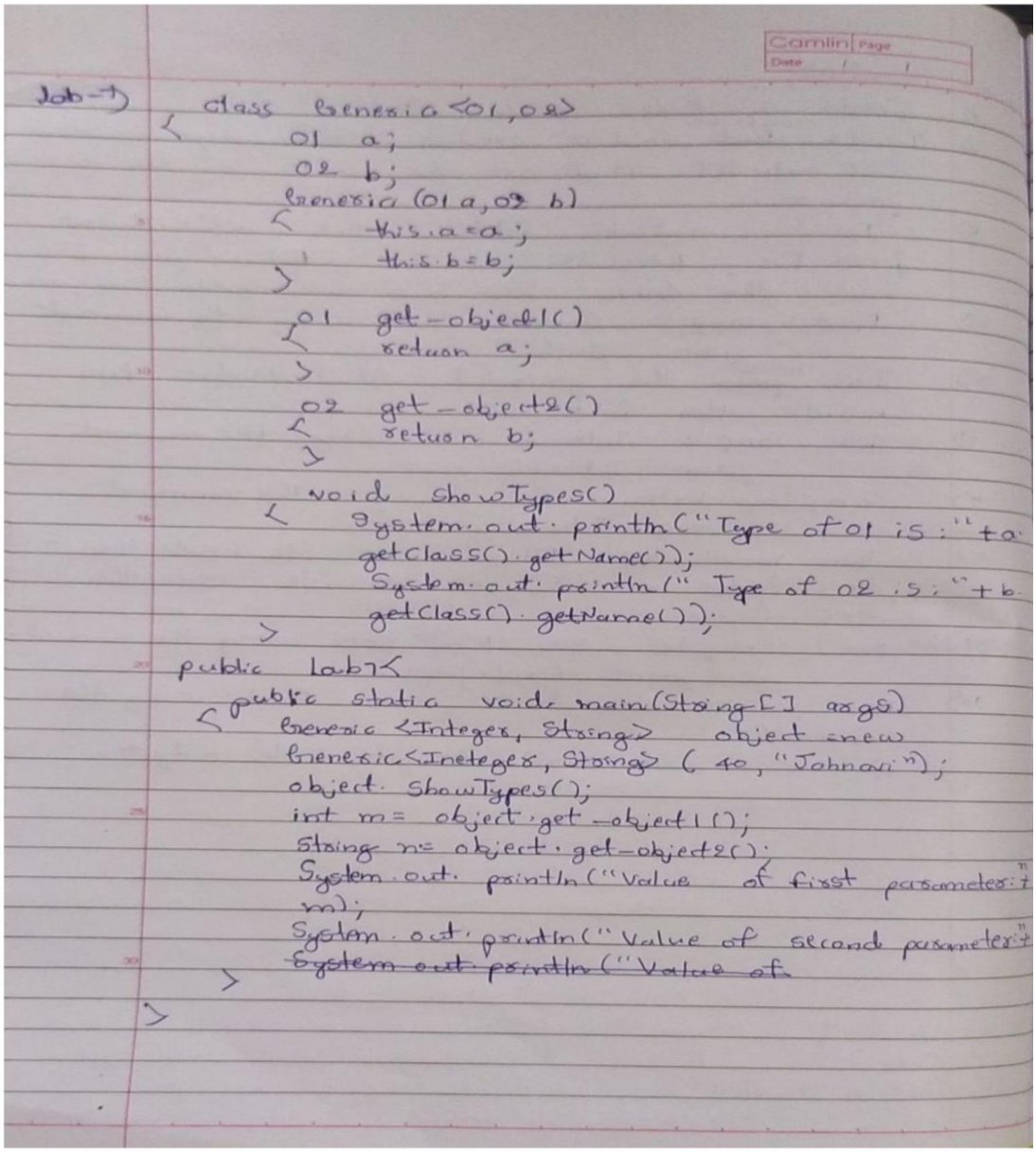
1) Create a folder named myPacks
2) Inside myPacks folder create another two folders CIE and SEE which are the names of the two packages.
3) Inside myPacks folder save the Student.java file, Internals.java file, External.java file and the drive class in a file named Final.java
4) First compile Student class using the command-
   javac Student.java
5) Then move the generated Student.class file inside the folder CIE.
6) Then compile Internals class using the command-
   javac Internals.java
7) Compile External file using the command-
   javac External.java
8) Then move the Internals.class file inside the CIE folder and External.class file inside the SEE folder.
9) Now, compile the Final class using the command
   javac Final.java.
10) Now, run the drive class Final using the command-
   java Final to get the output.


Command Prompt
C:\Users\HP-PC\Desktop\JAVA_PROGRAMS\myPacks>javac Student.java
C:\Users\HP-PC\Desktop\JAVA_PROGRAMS\myPacks>javac Internals.java
C:\Users\HP-PC\Desktop\JAVA_PROGRAMS\myPacks>javac External.java

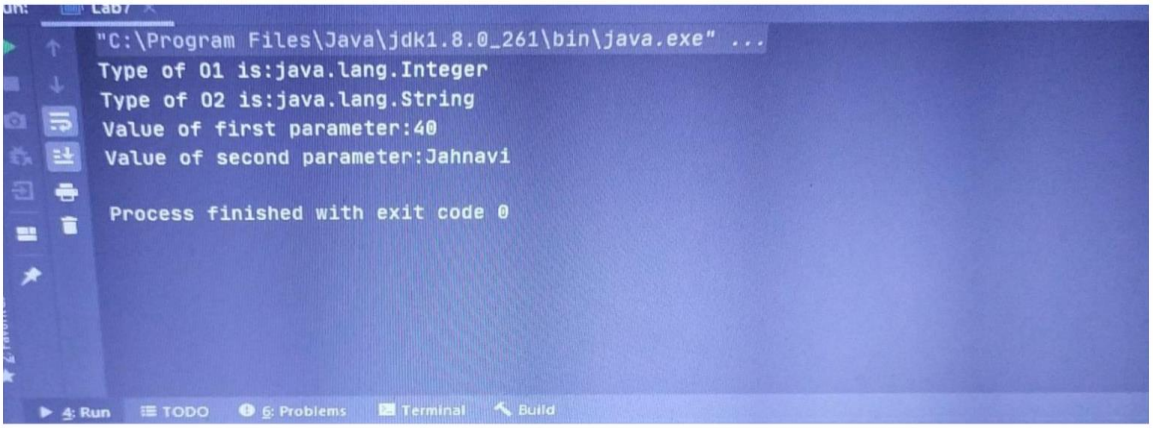

Command Prompt
C:\Users\HP-PC\Desktop\JAVA_PROGRAMS\myPacks>javac Final.java
C:\Users\HP-PC\Desktop\JAVA_PROGRAMS\myPacks>java Final
Enter the number of students:
2
Enter usn:
bm65
Enter name:
Jahnavi
Enter the semester:
3
Enter the cie marks for five subjects
50
50
50
50
50
Enter the see marks for five subjects
100
100
100
100
100
Enter usn:
bm03
Enter name:
Vaishnavi
Enter the semester:
3
Enter the cie marks for five subjects
49
49
49
49
49
Enter the see marks for five subjects
98
98
98
98
98
Usn:bm65
Name:Jahnavi
Semester:3
Type here to search


Usn:bm65
Name:Jahnavi
Semester:3
Final marks in subject1 : 100.0
Final marks in subject2 : 100.0
Final marks in subject3 : 100.0
Final marks in subject4 : 100.0
Final marks in subject5 : 100.0
Usn:bm03
Name:Vaishnavi
Semester:3
Final marks in subject1 : 98.0
Final marks in subject2 : 98.0
Final marks in subject3 : 98.0
Final marks in subject4 : 98.0
Final marks in subject5 : 98.0
C:\Users\HP-PC\Desktop\JAVA_PROGRAMS\myPacks>

7) Write a program to demonstrate generics with multiple object parameters.



```
Lab-7)  class Generic<O1,O2>
        {
            O1 a;
            O2 b;
            Generic(O1 a,O2 b)
            {
                this.a=a;
                this.b=b;
            }
            O1 get-object1()
            {
                return a;
            }
            O2 get-object2()
            {
                return b;
            }
            void showTypes()
            {
                System.out.println("Type of O1 is:"+a.
                getClass().getName());
                System.out.println("Type of O2 is:"+b.
                getClass().getName());
            }
        public Lab7{
            pubic static void main(String[] args)
            {
                Generic<Integer, String> object=new
                Generic<Ineteger, String>(40,"Jahnavi");
                object.showTypes();
                int m= object.get-object1();
                String n= object.get-object2();
                System.out.println("Value of first parameter:"+
                m);
                System.out.println("Value of second parameter:"+
                System.out.println("Value of
            }
        }
```

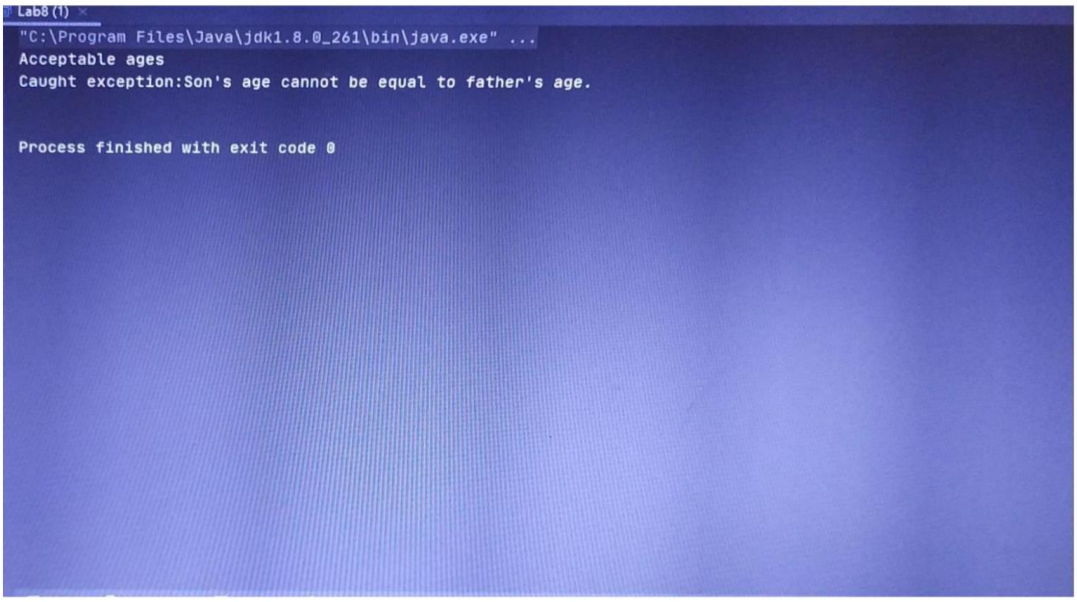


8) Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called “Father” and derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception Wrong Age( ) when the input age=father’s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

Lab-8)

```
class WrongAge extends Exception
{
    public String toString()
    {
        return "Son's age cannot be equal to
        father's age.\n";
    }
}
class Father {
    int fatherAge;
    Father(int fatherAge)
    {   this.fatherAge = fatherAge;
    }
}
class Son extends Father
{
    int sonAge;
    Son(int fatherAge, int sonAge)
    {       super(fatherAge);
            this.sonAge = sonAge;
    }
    void checkAge() throws WrongAge{
        if (fatherAge == sonAge)
        {   throw new WrongeAg();
        }
    }
}
public class Lab8 {
    public static void main(String[] args)
    {   Son s1 = new Son(40,10);
        Son s2 = new Son (30, 30);
        try{
            s1.checkAge();
            System.out.println("Acceptable ages.");
        }
        catch(WrongAge w){
            System.out.println("Caught exception:"
            w);
        }
```

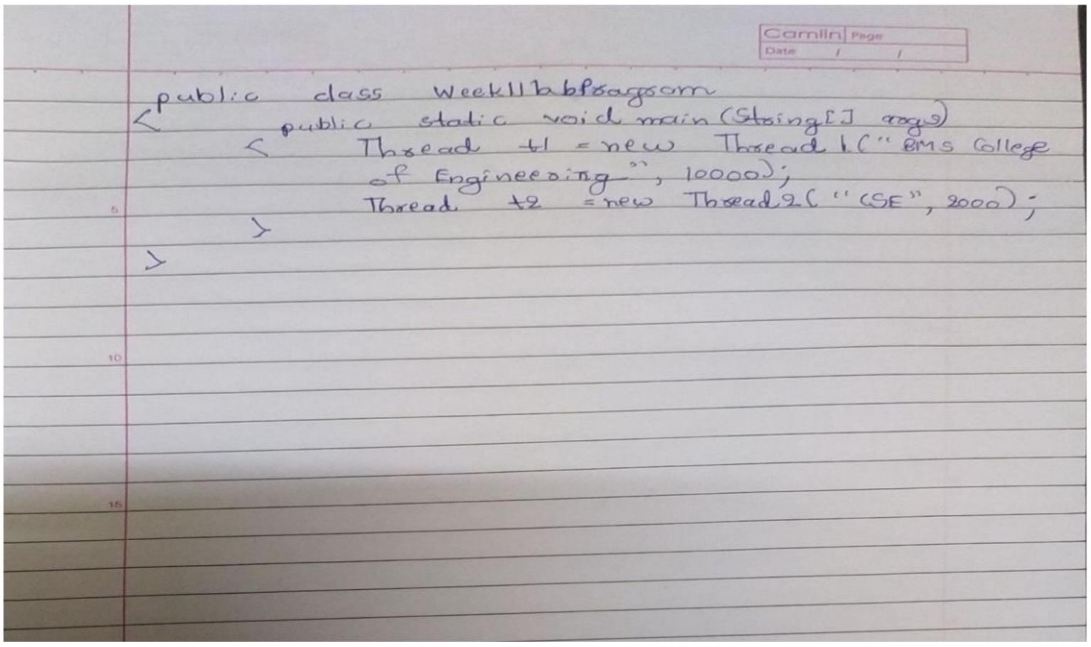
```
try {
    S2.checkAge();
    System.out.println("Acceptable age");
}
catch(WrongAge w)
{   System.out.println("Caught exception:"+
    w);
}
}
}
```



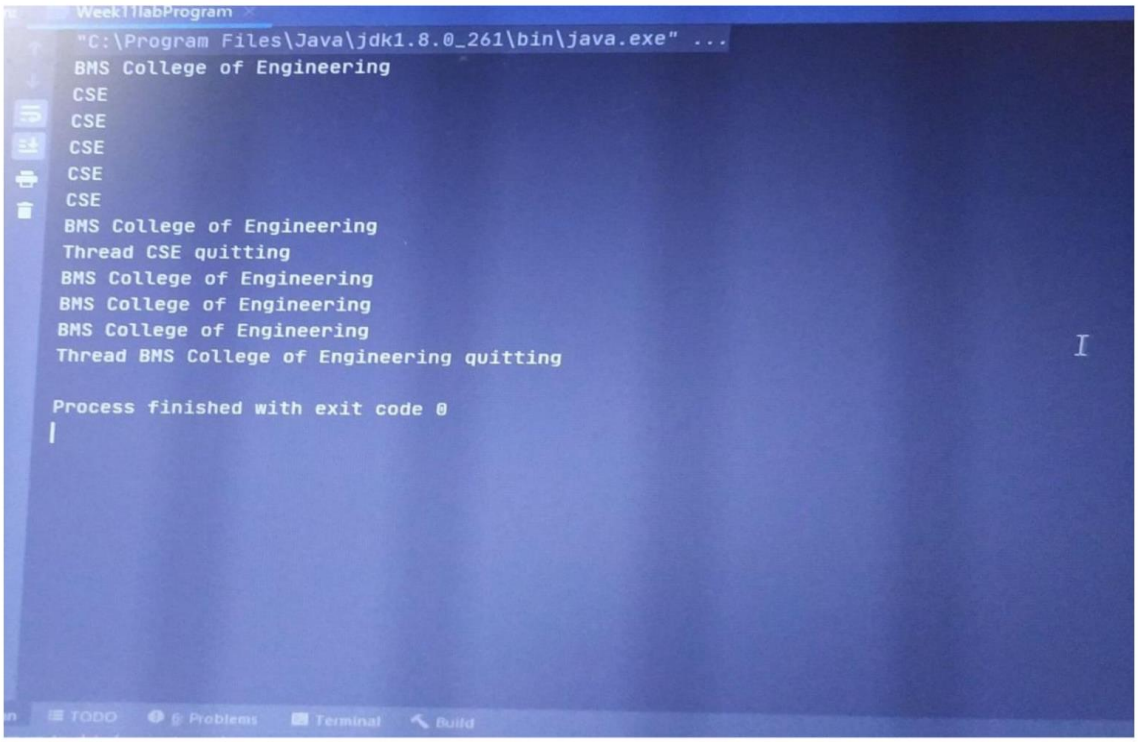
9) Write a program which creates two threads, one thread displaying “BMS College of Engineering” once every ten seconds and another displaying “CSE” once every two seconds.

Lab Program 8

```
class Thread1 implements Runnable
{
    Thread t;
    String name;
    int time;
    Thread1 (String name, int time)
    {
        this.name = name;
        this.time = time;
        t = new Thread (this, name);
        t.start();
    }
    public void run()
    {
        try
        {
            for (int n=5; n>0; n--)
            {
                System.out.println (name);
                Thread.sleep (time);
            }
        }
        catch (InterruptedException ie)
        {
            System.out.println ("Thread " + name +
                " got interrupted ");
        }
        System.out.println ("Thread " + name +
            " quitting");
    }
}
```



```
public class Week11bbProagram
{
    public static void main(String[] args)
    {
        Thread t1 = new Thread1("BMS College
        of Engineering", 10000);
        Thread t2 = new Thread2("CSE", 2000);
    }
}
```



10) 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 program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

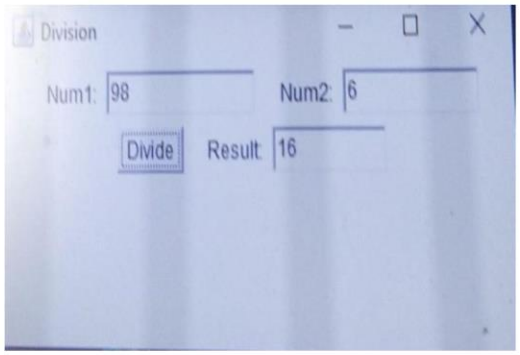
Lab-10

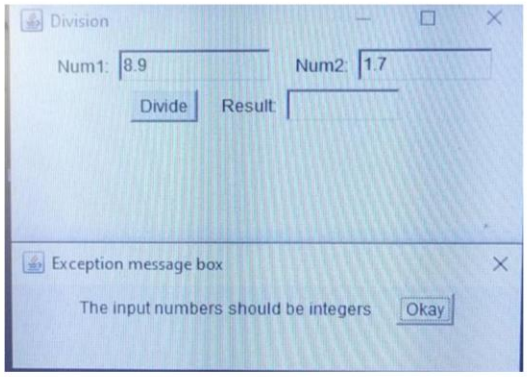
```
import java.awt.*;
import java.awt.event.*;
class DialogBox extends Dialog implements
ActionListener
{
    lab10a updated l;
    DialogBox(Frame parent, String title)
    {
        super(parent, title, false);
        l = (lab10a_updated) parent;
        setLayout(new FlowLayout());
        setSize(380,100);
        add(new Label(l.msg));
        Button b = new Button("Okay");
        add(b);
        b.addActionListener(this);
    }
    public void actionPerformed(ActionEvent ae)
    {
        dispose();
    }
}
public class lab10a_updated extends Frame
implements ActionListener
{
    TextField num1, num2, res;
    String num3;
```

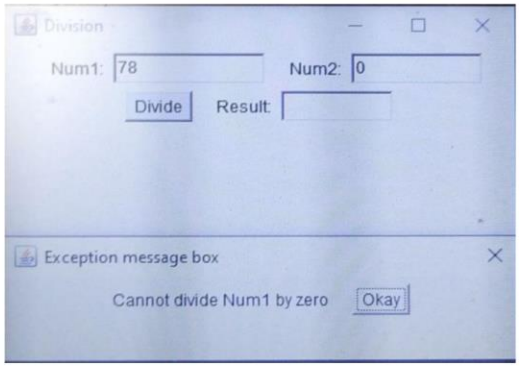
```
Button div;
String msg="";
public labio-updated()
{
    setLayout(new FlowLayout());
    num1 = new TextField(12);
    num2 = new TextField(10);
    res  = new TextField(8);
    Label number1 = new Label("Num1:",
    Label.RIGHT);
    Label number2 = new Label("Num2:",
    Label.RIGHT);
    LABEL
    Label result = new Label("Result:",
    Label.RIGHT);
    div = new Button("Divide");
    add(number1);
    add(num1);
    add(number2);
    add(num2);
    add(div);
    add(result);
    add(res);
    num1.addActionListener(this);
    num2.addActionListener(this);
    div.addActionListener(this);
    res.addActionListener(this);
    addWindowListener(new WindowAdapter
    {
        public void windowClosing(WindowEv
        actionPerformed
        {
            System.exit(0);
        }
    });
}
```

```
public void actionPerformed (ActionEvent ae)
{
    String s = ae.getActionCommand();
    if (s.equals("Divide"))
    {
        res.setText(divide());
    }
}
String divide()
{
    int n;
    int n1, n2;
    try
    {
        n1 = Integer.parseInt(num1.getText());
        n2 = Integer.parseInt(num2.getText());
        try
        {
            n = n1/n2;
            num3 = String.valueOf(n);
            return num3;
        }
        catch (ArithmeticException e)
        {
            msg = "Cannot divide Num1 by zero";
            DialogBox d = new DialogBox
            (this, "Exception message box");
            d.setVisible(true);
            return "";
        }
    }
    Catch (NumberFormatException nf)
    {
        msg = "The input numbers should be
        integers";
```

```
        DialogBox d = new DialogBox (this,
        "Exception message box");
        d.setVisible(true);
        return "";
    }
}

public static void main(String[] args)
{
    lab10_updated appwin = new lab10_updated();
    appwin.setSize(new Dimension(380, 180));
    appwin.setTitle("Division");
    appwin.setVisible(true);
}
}
```


Division
Num1: 98
Num2: 6
Divide
Result: 16


Division
Num1: 8.9
Num2: 1.7
Divide
Result:
Exception message box
The input numbers should be integers
Okay


Division
Num1: 78
Num2: 0
Divide
Result:
Exception message box
Cannot divide Num1 by zero
Okay