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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 discriminant b^2-4ac is negative, display a message stating that there are no real solutions.

Code:

```
import java.util.Scanner;  
class Quadratic  
{  
    double a, b, c, d, r1, r2;  
    void calculate()  
    {  
        d = b * b - 4 * a * c;  
        if (d > 0)  
        {  
            System.out.println("Roots are real and distinct.");  
            r1 = (-b + Math.sqrt(d)) / (2 * a);  
            r2 = (-b - Math.sqrt(d)) / (2 * a);  
            System.out.println("Root1 = " + r1 + " and Root2 = " + r2);  
        }  
        else if (d == 0)  
        {  
            System.out.println("Roots are real and equal.");  
            r1 = -b / (2 * a);  
            System.out.println("Root1 = Root2 = " + r1);  
        }  
        else  
            System.out.println("Roots are imaginary.");  
    }  
}
```

class MainRun

{

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

```
Scanner s = new Scanner (System.in);
```

```
Quadratic obj = new Quadratic();
```

```
System.out.println ("Enter the value of a");
```

```
obj.a = s.nextDouble();
```

```
System.out.println ("Enter the value of b");
```

```
obj.b = s.nextDouble();
```

```
System.out.println ("Enter the value of c");
```

```
obj.c = s.nextDouble();
```

```
obj.calculate();
```

}

}

Output:

enter the value of a

2

enter the value of a

1

enter the value of b

3

enter the value of b

-4

enter the value of c

Roots are imaginary

enter the value of c

Roots are real and equal

Root 1 = Root 2 = 2

Program 2

Write a Java program to create a class Student with members USN, name, marks (6 subjects). Include methods to calculate the percentage and display appropriate details. (Array of student object to be created).

Code:

```
import java.util.Scanner;
class Student
{
    int usn, i;
    String name = new String();
    double marks[] = new double[6];
    double sum = 0, per;
    void studentDetails()
    {
        System.out.println("Enter student details");
        Scanner sst = new Scanner(System.in);
        System.out.println("Enter student usn");
        usn = sst.nextInt();
        System.out.println("Enter student name");
        name = sst.next();
        System.out.println("Enter student marks");
        for (i=0; i<6; i++)
        {
            marks[i] = sst.nextInt();
        }
    }
    void display()
    {
        System.out.println("Student name " + name);
    }
}
```

```
System.out.println("USN"+usn);
System.out.println("Student marks");
for (i=0; i<6; i++)
{
    sum = sum + marks[i];
    per = sum / 120 * 100;
    System.out.println(marks[i]+":");
}
per = sum / 120 * 100;
System.out.println("Percentage"+per);
sum = 0;
```

}

class Run

```
{
```

```
public static void main (String args[])
{
    Scanner ss2 = new Scanner (System.in);
    System.out.print ("Enter total number of students");
    int n = ss2.nextInt();
    Student s1[] = new Student [n];
    for (int i=0; i<n; i++)
    {
        s1[i] = new Student ();
        s1[i].studentDetails();
    }
    System.out.println (n+" student details:");
    for (int i=0; i<n; i++)
        s1[i].display();
}
```

}

Output:

enter total number of students

3

enter student details

enter student usn

1

enter student name

Ram

enter student marks

20

19

16

20

15

19

enter student details

enter student usn

enter student name

Ragini

enter student marks

20

13

19

16

18

11

enter student details

enter student usn

3

enter student name

Rakesh

enter student marks

13

20

20

20

19

18

student details:

Student name Ram

USN1

Student marks

20.0 19.0 16.0 20.0 15.0 19.0

Percentage = 90.8333333 Student name Ravi

USN2

Student marks

20.0 13.0 14.0 16.0 18.0 11.0

Percentage = 76.6666667 Student name Rakesh

USN3

Student marks

13.0 20.0 20.0 20.0 19.0 18.0

Percentage = 91.6666667

Program 3

Create a class Book that contains four members: name, author, price and 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 3 book objects.

Code:

```
import java.util.Scanner;
class Books
{
    String name, author;
    int price, 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 Main

{

public static void main (String args[])

{

Scanner s = new Scanner (System.in);

int n, price, numpages, i;

String author, name;

System.out.println ("enter the numbers of books").

n = s.nextInt();

Books b[] = new Books[n];

for (i=0; i < n; i++)

System.out.println ("Book" + (i+1) + ":");

System.out.print ("enter the name of the book:");

name = s.next();

System.out.print ("enter the author of the book:");

author = s.next();

System.out.print ("enter price of the book:");

price = s.nextInt();

System.out.print ("enter number of pages of the book");

numpages = s.nextInt();

b[i] = new Books(name, author, price, numpage);

}

for (i=0; i < n; i++)

{

System.out.println ("Book" + (i+1) + ":" + n + b[i]);

}

}

Output:

enter the number of books

2

Book 1:

enter the name of the book: Jungle-Book

enter the author of the book: Rudyard-Kipling

enter price of the book: 1000

enter number of pages of the book: 500

Book 2:

enter the name of the book: Tales-of-Akbar-and-Birbal

enter the author of the book: Birbal

enter price of the book: 900

enter number of pages of the book: 400

Book 1:

Book name: Jungle-Book

Author name: Rudyard-Kipling

Price: 1000

number of pages: 500

Book 2:

Book name: Tales-of-Akbar-and-Birbal

Author name: Birbal

Price: 900

number of pages: 400

Drop
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Program 9

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

Code:

```
import java.util.*;  
import java.lang.*;  
abstract class Shape  
{  
    int x,y;  
    abstract void printarea (double x, double y);  
}  
  
class Rectangle extends Shape  
{  
    void printarea (double x, double y)  
    {  
        System.out.println ("area of rectangle is :" + (x*y));  
    }  
}  
  
class Triangle extends Shape  
{  
    void printarea (double x, double y)  
    {  
        System.out.println ("area of triangle is :" + (0.5*x*y));  
    }  
}
```

```
class Circle extends Shape
```

{

```
void printarea (double x, double y)
```

{

```
System.out.println ("area of circle is :" + (3.14*x*x))
```

{

{

```
public class Abstract
```

{

```
public static void main (String args [] )
```

{

```
Scanner s = new Scanner (System.in);
```

```
int ch, x, y;
```

```
System.out.println ("Enter 1 for rectangle, 2 for triangle, 3 for circle");
```

```
System.out.println ("Enter your choice");
```

```
ch = s.nextInt();
```

```
System.out.println ("Enter the value of x:");
```

```
x = s.nextInt();
```

```
System.out.println ("Enter the value of y: ");
```

```
y = s.nextInt();
```

```
Rectangle r = new Rectangle();
```

```
Triangle t = new Triangle();
```

```
Circle c = new Circle();
```

```
switch (ch)
```

{

case 1:

~~r.printarea (x, y);~~

~~break;~~

case 2:

~~t.printarea (x, y);~~

~~break;~~

case 3:

```
e.printarea(x,y);  
break;  
default:  
System.out.println("wrong choice");  
}  
}  
}  
}
```

Output:

enter 1 for rectangle , 2 for triangle , 3 for circle

enter your choice

1

Enter ^{the} value of x:

2

enter the value of y:

3

area of rectangle is: 6.0

Program 5

Code:

```
import java.util.*;  
class Account  
{  
    public static int min = 500;  
    string name;  
    int Account-num;  
    public float o-Price;  
    Scanner sc = new Scanner (System.in);  
    public void get-info()  
{  
        System.out.println ("Enter Name:");  
        name = sc.nextLine();  
        System.out.println ("Enter Account Number:");  
        Account-num = sc.nextInt();  
        System.out.println ("Enter opening Amount must be > 500:");  
        o-Price = sc.nextFloat();  
    }  
    public void show()  
{  
        System.out.print ("Name: " + name);  
        System.out.print (" Account number: " + Account-num);  
        System.out.print (" Amount: " + o-Price);  
    }  
}  
class Current extends Account  
{  
    float deposit, withdraw;  
    public void deposit()  
    {  
        System.out.println ("Enter Amount to deposit");  
    }
```

deposit = sc.nextFloat();

show();

o_Price = o_Price + deposit;

System.out.println ("Total Amount is : " + o_Price);

}

public void check_Bal()

{

if (o_Price < 500)

{

System.out.println ("Amount should be > 500").

o_Price = o_Price + 150;

System.out.println ("You have debited amount 150 from your account as penalty account balance is : " + o_Price);

}

}

public void withdraw_Bal()

{

System.out.println ("Enter Amount to withdraw").

withdraw = sc.nextFloat();

show();

if (o_Price < 500)

{

System.out.println ("For withdrawal Balance must > 500 rupees");

}

if (withdraw < o_Price)

{

o_Price = o_Price - withdraw;

System.out.println ("After withdrawal Balance " + o_Price);

}

else

{

System.out.println ("After ~~Insufficient~~ Balance cannot be less than ₹ 0").

}

check_Bal():

{

class Saving extends Account

{

float deposit, withdraw, intr;

public void deposit()

{

System.out.println ("Enter Amount to deposit");

deposit = sc.nextFloat();

show();

o_Price = o_Price + deposit;

System.out.println ("Total Amount is : " + o_Price);

}

public void check_interest()

{

intr = (o_Price * 2) / 100;

o_Price = o_Price + intr;

System.out.println ("Total Amount with interest is : ");

+ o_Price);

}

public void withdraw_Bal()

{

System.out.println ("Enter Amount to withdraw : ");

withdraw = sc.nextFloat();

show();

if (withdraw < o_Price)

{

o_Price = o_Price - withdraw;

System.out.println ("After withdraw Balance : " + o_Price);

}

else

{

System.out.println ("Insufficient Balance");

}

public class Accountnum

{

 static String ch;

 public static void main (String[] args)

{

 int count=0;

 Scanner sc = new Scanner (System.in);

 Current cu = new Current();

 Saving sa = new Saving();

 System.out.println ("Choose Account type:");

 System.out.println ("Press C for Current Account");

 System.out.println ("Press S for Saving Account");

 ch = sc.nextLine();

 if (ch.equalsIgnoreCase ("C"))

{

 cu.get_info();

 cu.check_Bal();

 while (count != 4)

{

 System.out.println ("1. Display\n2. Deposit\n3. Withdraw\n4. Exit");

 System.out.println ("Enter Your choice");

 int cho = sc.nextInt();

 switch (cho)

{

 case 1:

 cu.show();

 break;

 case 2:

 cu.deposit();

 break;

 case 3:

 cu.withdraw_Bal();

 break;

case 1:

System.exit(0);

break;

default:

System.out.println("Wrong choice!");

}

}

y

else if (ch.equalsIgnoreCase("8"))

{

Sav.getInfo();

while (count != 5)

{

System.out.println("1. Display \n 2. Deposit \n 3. Withdraw
4. Interest \n 5. Exit");

System.out.println("Enter your choice");

int cho = sc.nextInt();

switch (cho)

{

case 1:

Sav.show();

break;

case 2:

Sav.deposit();

break;

case 3:

Sav.withdrawBal();

break;

case 4:

Sav.checkInterest();

break;

case 5:

System.exit(0);

break;

default:

System.out.println ("Wrong choice!");

}

}

}

else

{

System.out.println ("Wrong choice!");

}

}

}

Output:

Choose Account type:

Press c for Current Account:

Press s for Saving Account:

c

Enter Name:

vagisha

Enter Account Number:

12345

Enter opening Account must be > 500:

600

1. Display
2. Deposit
3. Withdraw
4. Exit

Enter your choice

1

Name: vagisha

Account-number: 12345

Amount: 600.0

1. Display

2. deposit

3. Withdraw

4. Exit

Enter your choice

2

Enter Amount to deposit

500

1. Display

2 Deposit

3. Withdraw

4. Exit.

Enter your choice

4

Name: vagisha

Account-number: 12345

Amount: 600.0

Total Amount is: 1100.0

1. Display

2. deposit

3. withdraw

4. Exit

Enter your choice

1

Name: vagisha

Account-number: 12345

Amount: 1100.0

1. Display

2. deposit

3. withdraw

4. Exit

Enter Your choice

3

Enter Amount to withdraw

200

Name: vagisha

Account-number: 12345

Amount: 1100.0

After Withdraw Balance 900.0

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Program 6

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 SEB which has the class External which is a derived class of student. This class has an array that stores the SEB marks scored in five courses of the current semester of the student. Import the two packages in file that declares the final marks of n students in all five courses.

Code:

Student.java:

```
package CIE;  
public class Student {  
    public String usn, name;  
    public int sem;  
    public Student (String usn, String name, int sem)  
    {
```

this.usn = usn;

this.name = name;

this.sem = sem;

}

}

Internals.java:

```
package CIE;  
public class Internals extends Student {  
    public int m[ ] = new int [5];
```

public Internals (String usn, String name, int sem,
 int [] m)

{
 super (usn, name, sem);
 this . m = m;

}

Externals.java :

```
package SSB;
import CIE.Student;
public class Externals extends Student
{ public int sm [] = new int [5];
  public Externals (String usn, String name, int sem,
  int [ ] sm)
{ super (usn, name, sem);
  this . sm = sm;
```

}

Main.java :

```
import java.util.*;
import CIE.Student;
import CIE.Internals;
import SSB.*;
public class Main {
  public static void main (String args[])
  { int fm=0;
    Scanner in = new Scanner (System.in);
    System.out.println ("Enter number of students : ");
    int n = in.nextInt();
    Internals [ ] im = new Internals [n];
    Externals [ ] em = new Externals [n];
```

```

Student stu = new Student [2];
for (int i=0; i<n; i++)
{
    System.out.println ("Enter details of Student " + (i+1) + ":");
    System.out.println ("Enter name: ");
    in.nextLine();
    String name = in.nextLine();
    System.out.println ("Enter USN: ");
    String usn = in.nextLine();
    System.out.println ("Enter Semester: ");
    int sem = in.nextInt();
    int imarks[] = new int [5];
    int emarks[] = new int [5];
    System.out.println ("Enter Marks details:");
    for (int j=0; j<5; j++)
    {
        System.out.println ("Enter internal marks for course " +
                           (j+1) + ": ");
        imarks[j] = in.nextInt();
    }
    System.out.println ("Enter external marks for course " +
                           (j+1) + ": ");
    emarks[j] = in.nextInt();
}
stu[i] = new Student (usn, name, sem);
im[i] = new Internals (usn, name, sem, imarks);
em[i] = new Externals (usn, name, sem, emarks);
System.out.println ("Final marks details:");
for (int i=0; i<n; i++)
{
    System.out.println ("Student " + (i+1) + ":");
    System.out.println ("Name: " + stu[i].name);
    System.out.println ("USN: " + stu[i].usn);
    System.out.println ("Sem: " + stu[i].sem);
}

```

```
for (int j = 0; j < 5; j++)
```

$$fm = im[i].mij + em[i].smj.$$

System.out.println ("Final marks of course " + (j+1) +
" : " + fm);

$fm = 0;$

}

System.out.println();

}

}

Output:

Enter number of Students : 2

Enter details for Student 1 :

Enter Name : Vaishika

Enter USN : 4567

Enter Semester : 3

Enter Marks details :

Enter internal marks for course 1 : 34

Enter external marks for course 1 : 98

Enter internal marks for course 2 : 39

Enter external marks for course 2 : 97

Enter internal marks for course 3 : 33

Enter external marks for course 3 : 56

Enter internal marks for course 4 : 33

Enter external marks for course 4 : 64

Enter internal marks for course 5 : 40

Enter external marks for course 5 : 90

Enter details for Student 2 :

Enter Name : Monjil

Enter USN : 4789

Enter Semester : 3

Enter Marks Details:

Enter internal marks for course 1 : 90

Enter external marks for course 1 : 60

Enter internal marks for course 2 : 33

Enter internal marks for course 2 : 66

Enter external marks for course 3 : 94

Enter internal marks for course 3 : 87

Enter external marks for course 4 : 32

Enter internal marks for course 4 : 77

Enter external marks for course 5 : 35

Enter internal marks for course 5 : 45

Final Marks Details:

Student 1:

Name : Vaishika

USN : 4567

Sem : 3

Final marks of course 1 : 132

Final marks of course 2 : 136

Final marks of course 3 : 89

Final marks of course 4 : 97

Final marks of course 5 : 130

Student 2:

Name : Maijil

USN : 4789

Sem : 3

Final marks of course 1 : 100

Final marks of course 2 : 99

Final marks of course 3 : 121

Final marks of course 4 : 109

Final marks of course 5 : 80

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Program 7

WAP 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 takes both father and son's age and throws an exception if son's age is \geq father's age.

Code:

```
import java.util.*;  
class WrongAge extends Exception {  
    public WrongAge() {  
        super("invalid age provided");  
    }  
  
    class Father {  
        int fage;  
        public Father(int fage) throws WrongAge {  
            this.fage = fage;  
            if (fage < 0)  
                throw new WrongAge();  
            else {  
                System.out.println("the age of father is :" + fage);  
            }  
        }  
    }
```

class Son extends Father {

int sage;

public Son (int fage, int sage) throws WrongAge

{ super (fage);

this. sage = sage;

if (sage >= fage) {

 throws new WrongAge();

}

else {

 System.out.println ("The age of son is : " + sage);

}

}

}

class AgeRun {

public static void main (String args[]) {

Scanner s = new Scanner (System.in);

int fatherage, sonage;

System.out.println ("Enter the age of father");

fatherage = s.nextInt();

System.out.println ("Enter the age of son");

sonage = s.nextInt();

try {

 Father f = new Father (fatherage);

 Son so = new Son (sonage);

}

catch (WrongAge e) {

 System.out.println ("Exception caught");

}

}

Output:

enter the age of father

0

enter the age of son

2

exception caught

enter the age of father

32 9

enter the age of son

7

exception caught

enter the age of father

30

enter the age of son

2

the age of father is : 30

the age of father is : 30

the age of son is : 2

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 Display implements Runnable
{
    String message;
    int interval;
    public Display (String message, int interval)
    {
```

```
        this.message = message;
```

```
        this.interval = interval;
```

```
}
```

① Override

```
public void run()
{
```

```
    try
```

```

    {
        while (true)
```

```

            System.out.println (message);
            Thread.sleep (interval);
        }
    }
```

```
catch (InterruptedException e)
```

```

    System.out.println (e);
```

class DisplayRun

{
public static void main (String args[])

Thread t1 = new Thread (new Display ("BMS College of
Engineering", 10000));

t1.start();

Thread t2 = new Thread (new Display ("CSE", 2000));

t2.start();

}

}

Output:

BMS College of Engineering

CSE

CSE

CSE

CSE

LSE

BMS College of Engineering

CSE

LSE

CSE

CSE

CSE

BMS College of Engineering

CSE

CSE

CSE

CSE

CSE

⋮

and so on

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Lab Programs (Practice Programs)

- Creating label, button and TextField in a Frame using AWT.

Code:

```
import java.awt.*;
import java.awt.event.*;
public class AWTEExample extends WindowAdapter {
Frame f;
AWTEExample() {
f = new Frame();
f.addWindowListener(this);
Label l = new Label ("Employee id:");
Button b = new Button ("Submit");
TextField t = new TextField();
l.setBounds (20, 80, 80, 30);
t.setBounds (20, 100, 80, 30);
b.setBounds (100, 100, 80, 30);
f.add(b);
f.add(l);
f.add(t);
f.setSize (400, 300);
f.setTitle ("Employee info");
f.setLayout(null);
f.setVisible (true);
}
```

```
}
```

```
public static void main (String [] args) {
AWTExample awt_obj = new AWTEExample ();
}
```

```
}
```

2. Create a button and add an action listener for Mouse click.

Code:

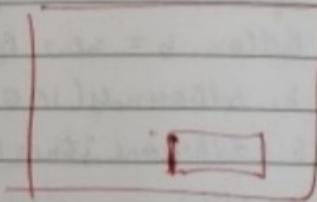
```
import java.awt.*;
import java.awt.event.*;
public class EventHandling extends WindowAdapter
implements ActionListener {
Frame f;
TextField tf;
EventHandling() {
f = new Frame();
f.addWindowListener(this);
tf = new TextField();
tf.setBounds(60, 50, 170, 20);
Button b = new Button("click me");
b.setBounds(100, 120, 80, 30);
b.addActionListener(this);
f.add(b);
f.add(tf);
f.setSize(300, 300);
f.setLayout(null);
f.setVisible(true);
}
public void actionPerformed(ActionEvent e) {
tf.setText("Welcome");
}
public void windowClosing(WindowEvent e) {
System.exit(0);
}
public static void main(String args[]) {
new EventHandling();
}
}
```

Programs on I/O

1. Examples

Code:

```
import java.io.*;  
public class ByteArrayInput {  
    public static void main (String [] args) throws IOException  
    {  
        byte [] buf = {35, 36, 37, 38};  
        ByteArrayInputStream bft = new ByteArrayInputStream (buf);  
        int k=0;  
        while ((k=bft.read ()) != -1)  
        {  
            char ch = (char) k;  
            System.out.println ("ASCII value of character is :" + ch + "  
                character is :" + ch);  
        }  
    }  
}
```



Output:

ASCII value of character is: 35 ; Special character is: #
ASCII value of character is: 36 ; Special character is: \$
ASCII value of character is: 37 ; Special character is: %
ASCII value of character is: 38 ; Special character is: &

2. Example 2

Code:

```
import java.io.*;  
public class FileExf {  
    public static void main (String [] args) throws IOException  
    {  
        FileInputStream fin = new FileInputStream ("fileExample.txt");  
        int content;  
        System.out.println ("Remaining bytes that can be read:  
            " + fin.available ());  
    }  
}
```

```

content = fin.read();
System.out.print((char) content + " ");
System.out.print(content + " ");
System.out.println("Remaining bytes that can be read: "
+ fin.available());
System.out.println("Remaining bytes that can be read: "
+ fin.available());
}
}

```

Output:

Remaining bytes that can be read: 19
 m 109 Remaining bytes that can be read: 18
 Remaining bytes that can be read: 18

Example.txt

my name is vagisha.

3. Example 3

Code:

```

import java.io.*;
public class FileEx2 {
  public static void main (String [] args) throws IOException {
    FileInputStream fin = new FileInputStream ("Example.txt");
    byte [] bytes = new byte [20];
    int i;
    char c;
    i = fin.read (bytes);
    System.out.println ("Number of bytes read: " + i);
    System.out.print ("Bytes read: ");
    for (byte b: bytes)
      c = (char) b;

```

System.out.print(c);

y

y

y

Output:

Number of bytes read: 19

Bytes read: my name is vagish.

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