Object Orient Programming in Java

A Report submitted to the BMS College of engineering

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Program 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.

Code:

```
import java.util.Scanner;
import java.lang.Math;
class prog1
{
public static void main(String xx[])
{
float a,b,c,d,r1,r2;
Scanner s1=new Scanner(System.in);
System.out.println("enter the coefficients");
a=s1.nextFloat();
b=s1.nextFloat();
c=s1.nextFloat();
d=b*b-(4*a*c);
if(d>0)
{
r1=(-b+(float)Math.sqrt(d))/(2*a);
r2=(-b-(float)Math.sqrt(d))/(2*a);
System.out.println("r1="+r1);
System.out.println("r2="+r2);
}
else if(d==0)
{
r1=(-b)/(2*a);
r2=(-b)/(2*a);
System.out.println("r1="+r1);
System.out.println("r2="+r2);
}
else
{
r1=(float)Math.sqrt(-d)/(2*a);
r2=-1*r1;
System.out.println("roots:\n"+"r1="+(-b/(2*a))+"+"+r1+"i"+"\nr2="+(-b/(2*a))+r2+"i");
}
}
}
```

Output:

```
PS C:\Users\sarth\Downloads\Java lab programs\program1> javac prog1.java
PS C:\Users\sarth\Downloads\Java lab programs\program1> java prog1
enter the coefficients
1 2 1
r1=-1.0
r2=-1.0
```

Program 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.

Code:

```java
import java.util.*;
class Student{
        private String usn;
        private int [] marks;
        private int [] credits;
        private String name;

        public void accept(){
                Scanner in = new Scanner(System.in);
                System.out.println("Enter your name: ");
                name=in.nextLine();
                System.out.println("Enter your usn: ");
                usn=in.nextLine();
                System.out.println("Enter the number of subject: ");
                int n;
                n=in.nextInt();
                marks = new int[n];
                credits = new int[n];
                for(int i=0;i<n;i++){
                        System.out.println("Enter the marks of subject "+(i+1)+" : ");
                        marks[i]=in.nextInt();
                        System.out.println("Enter credits of subject "+(i+1)+" : ");
                        credits[i]=in.nextInt();
                }
        }
        public void display(){
                System.out.println("Name: "+name+" USN: "+usn);
                for(int i=0;i<marks.length;i++){
                        System.out.println("The marks of a subject "+(i+1)+" : "+marks[i]);
                        System.out.println("The credits of the subject : "+credits[i]);
                };
        }
        public void sgpa(){
                double score=0;
                double sum=0;

                for(int i=0;i<marks.length;i++){
                        double grade;
                        if(marks[i]>=90)grade=10;
```

```java
                    else if(marks[i]>=80 && marks[i]<90)grade=9;
                    else if(marks[i]>=70 && marks[i]<80)grade=8;
                    else if(marks[i]>=60 && marks[i]<70)grade=7;
                    else if(marks[i]>=50 && marks[i]<60)grade=6;
                    else if(marks[i]>=40 && marks[i]<50)grade=5;
                    else grade=4;
                    sum=sum+credits[i];
                    score=score+credits[i]*grade;
            }
            score=score/sum;
            System.out.println("The SGPA of USN: "+usn+" Name: "+name+" is : "+score);
        }
}

public class Prog2{
        public static void main(String[]args){
                Student s= new Student();
                s.accept();
                s.display();
        s.sgpa();
        }
}
```

Output:

```
Enter your name:
Rohit
Enter your usn:
1BM22CS235
Enter the number of subject:
4
Enter the marks of subject 1 :
90
Enter credits of subject 1 :
4
Enter the marks of subject 2 :
92
Enter credits of subject 2 :
3
Enter the marks of subject 3 :
87
Enter credits of subject 3 :
3
Enter the marks of subject 4 :
95
Enter credits of subject 4 :
3
Name: Rohit USN: 1BM22CS235
The marks of a subject 1 : 90
The credits of the subject : 4
The marks of a subject 2 : 92
The credits of the subject : 3
The marks of a subject 3 : 87
The credits of the subject : 3
The marks of a subject 4 : 95
The credits of the subject : 3
The SGPA of USN: 1BM22CS235 Name: Rohit is : 9.76923076923077
```

Program 3: Create a class Book which contains four members: name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects.

Include a toString( ) method that could display the complete details of the
book. Develop a Java program to create n book objects.

Code:

```java
import java.util.*;
class Book{
    private String name;
    private String author;
    private double price;
    private int num_pages;
    public Book(){
    }

    public Book(String name,String author, double price, int num_pages){
        this.author=author;
        this.name=name;
        this.price=price;
        this.num_pages=num_pages;
    }

    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 name;
    }

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

    public double getPrice(){
        return price;
    }
```

```java
    public void setPages(int num_pages){
      this.num_pages=num_pages;
    }

    public int getPages(){
      return num_pages;
    }

    public String toString(){
      return "Book Name: "+name+" Author Name: "+author+" Price: "+price+" Pages: "+num_pages;
    }
}

public class Prog3{
  public static void main(String[]args)
  {
    Scanner in =new Scanner(System.in);
    System.out.println("Enter number of books: ");
    int n=in.nextInt();
    Book [] books= new Book[n];
    for(int i=0;i<n;i++)
    {
      books[i]=new Book();
      System.out.println("Enter the name of book: ");
      String name=in.next();
      in.nextLine();
      System.out.println("Enter the author of book: ");
      String author=in.next();
      in.nextLine();
      System.out.println("Enter the price of the book: ");
      double price=in.nextDouble();
      System.out.println("Enter the number of pages: ");
      int num_pages=in.nextInt();
books[i].setName(name);books[i].setAuthor(author);books[i].setPrice(price);books[i].setPages(num_pages);
      System.out.println("Book: "+books[i].getName()+" Author: "+books[i].getAuthor()+" details entered.");
    }
    for(int i=0;i<n;i++)
    {
      String s=books[i].toString();System.out.println(s);
    }
```

```
  }
}
```

Output:

```
Enter number of books:
2
Enter the name of book:
A
Enter the author of book:
B
Enter the price of the book:
254
Enter the number of pages:
568
Book: A Author: A details entered.
Enter the name of book:
C
Enter the author of book:
D
Enter the price of the book:
456
Enter the number of pages:
590
Book: C Author: C details entered.
Book Name: A Author Name: B Price: 254.0 Pages: 568
Book Name: C Author Name: D Price: 456.0 Pages: 590
```

Program 4: Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea( ). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes

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

Code:

```
abstract class Shape{
   private int a,b;
   Shape(){
   }
   abstract void printArea();
}

class Rectangle extends Shape{
   private int a, b;
      Rectangle(int a, int b)
   {
      this.a=a;
      this.b=b;
   }
   void printArea()
   {
      System.out.println("The area of rectangle is: "+(a*b));
   }
}

class Triangle extends Shape{
   private int a, b;
   Triangle(int a, int b)
   {
      this.a=a;
      this.b=b;
   }
   void printArea()
   {
      System.out.println("The area of triangle is: "+(0.5*a*b));
   }
}

class Circle extends Shape{
   private int a;
   Circle(int a)
   {
      this.a=a;
   }
```

```java
    void printArea()
    {
        System.out.println("The area of circle is: "+(3.14*a*a));
    }
}

public class Prog4{
    public static void main(String[]args)
    {
        Shape rectangle=new Rectangle(3,6);
        Shape triangle=new Triangle(4,6);
        Shape circle=new Circle(5);
        rectangle.printArea();
        triangle.printArea();
        circle.printArea();

    }
}
```

Output:

```
The area of rectangle is: 18
The area of triangle is: 12.0
The area of circle is: 78.5
```

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

interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed. Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks:

a) Accept deposit from customer and update the balance.
b) Display the balance.
c) Compute and deposit interest
d) Permit withdrawal and update the balance

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

Code:

```
import java.util.Scanner;
class Account{
    String name;
    String type;
    int acc_num;
    double dep;

    public void info(String name,String type,int acc_num, double dep){
        this.name=name;
        this.type=type;
        this.acc_num=acc_num;
        this.dep=dep;
    }

    public void details(){
        System.out.println("Name: "+name);
        System.out.println("Account Type: "+type);
        System.out.println("Account Number: "+acc_num);
        System.out.println("Current Balance: "+dep);
    }
}

class Savings extends Account{
    public void deposit(double amount){
        dep=dep+amount;
        System.out.println("Balance: "+dep);
```

```java
        }
    public void withdraw(double amount)
    {
        if(dep<amount)
        {
            System.out.println("Enter insufficient funds.");
        }
        else{
            dep=dep-amount;
        }
        System.out.println("Balance: "+dep);
    }
    public void interest(double t, double r){
        double dep1=dep*Math.pow((1+r/100.0),t);
        System.out.println("Interest: "+(dep1-dep));dep=dep1;
        System.out.println("Interest Deposited Amount : "+dep);
    }
}

class Current extends Account{
    public void deposit(double amount){
        dep=dep+amount;
        System.out.println("Balance: "+dep);
    }
    public void withdraw(double amount)
    {
        if(dep<amount)
        {
            System.out.println("Enter insufficient funds.");
        }
        else{
            dep=dep-amount;
        }
        check(dep);
    }

    public void check(double amount)
    {
        if(dep<2000)
        {
            if(dep<500)
            {
                dep=0;
```

```java
        }
        else
        {
           dep=dep-500;
        }
        System.out.println("Insufficient Balance!!!! Amount less than Rs. 2000.
Rs. 500 deducted. Rs.");
      }
      System.out.println("Balance: "+dep);
   }
}

public class Prog5
{
   public static void main(String[]args)
   {
      Scanner in = new Scanner(System.in);
      int c1=1;
      while(c1==1)
      {
         System.out.println("Enter Name: ");
         String name=in.next();
         in.nextLine();
         System.out.println("Enter Account Number: ");
         int acc_no=in.nextInt();
         int choice1;
         System.out.println("1.Savings 2.Current");
         System.out.println("Enter Account Type: ");
         choice1=in.nextInt();
         switch (choice1){
            case 1:
               Savings s = new Savings();
               System.out.println("Enter deposit");
               double balance=in.nextDouble();
               s.info(name,"Savings",acc_no,balance);
               s.details();
               System.out.println("1.Deposit 2.Withdraw 3.Interest 4.Exit");int
choice2;
               do{
               System.out.println("Enter your choice: ");
               choice2=in.nextInt();
               switch (choice2){
                  case 1:
                     System.out.println("Enter amount: ");
```

```java
                double amount1 = in.nextDouble();
                s.deposit(amount1);
                break;
            case 2:
                System.out.println("Enter amount: ");
                double amount2 = in.nextDouble();
                s.withdraw(amount2);
                break;
            case 3:
                System.out.println("Enter time period: ");
                double time=in.nextDouble();
                System.out.println("Enter rate: ");
                double rate=in.nextDouble();
                s.interest(time,rate);
                break;
            case 4:
                break;
            default:
                System.out.println("Invalid choice.");
        }}while(choice2>=1&&choice2<=3);
        break;
    case 2:
        Current c=new Current();
        do{
            System.out.println("Enter deposit(>2000)");
            balance=in.nextDouble();
        }while(balance<2000);
        c.info(name,"Current",acc_no,balance);
        c.details();
        System.out.println("1.Deposit 2.Withdraw 3.Exit");
        int choice3;
        do{
        System.out.println("Enter your choice: ");
        choice3=in.nextInt();
        switch (choice3){
            case 1:
                System.out.println("Enter amount: ");
                double amount1 = in.nextDouble();
                c.deposit(amount1);
                break;
            case 2:
                System.out.println("Enter amount: ");
                double amount2 = in.nextDouble();
                c.withdraw(amount2);
```

```java
                break;
            case 3:
                break;
            default:
                System.out.println("Invalid choice.");
        }}while(choice3>=1&&choice3<=2);
    default:
        System.out.println("Invalid Choice");
}
System.out.println("Enter 1 to continue or 0 to exit");
int c2 =in.nextInt();c1=c2;
}
in.close();
}
}
```

Output:

```
Enter Name:
Mohan
Enter Account Number:
6796352
1.Savings 2.Current
Enter Account Type:
1
Enter deposit
3000
Name: Mohan
Account Type: Savings
Account Number: 6796352
Current Balance: 3000.0
1.Deposit 2.Withdraw 3.Interest 4.Exit
Enter your choice:
1
Enter amount:
1000
Balance: 4000.0
Enter your choice:
3
Enter time period:
3
Enter rate:
7
Interest: 900.1720000000005
Interest Deposited Amount : 4900.1720000000005
Enter your choice:
4
Enter 1 to continue or 0 to exit
1
Enter Name:
Rahul
Enter Account Number:
6457786
1.Savings 2.Current
Enter Account Type:
2
Enter deposit(>2000)
4500
Name: Rahul
Account Type: Current
Account Number: 6457786
Current Balance: 4500.0
1.Deposit 2.Withdraw 3.Exit
Enter your choice:
2
Enter amount:
2400
Balance: 2100.0
Enter your choice:
2
Enter amount:
2400
Enter insufficient funds.
Balance: 2100.0
Enter your choice:
3
Invalid Choice
Enter 1 to continue or 0 to exit
0
```

Program 6: Create a package CIE which has two classes- Student and Internals. The class Personal has members like usn, name, sem. The class

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

Code:

```
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();
        }
}

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();
                }
        }
}

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

```java
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();
        }
    }
}


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
```

Program 7: Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called "Father" and derived class called "Son" which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge( ) when the input age<0. In Son class, implement a constructor that cases both father and son's age and throws an exception if son's age is >=father's age.

Code:

```java
import java.util.Scanner;
class WrongAge extends Exception {
  public WrongAge(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);
```

```java
        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:

```
Enter father's age and son's age:
45 25
Father's age: 45
Son's age: 25
PS C:\Users\sarth\Downloads\Java lab programs\prog7> java fatherson
Enter father's age and son's age:
32 43
Error: Son's age must be less than Father's age
```

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:

```java
class NewThread implements Runnable {
  String Name;
  Thread t;
  int n;
  NewThread(String threadname, int n) {
    Name = threadname;
    this.n = n;
    t = new Thread(this, Name);
    System.out.println("New Thread " + t);
    t.start();
  }
  public void run() {
    try {
      for (int i = 0; i < 10; i++) {
        System.out.println(Name + " : " + i);
        Thread.sleep(n);
      }
    } catch (InterruptedException e) {
      System.out.println(Name + "Interrupted");
    }
    System.out.println("Exiting");
  }
}

public class Prog8 {
  public static void main(String[] args) {
    NewThread ob1 = new NewThread("CSE", 2000);
    NewThread ob2 = new NewThread("BMS College Of Engineering", 10000);

  }
}
```

Output:

```
New Thread Thread[#21,CSE,5,main]
New Thread Thread[#22,BMS College Of Engineering,5,main]
CSE : 0
BMS College Of Engineering : 0
CSE : 1
CSE : 2
CSE : 3
CSE : 4
BMS College Of Engineering : 1
CSE : 5
CSE : 6
CSE : 7
CSE : 8
CSE : 9
BMS College Of Engineering : 2
Exiting
BMS College Of Engineering : 3
BMS College Of Engineering : 4
BMS College Of Engineering : 5
BMS College Of Engineering : 6
BMS College Of Engineering : 7
BMS College Of Engineering : 8
BMS College Of Engineering : 9
Exiting
```

Program 9: 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.

Code:

```java
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;

class SwingDemo{
  SwingDemo(){
    JFrame jfrm = new JFrame("Divider App");
    jfrm.setSize(275, 150);
    jfrm.setLayout(new FlowLayout());
    jfrm.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    JLabel jlab = new JLabel("Enter the divider and divident:");
    JTextField ajtf = new JTextField(8);
    JTextField bjtf = new JTextField(8);
    JButton button = new JButton("Calculate");
    JLabel err = new JLabel();
    JLabel alab = new JLabel();
    JLabel blab = new JLabel();
    JLabel anslab = new JLabel();
    jfrm.add(err);
    jfrm.add(jlab);
    jfrm.add(ajtf);
    jfrm.add(bjtf);
    jfrm.add(button);
    jfrm.add(alab);
    jfrm.add(blab);
    jfrm.add(anslab);
    ActionListener l = new ActionListener() {
      public void actionPerformed(ActionEvent evt) {
        System.out.println("Action event from a text field");
      }
    };
    ajtf.addActionListener(l);
    bjtf.addActionListener(l);
```

```java
        button.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent evt) {
                try{
                    int a = Integer.parseInt(ajtf.getText());
                    int b = Integer.parseInt(bjtf.getText());
                    int ans = a/b;
                    alab.setText("\nA = " + a);
                    blab.setText("\nB = " + b);
                    anslab.setText("\nAns = "+ ans);
                }
                catch(NumberFormatException e){
                    alab.setText("");
                    blab.setText("");
                    anslab.setText("");
                    err.setText("Enter  Only Integers!");
                }
                catch(ArithmeticException e){
                    alab.setText("");
                    blab.setText("");
                    anslab.setText("");
                    err.setText("B  should be NON zero!");
                }
            }
        });
        jfrm.setVisible(true);
    }
    public static void main(String args[]){
        SwingUtilities.invokeLater(new Runnable(){
            public void run(){
                new SwingDemo();
            }
        });
    }
}
```

Output: