VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



LAB REPORT on

Object Oriented Java Programming (23CS3PCOOJ)

Submitted by

Arnav Dinesh (1BM23CS052)

in partial fulfillment for the award of the degree of BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING



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Bull Temple Road, Bangalore 560019
(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering



CERTIFICATE

This is to certify that the Lab work entitled "Object Oriented Java Programming (23CS3PCOOJ)" carried out by Arnav Dinesh (1BM23CS052), who is bonafide student of B.M.S. College of Engineering. It is in partial fulfillment for the award of Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belgaum. The Lab report has been approved as it satisfies the academic requirements in respect of an Object Oriented Java Programming (23CS3PCOOJ) work prescribed for the said degree.

| Lab faculty Incharge Name - Dr.Prasad G R | Dr. Jyothi S Nayak |
|---|--------------------------|
| Professor | Professor & HOD |
| Department of CSE, BMSCE | Department of CSE, BMSCE |
| | |

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Github Link: https://github.com/ArnavRD/Javalab

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.

composit your . with . Sconner; import java. dang. Math; class quad & queblic estatic void main (stering [] augs) Scanner s= enew Scanner (system.in); system. out. feintly ("Enter a, cb, c:"); a = s. ment louble (); cb = s. ment Double (); c = s. ment louble (); if (a=0) system. out. frintly ("Not quadratic");

```
else it
    double d= cb " b-4 " a " c;
    if (d=00)
          double &= - of/(2 a);
         system. out . faintly ("Equal doots or 1= or?
   Descrip (d >0)
        double or 1 = ((-b)+(math. sgrt(d)))
        (double) (2 a);
        double on 2 = ((-it)+(math-esget(d))
        (double) (2 a);
        system. out. faintln (" The crooks well distinct and real ...");
        system. out. fauther ("or 1 is" + or 1);
       system. out. faintly ("cerz is"+cr2);
  The if (d<0)
       double on = (-ot)/(2 * a);
      double on = Math. sgrt (-d)/(2 a);
     System. out. faintly ("The chools are imaginary, system, out. faintly ("or i is" + or 1);
system. out. faintly ("or i is" + or 2);
```

Output in observation book

```
3

Enter a, do, c:

12

13

14

Me doots are anagroup...

or is -0.541666666

Az is 0.9344856955
```

Source code

```
import java.util.Scanner;
import java.lang.Math;
class quad{
        public static void main(String[] args)
                 double a,b,c;
                 Scanner s = new Scanner(System.in);
                 System.out.println("Enter a,b,c:");
                 a = s.nextDouble();
                 b = s.nextDouble();
                 c = s.nextDouble();
                 if(a==0)
                           System.out.println("Not quadratic");
                 else
                           double d = b*b-4*a*c;
                          if(d==0)
                           {
                                   double r=-b/(2*a);
                                   System.out.println("Equal roots r1=r2="+r);
                           }
                           else if(d>0)
                                   double r1 = ((-b)+(Math.sqrt(d)))/(double)(2*a);
                                   double r2 = ((-b)-(Math.sqrt(d)))/(double)(2*a);
                                   System.out.println("The roots are distinct and real...");
                                   System.out.println("r1 is" + r1);
                                   System.out.println("r2 is" + r2);
                          else if(d<0)
                                   double r1 = (-b)/(2*a);
                                   double r2 = Math.sqrt(-d)/(2*a);
                                   System.out.println("The roots are imaginary...");
                                   System.out.println("r1 is" + r1);
                                   System.out.println("r2 is" + r2);
                           }
         }
        System.out.println("Arnav Dinesh 1BM23CS052");
```

```
Enter coefficients a, b, c:

12

12

12

The roots are imaginary.

r1 = -0.5 + 0.8660254037844387i

r2 = -0.5 - 0.8660254037844387i

Arnav Dinesh 1BM23CS052
```

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.

import gava . atil . scarger; out subject Alachs, credits, grade;

```
void getstudenteetails ()
    orystem. Out. faintly ("Enter your mame:")
    mame = s. mest();
    system. out faintly (" Enton your clism:
    cush = S. crest ();
( ) ( ) ( ) ( ) ( ) ( )
       system. out. peintly "eiter mocks of subject
        +(a+1)+":");
       subject [ii]. subject Nooths = 5. nest I
       system. out. Januthy (" Fater oredits of isubject"
       + (i+1) +":");
  subject [i]. credits = s. mentent ();
      if (subject [i]. subject works >= 90) {
          crubject [ii], grade = 10;
       also if (orubject [i]. orubject Morks > = 80)
            osubject [i]. gerade = 9;
       alse if (subject [i]. and ject Marks >= 90)
             subject [i] geade = 8;
```

```
also if (subject(i). subject Months >= 60)
               subject [i]. geade = 7;
               csubject [ii). grade = 6;
            alse if (autject (ii) subject Marks >= 40)
               subject [i]. grade = 5;
            subject [ii]. grade =0;
word computesoner () {
        cint dotalledits =0, ctotal = 0;
        dor(aut i=0; i=4; i++)
             total Gedits = total Coedits + isubject [ii]. condits;
        dor(int i =0; i <9; i ++)
       some stotal / dotallowdits/
           total = total + ((osubject [ii] oredits) * (osubject [ii].
         3
SGIPA = dotal/clotal Bedits;
 3
       public statu void main (stoing []
            Student $1 = onew Student ();
            SI get Student Petails ();
            SI. getMarks();
            Si. computesoner);
3
```

```
O/P: Enter the delails of 1 ostudent
Enter details of the USN and marrie
18M23CS001.
Aemore
Enter the mounts
            is established to sold of
85
92
79
81
                    Medicine adjude active
$3 its false of (show [i] bythere ] I there will
Enter the oredits
     a class book which contains low
 3 - shall I speak - wan, some, rolling
 to set the values for the me one s
 shods do vet and get the Atlants I this
USN = LBM 23 CSOO4 ) products a land
name = semant all of should shipman
mooths of 1 orwest 80
marks of 2 subject 85
marks of 3 orubject 90
marks of 4 subject 92
ancests of 5 subject 79
marches of 6 isubject 8 1
anochs of 7 aubject 83
marks of 8 csubject 86
SGIPA: 9.3
    Monthly Toplan & to
```

Source code

```
import java.util.*;
class Stud det
{ int m[]=new int[8];
int c[]=new int[8];
int p[]=new int[8];
int g,sum;
String name, usn;
double sgpa;
 Scanner s=new Scanner(System.in);
void getdetails()
 System.out.println("Enter name:");
 name=s.next();
 System.out.println("Enter usn:");
 usn=s.next();
 for(int i=0; i<8; i++)
 System.out.println("Enter marks of subject:"+(i+1));
 m[i]=s.nextInt();
 System.out.println("Enter credits for subject:" +(i+1));
 c[i]=s.nextInt();
void gradepoint()
 for(int i=0; i<8; i++)
 if (m[i] > = 90 \&\& m[i] < = 100)
  p[i]=10;
 else if (m[i] > = 80 \&\& m[i] < 90)
  p[i]=9;
 else if (m[i] > = 70 \&\& m[i] < 80)
  p[i]=8;
 else if (m[i] > = 60 \&\& m[i] < 70)
  p[i]=7;
 else if (m[i] > = 50 \&\& m[i] < 60)
  p[i]=6;
 else if (m[i] > = 40 \&\& m[i] < 50)
  p[i]=5;
 else
  p[i]=0;
void calculate()
 for(int i=0; i<8; i++)
```

```
g+=c[i]*p[i];
 for(int i=0;i<8;i++)
 sum+=c[i];
 sgpa=g/sum;
void display()
 System.out.println("Name:"+name);
 System.out.println("USN:"+usn);
 System.out.println("SGPA=:"+sgpa);
public class student
public static void main(String a[]){
 Stud_det s1[]=new Stud_det[3];
for(int i=0; i<3; i++){
s1[i]=new Stud_det();
}
 for(int i=0; i<3; i++)
 System.out.println("Enter details of student:"+(i+1));
 s1[i].getdetails();
 for(int i=0; i<3; i++)
 s1[i].gradepoint();
 s1[i].calculate();
 for(int i=0;i<3;i++)
 System.out.println("Student:"+(i+1));
 s1[i].display();
System.out.println ("Arnav Dinesh 1BM23CS052");
```

```
Enter details of student:1
Enter name:
Arnav
Enter usn:
1BM23CS001
Enter marks of subject:1
Enter credits for subject:1
Enter marks of subject:2
93
Enter credits for subject:2
Enter marks of subject:3
89
Enter credits for subject:3
3
Enter marks of subject:4
Enter credits for subject:4
Enter marks of subject:5
98
Enter credits for subject:5
Enter marks of subject:6
Enter credits for subject:6
3
Enter marks of subject:7
Enter credits for subject:7
Enter marks of subject:8
89
Enter credits for subject:8
```

```
Enter details of student:2
Enter name:
Ariz
Enter usn:
1BM23CS002
Enter marks of subject:1
98
Enter credits for subject:1
3
Enter marks of subject:2
98
Enter credits for subject:2
Enter marks of subject:3
98
Enter credits for subject:3
Enter marks of subject:4
98
Enter credits for subject:4
Enter marks of subject:5
98
Enter credits for subject:5
Enter marks of subject:6
98
Enter credits for subject:6
Enter marks of subject:7
Enter credits for subject:7
3
Enter marks of subject:8
98
Enter credits for subject:8
3
```

```
Enter details of student:3
Enter name:
Vatsal
Enter usn:
1BM23CS003
Enter marks of subject:1
Enter credits for subject:1
Enter marks of subject:2
Enter credits for subject:2
Enter marks of subject:3
Enter credits for subject:3
Enter marks of subject:4
Enter credits for subject:4
Enter marks of subject:5
76
Enter credits for subject:5
Enter marks of subject:6
Enter credits for subject:6
Enter marks of subject:7
Enter credits for subject:7
Enter marks of subject:8
Enter credits for subject:8
```

Student:1

Name:Arnav

USN:1BM23CS001

SGPA=:9.0

Arnav Dinesh 1BM23CS052

Student:2

Name:Ariz

USN:1BM23CS002

SGPA=:10.0

Arnav Dinesh 1BM23CS052

Student:3

Name: Vatsal

USN:1BM23CS003

SGPA=:8.0

Arnav Dinesh 1BM23CS052

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.

```
Main code

import java. util. scamer;

class Book &

steiney mame;

steiney author;

double feice;

int num-pages;

Book() &

cthis. name = name;

cthis. author = author;

cthis. faire = faire;

this. faire = faire;

sthis. num-pages = num-pages;
```

```
fublic void setther (string manie)
     this . warre = crame;
 Jublic steining getterne ()
    outurn crame;
chiblic void setAuthor (steining author)
this author = author;
public string ægetsuthor ()
      outlin author;
quiblic void setherice (double faire)
quible double gethouse ()
Jublic word vsetNewPager (aint enum ylong
       this . mun - plager = mun - plages;
 3
```

```
quablic int gettlumbages ()
           oretion um-glage;
       fulle Adeing tosteing ()
           saturn " Name of the book: " + mame +
          " Author of the clook: " + author + "Point of the
          dook: " + yeinel + " Total number of glages:
Class Run &
       qublic static void main (other
          Scanner S = new Scanner (system. in)
         system. out. printer ("Enter cumber of dook:")
         cint on = s. mentInt();
         S. mentline ();
         do = new book [m];
         for (aut is = 0; i < on; it +1)
```

```
do [i] = onews Book ();
      system out . pointly (" Enter the mane of the
      dook: ");
       of [i] . setName (s. mesiline ());
      system. out faintly " Enter the author of the
       dook:");
       do[i] retAuthor(s. mentinei);
   Septem- out. Jainthon (" Enter the fence of the
       (book: ");
       of (i). rethouse (s. wentlouble());
   system. out. deinthu (" Enter mundeer of fages
     in the clook: ");
     ct [i] . osetNumbags(s. overtind ());
      S. creatline ();
 display (b);
 s. close ();
           system. out. famille ("Book" + (at) +":");
           System out foundling ( ct (i) tosting ()
3
```

Enter number of doods: 2 Enter the name of the book: dune Enter the author of the clook: frank Enter the gence of the cook: 1000 Enter the number of pages in the chook: 800 Enter the come of the book: dune glast two Enter the author of the cook: frank Enter the gence of the book: Enter the number of pages in the book: 1000 Book 1: Name of the cook: dune Author of the cook: from Paul of the book: 1000.0 Total number of dager : 8000 Book 2: Name of the dook: due glant due Author of illy abook: grank Pauce of the dook: 2000 Total common of glacyr: 1000

Source code

```
import java.util.Scanner;
System.out.println("Arnav Dinesh 1BM23CS052");
class Book {
  String name;
  String author;
  double price;
  int num_pages;
  Book() {
    this.name = name;
    this.author = author;
    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 author;
  }
  public void setPrice(double price) {
    this.price = price;
  public double getPrice() {
     return price;
  }
  public void setNumPages(int num_pages) {
    this.num_pages = num_pages;
  public int getNumPages() {
    return num_pages;
  }
```

```
public String toString() {
    return "Name of the book: " + name + ", Author of the book: " + author +
         ", Price of the book: " + price + ", Total number of pages: " + num_pages;
  }
}
class Run {
  public static void main(String[] args) {
     Scanner s = new Scanner(System.in);
     System.out.print("Enter number of books: ");
     int n = s.nextInt();
     s.nextLine();
     Book b[];
b = new Book[n];
     for (int i = 0; i < n; i++) {
       b[i] = new Book();
       System.out.print("Enter the name of the book: ");
       b[i].setName(s.nextLine());
       System.out.print("Enter the author of the book: ");
       b[i].setAuthor(s.nextLine());
       System.out.print("Enter the price of the book: ");
       b[i].setPrice(s.nextDouble());
       System.out.print("Enter the number of pages in the book: ");
       b[i].setNumPages(s.nextInt());
       s.nextLine();
     display(b);
     s.close();
  void display(Book[] b) {
     for (int i = 0; i < b.length; i++) {
       System.out.println("Book" + (i + 1) +":");
       System.out.println(b[i].toString());
  }
```

```
Arnav Dinesh 1BM23CS052
Enter number of books: 2
Enter the name of the book: Dune
Enter the author of the book: Frank
Enter the price of the book: 2000
Enter the number of pages in the book: 500
Enter the name of the book: Dune part 2
Enter the author of the book: Frank
Enter the price of the book: 5000
Enter the number of pages in the book: 800
Book 1:
Name of the book: Dune, Author of the book: Frank, Price of the book: 2000.0, Total number of pages: 500
Book 2:
Name of the book: Dune part 2, Author of the book: Frank, Price of the book: 5000.0, Total number of pages: 800
```

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.

```
abstract class offers &

abstract class offers &

ant dimension;

ant dimension;

furblic offer() &

This dimension; = 0;

this dimension; = 0;

This dimension; = dimension;

The dimension;
```

```
Class Reclarge antends shape & gublic Rectangle (int clength, in width)
                 dimension 1 = clength;
                 dimension 2 = wordth;
        queblic void gleint Assa () &
            cont acrea = dimension 1 * dimension 2;
System. out. Janually ("Acrea of Reclargle:"
          Tuiangle entends schape &
       dublic Tourngle (int clase, ant sheight)
              dimension 1 = cloase;
dimension z = height;
      gublic void geintseeal)
           double area = 0.5 " dimension 1 " dimension 2;
System. out. frintly (" serea of Briangle: "+area);
                   and the Heart
```

```
class Civil contends esnape ?
      public Circle (int viadur) &
          dimension 1 = readins;
        dimension 2 = 0;
     queblic void faint Acrea () &
      double werea = Math. PI dimension ( & dimension &;
      System . out . sperintln (" serea of Eircle: " + area);
class shapearea &
      queblic static void main (string [] augs)
         scamer oscamer = onew scamer/system.
        system. out. feintler (" Friter clerath and wordth for everlangle:");
        unt dength = scanner mentint ();
        int width = escamer. wenterto;
        shape ductoringly = new Rectangle (dongth, windly
        rectangle. joint see ();
       System. out fintlin ("Enter chase and cheight you Pouragle:");
       unt chare = scanner . west Int ();
       and deglit = scanner ment Int ();
       Shape triangle = new Toward (base, height);
```

Journall . Januthereal);

System out . Januther (" Entercradius you

Circle:");

circl cradius = escamer enertial();

State circle = new Eincle (cradius);

circle . Januthereal);

escamer . close();

3

3

```
Enter clength & width your cuciongle:
20
30
Asea of suctangle: 600
Enter down & high you doingle:
20
Area of doingle: 100.0
Enter evalue of Circle:
20
Area of wide: 1256.6370
```

Source code

```
import java.util.*;
abstract class Shape {
  int dimension1;
  int dimension2;
  public Shape() {
    this.dimension1 = 0;
    this.dimension2 = 0;
  }
  public Shape(int dimension1, int dimension2) {
    this.dimension1 = dimension1;
    this.dimension2 = dimension2;
  public abstract void printArea();
}
class Rectangle extends Shape {
  public Rectangle(int length, int width) {
     dimension1 = length;
     dimension2 = width;
  public void printArea() {
    int area = dimension1 * dimension2;
    System.out.println("Area of Rectangle: " + area);
class Triangle extends Shape {
  public Triangle(int base, int height) {
    dimension1 = base;
     dimension2 = height;
```

```
public void printArea() {
     double area = 0.5 * dimension1 * dimension2;
     System.out.println("Area of Triangle: " + area);
class Circle extends Shape {
  public Circle(int radius) {
     dimension1 = radius;
     dimension2 = 0;
  public void printArea() {
     double area = Math.PI * dimension1 * dimension1;
     System.out.println("Area of Circle: " + area);
  }
class shapearea {
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
     System.out.println("ArnavDinesh 1BM23CS052);
     System.out.println("Enter length and width for Rectangle:");
     int length = scanner.nextInt();
     int width = scanner.nextInt();
     Shape rectangle = new Rectangle(length, width);
     rectangle.printArea();
     System.out.println("Enter base and height for Triangle:");
     int base = scanner.nextInt();
     int height = scanner.nextInt();
     Shape triangle = new Triangle(base, height);
     triangle.printArea();
     System.out.println("Enter radius for Circle:");
     int radius = scanner.nextInt();
     Shape circle = new Circle(radius);
     circle.printArea();
```

```
scanner.close();
}
```

```
Arnav Dinesh 1BM23CS052
Enter length and width for Rectangle:
10
10
Area of Rectangle: 100
Enter base and height for Triangle:
20
20
Area of Triangle: 200.0
Enter radius for Circle:
50
Area of Circle: 7853.981633974483
```

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.

```
Main Codl
   double balance;
         this accountagle = accountagle
     3 celse
   3
```

```
void dixtay balance ()
     system. out. finith (" Current Balance:
   qual double interest date = 0.04
 ravAcit (storing customerHome, int accountHumber, double initial Balance)
       super Cauxtomer Vand, account Vander, "savings
        initial Balance);
void computationterest ()
      double interest = balance * interest Rate;
      chalance += interest;
      system. out - faintly ("Taleust added: "+ interest
            system. out. familler ("Insufficient balance:");
        alse
```

```
class (what contends Account & final double annumbalance = 500.0;
     ifinal double servicethalige = 50.0;
     Curtos Costoiney austonerName, int accountMumber, doubt
     cinitial Balance 9
         super (customer Name, account Humber, "Current", initiale
     word checklimmsBalance
         if (dolland < muminibalance)
               balance -= service harge
               system. out. femiler ("service charge imposed
              System. out . Jointh ("Insufficient balance.");
       ælse
             chalance -= amount
             check Minimus Balance ();
             Rystem . out . Jenuth ( "purount worthdrawer: " + amount),
```

```
doss Bank &

Jublic static void main (string[] angs)

ravoled cravings decount = enew sourted ("shee", 101, 100.

(worked coround secount = enew Currect ("sook", 102, 600,

regeture out femilly (" shavings secount: ");

ravings decount defosil (500);

ravings decount compute interest ();

ravings decount display balance ();

ravings decount display balance ();

reverent secount defosil (300);

current secount display balance ();

avorent secount display balance ();

3

3
```

Savings Account:

Amount defosited: 500.0

Interest added: 60.0

Amount withdrawn: 200.0

Current obalance: 1360.0

Current Account:

Amount defosited: 300.0

Seemed charge imposed due to dow obalance: 50.0

promount witholowin: 700.0

koveent doalance: 150.0

Source Code

```
class Account {
  String customerName;
  int accountNumber;
  String accountType;
  double balance;
  Account(String customerName, int accountNumber, String accountType, double initialBalance) {
    this.customerName = customerName;
    this.accountNumber = accountNumber;
    this.accountType = accountType;
    this.balance = initialBalance;
  }
  void deposit(double amount) {
    if (amount > 0) {
       balance += amount;
       System.out.println("Amount deposited: " + amount);
       System.out.println("Invalid deposit amount.");
  }
  void displayBalance() {
    System.out.println("Current balance: " + balance);
  }
}
class SavAcct extends Account {
  final double interestRate = 0.04;
  SavAcct(String customerName, int accountNumber, double initialBalance) {
    super(customerName, accountNumber, "Savings", initialBalance);
  void computeInterest() {
     double interest = balance * interestRate;
    balance += interest:
    System.out.println("Interest added: " + interest);
  }
  void withdraw(double amount) {
    if (amount > balance) {
       System.out.println("Insufficient balance.");
     } else {
       balance -= amount;
       System.out.println("Amount withdrawn: " + amount);
```

```
}
  }
class CurAcct extends Account {
  final double minimumBalance = 500.0;
  final double serviceCharge = 50.0;
  CurAcct(String customerName, int accountNumber, double initialBalance) {
    super(customerName, accountNumber, "Current", initialBalance);
  }
  void checkMinimumBalance() {
    if (balance < minimumBalance) {
       balance -= serviceCharge;
       System.out.println("Service charge imposed due to low balance: " + serviceCharge);
    }
  }
  void withdraw(double amount) {
    if (amount > balance) {
       System.out.println("Insufficient balance.");
    } else {
       balance -= amount;
       checkMinimumBalance();
       System.out.println("Amount withdrawn: " + amount);
  }
}
class Bank {
  public static void main(String[] args) {
    SavAcct savingsAccount = new SavAcct("Alice", 101, 1000.0);
    CurAcct currentAccount = new CurAcct("Bob", 102, 600.0);
    System.out.println("Savings Account:");
    savingsAccount.deposit(500);
    savingsAccount.computeInterest();
    savingsAccount.withdraw(200);
    savingsAccount.displayBalance();
    System.out.println("\nCurrent Account:");
    currentAccount.deposit(300);
    currentAccount.withdraw(700);
    currentAccount.displayBalance();
    System.out.println("Arnav Dinesh 1BM23CS052");
  }}
```

```
Savings Account:
Amount deposited: 500.0
Interest added: 60.0
Amount withdrawn: 200.0
Current balance: 1360.0

Current Account:
Amount deposited: 300.0
Service charge imposed due to low balance: 50.0
Amount withdrawn: 700.0
Current balance: 150.0

Arnav Dinesh 1BM23CS052
```

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.

dochage ci;

fublic class student {

Steing USN;

Stowng cname;

int sem;

dublic student (steing USN, steing mame, int sem)

{

This. USN = USN;

this. oname = cname;

this. sem = stem;

}

qublic void dixflay()

system. out. pointln ("student lotails acre ar follows:

System. out. pointln ("USN:" + USN);

```
system. Out. faintly ("Name:" + orane);
     system. out-faintly ("severter:" + sem);
factore cie;
dublic
        class internals
                      = onew int[5];
        fublic Internals (int[] marks)
         stublic void display ()
             system. out femille ("CIE Marker are as follows:
             for (int mm: marks)
 3
 factore osel;
 composit cis. student
 doir Enternal contends student &
                        = men int [5];
     spublic Enternal (string USN), ostring around, int orem,
     cut [] rumarks
       cut [] reemarks)
```

```
osyler (USN, mane, orem),
           This remarks = remarks
              void display () &
          system. out - familly (" SEE Marks are as you
          for (court comm: seemaster)
               system. out. familly (course)
       3
unfort your ditil scanner;
         cie. Student;
         in . Enternals;
cuplout see. Enternals;
glublic class Main &
      dublic static void amoin Estring []
          System. out family "Enley the student delails
         rearmen 12 = new orcanmer (system. in);
         Heing USN = s. neutine ();
         String mame = s. menting ();
         and rem = r. mentent()
         student stud = new student (USN, mane, sem),
         stud. sdiglay ();
         System. out. fointly ("Enter the CIE marks:")
```

```
unt [] marks = mew int [];

for (int i = 0, i < 5; i + 1)

i marks [i] = s. mentent ();

internals i = new Internals (marks);

in dixlay ();

system. out. fauthr ("Enter the SEE marks:");

cut [] smarks = crew int [5];

for (cint i = 0; i < 5; i + 1)

i smarks [i] = s. mentent ();

i enternals & = new Enternals (USN, name, sem, smooth);

children ();

s. close ();
```

Enter the number of students: 1

Entering details good Student: 1

Enter VSN: 1BM23CSOS +

Enter Name: About

Enter Semester: 3

Enter Semester: 3

Enter Subjects:

```
Enter SEE Marks for 5 subjects:
Subject 1: 90
Final Mouhe of Students:
student 1:
 USN: 1BM 23 CSO 51
Name: Ahash
Final Mouhe in 5 leulejets:
Subject 1: (264 175
Subject 2: 477 180
```

Source code

```
package cie;
public class Internals {
  public int[] intMarks = new int[5];
  public Internals(int[] marks) {
     System.arraycopy(marks, 0, intMarks, 0, marks.length);
package cie;
public class Student
 public String usn;
 public String name;
 public int sem;
public Student(String usn,String name,int sem)
 this.usn=usn;
 this.name=name;
 this.sem=sem;
package see;
import cie.Student;
public class Externals extends Student {
  public int[] seeMarks = new int[5];
  public Externals(String usn, String name, int sem, int[] seeMarks) {
     super(usn, name, sem);
     System.arraycopy(seeMarks, 0, this.seeMarks, 0, seeMarks.length);
  }
import cie.*;
import see.*;
import java.util.*;
public class Exams {
  public static void main(String[] args) {
     Scanner in = new Scanner(System.in);
```

```
System.out.print("Enter the number of students: ");
int n = in.nextInt();
in.nextLine();
Student[] s = new Student[n];
Internals[] ie = new Internals[n];
Externals[] ee = new Externals[n];
for (int i = 0; i < n; i++) {
  System.out.println("Enter details for student" + (i + 1));
  System.out.print("Enter USN: ");
  String usn = in.nextLine();
  System.out.print("Enter Name: ");
  String name = in.nextLine();
  System.out.print("Enter Semester: ");
  int sem= in.nextInt();
  System.out.print("Enter internal marks for 5 subjects: ");
  int[] intMarks = new int[5];
  for (int j = 0; j < 5; j++) {
     intMarks[j] = in.nextInt();
  }
  System.out.print("Enter SEE marks for 5 subjects: ");
  int[] seeMarks = new int[5];
  for (int j = 0; j < 5; j++) {
     seeMarks[j] = in.nextInt();
  }
  in.nextLine();
  s[i] = new Student(usn, name, sem);
  ie[i] = new Internals(intMarks);
  ee[i] = new Externals(usn, name, sem, seeMarks);
System.out.println("\nFinal marks of each student:");
for (int i = 0; i < n; i++) {
  System.out.println("Student " + (i + 1) + " (" + s[i].name + "):");
  for (int j = 0; j < 5; j++) {
     int finalMarks = ie[i].intMarks[j] + (ee[i].seeMarks[j] / 2);
     System.out.println("Course" + (i + 1) + ":" + finalMarks);
  }
```

```
System.out.println();
System.out.println("Arnav Dinesh 1BM23CS052");
}
in.close();
}
```

```
Enter the number of students: 1
Enter details for student 1
Enter USN: 1BM23CS052
Enter Name: Arnav
Enter Semester: 3
Enter internal marks for 5 subjects:
45
45
45
45
Enter SEE marks for 5 subjects: 80
80
80
80
80
Final marks of each student:
Student 1 (Arnav):
Course 1: 85
Course 2: 85
Course 3: 85
Course 4: 85
Course 5: 85
Arnav Dinesh 1BM23CS052
```

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 uses both father and son's age and throws an exception if son's age is >= father's age.

class Worneyge Exception willends Exception {

dublic Worneyge Exception (storing message)

{

dublic Worneyge Exception (storing message)

{

distribute {

devolected int age;

dublic Father (int age) throws worney get Exception {

af (alge < 0) {

throw mens worney begre Exception ('Age count declare allows);

}

this ag = agl;

```
cannot der cless than O.
this . rondy = nondy;
                     Don's age:
```

```
dublit
      class Main &
         day &
         day {
           don don = new Ron (40, 45),
        3
```

```
Non oron: wew from (40,20);

3 collete (Worongstop Eacethor cle)

8

System. out. Januth ("Elshor:"+2. golfman,
3
```

```
Everor: Age cannot due dess other 0.

Father's age: 40

Everor: son's age cannot due greater than or alguel do dather's age: 40

Everor: don's age cannot de dess other 0.

Father's age: 40

Non's age: 40
```

Source Code

```
class WrongAgeException extends Exception {
  public WrongAgeException(String message) {
     super(message);
  }
class Father {
  protected int age;
  public Father(int age) throws WrongAgeException {
     if (age < 0)
       throw new WrongAgeException("Age cannot be less than 0.");
    this.age = age;
     System.out.println("Father's age: " + this.age);
  }
class Son extends Father {
  private int sonAge;
  public Son(int fatherAge, int sonAge) throws WrongAgeException {
     super(fatherAge);
    if (sonAge < 0) {
       throw new WrongAgeException("Son's age cannot be less than 0.");
    if (sonAge >= fatherAge) {
       throw new WrongAgeException("Son's age cannot be greater than or equal to father's age.");
    this.sonAge = sonAge;
     System.out.println("Son's age: " + this.sonAge);
public class Main {
  public static void main(String[] args) {
     System.out.println("Arnav Dinesh 1BM23CS052");
    try {
       Father father = new Father(-5);
     } catch (WrongAgeException e) {
       System.out.println("Error: " + e.getMessage());
    try {
       Son son = new Son(40, 45);
     } catch (WrongAgeException e) {
       System.out.println("Error: " + e.getMessage());
    try {
       Son son = new Son(40, -10);
```

```
} catch (WrongAgeException e) {
    System.out.println("Error: " + e.getMessage());
}
try {
    Son son = new Son(40, 20);
} catch (WrongAgeException e) {
    System.out.println("Error: " + e.getMessage());
}
}
```

```
Arnav Dinesh 1BM23CS052
Error: Age cannot be less than 0.
Father's age: 40
Error: Son's age cannot be greater than or equal to father's age.
Father's age: 40
Error: Son's age cannot be less than 0.
Father's age: 40
Son's age: 20
```

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.

door college thread antends who ead &

Julia void owin() &

while (down)

srystem. out. Jointhn ("oms college of Engineering)

touy

{

Novead. sley (10000);

3 color (Interrupted Enception. 2)

E Movead. current Novead(). interrupt ();

dorect;

3

3

```
class esetthead sutends Reveal &
            System. out faintly ("CSE");
            Long
              Moread . wheel (2000);
            3 calch (Interoupted inception d)
                Thosad . avount Thosad (
3
gublic class
      dublic static void amain (storing[] augs)

E

Collegethread ();
                     cse = new coetheread ();
          costout ();
         cre. stort ();
       3
3
```

Source code

```
class CollegeThread extends Thread {
  public void run() {
    while (true) {
       System.out.println("BMS College of Engineering");
          Thread.sleep(10000);
       } catch (InterruptedException e) {
         Thread.currentThread().interrupt();
         break;
       }
class CseThread extends Thread {
  public void run() {
     while (true) {
       System.out.println("Arnav Dinesh 1BM23CS052");
       System.out.println("CSE");
       try {
         Thread.sleep(2000);
       } catch (InterruptedException e) {
         Thread.currentThread().interrupt();
         break;
  }
public class run {
  public static void main(String[] args) {
    CollegeThread collegeThread = new CollegeThread();
    CseThread cseThread = new CseThread();
    collegeThread.start();
    cseThread.start();
  }
}
```

```
BMS College of Engineering
Arnav Dinesh 1BM23CS052
CSE
BMS College of Engineering
Arnav Dinesh 1BM23CS052
CSE
Arnav Dinesh 1BM23CS052
CSE
Arnav Dinesh 1BM23CS052
CSE
CSE
```

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.

```
import javax. suring. *;
import your aut ;
import jowa. dut. event. ;
class swinglemo {
   swingsemo C X
       Forame iffern = new JForame ("Divider iffern, setting (275, 150);
        yferm, settayout (were Flowlayout ());
        ofern. set lefault close of mation ( From ExITEN_CLOSE);
        Trabel glab = new Trabel ("Enter the divider and dividered: ");
       Treatfield aft = new stantfield (8);
       Transfield diff = crew Transfield (8);
       Thutton button = new Jutton ("Calculate");
       Jeabel esser = view Jtable();
       I called alat = evens Tradel ();
       Tabel what = new Teabel ();
       Jistell anslab = new Jistel ();
        john add (see);
        jem. add (ijlab);
        yeur add (astf)
       your add lot
```

```
1 talk 150 mis
   inform. add (doutton);
   grifum . add (alab);
   gym. add (blat);
   ejefin. add (auslab);
   couldon add Action listmen Conew Action listmen () & fuller word action Performed (action Every )
       touy &
          wer settent (""); 34)
               alat. setient ("");
andat. setient ("");
unt a = Integer. clausent (ailf. get Touril)
               ant aux = a/d;
               alab. settent (string. format ("A = o/od" a);
colab. settent (string, format ("B= o/od", is);
and ab. settent (string, format ("Ans= o/od", ans)
          3 catch (Number Formal Enception e) &
            3 color (southwatic Enception e) {
                 ven. retrest ("& should de Non-gero!");
```

```
Aublic estatic void amain (string args [])

2 system. out. glandler (" 'w");

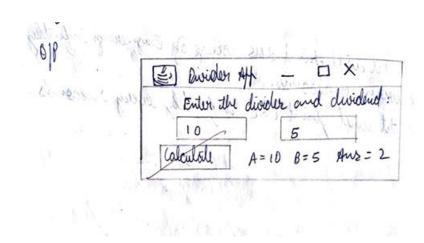
Swoingtthlities. invoke taler (Men Rumable ()) {

guttic void count() {

cuent swoinglemo();

}

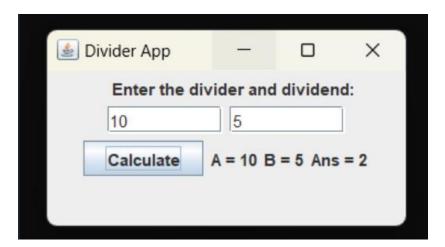
}
```



Source Code

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
class SwingDemo {
  SwingDemo() {
     JFrame ifrm = new JFrame("Divider App");
    ifrm.setSize(275, 150);
    jfrm.setLayout(new FlowLayout());
    ifrm.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
     JLabel jlab = new JLabel("Enter the divider and dividend:");
     JTextField aitf = 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();
    ifrm.add(err);
    jfrm.add(jlab);
    jfrm.add(ajtf);
    jfrm.add(bjtf);
    jfrm.add(button);
    jfrm.add(alab);
    ifrm.add(blab);
    jfrm.add(anslab);
     button.addActionListener(new ActionListener() {
       public void actionPerformed(ActionEvent evt) {
         try {
            err.setText("");
            alab.setText("");
            blab.setText("");
            anslab.setText("");
            int a = Integer.parseInt(ajtf.getText());
            int b = Integer.parseInt(bjtf.getText());
            int ans = a / b;
```

```
alab.setText(String.format("A = %d", a));
         blab.setText(String.format("B = %d", b));
         anslab.setText(String.format("Ans = %d", ans));
       } catch (NumberFormatException e) {
         err.setText("Enter Only Integers!");
       } catch (ArithmeticException e) {
         err.setText("B should be NON-zero!");
    }
  });
  jfrm.setVisible(true);
public static void main(String args[]) {
  System.out.println("Arnav Dinesh 1BM23CS052");
  SwingUtilities.invokeLater(new Runnable() {
    public void run() {
       new SwingDemo();
  });
}
```



Demonstrate Inter process Communication and deadlock

```
class & f
             valueSet = false;
   synchronised ant get () {
          vocit (); 3 catch ( intersufted Exception 2) &
             dystem. out. Jeintler ("In Parodurer waiting ")
wait ();
        day &
```

```
catch (Intersuptled Enception a) &
this. on = m;
value set = terre;
system. out. familler ("Part:" +on);
system. out. family ("In Intimate Consume
   Poroducer complements
foroducer (Qq) S
   this . 9 = 9 3
  cut it = 0;
  while (i < 3) &
     q. yut (i ++);
```

```
dq;
Consumer (Qq)
   this. 9 = 9,
  while (i < 3) &
    int or = q.get();
    system. Out gountly ("Consumed
   dg = new QC)
   new Paroducer (91);
   now Consumer (q);
   dystem. out. faintly ("Pareir Conterol - C to step.
```

```
Pour Control - C do estop.
Put: 0
```

```
Consumed: 0
Intimate Consumer
```

Peroducer waiting bot: 3 Intimate Peroducer

Coursemed: 3

Put: 4

Intimate Consumer

brot: 4

Source code

```
class Q {
  int n;
  boolean valueSet = false;
  synchronized int get() {
     while (!valueSet) {
       try {
          System.out.println("\nConsumer waiting\n");
          wait();
       } catch (InterruptedException e) {
          System.out.println("InterruptedException caught");
       }
     System.out.println("Got: " + n);
     valueSet = false;
     System.out.println("\nIntimate Producer\n");
     notify();
     return n:
  }
  synchronized void put(int n) {
     while (valueSet) {
       try {
          System.out.println("\nProducer waiting\n");
          wait();
       } catch (InterruptedException e) {
          System.out.println("InterruptedException caught");
     this.n = n;
     valueSet = true;
     System.out.println("Put: + n);
     System.out.println("\nIntimate Consumer\n");
     notify();
  }
}
class Producer implements Runnable {
  Qq;
  Producer(Q q) {
     this.q = q;
     new Thread(this, "Producer").start();
  }
```

```
public void run() {
     int i = 0;
     while (i < 3) {
       q.put(i++);
  }
class Consumer implements Runnable {
  Qq;
  Consumer(Q q) {
    this.q = q;
    new Thread(this, "Consumer").start();
  public void run() {
     int i = 0;
     while (i < 3) {
       int r = q.get();
       System.out.println("Consumed: " + r);
       i++;
}
class PCFixed {
  public static void main(String args[]) {
     System.out.println("Arnav Dinesh 1BM23CS052");
     Q q = \text{new } Q();
     new Producer(q);
     new Consumer(q);
     System.out.println("Press Control-C to stop.");
  }
}
```

```
Arnav Dinesh 1BM23CS052
Put: 0
Intimate Consumer
Producer waiting
Press Control-C to stop.
Got: 0
Intimate Producer
Put: 1
Intimate Consumer
Producer waiting
Consumed: 0
Got: 1
Intimate Producer
Consumed: 1
Put: 2
Intimate Consumer
Got: 2
Intimate Producer
Consumed: 2
```

Demonstrate Inter process Communication and deadlock

```
ryslem, out . Somethy (mane + "contened A. you
       3 cotch (Exception ie) {
      System. out. pointln ("A Interoupted");

system. out. pointln (mame + "toujung to call & losts");

ch. clast ();
synchronised void class () {
system. out. feindly ("Turide
   orynchronized word dove (A a) & spinon chance (). get Name ();
String channe = Rholead. Chare thread (). get Name ();
System. out. Jointly (mame + "contered B. base");
```

```
Thread. slep (1000);
   3 catch (Exception e) {
      System. out. familly ("
 system out faintly (mane + "il
a clart ();
            void clast () {
B of = onew BC);
Readlock () {
   Moread . current Mesad (). set Kuns ("Kain Misse
   Wholad I = mens Rholad (This, "hacing
    it . stoot ();
    sunchronized (a) &
```

dublic void own () {

osynchronized (b) {

osystem.out.pointln("Back in other thoused");

dublic static void main(strings args)

crystem.out.println("\n");

crow Deadlock ();

}

Output

Deadlock

Off

Acing Thouad entered B. boar

Main Thouad centered A. cfoo

Pacing Moreod Juying to Call A. clast ()

Main Thouad toughing to Call B. clast ()

Source code

```
class A {
  synchronized void foo(B b) {
     String name = Thread.currentThread().getName();
     System.out.println(name + " entered A.foo");
    try {
       Thread.sleep(1000);
     } catch (Exception e) {
       System.out.println("A Interrupted");
     System.out.println(name + " trying to call B.last()");
     b.last();
  }
  synchronized void last() {
     System.out.println("Inside A.last");
  }
}
class B {
  synchronized void bar(A a) {
     String name = Thread.currentThread().getName();
     System.out.println(name + " entered B.bar");
    try {
       Thread.sleep(1000);
     } catch (Exception e) {
       System.out.println("B Interrupted");
     System.out.println(name + " trying to call A.last()");
     a.last();
  synchronized void last() {
     System.out.println("Inside B.last");
  }
class Deadlock implements Runnable {
  A a = new A();
  B b = new B();
```

```
Deadlock() {
    Thread.currentThread().setName("MainThread");
    Thread t = new Thread(this, "RacingThread");
    t.start();

    synchronized (a) {
        a.foo(b);
    }

    System.out.println("Back in main thread");
}

public void run() {
    synchronized (b) {
        b.bar(a);
    }

    System.out.println("Back in other thread");
}

public static void main(String args[]) {
        System.out.println("Arnav Dinesh 1BM23CS052");
        new Deadlock();
}
```

```
Arnav Dinesh 1BM23CS052
MainThread entered A.foo
RacingThread entered B.bar
RacingThread trying to call A.last()
MainThread trying to call B.last()
```