## VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



## LAB REPORT on

# Object Oriented Java Programming (23CS3PCOOJ)

Submitted by

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



B.M.S. COLLEGE OF ENGINEERING
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## B.M.S. College of Engineering,

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 **Anu Sai Shree R (1BM23CS045)**, 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.

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## Github Link:

https://github.com/Anu1BM23CS045/Java-Lab-OOJ

## **Program 1**

## **Implement Quadratic Equation**

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.

```
System. out sprintln ("Real & distant visots: in Roots: 4711+" in Roots; +10).
  KAB .
1. Java longram that sprint cart onal solutions to the quadratic
                                                                          ulse if (d = = 0)
uquation ax2, bx1 c=0. Read in a, b, c and was the quadratic
  formula. If the discriminate be fac is nigative, display a
                                                                            011 = - b/ (double) (2+a).
 missage istating that more no real solutions.
                                                                            System . out . println ("Real and equal scott: in Root: "+ 2784" in Root: "374"
+ umport jouquatil Scanner
umport yavo lang . Matti:
                                                                            ou = - 6/ (2+a):
class quadratic &
                                                                            22 - +1ath . squt (-d)/(2+a);
                                                                             System out. println ("Root are imaginary: In Root!: "+11+"+i"+112+
                                                                                                 "In Reetz "+ 311+ '-1" + 312);
  Scanner & - neur Scanner ( system . in);
  wid guartal
  System . And . printer ( Enter a, b, c values ");
                                                                          wass Quadrun S
  a = 8. next 9nt ():
                                                                          public static void maintaining args(1)
  b = s. nexiste co:
  c = 8, nuitant ().
                                                                           Syptim . out . printer ( Anu Sai Shurk In 18M23 CSO45");
                                                                            Quadrate q= new Quadrate ();
  World compute ()
                                                                            9. egitaataU;
  while (a -- 0)
                                                                             . q. compute ();
  isyoun. enterunter ( the equation is not quadratic,
                                                                          3
          ou enter the a value");
   a = s. next 3nd ():
                                                                          Enter a, b, c values:
  d = b + b - 4 + a + c .
                                                                          Real and uqual roots:
                                                                          Root 1: -1.0
  4 (0 >0)5
  311 = (-b+ Math. squt (d))/(double) (+a);
  072 - (-6- Math. squ(d)) (double) (2+0);
```

```
Enter a.b., c values:

1 2 3

Reet au imaginary:

Reet 2: -1.0 + i 1.414

Reet 2: -1.0 + i 1.414

Enter a.b., c values:

1 -5 6

Ral iand distant viets:

Reet 2: 3.0

Reet 2: 3.0
```

```
import java.util.Scanner;
import java.lang.Math;
class Quadratic {
  int a, b, c;
  double r1, r2, d;
  Scanner s = new Scanner(System.in);
  void getdata() {
     System.out.println("Enter a,b,c values:");
     a = s.nextInt();
     b = s.nextInt();
     c = s.nextInt();
  void compute() {
     while (a == 0) {
       System.out.println("The equation is not quadratic,re-enter the a value:");
       a = s.nextInt();
     d = b * b - 4 * a * c;
     if (d > 0) {
       r1 = (-b + Math.sqrt(d)) / (double)(2 * a);
```

```
r2 = (-b - Math.sqrt(d)) / (double)(2 * a);
       System.out.println("Real and distant roots:\nRoot1:" + r1 + "\nRoot2:" +r2);
     } else if (d == 0) {
       r1 = -b / (double)(2 * a);
       System.out.println("Real and equal roots:\nRoot1:" + r1 + "\nRoot2:" + r1);
     } else {
       r1 = -b / (2 * a);
       r2 = Math.sqrt(-d) / (2 * a);
       System.out.println("Roots are imaginary:\nRoot1:" + r1 + "+i" + r2 +
"\nRoot2:" + r1 + "-i" + r2);
class Quadrun {
  public static void main(String args[]) {
    Quadratic q = new Quadratic();
    q.getdata();
    q.compute();
}
```

```
E:\>javac Quadrun.java
E:\>java Quadrun
Anu Sai Shree R
1BM23CS045
Enter a,b,c values:
Real and equal roots:
Root2:-1.0
E:\>javac Quadrun.java
E:\>java Quadrun
Anu Sai Shree R
1BM23CS045
Enter a,b,c values:
 Real and distant roots:
Root2:2.0
E:\>javac Quadrun.java
E:\>java Quadrun
Anu Sai Shree R
1BM23CS045
 nter a,b,c values:
 Roots are imaginary:
Root1:-1.0+i1.4142135623730951
Root2:-1.0-i1.4142135623730951
```

#### **Calculation Of Student SGPA**

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.

```
16/10/24.
Lab 2
2. Livelop Java Pregram de vouate la class éstudent with
  members usn, name, an array marks. Include methods to
 except and ealiplay actails and a method its walculate
  SETPA of ia istudent.
 Poreg:
  import java. will . scarinor;
 class student &
   catting uan, name;
   unt market J - nuv unt [8];
   int oudits[ ] - new int [8];
   idouble oppa:
   int affective excerti-0, total c = 0;
   word accept_det()
    Scanner is = new Scanner ( system. in);
    System. out. printer (" Enter USN;");
   usn = state s. neset ();
   System. out . printle ( Enter name: ");
    name = s. next();
   : System . wet. printer 1 Enter Marks & budits of 8 sub: 1);
    yor (int i = 0; i = 8; i++)
     System. out. printer ("Sub"+i+":");
      marks (i) = s. next 9nt ();
     weath (iJ - s. next Int ();
           call-sgpa ()
    unt grade;
    ghade & (mater
```

```
4 ( stud ( i ] . vale - agpa () = = -1.0)
          gradi - 10;
She if (gradi < 4) & outwer -1.0; 3
                                                                      E system out printer (studist name + with usn: "+ studiet.usn
            sieri + = (gradi + wudits[i]);
           statal c += condito(i);
                                                                      istuation airiay ():
         esternis ogpa = (double) earous suctail c;
  world display ()
                                                                  Enter wan and name: 18112365111 Quin
   System . out private ("Details: In Name: "+ name +" In Unit won);
                                                                  Enter subject Marks and coudits you a sub:
  System . and . printin ( " Marks of Subject : ");
                                                                  'sub1: 99 4
   System-out-print("Sub"+(i+1)+":"+ marks(i]+"");
                                                                 Sub 4: 86 3
   System . out . println ("Sgpa: "+ sgpa);
                                                                 Sub 5: 92 3
                                                                 Sub 6: 67 1
ulass studsgpa &
                                                                 Dub 3: 89 1
public static word main (string varge ( ))
                                                                 Datails:
System . out printer ("Anu Sai Shrue RIn 18192305045");
Student stud (1 + new student C3);
                                                                 Usn: 18M23 CS111
yor (int 1-0; 123; 1+1)
                                                                 Marks of subjects
                                                                Sub1: 99 Jub2: 87 Sub3: 90 Sub4: 86
  estud (1) - new student ();
                                                                 Sub7:95 Sub 8:89
  ested Cit. accept - act ():
                                                                 Sgpa: 9.45.
```

import java.util.Scanner;

```
class Student {
  int marks[] = new int[8];
  int credits[] = new int[8];
  String usn, name;
  double sgpa;
  int escore = 0, total_c = 0;

void accept_det() {
    Scanner s = new Scanner(System.in);
```

```
System.out.print("Enter usn and name:");
     usn = s.next();
     name = s.next();
     System.out.println("Enter Subject marks with it's respective credits:");
     for (int i = 0; i < 8; i++) {
       System.out.print("Sub" + (i + 1) + ":");
       marks[i] = s.nextInt();
       credits[i] = s.nextInt();
    }
  }
  double calc sgpa() {
     int grade;
     for (int i = 0; i < 8; i++) {
       grade = (\text{marks}[i] / 10) + 1;
       if (grade == 11)
          grade = 10;
       else if (grade < 4)
          return -1.0;
       escore += (grade * credits[i]);
       total c += credits[i];
     sgpa = (double) escore / total_c;
     return sgpa;
  void display() {
     System.out.println("Details:\nName:" + name + "\nUsn:" + usn + "\nMarks of
subjects:");
     for (int i = 0; i < 8; i++) {
       System.out.print("Sub" + (i + 1) + ": " + marks[i] + " ");
     }
     System.out.println("\nSgpa:" + sgpa);
  }
```

}

```
Anu Sai Shree R
1BM23CS045
Enter usn and name:1BM23CS111 Sun
Enter Subject marks with it's respective credits:
Sub1:99 4
Sub2:87 4
Sub3:90 3
Sub4:86 3
Sub5:92 3
Sub6:67 1
Sub7:95 1
Sub8:89 1
Enter usn and name:1BM23CS222 Moon
Enter Subject marks with it's respective credits:
Sub1:11 4
Sub2:22 4
Sub3:33 3
Sub4:44 3
Sub5:55 3
Sub6:66 1
Sub7:77 1
Sub8:88 1
Enter usn and name:1BM23CS333 Earth
Enter Subject marks with it's respective credits:
Sub1:
100 4
Sub2:99 4
Sub3:87 3
Sub4:91 3
Sub5:96 3
Sub6:81 1
Sub7:96 1
Sub8:76 1
```

```
Details:
Name:Sun
Usn:1BM23CS111
Marks of subjects:
Sub1: 99 Sub2: 87 Sub3: 90 Sub4: 86 Sub5: 92 Sub6: 67 Sub7: 95 Sub8: 89
Sgpa:9.45
Moonwith usn:1BM23CS222:Sgpa cannot be calculated:Any one sub is Failed
Details:
Name:Earth
Usn:1BM23CS333
Marks of subjects:
Sub1: 100 Sub2: 99 Sub3: 87 Sub4: 91 Sub5: 96 Sub6: 81 Sub7: 96 Sub8: 76
Sgpa:9.7
```

## Demonstration of Array of objects of each book type

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.

```
iclass Booksiens
   Lab 3
                                                                     public static word main (string arg (1)
  Q. buals in class book which contains of numbers : na
   point, num pages. Include a constructor to set
                                                                     System. Lett printen l'Anu Sai Show ( In 18M2 305046"):
   yer the members. Include nethods to set and get the
                                                                     Scanner s - new Scanner ( System in);
  idetails of the objects. Include a textring () method
                                                                     unt n, which numbages;
  could aspear the complete actacle to the book
                                                                     String name, authori:
                                                                      System . out printle ("Enter number of books: ");
 import yava, will bearners
                                                                      n. s. next9nt();
 ulas Books S
                                                                      BOOKS DEJ;
  String name, author:
                                                                      b = new Beeks [n];
  und prin numpages;
                                                                      yor (int i-0; ixn; i++)
  Books ( string name, String author, int price, int numpages)
                                                                        System . out . printer ("Enter name, author, wrice and
                                                                                              number of pages of Book + (i+1)+": ");
  this name name:
  this author - author
                                                                        author . s. nixt U;
  this price - price;
                                                                        price = s. next 9nt ();
  this . numPages . numpages;
                                                                        numPages = s. next 9 nt ();
                                                                        btil- new Books (name, author, price, numbages).
 public string destring ()
                                                                        System out printer l'in Books Sutails: ");
 string name, author, price, numbages;
                                                                        for (int i=0; isp; i++)
 name - " Beek name :" + this . name + " In" ;
 author= "Author name: " + this. author + "\n"
                                                                         System wout printer ("BOOK"+(i+1)+": In" + b(i)).
 presist + " Presist : "+ this. presist + "\n";
numbages + "Number of pages" + this numbages + "In";
viction name + author + price + numpages;
```

```
Cutput:

Enter number of books:

I unter name, author, point and number of pages of Book!:

bahu

Mahi

699

200
```

```
import java.util.Scanner;
class Books {
  String name, author;
  int price, numPages;
  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 Bookrun {
  public static void main(String arg[]) {
     System.out.println("Anu Sai Shree R\n1BM23CS045");
     Scanner s = new Scanner(System.in);
```

```
int n, price, numPages;
     String name, author;
     System.out.println("Enter number of books:");
     n = s.nextInt();
     Books b[];
     b = new Books[n];
     for (int i = 0; i < n; i++) {
       System.out.println("enter name, author, price and number of pages of Book"
+(i+1)+":");
       name = s.next();
       author = s.next();
       price = s.nextInt();
       numPages = s.nextInt();
       b[i] = new Books(name, author, price, numPages);
     System.out.println("\nBooks Details:");
     for (int i = 0; i < n; i++) {
       System.out.println("Book" + (i + 1) + ":\n" + b[i]);
  }
```

```
Anu Sai Shree R
1BM23CS045
Enter number of books:
enter name, author, price and number of pages of Book1:
bahubali
rajamouli
600
enter name, author, price and number of pages of Book2:
rajamouli
800
enter name, author, price and number of pages of Book3:
kantara
rs
200
Books Details:
Book1:
Book name:bahubali
Author name:rajamouli
Price:600
Number of pages:6
Book2:
Book name:rrr
Author name:rajamouli
Price:800
Number of pages:3
Book3:
Book name:kantara
Author name:rs
Price:200
Number of pages:3
```

## **Demonstration Of Abstract Class**

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

```
23/10/24
2004
Europe a Java Priogram to weath an abstract class
name snape that contains a untigues 2 an umpty method
named printArual). Provole 3 was - Rutangle, Triangle &
wiell . ..
umport yava. util. Scannor;
abstract class shapes
unt idimi, dimit;
idouble area;
Scanner 5 = new Scanner (System .in);
capstract wood printaria ();
   " (oret " time france property
class Rutangle extends Shape &
 Rutangle ()
 System . out . printer l'Enter aiminsions of ructangle: ");
  dim 1 = 3. next Int ();
  dim 2 - 5 next Int();
  word printaria ()
  ¿ ava = dim ra dimi;
   System. out. printer to Area of Rectangle + area);
 class Touangle usctends Shape &
 Truangle ()
  System out printer ("enter dimensions of triangle: ");
  aim 1= 3. nextont();
  dim 2 > s. next tral);
```

```
output.
                                                              enter diminuon
      10410 - / dim 1 = dim + 2) 12.0 :
                                                               Enter dimensións
       wich axunds shapes
                                                               Enter dimensions
  System out printer ("inter dimensions of will")
                                                               Avus of Rutangle: 6.0
                                                               Asua of Durange: 3.0
                                                               Asua of wich: 12.56
      Shapirun
public static word main (string args ()
System out puritte ( Anu 1);
Rictargu or > new Ractargu U;
Triangle + = new Inlangle 1).
Circle e - new Circle ();
or printoua ();
t. printaria ();
c. printaria ():
```

```
import java.util.Scanner;

abstract class Shape {
   int dim1, dim2;
   double area;
   Scanner s = new Scanner(System.in);
   abstract void printarea();
}

class Rectangle extends Shape {
   Rectangle() {
      System.out.println("Enter dimensions of rectangle:");
      dim1 = s.nextInt();
      dim2 = s.nextInt();
}
```

```
void printarea() {
     area = dim1 * dim2;
    System.out.println("Area of Rectangle:" + area);
class Triangle extends Shape {
  Triangle() {
     System.out.println("Enter dimensions of triangle:");
    dim1 = s.nextInt();
    dim2 = s.nextInt();
  void printarea() {
    area = (\dim 1 * \dim 2) / 2.0;
    System.out.println("Area of Triangle:" + area);
class Circle extends Shape {
  Circle() {
    System.out.println("Enter dimensions of circle:");
     dim1 = s.nextInt();
  }
  void printarea() {
    area = 3.14 * dim1 * dim1;
    System.out.println("Area of Circle:" + area);
class Shaperun {
  public static void main(String args[]) {
     System.out.println("Anu Sai Shree R\n1BM23CS045");
    Rectangle r = new Rectangle();
```

```
Triangle t = new Triangle();
    Circle c = new Circle();
    r.printarea();
    t.printarea();
    c.printarea();
}
```

```
D:\hehe>javac Shape.java

D:\hehe>java Shaperun

Anu Sai Shree R

1BM23CS045

Enter dimensions of rectangle:

2 3

Enter dimensions of triangle:

2 3

Enter dimensions of circle:

2 Area of Rectangle:6.0

Area of Circle:12.56
```

## Implementation of Bank

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.

```
System. out pointln ( " Insufficient funds !! ") ",
maintains 2 whinds of vaccount you It's customers
                                                                public word diplaytalance (18
                                                                System out printer ( twount Balances 4 balance)
 sprivate string waterwer name;
                                                               iciais Sovings Account untinde Account S
  protected asunt balance;
                                                                   private double interestlate;
                                                                    public Savings Account latting on, int acc, double it.
 public Account ( string constorner name ant acc no, double balance)
                                                                                          double in)
                                                                     super (en, acc, ub);
  this accret accore;
this balance balance:
                                                                       interest Rate = ing
                                                                    public void computeAnd DipositInterest () &
                                                                      double interest - getbelance ()+ unterestrate 100
                                                                      adiposit (interest);
  spublic double getBalance () &
    oution balance;
                                                                ceass covernt Account extends Account &
  public used deposit (double camount )5
                                                                    sprivate double minimum Balance;
                                                                    private double service Charge;
   System out printer ("Superited;" , amount);
                                                                     public coveret Account Catting on , int acc, double is,
                                                                          double, mb, double sc)
  System out printer ("Apposit amount must be positive.");
                                                                     super ( ous to on, acc, ib);
                                                                     minimum Balance - mb;
                                                                      source charge - sc;
 public void wishdraw (double amount)
  if Camount e - igusalance (1) {
     balance - = camount;
  System . out. printer ("withdrew: "+ amount + "balance is "+
```

```
Syptem out punter l'Enter choice: In 1. deposit in
    if (get Balance 1) & minimum Balance)
                                                                                                     2 with areas in 3 chiplay
      System .out . printin ("Balance is below minimum");
        balana - = survialhange:
       Spring and printer ( " Liducted source whongs " + sowie (hong);
                                                                          co. which Minimum Balance ();
      System out pounts ("Baiance ages accountion is " + balance);
                                                                           4(0-1)8
                                                                            System out printing Enter amount to be deposited : );
                                                                             double ant = sc. nextenouble();
                                                                             ca deposit cant): 3
public class Banks
                                                                            ula 4 (c--2) &
  public static word main (stringt s varys) ?
                                                                            System. out printer ("Enter camount to withdraw:");
      scanner st = new Scanner ( system . in);
                                                                              ant + se nestatouble ();
      System - out printer ("letter recontre name;");
                                                                                ca. with draw (ame): 3
      String name . St. next Sine ();
                                                                              ulse if (e = = 3) &
      Suptern . out . sprinten l'Enter caccardi;
                                                                              ca display Balance (); 3
      int occ. no + Sc. next Intel;
      System out printin ( there united balance : ');
                                                                             Mod
                                                                              System. axitleli
      deutil balance : sc. next Double ();
                                                                            3 while (bul);
      System out printen ("Enter minimum balance:");
                                                                       was 2: System out printer l'account is savings type!);
                                                                               Savings Account sar new Savings Account (name, acc_no,
      identil mir balance = sc. nextDoublell;
      Suprim seil ipuntin (" Erder interest rate "):
                                                                                                      balance, interest _ rate);
      deuble interest nate = se rexistorible();
                                                                               System out printer ("Enter whoise: In 1. dipositins, with
      System. out printer (" into sorvice charge: ");
                                                                                                 araw in 3 display balance");
      double wurie warge . w. next Double ();
      System out printer ("listemer name is: "+ name+" In Account
                                                                                int (1 = st. next Int ();
                           number: "+ au-no + "in Anu Sai Show &
                                                                                if 1(1==1) 5
                          In 181423C3045 1)
                                                                               System .out printen ("Enter comount to be apposited.");
                                                                                ant + se. next Double (1;
      switch (ch) &
                                                                                  sa. deposit (amt); 3
      wase 1: System. out. printer ("account is abount typi");
                                                                               System, out, printer ( enter amount to withdraw!);
                                                                               alse if (C1 == 2) &
               Coveretticount to new Coverettowns (nom, sine,
                                balance, min balance - owwie charge);
                                                                                ant = sc . next Double ();
```

```
uld if (11==3) &
        sa. compute and Duposit Intuist ();
           sa . aisplay Balance (); 3
      3 while (Dul);
Output:
unter customer name: ather
untu aceno:1
                                     witharw: 50. 0 balanus 550
unter unitial balance: 500
                                     entu choice:
                                     1. deposit
unter service charge: 50
                                        3 display balan 4
Enter choice
1. cuvunt ace
 Account number: 1
account is wound type
unter choice:
 1. deposit
 2. withdraw
 3. display batance
Deposited :100.0
inte choice
1. deposit
2. withdraw
3. displace badance
```

```
import java.util.Scanner;

class Account {
    private String customer_name;
    private int acc_no;
    protected double balance;

public Account(String customer_name, int acc_no, double balance) {
```

```
this.customer name = customer name;
    this.acc no = acc no;
    this.balance = balance;
  }
  public double getBalance() {
    return balance;
  public void deposit(double amount) {
    if (amount > 0) {
       balance += amount;
       System.out.println("Deposited: " + amount);
    } else {
       System.out.println("Deposit amount must be positive.");
 public void withdraw(double amount)
    if(amount<=getBalance()){</pre>
      balance-=amount;
      System.out.println("withdrew:"+amount + " balance is:"+ balance);
      }
    else
     System.out.println("Insufficient funds!!");
  public void displayBalance(){
    System.out.println("Current Balance: " + balance);
}
class SavingsAccount extends Account {
  private double interestRate;
  public SavingsAccount(String customerName, int accountNumber, double
initialBalance, double interestRate) {
    super(customerName, accountNumber, initialBalance);
```

```
this.interestRate = interestRate;
  public void computeAndDepositInterest() {
    double interest = getBalance() * interestRate / 100;
    deposit(interest);
  }
class CurrentAccount extends Account {
  private double minimumBalance;
  private double serviceCharge;
  public CurrentAccount(String customerName, int accountNumber, double
initialBalance, double minimumBalance, double serviceCharge) {
    super(customerName, accountNumber, initialBalance);
    this.minimumBalance = minimumBalance;
    this.serviceCharge = serviceCharge;
  public void checkMinimumBalance() {
    if (getBalance() < minimumBalance) {</pre>
       System.out.println("Balance is below minimum");
       balance-=serviceCharge;
       System.out.println("Deducted service charge:" +serviceCharge);
       System.out.println("Balance after deduction is:"+balance);
  }
public class Bank {
  public static void main(String[] args) {
      System.out.println("Anu Sai Shree R\n1BM23CS045");
    Scanner sc = new Scanner(System.in);
    System.out.println("enter customer name:");
    String name=sc.nextLine();
    System.out.println("enter accno:");
    int acc no=sc.nextInt();
    System.out.println("enter initial balance:");
    double balance=sc.nextDouble();
```

```
System.out.println("enter minimum balance:");
    double minimum balance=sc.nextDouble();
    System.out.println("enter interest rate:");
    double interest rate=sc.nextDouble();
    System.out.println("enter service charge:");
    double service charge=sc.nextDouble();
    System.out.println("Enter choice:\n 1.Current acc\n 2.Savings acc");
    int ch=sc.nextInt();
    System.out.println("Customer name is:"+ name+"\nAccount
number:"+acc no);
    switch(ch){
       case(1):
         System.out.println("account is current type");
         CurrentAccount ca = new
CurrentAccount(name,acc no,balance,minimum balance,service charge);
         do{ System.out.println("enter choice:\n 1.deposit\n 2.withdraw\n 3.display
balance");
         int c=sc.nextInt();
         ca.checkMinimumBalance();
         if(c==1)
           System.out.println("enter amount to be deposited:");
           double amt=sc.nextDouble();
            ca.deposit(amt);}
         else if(c==2){
           System.out.println("enter amount to withdraw:");
           double amt=sc.nextDouble();
           ca.withdraw(amt);}
         else if(c==3){
           ca.displayBalance();}
         else
          System.exit(0);
          }while(true);
      case(2):
          System.out.println("account is savings type");
```

```
SavingsAccount sa=new
SavingsAccount(name,acc no,balance,interest rate);
         do \{ System.out.println("enter choice: \n 1.deposit \n 2.withdraw \n
3.display balance");
         int c1=sc.nextInt();
         if(c1==1){
           System.out.println("enter amount to be deposited:");
           double amt=sc.nextDouble();
            sa.deposit(amt);}
         else if(c1==2){
           System.out.println("enter amount to withdraw:");
           double amt=sc.nextDouble();
           sa.withdraw(amt);}
         else if(c1==3){
          sa.computeAndDepositInterest();
           sa.displayBalance();}
         else{
          System.exit(0);
         }while(true);
```

```
D:\Anu\Engineering\java>java Bank
Anu Sai Shree R
1BM23CS045
enter customer name:
athu
enter accno:
enter initial balance:
enter minimum balance:
enter interest rate:
enter service charge:
Enter choice:
1.Current acc
2.Savings acc
Customer name is:athu
Account number:1
account is current type
enter choice:
1.deposit
2.withdraw
3.display balance
enter amount to be deposited:
100
Deposited: 100.0
```

```
enter choice:
 1.deposit
 2.withdraw
3.display balance
enter amount to withdraw:
withdrew:50.0 balance is:550.0
enter choice:
 1.deposit
 2.withdraw
 3.display balance
Current Balance: 550.0
enter choice:
 1.deposit
 2.withdraw
 3.display balance
4
```

## **Demonstration Of Package**

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.

```
13/11/2024
· buate la package CIE which has a classes - Student land Internals
The class Student was minkers like usn, name, sem. The
iclass Inturnals carrived from student chas an carriag that
stores the unternal marks severed in your courses of the
twittend isimister of the istudent. buate another spaceage
SEE which that the class External which its a derived
was of istudent. This class has an laveray that stores
the SEE marks severed in 5 courses of the current
isomester of the istudent. Import the 2 packages in
a fin that dictaris the final marks of a students
in all fur courses.
→ CIE:
  package eIE:
  umport y'ava. uitil. Scanner;
  public class Studings
  protected String usn-new String (1;
  protected String name-new String ();
  protected unt com:
  public word inputstudent Ditails ()
  Seanner & - new Scanner (System in);
   System out printent trave use, name and spressed semister. ).
   usn - se nixt();
   name = sc. nesell.
   sem = se, next Intlo:
  public roid asspray Student Dutails ()
  System. out. printin ( Student Ditails: In USN: ", usn: 'In Name: + name
                     + "In Prusent Sim: "+ sim).
```

```
package CIE;
                                                         407 (int i-0; i/5; il+4)
unipoli y'ala. util . Scanner;
                                                         System . out. printer ( "Enter sub" + (i+1) + "marks: ");
public class Internals withinds whident &
                                                        marks(i) - se nexts att);
 prouted unt market I - new unt (5);
 public word inputciemarks()
 public word validinal Marks ()
 Scanner se - nue Scanner (system. in);
 System out sprinter ("Enter de Range marks:");
                                                        for list ico; ich; i++)
 yor (and iso; iss; i+1)
                                                        yinal Movestill - super markstill + markstill;
 System . out . printen ("Enter sub"+ (i+1)+"marks:");
 marks [i] = se. next fat();
                                                       -puttic usid colispay Final Marks ()
                                                       System out printen (" Linas Marks: ").
SEE:
                                                       yor (int i=0; i<5; i++)
package SEE;
umpted CIE. +;
                                                        System . out privaten ("Sub"+(i+1)+":"+ final Marks (i)+"
umport java util Scanner;
                                                        system our printle ();
public class Externals vateras Internals &
  uprolected wite markst];
  protected int final arks ( );
                                                       public word adoptor student Ditails ()
Scanno De - nuo Scanno (System in);
                                                       System . out printer l'Student Litails: In USN: + usn + "InName: + name +
public Extremal CNS
                                                              "In Prusent Sum: "+ sum!
                                                       aisplay Final Marks ();
marks = new int(5);
final Maries - new int (5);
public uoid unpul stempeks (18
System, out. println("Enter SEE marks (aut of 60):");
```

```
main:
                                                                   enter UF marks
 amport SEF. "
                                                                   Enter Suchi marks: 45
 umport CIE. *
 import java util Searner;
                                                                          Sub 1 marks : 43
 class main &
 public static word main (String args )
 lystim. eul printin ("18M23(5045");
                                                                   Enter SEE marks (out of 50)
 Scanner de - new Scanner ( & your in).
                                                                    Enter Sub! marks: 43
                                                                          Sub2 marks: +6
 System . out printin ( " Enter number of Students: ");
  n- sc. next IntU:
  Exturnal estud [] = new Exturnals(n);
                                                                    Student Autail
  407 (int i.o; ixn; i++)
                                                                    umi
   System . out . printer ( "Enter Student + (i+1) + " dutails :
                                                                   Name. Sal
                                                                   Prusent Simi 3
   stud (il- new Externals():
   stud [i] input Student Dutails ();
                                                                  Find Marks
                                                                                         Sub3:87 Sub4:16
   usted (i) input (IFmants();
   ested [i]. unput SEF marks ();
   ested [i]. naltfinal Marks U:
   stud [ .: ] display Student Details ();
 Output
 Enter number of Students:1
  Enter Student 1 details:
        usn name and present semesty;
  sai
```

#### CIE

```
o Student.java
package CIE;
import java.util.Scanner;
public class Student {
   protected String usn = new String();
   protected String name = new String();
   protected int sem;
   public void inputStudentDetails() {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter usn,name and present semester:");
```

```
usn = sc.next();
    name = sc.next();
    sem = sc.nextInt();
  }
  public void displayStudentDetails() {
    System.out.println("Student details:\nUsn:" + usn + "\nName:" + name +
"\nPresent Sem:" + sem);
}
   o Internals.java
package CIE;
import java.util.Scanner;
public class Internals extends Student {
  protected int marks[] = new int[5];
  public void inputCIEmarks() {
     Scanner sc = new Scanner(System.in);
    System.out.println("Enter CIE marks:");
    for (int i = 0; i < 5; i++) {
       System.out.println("Enter sub" + (i + 1) + "marks:");
       marks[i] = sc.nextInt();
   SEE
   o Externals.java
package SEE;
import CIE.*;
import java.util.Scanner;
public class Externals extends Internals {
  protected int marks[];
  protected int finalMarks[];
  Scanner sc = new Scanner(System.in);
```

```
public Externals() {
    marks = new int[5];
    finalMarks = new int[5];
  }
  public void inputSEEmarks() {
     System.out.println("Enter SEE marks(out of 50):");
    for (int i = 0; i < 5; i++) {
       System.out.println("Enter sub" + (i + 1) + "marks:");
       marks[i] = sc.nextInt();
  }
  public void calcFinalMarks() {
    for (int i = 0; i < 5; i++) {
       finalMarks[i] = super.marks[i] + marks[i];
  }
  public void displayFinalMarks() {
     System.out.println("Final Marks:");
    for (int i = 0; i < 5; i++) {
       System.out.print("Sub" + (i + 1) + ":" + finalMarks[i] + " ");
     }
    System.out.println();
  }
  public void displayStudentDetails() {
     System.out.println("Student details:\nUsn:" + usn + "\nName:" + name +
"\nPresent Sem:" + sem);
    displayFinalMarks();
```

}

```
main.java
import SEE.*;
import CIE.*;
import java.util.Scanner;
class Main {
  public static void main(String args[]) {
    System.out.println("1BM23CS045\nAnu Sai Shree R");
    Scanner sc = new Scanner(System.in);
    int n;
    System.out.println("Enter number of Students:");
    n = sc.nextInt();
    Externals stud[] = new Externals[n];
    for (int i = 0; i < n; i++) {
       System.out.println("Enter Student" + (i + 1) + " details:");
       stud[i] = new Externals();
       stud[i].inputStudentDetails();
       stud[i].inputCIEmarks();
       stud[i].inputSEEmarks();
       stud[i].calcFinalMarks();
       stud[i].displayStudentDetails();
```

```
D:\myusn>java Main
1BM23CS045
Anu Sai Shree R
Enter number of Students:
Enter Student1 details:
Enter usn,name and present semester :
sai
Enter CIE marks:
Enter sub1marks:
45
Enter sub2marks:
Enter sub3marks:
45
Enter sub4marks:
Enter sub5marks:
Enter SEE marks(out of 50):
Enter sub1marks:
Enter sub2marks:
Enter sub3marks:
Enter sub4marks:
Enter sub5marks:
12
Student details:
Usn:1
Name:sai
Present Sem:3
Final Marks:
Sub1:88 Sub2:96 Sub3:87 Sub4:75 Sub5:62
```

```
Enter Student2 details:
Enter usn, name and present semester :
shree
Enter CIE marks:
Enter sub1marks:
Enter sub2marks:
50
Enter sub3marks:
43
Enter sub4marks:
23
Enter sub5marks:
34
Enter SEE marks(out of 50):
Enter sub1marks:
45
Enter sub2marks:
45
Enter sub3marks:
45
Enter sub4marks:
Enter sub5marks:
23
Student details:
Usn:2
Name:shree
Present Sem:3
Final Marks:
Sub1:90 Sub2:95 Sub3:88 Sub4:73 Sub5:57
```

## **Demonstration Of Exception Handling**

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

```
Lab 7
                                                               class Father 5
WAP that auronaticals chandling of a inceptions in
                                                               int tage;
unhoutance Due. bust a base class called as Fathor
                                                               gathor (unt a) &
and derived class " Son" which eatered the base class
In yother's class impliment is constructor which takes
the age and throws the vaception wronge Age () when
the unput age is cless than O. In Son's class implement
                                                                throw new wrong Age (fage);
ia constructor that besid both father's lage and
 throws exception if son's age > = gather's age.
import jasa udil Scanner;
                                                               was Son extends Fathers
was wrong Age worknow Exception &
whongage (int a)
                                                                Son (int to, int a)
 this a - a:
                                                                super (fa):
 public string to string (1) 
                                                               public wind sonvalidages throws son Age Exceeds Father Age &
was Sontigi Excude tathertige waterds Exception &
                                                                throw new SonAge Exceeds Father Age (fage age)
Ser Age Exceeds to therape ( into)
                                                                word display ()
                                                                 System. out printer ("Father's age: " + fage+ "In Son's Age." + age).
public string destring () &
 ordern a father's ("+fo+") age cannot be lesser than
          that of won ("+ a+")";
```

```
Enter Forther's age.
class Fathersons
public status word main (string args ) &
                                                                    Enter Son's age!
Scanner se - new Scanner (System in);
                                                                    DI
 System . out printen l'Enter Father's age: ").
                                                                    Ages are valid
 unt gage . sc. nextontel;
                                                                    Father's age: 24
 System . wid - printen ("Enter Son's age . ").
                                                                    Son's agress
  unt age - se next Int (1;
                                                                      Seen
  child. yathowalidage ();
  child . sorwalidage ();
  System . out printle ( Ages are valid );
 child display ();
  eatch ( worong Age c) &
  System our printen(e);
 eatch ( son Age Exceeds Father Age e) S
  System. out printen (e);
 Output!
 Entor Father's Age:
 Enter Bon's Age!
 -1 is a wivaged ages
Enter Father's Age
Enter Son's Age
 father's fillage cannot be cluster than that of son (20)
```

```
import java.util.Scanner;
class WrongAge extends Exception {
  int a;
  WrongAge(int a) {
    this.a = a;
  }
  public String toString() {
    return a + " is a invalid Age";
  }
}
class SonAgeExceedsFatherAge extends Exception {
  int fa, a;
```

```
SonAgeExceedsFatherAge(int fa, int a) {
    this.fa = fa;
    this.a = a;
  }
  public String toString() {
    return "father's(" + fa + ") age cannot be lesser than that of son(" + a + ")";
}
class Father {
  int fage;
  Father(int a) {
    fage = a;
  public void fathervalidage() throws WrongAge {
    if (fage < 0) {
       throw new WrongAge(fage);
class Son extends Father {
  int age;
  Son(int fa, int a) {
    super(fa);
     age = a;
  public void sonvalidage() throws SonAgeExceedsFatherAge {
    if (fage < age) {
       throw new SonAgeExceedsFatherAge(fage, age);
     }
  void display() {
    System.out.println("Father's age:" + fage + "\nSon's age:" + age);
```

```
class FatherSon {
  public static void main(String args[]) {
     Scanner sc = new Scanner(System.in);
     System.out.println("Anu Sai Shree R\n1BM23CS045");
    System.out.println("Enter Father's age:");
    int fage = sc.nextInt();
    System.out.println("Enter Son's age:");
    int age = sc.nextInt();
    Son child = new Son(fage, age);
    try {
       child.fathervalidage();
       child.sonvalidage();
       System.out.println("Ages are valid");
       child.display();
     } catch (WrongAge e) {
       System.out.println(e);
     } catch (SonAgeExceedsFatherAge e) {
       System.out.println(e);
```

```
E:\>javac FatherSon.java
E:\>java FatherSon
Anu Sai Shree R
1BM23CS045
Enter Father's age:
-1
Enter Son's age:
-1 is a invalid Age
E:\>javac FatherSon.java
E:\>java FatherSon
Anu Sai Shree R
1BM23CS045
Enter Father's age:
10
Enter Son's age:
20
father's(10) age cannot be lesser than that of son(20)
E:\>javac FatherSon.java
E:\>java FatherSon
Anu Sai Shree R
1BM23CS045
Enter Father's age:
24
Enter Son's age:
10
Ages are valid
Father's age:24
Son's age:10
```

# **Program 8**

## **Demonstration Of Threads**

program which creates two threads, one thread displaying "BMS College of Engineering" once every ten seconds and another displaying "CSE" once every two seconds.

# Algorithm:

```
Labs
                                                                 class main f
                                                                 public static wid main (String args ( ))
· With a program which whates & threads, one thread
displaying "EMS tellige to Engineering " once wery 10 seconds
and another display!" (SF" some every 2 seconds
                                                                   es t - new esci
                                                                  Thuad C - new Thread (t);
                                                                     c. start;
class BMS extends Thread
5
 public upid ounce
                                                                autput:
 for line in: 11 x = 5 : 11 +1)
                                                                 BMS college of Engineering
    System out printer ("BMS college of Engineering");
                                                                 CSF
                                                                 CSE
    Thruad weep (10000):
     watch ( Intorupled Exception e)
                                                                 oms tough of Engineering
 class Cs implements Rumable
 public used sunce
    Syptem . Des printen ("CSE"):
    Thouad sleep (2000);
    catch (Inwoughed Exception e)
       System . and . printer ( " Inwourpled.");
```

```
class BMS extends Thread {
  public void run() {
    for (int i = 1; i <= 5; i++) {
        System.out.println("BMS College of Engineering");
    }
}</pre>
```

```
try {
         Thread.sleep(10000);
       } catch (InterruptedException e) {
         System.out.println("interrupted.");
class CS extends Thread {
  public void run() {
    for (int i = 1; i \le 5; i++) {
       System.out.println("CSE");
       try {
         Thread.sleep(2000);
       } catch (InterruptedException e) {
         System.out.println("interrupted.");
class threadExtends {
  public static void main(String args[]) {
    System.out.println("Anu Sai Shree R\n1BM23CS045");
    BMS b = new BMS();
    CS c = new CS();
    b.start();
    c.start();
```

```
E:\hehe>javac threadExtends.java
E:\hehe>java threadExtends
Anu Sai Shree R
1BM23CS045
BMS College of Engineering
CSE
CSE
CSE
CSE
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
E:\hehe>javac threadImplements.java
E:\hehe>java threadImplements
Anu Sai Shree R
1BM23CS045
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
```

# **Program 9**

# **User Interface for division of 2 Numbers(Open Ended Exercise)**

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.

#### Algorithm:

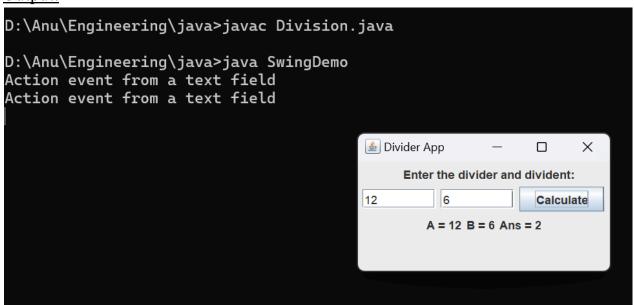
```
frm. add (aftf);
               27/1/24
Lab 9
                                                                         jum . add (bity);
" hvide a pregram that weater a user interpace of
                                                                          from . sold (button);
puporm integer duitsions. User unwo 2 numbers in the text
                                                                          jum , add (alab);
fulds, Num & Nums. Division of a numbers is
                                                                         frm . add(blab);
displayed.
                                                                         from .aad(anstab);
                                                                         Adienkistinur J = new Adienkistinur ()
import javoz swing . * ;
import yava.aut. +;
                                                                          public wid ladien Purgermed (Adien Frunt wet) &
import java. aut. went. +;
                                                                             System . out printer ("Action swent from a state
class Swing Dime &
    JEHAMI. jfrm - NEW JEHAMI ( Divider App "):
                                                                         ajty add Action Listenus;
     ifrum . set Sige (275, 150);
                                                                         bit . add Action historical );
    ifim sitrayouthew Flowhayout()).
                                                                         button. add Action Listence (new Action Listence (1) &
    offen sit Defauttless Operation (JFram EXIT. ON-CLOSE):
                                                                            public void action Purpormed (Action Event wet) &
    Ilabel flat = new Thabelt Fram the divider and divident !)
                                                                                int a - Intiger . parsunt (afth . get Lixt (1):
    I trait ild aft - new IText + ild(8)
                                                                                unt b. Integer . parseint (bity. get Text ():
    J Frattild bity - new J trat Field (2);
                                                                              - unt cans alb:
                                                                                alab.sutiat("In A = "+a);
    Thutten button = new Jautten ( (alculate ):
                                                                               blab. suttext ("InB = "+b);
                                                                               anslab - sittext("In Ans "+ ans);
    Jakel www. new Jeakell);
    Jeabel alab - new Jeabel ();
                                                                           eatch (Number Format Exception e) &
    Jeabel blab : new Jeabell;
                                                                            alab settlest ("1);
   Jeabel anslab , new Jeabel ().
                                                                            blab set Int ("").
                                                                           ans lab. set Jeat ( "):
   form. add (vvi);
                                                                           wor. all Jest ("Enter Only Inleger !");
   from . add ( flab);
```

```
rater (Arithmetic Fragion e) &
       alab. set Jest ("");
       blab set Jext (" ");
      ansiab setted ( ");
      wor. settleat("B should be NON Zuro!");
  3):
  jfrm. su visikle (tul);
                word main (string args( )) &
  public static
   Swing Utilities . unvoke Later (new Runnable () &
                 nue Swingsumo ();
         public word run () &
                 win sain Lugarnid (Action Front
             in a some of the state of the state the
autput:
 [ Dividur App
   Enter the divider and
      divident
  [Calculat | A=12 B=6 Ans=2
```

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
class SwingDemo {
  SwingDemo() {
    // create iframe container
    JFrame ifrm = new JFrame("Divider App");
    jfrm.setSize(275, 150);
    ifrm.setLayout(new FlowLayout());
    // to terminate on close
    jfrm.setDefaultCloseOperation(JFrame.EXIT ON CLOSE);
    // text label
    JLabel ilab = new JLabel("Enter the divider and divident:");
    // add text field for both numbers
    JTextField aitf = new JTextField(8);
    JTextField bitf = new JTextField(8);
    // calc button
    JButton button = new JButton("Calculate");
    // labels
    JLabel err = new JLabel();
    JLabel alab = new JLabel();
    JLabel blab = new JLabel();
    JLabel anslab = new JLabel();
    // add in order :)
    jfrm.add(err); // to display error bois
    jfrm.add(jlab);
    ifrm.add(ajtf);
    jfrm.add(bjtf);
    ifrm.add(button);
    ifrm.add(alab);
    ifrm.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);
  bitf.addActionListener(1);
  button.addActionListener(new ActionListener() {
     public void actionPerformed(ActionEvent evt) {
       try {
          int a = Integer.parseInt(aitf.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!");
     }
  });
  // display frame
  ifrm.setVisible(true);
public static void main(String args[]) {
  // create frame on event dispatching thread
  SwingUtilities.invokeLater(new Runnable() {
     public void run() {
       new SwingDemo();
  });
```

```
}
```



# **Program 10**

# Demonstrate Inter process Communication and deadlock(Open Ended Exercise)

# Algorithm:

```
Inter Process Communication
class Q &
 unt n:
  boolian valuisit - false;
  sychronized unt get() {
      while ( I walle Set)
      JUH &
         System. out sprinten ("In consumer waiting (");
         wait ().
        3 vatch (Interrupted Exception e) E.
        System. out printen ("Interrupted Exception Caught").
                                           further waters
     System . out . printen ("Got: "+ n),
       valueset = false;
      System. out. printer l'in Intimate Broduces (n°).
      notify (1;
      outwer n.
     3
```

```
synchronized void pur cunt nis
   while (value Set)
   wy &
       System out printen ('In Producer nailing (no)
      watt()
   Frater (Interrupted Exception e) &
    System out printen ( Intorcupted Exception caught ?
   this. non:
    value Set - tous :
   System well printen ("Put: "+n).
    System . out. printen ("In Intimate Consumer In");
    notify ();
    where they arrend book were gravit
iclass Produces umpliments Runnakus
   P 2:
   Producer (09) 2
  this. 9 = 9;
   new Thread (this, " Preducer"). start().
 public void run() &
     unt 1001
     while (ix15) &
      unt or = q. get ().
     System. out. printen ("consumed:"+4).
      ut + .
3 3 3
```

```
synchronized word bor (Aa)&
   public state word main (string args )
                                                                   String name - Touad coverent Touad (), getName(),
    Q9 = new 00;
                                                                   System out printentname+ intered & bar")
                                                                   Ay &
     new Product (9).
                                                                     Thouad slup(1000).
     new consumer (g):
                                                                   3 eaten (exception c) &
     System out printer ("from Control - ( to stop ").
                                                                   System .out. puntle ("B Intoumpled")
                                                                  System out prierten (name + "brying to call A-last (1);
                                                                  a last();
DeadLock
cease A & Committee of the
                                                                  upid sasters
                                                                     System . Out . println ("Inside A. last")
  synchronized word 400 (Bb) &
       String name: Thread wound Thread (1 get Namel)
                                                               was Deadlock implements Rumable &
       System . out printen (name+ "unitoud A. fee ");
                                                                 Aa = new A():
       etry &
                                                               ( B b = new BC1
          Thread. slep (1000)
       I catch (Soccupion e) {
                                                                Dradhock () &
        System our printer ( A Interrupted ").
                                                                   Muaa. wow Thread (1 set Name ( "Main Toread"),
                                                                   Thread + + new Thread this, "Racing Thready.
      System. out. printer ("1/2 movempted");
                                                                    1. start (1)
     D. Last ():
                                                                    a. foo (b);
                                                                    System. out. Drintld Book in main Truad ).
     word last (18
        System, out printin( ) nside A. last " );
                                                                    public word run()s
                                                                    b. bar (a);
                                                                    System out printer ("Back in other thread")
```

```
public static void main (string args 7) &

nuv Diadlock ();

3 house () house the main args of the state of t
```

Inter process communication Prus Control - C to stop Put: 0 Intimate Consumor Producer waiting Geot: 0 Intimate Producer Put : 1 Intimate Consumor Producer wainling consumia: 0 Got: 0 Intimate Producos Consumia:1 Put: 2 Intimate Producer Consumed: 2 Put 3 Intimate Consumor Producer waiting Got: 3

```
Duadlock

Racing Ihruad untived B. bor

Main through untived A. foo

Racing Thread arrying to call A. lad

Main thread trying to call B. lad.
```

```
Inter process Communication
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 < 15) {
       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 < 15) {
       int r = q.get();
       System.out.println("consumed:" + r);
       i++;
```

```
}
}
class PCFixed {
  public static void main(String args[]) {
    Q q = new Q();
    new Producer(q);
    new Consumer(q);
    System.out.println("Press Control-C to stop.");
}
```

D:\Anu\Engineering\java>java PCFixed Press Control-C to stop. Intimate Consumer Producer waiting Put: 0 Got: 10 Producer waiting Intimate Consumer Intimate Producer Got: 5 Producer waiting Intimate Producer consumed:10 Put: 11 Got: 0 consumed:5 Put: 6 Intimate Producer Intimate Consumer Intimate Consumer Put: 1 Producer waiting Intimate Consumer Producer waiting consumed:0 Got: 11 Got: 6 Producer waiting Intimate Producer Intimate Producer Got: 1 Put: 7 consumed:11 Intimate Producer Put: 12 Intimate Consumer consumed:1 Intimate Consumer Put: 2 Producer waiting Intimate Consumer consumed:6 Producer waiting Got: 7 Producer waiting Got: 12 Intimate Producer Got: 2 consumed:7 Intimate Producer Put: 8 Intimate Producer consumed:12 Intimate Consumer consumed:2 Put: 13 Put: 3 Intimate Consumer Producer waiting Intimate Consumer Got: 8 Producer waiting Producer waiting Intimate Producer Got: 3 consumed:8 Got: 13 Intimate Producer Put: 9 Intimate Producer consumed:3 Intimate Consumer Put: 4 consumed:13 Intimate Consumer Put: 14 Producer waiting Got: 9 Intimate Consumer Producer waiting Intimate Producer Got: 4 Got: 14 consumed:9 Intimate Producer Intimate Producer Put: 10 consumed:4 Intimate Consumer consumed:14 Put: 5

```
-Deadlock
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();
          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();
            void last() {
               System.out.println("Inside A.last");
```

```
class Deadlock implements Runnable {
  A = new A();
  B b = new B();
  Deadlock() {
       Thread.currentThread().setName("MainThread");
       Thread t = new Thread(this, "RacingThread");
       t.start();
       a.foo(b); // get lock on a in this
       thread.
       System.out.println("Back in main
          thread ");
       public void run() {
          b.bar(a); // get lock on b in other
          thread.
          System.out.println("Back in other
            thread ");
          public static void main(String args[]) {
            new Deadlock();
       }
```

```
D:\Anu\Engineering\java>javac deadlock.java

D:\Anu\Engineering\java>java Deadlock

MainThread entered A.foo

RacingThread entered B.bar

RacingThread trying to call A.last()

MainThread trying to call B.last()

Inside A.last

Back in main thread

Inside A.last

Back in other thread
```