VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



LAB REPORT

on

OBJECT ORIENTED JAVA PROGRAMMING

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
(Autonomous Institution under VTU)
BENGALURU-560019 Sep
2024-Jan 2025

B. M. S. College of Engineering,

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(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" carried out by SANCHIT MEHTA(1BM23CS299), 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 during the year 2024-25. The Lab report has been approved as it satisfies the academic requirements in respect of Object-Oriented Java Programming Lab - (23CS3PCOOJ) work prescribed for the said degree.

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LABORATORY PROGRAM – 1

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

equation for thought at funts all lead solutions to the quadratic equation of the discriminant is regative, display there are no 26/09/2020 head solution.
guodiatic Equation
import gava. Util , scanner,
fublic class guadratic Solver S
bublic static void main (string E 7 ags) {
double a = scanner, nort bouble ();
System. Out - print ("Enter (10 eggicent 6:");
double b = scanney nextouble);
System. out. print ("Enter (oefficient");
double c = scanner: next Double ();
double discuminant = b*6-4+a*(;
if (discuminant > 0) 5
clouble roof 1 = (-b + Marg. Sgrt
(discimant)) / (2*a);
double root 2 = (-b+ Math. Squt (discu-
-mane)):/(2*a))
System. Out: punt ("Roots are real and different");
and different ");
, a de la companya de
elie i (discimant ==0)}
else if $(discrimant == 0)$ of $double 100 + = -6/(2*a)$.
existen. But. boint Roots are leaf and
Same, soot);
9 elses
double real part = -b/(2*a);
double imaginary part = math squt (-discimi-
System. out. frint ("Roots are complex and
Same, soot); g elses (double real fait = -b/(2*a); double imaginary part = math. sqot (-discimi- mant)/(2*a); system. out. frint ("Roots are complex and different (on Root 1 = x. 2f + x. 2f in Root 2 = x. 2f - x. 2f in);

-VISION-Page No. : Scanner · Close () Output: > Entre Coefficient a: 12 Enter coefficient b:13 Enter coefficient C:14 Roots are complex and different Root 1 = -0.54 +0.930 Root 2 =-0.54 = 0.931 Enter coefficient a: 2 Enter Coefficient 6:0 Enter Coefficient C:0 Root 1=0:00 Root 2 = -0.50 Enter coefficient a:1 Enter coefficient Roots are seal and same

```
Code:
import java.util.Scanner;
public class lab1 {
  public static void main(String[] args) {
     try (Scanner scanner = new Scanner(System.in)) {
       System.out.print("Enter coefficient a: ");
       double a = scanner.nextDouble();
       System.out.print("Enter coefficient b: ");
       double b = scanner.nextDouble();
       System.out.print("Enter coefficient c: ");
       double c = scanner.nextDouble();
       if (a == 0) {
          System.out.println("Coefficient a cannot be zero for a quadratic equation.");
          return;
       double discriminant = b * b - 4 * a * c;
       if (discriminant > 0) {
          double sqrtDiscriminant = Math.sqrt(discriminant);
          double root1 = (-b + sqrtDiscriminant) / (2 * a);
          double root2 = (-b - sqrtDiscriminant) / (2 * a);
          System.out.println("The roots are real and different.");
          System.out.println("Root 1: " + root1);
          System.out.println("Root 2: " + root2);
       \} else if (discriminant == 0) {
          double root = -b / (2 * a);
```

```
System.out.println("The root is real and repeated.");

System.out.println("Root: " + root);

lese {

System.out.println("There are no real solutions.");

}

}
```

OUTPUT

```
Microsoft Windows [Version 10.0.22631.4460]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sanch\cd C:\Users\sanch\Desktop\java> labl.java

C:\Users\sanch\Desktop\java>java labl.
Enter coefficient a: 12
Enter coefficient c: 14
There are no real solutions.

C:\Users\sanch\Desktop\java>java labl
Enter coefficient b: 1
Enter coefficient b: 1
Enter coefficient c: 0
The roots are real and different.
Root 1: 0.0
Root 2: -0.5

C:\Users\sanch\Desktop\java>java labl
Enter coefficient a: 1
Enter coefficient c: 1
The root is real and repeated.
Root: -1.0
```

LABORATORY PROGRAM - 2

Develop a Java program to create a class Student withmembers usn, name, an array credits and an array marks. Include methods to accept and display details and amethod to calculate SGPA of a student

	30/10/2024
\$.	Develop a java program to create a class student with mambers, ism, name, an array credit's and an array marks. Include methods to accepto and display details.
	import java. Util. Scanner
	Class Student S String usn; String name;
	int Tacks; int marks; Void accepting details of students). §
	Scander (c = 'New Scanner (System . in), System." print ln ("Enter USN: "); USN = Sc. next line();
	System. out fried ("Enter name!"); name = Sc. nextline();
	System.out. print ("Enter no of subjects:"). int n = Sc. next Int(). Cledits = new.Int [n];
	System. out punt ("Enter credits for sub"+
	mouts[i] = Sc. next Int();
	word dis play Details () & System out find lin ("USN: "+USM);
	System 'Out plint la ("Name: "+ mame); System 'Out plint la (" Cledit and Morks: ");

or (int 1=0; i < Credits. length; i++) \$) system-our frim lu ("Subject" + (i+1)+":
credits = " + credits [is + "Horrs = + marks[i]): double calculate SGIPA() } int total (udis = 0) double weighted Sum = 0.0. for (int i= 0; ic cledits - length; i++) { weighted sum + = marks(i) * credits[i]; r to tal cadits += Credits [i]; setum weighted sum / total credits spublic state void main (string (] args) } Student student = new student (); Student. accept Details (), student. display details (). double sapa (= Student Calculate SGPAU; System . Out. printlu (SGPA =" + Sg ka). Dulfut: > Enter the number of stadenty: \$1 Enter USN + 1 BM23 0 C 8299 Enly Name: Sanchit Mehlo Enter number of subjects : 3 the credits for subject 1: 4 Enler the checks for subject 1: \$ 89 Ender the Gedits Ofor subject 2: \$ 3 Endy the marks for Subject 2: 1 Ender the marks for Subject 3: 1 Ender the marks for Subject 3: 97

USN: IBM 23(5299

Name: Sanchit Mehta

Credits and maps:

Subject 1: credits = 4, marks = 89

Subject 2: Credits = 3, marks = 94

Subject 1: Credits = 1, marks = 97

Subject 1: Credits = 1, marks = 97

```
Code:
import java.util.Scanner;
class Student {
  String usn;
  String name;
  int[] credits;
  int[] marks;
  public Student(int numSubjects) {
     credits = new int[numSubjects];
    marks = new int[numSubjects];
  }
  public void acceptDetails() {
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter USN: ");
     usn = scanner.nextLine();
     System.out.print("Enter Name: ");
     name = scanner.nextLine();
     for (int i = 0; i < credits.length; i++) {
       System.out.print("Enter credits for subject " + (i + 1) + ": ");
       credits[i] = scanner.nextInt();
       System.out.print("Enter marks for subject " + (i + 1) + ": ");
       marks[i] = scanner.nextInt();
```

```
}
  public void displayDetails() {
     System.out.println("USN: " + usn);
    System.out.println("Name: " + name);
     for (int i = 0; i < credits.length; i++) {
       System.out.println("Subject"+(i+1)+"-Credits:"+credits[i]+", Marks:"
+ marks[i]);
  public double calculateSGPA() {
     double totalCredits = 0;
     double totalGradePoints = 0;
     for (int i = 0; i < credits.length; i++) {
       double gradePoint = getGradePoint(marks[i]);
       totalGradePoints += gradePoint * credits[i];
       totalCredits += credits[i];
return totalCredits == 0 ? 0 : totalGradePoints / totalCredits;
  public double getGradePoint(int mark) {
     if (mark >= 90) return 10.0;
     else if (mark \geq= 80) return 9.0;
     else if (mark \geq 70) return 8.0;
     else if (mark \geq 60) return 7.0;
    else if (mark \geq 50) return 6.0;
    else if (mark \geq 40) return 5.0;
     else return 0.0; // Fail
  }
}
public class lab2 {
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter number of subjects: ");
     int numSubjects = scanner.nextInt();
     Student student = new Student(numSubjects);
     student.acceptDetails();
     student.displayDetails();
     double sgpa = student.calculateSGPA();
     System.out.printf("SGPA: %.2f\n", sgpa);
  }
}
```

1

OUTPUT

```
Microsoft Windows (Version 10.0.2631.0960)
(C) Microsoft Corporation. All rights reserved.

C:\Users\sanch\Desktop\java>javac tab2.java

C:\Users\sanch\Desktop\java>javac tab2.java

C:\Users\sanch\Desktop\java>javac tab2.
Enter number of subjects: 5
Enter USN: 1873/35399
Enter Name: Sanchit
Enter usn: 1873/35399
Enter Name: Sanchit
Enter credits for subject 1: 99
Enter credits for subject 2: 98
Enter credits for subject 3: 3
Enter credits for subject 3: 3
Enter credits for subject 3: 3
Enter marks for subject 4: 2
Enter marks for subject 4: 2
Enter marks for subject 5: 1
Enter marks for subject 5: 1
Enter marks for subject 5: 3
Enter credits for subject 5: 3
Enter credits for subject 5: 3
Enter credits for subject 5: 3
Enter marks for subject 5: 3
Enter credits: 3, Marks: 89
Enbject 2 - Credits: 3, Marks: 89
Enbject 3 - Credits: 2, Marks: 85
Enbject 5 - Credits: 2, Marks: 85
Enbject 5 - Credits: 2, Marks: 85
Enter marks for subject 1: 78
Enter marks for subject 1: 78
Enter marks for subject 1: 78
Enter marks for subject 2: 98
Enter marks for subject 2: 98
Enter marks for subject 2: 98
Enter Credits: 1, Marks: 78
Enter credits: 1, Marks: 78
Enter marks for subject 2: 98
Enter credits: 1, Marks: 78
Enter credits: 2, Marks: 98
Enter credits: 3, Marks: 98
Enter credits: 5, Marks: 98
Enter credits: 5, Marks: 78
Enter credits: 60
E
```

```
::\Users\sanch\Desktop\java>java lab2
Enter number of subjects: 4
Enter USN: lbm23cs189
Enter Name: piyush
Enter credits for subject 1: 4
Enter marks for subject 1: 80
Enter credits for subject 2: 3
Enter marks for subject 2: 87
Enter credits for subject 3: 2
Enter marks for subject 3: 92
Enter marks for subject 4: 1
Enter credits for subject 4: 67
USN: lbm23cs189
Jame: piyush
Subject 1 - Credits: 4, Marks: 80
Subject 2 - Credits: 3, Marks: 87
Subject 3 - Credits: 2, Marks: 92
Subject 4 - Credits: 1, Marks: 67
SGPA: 9.00
```

1

LABORATORY PROGRAM - 3

Create a class Book which contains four members: name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects. Include a toString() method that could display the complete details of the book. Develop a Java program to create n book objects.

	19/10/2024 Date Page No.
P	Create a day Book which contains 4 members:
	mame author frice, num-pages. In clude a
	Constructor to set values for the members
	details of the objects. Include a to
	stongs abrethod that would display the
	Complete details of the book. Developa
	Java frogram to create on book objects.
1	
Aus	import java. Util. Scanner;
	Class Book &
	Luncho St.
	burate String name;
	frivate String author;
	fivate double pro;
+	frivate int num lages;
	double book (String name, string autum,
	double price; per int numbages) }
	this name = name .
	this author = author;
-	this plice = price;
	Huis: num Pages = Mum Pages;
	public void set Name (string name) f
- /	fublic void set Name (string name) of thes. name = name;
	Subic void setAuthor (swing author) {
	fubic void setAuther (swing author) { Mis.author = author;
	y .
	fuelic void set Price (double price) ? 4 this price = price;
-	this blice = blice:
	9
The same of the same of	

fuelic voted set Numbages (trit numbages) } public String get Name!) f Sublic String get Author (1) fublic String get Price () }
return plice; fublic int get Num Pages () f public string tostning() & Selwa "Book Name:" + marse + " n" + "Author: + author + "In" + "Rice:" + price + "In" + "Number of foges" + numlages; I floor book I bears fublic Class Main 2 5 Spublic static void main (string [] args) } try (Scanner & Scanner = new (Scanner (System.in))

System. Out printlenter the no. of books:

inte m = Scanner. mext Int(). Scanners, next Line ().

Book[] books = new Book[m], for (inti=0; ixm; i++) f book" + (i+1) + ":"); System out print ("Name: "). String name = Scanner next line 1); System our print ("Author!"); String author = Scanner. next line (); System out print ("Price: "); double price = Scanner · mext Double 12; Samer. next (ine (); books [i] = new Book (name, author, poice numlages); System out frint la (") on Book Details: "), of (Book book ; books) { System our privalin (book);

Outfut : Sula number of books: 3. Sulle delails for book!: Name: The Akchemist · Author: Sandlit Poise: 7999.99 No of Pages: 289 Enter details jor book 2 Nome: Three men in a Boat Author: Pirusti Price : 101.99 No of Pages: 34 Enter details for book 3: Name: xx20 Author : abc Price: 171.99 No. of Bges: 91 a find the model of the Bartoda Santa Donata of March Referred to the was the sand I Damping Allered Horas Super

```
Code:
import java.util.Scanner;
class Book {
  private String name;
  private String author;
  private double price;
  private int numPages;
  public Book(String name, String author, double price, int numPages) {
     this.name = name;
     this.author = author;
    this.price = price;
     this.numPages = numPages;
  public void setName(String name) {
     this.name = name;
  public void setAuthor(String author) {
     this.author = author;
  public void setPrice(double price) {
     this.price = price;
  public void setNumPages(int numPages) {
    this.numPages = numPages;
  public String getName() {
    return name;
  public String getAuthor() {
    return author;
  public double getPrice() {
    return price;
  public int getNumPages() {
    return numPages;
```

```
public String toString() {
     return "Book Name: " + name + "\n" +
          "Author: " + author + "\setminusn" +
          "Price: $" + price + "\n" +
          "Number of Pages: " + numPages;
public class LAB3{
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter the number of books: ");
     int n = scanner.nextInt();
     scanner.nextLine(); // Consume the newline character
     Book[] books = new Book[n];
     for (int i = 0; i < n; i++) {
       System.out.println("\nEnter details for book " + (i + 1) + ":");
       System.out.print("Name: ");
       String name = scanner.nextLine();
       System.out.print("Author: ");
       String author = scanner.nextLine();
       System.out.print("Price: ");
       double price = scanner.nextDouble();
       System.out.print("Number of Pages: ");
       int numPages = scanner.nextInt();
       scanner.nextLine();
       books[i] = new Book(name, author, price, numPages);
     }
     System.out.println("\nBook Details:");
     for (Book book: books) {
       System.out.println(book);
       System.out.println();
     }
     scanner.close();
```

```
}
```

OUTPUT

```
C:\Users\sanch\Desktop\java>java LAB3
Enter the number of books: 3
Enter details for book 1:
Name: The Alchemist
Author: Sanchit
Price: 7999.99
Number of Pages: 289
Enter details for book 2:
Name: Three men in a Boat
Author: Piyusg
Price: 181.99
Number of Pages: 34
Enter details for book 3:
Name: xyz
Author: abc
Price: 171.99
Number of Pages: 91
Book Details:
Book Name: The Alchemist
Author: Sanchit
Price: $7999.99
Number of Pages: 289
Book Name: Three men in a Boat
Author: Piyusg
Price: $101.99
Number of Pages: 34
Book Name: xyz
Author: abc
Price: $171.99
Number of Pages: 91
```

LABORATORY PROGRAM-4

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

24/10/2024 Date VISION-Page No.
O Develop a pua program to create a abstract class
empty method named blint Ma(). Provide there
classes married seclargle, travels and circle sudy
fact them one of the classes enterels the
class shape tack one of the Classes contain
only method funt Area & that prints the area
of the given shape.
An abstract class shape &
Aller and the second of the se
Spotected but demensions;
for tected int demension 2:
faible Shale line di lai l
faible Shape (int dimension), ent dimension2)
this dimension (= dimension);
this dimension 2 = dimensioni 2,
19.101 . 101.11
Pulli allin a comment
fublic abstract void frint Alea ();
Class Reclangle extends shapes
The shapes
Soublic Rechangle (i) 1 all
Spublic Rectangle (int width, intheight) ?
3 Super (width, height);

System. Out pivelen ("Alea of Rochange: "+ ared! Sublic void Spirit Area () } Class Tecangle extends shape & x Shape ox leads shape { Spublic Trougle (int base, In height) S Super (base, height); fullic void front Ava() { double area = 0.5 * dimension (+ dimension 2 Systemiracio : printlu ("Area of trangle: "+ area); Class Circle extends Shapeof Spublic Cercle (int radius) & Super (rodius, o); fullic void flint Area () } double area = Math. PI & dimension 1 * 2 System. out printly ("Alea of Gyol:"+ area);

```
fublic class laby }

fublic static void main (string()

& Machangle

Shope = new Rechangle (5,16)
                           Shape Evangle = new Terangle (5,10) 3
triangle punt Alea ();
                          Shape circle = new Corcle (7);
                           Circle buint Area();
```

```
Code:
abstract class Shape {
  int dimension1;
  int dimension2;
  Shape(int dimension1, int dimension2) {
    this.dimension1 = dimension1;
    this.dimension2 = dimension2;
  }
  public abstract void printArea();
}
class Rectangle extends Shape {
  public Rectangle(int width, int height) {
1
```

```
super(width, height);
  public void printArea() {
     int area = dimension1 * dimension2;
     System.out.println("Area of Rectangle: " + area);
  }
}
class Triangle extends Shape {
  public Triangle(int base, int height) {
     super(base, 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) {
     super(radius, 0);
  public void printArea() {
     double area = Math.PI * dimension1 * dimension1;
     System.out.println("Area of Circle: " + area);
public class lab4 {
  public static void main(String[] args) {
     Shape rectangle = new Rectangle(5, 10);
     rectangle.printArea();
     Shape triangle = new Triangle(5, 10);
     triangle.printArea();
     Shape circle = new Circle(7);
     circle.printArea();
```

OUTPUT

```
Microsoft Windows [Version 10.0.22631.4460]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sanch>cd C:\Users\sanch\Desktop\java

C:\Users\sanch\Desktop\java>javac lab4.java

C:\Users\sanch\Desktop\java>java lab4

Area of Rectangle: 50

Area of Circle: 153.93884802589985
```

LABORATORY PROGRAM – 5

Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed. Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks: a) Accept deposit from customer and update the balance. b) Display the balance. c) Compute and deposit interest d) Permit withdrawal and update the balance Check for the minimum balance, impose penalty if necessary and update the balance.

7/		VISION Page No.
9	Develop a java floglam to create that maintains two kinds of account that maintains two kinds of account other current account. The Savings account plovides comportive drows facilities but no cheque book the current Account provides clue but no intest. Current account ho also maintain a minimum bala balance falls below this level, a suinefosed create a class Account that store account number and type of account account member and type of account accoun	a clars Bank unds for it's unt and the unt intest and k facility. que book facility lders should nee and if evoice charge is as Customer mano, cust. Flore this Sov-acct to leguirements. Les to achieve the
a	(c) Compute the deforit intest (d) felmit certhdrawd and applace check for minimum balance, impos necessary and update the balance	e the balance

umport jour will Scanner. Class Account & String Customer Name, String type Account; double balance; long the account; double balance, double account this Customer Name - Customer Name; Huis-typeAccount = typeAccount, this balance = balanca. His. accomen = accomen. · public void deposit (double amount) if (amount >0) & balance + = amount, else System. Out plently ("Invalid Amount") Sublic word display () "System out further ("The balance is" + balance); Class Sourcet extends Account of double intertRate; Sovace (String Customer Name, double balance, long Seefer (Customer Nome, balance, accomm this intrest Rake = intrest Rate; foublic (amfount Intrest() Souble indust = balance + (inhest Rate/100) deposite (intrest); System. Out printly ("Intrest Compound=" Sublic withdrow (double amount) if (amount > 0 & & amount <= balance) balance - = amount,

else System and printlin ("Involed amount"); Class curace extends Account final double MMBal = 4000; final double Service-charge = 100; public void withdraw (double amount) if (amount >0 & & amount < = balance) balance -= amount; System out - printly ("withdrew" + cleck Mm Balance (): forblic void Check HEB alance US else System out frintly ("Invalid amount");

Sublic word CheckMinBalance Of if (balance & Min Bal) System. out friedly Minimum Rolance is not mainlained "); fublic class Bank & fublic static void main (String () ags) 5 Sou Acc Sovings = new Sou Acc (" Dran", 123457411L (500 9.4): cavings display (); Guings. dela (1 (1000); Sovings. display(): Souther withdraw (500); Soullys-display () Sovings. compound Introst (); System out pointly (Corrent account operation

Divine Page No. Cus Arc current = new CusArc ("Sanchit", 12345678996, 2000) current display (1; aurent deposit (500); argent display (); auxent - withofano (1200); (went display (). Outfut: The balance is: 5500 Deposited ! 1000 The balance is: 6500 Withdrew: 500 The balance is: 6000 Defosited: 564 The Intest Compounded: 564/ The balance is: 6564 Current acrount operations The balance is! 2000 Deposited: 500 The balance is : 2500 Withdrew : 1200 The balance is: 1300

Code:

```
import java.util.Scanner;
class Account {
  String customerName;
  long accountNum;
  double balance;
  public Account(String customerName, long accountNum, double balance) {
     this.customerName = customerName;
     this.accountNum = accountNum;
     this.balance = balance;
  public void deposit(double amount) {
    if (amount > 0) {
       balance += amount;
       System.out.println("Deposited: " + amount);
     } else {
       System.out.println("Invalid amount");
     }
  public void withdraw(double amount) {
     if (amount > 0 \&\& amount \le balance) {
       balance -= amount;
       System.out.println("Withdrew: " + amount);
       System.out.println("Invalid request or insufficient funds");
  public void display() {
    System.out.println("The balance is: " + balance);
}
class SavAcc extends Account {
  double interestRate;
  public SavAcc(String customerName, long accountNum, double balance, double interestRate) {
     super(customerName, accountNum, balance);
     this.interestRate = interestRate;
  public void compoundInterest() {
     double interest = balance * (interestRate / 100);
     deposit(interest);
     System.out.println("Interest compounded: " + interest);
1
```

```
}
}
class CurAcc extends Account {
  static final double minbal = 1000;
  static final double servicecharge = 100;
  public CurAcc(String customerName, long accountNum, double balance) {
    super(customerName, accountNum, balance);
  public void withdraw(double amount) {
    if (amount > 0 \&\& amount \le balance) {
       balance -= amount;
       System.out.println("Withdrew: " + amount);
       checkMinBalance();
     } else {
       System.out.println("Invalid request or insufficient balance");
  public void checkMinBalance() {
    if (balance < minbal) {
       balance -= servicecharge;
       System.out.println("Minimum balance not maintained. Service charge imposed: " +
servicecharge);
     }
  }
}
public class lab5 {
  public static void main(String[] args)
    SavAcc savings = new SavAcc("aman", 123457911, 5500.0, 9.4);
     savings.display();
    savings.deposit(1000.0);
     savings.display();
     savings.withdraw(500.0);
     savings.display();
     savings.compoundInterest();
     savings.display();
    System.out.println("current account operations\n");
     CurAcc current = new CurAcc("sanchit", 1234567899, 2000.0);
     current.display();
    current.deposit(500.0);
     current.display();
```

```
current.withdraw(1200.0);
current.display();
}
```

OUTPUT

```
C:\1bm23cs299>java lab5
Enter customer name for savings account: sanchit
Enter account number for savings account: 111
Enter initial balance for savings account:
Enter interest rate for savings account: 12
The balance is: 23.0
Enter the amount to deposit in savings account: 222
Deposited: 222.0
The balance is: 245.0
Enter the amount to withdraw from savings account: 21
Withdrew: 21.0
The balance is: 224.0
Deposited: 26.88
Interest compounded: 26.88
The balance is: 250.88
Enter customer name for current account: Enter account number for current account: xyz
Enter initial balance for current account: 1111
The balance is: 1111.0
Enter the amount to deposit in current account: 125678
Deposited: 125678.0
The balance is: 126789.0
Enter the amount to withdraw from current account: 2223
Withdrew: 2223.0
The balance is: 124566.0
```

LABORATORY PROGRAM - 6

Create a package CIE which has two classes - Personal 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 Personal. 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.

	ts in an rive courses.
0	Create a fackage CIE usticle stoles two classes - Personal and Internals. The class ferronal chas mankers like using and Internals. The class Internals has an away that
-4	and Internals. The class ferroval chas mankers like Usa,
	mame, sem - The class Internals has an away that
	stores the internal marks scared in 5 courses of the
	package SEE which has the class External which is
	derived class of Personal. This class has an away that
	CA TATABA TATABA TATABA
-	stores the see marks Imfall the two packages in a semester of the student Imfall the two packages in a
	file that declares the final marks of in students in all
	five courses
	five constant
,	
fur	fackage Cil; fublic class Internals & int[] marks = new Int[5);
	fublic class Internet
	int[] marks = new (ne(s)
	2. (
	chublic internols (IntC3 marks)
	3
	this marks = marks;
	this masks = marks;
	fublic void display () }
	Jublic Olla company
	System. Out. printly ("CIE Harks: In"); for (int num: marks) 3 System. Out. printly (Mum);
	System. Out. phintly (CIE Harris. Com
	(or / int num: marks)?
	System. Our printly (Mann);
	Company of the State of the Sta
	4 1 2
-	1 Jan 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	public int get total CIE prompt +
	public int get Total (IE works () } int total = 0;
	(or (int yun imales))
	lotal + = num:
	for (int num: mates) of total + = num;
-	2 4 return total;
	2 y return tord,

fackage see; impost cie. student; Sublic class External extends Students int[] seemasks = new Int[5]. fublic External (String USN, String name, int Sem, int [] seemarks) Super (USN, name, sem), His. Seemarks = seemarks. fublic void display () } Jyskin out printly ("SEE marks are: ""). System. out picuela (nam); father int public int gethalf () & int total = 0. for (int num: see marky) total += nam; Leturn total (2;

package cie; public class Student & fublic String USN; fublic String mame; fublic int sem; Gublic Student (String USN, String name, this USN = USN; His name = name; this sem = sem; fublic void display (1.5 System out printly (" Student Delails:"); System out printly ("USN:" + USN); System out printly ("Name:" + manne); ystem out printly ("Semester:" + Sem);

impost gava. util . sconner emport cie. Student import Cir. Tutlemols insport see . External fublic class lab 6 gs. Sublic Static void main (String (I args) Scanner S= new Scanner (System. (n); System. Out plintly ("Enter number of int n = S. next Int(); Somext line().

Los (inti=1; ix=m; i++) System Out funtly ("Enter details System. out. printle ("Enter USN:"). String USN = s. neutline(): System out pundly ("Enter mare: ");
String name = s-ment Int (); s. mext Line (); Student stud = new Student (USN, Stud. display 1,

System out puntly l'Enter CIE marks for 5 subjects: "). (not 7 5 mashs = new int [5]; for (int j = 0 if 25; get) Smorts [] = Smext Intl. External external march = new External (USN, name, Sem, Smalls). external marks . displaye; S. next line 11. S. close(), Outful: - Enter number of students. Enter details of Student 1: Enter USN: 1 bm 23 cs 222 David Enter Name! Ehrer semester:

Student Delaile:		
- DIN 1 16 m 23ct 222		1 1 1 1 1 1 1 1
Mary 242		Enter details for Student 2:
Semanty Uz		1 hm 2205123
Enter CEE marks for 5 subjects:		Enth Name:
		a.bc
42		Ender Semester:
		Z Z
49		Studay Defails:
4.7		USN: 16-2705127
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and the one as follows:		Eyeler SEE Marks for & Subjects:
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92		
92 8 8		1
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88		1 2/11/24
88		28/11/24
88		28/11/24
92 88 98 4996		15 28/11/24
88		19 28/1/24
88		15 28/11/24
88		19 28/11/29
88		28/11/24
88		28/11/24

Code: package cie; public class Internals { int[] marks = new int[5]; public Internals(int[] marks) { this.marks = marks; public void display() { System.out.println("CIE Marks: \n"); for (int num : marks) { System.out.println(num); } } 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; <u>this.name</u> = name; this.sem = sem;public void display() { System.out.println("Student Details:"); System.out.println("USN:"+USN);System.out.println("Name: " + name); System.out.println("Semester: " + sem); } } package see; import cie.Student; public class External extends Student { int[] seemarks = new int[5]; public External(String USN, String name, int sem, int[] seemarks) { super(USN, name, sem); this.seemarks = seemarks; public void display() { System.out.println("SEE Marks are: \n"); for (int num : seemarks) { System.out.println(num); } import java.util.Scanner; import cie.Student;

```
import cie. Internals;
import see.External;
public class lab6 {
  public static void main(String[] args) {
    Scanner s = new Scanner(System.in);
    System.out.println("Enter the number of students:");
     int n = s.nextInt();
    s.nextLine();
     for (int i = 1; i \le n; i++) {
       System.out.println("\nEnter details for Student " + i + ":");
       System.out.println("Enter USN: ");
       String USN = s.nextLine();
       System.out.println("Enter Name: ");
       String name = s.nextLine();
       System.out.println("Enter Semester: ");
       int sem = s.nextInt();
       s.nextLine();
       Student stud = new Student(USN, name, sem);
       stud.display();
       int[] marks = readMarks(s, "CIE");
       Internals internalMarks = new Internals(marks);
       internalMarks.display();
       int[] smarks = readMarks(s, "SEE");
       External externalMarks = new External(USN, name, sem, smarks);
       externalMarks.display();
       int[] finalMarks = new int[5];
       System.out.println("Final Marks (CIE + 1/2 SEE) for each subject:");
       for (int j = 0; j < 5; j++) {
          finalMarks[j] = marks[j] + (smarks[j] / 2);
         System.out.println("Subject " + (j + 1) + ": " + finalMarks[j]);
       }
     }
    s.close();
  public static int[] readMarks(Scanner s, String examType) {
    System.out.println("Enter the " + examType + " marks (5 subjects): ");
```

```
int[] marks = new int[5];
for (int i = 0; i < 5; i++) {
    marks[i] = s.nextInt();
}
return marks;
}</pre>
```

```
Enter the number of students: 2
Enter details for student 1:
USN: 1bm23
Name: sam
Semester: 3
Enter internal marks for 5 courses:
30 39 29 28 30
Enter SEE marks for 5 courses:
86 87 89 90 99
Enter details for student 2:
USN: 1bm24
Name: xyz
Semester: 2
Enter internal marks for 5 courses:
39 34 35 36 34
Enter SEE marks for 5 courses:
99 98 87 86 80
Final Marks of Students:
USN: 1bm23
Name: sam
Semester: 3
Internal Marks: 30 39 29 28 30
SEE Marks: 86 87 89 90 99
Final Marks: 116 126 118 118 129
USN: 1bm24
Name: xyz
Semester: 2
Internal Marks: 39 34 35 36 34
SEE Marks: 99 98 87 86 80
Final Marks: 138 132 122 122 114
```

LABORATORY PROGRAM - 7

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

Divik a Program that demonstrates handling of the leftons in heritance fire. Create above class colled Jaken and a demond class called "Son" which extends the base class. In Shru class, implement a construct which takes the age and knows the exception way place to what the infut age 20. In the Son Class, implement a constructor that uses both father and son's age and throws an exception of Sans age is > father sage. And Class Wrongfge Exception & Stends Exception & Setur "Wrongfge Exception"; Setur "Wrongfge Exception"; Class Jather & int age; Take (int age) thrown Wrongfge Exception & fage 20) Throw new Wrongfge Exception (2.4	(i) 1-24	
Revised class Called "Son' induct lettereds the base class I and Salver class Called "Son' inductal extends the base class I and Salver class the sage and knows the exception Wonglige (I whan the infut age 20. In the Son Close I implement a Constructor that was both father and Son's age and throws an exception if Son's age is > = father's age. Am Class Wronglighter Ception Pextends Exception & Seitum "Wronglighter Ception & String Cof Seitum "Wronglighter String to String Cof String Cof Seitum "Wronglighter Ception"; Jake (indage) throws Wronglighter Ception & if lage < 0) Take (indage) throws Wronglighter Ception & If lage < 0)	214	/// 24-	200
Sather class, implement a Construction which takes the age and throws the exception Wongfige (I when the infut age 20. In the Son Close, implement a Construction that uses both father and son's age and throws an exception if Son's age is > = father is age. And Class Wrongfige Exception fixtends Exception of fuelic String to String Cof Return "Wrongfige Exception"; Y Class Jather of Jake (ind age) throws Wrongfige Exception of fage 20) The age; Throw new Wrongfige Exception (0 W	in inheritance fue Create above class called John	u and a
Inful age 20. In the som Close ; implement a construction that uses both father and som's age and throws are exception if som's age is > = father age. And Class Wrongfige Exception Dxtends Exception of fullic String to String Cys Return "Wrongfige Exception"; Y Class Jather of Jaker (ind age) throws Wrongfige Exception of if lage < 0) Throw new Wrongfige Exception (7	Statue class, implement a construction which to	ares the
Constructor that uses some father and some age to throws an exception if Som's age is > = father is age. Am Class Wrong Age Exception Destends Exception of fuelic String to String C) of Setum "Worong Age Exception"; Setum "Worong Age Exception"; Jather of int age) throws Wrong Age Exception of throw new Wrong Age Exception (inful age to In the Son Class, impleme	nt a
Setum "Woong Age Exception"; Jather (indage) throws Wong Age Exception & If (age < 0) Throw new Wrong Age Exception (1 - 1 - Ut - M. A a harm 1 APT 11 A 11 M (Mac)	a we or a
Return "Woongthee Exception"; Class Father & int age; Jather (int age) thrown Wongfige to ception & if (age < 0) throw new Wrongtge Exception (Am	Class Wrong green ception & xtend Exuption 7	
Return "Woongthee Exception"; Class Father & int age; Jather (int age) thrown Wongfige to ception & if (age < 0) throw new Wrongtge Exception (fullic String to String C) of	4-4-1
Class Jather & int age; Josher (inel age) thrown Wong Age to le prior & if (age < 0) throw new Wrong Age Exception (21 " 2 2 Exa P kins ".	
Class Jather & int age; Josher (inel age) thrown Wong Age to le prior & if (age < 0) throw new Wrong Age Exception (return (e) rong tige coep tron	
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Jather (include) thrown Wong Age to Cephon & If (age < 0) Throw new Wrong Age Exception (captioned = make and call	
Jather (indage) thrown WongAge to Cephon & If (age < 0) Throw new WrongAge Exception (Class Father &	
throw new WrongAge Exception (int age;	
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1	1	Husage = age;	
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[1 Jel Bell): Clare Son extends Father & last State South System out punt ("Enter son say) Son (but father pochet son age) throws .

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Complete (Jakes Hys.);

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System one purely (Exception Cangle + C), Mut get lange () 5 return Son Age; Owfue Enter Jakan 19 19 19 John Jake 12 12 Enter Son Rage : 22 Exception Carple : Way Botacoper fichler clan Exception Hand ling Inhandrance of fello solic vaid more (sony (7 angs) Father's age 12 lay of Jather for some Entre 10-12 age -21 Exception Caughe Way Pyc Exception Father Land

F 100	Date Page No.
Enter father age: -33 Exception Caught: Whongs	ge Exception
The later the Standard and the	1 1 24
Syste la c. pass for carried	28)"(
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Code:

```
import java.util.Scanner;
class WrongAgeException extends Exception {
  public String toString() {
    return "WrongAgeException";
}
class Father {
  int age;
  Father(int age) throws WrongAgeException {
    if (age < 0) {
       throw new WrongAgeException();
     }
     this.age = age;
  int getAge() {
    return age;
}
class Son extends Father {
  int sonAge;
  Son(int fatherAge, int sonAge) throws WrongAgeException {
    super(fatherAge);
    if (sonAge < 0 \parallel sonAge >= fatherAge) {
       throw new WrongAgeException();
     }
     this.sonAge = sonAge;
  int getSonAge() {
    return sonAge;
}
public class lab7 {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
     try {
       System.out.print("Enter Father's age: ");
       int fatherAge = scanner.nextInt();
```

```
Father f1 = new Father(fatherAge);
System.out.println("Father's age: " + f1.getAge());
System.out.print("Enter Son's age: ");
int sonAge = scanner.nextInt();

Son s1 = new Son(fatherAge, sonAge);
System.out.println("Son's age: " + s1.getSonAge());
} catch (WrongAgeException e) {
System.out.println("Exception caught: " + e);
} finally {
scanner.close();
}
}
```

```
C:\1bm23cs299>java lab7
Enter Father's age: 12
Father's age: 34
Exception caught: WrongAgeException

C:\1bm23cs299>java lab7
Enter Father's age: 12
Father's age: 12
Enter Son's age: -23
Exception caught: WrongAgeException

C:\1bm23cs299>java lab7
Enter Father's age: -33
Exception caught: WrongAgeException
```

LABORATORY PROGRAM - 8

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

another displaying CSE once every two seconds
O Write a program which creates two threeds, once thread displaying "BMS College of Engineery" once every 10 sees and other displaying "SE" livery took seconds.
once every 10 sees and other displaying "SE"
every tros seconds.
Class threads extends Thread
String Si
int time;
threads (Strings, Int time)
Hus. S = S. His. Hime = time;
y
fublic void Run (1) }
fublic void run () of try of while (true)
While (the)
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System. out printly(s): Thread. sleep (Home * 1000);
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Catch (Exception e) of System. Our puns ln(e);
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spublic class Main & fullic Static Void main (String [] angs) Hureads t, = new threads (
"BMS College of Engineering" threads to = new threads ("CSE", 2). t (. Start (); ty. Start(1; BMS college of Enginelling Output! CSE CSE CSE? CSE BMS college of Engineering CCE (SE CSE (SE ESE BMS College of Engineering.

```
class threads extends Thread{
  String s; int time;
  threads(String s, int time){
     this.s = s;
     this.time = time;
  public void run(){
     try{
       while(true){
          System.out.println(s);
          Thread.sleep(time * 1000);
        }
     }
     catch(Exception e){
       System.out.println(e);
     }
  }
}
public class lab8{
  public static void main(String[] args) {
     threads t1 = new threads("BMS College of Engineering", 10);
     threads t2 = new threads("CSE", 2);
     t1.start();
     t2.start();
}
```

LABORATORY PROGRAM - 9

Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

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09 Write a program that creater	a user invertace
to perform integer division	the user enters
Nums is displayed in the	Regielt wold inter
the divide button is clicked. I	[Number Num2
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throw a Numbert amalexa	lition. If Num2
were zero, the program I	sould This
an Author the Exception Dis	alan Ray
exception in a menage di	- J
An import your austix	*K. 371 3 Kron
An import gava aux+ *	
Class Division Main 1 extends For Action listener &	ance Implements
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Button dhesult:	
Label one Result;	
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al Result = new But	ton ("Resule").
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Label number 2 = n	ew Label ("Number 2:",
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```

```
import java.awt.*;
import java.awt.event.*;
class DivisionMain1 extends Frame implements ActionListener
        TextField num1,num2;
        Button dResult;
        Label outResult;
        String out="";
        double resultNum;
        int flag=0;
        public DivisionMain1()
                setLayout(new FlowLayout());
                dResult = new Button("Result:");
                Label number1 = new Label("Number 1:",Label.RIGHT);
                Label number2 = new Label("Number 2:",Label.RIGHT);
                num1=new TextField(5);
                num2=new TextField(5);
                outResult = new Label("",Label.RIGHT);
                add(number1);
                add(num1);
                add(number2);
                add(num2);
                add(dResult);
                add(outResult);
                num1.addActionListener(this);
                num2.addActionListener(this);
                dResult.addActionListener(this);
                addWindowListener(new WindowAdapter(){
                         public void windowClosing(WindowEvent e)
```

```
System.exit(0);
                 });
        public void actionPerformed(ActionEvent e)
                 int n1,n2;
                 try
                 {
                          if (e.getSource() == dResult)
                                  n1=Integer.parseInt(num1.getText());
                                  n2 = Integer.parseInt(num2.getText());\\
                                  if(n2==0)
                                  {throw new ArithmeticException();}
                                  out=n1+"/"+n2+"";
                                  resultNum=n1/n2;
                                  out+=resultNum;
                 catch(NumberFormatException e1)
                          flag=1;
                          out="Number Format Exception!"+e1;
                 catch(ArithmeticException e1)
                          flag=1;
                          out="Divide by 0 Exception!"+e1;
                 outResult.setText(out);
                 invalidate();
                 validate();
        }
}
public class Main
        public static void main(String args[])
                 DivisionMain1 obj=new DivisionMain1();
                 obj.setSize(new Dimension(800,400));
                 obj.setTitle("DivisionOfIntegers");
                 obj.setVisible(true);
        }
}
```



LABORATORY PROGRAM – 10

Demonstrate Inter process Communication and deadlock

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Synchronized Vord last () of Juside A-last"),

J. System. Dut. puntly ("I Juside A-last"), Class Deadlock implements Runnable & A a = new A(), Bb = new B(); Deadlock (15 Thread. Custer & Thread (). Sch Name ("Main Thread Threed t = new Thread (this " Rocing Thread") 1 start (1; a foo (6); System out fundly ("Back in man threed"). faiblic word hund b. bar(a). System. our frankly ("Back in other thread"). chubic Static void main (Strings Tags) } new Deadlock (1.

```
Code(i):
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 {
1
```

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

```
Press Control-C to stop.
Put: 0
Intimate Consumer
Producer waiting
Got: 0
Intimate Producer
Put: 1
Intimate Consumer
consumed:0
Producer waiting
Got: 1
Intimate Producer
consumed:1
Put: 2
Intimate Consumer
Producer waiting
Got: 2
Intimate Producer
consumed:2
Put: 3
Intimate Consumer
```

```
Code(ii):
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 A.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(); 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(); }
}
```

MainThread entered A.foo
RacingThread entered B.bar
MainThread trying to call B.last()
RacingThread trying to call A.last()
^C



