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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(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 **Bhuvan A(24BECS400)**, 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/abhuvan345/Java

Program 1

Develop a Java program that prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a, b, c and use the quadratic formula. If the discriminate b^2 -4ac is negative, display a message stating that there are no real solutions.

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	System out paint (" Enter the coefficient b: ");	Enter the coefficient, b = 10
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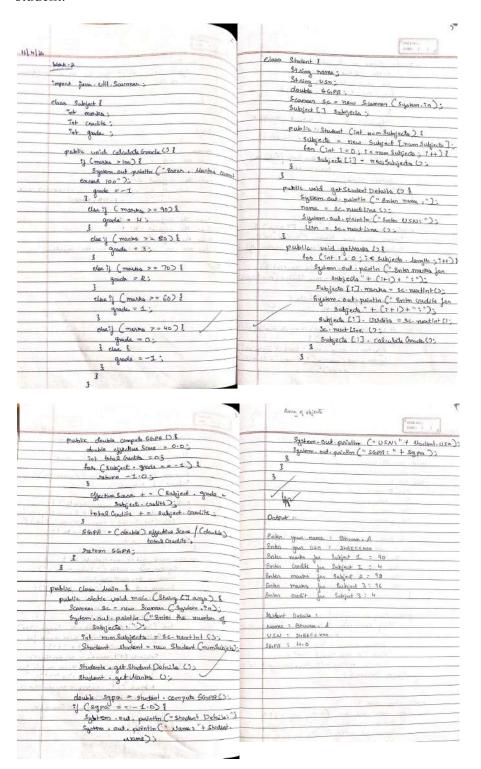
```
Code:
import java.util.Scanner;

public class QuadraticEquation {
   public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Bhuvan. A");
        System.out.println("24BECS400");

        System.out.print("Enter the coefficient a: ");
        double a = scanner.nextDouble();
```

```
System.out.print("Enter the coefficient b: ");
    double b = scanner.nextDouble();
    System.out.print("Enter the coefficient c: ");
    double c = scanner.nextDouble();
    double discriminant = b * b - 4 * a * c;
    if (discriminant > 0) {
      double root1 = (-b + Math.sqrt(discriminant)) / (2 * a);
      double root2 = (-b - Math.sqrt(discriminant)) / (2 * a);
      System.out.println("The roots of the equation are: " + root1 + " and " + root2);
    \} else if (discriminant == 0) {
      double root = -b/(2 * a);
      System.out.println("The root of the equation is: " + root);
    } else {
      System.out.println("There are no real solutions to the equation.");
 }
C:\Users\bmsce\Desktop>java QuadraticEquation
Bhuvan. A
24BECS400
Enter the coefficient a: 6
Enter the coefficient b: 17
Enter the coefficient c: 12
The roots of the equation are: -1.333333333333333 and -1.5
C:\Users\bmsce\Desktop>
C:\Users\bmsce\Desktop>java QuadraticEquation
Enter the coefficient a: 10
Enter the coefficient b: 10
Enter the coefficient c: 10
There are no real solutions to the equation.
C:\Users\bmsce\Desktop>java QuadraticEquation
Enter the coefficient a: 5
Enter the coefficient b: 10
Enter the coefficient c: 2
The roots of the equation are: -0.2254033307585166 and -1.7745966692414832
```

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



```
Code:
import java.util.Scanner;
class Subject {
  int marks;
  int credits;
  int grade;
  public void calculateGrade() {
     if (marks > 100) {
       System.out.println("Error: Marks cannot exceed 100.");
       grade = -1;
     } else if (marks \geq = 90) {
       grade = 4; // A
     } else if (marks \geq 80) {
       grade = 3; // B
     } else if (marks \geq 70) {
       grade = 2; // C
     } else if (marks \geq = 60) {
       grade = 1; // D
     \} else if (marks \geq 40) {
       grade = 0; // E
     } else {
       grade = -1; // F
class Student {
  String name;
  String usn;
  double SGPA;
  Scanner sc = new Scanner(System.in);
  Subject[] subjects;
  public Student(int numSubjects) {
     subjects = new Subject[numSubjects];
     for (int i = 0; i < numSubjects; i++) {
       subjects[i] = new Subject();
  }
  public void getStudentDetails() {
     System.out.println("Enter name: ");
     name = sc.nextLine();
```

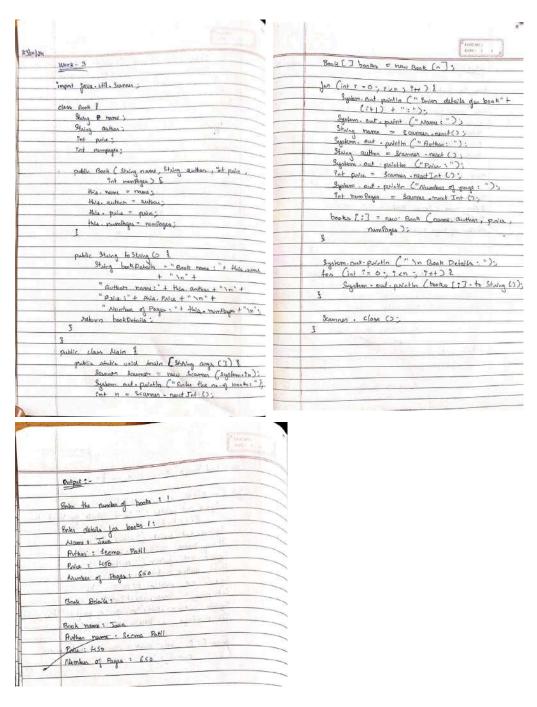
```
System.out.println("Enter USN: ");
     usn = sc.nextLine();
  public void getMarks() {
     for (int i = 0; i < subjects.length; <math>i++) {
       System.out.println("Enter marks for subject " + (i + 1) + ": ");
       subjects[i].marks = sc.nextInt();
       System.out.println("Enter credits for subject " + (i + 1) + ": ");
       subjects[i].credits = sc.nextInt();
       sc.nextLine();
       subjects[i].calculateGrade();
  }
  public double computeSGPA() {
     double effectiveScore = 0.0;
     int totalCredits = 0:
     for (Subject subjects) {
       if (subject.grade == -1) {
          return -1.0;
       effectiveScore += (subject.grade * subject.credits);
       totalCredits += subject.credits;
     SGPA = (double) effectiveScore / (double) totalCredits;
     return SGPA;
  }
public class Main {
  public static void main(String[] args) {
     System.out.println("Bhuvan. A\n" + "24BECS400");
     Scanner sc = new Scanner(System.in);
     System.out.println("Enter the number of subjects: ");
     int numSubjects = sc.nextInt();
     Student student = new Student(numSubjects);
     student.getStudentDetails();
     student.getMarks();
     double sgpa = student.computeSGPA();
     if (sgpa == -1.0) {
```

```
System.out.println("Error: Marks cannot exceed 100.");
} else {
    System.out.println("Student Details:");
    System.out.println("Name: " + student.name);
    System.out.println("USN: " + student.usn);
    System.out.println("SGPA: " + sgpa);
}
}
```

```
::\Users\bmsce\Desktop\24BECS400>java Main
24BECS400
Enter the number of subjects:
Enter name:
Bhuvan, A
Enter USN:
24BEC5400
Enter marks for subject 1:
Enter credits for subject 1:
Enter marks for subject 2:
Enter credits for subject 2:
Enter marks for subject 3:
Enter credits for subject 3:
Student Details:
Name: Bhuvan. A
USN: 24BECS400
SGPA: 4.0
C:\Users\bmsce\Desktop\24BECS400>java Main
Bhuvan. A
24BECS400
Enter the number of subjects:
Enter name:
Abhay
Enter USN:
24BECS404
Enter marks for subject 1:
Enter credits for subject 1:
Enter marks for subject 2:
Enter credits for subject 2:
Enter marks for subject 3:
Enter credits for subject 3:
Student Details:
Name: Abhay
USN: 24BECS404
SGPA: 3.3636363636363638
```

```
C:\Users\bmsce\Desktop\24BECS400>java Main
Bhuvan. A
24BECS400
Enter the number of subjects:
Enter name:
Sanketh
Enter USN:
24BECS422
Enter marks for subject 1:
99
Enter credits for subject 1:
Enter marks for subject 2:
Enter credits for subject 2:
Enter marks for subject 3:
Enter credits for subject 3:
Student Details:
Name: Sanketh
USN: 24BECS422
SGPA: 3.727272727272727
```

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



```
Code:
import java.util.Scanner;
// Define the Book class
class Book {
  String name;
  String author;
  int price;
  int numPages;
  // Parameterized constructor
  public Book(String name, String author, int price, int numPages) {
     this.name = name;
     this.author = author;
     this.price = price;
     this.numPages = numPages;
  // toString method to return the book details
  public String toString() {
     String bookDetails = "Book name: " + this.name + "\n" +
                  "Author name: " + this.author + "\n" +
                  "Price: " + this.price + "\n" +
                  "Number of pages: " + this.numPages + "\n";
    return bookDetails;
// Main class to run the program
public class Main {
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
    // Read the number of books
       System.out.println("Bhuvan. A\n24BECS400");
     System.out.print("Enter the number of books: ");
     int n = scanner.nextInt();
    // Define an array of Book objects
     Book[] books = new Book[n];
    // Loop to read book details
     for (int i = 0; i < n; i++) {
       System.out.println("Enter details for book " +(i + 1) + ":");
       System.out.print("Name: ");
       String name = scanner.next();
```

```
System.out.print("Author: ");
String author = scanner.next();
System.out.print("Price: ");
int price = scanner.nextInt();
System.out.print("Number of pages: ");
int numPages = scanner.nextInt();

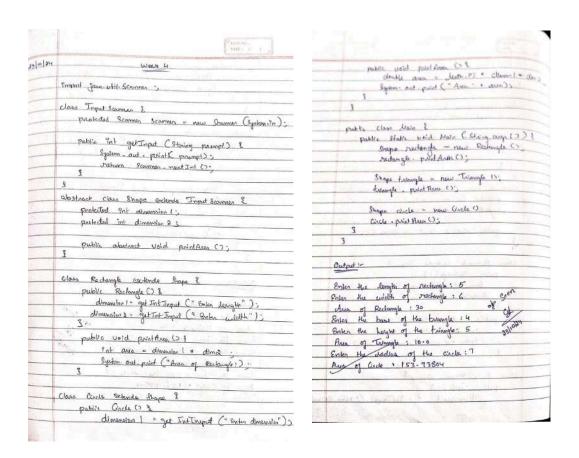
// Create a new Book object and add it to the array books[i] = new Book(name, author, price, numPages);
}

// Loop to display book details
System.out.println("\nBook Details:");
for (int i = 0; i < n; i++) {
    System.out.println(books[i].toString());
}

// Close the scanner scanner.close();
}
</pre>
```

```
C:\Users\bmsce\Desktop\24BECS400>java Main1
Bhuvan.A
24BECS400
Enter the length of the rectangle: 5
Enter the width of the rectangle: 6
Area of Rectangle: 30
Enter the base of the triangle: 4
Enter the height of the triangle: 5
Area of Triangle: 10.0
Enter the radius of the circle: 7
Area of Circle: 153.93804002589985
C:\Users\bmsce\Desktop\24BECS400>
```

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



Code: import java.util.Scanner;

```
class InputScanner {
    protected Scanner scanner = new Scanner(System.in);
    public int getIntInput(String prompt) {
        System.out.print(prompt);
        return scanner.nextInt();
    }
}
abstract class Shape extends InputScanner {
    protected int dimension1;
    protected int dimension2;
```

```
public abstract void printArea();
class Rectangle extends Shape {
  public Rectangle() {
     dimension1 = getIntInput("Enter the length of the rectangle: ");
     dimension2 = getIntInput("Enter the width of the rectangle: ");
  public void printArea() {
     int area = dimension1 * dimension2;
     System.out.println("Area of Rectangle: " + area);
class Triangle extends Shape {
  public Triangle() {
     dimension1 = getIntInput("Enter the base of the triangle: ");
     dimension2 = getIntInput("Enter the height of the triangle: ");
  public void printArea() {
     double area = 0.5 * dimension1 * dimension2;
     System.out.println("Area of Triangle: " + area);
class Circle extends Shape {
  public Circle() {
     dimension1 = getIntInput("Enter the radius of the circle: ");
  public void printArea() {
     double area = Math.PI * dimension1 * dimension1;
     System.out.println("Area of Circle: " + area);
public class Main1 {
```

```
public static void main(String[] args) {
         System.out.println("Bhuvan.A\n24BECS400");
        Shape rectangle = new Rectangle();
        rectangle.printArea();

        Shape triangle = new Triangle();
        triangle.printArea();

        Shape circle = new Circle();
        circle.printArea();
    }
}
```

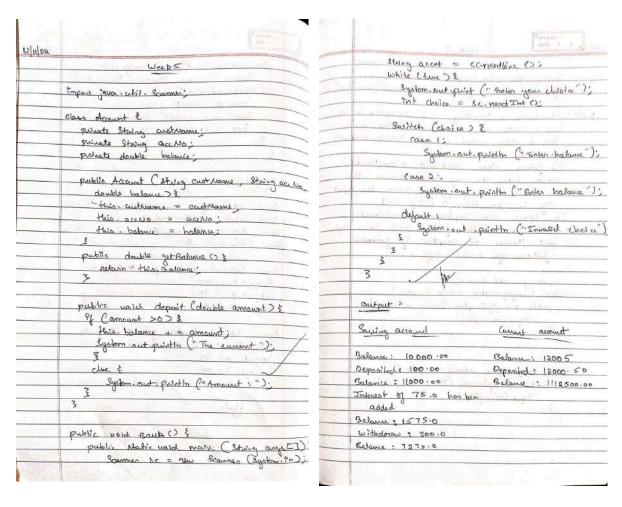
```
C:\Users\bmsce\Desktop\24BECS400>java Main
Bhuvan. A
24BECS400
Enter the number of books: 6
Enter details for book 1:
Name: Java
Author: SemmaPatil
Price: 450
Number of pages: 650
Enter details for book 2:
Name: DBMS
Author: Umadevi
Price: 600
Number of pages: 560
Enter details for book 3:
Name: COA
Author: Megha
Price: 890
Number of pages: 640
Enter details for book 4:
Name: LD
Author: Geetha
Price: 1000
Number of pages: 780
Enter details for book 5:
Name: DS
Author: Rajeshwari
Price: 800
Number of pages: 650
Enter details for book 6:
Name: Unix
Author: Ashvini
Price: 800
Number of pages: 430
```

```
Book Details:
Book name: Java
Author name: SemmaPatil
Price: 450
Number of pages: 650
Book name: DBMS
Author name: Umadevi
Price: 600
Number of pages: 560
Book name: COA
Author name: Megha
Price: 890
Number of pages: 640
Book name: LD
Author name: Geetha
Price: 1000
Number of pages: 780
Book name: DS
Author name: Rajeshwari
Price: 800
Number of pages: 650
Book name: Unix
Author name: Ashvini
Price: 800
Number of pages: 430
```

Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks:

- a) Accept deposit from customer and update the balance.
- b) Display the balance.
- c) Compute and deposit interest
- d) Permit withdrawal and update the balance Check for the minimum balance, impose penalty if necessary and update the balance.



```
Code:
import java.util.Scanner;
class Account {
  private String customerName;
  private String accountNumber;
  protected double balance;
  public Account(String customerName, String accountNumber) {
    this.customerName = customerName;
    this.accountNumber = accountNumber;
    this.balance = 0.0;
  public void deposit(double amount) {
    balance += amount;
    System.out.println("Deposited amount: " + amount);
  public void displayBalance() {
    System.out.println("Balance amount: " + balance);
  public void withdraw(double amount) {
    if (amount <= balance) {
       balance -= amount;
       System.out.println("Withdraw amount: " + amount);
    } else {
       System.out.println("Insufficient balance for withdrawal!");
  protected double getBalance() {
    return balance;
class SavAcct extends Account {
  private double interestRate;
  public SavAcct(String customerName, String accountNumber, double interestRate) {
    super(customerName, accountNumber);
    this.interestRate = interestRate;
  public void computeAndDepositInterest() {
    double currentBalance = getBalance();
```

```
double interest = currentBalance * interestRate / 100;
    deposit(interest);
    System.out.println("Interest deposited: " + interest);
class CurAcct extends Account {
  private double minimumBalance;
  private double serviceCharge;
  public CurAcct(String customerName, String accountNumber, double minimumBalance, double
serviceCharge) {
    super(customerName, accountNumber);
    this.minimumBalance = minimumBalance;
    this.serviceCharge = serviceCharge;
  public void withdraw(double amount) {
    if (getBalance() - amount < minimumBalance) {</pre>
       System.out.println("Service charge imposed: " + serviceCharge);
       deposit(-serviceCharge);
       System.out.println("Insufficient balance.");
     } else {
       super.withdraw(amount);
public class Bank {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.println("Enter customer name for Savings Account:");
    String savingsCustomerName = scanner.nextLine();
     System.out.println("Enter account number for Savings Account:");
    String savingsAccountNumber = scanner.nextLine();
    System.out.println("Enter interest rate for Savings Account:");
    double interestRate = scanner.nextDouble();
    SavAcct savingsAccount = new SavAcct(savingsCustomerName, savingsAccountNumber,
interestRate);
    savingsAccount.deposit(1000);
    savingsAccount.computeAndDepositInterest();
    savingsAccount.displayBalance();
```

```
System.out.println("Enter amount to withdraw from Savings Account:");
     double withdrawAmount = scanner.nextDouble();
    savingsAccount.withdraw(withdrawAmount);
    savingsAccount.displayBalance();
    scanner.nextLine();
    System.out.println("Enter customer name for Current Account:");
    String currentCustomerName = scanner.nextLine();
     System.out.println("Enter account number for Current Account:");
    String currentAccountNumber = scanner.nextLine():
    System.out.println("Enter minimum balance for Current Account:");
    double minimumBalance = scanner.nextDouble();
    System.out.println("Enter service charge for Current Account:");
    double serviceCharge = scanner.nextDouble();
    CurAcct currentAccount = new CurAcct(currentCustomerName, currentAccountNumber,
minimumBalance, serviceCharge);
    currentAccount.deposit(2000);
    currentAccount.displayBalance();
    System.out.println("Enter amount to withdraw from Current Account:");
    double currentWithdrawAmount = scanner.nextDouble();
    currentAccount.withdraw(currentWithdrawAmount);
    currentAccount.displayBalance();
    System.out.println("Enter amount to withdraw from Current Account (may incur service
charge):");
    currentWithdrawAmount = scanner.nextDouble();
    currentAccount.withdraw(currentWithdrawAmount);
    currentAccount.displayBalance();
    scanner.close();
```

```
D:\24BECS400\week5>javac Bank.java
D:\24BECS400\week5>java Bank
Enter customer name for Savings Account:
Bhuvan. A
Enter account number for Savings Account:
20110215220
Enter interest rate for Savings Account:
Deposited amount: 1000.0
Deposited amount: 20.0
Interest deposited: 20.0
Balance amount: 1020.0
Enter amount to withdraw from Savings Account:
10
Withdraw amount: 10.0
Balance amount: 1010.0
Enter customer name for Current Account:
Sachin
Enter account number for Current Account:
2055425102
Enter minimum balance for Current Account:
1000000
Enter service charge for Current Account:
Deposited amount: 2000.0
Balance amount: 2000.0
Enter amount to withdraw from Current Account:
20000
Service charge imposed: 10.0
Deposited amount: -10.0
Insufficient balance.
Balance amount: 1990.0
Enter amount to withdraw from Current Account (may incur service charge):
Service charge imposed: 10.0
Deposited amount: -10.0
Insufficient balance.
Balance amount: 1980.0
D:\24BECS400\week5>
```

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.

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	Internals game
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the SEE marks scored in fine courses of	Import Jave util Scorner
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import gava util Sommer;	
public class Hain ?	Student Java
public class with with main (String argues) !	THE THE STREET STREET SHOWS AND STREET
System our - paint (Erater no of Streeters ");	package CIE;
Students)	Emport Jaia, Util-Scanner;
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Externals [] Students = new Externals [17];	public class Student &
Maria agra chia	
for Cint? =0; TKN; 9+1)}	protected Strong usn:
System out greath C" Easterny obtails for sholar	protected String hame;
+ (2+0) + "2");	prontected but semi
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Public using Taput Student Polarie 17 }	
Public word Input Stradent Polaria 17 & Carrier & New Samuer (System ")	
Public void input Stadent Pobolic 17 } Parenes & - new Samue (System in) System aut point (system user ");	
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Public word "input Structust Polarica "? } Scarces & " wow Scarmen (System "in? System out print ("outer UEV"); USA = C. rest Fine (); System out prints ("outer Surfer Sumstan"); Som - 8 - Parel Fine ();	
Patrice using Input Structure Patrice 17 & General & - was Scarmen (Supatrace In) Suptem and point (Sante UEN) Suptem and point (Sante Commission) Som - S- Parch In (1)	
Patrice void Input Stadard Patrice () & Garanea & - van Garanea (System In) System aut point (* auto (UEN*)) System aut paint (* Coute (UEN*)) System aut paint (* Coute (UEN*)) Som - 8 - Part In+ ();	
Patric word Input Structure Patrick () } Scanness &= new Scanner (System In) System out print (Sante UEN "); SS. = (next Dis () ; System out points ("Sufer Countries"); Som = S - Paret In ();	
Public word Input Structurt Detroite 17 & Connect & - war Commen (Synthemin) Synthem aut point (Souther WEN) Synthem aut printin ("Sufer Committee"); Synthem aut printin ("Sufer Committee"); Em - S- Prent Int ();	
Patrice void Input Student Johnice () & Laconsea & - van Economy (System in) System aut point (* auto (UEN*)) System aut point (o' Cuter (UEN*)) Em - 8 - Part Int (); E Contput:- Enter details for ("Suter Economic"))	
Patrice using Input Structury Patrice 17 & Canada & - name Sommen (Supatranta) Supatranta patrice (Consecutive 1); Supatranta patrice (Consecutive 1); Supatranta patrice (Consecutive 1); Som - S - Pared In + (2); Enter data la face Structure 1; Enter data la face Structure 1; Soften USN 1 August Structure 1;	
Patric void Input Student Potaria () ? Sames & - van Samun (System in) System out point ("ante UEN") System out points ("Enfor counts") Som - 5 - Part Int (); E Catput: Entry details you Student !: Entry USN ; USEC Stoop Buty James & Recomment	
Patric void Input Student I State 1) ? Scarce & - van Scarry (System in) System out point (Santa UEN) System out points (Sufer Consister) System out points (Sufer Consister) Enter - & - Prod Int (S) Enter data UEN I fam Student I: Enter data UEN I fam Student I: Enter James : Riverance I Enter Scarce : Riverance I	
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Patric void Input Student I Static () ? Scanses & - van Scanny (System in) System out point (Santa UEN); System out points ("Sufer Consiste"); Som - S - Paul Int (); E Oratput: Enter details for Student 1; Enter UEN : Inect store Enter James : Edward . Enter Scanses : Edward . Enter Scanses : Edward . Enter Scanses : Edward . Enter Jumes Learts for > 8 Subjects .	
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Partie word Input Student Palmia () ? Scarces & - new Scarmy (System in) System out point (Conten were "); System out point ("Sufer Consiste"); Som - S. Pred Int (); Enter Consister ("Sufer Consister"); Enter USN 1 Here (Student 1: Sonta USN 1 Here (Student 1: Solar Scarces Lanks for 38 subjects: Subject 1 1 100 Subject 2 : 60 Subject 2 : 60 Solar School Lanks for 3 subjects: Benter School Lanks for 3 subjects: Subject 2 : 60 Subject 1 : 100 Solar School Lanks for 3 subjects:	
Partie word Input Student Patrice () ? Scores & - new Economy (System in) System out point (Fanter West); System out points ("Sufer Economics"); En - S - Pract Int (); E Contput: Enter details for Student !: Enter USN ; Jusce (Stoco Enter James : Ebosson I Sote Severall ; So Subject ! 100 Subject ! 100 Subject ! 500 Subject 2 : 66 Enter Satemal Nache for 3 Subjects : Language ! 1 : 100 Subject ! 100 Subject	
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Partie void Input Student Patrice ()? Parenes & - vow Essenie (Systemin) System and point (System were "); System and points ("Sufer Sumster"); Em - S. Prent Int (); Enter Subject: Solar details for Student !: Enter USN ! Tube (Stoo Relen Danie : Chairman of Solar Danie : Chairman of Solar Tubous Lanks for 38 subjects . Subject ! Los Subject 2 : So Subject 2 : So Subject 2 : So Subject 3 : So Subject 3 : So Subject 4 : So	
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Public void Input Stadent Patrice (1) } Paramen & - new Emmun (Systemin) System out point ("Inter were") System out points ("Sector Sumetro") Em - S. Paul Int ("Sector Sumetro") Em - S. Paul Int (") Enter details you Stadent !: Enter USN 1 HUBELStoo Enter Dame : Character ! Enter Sumetro : S Solet Humes Lanks for 28 subjects : Subject !: 100 Enter Salvand Lanks for 3 subjects : Lutyect 2: 50 Enter Salvand Lanks for 3 subjects : Lutyect 3: 99 Subject 3: 99 Subject 3: 99	

```
Code:
CIE
-Internals.java
package CIE;
import java.util.Scanner;
public class Internals extends Student {
  protected int[] internalMarks = new int[5];
  public void inputCIEmarks() {
     Scanner s = new Scanner(System.in);
     System.out.println("Enter Internal Marks for 5 subjects:");
     for (int i = 0; i < 5; i++) {
       System.out.print("Subject " + (i + 1) + ": ");
       internalMarks[i] = s.nextInt();
-Student.java
package CIE;
import java.util.Scanner;
public class Student {
  protected String usn;
  protected String name;
  protected int sem;
  public void inputStudentDetails() {
     Scanner s = new Scanner(System.in);
     System.out.print("Enter USN: ");
     usn = s.nextLine();
     System.out.print("Enter Name: ");
     name = s.nextLine();
     System.out.print("Enter Semester: ");
     sem = s.nextInt();
  public void displayStudentDetails() {
     System.out.println("USN: " + usn);
     System.out.println("Name: " + name);
     System.out.println("Semester: " + sem);
  }
```

```
SEE
-Externals.java
package SEE;
import CIE.Internals;
import java.util.Scanner;
public class Externals extends Internals {
  protected int[] externalMarks = new int[5];
  protected int[] finalMarks = new int[5];
  public void inputSEEmarks() {
     Scanner s = new Scanner(System.in);
     System.out.println("Enter SEE Marks for 5 subjects:");
     for (int i = 0; i < 5; i++) {
       System.out.print("Subject " + (i + 1) + ": ");
       externalMarks[i] = s.nextInt();
  }
  public void calculateFinalMarks() {
     for (int i = 0; i < 5; i++) {
       finalMarks[i] = internalMarks[i] + (externalMarks[i] / 2);
  }
  public void displayFinalMarks() {
     displayStudentDetails();
     System.out.println("Final Marks in 5 subjects:");
     for (int i = 0; i < 5; i++) {
       System.out.println("Subject " + (i + 1) + ": " + finalMarks[i]);
Main.java
import SEE.Externals;
import java.util.Scanner;
public class Main {
  public static void main(String[] args) {
       System.out.print("Bhuvan. A\n 24BECS400\n");
     Scanner s = new Scanner(System.in);
```

```
System.out.print("Enter number of students: ");
int n = s.nextInt();
Externals[] students = new Externals[n];
// Input and calculate marks for each student
for (int i = 0; i < n; i++) {
  System.out.println("\nEntering details for Student " + (i + 1) + ":");
  students[i] = new Externals();
  students[i].inputStudentDetails();
  students[i].inputCIEmarks();
  students[i].inputSEEmarks();
  students[i].calculateFinalMarks();
// Display final marks for each student
System.out.println("\nFinal Marks of Students:");
for (int i = 0; i < n; i++) {
  System.out.println("\nStudent" + (i + 1) + ":");
  students[i].displayFinalMarks();
```

```
Microsoft Windows [Version 10.0.2263].48460]
(c) Microsoft Corporation. All rights reserved.

D:\24BECS480\Main>javac -d Main.java
error: no source files

D:\24BECS480\Main>javac -d Main.java
error: no source files

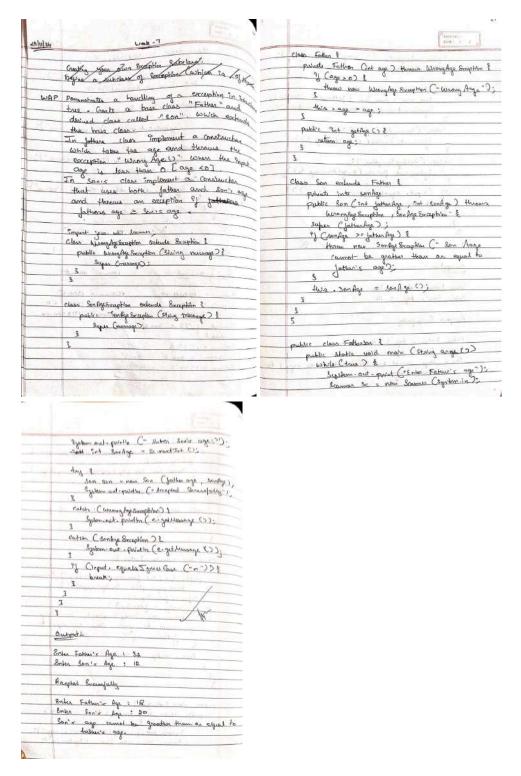
D:\24BECS480\Main>javac -d Main.java
error: could not find or load main class Main
Error: Could not find or load main class Main
Caused by: java.lang.ClassBotFoundException: Main
D:\24BECS480\Main>java Nain.java

A 24BECS480\Main>java Nain.java

Enter number of students: 3

Entering details for Student 1:
Enter USW: 24BECS480
Enter Name: Bhuvan
Enter Semester: 3
Enters Internal Marks for 5 subjects:
Subject 1: 100
Subject 2: 99
Subject 2: 99
Subject 4: 99
Subject 2: 180
Subject 3: 180
Subject 3: 180
Subject 4: 180
Subject 5: 180
Enter SEE Marks for 5 subjects:
Subject 1: 180
Subject 5: 180
Enter SEE Marks for 5 subjects:
Subject 1: 180
Subject 3: 180
Subject 3: 180
Subject 3: 180
Subject 4: 180
Subject 4: 180
Subject 3: 98
Subject 4: 99
Subject 3: 98
Subject 4: 99
Subject 3: 98
Subject 3: 99
```

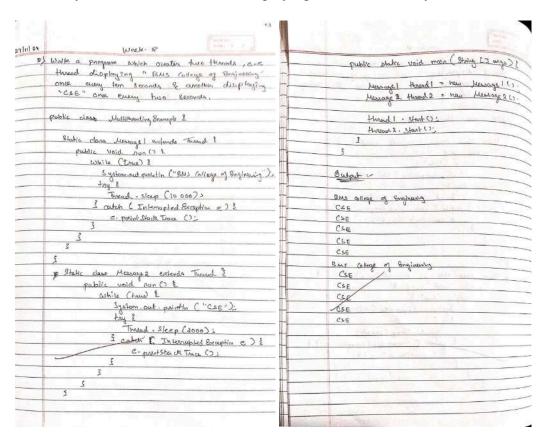
Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called "Father" and derived class called "Son" which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge() when the input age<0. In Son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



```
Code:
import java.util.Scanner;
class WrongAgeException extends Exception {
  public WrongAgeException(String message) {
    super(message);
class SonAgeException extends Exception {
  public SonAgeException(String message) {
    super(message);
  }
class Father {
  private int age;
  public Father(int age) throws WrongAgeException {
    if (age < 0) {
       throw new WrongAgeException("Wrong age");
    this.age = age;
  public int getAge() {
    return age;
}
class Son extends Father {
  private int sonAge:
  public Son(int fatherAge, int sonAge) throws WrongAgeException, SonAgeException {
    super(fatherAge);
    if (sonAge >= fatherAge) {
       throw new SonAgeException("Son's age cannot be greater than or equal to father's age");
    this.sonAge = sonAge;
  public int getSonAge() {
    return sonAge;
public class FatherSon{
  public static void main(String[] args) {
    while(true){
       System.out.print("Bhuvan. A \n 24BECS400\n");
       Scanner sc = new Scanner(System.in);
       System.out.print("Enter Father's Age: ");
       int fatherAge = sc.nextInt();
```

```
System.out.print("Enter Son's Age: ");
      int sonAge = sc.nextInt();
     try {
         Son son = new Son(fatherAge, sonAge);
         System.out.println("Accepted Succesfully");
      catch (WrongAgeException e) {
         System.out.println(e.getMessage());
      catch (SonAgeException e) {
         System.out.println(e.getMessage());
      System.out.println("Would you like to re-enter details (Y/n)");
      String input = sc.next();
      if (input.equalsIgnoreCase("n")) {
         break;
      }
   }
}
        D:\24BECS400\week7>javac FatherSon.java
        D:\24BECS400\week7>java FatherSon
        Bhuvan. A
         24BECS400
        Enter Father's Age: 32
        Enter Son's Age: 12
         Accepted Succesfully
        Would you like to re-enter details (Y/n)
        y
Bhuvan. A
         24BECS400
        Enter Father's Age: 18
        Enter Son's Age: 20
Son's age cannot be greater than or equal to father's age
Would you like to re-enter details (Y/n)
        y
Bhuvan. A
         24BECS400
        Enter Father's Age: 0
        Enter Son's Age: 0
        Son's age cannot be greater than or equal to father's age Would you like to re-enter details (Y/n)
        y
Bhuvan. A
         24BECS400
        Enter Father's Age: -1
        Enter Son's Age: 0
        Wrong age
        Would you like to re-enter details (Y/n)
```

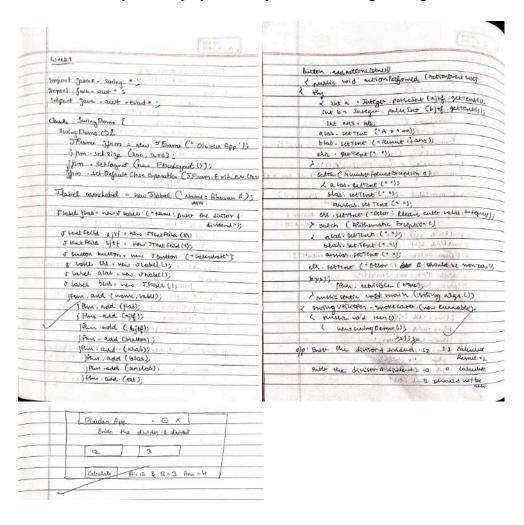
Write a program which creates two threads, one thread displaying "BMS College of Engineering" once every ten seconds and another displaying "CSE" once every two seconds.



Code:

```
while (true) {
             System.out.println("CSE");
             try {
                Thread.sleep(2000);
             } catch (InterruptedException e) {
                e.printStackTrace();
          }
  public static void main(String[] args) {
      Message1 thread1 = new Message1();
      Message2 thread2 = new Message2();
      thread1.start();
      thread2.start();
D:\24BECS400\week8>java Deadlock
RacingThread entered B.bar
MainThread entered A.foo
RacingThread trying to call A.last()
MainThread trying to call B.last()
D:\24BECS400\week8>
D:\24BECS400\week8>javac MultiThreadExample.java
D:\24BECS400\week8>java MultiThreadExample
BMS College of Engineering
CSE
BMS College of Engineering
CSE
CSE
CSE
```

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



Code:

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

class SwingDemo {
    SwingDemo() {
        // create jframe container
        JFrame jfrm = new JFrame("Divider App");
        jfrm.setSize(275, 150);
        jfrm.setLayout(new FlowLayout());
        // to terminate on close
```

```
jfrm.setDefaultCloseOperation(JFrame.EXIT ON CLOSE);
// text label
JLabel jlab = 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 :)
ifrm.add(err); // to display error bois
jfrm.add(jlab);
jfrm.add(ajtf);
ifrm.add(bitf);
jfrm.add(button);
jfrm.add(alab);
jfrm.add(blab);
ifrm.add(anslab);
ActionListener l = new ActionListener() {
  public void actionPerformed(ActionEvent evt) {
     System.out.println("Action event from a text field");
};
aitf.addActionListener(1);
bjtf.addActionListener(1);
button.addActionListener(new ActionListener() {
  public void actionPerformed(ActionEvent evt) {
       int a = Integer.parseInt(ajtf.getText());
       int b = Integer.parseInt(bjtf.getText());
       int ans = a / b;
       alab.setText("\nA = " + a);
       blab.setText("\nB = " + b);
       anslab.setText("\nAns = " + ans);
     } catch (NumberFormatException e) {
       alab.setText("");
       blab.setText("");
       anslab.setText("");
       err.setText("Enter Only Integers!");
     } catch (ArithmeticException e) {
       alab.setText("");
```

```
blab.setText("");
            anslab.setText("");
            err.setText("B should be NON zero!");
    });
    // display frame
    jfrm.setVisible(true);
  public static void main(String args[]) {
    // create frame on event dispatching thread
    SwingUtilities.invokeLater(new Runnable() {
       public void run() {
         new SwingDemo();
    });
C:\Windows\System32\cmd.e X
Microsoft Windows [Version 10.0.22631.4460]
(c) Microsoft Corporation. All rights reserved.
D:\24BECS400\week8>javac SwingDemo.java
D:\24BECS400\week8>java SwingDemo
                                               Divider App
                                                                    Action event from a text field
                                                    Enter the divider and divident:
                                                              3
                                                            A = 12 B = 3 Ans = 4
                                                   Calculate
```

Program 10
Demonstrate Inter process Communication and deadlock.

Facilities (CAL 3 / g)	(n. 4-14)
	a: last ():
Wa k - 10	Void lost (?)
Class A &	SOP (" Turicle B- (ant')
Synchosized void too (Bb)	\$
\$ 100 (DB)	Alle \$75 to all the second posterior
Shirty name = Truend. Current Turend () - goldance 1)	class padlock implements Runneble &
SOP (mane + " carled A - too");	A a = new A (?:
	9 b = new B (2)
try &	March 20/2003 A 122 20000
thread -skep (1000):	Thread current Thread () + Schrome C'Marc')
colin Cerception o > &	Thread to new Thread (this " Rady"
COP ("A Interpret (").	# (start (2)
3 (O hair A D	a rteo (b);
SOP (name + "thing to call Bilest ()");	sor ("Back in more")
	1 1 1 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3	bublic held from () & () &
Vold lost ()	b. bor (a) 5
\$ 000 ("\times 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sop (" Back in other timesel")
Scp ("Foolda A -last");	- o 5 the - and the plantage will be
3	patric States used man (Strong angus)
Class R &	Sor (" Name: Bhurni);
sunataiged vald bas (Aa)	new Desellack (C)
1/	3
String name > Tweed . coment Three (1 . getters);	and the second second second with the
SOP (name + " entered B. bon").	A Physical Leading Company (Max)
try 2	
Thread - sleep (1000):	The table state of the state of
auton (Exception e) &	De l'acceptant de l'étre de la langue de l'acceptant de la langue de l
30p ("B Tritesupped"?"	
The state of the s	
an ameaupra	3 1/2 (m 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2
	3 N. (m. 14 M. C. (C. + 1) (12)
	3 N. (m. 14, E. (C. +) 100 (
Funda ()	2 (m. 14, 2 (m. 1) 19.00
10) Demonstrate later process Commounication & deadless	2 1 (1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Funda ()	4 N. (m. 1 m. C + C + 1 m. 1
10) Demonstrate Inter process Communication & deadless	3 N. (m. 14, C. (C. +) 120 (
10) Demonstrate later process Commounication & deadless	3 N. (m. 1, 14, 12, 14, 14, 14, 14, 14, 14, 14, 14, 14, 14
10) Demonstrate Inter process Communication & deadless P. Output: Puts 0	3 N. (m. 14, 12, 14, 14, 14, 14, 14, 14, 14, 14, 14, 14
10) Demonstrate Inter process Communication & deadless	A. Commission (Control of the Control of the Contro
10) Demonstrate Inter process Communication & decodery P. Output: Puts 0 Intinet Consumer	2 (1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10) Demonstrate later process Communication & decoding P. Output: Puts 0 Intimate Consumer Proclum working	4 1 (m. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10) Demonstrate Inter process Communication & decodery P. Output: Puts 0 Intinet Consumer	
Demonstrate later process Communication & deadless P. Output: Puts 0 Intimate Consumer Produces writing Got: 0	A. Communication of the second
Demonstrate later process Communication & deadless P. Output: Puts 0 Intimate Consumer Freducer writing Goot: 0	
Demonstrate later process Communication & deadless P. Output: Puts 0 Intimate Consumer Produces writing Got: 0	AN (m. land do 1) go
10) Demonstrate Inter process Communication & decoding F. Output: Puts 0 Intimate Consumer Produces westing Got: 0 Initimate Produces Put: 1	
Demonstrate later process Communication & deadless P. Output: Puts 0 Intimate Consumer Freducer writing Goot: 0	
10) Demonstrate Inter process Communication & decoding F. Output: Puts 0 Intimate Consumer Produces westing Got: 0 Initimate Produces Put: 1	
Demonstrate later process Communication & deadless P. Output: Puts 0 Intimate Consumer Producer westing Gost: 0 Initimate Producer Put: 1 Intimate Consumer	
10) Demonstrate Inter process Communication & decoding F. Output: Puts 0 Intimate Consumer Produces westing Got: 0 Initimate Produces Put: 1	
Demonstrate Inter process Communication & decollect P. Output: Put a O Intimate General Freducer uniting Goet: O Intimate Perducer Put - 1 Intimate Consumer	
Demonstrate baker process Communication & decoding P. Output: Put: 0 Intimate Consumer Procluser working Goet: 0 Initimate Parduon Put: 1 Intimate Consumer Output:- Rawing Thread Contend B-bar	The state of the s
Demonstrate later passes Communication & decodicy P. Output: Puts 0 Intimate Consumer Pacolican westing Got:0 Thilimate Paroleses Put:1 Textracto Consumer Output:- Resulting Thread contessed & boan Usin Proceed contessed A too	
Demonstrate later passes Communication & decoding P. Output: Puts o Intimate Consumer Produces writing Goot : 0 Initimate Paradison Put: 1 Intimate Consumer Output:- Racing Turned contend & bar Hair Turned entered A too Racing Turned training to cold A-last ()	
Demonstrate later passes Communication & decodicy P. Output: Puts 0 Intimate Consumer Pacolican westing Got:0 Thilimate Paroleses Put:1 Textracto Consumer Output:- Resulting Thread contessed & boan Usin Proceed contessed A too	
Demonstrate later passes Communication & decoding P. Output: Puts o Intimate Consumer Produces writing Goot : 0 Initimate Paradison Put: 1 Intimate Consumer Output:- Racing Turned contend & bar Hair Turned entered A too Racing Turned training to cold A-last ()	
Demonstrate later process Communication & decoding F. Output: Put c 0 Intimate Consumer Produces writing Got: 0 Intimate Produces Put:1 Intimate Consumer Output:- Rawing Thread contend B-bar Liain Thread entered A-too Raving Thread training to coll A-last () Liain Thread training to coll B. last()	
Demonstrate later process Communication & decoding F. Output: Put c 0 Intimate Consumer Produces writing Got: 0 Intimate Produces Put:1 Intimate Consumer Output:- Rawing Thread contend B-bar Liain Thread entered A-too Raving Thread training to coll A-last () Liain Thread training to coll B. last()	
Demonstrate later passes Communication & decoding P. Output: Puts o Intimate Consumer Produces writing Goot : 0 Initimate Paradison Put: 1 Intimate Consumer Output:- Racing Turned contend & bar Hair Turned entered A too Racing Turned training to cold A-last ()	
Demonstrate later process Communication & decoding F. Output: Put c 0 Intimate Consumer Produces writing Got: 0 Intimate Produces Put:1 Intimate Consumer Output:- Rawing Thread contend B-bar Liain Thread entered A-too Raving Thread training to coll A-last () Liain Thread training to coll B. last()	

Code:

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

```
Deadlock() {
    Thread.currentThread().setName("MainThread");
    Thread t = new Thread(this, "RacingThread");
   t.start();
   // Ensure that main thread always calls a.foo(b)
    synchronized (a) { // Lock a before b to avoid circular waiting
      a.foo(b); // get lock on a in this
    System.out.println("Back in main thread");
 public void run() {
    // Ensure that the other thread always calls b.bar(a)
    synchronized (b) { // Lock b before a to avoid circular waiting
      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:\24BECS400\week8>javac Deadlock.java
D:\24BECS400\week8>java Deadlock
RacingThread entered B.bar
MainThread entered A.foo
RacingThread trying to call A.last()
MainThread trying to call B.last()
D:\24BECS400\week8>javac Deadlock.java
D:\24BECS400\week8>java Deadlock
RacingThread entered B.bar
MainThread entered A.foo
RacingThread trying to call A.last()
MainThread trying to call B.last()
```

Process Communication

```
class Q {
  int n;
  boolean valueSet = false;
  synchronized int get() {
    while (!valueSet) {
       try {
         System.out.println("\nConsumer waiting");
         wait(); // Consumer waits if value is not set
       } catch (InterruptedException e) {
         System.out.println("InterruptedException caught in get()");
         Thread.currentThread().interrupt(); // Re-interrupt the thread
       }
    System.out.println("Got: " + n);
    valueSet = false; // Mark the value as consumed
    System.out.println("\nIntimate Producer");
    notify(); // Notify producer to put new value
    return n;
  }
  synchronized void put(int n) {
    while (valueSet) {
       try {
         System.out.println("\nProducer waiting");
         wait(); // Producer waits if value has already been set
       } catch (InterruptedException e) {
         System.out.println("InterruptedException caught in put()");
         Thread.currentThread().interrupt(); // Re-interrupt the thread
       }
    this.n = n;
    valueSet = true; // Mark the value as produced
    System.out.println("Put: " + n);
    System.out.println("\nIntimate Consumer");
    notify(); // Notify consumer that value is available
  }
```

```
class Producer implements Runnable {
  Qq;
  private static final int MAX_ITEMS = 15;
  Producer(Q q) {
    this.q = q;
    new Thread(this, "Producer").start();
  public void run() {
    int i = 0;
    while (i < MAX_ITEMS) { // Produce only up to MAX_ITEMS
       q.put(i++);
    }
class Consumer implements Runnable {
  Qq;
  private static final int MAX ITEMS = 15;
  Consumer(Q q) {
    this.q = q;
    new Thread(this, "Consumer").start();
  public void run() {
    int i = 0;
    while (i < MAX ITEMS) { // Consume only up to MAX ITEMS
       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);
```

```
Producer waiting
Got: 11
Intimate Producer
Consumed: 11
Put: 12
Intimate Consumer
Producer waiting
Got: 12
Intimate Producer
Consumed: 12
Put: 13
Intimate Consumer
Producer waiting
Got: 13
Intimate Producer
Consumed: 13
Put: 14
Intimate Consumer
Got: 14
Intimate Producer
Consumed: 14
D:\24BECS400\week8>
```

}

System.out.println("Press Control-C to stop.");