# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



#### LAB REPORT

on

# OBJECT ORIENTED JAVA PROGRAMMING

Submitted by

Samriddhi Singh (1BM23CS295)

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,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

#### **Department of Computer Science and Engineering**



#### **CERTIFICATE**

This is to certify that the Lab work entitled "OBJECT ORIENTED JAVA PROGRAMMING" carried out by Samriddhi Singh(1BM23CS295), who is a bona fide 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.

Dr. Nandhini Vineeth

Associate Professor, Department of CSE, BMSCE, Bengaluru Dr. Kavitha Sooda

Professor and Head, Department of CSE BMSCE, Bengaluru

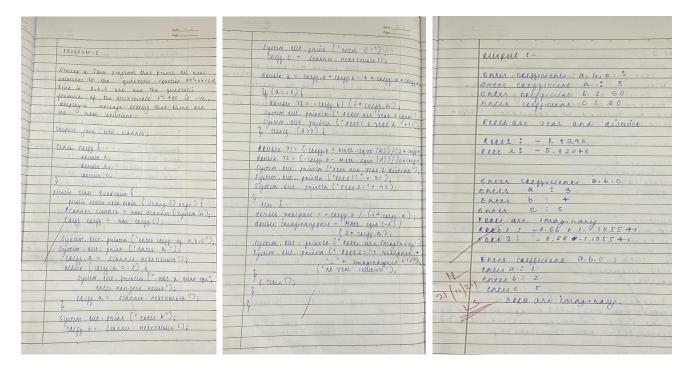
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Github Link: <a href="mailto:samriddhisingh05/1BM23CS295\_java">samriddhisingh05/1BM23CS295\_java</a>

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.

#### Algorithm:



```
import java.util.Scanner;

class Coeff {
    double a;
    double b;
    double c;
}

public class QuadraticEquation {
    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);
        Coeff coeff = new Coeff();

        System.out.println("Enter the coefficients of a, b, c:");
}
```

```
System.out.print("Enter coefficient a: ");
coeff.a = scanner.nextDouble();
while (coeff.a == 0) {
  System.out.println("Not a quadratic equation. Please enter a non-zero value for a:");
  coeff.a = scanner.nextDouble();
System.out.print("Enter coefficient b: ");
coeff.b = scanner.nextDouble();
System.out.print("Enter coefficient c: ");
coeff.c = scanner.nextDouble():
double d = coeff.b * coeff.b - 4 * coeff.a * coeff.c;
if (d == 0) {
  double r1 = -coeff.b / (2 * coeff.a);
  System.out.println("Roots are real and equal.");
  System.out.println("Root 1 and Root 2: "+r1);
\} else if (d > 0) {
  double r1 = (-coeff.b + Math.sqrt(d)) / (2 * coeff.a);
  double r2 = (-coeff.b - Math.sqrt(d)) / (2 * coeff.a);
  System.out.println("Roots are real and unique.");
  System.out.println("Root 1: " + r1);
  System.out.println("Root 2: " + r2);
} else {
  double realPart = -coeff.b / (2 * coeff.a);
  double imaginaryPart = Math.sqrt(-d) / (2 * coeff.a);
  System.out.println("Roots are imaginary.");
  System.out.println("Root 1: " + realPart + " + " + imaginaryPart + "i");
  System.out.println("Root 2: " + realPart + " - " + imaginaryPart + "i");
scanner.close();
```

```
Microsoft Windows [Version 10.0.22631.4317]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Admin>cd\

C:\zeta 295

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C:\zeta 295-java QuadraticEquation.java

C:\zeta 295-java Quadra
```

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 amethod to calculate SGPA of a student.

# Algorithm:

|  | Poge   | Date   |
|--|--|--|
| Date   |  | 1  |
| Pope   | veil are studentederail () (   | 9 essig ( Marks >= 110)  |
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|  | Name = St. neme 1);  | AL SI D MAN 11 MAN   |
| Develop a Java Incoron to create a class   | usn = ce, neut ();   | cus of [ marks >= 60) [  |
| Student with members un, name.   | Lange of the sale of the Committee word & the  | Subjects (i). Subject MATKI = 7;   |
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| an array cruite and an array marke.<br>Endude methods to accept & display  | druble get Marks 12 2  | else if ( misse >= 50) h   |
| describe and hear to accept a augusty  | System . eur. printer ("enter marke & creden of  | 111111 111   |
| details and a method to calculate squa   |  | Surject [1]. susject MARKs = 6;  |
| of a student.  | each surject "?;   | 4  |
|  | deute tetal credits = 0;   | elseif ( MARKI >= 40) &  |
| import java until scannes;   | deuble tetal grade points = 0;   | surject [i] . surject maxx = 5;  |
| 24033.6 = 73.434   |  | 2  |
| Class subject of   | yes (int i=0; i < no. of subjects; i++) &  | I else 1   |
| int suffer marks;  | deuste marks = sc. nent Deuste ();   |  |
| int credite;   | deuble credit = 16, pent Double ();  | Distant ISI Comment  |
| int grade;   | acusic creatis - 10. nene Deliste 17;  | Dusjeets 11). Lusjeet Marke = 0;   |
| # 1 0 0111   |  |  |
| C 5 1111 C 5   | if [marks <0 11 marks >100) f  | THE PROPERTY OF THE PARTY OF TH |
| class student I was some was used  | eystem elit, print (" envaled mains");   | ausjects 112. creaits = (ine) creait;  |
| private exacte final int new ey suspects = 5;  | Alexander a stare with married   | Juspects [17. grade = suspects [17. creates *  |
| String hame:   | centinue;  | susjects II). Eutquemarks;   |
| String usn;  | 1 common ,   | tataucrain += auguss 117. cruin;   |
| deuple SGPA;   | / / White all manded of allowing   | territoria - augustili. critais;   |
| Subject 1) inspects;   | A store the majoral of minimary and  | tetal Gradepins += surjus 113. grade;  |
| Subject 1 subjects;  | if (marks == 100) d  | J. Miles Marie III   |
| Scannes SC ;   | Sugarts Let. Surject Marks = 10;   | C . 14 s. December and C . 14 services 1   |
|  | 2  | SGPA = tetalgrace points / tetal credits;  |
| Student ( scapnes scannes)   | f a comment and t  | return tetaloredits;   |
| susjects = new subject [ no. ex subjects ];  | else if (MATKI >= 90) &  | , remark transferred,  |
| yer (ins 1'=0; 1' < no-eq. suspers; 6++) &   | surject (c). SurjectMATKI = 10;  | 4  |
| susjects [1] = new susjects ();  | 10   | void compute SGIA () h   |
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| - I f  | else if ( MATKS >= 80) &   |  |
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| Eystem eut. print ("enter no. ex studente")  | tan.   | 18 3   |
| 0.0  | Sam  | T8 3   |
| for (int i=0; i < no. ex - students; i++)?   | 16M23CS295   |  |
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|  |  |  |

```
import java.util.Scanner;
class Subject {
  int subjectMarks;
  int credits;
  int grade;
class Student {
  private static final int NUMBER OF SUBJECTS = 8;
  String name;
  String usn;
  double SGPA;
  Subject[] subjects;
  Scanner sc;
  Student(Scanner scanner) {
    subjects = new Subject[NUMBER OF SUBJECTS];
    for (int i = 0; i < NUMBER OF SUBJECTS; i++) {
       subjects[i] = new Subject();
    this.sc = scanner;
  }
  void getStudentDetail() {
    System.out.println("Enter name and USN:");
    name = sc.next();
    usn = sc.next();
  }
  double getMarks() {
    System.out.println("Enter marks and credits of each subject:");
    double totalCredits = 0;
    double totalGradePoints = 0;
    for (int i = 0; i < NUMBER OF SUBJECTS; i++) {
       double marks = sc.nextDouble();
       double credits = sc.nextDouble();
       if (marks < 0 \parallel marks > 100) {
         System.out.println("Invalid marks. Please enter marks between 0 and 100.");
         i--;
         continue;
```

```
}
       if (marks == 100) {
          subjects[i].subjectMarks = 10;
        } else if (marks \geq 90) {
          subjects[i].subjectMarks = 10;
        \} else if (marks \geq = 80) {
          subjects[i].subjectMarks = 9;
        \} else if (marks \geq = 70) {
          subjects[i].subjectMarks = 8;
        } else if (marks \geq = 60) {
          subjects[i].subjectMarks = 7;
        \} else if (marks \geq 50) {
          subjects[i].subjectMarks = 6;
        \} else if (marks \geq = 40) {
          subjects[i].subjectMarks = 5;
       } else {
          subjects[i].subjectMarks = 0;
       subjects[i].credits = (int) credits;
       subjects[i].grade = subjects[i].credits * subjects[i].subjectMarks;
       totalCredits += subjects[i].credits;
       totalGradePoints += subjects[i].grade;
     SGPA = totalGradePoints / totalCredits;
     return totalCredits;
  }
  void computeSGPA() {
     System.out.println("SGPA: " + SGPA);
}
public class StudentMain {
  public static void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     System.out.print("Enter the number of students: ");
     int numberOfStudents = sc.nextInt();
     for (int i = 0; i < numberOfStudents; i++) {
       System.out.println("\nProcessing details for student " + (i + 1) + ":");
       Student student = new Student(sc);
       student.getStudentDetail();
```

```
student.getMarks();
student.computeSGPA();
}
sc.close();
}
```

```
Command Prompt
Microsoft Windows [Version 10.0.22631.4317]
(c) Microsoft Corporation. All rights reserved.
C:\Users\Admin>cd\
C:\>cd 295
C:\295>set path="C:\Program Files\Java\jdk-23\bin"
C:\295>javac StudentMain.java
C:\295>java StudentMain
Enter the number of students: 2
Processing details for student 1:
Enter name and USN:
sam 1bm23cs295
Enter marks and credits of each subject:
95 3 87 4 99 2 81 1 93 3
SGPA: 9.615384615384615
Processing details for student 2:
Enter name and USN:
ram 1bm23cs300
Enter marks and credits of each subject:
98 3 78 3 89 4 90 1 70 2
SGPA: 8.923076923076923
C:\295>
```

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.

#### Algorithm:

| Date   | Date/ Foge  | Output:  |
|--|---|--|
| PROGRAM-3  |   | de la Harris Process son contractor                    |
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| mention a class each which certains four   | Scanner 5 = new scenner ( cyrum, in);   | and the second second second second                    |
| munus: name, author, price, num-page   | IAT N   | BOOK 1:  |
| for the market to set the values   | System euc. printle ("enter no ex pears:").   |  |
| for the members. Include methods to set and  | n = s. nextla (0;<br>s. nextlace ();  | enter name of beek: Atto the Alchemist                 |
| get the during of the chijects. Include a  | S. nextine ();  | enter author ex beek: 200 control paule                |
| ceasure detain by the beak occurred a  | han III and a tal   | enter ence ex beau. 250                                |
| Tava paymen to create in beek chypass.   | teeks $U b = new coaks [n];$ yes line $i = 0$ ; $i \times n$ ; $i + t$ ) $k$  | enter hundre et  |
| Charle to beek objects.  | System. cut. printer ("ecck"+ (141)+":");   | enter number of pages in beek: 200                     |
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| class cours of   | System. Ell. frint ("enter author of book:");   | entra mana a lana T                                    |
| String name;   | Grine author = S neroune ();  | enter name of been: The grapes of wrath                |
| String author:   | System . eur print l'enter price ex beck: ");   | enus author of book: Tehn                              |
| int paice:   | (int price = s. next Int ();  | enter price of book: 300                               |
| int numpage;   | Cystem. all. mint ("enter no ex paper in beck")   | ender number of pager: 400                             |
|  | int numpers = s, negeting 13;   | 1 destaure 3 de la |
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| b  | Y and the same of |  |

```
import java.util.Scanner;

class Books {
    String name;
    String author;
    int price;
    int numPages;

Books(String name, String author, int price, int numPages) {
        this.name = name;
        this.author = author;
        this.price = price;
}
```

```
this.numPages = numPages;
  }
  public String toString() {
    return "Book name: " + this.name + "\n" +
         "Author name: " + this.author + "\n" +
         "Price: " + this.price + "\n" +
         "Number of pages: " + this.numPages + "\n";
public class Main1 {
  public static void main(String[] args) {
    Scanner s = new Scanner(System.in);
    int n;
    System.out.println("Enter the number of books: ");
    n = s.nextInt();
    Books[] b = new Books[n];
    for (int i = 0; i < n; i++) {
       System.out.println("Book " + (i + 1) + ":");
       System.out.print("Enter name of book: ");
       String name = s.next();
       System.out.print("Enter author of book: ");
       String author = s.next();
       System.out.print("Enter price of book: ");
       int price = s.nextInt();
       System.out.print("Enter number of pages in the book: ");
       int numPages = s.nextInt();
       b[i] = new Books(name, author, price, numPages);
    System.out.println("\nBook Details:");
    for (Books book: b) {
       System.out.println(book.toString());
    s.close();
```

```
Microsoft Windows [Version 10.0.22631.4317]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Admin>cd\

C:\\295
C:\\295>set path="C:\\Program Files\\Java\\jdk-23\\bin"

C:\\295>java StudentMain.java

C:\\295>java StudentMain
Enter the number of students: 2

Processing details for student 1:
Enter name and USN:
sam 1bm23cs295
Enter marks and credits of each subject:
95 3 87 4 99 2 81 1 93 3

SGPA: 9.615384615384615

Processing details for student 2:
Enter name and USN:
ram 1bm23cs300
Enter marks and credits of each subject:
98 3 78 3 89 4 90 1 70 2

SGPA: 8.923076923076923

C:\\295>
```

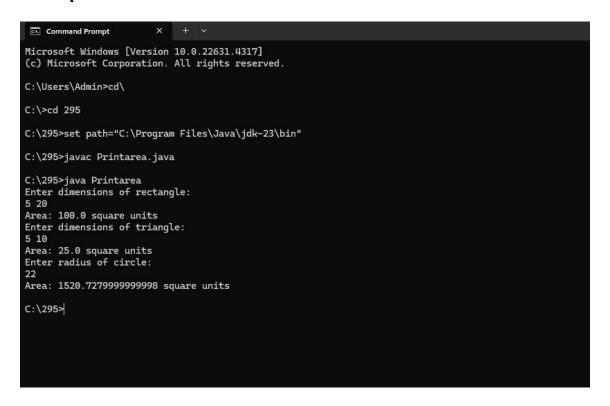
Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes name Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea()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

#### Algorithm:

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| Develop a java program to create an  | Class Triangle extends share 1                     | NAU (  |
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| two integers & an empty method named   | system out printly Center dinerio                  | The state of the s |
| Print Area (). Provide three class ramed   | triangu );   | 5 10   |
| Rectangle, Triangle and circle such that each  | June J= new scanner (surrem :- )                   | 5 20 20 11 11 11 11  |
| the of classes extends class those . Each  | . Text Delible 13:                                 | Samuel and the continued from  |
| Che of classes centain ency method   | bz s. hext Deuble ();                              | Area: 100.0 cg units   |
| print ries that prints area of given   | Result = (A * b) / 2;                              | Material to with the author Court of   |
| Shape.   | System. Out. printer ("Area:"+ nesuls+             | CLESON HEER LOCUES, The CHINAS DECEMBE   |
|  | 4 "squries");                                      | ALCO ALCO AND  |
| import favo. util. scanner;  | 2 e manage lieu many sery m                        | enter dimension of triangle  |
| 01   | (1000) 100 100 100                                 | Marine Charge Standard Court Court   |
| abstract class shape 's  | Class circle extends shape &                       | il & second mondia a marrial alla  |
| deuble a:  | Veid printAnea () S                                | belease gette speed die level, a south   |
| deuste b   | System . Out. printle (" enter nadius ex circle"). | Aren: 25.0 sq units  |
| Cos man deable neither; = 2 mass?  | Scanner S = new Scanner ( Custern in ).            | TALL STATE OF THE  |
|  | A = 5. NEXT DEUBLE ();<br>result = 3.142 * A * A;  | That teemer (seemen home) account to 2   |
| abstract void printhren ();  | result = 3.142 * a + a;                            | enter produce of virolo  |
| WHEN THE HEAVEN TO AREA TO MENTER THE MENTER THE PROPERTY OF T | lystem eut. frintln [ Anen + nesult + "ig unis     | areas a santing the many least a santing   |
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| class Kentangle entends Shape &  | Class Print Area 2                                 | Salute Manage marker in carrie   |
| veid princhrea () & many many  | Class Print Area                                   | Area: 1520.7279 sq. units  |
| System out frently ( enter dimension of  | public static void main ( curry args 17)3          | / Marian Marian Marian   |
| receangle );   | Rectarge & = new rectarge ();                      | A Company of the comp |
| scarner s = new scarner (system in);   | Triangle t = new Triangle ();                      | North American American  |
| a = s. nextocuble ();  | circle c = new circle ();                          |  |
| 6 = S. heatbousse ()   | 2. printArea ();                                   | 2/11/  |
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| · Manni Mar Manni  | 24   | and the moral and amount for times &   |
|  |  | - 3-48 100 1 m   |

```
import java.util.Scanner;
abstract class Shape {
   double a;
   double b;
   double result;
   abstract void printArea();
}
class Rectangle extends Shape {
```

```
void printArea() {
     System.out.println("Enter dimensions of rectangle:");
     Scanner s = new Scanner(System.in);
     a = s.nextDouble();
     b = s.nextDouble();
     result = a * b;
     System.out.println("Area: " + result + " square units");
  }
class Triangle extends Shape {
  void printArea() {
     System.out.println("Enter dimensions of triangle:");
     Scanner s = new Scanner(System.in);
     a = s.nextDouble();
     b = s.nextDouble();
     result = (a * b) / 2;
    System.out.println("Area: " + result + " square units");
class Circle extends Shape {
  void printArea() {
     System.out.println("Enter radius of circle:");
     Scanner s = new Scanner(System.in);
     a = s.nextDouble();
     result = 3.142 * a * a;
     System.out.println("Area: " + result + " square units");
class Printarea {
  public static void main(String args[]) {
     Rectangle r = new Rectangle();
     Triangle t = new Triangle();
     Circle c = new Circle();
     r.printArea();
     t.printArea();
     c.printArea();
```



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 Savacct 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.

# Algorithm:

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| The state of the s | Class Current Account entends Account &  | public Cless Bank &  |
| veid Compute Interest () &   | double minimum balance = 500.0;  | public static void main (string (7 args  |
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|      | Case 3: 1032 2 Charles Company   |
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|      | P. Stellenskat Schustelle same al           |
|      | Enter your Chine: 4                         |
|      | enterele added: 20.0                        |
|      | Updated Balance: 520.0.                     |
|      | 1 C ALCONOMISMOS AND A CONTROL OF           |
|      | Enter yeur Cheice: 2                        |
| 1    | ener withdrawal amount: 10                  |
| 1    | Withdraum: 10.0.                            |
| 1    | Updated Balance : 510.0                     |
| +    | My name o wante                             |

enter custemes name: ryz

enter account number: 13t

enter account type ((average / current): current

Enter gener choice: 1

enter deposit annuat: 210

Repetited: 210.0

Updated talence: 200.0

Enter your choice: 2

Enter noithdrawal annuat: 10.

Withdrawa: 10.0

Updated Balance: 200.0

Balance is below minimum. service

charge inspect.

Updated Balance: 150.0

Updated Balance: 150.0

```
import java.util.Scanner;
class Account {
  String customerName;
  int accountNumber;
  double balance;
  Account(String name, int accNumber) {
    customerName = name;
    accountNumber = accNumber;
    balance = 0.0;
  }
  void deposit(double amount) {
    balance += amount;
    System.out.println("Deposited: " + amount + "\nUpdated Balance: " + balance);
  void displayBalance() {
    System.out.println("Account Balance: " + balance);
  void withdraw(double amount) {
    System.out.println("Withdrawal is specific to account type.");
  void computeInterest() {
    System.out.println("Interest computation not applicable for this account type.");
class SavingsAccount extends Account {
  double interestRate = 0.04;
  SavingsAccount(String name, int accNumber) {
    super(name, accNumber);
  void computeInterest() {
    double interest = balance * interestRate;
    balance += interest;
    System.out.println("Interest added: " + interest + "\nUpdated Balance: " + balance);
```

```
void withdraw(double amount) {
    if (balance >= amount) {
       balance -= amount;
       System.out.println("Withdrawn: " + amount + "\nUpdated Balance: " + balance);
    } else {
       System.out.println("Insufficient balance.");
  }
class CurrentAccount extends Account {
  double minimumBalance = 500.0;
  double serviceCharge = 50.0;
  CurrentAccount(String name, int accNumber) {
    super(name, accNumber);
  }
  void checkMinimumBalance() {
    if (balance < minimumBalance) {
       System.out.println("Balance is below minimum. Service charge imposed.");
       balance -= serviceCharge;
       System.out.println("Service Charge: " + serviceCharge + "\nUpdated Balance: " + balance);
  }
  void withdraw(double amount) {
    if (balance >= amount) {
       balance -= amount;
       System.out.println("Withdrawn: " + amount + "\nUpdated Balance: " + balance);
       checkMinimumBalance();
    } else {
       System.out.println("Insufficient balance.");
public class Bank {
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.print("Enter customer name: ");
    String name = sc.nextLine();
    System.out.print("Enter account number: ");
    int accNumber = sc.nextInt();
    sc.nextLine();
```

```
System.out.print("Enter account type (Savings/Current): ");
String accType = sc.nextLine();
Account account;
if (accType.equalsIgnoreCase("Savings")) {
  account = new SavingsAccount(name, accNumber);
} else if (accType.equalsIgnoreCase("Current")) {
  account = new CurrentAccount(name, accNumber);
} else {
  System.out.println("Invalid account type.");
  sc.close();
  return;
while (true) {
  System.out.println("\nMenu:");
  System.out.println("1. Deposit");
  System.out.println("2. Withdraw");
  System.out.println("3. Display Balance");
  System.out.println("4. Compute Interest");
  System.out.println("5. Exit");
  System.out.print("Enter your choice: ");
  int choice = sc.nextInt();
  switch (choice) {
    case 1:
       System.out.print("Enter the deposit amount: ");
       double depositAmount = sc.nextDouble();
       account.deposit(depositAmount);
       break;
    case 2:
       System.out.print("Enter the withdrawal amount: ");
       double withdrawAmount = sc.nextDouble();
       account.withdraw(withdrawAmount);
       break;
    case 3:
       account.displayBalance();
       break;
    case 4:
       account.computeInterest();
       break;
    case 5:
       System.out.println("Exiting.");
       sc.close();
       return;
    default:
```

```
System.out.println("Invalid choice.");
}
}
}
```

```
Microsoft Windows [Version 10.0.22631.4317]
(c) Microsoft Corporation. All rights reserved.
 C:\Users\Admin>cd\
C:\>cd 295
C:\295>set path="C:\Program Files\Java\jdk-23\bin"
 C:\295>javac Bank.java
 C:\295>java Bank
Enter customer name: sam
Enter account number: 123
Enter account type (Savings/Current): savings
Menu:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest
5. Exit
Enter your choice: 1
Enter the deposit amount: 500
Deposited: 500.0
Updated Balance: 500.0
Menu:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest
5. Exit
Enter your choice: 2
Enter the withdrawal amount: 10
Withdrawn: 10.0
Updated Balance: 490.0
Menu:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest
5. Exit
Enter your choice: 5
Exiting.
 C:\295>javac Bank.java
C:\295>java Bank
Enter customer name: xyz
Enter account number: 234
Enter account type (Savings/Current): current
Menu:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest
5. Exit
Enter your choice: 1
Enter the deposit amount: 210
Deposited: 210.0
Updated Balance: 210.0
 Menu:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest
5. Exit
Enter your choice: 2
Enter the withdrawal amount: 10
Withdrawn: 10.0
Updated Balance: 200.0
Balance is below minimum. Service charge imposed.
Service Charge: 50.0
Updated Balance: 150.0
       nu:
Deposit
Withdraw
Display Balance
Compute Interest
Exit
 Enter your choice: 5
Exiting.
```

Create a package CIE which has two classes- Student and Internals. The class Personal has members like usn, name,sem. The class internals has an array that stores the internal marks scored in five courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Student. This class has an array that stores the SEE marks scored in five courses of the current semester of the student. Import the two packages in a file that declares the final marks of n students in all five courses.

# Algorithm:

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| Page   |  | fackage JEE;   |
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| Cheate a package C16 which has true  | System. Que. Printes ("VIN:" + uses);  | import CIE. Student;   |
|  | System suc princip ( Name : "+ name);  | public Unio External carendo Student   |
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| dear The Men in the lien, here   |  | I int () enternal Marks = hen int[5];  |
|  | 3  | internal marks = New (nt18);   |
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| semutes of the saugent princip   | int () internaments: new int [5];  | System fee (int 6.0, 625; 1++) &   |
|  | and remain the property of the state of the constant   | enicenaemaske [i] = maske [i];   |
| received the identity marks of a crime.  | public Internals (int 17 marce)  | I clar b   |
| all five course.   |  | System cut. printle (" provide exactly   |
|  | Control (is 1:0: 1 × 5; 1++) }   | 5 marks fer see ");  |
| N N  | 2. Marin (10, 145; (1+1))  | hand for tee );  |
| Package CIE;   |  | 2  |
| public class Sendenc &   | a surface ( Provide exactly  |  |
| String who:  | 5 mares fer internale );   | Veil dieplaytaternacharks () &   |
| String Name;   | 1 massa po   | System. cut. print ("see marks: "):  |
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| pussis Etuaine ( string us, cring name,  | Void dispayantisme Marks () ( "Internet Marks: ").   | for (int iz); ix externeemarks unjus   |
| in sen i   |  | (++) E   |
| this usn = usn;  | for Cint i=0; ix internal Marke-length.  | System. eur. print Centuralmarke 1134  |
|  | fer ( let 1=0; the international transport,  | " ").  |
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|  | 4  | USN 16M23  |
| inspere fave letter scances;   | enternale (i) = new External (uen, name,   |  |
| The state of the s | sen, enternal Marker;  | Name: Sam  |
| pussio Class Main &  | Carlo de la companya  | Semutes: 3   |
| public reason view main ( sering is args) f  | C. C   | enter internal marks for 5 centres:  |
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| Lysten, our prine ("crees no by success?)  | for Cint i=0; i <n, i<="" r+1)="" td=""><td>ENLES SEE MARKS for scurses</td></n,>  | ENLES SEE MARKS for scurses  |
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| External 17 externals = new External (n1;  | A CORCA  | U1N: 16m22   |
| for (int i=0; i <n; i++)="" td="" {<=""><td>f.o. f (" Final marks:");</td><td>Namu: ram</td></n;>  | f.o. f (" Final marks:");  | Namu: ram  |
| for the Contraction for student't  | fer (int j=0, j<5, j+1) {  |  |
| 10. Pla C'entra sursin fer munich +  |  | remented: 3  |
|  |  |  |
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| String was scarces near 0;   | enternal [i] (200)   | (SE MALK) : 49 9) 27 16 20.  |
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| Change ten = Tanaca next O;  1.11 (" name: ");  Change neme = Tanaca next O;  Change neme = Tanaca next O;   | enternal [i] (200)   | See Mari : 19 91 87 16 80  |
| Change was = (cancer near O;  111 ("Name: ");  (thing neme = (cancer near O;  121 ("Name: ");  int line = (anner near O;  int line = (anner near O;  | CALCADAN [1] - CALCADAN MASKILI].  | Set Marks: 19 91 87 86 80.   |
| Change ten = Tanaca next O;  1.11 (" name: ");  Change neme = Tanaca next O;  Change neme = Tanaca next O;   | enternal [i] (200)   | SEC MALK! : 49 91 87 86 80   |

# **Code: CIE** Internals.java package CIE; public class Student { String usn; String name; int sem; public Student(String usn, String name, int sem) { this.usn = usn;this.name = name; this.sem = sem;} public void display() { System.out.println("USN: " + usn); System.out.println("Name: " + name); System.out.println("Semester: " + sem); } package CIE; public class Internals { int[] internalMarks = new int[5]; public Internals(int[] marks) { if (marks.length == 5) { System.arraycopy(marks, 0, internalMarks, 0, 5); } else { System.out.println("Please provide exactly 5 marks for internals."); } void displayInternalMarks() { System.out.print("Internal Marks: "); for (int i = 0; i < internalMarks.length; <math>i++) { System.out.print(internalMarks[i] + " "); System.out.println();

```
SEE:
   Student.java
package SEE;
import CIE.Student;
public class External extends Student {
  int[] externalMarks = new int[5];
  public External(String usn, String name, int sem, int[] marks) {
     super(usn, name, sem);
     if (marks.length == 5) {
       System.arraycopy(marks, 0, externalMarks, 0, 5);
       System.out.println("Please provide exactly 5 marks for SEE.");
  }
  void displayExternalMarks() {
     System.out.print("SEE Marks: ");
     for (int i = 0; i < \text{externalMarks.length}; i++) {
       System.out.print(externalMarks[i] + " ");
     System.out.println();
   Main.java
import CIE.Student;
import CIE.Internals;
import SEE.External;
import java.util.Scanner;
public class Main {
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter the number of students: ");
     int n = scanner.nextInt();
```

```
Student[] students = new Student[n];
Internals[] internals = new Internals[n];
External[] externals = new External[n];
for (int i = 0; i < n; i++) {
  System.out.println("Enter details for student " + (i + 1) + ": ");
  System.out.print("USN: ");
  String usn = scanner.next();
  System.out.print("Name: ");
  String name = scanner.next():
  System.out.print("Semester: ");
  int sem = scanner.nextInt();
  students[i] = new Student(usn, name, sem);
  System.out.println("Enter internal marks for 5 courses:");
  int[] internalMarks = new int[5];
  for (int j = 0; j < 5; j++) {
     internalMarks[i] = scanner.nextInt():
  internals[i] = new Internals(internalMarks);
  System.out.println("Enter SEE marks for 5 courses:");
  int[] externalMarks = new int[5];
  for (int j = 0; j < 5; j++) {
     externalMarks[i] = scanner.nextInt();
  externals[i] = new External(usn, name, sem, externalMarks);
System.out.println("\nFinal Marks of Students:");
for (int i = 0; i < n; i++) {
  students[i].display();
  internals[i].displayInternalMarks(); // Using the standard for loop to display internal marks
  externals[i].displayExternalMarks(); // Using the standard for loop to display external marks
  System.out.print("Final Marks: ");
  for (int j = 0; j < 5; j++) {
     int finalMark = internals[i].internalMarks[i] + externals[i].externalMarks[i];
     System.out.print(finalMark + " ");
  System.out.println("\n");
scanner.close();
```

# }

```
C:\Windows\System32\cmd.e ×
Microsoft Windows [Version 10.0.22631.4460] (c) Microsoft Corporation. All rights reserved.
C:\295>javac marks.java
C:\295>java marks
Enter the number of students: 2
Enter details for student 1:
USN: 1bm23
Name: sam
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
C:\295>
```

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  $\geq$  father's age.

# Algorithm:

| I MANDON!   | class father & ine fatherage;  | fublic veil displayings () {  for ("188hbar ago:" + faction ago);  for ("sen' ago:" + senage);   |
|---|--|--|
|   | ine fatherhae:   | See Consulation of the second  |
| Write a program that semenstrates hereling  |  | for ( see age + father hge)  |
| of exceptions in inheritance than tree.   | pusice Father (int age) thrown wrecome collection).  | can age : + cenage);   |
| Greate a base class celled tather are   | (ntextion)   | and proof the state of the stat |
| barried class called "son" which execute the  |  |  |
| base day an lather day, implement a   | three new wronjege encepuer (40)   | have of  |
| constructer which takes age and thrown  | threw new wronging encepeion ( age);   | Public class crueption transling Internance & perm (lung 11 arg.) & Canner Cupum in  |
| the exception wranginger when the   | 7  | from (ling 1) args ) s   |
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| SAUTE DIEBER  | ina senage;  | int father Age = scenner. nextent 1).  |
| invest java . uei . Icannes ;   |  |  |
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|   | threw new Wrengage Enception (Confige);  | TO PERANA CO)  |
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| fuelle invaliation Agretaception (ini fatherage   | 'y Clerrige >= pathernge) & three No [waldcinge exception (fathernge, lennge);   | The state of the s |
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| be greater than es equal to   |  | AND  |
| 2 , father's age ");  | THE STATE SURFACE.   | Scanne Clere ();   |
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|       | Sen's age carnet be greater than er equal to father's age.   |
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|       | Enter Father's Age: 40 6 Nter Cen's Age: 12  |
|       | Sather's Age: 12  Sather's Age: 12  Sather's Age: 12.  |
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```
import java.util.Scanner;
class WrongAgeException extends Exception {
public WrongAgeException(int age) {
System.out.println("Age cannot be negative. Invalid age: " + age);
class InvalidSonAgeException extends Exception {
public InvalidSonAgeException(int fatherAge, int sonAge) {
System.out.println("Son's cannot be greater than or equal to father's age");
  }
class Father {
  int fatherAge;
public Father(int age) throws WrongAgeException {
 if (age < 0) {
 throw new WrongAgeException(age);
  this.fatherAge = age;
class Son extends Father {
  int sonAge;
public Son(int fatherAge, int sonAge) throws WrongAgeException, InvalidSonAgeException {
 super(fatherAge);
 if (sonAge < 0) {
 throw new WrongAgeException(sonAge);
 if (sonAge >= fatherAge) {
 throw new InvalidSonAgeException(fatherAge, sonAge);
  this.sonAge = sonAge;
public void displayAges() {
System.out.println("Father's Age: " + fatherAge);
System.out.println("Son's Age: " + sonAge);
  }
public class ExceptionHandlingInheritance {
public static void main(String[] args) {
Scanner scanner = new Scanner(System.in);
```

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

C:\cs295>javac ExceptionHandlingInheritance.java

C:\cs295>java ExceptionHandlingInheritance
Enter Father's Age: 48
Enter Son's Age: 48
Enter Son's Age: 48
Enter Son's Age: 48
Enter Son's Age: 48
C:\cs295>javac ExceptionHandlingInheritance.java

C:\cs295>javac ExceptionHandlingInheritance
Enter Father's Age: 50
Enter Son's Age: 20
Father's Age: 50
Son's Age: 20

C:\cs295>javac ExceptionHandlingInheritance.java

C:\cs295>javac ExceptionHandlingInheritance
Enter Father's Age: 20
Enter Son's Age: 3
Age cannot be negative

C:\cs295>javac ExceptionHandlingInheritance.java

C:\cs295>javac ExceptionHandlingInheritance.java

C:\cs295>javac ExceptionHandlingInheritance.java

C:\cs295>javac ExceptionHandlingInheritance
Enter Father's Age: 20
Enter Son's Age: -2
Age cannot be negative

C:\cs295>javac ExceptionHandlingInheritance
Enter Father's Age: -2
Age cannot be negative

C:\cs295>javac ExceptionHandlingInheritance
Enter Fon's Age: -2
Age cannot be negative
```

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.

# Algorithm:

| Class Duplay Thread entends Thread &                   | Thread steep ( interval + (ces); } 3  Cades ( Interrupted exception e)  |
|--|---|
| fublic Display Thread (String message, int interval) { | puses static void mais (cong 11 age  puses static void mais (cong 11 age  puses static void mais (cong 11 age  puses static void mais (cong 11 age)  ("EMSCE", 10); |
| this interval = interval; }  Kurlie void nun () \$     | Display Threat Threat 2 = New Display Three (colo", 2);   |
| by & Niue (true) {                                     | N 129<br>28/129   |

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|     | CSE                        |
|     | CSE college of engineering |
|     | (16                        |
| 334 | 223                        |
|     | CIE                        |
|     | C16                        |
|     | BMS cellege of engineering |
|     |                            |
|     |                            |

#### Code:

```
class DisplayThread extends Thread {
     private String message;
     private int interval;
Public DisplayThread(String message, int interval)
   this.message = message;
   this.interval = interval; }
public void run()
try {
while (true) {
   System.out.println(message); Thread.sleep(interval * 1000); }
catch (InterruptedException e)
       System.out.println("Thread interrupted: " + message); } }
public static void main(String[] args) {
 DisplayThread thread1 = new DisplayThread("BMS College of Engineering", 10);
 DisplayThread thread2 = new DisplayThread("CSE", 2);
}
```

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.

#### Algorithm:

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| ingest ions, aut, *:   | add (number 1);  | Anthoreusersequin (); */ cut = n1+ " +  h2+ " ;  negate NUM = N1/n2;                     |
| java ant ent: ";   | add (num1);<br>add (numes 2);<br>add (num2);   | out += Ctring value of (result Num); repaint ();   |
| PUBLIC CLEEK DIVILIENMAIN! EASEALE FRANCE insplements.   | add (entreput);  | t t  |
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| Butten delevet;  | Winden Adapter ()  | Catch ( A nithmetic exception 62)  |
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|     | }  |
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|     | number 23 15 Result  |
|     | Result: 2.666666   |
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| -   | and allowed a test   |

```
import java.awt.*;
import java.awt.event.*;
public 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("Result:", 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 we) {
         System.exit(0);
       }
    });
```

```
setSize(300, 200);
  setVisible(true);
}
public void actionPerformed(ActionEvent ae) {
  int n1, n2;
  try {
    if (ae.getSource() == dResult) {
       n1 = Integer.parseInt(num1.getText());
       n2 = Integer.parseInt(num2.getText());
       if (n2 == 0) {
         throw new ArithmeticException("Cannot divide by zero");
       resultNum = (double) n1 / n2;
       out = "Result: " + resultNum;
       flag = 0;
    }
  } catch (NumberFormatException e1) {
    flag = 1;
    out = "Number Format Exception: " + e1.getMessage();
  } catch (ArithmeticException e2) {
    flag = 1;
    out = "Divide by Zero Exception: " + e2.getMessage();
  repaint();
}
public void paint(Graphics g) {
  if (flag == 0) {
    g.drawString(out, 100, 150);
  } else {
    g.drawString(out, 100, 200);
    flag = 0;
}
public static void main(String[] args) {
  DivisionMain1 dm = new DivisionMain1();
```

```
dm.setSize(new Dimension(800, 400));
dm.setTitle("Division of Integers");
dm.setVisible(true);
}
```



Demonstrate Inter process Communication and deadlock

# Algorithm:

i)

|          |                                  | Page -              |                   |
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| patify ();  Class Produces implements Connecte ()  The part ();  The par |         | Dote/_<br>Page   |   |
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| this of g;  New Thresh (this, 'consumer') start ();  fublic vidence ();  fublic vidence ();  ine i = 0;  while (i < 15) ?  ine i = 1, get ()  Guerra eu. princh ('consumer' + v);  (++;  );  | 70      |  |   |
| new threek (this, 'consumer') . Mart ();  fublic vid num () f  int i= 0;  while ('i' 15) &  int i = q; get ()  Gystem but princts ('consumed:'+8);  (++;  )  |         |  |   |
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| public void run () {  Int i= 0;  white (i < 15) };  Int i = q; get ()  Cyption, but, princip ('Censument'+8);  (++;  );  (   | 01.     | 4 miles ( This, cenumer'). Start ()  | ; |
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class Q {
  int n;
  boolean valueSet = false;

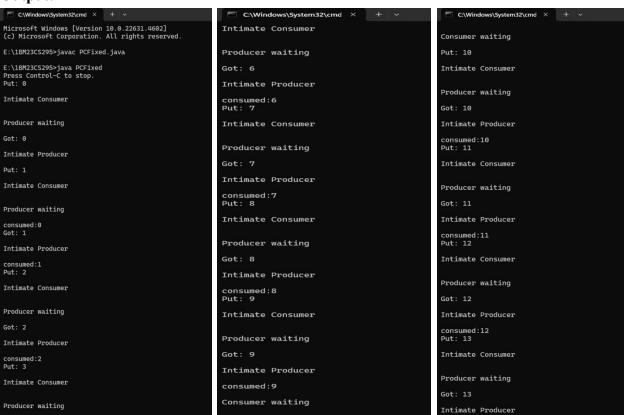
synchronized int get() {
  while (!valueSet)
    try {
       System.out.println("\nConsumer waiting\n");
       wait();
    } catch (InterruptedException e) {
       System.out.println("InterruptedException caught");
    }

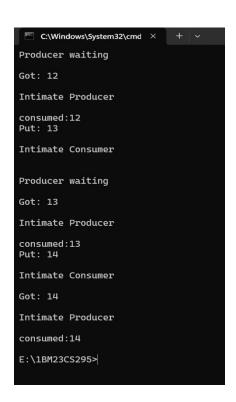
System.out.println("Got: " + n);
  valueSet = false;
  System.out.println("\nIntimate Producer\n");
  notify();
  return n;
```

```
}
  synchronized void put(int n) {
    while (valueSet)
       try {
         System.out.println("\nProducer waiting\n");
         wait();
       } catch (InterruptedException e) {
         System.out.println("InterruptedException caught");
    this.n = n;
    valueSet = true;
    System.out.println("Put: " + n);
    System.out.println("\nIntimate Consumer\n");
    notify();
  }
class Producer implements Runnable {
  Qq;
  Producer(Q q) {
    this.q = q;
    new Thread(this, "Producer").start();
  public void run() {
    int i = 0;
    while (i < 15) {
       q.put(i++);
     }
 }
class Consumer implements Runnable {
  Qq;
  Consumer(Q q) {
    this.q = q;
    new Thread(this, "Consumer").start();
  }
  public void run() {
    int i = 0;
    while (i < 15) {
       int r = q.get();
```

```
System.out.println("consumed: " + r);
    i++;
}

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





# ii) Algorithm:

| Date/<br>Page  | Date   |  |
|--|--|--|
|  |  |  |
| denie of deadlock -  | synchronized veid last () &                    |  |
| ALIA PERLIMBARA PATRI  | Form (" Inside A. last"); }                    |  |
| Cless A  | g and Average Association                      |  |
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| Synchronized void fee (86)   | Maintenant Human to Call a lace (1)            |  |
| String name = Thread - current Thread (). getNami  | LOVE There there as all a realth               |  |
| 1.0.18n (name + "entered 1.feo");  | A a = new A();                                 |  |
| try  | 86 = new B();                                  |  |
| ( Cring name = Threat - Current Threat (). gurrous,  (10.10 ( name + "entered 1. feb ");  try f  Threat. clep (1000); &  | Deadleck () &                                  |  |
| water was a last and a   | Thread (11) read (). CetName ("Main Thread).   |  |
| Catch (Exception e)  | Thread t = new Thread (this, "Racing Thread"); |  |
| Some City  | t. Start ():                                   | DX Per   |
| " No. Pin ("A interrupted "); &  | 9. fee (6);                                    |  |
| 6. (ast (): 3  | Joseph (" Back in main threnk");               | Oliterat:  |
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| Synchronized void last ()  |  | Casing Threat ensured 8. bas   |
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| A AMARIAN AMAR | 1 b. bas (a);                                  | S a Riva Alli  |
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| cless & &  |  | AND THE PERSON OF THE PERSON O |
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| Catch (exception e) h  |  | CALLER WIND ALAND ALAND  |
| 10.11n ft a language x 11 2  |  |  |
| S.O.P.In (Name + "trying to call A last 1)   |  |  |
| A last 10; 2   |  | The state of the s |
|  |  |  |

```
Code:
class A {
  synchronized void foo(B b) {
     String name = Thread.currentThread().getName();
     System.out.println(name + " entered A.foo");
       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();
    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();
}
```

```
Microsoft Windows [Version 10.0.22631.4602]
(c) Microsoft Corporation. All rights reserved.

E:\1BM23CS295>javac Deadlock.java

E:\1BM23CS295>java Deadlock
MainThread entered A.foo
RacingThread entered B.bar
MainThread trying to call B.last()
RacingThread trying to call A.last()
```