VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



LAB REPORT on

Object Oriented Java Programming (23CS3PCOOJ)

Submitted by

Ashwini L(24BECS430)

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 to 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 (23CS3PCOOJ)" carried out by **ASHWINI L** (24BECS430), who is a 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.

Dr. Prasad G R Professor Ph.D. Department of CSE, BMSCE

Dr. Jyothi S Nayak Professor & HOD Department of CSE, BMSCE

Index

Sl. No.	Date	Experiment Title	Page No.
1	09-10-2024	Implementation of Quadratic Equation	4-5
2	16-10-2024	Student data consisting (usn,name,an array of credits and marks and method to calculate SGPA of each student).	6-8
3	23-10-2024	Constructors	9-13
4	23-10-2024	Abstract Class	14-17
5	13-11-2024	Inheritance	18-22
6	13-11-2024	Packages	23-28
7	20-11-2024	Exceptions	29-32
8	27-11-2024	Threads	33-34
9	27-11-2024	Open-ended questions(user-interface)	35-39
10	27-11-2024	Open -ended questions(process-communication and deadlock)	40-48

Github Link:

https://github.com/Ashvinigowda/Java-programs-

Program 1

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

```
12000000
                                                              System- aut. println ("No real solution."):
1. Develop a java program that points all seed solution
 to the quadratic equation axis + bx+c = 0. Ecod in
 a.b.c. and we the quadratic formula It the
 descriminate b'- 4ac is negative, display a message
 stating that There are no real solutions.
                                                            Output:
import java util. Scanner;
                                                            Enter the value of a: 5
  put Clau Quadratic Equation (
                                                            Enter the value of b: 12
    public static void main (string () angs) {
      Scanner Scanner - new Scanner (System. In);
                                                            Enter the value of c: 5
                                                           Two real solutions: -0.5366750419282
  System. out. Print (" Enter a cotte value for a: ");
  double a = scanner next Double ();
                                                             -1.86332495807108
  System. out. Print ("Entire the value for b:");
  double b = source, next Double ();
  System. out. Print ("Enter the value for c:");
  double c = gearner, next Double ();
  geanner close ();
  double discriminant = b b b , 4 a * c;
 14 ( davaminant >0) }
  double root 1 = (-b+ Math, sqrtt discentinant)) (6 % a);
 double root 2 = (-b- Math, sqrt(discerninant))/(2 a);
 System. out printle ("Two real solution;" + roots +
  " and " + root );
 elie 4 ( duouminant==0) {
  double root = - 6/(2 * a);
    System, out, println ("One real solution; " + 700+);
```

```
import java.util.Scanner;
class quadratic equation {
  public static void main(String[] args) {
     System.out.println("Ashwini L" +"24BECS430");
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter the value for a: ");
     double a = scanner.nextDouble();
     System.out.print("Enter the value for b: ");
     double b = scanner.nextDouble();
     System.out.print("Enter the value for c: ");
     double c = scanner.nextDouble();
    scanner.close();
    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("Two real solutions: " + root1 + " and " + root2);
     \} else if (discriminant == 0) {
       double root = -b / (2 * a);
       System.out.println("One real solution: " + root);
     } else {
       System.out.println("No real solution.");
```

Output:

```
C:\Users\bmsce\Documents\24becs430>java quadraticequation
Ashwini L24BECS430
Enter the value for a: 5
Enter the value for b: 12
Enter the value for c: 5
Two real solutions: -0.53667504192892 and -1.86332495807108
```

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.

```
System. out. print ("Enter made for subject "+ (++1)+":");
Develop a Java Program to create a class student Develop a Java Program to create a class student with neurob members USN. Name. An array credit & court of accept & daplay an array marks include methods to accept & daplay details & a method to calculate SGPA 9 a student.
Week- 02
                                                                                                                                          marks [i] = 3c. next 1 rd (7;
                                                                                                                             Void de play details () {

System. out privath ("In Student Details!");

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

System. out. privath ("Name:" + Name);

System. out. privath ("Subject Discidedus");
    import java. util scanner
Class student f
    import
                  String USN;
                                                                                                                                     System. Old. P.

for (Int i= 0; 1 × n; 1,+1) {

System. old. printly ("Subject" + (1+1) + ": Guedate="+

System. old. printly ("Subject" + (1+1) + ": Guedate="+

Coedita[1] + ", Haveta = "+ monts [1]);
                  String Name;
int[] Gudite;
                  INTED marker;
                                                                                                                             double calculate Stops () {

Int +0+al executs = 0;

Jouble +0+alpoints = 0.0;
                    accept Details () {
                         scanner SC = New Scanner (System In);
                               System. out. Print("Enter USN;");
USN = SC. NEXTLINE ();
                                                                                                                                    double totalpoint = (1+1) {

Yor (int 1=0; 1 < n; 1+1) {

Yor (int 1=0; 1 < n; 1+1) {

Yor (graduptoint = calculate grade point (maxle [1]);

+otal Condite + = Gradupoint * Condite [1];

+otal points + = gradupoint * Condite [1];
                               system. out Print ("Enter Name:");
                               Name = Sc. nexture ();
                               System out Print ("Enter number of subjects.");
                                                                                                                                   return total points / total credits;
                                    n = sc. next Int ();
                                Cudita = new int[n];
marke = new int[n];
                                                                                                                                          calculate grade point (Int marks ) [
                                                                                                                                         Ty Cmarke >= 90) return 10;
else of (marke >= 80) return 9;
else of (marke >= 70) return 3;
                          for Cint 1=0; 1 ×n; 1++) {
                                 System. out. print("Enter exidite for subject"+ (1+1) + ":");
                                                                                                                                          else if (marks > = 60) rectures 7;
                                                                                                                                         else of Cmarts >= 50) rection 6;
                                    Gudita [i] = sc. next (nt ():
                                                                                                                                         else of (marks >= 46) return 5;
                                                                                                                                          else retwer o;
```

```
Public Stalic word main (String [] angs)?

Student 3 = new suitdent [];

s. accept Details ();

s. dieplay Details ();

double SAPA = S. calculate SAPA ();

System. out. println("SAPA;" + sappa);

}.
```

```
import java.util.Scanner;
class student {
  String usn;
  String name;
  int[] credits;
  int[] marks;
  int n;
  void acceptDetails() {
     Scanner sc = new Scanner(System.in);
    System.out.print("Enter USN: ");
    usn = sc.nextLine();
    System.out.print("Enter Name: ");
    name = sc.nextLine();
    System.out.print("Enter number of subjects: ");
    n = sc.nextInt();
    credits = new int[n];
    marks = new int[n];
    for (int i = 0; i < n; i++) {
       System.out.print("Enter credits for subject " + (i + 1) + ": ");
       credits[i] = sc.nextInt();
    System.out.print("Enter marks for subject " + (i + 1) + ": ");
       marks[i] = sc.nextInt();
  void displayDetails() {
    System.out.println("\nStudent Details:");
    System.out.println("USN: " + usn);
    System.out.println("Name: " + name);
    System.out.println("Subject-wise details:");
     for (int i = 0; i < n; i++) {
       System.out.println("Subject " + (i + 1) + ": Credits = " + credits[i] + ", Marks = " + marks[i]);
  double calculateSGPA() {
    int totalCredits = 0;
    double totalPoints = 0.0;
     for (int i = 0; i < n; i++) {
       int gradePoint = calculateGradePoint(marks[i]);
```

```
totalCredits += credits[i];
     totalPoints += gradePoint * credits[i];
  return totalPoints / totalCredits;
int calculateGradePoint(int marks) {
  if (marks \geq= 90) return 10;
  else if (marks \geq= 80) return 9;
  else if (marks \geq 70) return 8;
  else if (marks \geq 60) return 7;
  else if (marks \geq 50) return 6;
  else if (marks \geq 40) return 5;
  else return 0; // Fail
public static void main(String[] args) {
  student s = new student();
  s.acceptDetails();
  s.displayDetails();
       double sgpa = s.calculateSGPA();
  System.out.println("SGPA: " + sgpa);
```

Output:

```
C:\Users\bmsce\Documents\24becs430>java student
Enter USN: 24BECS430
Enter Name: ASHWINI L
Enter number of subjects: 3
Enter credits for subject 1: 4
Enter marks for subject 1: 100
Enter credits for subject 2: 3
Enter marks for subject 2: 98
Enter credits for subject 3: 4
Enter marks for subject 3: 92
Student Details:
USN: 24BECS430
Name: ASHWINI L
Subject-wise details:
Subject 1: Credits = 4, Marks = 100
Subject 2: Credits = 3, Marks = 98
Subject 3: Credits = 4, Marks = 92
SGPA: 10.0
```

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.

```
constructor class.
imposet java. util. scanner
       BOOK S
class
        Portvate String mame;
       Private String author;
       Private double price;
       Private int numpages;
      Public Book Cstring name, String author, double price,
                  int numpages)
          thie . name = name;
          this . author = author;
         this . price = price;
         this . numpages = numpages;
               Storing get Manne () {
              String get Author () {
              double getPrice () {
       Public
               return price;
               ent getNumpages () [
       Public void SetName (String name) {
            thee . name = name;
        }.
```

```
Public void set Author ( String and
                                                                               boots[i]= new Boot Chame, author, price, nun-poges)
         this author: author;
                                                                           System out. println ("In Book Details:");
  Public void setPrice (double price) {
                                                                          you (Int 1:0; 1Kn; 1++) {
                                                                                System out, printle ("In Delails of Book"+(1+1)+":");
        this price = price;
                                                                                System.out, printin(books[1] to String());
 public void setnumpage ( not num pager) {
    the numpages = numpages;
}
                                                                              Scanner. close ();
 public string to string () {

return "Book Name:" + name + "In Author: "+
      author+ "In Price: $"+price+ "In Number of pages."
                                                                  Output:
                                                                 Enter the number of books you want to be ate: I
                                                                 Enter the details for book !:
                                                                 Enter book rame: DOJ
public static void main (String [Jargs) [
                                                                 Enter author name: SEEMA PATIL
    Scanner Scanner = new Scanner (System. In);
    System. out. print (" Exter the number of boots you
                                                                 Enter price: 500
                                                                 Enter the number of pages: 1000
      want to create; );
    int n = Scarner. next Int ();
    Acanner. next Line ();
                                                                 Book Details
                                                                 Details of Books:
Book Name: OOJ
    Boot[] boots = new Boot[n];
    for (Int 1=0; ikn; 1++) {
       System.out. printer ("Enter details for book"+
                                                                 Author: SEEMA PATIL
         (+1)+":");
                                                                 Price: $500.0
                                                                 Number of pages: 1000
       System. out. print ("Enter author rame: ");
        String author = scarrer. next Line ();
      System out print (" Enter price : ");
      double price = Scanner. next Double ();
                                                                olpseen
      System out print("Enter number of pages:");
      int num-pages = scarner. next int ();
scarner. next Line ();
```

```
import java.util.Scanner;

class Book {
    private String name;
    private String author;
    private double price;
    private int numPages;

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

```
public String getName() {
    return name;
  public String getAuthor() {
    return author;
  public double getPrice() {
    return price;
  public int getNumPages() {
    return numPages;
  public void setName(String name) {
    this.name = name;
  public void setAuthor(String author) {
    this.author = author;
  public void setPrice(double price) {
    this.price = price;
  public void getNumPages(int numPages) {
    this.numPages = numPages;
  public String toString() {
    return "Book Name: " + name + "\nAuthor: " + author + "\nPrice: $" + price + "\nNumber of
Pages: " + numPages;
  public static void main(String[] args) {
    System.out.println("ASHWINI L"+"24BECS430");
    Scanner scanner = new Scanner(System.in);
    System.out.print("Enter the number of books you want to create: ");
    int n = scanner.nextInt();
    scanner.nextLine();
    Book[] books = new Book[n];
    for (int i = 0; i < n; i++) {
       System.out.println("Enter details for book " + (i + 1) + ":");
```

```
System.out.print("Enter book name: ");
String name = scanner.nextLine();

System.out.print("Enter author name: ");
String author = scanner.nextLine();

System.out.print("Enter price: ");
double price = scanner.nextDouble();

System.out.print("Enter the number of pages: ");
int numPages = scanner.nextInt();
scanner.nextLine();

books[i] = new Book(name, author, price, numPages);
}

System.out.println("\nBook Details:");
for (int i = 0; i < n; i++) {
    System.out.println("\nDetails of Book " + (i + 1) + ":");
    System.out.println(books[i].toString());
}
scanner.close();
}
</pre>
```

Output:

```
ASHWINI L24BECS430
Enter the number of books you want to create: 6
Enter details for book 1:
Enter book name: 00J
Enter author name: SEEMA PATIL
Enter price: 500
Enter the number of pages: 1000
Enter details for book 2:
Enter book name: DATA STRUCTURES
Enter author name: 400
Enter price: 750
Enter the number of pages: 1700
Enter details for book 3:
Enter book name: SDM
Enter author name: GIRISH
Enter price: 600
Enter the number of pages: 750
Enter details for book 4:
Enter book name: LOGIC DESGIN
Enter author name: GEETHA
Enter price: 450
Enter the number of pages: 700
Enter details for book 5:
Enter book name: DBMS
Enter author name: UMA DEVI
Enter price: 800
Enter the number of pages: 1500
Enter details for book 6:
Enter book name: COA
Enter author name: MEGHA
Enter price: 400
Enter the number of pages: 750
```

Book Details: Details of Book 1: Book Name: OOJ Author: SEEMA PATIL Price: \$500.0 Number of Pages: 1000 Details of Book 2: Book Name: DATA STRUCTURES Author: 400 Price: \$750.0 Number of Pages: 1700 Details of Book 3: Book Name: SDM Author: GIRISH Price: \$600.0 Number of Pages: 750 Details of Book 4: Book Name: LOGIC DESGIN Author: GEETHA
Price: \$450.0
Number of Pages: 700 Details of Book 5: Book Name: DBMS Author: UMA DEVI Price: \$800.0 Number of Pages: 1500 Details of Book 6: Book Name: COA Author: MEGHA Price: \$400.0 Number of Pages: 750

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 contains only the method printArea() that prints the area of the given shape.

```
Muck-04
  Abstract Claus
  import java util. Scanner;
  abstract days shape &
        int dimensions:
       int dimension2;
          abstract void printAreac);
           scectargle Extends Shape {
     Class
          public lecturale (ent lingth, int width) {
              this . dimension 1 = length;
              this . dimension2 = width;
         void printArea () {
               int area = dimension 1 " dimension 2;
              System. out. println (" Rectargle Area: "+ area);
        Class Triangle Extends shape {
              public Triangle Cint base, ent height) {
                 This . dimension 1 = base;
                 this . dimension 2 = height;
             void prent Area () {
                double area = 0.5 to dimension 1 to dimension 2;
                System. out. println ("Triangle Area: " + area);
        Clase Circle Extends Shape
             private firal double pr= 3.14;
             Dublic Circle ( intradius) [
                 their dimension 1= readine;
                 this . dimension 2 = 0;
```

```
double oxea = p1 x dimension 1 x dimension 1;
                                                                        OLP.
          System.out. print in ("Circle Area;" + oxee a);
                                                                        Enter length of rectangle: 12
Enter width of rectangle: 10
                                                                        Rectargle Area: 120.
                                                                        Enter base of triangle: 4
Enter height of triangle: 5
Triangle Area: 10.0
        public Static void main (String () augs){
Public Class main (
          Scanner. Scanner = new Scanner (System. in);
                                                                        Enter radius 9 circle: 5
Circle Area: 78.53975.
          System, out, print ("Ento legte of rectargle:);
          int length . scanner . next Int ();
                                                                          olp Seen
         System . cut. print (" Entir width of rectangle :).
         Int what = scanner next 1 of ();
                                                                            St
        Rectargle rectargle = new lectargle Clergth, widte);
         rectargle . print Area ();
       System, out. printla Ento bace of
        int bare = scanner. next int ();
      System out print ("Enter height of
      Sysum. Out. print Enter height of ret height = scanner. Next Int ();
Triangle triangle = new Triangle Chare, height);
        Irrangle, print Area ();
      System. out prost ("Entry radius of circle:");
int radius = Beamer. next Ind ();
      Circle, circle = new Circle (radius,);
      circle · printArea();
      Scanner. close ();
```

```
import java.util.Scanner;
abstract class Shape {
  int dimension1;
  int dimension2;
abstract void printArea();
}
class Rectangle extends Shape {
  public Rectangle(int length, int width) {
    this.dimension1 = length;
    this.dimension2 = width;
}
```

```
}
  void printArea() {
    int area = dimension1 * dimension2;
    System.out.println("Rectangle Area: " + area);
class Triangle extends Shape {
  public Triangle(int base, int height) {
    this.dimension1 = base;
    this.dimension2 = height;
  void printArea() {
    double area = 0.5 * dimension1 * dimension2;
    System.out.println("Triangle Area: " + area);
class Circle extends Shape {
  private final double pi = 3.14159;
  public Circle(int radius) {
    this.dimension1 = radius;
    this.dimension2 = 0;
  void printArea() {
    double area = pi * dimension1 * dimension1;
    System.out.println("Circle Area: " + area);
  }
public class Main {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.println("Name:ASHWINI.L, USN:24BECS430");
    System.out.print("Enter length of rectangle: ");
    int length = scanner.nextInt();
```

```
System.out.print("Enter width of rectangle: ");
     int width = scanner.nextInt();
    Rectangle rectangle = new Rectangle(length, width);
    rectangle.printArea();
     System.out.print("Enter base of triangle: ");
    int base = scanner.nextInt();
    System.out.print("Enter height of triangle: ");
     int height = scanner.nextInt();
    Triangle triangle = new Triangle(base, height);
    triangle.printArea();
    System.out.print("Enter radius of circle: ");
    int radius = scanner.nextInt();
    Circle circle = new Circle(radius);
    circle.printArea();
    scanner.close();
Output:
```

```
C:\24BECS430>java Main
Name:ASHWINI.L , USN:24BECS430
Enter length of rectangle: 12
Enter width of rectangle: 10
Rectangle Area: 120
Enter base of triangle: 4
Enter height of triangle: 5
Triangle Area: 10.0
Enter radius of circle: 5
Circle Area: 78.53975
```

Develop a Java program to create a class Bank that maintains two kinds of accounts for its customers, one called savings account and the other a 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.

```
Week-05
                                                                 super ( automernane, account number);
                                                                 this interest note = interestrate;
 import java. wil. Scanner;
                                                                 public void compute and deposit interest (){
  class Account &
                                                                     double concert balance = get balance ();
    Private String customer Name;
                                                                     double interest = coverent balance
    private String account Number;
                                                                    deposit Cinterest)
                                                                     System out. printinc "interest depolated: "+ interest);
   protected daible balance;
   public Account (String automerName, String accountNumber)
     this. customer Name = customer Name;
    this . account Number = account Number
                                                                clau cworAct Eilerde account {
                                                                    private double minimumbalance;
    this . balance = 0.0;
                                                                     public curracet (String curtornerrane, String accounting
                                                                    private double service charge;
  public void depoint Cdouble amount) {
     System. out. println ("Deposited amount: "+ amount);
                                                                                     soulce charge).
                                                                  super (customernane, account number);
    System. out. println("Balance amount:"+ balance);
  public. void display Balance () {
                                                                   this . minimum balance = minimum balancet;
                                                                   this . sowice charge = sowice charge;
  public void withdraw (double amount) {
    1.1 (amount <= balance) {
                                                                    public vold withdraw (double amount) {
                                                                       1.4 (getBalance C) - amount < minimum balance) [
     System out. printh ("withdraw amount: "+ amount);
     balance - = amount;
                                                                          System out Printla C'service charge imposed: "+ service charge);
      System out printhe" Inefficient balance for withdrawal 1");
                                                                                 source charge);
                                                                       System out println & "Insufficient Balance");
                                                                       depotet C-
  protected double get Balance () {
     return Balance;
                                                                       else
                                                                        super withdraw (amount);
class SavAcct extends Account (
  private double intoutlate;
  Dublic 408 Southor (String enformer Name, String accountnumber.
  double intrutrate)
```

```
public clau Bank f
    public static void main (String Dargs) {
                                                                      Output
      Scarner scanner = new Scarner (System. In);
                                                                      Saving account
       SOPC Enter cutomer name for Savings account: 1);
                                                                       Balance: 10,000.00
      String Sourings Customer Name: Scanner. nexthire();
                                                                      Depointed: 100.00
       System out, point he Enter account number for Savings account);
                                                                       Intrut & 75.0 has been added
      Shing Savings Account Number - Scanner . Next line ();
SOP ( "Enter interest note for savings Account");
      double Interest Rate = scarner. next Double ();
                                                                       Balance : 1575.0
       Sav-Act saving Account = new Sav Acet ( savings Cutto mer Name
                                                                       with draw: 300.0
       Savinga Account Number, Interest (laty);
                                                                       Balana: 7275.0
                                                                       Current Account
       Curact current Account = new
       Coveract Convert Contorner Name, convert Account Number.
                                                                       Balarce: 12005
                                                                        Deposited: 12000.50.
        men Bal , souria Charge);
         current Account . depoint (2000);
                                                                        Balance ! 11125,00,00.
         current Auount. dieplay Balance ();
         SOPC ETTER amount to withdraw from Current hearen");
        double current intravan Amount = Scann, next Double ();
         current Account withdraw ( wount 10th draw Amount);
         current Account. display Balance ();
         System out printing "Enter amount to withdraw from
                             Current Account Cropy mour Sourice
                             Charge):");
         Current Dittoraw Amount = Scarrer, next Double (3)
         current Account. Withdraw ( current 10: thoraw Amount);
        current Account. display Balance ( );
         Scanner, close ();
     }.
```

```
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();
```

Output:

```
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:
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:
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
```

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.

```
Create a package CIE which has two classes - Student and
Internals. The class Student has members like usn. name. Son
                                                                     public Class Internals extends Student of
The class intervals derived from student has an accuracy that
                                                                       private int [] Internal Marks = new Int [5];
stones the internal morte second in five courses of the
current semestre q the student becate another package see
                                                                       public Internals Cisting USA, String rame, Int son, Int()
which has the class external which it a downed class of
                                                                                       Internal Marker) {
Student This class has an away that stores this SEE marks
                                                                           Super ( win , name . sem);
scored in five covering the current sensition of the student.

Import the two packages in a file that declares the
                                                                           this . Interal Marks : Interal Marks;
final marks of n students in all flow courses.
                                                                        public void diplay Internal Marke () {
                                                                            System. out. print ("Internal Marks: ");
                                                                            for Cint mart: internal Marke) f
                                                                                 System. out, print ( Marc + ");
 Dackage CIE:
  public class Student (
                                                                              System. out. println();
       protected String usn;
       protected string name;
                                                                         public int[) get hteral Marks () {
       protected ent sem;
                                                                            section internal Marks;
      public Student (String usn, String name, Int sem) [
         thu. usn = usn;
         this . name = name;
                                                                  ASEEU
                                                                   package SEE;
         this . sem = Sem;
                                                                   Import CIE, Student;
                                                                   public class External extends Student {
     public void display Student Details () {
                                                                      private int [] external MaxEs = new int [5];
        System out printinc" USN: "+ wn+", Name: " + ramet"
                                                                      public External (String uen, String rame, Int sen, Int []
         Senester: " + sem);
                                                                             externals Marks) {
                                                                           super (uen, name, sem);
                                                                           this. external Marks = external Marks;
   }.
                                                                      public void diplayExtornal larks () {
                                                                          System. out. print ("External Marke: ");
                                                                         you Cint mark : external Harcks) {
                                                                              System. out, println (mark +" ");
                                                                          Guten. aut. println ();
```

```
public intil getExtural.
                                                                  System. out. printlnC" Enter details for SEE Student "(CI+1)+ ";");
          return external Harts;
                                                                  system out. print ("USN; ");
                                                                  usn = scanner . next-line ();
                                                                  System. out. print ("Name".");
    3.
                                                                  name = scanner, next Hame(); j.
                                                                  int[] ExternalMarta = new int[5];
Main file.
                                                                  forcerd j = 0; j < 5; j++) {
  Import CIE. Internals;
                                                                       External Marke [j] = Scarner next Int ();
  Import SEE. Externals;
  import java util Scanner;
                                                                   Studenti (i): new pouroral Cuen name. sen);
  public class Studentmarts {
                                                                    Internals(i) = new Internals Cinternal marks);
      public static word main CString[] orgs) {
                                                                    External. [1] = new External Cuen, rame, Sen. Externalmarker);
       Scanner scanner = new Scanner (System. In);
       System out print (" Enter number of Students: ");
                                                                   System. out. printin ("In Final marks of Students:");
        int n = scanner. next Int ();
                                                                    for Cent 1 = 0; ixn; i++) {
       Scanner . next Line ();
                                                                       Students [1]. die play pour onal Info ();
       Internals [] ciestudente = new Internals [n];
                                                                       Internal [1] display Internal Harks ();
       External, [] seestudents = new External [n];
                                                                       Externals [1]. dis play External Marks ();
                                                                       System out print ("Final Harks:");
       for (int 1 = 0; 1 kn; 1++){
                                                                        for ( Int j=0; jx5; j++) {
        System out, println("Exter details of CIE Student"+
                                                                              int finalmart = internals [1]. internalmarts []]+
                                                                                 External [i]. Externalmarke [j];
           C ++1)+ ": ");
         System. ord. print (USN; );
        String usn = scanner. next Line ();
         System. out. print ( Name: ");
                                                                         System. out. println ("In");
        String name = scanner. Nex+tine ();
        System - out print ( " Semester ! ");
                                                                         scanner. close ();
        Int sen = scarner . Hest Int ();
        Int[] interallarts = new int[5]
        System out printing " Enter Internal marke for 5 courses:");
        fox (int j=0; j < 5; j++) {
           Internal Marks []] = Scanner. next Int ();
       cie Studerts [1) = new Intervale Coun, name, gen, Interval Hark
       Scanner nextline ();
```

```
CIE
-Internals.java

package CIE;
public class Internals extends Student {
    private int[] internalMarks = new int[5];
    public Internals(String usn, String name, int sem, int[] internalMarks) {
        super(usn, name, sem);
        this.internalMarks = internalMarks;
    }
    public void displayInternalMarks() {
        System.out.print("Internal Marks: ");
        for (int mark : internalMarks) {
            System.out.print(mark + " ");
        }
        System.out.println();
}
```

```
}
  public int[] getInternalMarks() {
     return internalMarks;
SEE
-Externals.java
package SEE;
import CIE.Student;
public class External extends Student {
private int[] externalMarks = new int[5];
  public External(String usn, String name, int sem, int[] externalMarks) {
     super(usn, name, sem);
     this.externalMarks = externalMarks;
  public void displayExternalMarks() {
     System.out.print("External Marks: ");
     for (int mark : externalMarks) {
       System.out.print(mark + " ");
     System.out.println();
  public int[] getExternalMarks() {
     return externalMarks;
Student.java
package CIE;
public class Student {
   protected String usn;
  protected String name;
  protected int sem;
  public Student(String usn, String name, int sem) {
     this.usn = usn;
     this.name = name;
     this.sem = sem;
  }
  public void displayStudentDetails() {
    System.out.println("USN: " + usn + ", Name: " + name + ", Semester: " + sem);
```

```
}
main.java
import CIE.Internals;
import SEE.External:
import java.util.Scanner;
public class Studentmarks {
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter number of students: ");
     int n = scanner.nextInt();
     scanner.nextLine();
     Internals[] cieStudents = new Internals[n];
     External[] seeStudents = new External[n];
     for (int i = 0; i < n; i++) {
       System.out.println("Enter details for CIE Student " + (i + 1) + ": ");
       System.out.print("USN: ");
       String usn = scanner.nextLine();
       System.out.print("Name: ");
       String name = scanner.nextLine();
       System.out.print("Semester: ");
       int sem = scanner.nextInt();
       int[] internalMarks = new int[5];
       System.out.println("Enter internal marks for 5 courses: ");
       for (int j = 0; j < 5; j++) {
          internalMarks[j] = scanner.nextInt();
       cieStudents[i] = new Internals(usn, name, sem, internalMarks);
       scanner.nextLine();
       System.out.println("Enter details for SEE Student " + (i + 1) + ": ");
       System.out.print("USN: ");
       usn = scanner.nextLine();
       System.out.print("Name: ");
       name = scanner.nextLine();
       System.out.print("Semester: ");
       sem = scanner.nextInt();
       int[] externalMarks = new int[5];
       System.out.println("Enter external marks for 5 courses: ");
       for (int j = 0; j < 5; j++) {
          externalMarks[i] = scanner.nextInt();
       seeStudents[i] = new External(usn, name, sem, externalMarks);
       scanner.nextLine();
     System.out.println("\nFinal Marks for all students:");
```

```
for (int i = 0; i < n; i++) {
  cieStudents[i].displayStudentDetails();
  cieStudents[i].displayInternalMarks();
  seeStudents[i].displayStudentDetails();
  seeStudents[i].displayExternalMarks();
  int[] internalMarks = cieStudents[i].getInternalMarks();
  int[] externalMarks = seeStudents[i].getExternalMarks();
  int[] finalMarks = new int[5];
  for (int j = 0; j < 5; j++) {
     finalMarks[j] = internalMarks[j] + externalMarks[j];
  System.out.print("Final Marks: ");
  for (int mark : finalMarks) {
    System.out.print(mark + " ");
  System.out.println("\n");
  System.out.print("Ashwini L 24BECS430");
scanner.close();
```

Output:

```
Enter number of students: 1
Enter details for CIE Student 1:
USN: 24BECS430
Name: ASHWINI L
Semester: 3
Enter internal marks for 5 courses:
30
34
32
36
35
Enter details for SEE Student 1:
USN: 80
Name: 85
Semester: 86
Enter external marks for 5 courses:
Exception in thread "main" java.util.NoSuchElementException
D:\week-06>java Studentmarks.java
Enter number of students: 1
Enter details for CIE Student 1:
USN: 24BECS430
Name: ASHWINI L
Semester: 3
Enter internal marks for 5 courses:
30
34
35
36
32
Enter details for SEE Student 1:
USN: 24BECS430
Name: ASHWINI L
Semester: 3
Enter external marks for 5 courses:
87
86
85
89
82
Final Marks for all students:
USN: 24BECS430, Name: ASHWINI L, Semester: 3
Internal Marks: 30 34 35 36 32
USN: 24BECS430, Name: ASHWINI L, Semester: 3
External Marks: 87 86 85 89 82
Final Marks: 117 120 120 125 114
Ashwini L 24BECS430
```

Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called "Father" and a 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.

Observation:

Week-OT NAP to demonstrate Handling of exceptions in inheritance string tree. Create a base class of called jatture and derived class called as son, which extends the base class. In father's class implement a constructor which take the age and throws the exception wrong Age () when the 1/p age is her than O. In son's class implement a constructor that uses jattivis & Son's age and thurons exception if father's age >= son's age. import java. util. Scanner; class WrongAge Exception extends Exception { public Drong Age Exception (Stuig meroge) { super comerage); class SonAge Exception extends. Exception (public SonAge Exception (String message) { Super Coneriaged ;] mare) miser public Father Cint age) throws wrong Age Exception & throw new Wrong Age Exception (" Wrong age");

```
class Son extends + ainer 1
                                                                       System. out. println ("would you like so re-enter distance
      private int sonage;
      private int songe; public Son C int juturilye, int songe) throws wrongly
                                                                        cyin)");
                                                                       String input , so next ();
                                                                      if Cinput coquals. Ignore (are ("n")) {
      Exception. SonAge Exception (
       super Gatter Age);
                                                                          breat;
            theren new Sounding Exception ("Son's age cannot be greater than or equal to fathers age");
       14 ( SmAge > = LatterAge) f
                                                                   3.
      This sonAge = songilge;
                                                                    Name: Ashwini. L
     public Int gettinge () {
                                                                    USN: 24BECS 430
         section sonAge;
                                                                    Enter fallion's age: 35
                                                                    Exter son's age: 20
                                                                    secopted succentully
                                                                    would you like to re-enter details (y/n)
   Public class Father Son &
      public static roid main (sung [] orgs) {
         while (true) [
                                                                    Enter father 1 age: 20
              Scarner SC = new Scarner (System in);
                                                                                         be greater than or Equal to Sathers
                                                                           Son's
                                                                    Enter
               System out print (" Enter Father's age: ");
                                                                    son's
               Int fatherage = Sc. next had ();
               System . out . print ("Exto Son's age: ");
               ind sonlige: sc. next lat ();
                     Son son = new Son C father lige, SomAge);
                     System out println ("Accepted Succentrally");
               catch CoonAgeErcuption e) {
                   Eyetro. out printle (e. get Manageco);
              coulch (Son Age Exception e) {
                  System. out. println(e.getnerage());
```

```
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");
      }
}</pre>
```

```
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){
       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 Successfully");
       catch (WrongAgeException e) {
         System.out.println(e.getMessage());
       catch (SonAgeException e) {
         System.out.println(e.getMessage());
         System.out.println("Ashwini L"+"24BECS430");
       System.out.println("Would you like to re-enter details (Y/n)");
       String input = sc.next();
       if (input.equalsIgnoreCase("n")) {
         break;
       }
   }
 }
```

Output:

```
Enter Father's Age: 35
Enter Son's Age: 20
Accepted Succesfully
Ashwini L24BECS430
Would you like to re-enter details (Y/n)

y
Enter Father's Age: 20
Enter Son's Age: 33
Son's age cannot be greater than or equal to father's age
Ashwini L24BECS430
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.

Observation:

```
27/11/24
                                                                     public class Hult-Threading Example {
Write a program which oceates two threads. on
thread diplaying "BMS college of Engineering" once
to seconds & another displaying 'CSE' and every
                                                                        public state void main (String[] orgs)
                                                                            Mullithreading thread (= new Multithreading ();
                                                                            Multitheoding thouad2 : new Multitheoding(C);
two seconds.
class Multithuading extends Thouad f
                                                                             threadle start ();
   public void main run () {
                                                                             thread 2. Start ();
                System. out. println("BMS College of
            while (true) {
                                                                     3.
                thread. sleep (10000);
                                                                   Output:
                                                                    BMS College of Engineering
        I catch (Interrupted Exception e) {
             System. out. priniln(e);
                                                                    CSE
                                                                   CSE
                                                                   CSE
                                                                   CSE
                                                                   CUSE
                                                                       College of Engineering.
                                                                   BMS
       Multithreading 2 extends thread {
                                                                   CSE
    public void onun () {
                                                                   CSE
                                                                   CSF
             while ( true) {
                                                                   CSE
                 System out printing "CSE");
                 Thread. Sleep (2000);
          I cotch (Interrupted Exception e) {
                 System. out. println(e);
```

```
class DisplayMessage1 extends Thread {
  public void run() {
    try {
      while (true) {
         System.out.println("BMS College of Engineering");
         Thread.sleep(10000);
      }
    } catch (InterruptedException e) {
```

```
System.out.println(e);
    }
  }
class DisplayMessage2 extends Thread {
  public void run() {
    try {
      while (true) {
         System.out.println("CSE");
         Thread.sleep(2000);
    } catch (InterruptedException e) {
      System.out.println(e);
  }
public class MultiThreadingExample {
  public static void main(String[] args) {
    DisplayMessage1 thread1 = new DisplayMessage1();
    DisplayMessage2 thread2 = new DisplayMessage2();
    thread1.start();
    thread2.start();
  }}
Output:
D:\>java MultiThreadingExample
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
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.

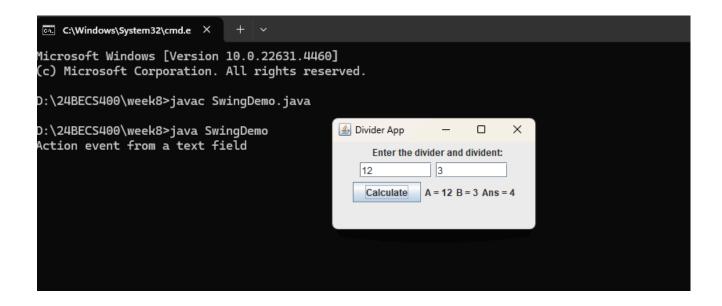
```
ajif. add Action Literer CD;
Neck-09
                                                                    bitt. addActronLiterer (1);
                                                                    button. add Action Luterer Crew Action Luterer Cof
import javax. swing. ";
                                                                       public void action Performed (Action Event evi) {
import java aut. ";
imposet java, aut. event. "
                                                                           int a = Integer. pasce Int (ajth. getText());
class Swing Derro &
    JErrane Jern: new JErrane (" Britis Divider App");
                                                                          int a = Integer . powelnt(bj+f. get Text (>);
                                                                           int ans=a/b:
    j. Srm. set Size (275, 150);
   jfrm. setlayout (new Flowlayout ());
                                                                          alab. Set Text ("(nA = "+a);
   Jfrm. Set Dejault Close Operation (Sframe. EXIT_ON_CLOSE);
                                                                          blab. settext ("In B= "+b);
  Itabel Jlab: new Itabel (" Enter the divider and divident;").
                                                                          anslab. DetText C'In Ane = " + ans);
  JTextfield giff = new JTextfield (8);
                                                                          I catch ( Number format Exception e) {
                                                                             alab. Set. Text (" ");
  ITextfield biff = new IText Field (8);
                                                                             blab. setText (" ');
                                                                             are lab . Set Text (" ');
  J Button button = new J Button ("Calculate");
                                                                             evr. Set Text ("Enter Only Integurs!");
  I Label vor = new I Label ();
                                                                          } catch (Arithmetic Exception e) {
 Itabel alab = new Itabel();
                                                                           alab. setText("");
 Slabel blab - new Slabel();
                                                                           blab. Set Text C" ");
                                                                           analab. get Text ("");
 Jeabel andab : new Jeabel ();
                                                                           evir. setText ("Bshould be NON goo!");
 J.frm. add (eve);
 Jfm. add (Jab);
 ifrm. add Cloff);
 jfrm. add (bjff)
                                                                        33;
                                                                       John, set Visible (bull);
 Jfrm. add (bullen);
Jfm. add (blab);
                                                                       public static roid main (Steing []args) {
Ifm. add (anelab);
                                                                          Swing UHlitter. Invoketates (new Runnable () {
ActionLuteror 1 = new Action Listener () {
  public void actionPoyomed (Action Event ev+) {
                                                                             public void nun () {
     System. out. println ("Action went from a text field");
                                                                            new Swing Domo ();
                                                                           3);
  1;
```

```
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 ajtf = new JTextField(8);
    JTextField bjtf = new JTextField(8);
    // calc button
    JButton button = new JButton("Calculate");
    // labels
    JLabel err = new JLabel();
    JLabel alab = new JLabel();
    JLabel blab = new JLabel();
    JLabel anslab = new JLabel();
```

```
// add in order :)
jfrm.add(err); // to display error bois
jfrm.add(jlab);
jfrm.add(ajtf);
jfrm.add(bjtf);
jfrm.add(button);
jfrm.add(alab);
ifrm.add(blab);
jfrm.add(anslab);
ActionListener l = new ActionListener() {
  public void actionPerformed(ActionEvent evt) {
     System.out.println("Action event from a text field");
  }
};
ajtf.addActionListener(l);
bitf.addActionListener(1);
button.addActionListener(new ActionListener() {
  public void actionPerformed(ActionEvent evt) {
     try {
       int a = Integer.parseInt(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();
     }
  });
```

Output:



Program 10

Demonstrate Inter process Communication and deadlock.

Observation:

```
class themaste furnable f
Week-108.
                                                                         QN:
                                                                         private state find Int MAXITEMS = 15;
Clau Q. {
                                                                         Producer (Qa) [
   boolean value set = falee;
   int n;
                                                                         thu. or = or;
                                                                          new three od (this, " Aro ducer ). start ();
  synchosonized int get () { while (! Value Set) {
        System. out, println("In Curtomer waiting");
                                                                         public void sun() {
     try (
                                                                           Prit 1 = 0;
                                                                           while CIX MAXITEMS) {
          System. out-pxinth (" Intruppted Exception aught in
        I catch ( Interrupted Exception e) {
                                                                            a. put (+++);
                                                             get () ").
          Thread current Thread (). Interupt ();
                                                                      class Concurrer implements Runable &
    System. out. pxxxx("Got: "+n);
ratust= falle;
                                                                       private static fral int MAXITEMS=15;
    System out printince in Introduce"; notify();
                                                                       Concumer(Q.N) {
                                                                       thu, or = a;
                                                                       hew thread (The , "Consumor"). Start ();
     return n;
                                                                       public void run () {
   Synchronized void ped (int n) {
    until ( Value Set ) {
                                                                         int 1=0;
         Suture. out. prish("h. Produce worting");
                                                                        while CIKMAK ITEMS) {
                                                                         Int n= or get ();
       tray {
                                                                          System, out. prostln("Conssumed;" tr);
          System. out. printle "Intoxupted Exception in put (1");
          wait ();
         Jostch (Intercupted Exception e) {
         Thread. (wount Thread(). Intercupt();
                                                                      class PCFIxed &
                                                                       public static void main (Strugglugs []) {
       =this.n=n;
                                                                       Q'oy = new QC);
       Value Set = True;
       System. out. println("Put: "+n);
                                                                      new Producer (4);
       System. out. printly "In Intimale Consumer");
                                                                      System, out. println" Pres Control - C to Stop
       notify ();
```

```
class Deadlock Implements surrothe f
 Heek-10
                                                                         A a = new AC);
                                                                        B b = new BCD;
 Proceed Communication
                                                                        · Thread. current Thread (). get Name ( " Main Bread");
  Proposet javase
                                                                           threadt = recothered ( The, " Racing Thread ");
 Deadlock: Code
                                                                            4. Stood ();
 Class A f
        String name & Thread. current Thread (). get Name ();
     Synchronized void geo(B b) {
                                                                            Synchronized (a) [
                                                                                a, - (00(b);
       System.out.prontin(normed "entered 1 - 700");
                                                                             System. out. printh ("Back in main thread");
       try {
         Thrusad. Slup (1000);
            System out produc A niverapter );
         jearch (exaption e) (
                                                                      public void run () f.
                                                                          synchronized (b) {
       Systems out, printin Chane + "trying to call B. last ()");
                                                                             b. box (a);
                                                                          System, out printle ("Back in other thread");
       b. last ();
                                                                         public static voted main (Steeling [] ange) f
      Syndronized void last () {
            System. out. println ("Inide A. lat");
                                                                            nu Deadlock ();
Class & {
     Syndronized void bor (4a) {
        Story have = thousand, concent Thousand (), get Name ();
        System. out. printle (name + "entered 8. bar");
      try
          twead. slup (1000);
          Jostan (exaption e) {
             System. out. printin("B interrupted");
         Egylum, out. println(rame + "trying to tall A. be+()");
          a last co;
          synthronized void lost () {
          "System. Out. printly ("Ireide B. lay");
```

Code:

-Process communication

```
class Q {
int n;
  boolean valueSet = false;
  synchronized int get() {
    while (!valueSet) {
       try {
         System.out.println("\nConsumer waiting");
          wait();
       } catch (InterruptedException e) {
         System.out.println("InterruptedException caught in get()");
         Thread.currentThread().interrupt();
       }
     System.out.println("Got: " + n);
    valueSet = false;
    System.out.println("\nIntimate Producer");
    notify();
    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();
       }
    this.n = n;
    valueSet = true;
    System.out.println("Put: " + n);
    System.out.println("\nIntimate Consumer");
    notify();
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) {
       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);
    System.out.println("Press Control-C to stop.");
```

```
- 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();
}
```

Output:

```
Press Control-C to stop.
Put: 0
Intimate Consumer
Producer waiting
Got: 0
Intimate Producer
Put: 1
Intimate Consumer
Producer waiting
Consumed: 0
Got: 1
Intimate Producer
Consumed: 1
Intimate Consumer
Producer waiting
Got: 2
Intimate Producer
Consumed: 2
Put: 3
Intimate Consumer
Producer waiting
Got: 3
Intimate Producer
Consumed: 3
Put: 4
Intimate Consumer
Producer waiting
Got: 4
Intimate Producer
Consumed: 4
Put: 5
```

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>java Deadlock RacingThread entered B.bar MainThread entered A.foo RacingThread trying to call A.last() MainThread trying to call B.last()