VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



LAB REPORT

on

OBJECT ORIENTED JAVA PROGRAMMING

Submitted by

SUJAN G E (1BM23CS347)

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)

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 SUJAN G E(1BM23CS347), who is bonafide student of B. M. S. College of Engineering. It is in partial fulfillment for the award of Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belgaum during the year 2024-25. The Lab report has been approved as it satisfies the academic requirements in respect of Object-Oriented Java Programming Lab - (23CS3PCOOJ) work prescribed for the said degree.

Dr. Nandhini Vineeth

Associate Professor, Department of CSE,

CSE

BMSCE, Bengaluru

Dr. Kavitha Sooda

Professor and Head,

Department of

BMSCE, Bengaluru

INDEX

Sl. No.	Date	Experiment Title	Page No.
1	26/09/2024	Quadratic Equation	4-7
2	03/10/2024	Student SGPA Calculator	8-13
3	19/10/2024	Book Details	14-18
4	24/10/2024	Abstract Shape	19-23
5	07/11/2024	Bank Simulation	24-34
6	14/11/2024	CIE/SEE Packages	35-43
7	21/11/2024	Father-Son Verification (Exceptions)	44-49
8	05/12/2024	Multi-Threading	50-53
9	12/12/2024	Custom Division Using Awt	54-59
10	19/12/2024	Inter-process Communication and Deadlock	60-68

PROGRAM 1:

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

```
@ Implement quadratte equo print all read solo of earn as
 ax + 6x + C = 0. Read a, bic, and un ouradrate formula
 import java. util. scanner:
  dan quadratic
    float d;
    Scanner Sc = new Scanner (sylamin),
   vold check ()
    System-out println ("Enter the values of a, b, and c");
    Enta = sc. next (nt();
    Prof b = sc.nextInt();
     Ent c = sconextint();
    91 (a = = 0)
     system.out.println("Envalid equation");
      else
        d= b x 6 - H x a x l;
        Sylmout Bentlo(d),
        System.out-Prendent "the solution are");
        (0<b) ) 35
         Systemoud . printing 1 roots are uneque ");
          double 71 = (-6 + Math. sqrt (d))/(2 ta),
          system out operation(1);
         36(970)
        syllen out print in ( roots one Emaginary ");
         double rs = malh saport(-d)/(2+a);
         double 72 = (6) (6+a);
         System out printles(22+"+1"+81+"+72+"-1"+31);
```

```
Public class main
    Public static void main(string[] urgs)
    a quadratic qui = new quadratic();
     quicheck();
   4
: וטקדטס
                                enter the value of a, b, c
 Enter the value of 0, b, and C
                                 1 2 3
  1 -3 2
                                -8.0
  the Solution are
                                the solution are
  roots are uneque
                                2.0 1.0
```

```
import java.util.Scanner;
class Quadratic {
float d;
   Scanner sc = new Scanner(System.in);
     void
solver()
        System.out.println("enter the values of a,b, and
c");
             int a = sc.nextInt();
                                           int b =
sc.nextInt();
                    int c = sc.nextInt();
        if (a == 0) {
            System.out.println("invalid equation");
else{
            d= b*b - 4*a*c;
            System.out.println(d);
            System.out.println("the solutions are");
if(d>0){
                System.out.println("roots are unique ");
double r1 = (-b+Math.sqrt(d))/(2*a);
                                                     double
r2 = (-b-Math.sqrt(d))/(2*a);
                System.out.println(r1 +" " + r2);
            if(d==0){
                System.out.println("roots are equal ");
double r = -b/(2*a);
                System.out.println(r);
if(d<0){
                System.out.println("There are no real roots" );
    }
public class QE {
    public static void main(String[] args) {
```

```
}
```

```
Microsoft Windows [Version 10.0.26100.2605]
(c) Microsoft Corporation. All rights reserved.

C:\java>javac QE.java

C:\java>java QE
enter the values of a,b, and c
3 4 7
-68.0
the solutions are
There are no real roots

C:\java>javac QE.java

C:\java>java QE
enter the values of a,b, and c
1 2 1
0.0
the solutions are
roots are equal
-1.0

C:\java>javac QE.java

C:\java>javac QE.java
```

PROGRAM 2:

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.

```
Develop a Jove mog- to credit a class student with member ( CAPA: usn, name, credit warray, gradupoint array, cal
  Emport davo utlle Swanner;
    class student
     2
      ProEvate storng usno
      Prevale shong name;
     Prograte stentij credits;
    Prevale double [] marks;
   Public 5 feedent (Ent num Subjects)
           credits = new ent [numsubjects];
             morks = new double[ numbubjects] ;
    Rublic word accept Details()
             Scanner Sc = new Scanner (syltar . En);
           System. Out. Doentif "Enter USN");
           usn = Sc. next (Ene ()°,
            Sytum roud - Printin ("enter name");
              name = sc. nextlenel);
          for (Ent ?= 0; & credits. length , 2++)
                Syptem out . Posent ("Enter credits for Subject" + (E+1) +15, ");
                  Credity [i] = SconentInt();
                  System. out. Point ("Entire gradepoints for subject"+ (PH) + " (PH
                 marks[i] = Sc. neotDouble ();
    4
```

```
Public vold desplay Details ()
   System. Oct . Prentln ("USM" +USN);
   System. Out . prontly ("Name"+name";
    for lent ?-0; ?ccredets. length , ?++).
       Scylim . Ocal - Print In ("subject + + (F+1) + "-credits:"+ Credit Ti)+
         ", grade points;" + morki[i]);
    Public double calculatisapa()
       double total points=0;
        int. total credb 1=0;
       for (Ent &= 0., &1 credits. length, E++)
          totalPoints += (monles[:) x (sedsk[i]);
          -totalcredits = credits [i];
     seturn total Points / total (seclos),
  4
                           TO COUNTY H. GOOD Plant
Public Static Mainsgra.
 2 public , talic void main (strings [ ] args)
     d Scanner Sc = new Scanner (Syntimen);
       Scrietar out. Prosito l'Autor the no. of subjects");
       Ent num Subjects = Sc. next Int();
       Sutent Suldet = new Steedert (num Subjects);
       5 wholet. accept Delce b();
```

```
Septem. oul Proble (" tuded Defects");
     Steedent. display Detechs ();
    double sgpa = steeded . Cladudato sqpa();
    System coul Posinoln ("SUPP" + 14PP);
    sc. dosels;
ידטקדטס י
  Enter number of subjects 2
  tales
        USh = 20
  Cuti
        name : ABC
  enter credit for subjet 1:20
       Gradeponts for subjet 1:9
  Gutr
      Credit for subject 2:4
 Cutes
  Enter Grad points for subject 2: 7
 Stutdent dutails.
 USN: 20
 Name : ABC
Subject 1 - Credil : 2, good portig
Subjet 2 - credits: 4, grade Pout : 7
 SGPA = 7-66.
```

```
import
java.util.Scanner; class
Student {
            String
usn;
        String name;
int numSubjects;
int[] credits;
                  int[]
marks; double sgpa;
    public 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 the number of
                                                                   ");
                                                       subjects:
numSubjects = sc.nextInt();
         credits = new
int[numSubjects];
                    marks = new
int[numSubjects];
        for (int i = 0; i < numSubjects; i++) {</pre>
            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();
    public void displayDetails() {
        System.out.println("\nStudent Details:");
        System.out.println("USN: " + usn);
        System.out.println("Name: " + name);
        System.out.println("Subjects and Marks:");
        for (int i = 0; i < numSubjects; i++)</pre>
```

```
System.out.println("Subject " + (i + 1) + ": Marks = " + marks[i]
+ ", Credits = " + credits[i]);
          public void
calculateSGPA() {
                         int
totalCredits = 0;
totalGradePoints = 0;
        for (int i = 0; i < numSubjects; i++) {</pre>
int grade = calculateGrade(marks[i]);
totalGradePoints += grade * credits[i];
totalCredits += credits[i];
         sgpa = (double) totalGradePoints /
totalCredits;
       private int calculateGrade(int
               if (marks >= 90) {
marks) {
return 10;
       } else if (marks >= 80) {
return 9;
       } else if (marks >= 70) {
return 8;
       } else if (marks >= 60) {
return 7;
       } else if (marks >= 50) {
return 6;
       } else if (marks >= 40)
             return 5;
} else {
                     return 0;
   public void displaySGPA() {
        System.out.printf("SGPA:" + sgpa);
    public static void main(String[] args) {
Student student = new Student();
student.acceptDetails();
student.displayDetails();
        student.calculateSGPA();
student.displaySGPA();
```

```
Microsoft Windows [Version 10.0.26100.2605]
(c) Microsoft Corporation. All rights reserved.

C:\java>javac Student.java

C:\java>java Student
Enter USN: 1bm23cs347

Enter Name: sujan
Enter the number of subjects: 3
Enter credits for subject 1: 4
Enter marks for subject 1: 80
Enter credits for subject 2: 3
Enter marks for subject 2: 68
Enter credits for subject 3: 3
Enter marks for subject 3: 78

Student Details:
USN: 1bm23cs347

Name: sujan
Subjects and Marks:
Subject 1: Marks = 80, Credits = 4
Subject 2: Marks = 68, Credits = 3
Subject 3: Marks = 78, Credits = 3
Subject 3: Marks = 78, Credits = 3
SGPA: 8.1
C:\java>
```

PROGRAM 3:

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

```
create a claus which contains member name author, Price numpuye,
1 Enclutede a constructor, a seller à a getter Enclude a strêng
 method w.A. w. P to creale n book objects
us
  class Book
   Prévate Stornginame;
   Prevate streng author,
   Prévale String price;
   Prévate ent num pages;
  Public Book (string name, string author, double price, int num Pages)
    this name = name ?
    this. price = price;
    thes. numbages = numpages;
 Public void selter string name, string author, double price,
      Put num Pages)
      this name = name;
      thes. rounthor = author;
      thes. price = price;
      this numpages = numpages;
   Public String getter()
      return to string ();
   Public String to String()
    return " Book Name: " + name + " ; Author": + author + ", Price
        ers" + Price + ", Pages " + hum Pager",
   4
 3
```

```
Public class Bookmain
 Public States void muen (strong [] args)
   Scanners Sx = new Scanner (Syptem. in);
   System - out . Prentl A (" Enter no. of books");
         h = Sx onext Int ();
   Ent
  Book[] book; = new 1300k[n];
 for ( Put 9=0; 92n; 9++)
 System. Out. Prentln 1" Enter delasts of book" + (E+1));
 System out . Prentla l' Enter name, author, price, no of pages");
          String name = sx.nextline();
          Strong author = sx. nextline();
          double - price = sx-nextDouble(),
           Put numpages = sx. nextInt();
   books [i] = new Book [name, author, price, numpages);
  System. out. posintin (books[i] getteren);
    Sx. close ();
```

OUTPUT : - BOOK : Enter the number of books: 2 Enter name of books: ABC Enter author of book 1: x42 Enter price of books: 99 Enter number of Pages in book 1 = 150 Enter the name of books: abc Enter author of book 2: xyz Enter proce of 60062: 199 Enter number of page in book 2 = 200 Book Deteils: Book name : ABC Author name: XYZ Price : 99 Number of page : 950 Book name ; abc Aathor name: xy3 Pronce: 199 number of pages: 200

```
import java.util.Scanner;
class Book {
int price;
String author;
String name;
int pages;
     public Book(int price, String author, String name, int pages)
          this.price = price;
                                       this.author = author;
this.name = name;
                          this.pages = pages;
    public void setter() {
        System.out.println("enter the price, author, name and pages of the
book");
this.price=sc.nextInt();
this.pages=sc.nextInt();
this.pages=sc.nextInt();
book");
                Scanner sc = new Scanner(System.in);
                                   this.author= sc.next();
    public void getter() {
        System.out.println("Book Details:");
        System.out.println("Price:"+price);
        System.out.println("Author:"+author);
        System.out.println("Name:"+name);
        System.out.println("Pages: "+pages);
    public String toString() {
                return "these are book details";
public class Pro {
    public static void main(String[] args) {
Scanner s1 = new Scanner(System.in);
        System.out.println("enter the number of books");
int n = s1.nextInt();
       Book []b1 = new Book[n];
                 for(int i=0;i<n;i++){</pre>
                                                     b1[i] =
new Book(200, "sachin", "The Pride", 111);
```

```
b1[i].getter();
b1[i].getter();
System.out.println(b1[i]);

}
}
}
```

```
enter the number of books
Book Details:
Price:200
Author:sachin
Name:The Pride
Pages:111
enter the price,author,name and pages of the book
150
virat
TheCentury
120
Book Details:
Price:150
Author:virat
Name:TheCentury
Pages:120
these are book details
```

PROGRAM 4:

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

```
1 Develop a program for an abstract class shape howeng two
 vargable and an empty method prentareas. proved three
 claim name trangle roce, circle which extends shape,
  print Aseaco
    da import java. util. Scanner
    abstract class Shape
    d Put dim 1;
      Ent dem 2º
      Public Shape ()
        this dims = 0;
        thes- dem = = 0;
      Public Shape (Ent dems, Ent dems)
        ters. dem 1 = dem 1;
        this. dim2 = dem2;
     Public abstract vold prentAreal);
   4
class Rectangle extends Shape
  ( Public Redangle ( int length, Int wholth)
      dema = length ",
      dem 2 = weath;
  Public Vold PrintAreal)
     Ent area = dems + dem 2°
     System. out Prentin ("Area of Reclarage: "+ area);
3
```

```
Class Preangle extends Shape.
     Public Treangle (Ent base, Ent helight)
          dem 1 = bare;
         dem = helafit;
     Public vold PrintAreal)
      double area = 0.5 × dems × dems;
      System. Out . Possella ( "Area of sle: " + area);
 4
Class DECCle extends shape
   J
   Public Circle (Ent radius)
       dem1 = radius.
       dem 2 = 0;
   Public vold Point Asea()
      double area = Math.PI * dems *dims;
 3
  Public clan Shapes
  d
   Public static void main (Shengy [] args)
       Scanner in = new Scanner (Scrittm. in);
      System. out. prentle ("Enter length & wedth for Rectangle");
      Ent length = En. next Int ();
       ent wedth = en. nextInt();
       Shape rectangle . Prohthreas ();
```

```
Septem out . Prenth ( texter bow & height for Treangle");
     ent bare = Enonext Int();
      Put holight - Pro next Int();
      Shape to langle = new Preangle (bow, herght);
      treangle - Prent Area'l's,
     System. Out. Prentln ("Enter rodlus of Cercle");
      Ent radius = EnonextInt();
      Shape cercle = new Cercle (radius);
      cercle . Print Arear ();
       in oclose ();
  4
OUTPUT:
 · onter length & width for Rectangle:
     20 30
    Area of Redangle: 600
    that bou & height for Manthe:
    20 HO
    Area of Triangle: 400
    Enter radius por cercle:
   40
   Area of cerde : 5026.5482.
```

```
abstract class Shape {
int dim1; int
dim2;
       abstract void
printArea();
} class Rectangle extends Shape {
public Rectangle(int length, int width) {
this.dim1 = length;
                     this.dim2 =
width;
        void
printArea() {
       int area = dim1 * dim2;
       System.out.println("Area of Rectangle: " + area);
} class Triangle extends Shape {
public Triangle(int base, int height) {
this.dim1 = base; this.dim2 =
height;
          void
printArea() {
       double area = 0.5 * dim1 * dim2;
       System.out.println("Area of Triangle: " + area);
class Circle extends Shape {
public Circle(int radius) {
this.dim1 = radius;
this.dim2 = 0;
        void
printArea() {
       double area = Math.PI * dim1 * dim1;
       System.out.println("Area of Circle: " + area);
```

```
}
} public class
Main {
   public static void main(String[] args) {
   Shape rectangle = new Rectangle(8,9);
        Shape triangle = new Triangle(8, 6);
        Shape circle = new Circle(14);

rectangle.printArea();
triangle.printArea();
circle.printArea();
}
```

```
Area of Rectangle: 72
Area of Triangle: 24.0
Area of Circle: 615.7521601035994
PS C:\Users\satis\OneDrive\Documents\ooj_lab>
```

PROGRAM 5:

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

- a) Accept deposit from customer and update the balance.
- b) Display the balance.
- c) Compute and deposit interest
- d) Permit withdrawal and update the balance

Check for the minimum balance, impose penalty if necessary and update the balance.

```
5. Develop a Fava program to create a clair bank that maintains
  two hands of account for ets customers, one of them called
  sawings account and the others current account. The saverny account
  provides compound interest and with doount facilities but no
  cheque book facellity, The current account proveder cheque
  book facility but no interest current account holder should
   also matrials a intremum balance and of the balance falls below
   this level, a service charge is imposed.
  Create a clair Account that stores culomer name, account
   number and type of account. From this derive the
  clauses cur-acct and saw-acct to make them more specific
  to their requirements. Include the necessary method in order
  to achive the following tasks.
  @ Accept dyposite from customer and uptilate the balance.
 6 D& play the balance
 @ Compute and deposite interest
 @ Permit withdrawal and update the balance
 checke for the menemen balance, 9 mpose penalty if necessary and
 update the balance.
ms Emport Lava-util. Scanner;
    class Account &
      strong curtname;
       ent acc-no;
       strong accetype,
    Public Account (sweng custome, ent account no, string type
       Cust-name = cus.name;
       acc-no = account-no;
       acl-type = type-acl;
       balance = 0.0;
```

```
Public void deposit (double amount)
       ? ( ( amount >0)
             balance = balance + account;
            System out point in ("A round dyos ted:" + amount);
            System . out printle (" up dated balance: " + balance);
       eluatre
          System . Out. pointln (visoraled ")",
   Public void displaybalance ()
       Syntem. Out. pointle ("Balance"+ balance);
 4
Class Savacet extend Account
  Prevate double EnterestRate;
  Public SavAccount (String Contemes Name
       Super (custoname, ace-no);
       this of interestrate = Enterestrate;
   3
  Public void DepositIntret()
   d double Entired = balance + (Enteret Fale /100);
      balance = balane + Entered;
      Scotem. out pointly (" Interest added: " + Enterest);
     Systemo out . printin ("up dated balance", " + balance);
```

```
withdraw ( double amount
       (amount == balance)
          balance = balance - amount;
           System - out - println ("Amount withdraw": " + amount);
           System - och - pointlin ("updeeled balance" + balance);
      3 che
          System. out-pointful "Insufficient balance");
     8
clous aurrent
class curact extends accounted
 double menemum balance;
 double service charge;
 Public Curact (string contrame, ent acoro, double menimentalance,
         double Servicecharce)
   L super (cutoriesme, accho)
      this. Service change;
  3
 Public vold with draw (double amount)
   if (ambunt c = balance)
       balance e-amount?
       System out point (" Amount withdown" + amount);
       Tot balance a menemembalance)
          imposepenally();
       System.out. println ("updated balance" + balance);
          system. och. Trointih (" In sufficient balance");
    24
```

```
Prevale vaid emposeDenally()
         balance = balance - service charge;
         System. Old - println( Balance is mener , service charge imposed + services
     3
Public claus Bank
    Public stedic void main (string Dasgn)
      Scanner Scanner = new Scanner (Systemo ?n),
      System. ocd . println ("choose account type: in 1. Saveng accin
                                                    2. current all ");
      Put choice = Scanner-newtint();
      Scanner next (enec);
      5 yetem · out · printin (" tolar customor name");
      string name = Scanner . next line();
      System . out . println (" the account numbers");
      Ent ace-noun = Scanner-next Ent ();
      Ef (chorce = =1)
         System-out- Proten ("this Entret rale for sowing acc");
         double Enterent Part = Scanner. next Double ();
         Sou Acet Savoccout-reco sau Ace (name, acenum, interestrecte);
         system and Printly (" cuts amount to deposite");
         double deposite = 9 comes rest couble ();
          San Account. Exposets ( deposets);
          Say Acces Compute and Deposite Introst ();
         System out opsintin ( o entr amount to withdraws ");
          double with document = scanner. next Double ();
         Sav Acc. with tocus (with to an Account);
       4
```

```
ette of (chorce == 2)
         System. och printin " till reinen balane for corrad ace ",
( ange);
          double men balance = scanner next double ();
          Syntin · out · println (" Entr service Charge ")",
           double servicecharg = scanner, nextdouble();
                   Cur Account = new curacul (mame, accnown, mornbalance,
                                   servicethorge);
         System . Och println " fits amount to ceithdraw 1);
         double withdrawamound = scanner-next double ()",
         Cur Acco withdraw (withdraw horound);
          elre
           System · Octops notin (" Ir valid ");
         Scanniero clareco;
    4
    OUTPUT
         choose account type:
          1. Savengs Account
          2. current account
                                             culqueshames
                                       enter
          Enter curtomer name:
                                        abc
                                        ontrace-no;
            ABC
                  acc-no %
           enter
            Enter Enterest rate for savings account:
                                         outer men balance for current acc
                                           1000
                                          outr service charge for falling
            Enter amount to deposite :
                                                   below non balant;
            1000
            Amount doposited: 1000
                                          onto amond to deposite.
                                           200
            opdated balance: 1000
            Interest added : 60
                                            500
             update balance: 1060
                                           Amoud deposite: 500:0
                                           spartes balance 500.0
            Amount wit
             Enter amount to with draw ;
                                          Enter amound to withdraw : 100
                                           Balance fise bitelow nin : 200
             500
            Amount withdraw : 500.0
                                           opdatel balance : 200
            opdated balance : 560.
```

```
import java.util.Scanner;
class Account {
    String customerName;
int accountNumber;
String accountType;
double balance;
     public Account(String customerName, int accountNumber, String accountType)
         this.customerName = customerName;
                                                   this.accountNumber =
accountNumber;
                      this.accountType = accountType;
                                                              this.balance =
0.0;
          public void deposit(double
amount) {
                if (amount > 0) {
balance += amount;
            System.out.println("Amount deposited: " + amount);
System.out.println("Updated balance: " + balance);
       } else {
            System.out.println("Invalid deposit amount!");
    public void displayBalance() {
        System.out.println("Balance: " + balance);
} class SavAcct extends
Account { private double
interestRate;
     public SavAcct(String customerName, int accountNumber, double interestRate)
          super(customerName, accountNumber, "Savings");
this.interestRate = interestRate;
          public void computeAndDepositInterest() {
double interest = balance * (interestRate / 100);
balance += interest;
```

```
System.out.println("Interest added: " + interest);
System.out.println("Updated balance: " + balance);
          public void withdraw(double
                 if (amount <= balance)</pre>
amount) {
             balance -= amount;
           System.out.println("Amount withdrawn: " + amount);
System.out.println("Updated balance: " + balance);
       } else {
           System.out.println("Insufficient balance!");
} class CurAcct extends
Account {
          double
minimumBalance;
                  double
serviceCharge;
    public CurAcct(String customerName, int accountNumber, double
accountNumber, "Current");
                            this.minimumBalance = minimumBalance;
this.serviceCharge = serviceCharge;
          public void withdraw(double
amount) {
                if (amount <= balance)</pre>
             balance -= amount;
           System.out.println("Amount withdrawn: " +
amount);
                   if (balance < minimumBalance) {</pre>
imposePenalty();
           System.out.println("Updated balance: " + balance);
} else {
           System.out.println("Insufficient balance!");
          private void
imposePenalty() {
                        balance
-= serviceCharge;
       System.out.println("Balance fell below minimum. Service charge imposed: "
+ serviceCharge);
```

```
public class Bank
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Choose account type:\n1. Savings Account\n2.
Current Account");
                         int choice = scanner.nextInt();
scanner.nextLine();
        System.out.println("Enter customer name: ");
        String name = scanner.nextLine();
        System.out.println("Enter account number: ");
int accNum = scanner.nextInt();
        if (choice == 1) {
            System.out.println("Enter interest rate for savings account: ");
double interestRate = scanner.nextDouble();
            SavAcct savAccount = new SavAcct(name, accNum, interestRate);
            System.out.println("Enter amount to deposit: ");
double deposit = scanner.nextDouble();
savAccount.deposit(deposit);
            savAccount.computeAndDepositInterest();
            System.out.println("Enter amount to withdraw: ");
double withdrawAmount = scanner.nextDouble();
savAccount.withdraw(withdrawAmount);
        } else if (choice == 2) {
            System.out.println("Enter minimum balance for current account: ");
double minBalance = scanner.nextDouble();
            System.out.println("Enter service charge for falling below minimum
balance: ");
            double serviceCharge = scanner.nextDouble();
            CurAcct curAccount = new CurAcct(name, accNum, minBalance,
serviceCharge);
            System.out.println("Enter amount to deposit: ");
double deposit = scanner.nextDouble();
curAccount.deposit(deposit);
            System.out.println("Enter amount to withdraw: ");
double withdrawAmount = scanner.nextDouble();
curAccount.withdraw(withdrawAmount);
```

```
} else {
          System.out.println("Invalid account type selected.");
}
scanner.close();
    }
}
```

Output:

```
Choose account type:
1. Savings Account
2. Current Account
Enter customer name:
sagar
Enter account number:
1234
Enter interest rate for savings account:
Enter amount to deposit:
5000
Amount deposited: 5000.0
Updated balance: 5000.0
Interest added: 150.0
Updated balance: 5150.0
Enter amount to withdraw:
4800
Amount withdrawn: 4800.0
Updated balance: 350.0
```

```
Choose account type:
1. Savings Account
2. Current Account
Enter customer name:
chetan
Enter account number:
9876
Enter minimum balance for current account:
1000
Enter service charge for falling below minimum balance:
Enter amount to deposit:
6000
Amount deposited: 6000.0
Updated balance: 6000.0
Enter amount to withdraw:
5200
Amount withdrawn: 5200.0
Balance fell below minimum. Service charge imposed: 150.0
Updated balance: 650.0
```

PROGRAM 6:

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 cle having two claves - student & Interno
the clau Personal has member (like USA, name, sem, the clau
                                        two classes - Steedent & Tenternals
 Intermed has an array that stones the Potermal marks coved in five
 courses of the current semester of the student. Create another package
This dan has an army that stores the SEE mortes scored in five
Courses of the current exemples of the student. Import the teop packages on a file that declares the final marks of a students
  en all five courses.
us class student
     Public Ent osn;
Public string name;
Public Ent Sem;
        ented imorts = newent[5];
       Public student [ Ent osn , strong name, Ent sem)
        d this ousn = usn;
           this, name = name",
            Has. Sem = Sem;
          4
       Public vold shows
         System. out positin (" usn: "+ usn + 11+ " Name "+ name +"
     package cie;
     class enternal extends student
       Public enternal (ent ush istring rame, int sem, intilimark)
          super (usn, name, same);
          this . Emark = Pmark; L
       3
```

```
Package SEE;
emport crestaded;
Public class external extends Student
 Public Ent Smark[] = new entis];
  Public external (Phl Usn, String name, Phl Sem, Phl [] Smork)
     super (cun, name, sem);
      thus , smark = 5 mark;
    3
  Emport cle Proternals,
   Emport see Externals:
   Emport java. ulil. Scanners;
Public clantest
* public static vold moun(string **[])
  Scanner Sx = new Scanner (System. En)
  ENTED cmark = neco Ent[5];
  Put error & = new fut [5];
  System. out printle (unto number of students");
  Ent n = Scone xt Int();
  for ( Pot K=0 , KCn; K++)
  & system o out o possition ("Enter uso, name, sem");
    Ent usn = sc. next Int();
    Strong name = sxc next(hel);
    · Put sem = sx. next Int();
   System out opolith ("this 5 Subjects mark in Entral")
    for (Pul ? = 0°, 805°, 9+1)
       (mark[i] = restInt();
    sixtem.outopointln (" ender see mores of s subject");
      for (int 8=09, 9 45', 9++)
          emark[i] = nest cut();
```

```
Package SEE;
emport crestaded;
Public class external extends Student
 Public Ent Smark[] = new Ent[5];
  Public external (Pol usn, String name, Pol Sem, Pol [] Smork)
     super (cun, name, sem);
      thus , smark = 5 mark;
    3
  Emport cle Proternals,
   Emport see Externals:
   Emport java. ulil. Scanners;
Public clantet
* public static vold moun(string **[])
  Scanner Sx = new Scanner (System. En)
  ENTED cmark = neco ent[5];
  Put error & = new 9nt [5];
  System. out printle (unto number of students");
  Ent n = Scone xt Int();
  for ( Pot K=0 , KCn; K++)
  & system o out o possition ("Enter uso, name, sem");
    Ent usn = sc. next Int();
    Strong name = sxc next(he();
    · Put sem = sx. next Int();
   System out opolith ("this 5 Subjects mark in Entral")
    for (Pul ? = 0°, 805°, 9+1)
       (mark[i] = restInt();
    sixtem.outopointln (" ender see mores of s subject");
      for (int 8=09, 9 45', 9++)
          emark[i] = nest cut();
```

```
Enternal (1 = new Enternal (osn, name, Sem, cmersk);
    external e1 = new external (usn, name, Sem & mosk);
  System out. prouter (" Details); enhous
   for [ Pot 9=0; 900 5; 9++)
      System ocaloporiulh ("Total narks of steedlet");
        el-show();
     System. out-printh("i1. "most [i] + e1. smork(2);
  333
OUTPUT
        no of students
   enter
  entor usn, name, sem
   23
   Robert
  enter 5 Subject marks 9n9ntunals
   38
   37
30
    3图
    39
        See morks of 5 subjects.
  enter
   78
89
   96
   98
 Details
             name: Robert sem: 3
  USN : 23
                en subject
 Total marks
  77
  78
   83
   63
```

```
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 < 0
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[j] = 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");
        scanner.close();
```

```
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[]
externalMarks;
```

Output:

```
Enter number of students: 2
Enter details for CIE Student 1:
USN: 1
Name: sagar
Semester: 2
Enter internal marks for 5 courses:
38 40 41 45 46
Enter details for SEE Student 1:
USN: 1
Name: sagar
Semester: 2
Enter external marks for 5 courses:
39 42 45 50 48
Enter details for CIE Student 2:
USN: 2
Name: chetan
Semester: 3
Enter internal marks for 5 courses:
40 44 46 47 50
Enter details for SEE Student 2:
USN: 2
Name: chetan
Semester: 3
Enter external marks for 5 courses:
40 44 46 47 50
Final Marks for all students:
USN: 1, Name: sagar, Semester: 2
Internal Marks: 38 40 41 45 46
USN: 1, Name: sagar, Semester: 2
External Marks: 39 42 45 50 48
Final Marks: 77 82 86 95 94
USN: 2, Name: chetan, Semester: 3
Internal Marks: 40 44 46 47 50
USN: 2, Name: chetan, Semester: 3
External Marks: 40 44 46 47 50
Final Marks: 80 88 92 94 100
```

PROGRAM 7:

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

```
1. with a program that demostrates handling of exceptions in
   Enherstance tree create about claim in Father clair, Empliment
   a constructor which take the age and throws the exception
   wrong age () when the Enput age co . In son clan Empliment a
   Constructor that uses both father and son's age and throws
  an exception if son's ace is >= fatheris age.
ms Enport Lawo. cetil. scanners,
    class wrong age Exception extends Exception
     Public Wrong Agrenception (9 hong message)
         Super (merrage);
    clas sonAge Exception extends exception
       Public SonAge Exception (string menage)
       & supper (menage),
   Clas Fathers
     d prevate ent age;
        Public Fathers Ent age) throws wrong Age Exception
        dal (ageco)
            d throw new wrong Age Roception ("wrong age");
           this cage = age;
        Public Ent get Age ()
            d return age;
  claus son extends Fothers
     Public son (Ent feetlang, Ent son Age) throw wrong Age exception,
    a poercete ent son Age;
                 son Age troception
        Super ( Godler Age);
        El (son Age > = footherAge)
           & throw new son Agreeception (" son's agre cornot be greater than
                or equal to father's ege");
              4 this . Son Age = Son Age;
```

```
Public Pul ox150nAge (
           return Son Age .
Public class Father son
      Public Static void main (shing [] ongs)
        d while ( true)
           Scanner Sc = new Scanner (System . 9n);
           Systemoulopselle ("Enter Father's age " ")
           End Fremostage = Sc. next Ind ();
          System. ocal - privato ("Enter son's Age: ");
          But sonage = sconed Inti);
         trys
              Son son = new Son (father Age, son Age);
              System - och - posintln ( * Accepted scaces fully ");
           couch (wording Agr Exception e)
               System.och opsentin(c.getmenage());
          coulch ( wrong SonAge Exception e)
              d System outoposintho (e. getorenage(1);
          colch (son Age
         System . Oul . printh ["cooyed you leke to re-enter detaile (4 (N)"
        Strong Enput = sc. nextor;
         Ef (Enput. equalt grovecum (vn m) 9}
            break?
```

```
CUTPUT :
 Enter Father : Age: 40
 Char Son's Age: 12
 Accepted succeptuly
 would you leke to re-enter detally (YIN)
  Y
 Enter Father Age: - 8
 Contin Son's Age: 40
 wrong age
  would you ceke to se-enter details (YIN)
   4
  Enter Feether Age : 5
  entr Son's Age : 14
  Son's age connot be greater than or equal to father's age
  N 2111/24 re-enter delasts (4/W)
```

```
import java.util.Scanner;
class WrongAgeException extends Exception {
public WrongAgeException(String message) {
super(message);
 class SonAgeException extends Exception
   public SonAgeException(String
class Father {     int age;     public
Father(int age) throws WrongAgeException {
if (age <= 0) {
               throw new
WrongAgeException("Wrong age");
this.age = age;
   } public int
getAge() {
return age;
} class Son extends
Father {      int sonAge;
   public Son(int fatherAge, int sonAge) throws
if (sonAge >= fatherAge) {
         throw new SonAgeException("Son's age cannot be greater than or equal
to father's age");
if(sonAge <= 0){</pre>
      throw new WrongAgeException("Wrong age");
this.sonAge = sonAge;
      public int
getSonAge() {
return sonAge;
```

Output:

```
Enter Son's Age: 26
Accepted Succesfully
PS C:\Users\satis\OneDrive\Documents\ooj_lab> javac FatherSon.
PS C:\Users\satis\OneDrive\Documents\ooj_lab> java FatherSon
Enter Father's Age: 30
Enter Son's Age: 32
Son's age cannot be greater than or equal to father's age
```

Enter Father's Age: 30 Enter Son's Age: 0

Wrong age

PROGRAM 8:

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

```
wifte a program which creates two threads. deplay "Bons college
 at engineering " once every ten seconds and anothers displaying
 "ESE" every two seconds.
us class threads 1
     Public states vaid main (strong aroys[])
        Thereach threachorns: new threadlinew ofsplay oms ());
        Threads threads sc = new thread (new poplary CSE(1);
        thread Bms. stadles;
        thread (se ostart();
   8
   class orgalay BMS Pmpliments Runnable 1
      public vold punc) {
        try &
          3 3 Syntam. out-pointln("Ams college of engg");
         ealth (Interrupted exception e) s
              System - o at - pointln ("Interrupted" + e. git message );
   class DEsplayere Emplaments Runnables
       public void man() {
          to uy d
                while (free) of
                    System-out-pointln ("CSE");
                    thread . slep (2000);
         catch (Interrupted Exception e) (
             System - out. mint(n("Intrerrupted" + e.get munuy (1);
       4
```

```
OUTPUT!
    BMS college of engg
    CSC
CSC
CSC
CSC
CSC
     BMS college of Engg
     CSE
     CSE
      CSE
      AC.
      C: Tusers IBMSCELDESKtopl Homead>
```

```
class ThreadDemo extends Thread{
public void run(){     while(true){
   System.out.println("BMS College Of Engineering");
try{
    Thread.sleep(10000);
catch(InterruptedException e){
    e.printStackTrace();
} class CSEThread extends
Thread{     public void run(){
while(true){
   System.out.println("CSE");
try{
    Thread.sleep(2000);
catch(InterruptedException e){
    e.printStackTrace();
} public class
Demo{
   public static void main(String[] args){
    ThreadDemo t1 = new
ThreadDemo(); CSEThread t2 = new
CSEThread(); t1.start();
t2.start();
```

Output:

DMC C		0.6		
CSE CSE CSE	College	0 f	Engineering	
CSE CSE BMS C CSE CSE CSE	College	Of	Engineering	
CSE CSE BMS C CSE CSE	College	Of	Engineering	
CSE CSE	College	Of	Engineering	
CSE CSE BMS C CSE CSE	College	Of	Engineering	
CSE CSE BMS C CSE CSE	College	Of	Engineering	
CSE CSE CSE				

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

Observation:

```
9. Write a program that creates a ans Enterface to perform
Entiger de vision, the user enters two no. Ent the text fields,
 Num i and Nama is displayed in the Result field when
 the divide button is clicked. if nun 1 or nun 2 as ness not
 an Ehliger, the the program would throw an Arithmete tocape,
 Display the exception in a mesage dialog box.
us Empost gava aut. *;
    Emport s'ava. auts event. *;
    public class Divienments 1 extends France Emplements Actions
     d TextField
      nums, mum 2;
      Button dresult;
      habel outResult, strong out = " "
      double result Noun;
      ent flag =0;
      Public Devisionmain 10)
      Settagout (new-low Layout());
     dresult = new Bullon ("RESULT");
     Label numbers = newhabel("Number I:", habel, RTGHT);
     Lab el numbers = new habel ("Num bers: " habel. RTG, HT);
     nam1=new Textfeld(s);
     neun 2 - neco Textfield (5)
     outpenult = new Label (kerult, Loubel Right);
     addlnumbers); addlnum2); addlnumbers2); addlnum(2);
     add (deenell); add (aut percell);
```

```
num 1. add Actions stener (this); num 2. add Action los thes (new
  windownAdapter()
  public void windowclusing (window event we).
  d System SQD8HOD;
  多);
  public void actionper formed ( network we)
    System. exit(0);
  83;
 public void action Conformed (Acit of vent eve)
   int na, na; try
       1 is(ae. gd source() == dpesalt)
          m= Enfegs, perseinl (hums. gatTed());
          no: Tutogs, parse tot (news. got (ext.));
         if (0000)
         Throw new Andrew (Ctoppeption
         resultarum=noln2; out +=s trong. value of (sent mus);
         repaint();
       cotch (Numberformal Exception e1)
       2 flag =1;
          out = "Number Format traception;" + e2;
           ore pound ();
      Catch (Assthuretic exception e2)
         "out = " Divide by o exception !" + ez;
      d flag = 1;
         repaint();
        2
     2
```

```
Public vold paint (opaphi cs g)
   of (floy ==0)
   of (flog ==0)
g. chrow & Wing out Rent, getx () + out PP ult getco; ather, outperg
    gett) + Outpend.
      gel fleaghter -8);
     elle g- chawstry (ord, 2000, 200);
      blag = o,
   Public state aid main (strange ] asys)
     Division moding don= neco Derision mada ();
   dm. selbordone Dimenso (800, 400));
    donat Title ("DIVIS rongentayor"); &
   dmoset visible (mil);
                       bornes (comed
                med - 1 plinds by occupies
```

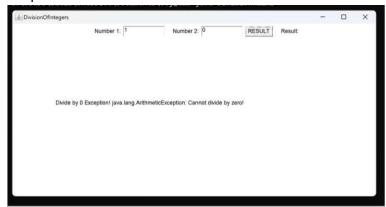
```
import java.awt.*; import java.awt.event.*; public class DivisionMain1 extends Frame
implements ActionListener {
  TextField num1, num2;
  Button dResult;
  Label outResult;
                     String out =
""; double resultNum;
flag = 0;
DivisionMain1()
        setLayout(new FlowLayout());
    dResult = new Button("RESULT");
    Label number 1 = new Label("Number 1:", Label.RIGHT);
                                                                Label number2
= new Label("Number 2:", Label.RIGHT);
                                             num1 = new
                 num2 = new TextField(5);
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);
    });
     setTitle("Division Calculator");
                                       setSize(300,
           setVisible(true);
      public void actionPerformed(ActionEvent ae)
```

```
int n1, n2;
(ae.getSource() == dResult)
             n1 = Integer.parseInt(num1.getText());
                                                              n2 =
Integer.parseInt(num2.getText());
         if (n2 == 0)
                     throw new ArithmeticException("Cannot divide by zero!");
        out = n1 + "/" + n2 + " = ";
                                           resultNum =
(double) n1 / n2;
                         out += String.valueOf(resultNum);
                                                                  repaint();
      } catch(NumberFormatException e1)
      flag = 1; out = "Number Format Exception! " + e1;
                                                                   repaint();
    catch(ArithmeticException e2)
             flag = 1; out = "Divide by 0 Exception! " + e2;
repaint();
  public void paint(Graphics g)
        if(flag
 =0
      g.drawString(out, outResult.getX() + outResult.getWidth(), outResult.getY() +
outResult.getHeight() - 8);
                                        flag = 0;
      g.drawString(out, 100, 200);
```

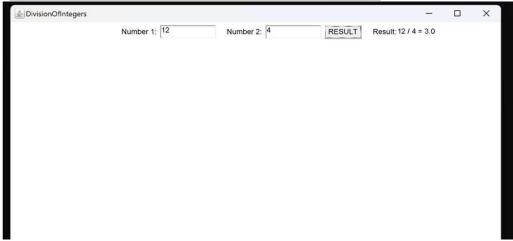
```
public static void main(String[] args)
{
```

```
DivisionMain1 dm=new DivisionMain1(); dm.setSize(new Dimension(800,400)); dm.setTitle("DivisionOfIntegers"); dm.setVisible(true);
}
```

Output:







PROGRAM 10:

Demonstrate Inter process Communication and deadlock

1. Demonstration of Inter process Communication Observation

```
10 penas troite Interprocess communication and decolocks
~ Clama
  poolean values et = false;
  synchronized and get ()
  1 while ( value et)
  by I system companion ("Gorscenes wenting");
      waster;
     Catch (Interrupted exception e)
     a system out posset in ("to translet Exception caught");
3
Septemoout posset in ("Got: "+in);
      Septemooul - posed in ("got: "+");
      valueset = false;
       System out product ( "Internal Product ") ",
       notify ();
       return n;
      Syndronized void put(intr)
         while (value et)
               satur. out produl & proce waitings):
         addle (Intropted exception e)
         System. out printly of in trupted exception caught ");
          fesson = h;
          valusat = focus
         Septer road opender ( Pad + A);
         Situ -o at mutter [ " Turnail consumors)
          rotfy();
```

clair Producer Emplements Runnable eq: Produces (9 ar). This q=q; new Thread (thi, "produser") start (); 2 public void sun() d int : = 09 while (icis) Lay put (itt); 3 clair consumer implicate Romodeli Public static vaid main(shings ang) class pcfixed Sylling out profile (Tolland P L gar=new (1); newpooducer(a); System out prither ("moren contrat (to 1top"); (netrolled pold betworking OUTEUT: (bealow states ortho (1 Arapted enception 6) Soften out of rable in properties out of (or + 16,90) atropo 600 - atropo Character for the fortuna con and

```
class Q { int n; boolean valueSet
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
} synchronized void put(int n) { while(valueSet)
System.out.println("\nProducer waiting\n"); wait();
} catch(InterruptedException e) {
System.out.println("InterruptedException caught");
} this.n = n; valueSet
System.out.println("Put: " + n);
System.out.println("\nIntimate Consumer\n"); notify();
class Producer implements Runnable {
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 {
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.");
```

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
Put: 2
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 Intimate Consumer Producer waiting Got: 5 Intimate Producer consumed:5 Intimate Consumer Producer waiting Got: 6

Intimate Producer consumed:10 Put: 11 Intimate Consumer 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

Intimate Producer

consumed:6 Put: 7

Intimate Consumer

Producer waiting

Got: 7

Intimate Producer

consumed:7 Put: 8

Intimate Consumer

Producer waiting

Got: 8

Intimate Producer

consumed:8

Put: 9

Intimate Consumer

Producer waiting

Got: 9

Intimate Producer

consumed:9 Put: 10

```
@ Demonstration of
  clan o
 Lsynchomized void fool Bb)
   string name = Thread. Current thread() get name();
     Sylu coul proule (name + ventered A. foo);
         Thread sleep (1000);
        Catch (Exeptione)
        a syndoo at-midhlon raterupted ");
        3
        sylur-out. prills (name + " trying to call B. lant ()");
        b. laster;
        Synchronized roid last ()
       a stepter coul pr. Als (" tris ide A-last");
  class 13
   Syn chronized vold bas(A a)
    of strong name = ThreadoCurrent Thread (). git name ();
       Streng home = Thread.
        SOP (name + " entered B. bar);
       try thread. sleep (1000);
       cutch (Execution e)
           Systemsout-prendln (" & Introupted");
         System out routin (name + "trying to call A. (aut () ");
           a larter;
          Syndmonized 208d Cartes
          as your outoposation invide A-lasty;
```

```
Deadlock Emplements Runnable
2
  Aa=new Ac);
  13 b = new 13(1);
 Dead lock
   2
    Thread . awel Thread () . Selvome ("NDEn Thread") 5
    Threadt = new Thread (this, "Do any Thread");
    t-stort co;
    a. 100(6);
    SOP (" Block in main thread ");
   3
  Public void runco
    a b. bar (a);
     SOPI " Back in other thread ");
   Publis states void moen (string origit)
   new Dead lock or;
                         (a a) had boy low morte and
   System out position raise +1 tought to coul so tout to"
```

SOURCE CODE:

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

OUTPUT:

```
MainThread entered A.foo
RacingThread entered B.bar
RacingThread trying to call A.last()
MainThread trying to call B.last()
^C
C:\Users\satis\OneDrive\Documents\ooj_lab>
```