# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



# LAB REPORT

on

# Object Oriented Java Programming (23CS3PCOOJ)

Submitted by

K C SAI NITHIN(1BM23CS130)

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 **K C SAI NITHIN(1BM23CS130)**, who is bonafide student of **B.M.S. College of Engineering**. It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum. The Lab report has been approved as it satisfies the academic requirements in respect of an Object Oriented Java Programming (23CS3PCOOJ) work prescribed for the said degree.

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# Index

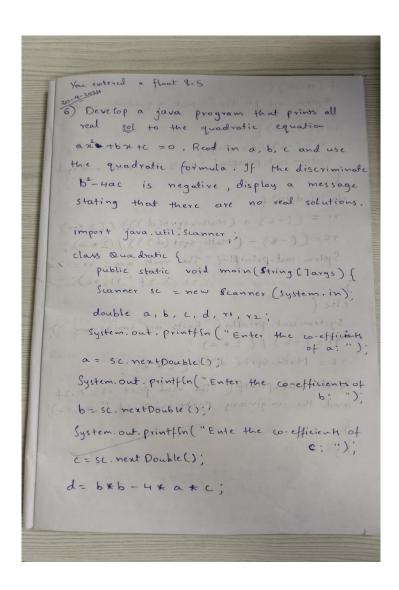
III CA			
Sl. No.	Date	Experiment Title	Page No.
1	30/09/2024	Quadratic Equation	4
2	7/10/2024	Calculation of SGPA of the students	6
3	14/10/2024	Two Strings	10
4	21/10/2024	Shape Area calculator	13
5	28/10/2024	Bank account	17
6	11/11/2024	Package CIE SEE	24
7	28/11/2024	Exception Father and Son's ages	28
8	28/11/2024	Multithreading	31
9	28/11/2024	Division app	33
10	28/11/2024	a) IPC b) Deadlock	35

#### Github Link:

https://github.com/KCSAINITHIN/OOJ-LAB-PROGRAMS

# Program 1

Implement Quadratic Equation



```
if (a==0) {

System out. println(" Not a quadratic equality)

clse if (d==0) {

Y1: (-b) / (2 * a);

System out. println(" Roots are real and equal;

Y1);

clse if (d70) {

Y1 = ((-b) + (Math. sqxt(d))) / (2 * a);

Y2 + ((-b) - (Math. sqxt(d))) / (2 * a);

System out. println(" The roots ave: Y1 = 1.00, Y2 = -2.00

Y2 + 1.2 f", Y1, Y2);

Clse (

System out. println(" Roots are imiginary");

Y1 = (-b) / (2 * a);

Y2 = Math. sqxt(-d) / (2 * a);

System out. println(" The veal part is: 7.24 and the imiginary party is: 7.24 and the imiginary party is: 7.24 ", Y1, Y2);

3

}

System out. println(" The veal part is: 7.24 and the imiginary party is: 7.24 ", Y1, Y2);

3

}

**Coots are real and equal; -1.00

**Coots are real and equal; -1.00
```

```
Code:
import java.util.Scanner;
class Quadratic {
  public static void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     double a, b, c, d, r1, r2;
     System.out.println("Enter the coefficient a: ");
     a = sc.nextDouble();
     System.out.println("Enter the coefficient b: ");
     b = sc.nextDouble();
     System.out.println("Enter the coefficient c: ");
     c = sc.nextDouble();
     d = b * b - 4 * a * c;
     if (a == 0) {
        System.out.println("Not a quadratic equation!");
     \} else if (d == 0) {
       r1 = (-b) / (2 * a);
```

```
System.out.printf("Roots are real and equal: \%.2f\%n", r1); \\ else if (d > 0) \\ \{r1 = ((-b) + (Math.sqrt(d))) / (2 * a); \\ r2 = ((-b) - (Math.sqrt(d))) / (2 * a); \\ System.out.printf("The roots are: r1 = \%.2f, r2 = \%.2f\%n", r1, r2); \\ else \\ \{ // d < 0 \\ System.out.println("Roots are imaginary."); \\ r1 = (-b) / (2 * a); \\ r2 = Math.sqrt(-d) / (2 * a); \\ System.out.printf("The real part is: \%.2f and the imaginary part is: \%.2f i\%n", r1, r2); \\ sc.close(); \\ \} \\
```

Calculation of CGPA of the students

```
System. Out. println ("Enter credits for subject
2) Develop a Java program to create a class
  Student with members usn, name, on array
  credits and an array marks. Include methods to
  accept and display details and a method to
  cale SGPA of a student.
Ans import java. util. Scanner;
  public class student f
   String name, usn;
    double SGPA;
    int[] marks = new int[4];
                                                            voil compute sgpA () (
    int( ] credits = new int [4];
   double[] grade points = new double [4];
                                                                total =0;
   double total = 0, credit_total = 0;
                                                               credit_total =0 : (11) | altan) =
                                                               for (intj =0; j K4; j ++) (=1)
  Scanner sc = new Scanner (System.in);
                                                                total + = gradepoints [j] + credits [j];
  void gets student Details () (
                                                                creditatotal += credits (i);
  System.out. println ( "Enter the name:");
  System.out.printla ("Enter USN: ");
                                                              SGPA = total / credit total;
 Usn = sc. nextline():
                                                             void display()(
                                                                system.out. println ("Name: "tname);
 void get Marks () {
                                                                System.out. println ("USN: +usn);
                                                                System-outprintul "sgpA: "+sgpA);
         System.out. print In ("Futer" + (j+1)+
```

```
Enter credits for subject 1:
    public static void main (String () args) (
     Scanner sc = new Scanner ( system . in);
    System.out.println ("Enter number of students: ");
                                                      Enter 2 subject marks:
    int number of Students = Sc. nextline (1;
                                                       Enter credits for subject 2:
    Sc. nextline (); ( ) a poor ) - ( ) the in there
    Student () student = new Student (number of Students);
                                                      Enter 3 subject marks:
    for (int i=0; i < number of Students; i++) (.
                                                       Enter credit for subject 3;
     students[i] = new Studen();
     Students [i] . get Student Details ();
     students[i], getMarks();
                                                       Enter 4 subjects marks:
     Students [i]. compute SGPAN;
    students (i). display();
                                                       Enter credits for subject 4:
                                                       Name: SAI
      System. out. println ("18M23cs130");
      System out . println * ("KC SAI NITHIN").
                                                       USN : 1234
                                                       SGPA: 9.0307
                                                       Enter name .
                                                        NITHIN
  Output ->
                                                        Enter USN :
 Enter number of students:
                                                        12345
                                                        Enter 1 Subject marks:
 SAI
                                                        Enter credits for subject 1:
Enter USN:
1234
                                                        Enter 2 Subject marks:
Enter I subject marks:
```

```
Enter credits for subject 2:

3

Enter 3 subject marks:

78

Enter credits for subject 3:

3

Enter credits for subject 4:

3

Name: NITHIN

USN: 12345

SGPN: 9.42307.
```

```
import java.util.Scanner;
public class Student {
  String name, usn;
  double SGPA;
  int[] marks = new int[4];
  int[] credits = new int[4];
  double[] gradepoints = new double[4];
  double total = 0, credittotal = 0;
  Scanner sc = new Scanner(System.in);
  void getStudentDetails() {
     System.out.println("Enter name:");
     name = sc.nextLine();
     System.out.println("Enter USN:");
     usn = sc.nextLine();
  }
  void getMarks() {
     for (int j = 0; j < 4; j++) {
       System.out.println("Enter" + (j + 1) + " subject marks:");
       marks[j] = sc.nextInt();
       System.out.println("Enter credits for subject " + (j + 1) + ":");
       credits[j] = sc.nextInt();
       gradepoints[j] = (\text{marks}[j] / 10.0) + 1;
       if (gradepoints[j] > 10) {
          gradepoints[i] = 10;
       }
     sc.nextLine();
  }
  void computeSGPA() {
     total = 0;
     credittotal = 0;
     for (int j = 0; j < 4; j++) {
       total += gradepoints[j] * credits[j];
       credittotal += credits[j];
     SGPA = total / credittotal;
```

```
}
  void display() {
    System.out.println("Name: " + name);
    System.out.println("USN: " + usn);
    System.out.println("SGPA: " + SGPA);
  }
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.println("Enter number of students:");
    int numberOfStudents = sc.nextInt();
    sc.nextLine();
    Student[] students = new Student[numberOfStudents];
    for (int i = 0; i < numberOfStudents; i++) {
       students[i] = new Student();
       students[i].getStudentDetails();
       students[i].getMarks();
       students[i].computeSGPA();
       students[i].display();
     }
              System.out.println("1BM23CS130");
         System.out.println("K C SAI NITHIN");
}
```

Two Strings

```
Treate a class book which contains four members
 name, author, nun pages. Include à constructor
to set the values for the members. Include
methods to set and get the details of the
 objects. Include a to String () method that could
 display the complete details of the book. Develop
 a Java program to create in book objects.
 import java. util. scanner; = " ) withing the most of
 class Book (
  Private String name good can = 2000 = [ ] dood
  Private String author:
  private int price;
  private int num Pages; " Instring the most age
 public Book ( string name, string author, int price,
     int numpages) (
    this name = name; 1 tors
   this author = author " ) to be to motive
    this. prices = price; a town 2 = volters print
    this, numlages = numlager ) wing two mother
  Public String tostring (1) thing the most and
     return "Book name: " + this name it " in" +
```

```
books LiT = new Book (name, author, price, humpages
    "price" + this price + " 1 " +
                                                   System out printle ( - in Book Details ");
    "Number of pages: "+ this num pages + " \n";
                                                    for (int i = 0; i(n; i+r) {
                                                         System. out println (books [i] to string ());
 public static void main (string (large) {
                                                      s.closecr;
   Scanner s = new scanner (system.in):
  System out printle ("Enter the number of books: ");
                                                  Output :-
  Book [] = books = new Book [n];
                                                  Enter the number of books: 2
  for (int i = 0; i kn; i++) {
                                                  Enter details for book 1 :
  System. out println ("Enter details for book"+
                                                   Name : history
                     (i+1) + -:+9;
                                                   Author: babar
 System.out.print ( " Name : ");
 String name = s. next ();
                                                  Number of pages: 1000
 System out print ("Author: "):
                                                   Enter details for book 2:
 String author = s, next ();
                                                  Name: science
System out. print ("Print "); capaliness and
                                                   price : 1000
int price = sinex+ Int();
                                                   Number of pages: soo
System. out. print ("Number of pages: ");
int num Pages = s. next Int();
```

```
Book Details:

Book name: history

Author va-e: babar

price: 100

Number of pages: 1000

Book name: science

Author name: numbon

price: 1000

Number of pages: 500
```

```
Code:
import java.util.Scanner;
class Book {

private String name;

private String author;

private int price; private

int numPages;

public Book(String name, String author, int price, int numPages) {

    this.name = name;
    this.author = author;
    this.price = price;
    this.numPages = numPages;
}
```

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

Shape Area calculator

```
21-10-24
+ Develop a Java program to Create an abstract
  class named shape that contains two integers
  and an empty method named print Area().
  Provide three chasses named Rectangle, Triangle
  and circle such that each each one of the
  chasses extends the class shape. Each one of
  the classes contain only the method print
  that prints the area of given Shape.
  import java util . Scanner;
 class Input Scanner (
   protected Scanner Scanner;
  public Input Sconner () {
     Scanner = new Scanner ( System .in);
  public int get Input (String message) f
       System. out. print (message);
        return scanner. next Int();
  abstract class shape extends Input Scanners
  protected int dimension;
      protected int dimension 2.
      public abstract void print Areacs:
```

```
Shape reclargle = new Rectangle ().
  class Rectangle extends shope (
                                                   redagle. printAreal);
   public Triangle ()
                                                  Shape triangle = new Triangle ();
    this dimension = get Input ("Enter box of the
                             triangle : " ]
                                                   triangle . Print Avea ():
    this dimension 2 = get Input (" Easer height
                                                  Shape circle = new Circle ();
                             of the triangle:
                                                circle . print Area ();
 @ Override
                                                   System. out-printly ("In K C Sai Nithin-130"
 public void printAreal) (
   double area = 0.5 * dimension 1 * dimension
                                                Output ->
    System . out . println ("Area of Triangle: "+ area);
                                                Enter length of the rectangle: 20
                                                Enter width of the rectangle: 20
                                                Area of Rectangle: 400
 Class Eircle extends shape (
                                                 Enter base of the triangle: 30
     public Civde () (
                                                 Enter height of the triangle: 40
      this dimension = get I upat ("Enter radius of the
                                                Area of Triangle: 600.0
                                  circle: ")
                                                 Enter radius of the circle :10
Boverride
                                                 Area of circle: 314.159...
 public void print Area () {
 double area = Math. PI * dimensional * dimensional,
                                                  K C SAI NITHIN
 System.out. println ("Area of circle: "tarea);
                                                 1B23C5130
                                                ayanio
public class Shape Arcalalcutor (
  public static void main (String (Jargs) (
```

```
import java.util.Scanner;
class InputScanner {
  protected Scanner scanner;
  public InputScanner() {
    scanner = new Scanner(System.in);
  }
  public int getInput(String message) {
    System.out.print(message);
    return scanner.nextInt();
  }
}
abstract class Shape extends InputScanner {
  protected int dimension1;
  protected int dimension2;
  public abstract void printArea();
}
class Rectangle extends Shape {
  public Rectangle() {
    this.dimension1 = getInput("Enter length of the rectangle: ");
    this.dimension2 = getInput("Enter width of the rectangle: ");
  }
  public void printArea() {
    int area = dimension1 * dimension2;
    System.out.println("Area of Rectangle: " + area);
  }
}
class Triangle extends Shape {
  public Triangle() {
    this.dimension1 = getInput("Enter base of the triangle: ");
    this.dimension2 = getInput("Enter height of the triangle: ");
  }
  public void printArea() {
    double area = 0.5 * dimension1 * dimension2;
    System.out.println("Area of Triangle: " + area);
```

```
}
class Circle extends Shape {
  public Circle() {
     this.dimension1 = getInput("Enter radius of the circle: ");
   }
  public void printArea() {
     double area = Math.PI * dimension1 * dimension1;
     System.out.println("Area of Circle: " + area);
   }
}
public class ShapeAreaCalculator {
  public static void main(String[] args) {
     Shape rectangle = new Rectangle();
     rectangle.printArea();
     Shape triangle = new Triangle();
     triangle.printArea();
     Shape circle = new Circle();
     circle.printArea();
   }
}
```

#### Bank account

```
5) Develop a gava program to create a class
                                                    im port java. util. Scanner;
                                                    class Account (
             that maintains two kinds of account
                                                     String constoner Name ;
    for its constoners, one called saving account and the
                                                     int account Type
   other current account. The savings account Provide
                                                     double balance
    compound intrest and withdrawl facilities but w
                                                     Account (String name, int accNumber, String acctyri)
   Cheque book facility. The current account
                                                          Coustomer Name = name ;
   provides cheque book facility but no intent.
                                                         a ccount Number = acc Number;
   Current account holders should also maintain
                                                         account Type = acc Type;
   a minimum balonce and if the balance falls
                                                           balance = p;
  below this level, a service change is imposed
                                                    public void deposit (double amount)
  ( reale a class Account that stores constomer no
   account number and type of account. From this
                                                          balance += amount;
                                                     System. out. println ("Deposited; " + amount + ".
           the classes cur-acct and sov-acct to
  make them more specific to their requirement.
                                                                      Updated balance "+balance);
  Include the necessary methods in order to
                                                     Public void display Balance () (
  achieve and update the bolonce tasks
                                                          System. Out. Println (" Account Balance: "+
a) Accept deposit from constoner and update
                                                                                              bolonce
   the balance
                                                    public void withdraw (double amount) (
b) Display the balance.
                                                        System out println (" This operation is
1) Compute and deposit interest
                                                           specific to account type . " ); }
d) Permit withdrawl and update the balance
e) Check for the minimum balance, impose penalty
                                                     class Save Account extends Account (
  if necessary and update the balance.
                                                           double intrestRate = 0.04
```

```
SavAccount ( String nave , int acc Number ) (
                                                          it (balance & minBalance) (
     super (name, ace Number, " Savings");
                                                               balance - = service Charge;
                                                         System.out. println ("Balance below minimum
 Public voil compute Intrest () (
                                                                         Service charge imposed: "
                                                                          + service charge + ". updated balance
     double intrest = balance + intrest Rate;
                                                                           + balance);
    balance += interest
    System.out. println ("Interest added: +
                          interest + ". updated balance
                                                     public void withdrow (double amount) of
                         " + balance);
                                                          if (bolonce 7 = amount) (
                                                               balance -= amount ;
Goverride
public void withdraw (double amount) (
                                                          System.out. println ("withdrown" + amount +".
     if (balance >= amount) {
                                                                            uplated balance: "+ balance)
                                                            CheckMin Balance();
           balance = amount }
   System, out. printly ("Withdrawn: "+ amount 4".
                                                           else
                      Updated balance : " + balance);
                                                            System.out. println ( " Insufficient balance.");
      System. out. Printly ("Insufficient balonce")
                                                        Public class Bank ( )
Class Curticount extends Account (
    double minBalance = 500.0;
    double servicecharge = 50.0;
CurAccount (string name, int acc Number) {
  super (name, acc Number, "(urrent");
```

```
string acctype = sc. nent() .
 public class Bank (
  public static void main (String () args)
                                                           if (acetype.equals ("saving")) (
     Sconner sc = new Scomer ( System in);
                                                            switch (chaice) (
    System.out. printly ("Enter customer name: ")
                                                           Case 1 :
     String namesc. next ();
                                                            System out print (" Enter the deposit amounts)
     System. out. printh ("Enter account number: ").
                                                             double deposit Amoun
    int accountnumber = sc. next Int ();
                                                             double deposit Amount = sc. nextDouble ();
                                                              saving Account . deposit (deposit Amount);
    sav Account savings Account = NEW Sav Account
                                     (name, accounting
   System out printly ("Enter customer manne:");
                                                              case 2:
   String namel=sc.nent();
                                                              System and print ( "Enter the withdrawl amount:");
   System. Out. Println ("Enter account member:");
                                                               double withdrawl Amount = sc next Double ();
                                                              Savings Account . withdrow (withdrow ( A would )
   int account number 1=sc. neut Int ();
    SavAccount saving A count
                                                               break;
   CurAccount current Account = new CurAccount
                                                             savings Account. compute Intrest ()
                                    ( name 1, account much
 while (true) f
                                                           Case 4.
  System. out. println ("In ... Henre - - ..");
                                                           System out . println ("customer nane: " + saving Accord.
  System.out. printle ("I. Deposit in 2. Withdraw in 3.
                                                           septem. out. print la ("Acout member : " +
                                                                                savings Account account Number):
                        Compute Interest for Savings
                                                           Septem.out. printly ("Type of Account: "+
                        Account In4. Display
                                                                               savings Account account Type);
                        Account Details (n5. Enit");
                                                           Savings Account. display Balance ()
System. out, print ("Enter the type of Account
                                                               break ;
                             ( soving / current): ")
```

```
System. out println ( " Custoner name: " + current Account
  System. exit (0);
                                                                                           customer Nave)
                                                      system. out Println ("Account number: "+
   break;
                                                                         current Account, account N unber);
default:
                                                      System out printly ("Type of Account: "+
     System.out. println ("Invalid choice,").
                                                                           current Account. account type);
                                                       current Account displayBalance ();
                                                        break .
 else if (acc type. equals ("current"))
                                                       coscs:
    switch (choice)
                                                          System. exit (0);
                                                           break;
    cose 1:
    System-out. print ("Enter the deposit amount.
                                                         default:
      double deposit Amount = sc . next Pouble ();
                                                            System out . println (" Invalid choice ").
      current Account deposit (deposit Amount):
      break ;
                                                          System. out . println (" Invalid account type. ")
    System out print ( "Enter the withdrawl camount: ")
    double withdraw[ Amount = sc. next Double ();
    current Account . wi thedrow ( widwith d row of Amount);
     break;
   cases:
      System-out-println ("corrent accounts do not com
     break; interest ");
```

```
adjut:
                                                              3. Compute Intrest for savings Account
   Enter customer name
                                                              4. Display Account Details
   Sai
                                                               5. Exit
  Futer customer mane
                                                               Enter your choice: 3
  nithin
                                                               Enter the type of account (saving | current): saving Interest added: 3600.0. Updated balance: 93600.0
  Enter account number.
   - - - Menu -
                                                                        Menu - - -
  1 - Deposit
                                                               1. Deposit
                                                                2 Withdraw
3. Compute Interest for Saving Account
4. Display Account Details
  2. Withdrow
  3. Compute Suterest for savings Account
  M. Display Account Details
  5. Eni +
                                                                Enter the type of account (saving | current): saving
  Enter your choice:
                                                                  Customer name : Sai
 Enter the type of occount (saving /warrent); saving
                                                                   Account number: 1
                                                                    Type of Account savings
  Enter the defosit amount: 100000
                                                                  Account Balance : 93600
  Deposited: 10000.0 Updated balance: 100000.0
 - - - - Menu -
  1. Deposit
  2. Withdraw
  3. Compute Interest for Saving
 4. Display Account Details
 S. Exit
 Enter your choice: 1
Enter the type of account (soving | current); saving
Enter the deposit amont: 10000

Deposited: 10000.0 Updated balance: 190000.0
```

```
Code:
```

```
import java.util.Scanner;
class Account {
  String customerName;
  int accountNumber;
  String accountType;
  double balance;
  Account(String name, int accNumber, String accType) {
    customerName = name;
    accountNumber = accNumber;
    accountType = accType;
    balance = 0;
  }
  public void deposit(double amount) {
    balance += amount;
    System.out.println("Deposited: " + amount + ". Updated balance: " + balance);
  public void displayBalance() {
    System.out.println("Account Balance: " + balance);
  }
  public void withdraw(double amount) {
    System.out.println("This operation is specific to account type.");
  }
}
class SavAccount extends Account {
  double interestRate = 0.04;
  SavAccount(String name, int accNumber) {
    super(name, accNumber, "Savings");
  }
  public void computeInterest() {
    double interest = balance * interestRate;
    balance += interest;
    System.out.println("Interest added: " + interest + ". Updated balance: " + balance);
```

```
}
  public void withdraw(double amount) {
    if (balance >= amount) {
       balance -= amount;
       System.out.println("Withdrawn: " + amount + ". Updated balance: " + balance);
       System.out.println("Insufficient balance.");
  }
}
class CurAccount extends Account {
  double minBalance = 500.0;
  double serviceCharge = 50.0;
  CurAccount(String name, int accNumber) {
    super(name, accNumber, "Current");
  }
  public void checkMinBalance() {
    if (balance < minBalance) {
       balance -= serviceCharge;
       System.out.println("Balance below minimum. Service charge imposed: " + serviceCharge + ".
Updated balance: " + balance);
  }
  public void withdraw(double amount) {
    if (balance >= amount) {
       balance -= amount;
       System.out.println("Withdrawn: " + amount + ". Updated balance: " + balance);
       checkMinBalance();
     } else {
       System.out.println("Insufficient balance.");
  }
public class Bank {
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.println("Enter customer name:");
    String name=sc.next();
    System.out.println("Enter account number:");
    int accountnumber=sc.nextInt();
```

```
SavAccount savingsAccount = new SavAccount(name, accountnumber);
System.out.println("Enter customer name:");
    String name1=sc.next();
    System.out.println("Enter account number:");
    int accountnumber1=sc.nextInt();
    CurAccount currentAccount = new CurAccount(name1, accountnumber1);
    while (true) {
       System.out.println("\n---- MENU ----- ");
       System.out.println("1. Deposit\n2. Withdraw\n3. Compute Interest for Savings Account\n4.
Display Account Details\n5. Exit");
       System.out.print("Enter your choice: ");
       int choice = sc.nextInt();
       System.out.print("Enter the type of account (saving/current): ");
       String accType = sc.next();
       if (accType.equals("saving")) {
         switch (choice) {
            case 1:
              System.out.print("Enter the deposit amount: ");
              double depositAmount = sc.nextDouble();
              savingsAccount.deposit(depositAmount);
              break;
            case 2:
              System.out.print("Enter the withdrawal amount: ");
              double withdrawalAmount = sc.nextDouble();
              savingsAccount.withdraw(withdrawalAmount);
              break;
            case 3:
              savingsAccount.computeInterest();
              break:
            case 4:
              System.out.println("Customer name: " + savingsAccount.customerName);
              System.out.println("Account number: " + savingsAccount.accountNumber);
              System.out.println("Type of Account: " + savingsAccount.accountType);
              savingsAccount.displayBalance();
              break:
            case 5:
              System.exit(0);
              break;
            default:
              System.out.println("Invalid choice.");
       } else if (accType.equals("current")) {
         switch (choice) {
```

```
case 1:
              System.out.print("Enter the deposit amount: ");
              double depositAmount = sc.nextDouble();
              currentAccount.deposit(depositAmount);
              break;
            case 2:
              System.out.print("Enter the withdrawal amount: ");
              double withdrawalAmount = sc.nextDouble();
              currentAccount.withdraw(withdrawalAmount);
              break;
            case 3:
              System.out.println("Current accounts do not earn interest.");
              break;
            case 4:
              System.out.println("Customer name: " + currentAccount.customerName);
              System.out.println("Account number: "+currentAccount.accountNumber);\\
              System.out.println("Type of Account: " + currentAccount.accountType);
              currentAccount.displayBalance();
              break;
            case 5:
              System.exit(0);
              break;
            default:
              System.out.println("Invalid choice.");
       } else {
         System.out.println("Invalid account type.");
       }
    }
  }
}
```

# Package CIE SEE

```
public void displayfinal Marks () (
                                 marks[i] = s. next[n+();
                                                                11SEE. Externals a
                                                                                              display Student Details ();
 Ocreate a package CIE
                                                                                              System. out. println(" Final
                                                                package SEE ;
 which has two classes - student
                                                                                              Marks (Internal + External):")
 and internals has an array
                                                                import CIE. Internals;
 that stores the internal marks
                                 11 CIE . Student . java
                                                                                              for (int i=0; i < 5; i++) (
                                                                import pava . util . Scanner;
                                                                public class Externals extends System.out. println ("course"
 scored in five courses of the
                                package CIE;
 current semester of the
                                                                                               + (i+1) + ": " + find Mark(i))
 Student. Create another pochage
                                 import java util . & conner:
                                                                Internals ( - M
  SEE which had the class
                                                                 protected int marks (] =
                                public class Student (
                                                                                   new int [5]
  External which is derived
                                     protected string name;
                                                                protected intfinal Marks[] =
  class of a Student. This
                                     protected string usn;
                                                                                                11 Main
                                                                  new int (5);
  class has an array that stores
                                     protected strong sem;
                                                                                                import SEE. Externals
                                                                  public Externaly () (
  the SEE marks scored in
                                 public void input student Ataiker
                                                                                                import java. util. Beanner
  five courses of the current
                                                                   marks = new int (5);
  semests of the student.
                                                                   final Marks = new int (5);
                                                                                                Class Main &
                                  Scanner s = new Scanner
  Import the two packages
                                                                                                public static void main
                                                   (System.in)
  in a file that declares
                                 bystem-out-print ("Enter USN: ")
                                                                                                 (String args[])
                                                                 public void inputSEE marks () [
  the Bi-find marks of n
                                 usn = s.nextline()
                                                                                                 Sconner. out. print
                                                                  Scanner s = new Scanner
  Students in all five courses.
                                                                                     (system.in); ("Enter the number of
                                 System out. print ("Enter Nam:"
                                                                                                     Students: "):
                                                                 System out println ("Enter
 11 CIE. Internals
                                 name = s. nextline ()
                                                                                                  int n = scanner . ment Int ();
                                 System. out. print ("Enter
                                                                  SEE Marks for 5 courses: ")
 Package CIE:
                                                                                                 Externals [] Students =
                                                                  for (int i=0; ics; i++) [
 import java. util. Scanner;
                                 sem = s.next Int();
                                                                                                         new Externals [n]:
 public class Internals
                                                                  Systemout, print ("Enter SEE
                                                                                                  for (int i = 0; icn; i++)(
 extends Student (
                                 public void display Student Details()
                                                                   marks for course" + (i+1) +":")
                                                                                                   Students (i) - new External
     protected int marks ()
                                                                   marks (i) = s = x + x + Int ();
                                                                                                   System.out. println (" In
                                   System. out. println ("USN:
           = new int [5];
                                                                                                  Enter details for student "
                                 System out printly ("Name: "
Public void input CIEmarks ()
                                                                                                   + (i+1));
                                                                  Public void CalculateFinal Marks () Students [i]. input Student
    Scanners = new Scanner
                                  system out . println (" Semester."
                                                                                                                        Details ();
                  (System.in);
                                                                      for (int i=0; i (5; i++)
                                                                                                   Students [i]. input (IE marks ())
System. out. println "Enter
                                                                     final Marks [i] = marks [i] +
                                                                                                    Student [i]. In put SEE mark ();
 Internals Marks for 5 courses:")
                                                                            this. marks [i]; 34
                                                                                                   Student (i) . calculate Final Morks ()
for (inti=0; iL5; i+t)!
System. out. Print ("Enter marks for
```

```
System. out . println (" In Displaying
                                 Enter marks for course 2: 45
 final marks for all students : ");
                                 Enter marks for course 3: 43
 for (int i = 0; i kn; i++) {
                                  Enter w
  System out println ("In Student Enter marks for courses: 4.
  +(1+1)+":");
  Students (i) - display Final Marks (); Enter SEE Marks +
                                 Enter SEE Marks for course 2
                                 Enter SEE Marks for course 3 : 43
 Output ->
                                 Enter SEE Marks for course 4: 38
                                  Enter SEE Marks for Courses: 49
         the no of students: 2
                                 Displaying final marks for all
 Enter details for student 1
 Enter USN : 1BM23C5130
    en Name: K C SAI NITHIN
                                 USN: 18M23CS130
    ten Semesten: 3
                                 Name: KC SAI NITHIN
    ten marks for course 1: 46
     en marks for course 2; 42
                                 Final Marks (Internals + Externs)
    ter marks for course 3: 47
                                  course 1 : 86
                                  course 2 : 90
                                   courses: 76
 Enter marks for course 5: 39
                                  coursey: 96
 Enter SEE marks for 5 courses:
                                  courses: 98
 Enter SEE marks for coursel: 43
 Enter SEE marks for course 2:45
                                  Student 2:
Enter SEE marks for course 3: 38
                                  USN: 48M23CS154
                                  Name: KISHORE CHANDRAN
Enter SEE marks for course 4: 48
                                  Final Marks (Internal + E
Enter details for student 2
                                   course1:92
Enter USN : 18M23CS154
                                  Courses: 94
Courses: 86
Enter Name: Kishore Chandra N
                                   course 4: 76
                                   course 5 - 96
     Internal Marks for 5 courses
```

```
CIE/
Inetrnals-
package CIE;

import java.util.Scanner;

public class Internals extends Student {
    protected int marks[] = new int[5];

    public void inputCIEmarks() {
        Scanner s = new Scanner(System.in);
        System.out.println("Enter Internal Marks for 5 courses:");
        for (int i = 0; i < 5; i++) {
            System.out.print("Enter marks for course " + (i + 1) + ": ");
```

marks[i] = s.nextInt();

Code:

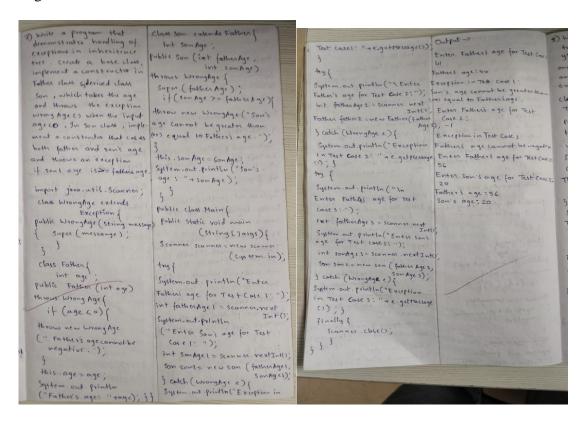
}

```
}
Student-
package CIE;
import java.util.Scanner;
public class Student {
  protected String usn;
  protected String name;
  protected int sem;
  public void inputStudentDetails() {
    Scanner s = new Scanner(System.in);
    System.out.print("Enter USN: ");
    usn = s.nextLine();
    System.out.print("Enter Name: ");
    name = s.nextLine();
    System.out.print("Enter Semester: ");
    sem = s.nextInt();
  }
  public void displayStudentDetails() {
    System.out.println("USN: " + usn);
    System.out.println("Name: " + name);
    System.out.println("Semester: " + sem);
  }
}
SEE/
Externals-
package SEE;
import CIE.Internals;
import java.util.Scanner;
public class Externals extends Internals {
  protected int marks[] = new int[5];
  protected int finalMarks[] = new int[5];
  public Externals() {
    marks = new int[5];
    finalMarks = new int[5];
  }
  public void inputSEEmarks() {
    Scanner s = new Scanner(System.in);
    System.out.println("Enter SEE Marks for 5 courses:");
```

```
for (int i = 0; i < 5; i++) {
       System.out.print("Enter SEE marks for course " + (i + 1) + ": ");
       marks[i] = s.nextInt();
     }
  }
  public void calculateFinalMarks() {
     for (int i = 0; i < 5; i++) {
       finalMarks[i] = marks[i] + this.marks[i];
     }
  }
  public void displayFinalMarks() {
     displayStudentDetails();
     System.out.println("Final Marks (Internal + External):");
     for (int i = 0; i < 5; i++) {
       System.out.println("Course" + (i + 1) + ":" + finalMarks[i]);
  }
}
CIE SEE/
Main-
import SEE.Externals;
import java.util.Scanner;
class Main {
  public static void main(String[] args) {
     Scanner scanner = new Scanner(System.in);
     System.out.print("Enter the number of students: ");
     int n = scanner.nextInt();
     Externals[] students = new Externals[n];
     for (int i = 0; i < n; i++) {
       students[i] = new Externals();
       System.out.println("\nEnter details for student " + (i + 1));
       students[i].inputStudentDetails();
       students[i].inputCIEmarks();
       students[i].inputSEEmarks();
       students[i].calculateFinalMarks();
     }
```

```
System.out.println("\nDisplaying final marks for all students:"); \\ for (int i = 0; i < n; i++) \{ \\ System.out.println("\nStudent " + (i+1) + ":"); \\ students[i].displayFinalMarks(); \\ \} \\ \} \\ \}
```

Exception Father and Son's ages



```
Code:
 import java.util.Scanner;
 class WrongAge extends Exception {
   public WrongAge(String message) {
      super(message);
   }
 }
 class Father {
   int age;
   public Father(int age) throws WrongAge {
      if (age < 0) {
        throw new WrongAge("Father's age cannot be negative.");
      this.age = age;
      System.out.println("Father's age: " + age);
 }
 class Son extends Father {
   int sonAge;
   public Son(int fatherAge, int sonAge) throws WrongAge {
      super(fatherAge);
      if (sonAge >= fatherAge) {
        throw new WrongAge("Son's age cannot be greater than or equal to Father's age.");
      this.sonAge = sonAge;
      System.out.println("Son's age: " + sonAge);
 }
 public class Main {
   public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      try {
        System.out.println("Enter Father's age for Test Case 1:");
        int fatherAge1 = scanner.nextInt();
        System.out.println("Enter Son's age for Test Case 1:");
        int sonAge1 = scanner.nextInt();
        Son son1 = new Son(fatherAge1, sonAge1);
        } catch (WrongAge e) {
        System.out.println("Exception in Test Case 1: " + e.getMessage());
      }
```

```
try {
    System.out.println("\nEnter Father's age for Test Case 2:");
    int fatherAge2 = scanner.nextInt();
    Father father2 = new Father(fatherAge2);
     } catch (WrongAge e) {
    System.out.println("Exception in Test Case 2: " + e.getMessage());
  }
   try {
    System.out.println("\nEnter Father's age for Test Case 3:");
    int fatherAge3 = scanner.nextInt();
    System.out.println("Enter Son's age for Test Case 3:");
    int sonAge3 = scanner.nextInt();
    Son son2 = new Son(fatherAge3, sonAge3);
     } catch (WrongAge e) {
    System.out.println("Exception in Test Case 3: " + e.getMessage());
     } finally {
    scanner.close();
}
```

# Multithreading

```
8) Write a program which creates
 two threads, one thread displa-
 ying "BMS College of Engineering"
                               System. out. privitle ("Department
 once every ten seconds and
 another displaying "(SE" once
                               Thread interupted:
 every two seconds.
 class College Thread extends
                              public class Multi Thread Demo!
 Thread (
                               public static void main
 public void runcof
                                 (String () args)
  try s
                                 College Thread college Thread =
  while (true) f
                                 new college Thread ();
 System.out. println (" BMS
                                Department Thread department
 ( ollege of Engineering" );
                                Thread = new Department Threado;
Thread. Sleep (10000);
                                 college Thread. start ();
                                  department Thread stort ();
                                 Output ->
 3 catch (Interupted Exception e)
  System. out. println (" college
                                 BMS College of Engineering
  Thread interupted: " +
  e.getMessage());
  4
                                BMS College of Engineering
  class Department Thread extends
                                 CSE
  Thread f
                                 CSE
  Public void run ().
                                  CSE
                                  CSE
                                  CSE
   while (true)
                                  BMs College of Engineering
   System.out. println (" (SE")
                                  CSE
    Thread. sleep (2000)
                                  CSE
                                  CSE
                                  CSE
   catch (Interupted Expections)
```

```
class CollegeThread extends Thread {
  public void run() {
    try {
       while (true) {
         System.out.println("BMS College of Engineering");
         Thread.sleep(10000); // Pause for 10 seconds
       }
     } catch (InterruptedException e) {
       System.out.println("CollegeThread interrupted: " + e.getMessage());
  }
}
class DepartmentThread extends Thread {
  public void run() {
    try {
       while (true) {
         System.out.println("CSE");
     } catch (InterruptedException e) {
       System.out.println("DepartmentThread interrupted: " + e.getMessage());
     }
  }
}
public class MultiThreadDemo {
  public static void main(String[] args) {
    CollegeThread collegeThread = new CollegeThread();
    DepartmentThread departmentThread = new DepartmentThread();
    collegeThread.start();
    departmentThread.start();
  }
}
```

Division app

```
int result = num / numz :
                                                                                                       output ->
                                  Thabel num | Label =
 9) Write a program that creates
                                                                  result Field, set Text (String.
                                  new Jlabel ("Enter Num!: 4).
  a user interface to perform
                                                                                                      1) Enter Num 1: 15
                                                                  value of (result)); 4
                                  num ( Feild = new JTextfield (10).
  integer divisions. The user
                                                                                                         Enter Numz: 0
                                                                  cotch ( Number Format Exception
                                                                                                           Divide
  enters two numbers in the
                                  J Label num 2 Label -
  text fields, Num1 and Num 2.
                                 new Jlabel (" Enter Numz: ")
                                                                                                         Result:
  The division of Num 1 and Numz
                                  num2 Field = new J Text Field(10);
                                                                  Joption Plane. Show Message Dioba
                                                                                                         Arithmetic Error
  is displayed in the Result field
                                  divide Button = new J Button
                                                                   (frome, "Please enter valid integers.")
  when the Divide button is clicked
                                                  ("Divide");
                                                                   "Input Error", JoptionPlan.
  If Numi (01) Numz were not an
                                  J Label result Label =
                                                                    Error_Hessage); 3
  integer, the program would tho
                                  new Jlobel ("Result: ");
                                                                                                      2) Enter Num 1: 5.0
  throw a Number Format Exception
                                  Yesult Field = new J. Teat Field (10); result Field oset Editable (false);
                                                                   Catch (Arithmetic Exception ex) (
                                                                                                          Enter Numz: 2.5
  If the Num 2 were zero the
                                                                                                                Dividel
 Program would throw an Arith-
                                                                    Joptianpane-show Message Dialog
                                                                                                           Regult:
 metic Exception Display the
                                   frame add (num1 Label 4);
                                                                    ( frame, "Connet divide by zero.")
 exception in a message dialog
                                                                                                            Input Error
                                   frame add (num 1 Feild);
                                                                     "Arithmetic Error", Joption Plane
                                   frame add (numz Label)
                                                                                                             Pleaseenter
  import javax swing . + ;
                                                                                   ERROR-MESSAGE)
                                   frame add (num 2 Field)
  import java. aw + . * ;
                                                                   Catch (Exceptionex) (
                                    frome odd (divide Button):
  import java.out. event.
                                    frame add (result Label)
                                                                      Joption Plane. Show Message Dialog
                                                                                                        3) Enter Numi: 20
                    Action Event;
                                    fromeradd (result Field);
  import java aut event Action
                                                                    ( frame, "An error occured:"+
                                                                                                          Enter Numz: 10
                     Listener;
                                  divide Button, add Action Listner
                                                                       ex-gethersage (), "Error",
                                                                                                               Divide
  public class Division App f
                                  (new Action Listner) }
                                                                                                           Respect: 12
   private Frame frame;
                                                                        JoptionPane. Error-Menage)
                                  Public void action Performed
   private JTentfield
                                  (Action Event e) f
   num | Feild, num 2 Field,
   result Field;
  Private J Button divide Button;
                                   string num Text =
                                                                        frame setVisible (true)
  Public Division App () [
                                   num | Freld, get tent()!
  from = new JFrame (" Integer
                                   String numz Text=
                     Division")
                                   munz Field. get Text();
 frame. set Lay out (new Flowlay out
                                                                    public state void main
                                  int num = Integer, parsent
                                                                     (String () args) (
 frame. Setsize (300,200).
                                   (num 1 Tent);
                                                                          new Division App ();
 from set Default Close operation
                                  int num = Integer . ParseInt
( J Frame. EXI T_ON-CLOSE ) !
                                                   (name Text)
```

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class DivisionApp {
  private JFrame frame;
  private JTextField num1Field, num2Field, resultField;
  private JButton divideButton;
  public DivisionApp() {
    frame = new JFrame("Integer Division");
    frame.setLayout(new FlowLayout());
    frame.setSize(300, 200);
    frame.setDefaultCloseOperation(JFrame.EXIT ON CLOSE);
    JLabel num1Label = new JLabel("Enter Num1: ");
    num1Field = new JTextField(10);
    JLabel num2Label = new JLabel("Enter Num2: ");
    num2Field = new JTextField(10);
    divideButton = new JButton("Divide");
    JLabel resultLabel = new JLabel("Result: ");
    resultField = new JTextField(10);
    resultField.setEditable(false);
    frame.add(num1Label);
    frame.add(num1Field);
    frame.add(num2Label);
    frame.add(num2Field);
    frame.add(divideButton);
    frame.add(resultLabel);
    frame.add(resultField);
    divideButton.addActionListener(new ActionListener() {
       public void actionPerformed(ActionEvent e) {
         try {
```

```
String num1Text = num1Field.getText();
         String num2Text = num2Field.getText();
         int num1 = Integer.parseInt(num1Text);
         int num2 = Integer.parseInt(num2Text);
         int result = num1 / num2;
         resultField.setText(String.valueOf(result));
       } catch (NumberFormatException ex) {
         JOptionPane.showMessageDialog(frame, "Please enter valid integers.",
                           "Input Error", JOptionPane.ERROR_MESSAGE);
       } catch (ArithmeticException ex) {
         JOptionPane.showMessageDialog(frame, "Cannot divide by zero.",
                           "Arithmetic Error", JOptionPane.ERROR_MESSAGE);
       } catch (Exception ex) {
         JOptionPane.showMessageDialog(frame, "An error occurred: " + ex.getMessage(),
                           "Error", JOptionPane.ERROR_MESSAGE);
     }
  });
  frame.setVisible(true);
}
public static void main(String[] args) {
  new DivisionApp();
}
```

Division app a) IPC Algorithm:

```
Output ->
                                                              (onsumer (QQ) (
                                 System.out. printh
  10)a) Write
                  java
                          progra
                                                                                              Pres Control-c to stop
                                 " Interupted Exception
                                                                this . 1 = 9;
                                                                                               put:0
    for interprocess communication caught ");
                                                              new Thread (this, "Consumer")
                                                                                               Intimate Consumer
                                                              start ();
    continued, To avoid colling
                                                                                               Producer waiting
                                this . n = n;
    Java includes an elegant
                                 value set = true;
                                                                                                Got: 0
                                                              public void run () {
    interprocess communication
                                                                                               Intimate Producer
                                 System. out. println ("Put;"
                                                                int 1=0;
    mechanism via the wait!)
                                                                                               put: 1
                                                              while (ikis) q
    notify(), and notify AII()
                                                                                                Intimate Consumor
                                  System. Out. printlu ("In
                                                               int r=q.get();
    methods. These methods one
                                  Intimate Consumer (nº)
                                                                                                Producer waiting
                                                              Sustem. out. printfn ("consumed."
    Implemented as final
                                   notify ():
                                                                                                producer vailing
    nethods in Object, so
                                                                                                 Consumelo
                                                               i++ jourgest . band
    all classes have them.
                                                                                                 Got: 1
                                   class Produces implements
                                                                 trail print about
                                                                                                 Intimate Consumor
  class & f
                                   Runnable (
                                                                                                 Consumed: 1
   intn ;
                                    Qq;
                                                                                                  put 2
   boolean value set = false;
                                                              class PCFixed [
                                   Producer (Qq) [
                                                                                                   Intimate cousum
                                                               public static void main
   synchronized int get () {
                                    this. 9 = 9 ;
                                                                                                   produce waiting
   while (! valueset)
                                                               (String args ( ) (
                                    new Thread (this,
                                                                                                    Got: 2
   try (
                                                                Qq = new Q();
                                     "Produce"). start();
                                                                                                    Intimate produces
                                                               new producer (q):
  System. out. printlin (" In Consumer
                                                                                                    Consumer : 2
                                    public void run ()
                                                                new Consumer (a)
  waiting (n");
                                                                System out printly
                                                                                                     Intimate consumer
                                    int i = o
  wait (); }
                                    while ( 1 (15) )
                                                                                                     producer waiting
                                                                (" frem Control - C to
  catch (Interrupt Exception e) {
                                                                   Stop. ");
                                                                                                     Got: 3
                                     2. put (1++):
  System. out. println ("In
                                                                                                     Intimate producer
  Intimate Producers (n");
                                                                                                      consumed: 3
  notify ();
                                                                                                  1 put:4
  return n;
                                                                                                       Intimate Consum
                                                                                                       producer waiting
Synchronized void put (int n) {
                                    class Consumer implements
                                                                                                       Got 4
while (value set)
                                    Runnablef
```

```
Code:
class Q {
int n;
boolean valueSet = false;
synchronized int get() {
while(!valueSet)
try {
System.out.println("\nConsumer waiting\n");
wait();
} catch(InterruptedException e) {
System.out.println("InterruptedException caught");
}
System.out.println("Got: " + n);
valueSet = false;
System.out.println("\nIntimate Producer\n");
notify();
return n;
synchronized void put(int n) {
while(valueSet)
try {
System.out.println("\nProducer waiting\n");
wait();
} catch(InterruptedException e) {
```

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

```
Consumer(Q q) {
this.q = q;
new Thread(this, "Consumer").start();
}
public void run() {
int i=0;
while(i<15) {
int r=q.get();
System.out.println("consumed:"+r);
i++;
}
}
class PCFixed {
public static void main(String args[]) {
Q q = new Q();
new Producer(q);
new Consumer(q);
System.out.println("Press Control-C to stop.");
}}
```

# a) Deadlock

```
System. out. println
                                                                Deadlock () (
    10) 6
                                   ( a guside A . last ");
                                                               Threat. currentthread ().
    Dead lak
                                                               getName (" Main Thread):
    A thread enters the
                                                               Threadat = new Thread
    monitor on object x and
                                  Class B (
                                                               (This, "RacingThread"):
   another thread enters the
                                   synchronized void bon (A a)
                                                                t. start ()
    monitor on object Y. It
                                   String name = Thread.
                                                               a. foot (b);
    the thread in X tries to
                                   current Thread (). get Nau()
                                                               System. println (" Back
                                   System.out.printlu
    call any synchronized
                                                               in main thread "):
                                   (name + " cutered B.bar")
    method on x , it will block
    as expected
                                    try 5
                                                               public void runco (
                                    thread . sleep (1000)
                                                                b. ban (a);
                                    I catch (Exception e)
                                                                System.out. println
  Class A &
                                    System.out. println
                                                                ("Back in other thread");
 Synchronized void foo(Bb) f
                                   ("B Interupted")
  String name = Thread.
                                                               public static void main
  current Thread() .get Name();
                                   System. out. printen
                                                                (String args [7) [
  Systems outsprintly ( name +
                                   (name + "trying to call
                                                                 new Deadlock ();
  "entered A. foo");
                                     A. last()"):
                                    a.last():
  Thread. sleep (1000);
                                                                                28/12
 I catch (Exception e) (
                                                                Output->
                                   void last () [
 System.out. println
                                                                Main Thread entered A. foo
                                    System.out. println
                                                                Racing Thread entered A. foo
 ("A Interupted");
                                    (Unside A. tast")
                                                                Racing Thread entered B.ban
System. out printin
                                                                MainThread trying to call B. laste)
 "one + "trying to call B.losto")"
                                                                Inside Alast
                                     class Deadlock implements
 b. last ();
                                                                 Racing Thread trying to call A. last()
                                     Runnable (
                                                                 Back in main thread
void last ()
                                      A a = new AC);
                                                                 guside A-last
                                      Bb = new B();
                                                                 Back in other thread
```

```
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();
}
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();
void last() {
System.out.println("Inside A.last");
}
}
class Deadlock implements Runnable
A a = new A();
B b = new B();
Deadlock() {
Thread.currentThread().setName("MainThread");
Thread t = new Thread(this, "RacingThread");
t.start();
a.foo(b);
System.out.println("Back in main thread");
public void run() {
b.bar(a);
System.out.println("Back in other thread");
}
public static void main(String args[]) {
```

new Deadlock();