VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.



LAB REPORT on

Object Oriented Java Programming (23CS3PCOOJ)

Submitted by

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in partial fulfillment for the award of the degree of BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING



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CERTIFICATE

This is to certify that the Lab work entitled "Object Oriented Java Programming (23CS3PCOOJ)" carried out by Keerthana H Bhat(1BM23CS148), who is a bonafide student of B.M.S. College of Engineering. It is in partial fulfillment for the award of Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belgaum. The Lab report has been approved as it satisfies the academic requirements in respect of an Object Oriented Java Programming (23CS3PCOOJ) work prescribed for the said degree.

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Index

Sl. No.	Date	Experiment Title	Page No.
1	30/9/24	Quadratic Equations	4-6
2	7/10/24	Calculation of SGPA	7-12
3	14/10/24	tostring() book details	13-17
4	21/10/24	Finding area using abstract class	18-21
5	28/10/24	Bank class using inheritance concept	22-30
6	11/11/24	Marks card of student using Packages	31-36
7	28/11/24	Father's age and Son's age usingException Handling	37-41
8	28/11/24	Display the college name and department using threads	42-44
9	28/11/24	Creation of Divider app	45-48
10	28/11/24	a) Demonstration of Inter process communicationb) Demonstration of Deadlock	49-59

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

```
System , out print In ("Root are equal").
                                                              System out quintle ( "Root 1 = " +xoot 1)
                                                             else i[(d>0)
                                                                 System. out printle ("Roots are real and difference,
import yara lang , Math ;
         double rout 1, 20012, realport, imapart, d',
         void getal)
          Scanner &c - new Scannor (System.in);
          System. out print In ("Enter the value of a");
           a = sc. next (nt ();
          System. out probt in ("kuter the value of ")
            b=sc. next Int ();
          System. out . print In ("Enter the value of "
          c=sc. nextInt();
             200tlo 200t2 = -b/(2* a);
```

```
Code:
import java.util.Scanner;
import java.lang.Math;
class Quadratic{
       int a,b,c;
       double root1,root2,realpart,imagpart,d;
       void getd()
{
       Scanner sc=new Scanner(System.in);
       System.out.println("Enter the value of a");
       a=sc.nextInt();
       System.out.println("Enter the value of b");
       b=sc.nextInt();
       System.out.println("Enter the value of c");
       c=sc.nextInt();
}
       void compute()
{
       d=b*b-4*a*c;
       if(d==0)
{
       root1=root2=-b/(2*a);
       System.out.println("Roots are equal");
       System.out.println("Root1="+root1);
       System.out.println("Root2="+root2);
}
       else if(d>0)
       System.out.println("Roots are real and different");
       root1=(-b+Math.sqrt(d))/(2.0*a);
       root2 = (-b-Math.sqrt(d))/(2.0*a);
       System.out.println("Root1="+root1);
       System.out.println("Root2="+root2);
}
       else if(d<0)
       System.out.println("Roots are imaginary");
       realpart=-b/(2*a);
       imagpart = Math.sqrt(-d) / (2.0 * a);
       System.out.println("Root1=" + realpart + " + " + imagpart + "i");
       System.out.println("Root2=" + realpart + " - " + imagpart + "i");
```

```
}
}}
class QuadraticMain{

    public static void main(String args[])
{
        Quadratic q=new Quadratic();
        q.getd();
        q.compute();
        System.out.println("name:Keerthana H Bhat");
        System.out.println("USN:1BM23CS148");
}
Output:
```

```
C:\Windows\System32\cmd.e X
Microsoft Windows [Version 10.0.22631.4169]
(c) Microsoft Corporation. All rights reserved.
D:\1BM23CS148>javac QuadraticMain.java
D:\1BM23CS148>java QuadraticMain
Enter the value of a
Enter the value of b
Enter the value of c
Roots are real and different
Root1=-1.0
Root2=-2.0
D:\1BM23CS148>java QuadraticMain
Enter the value of a
Enter the value of b
Enter the value of c
Roots are real and different
Root1=-2.0
Root2=-3.0
D:\1BM23CS148>javac QuadraticMain.java
D:\1BM23CS148>java QuadraticMain
Enter the value of a
Enter the value of b
Enter the value of c
Roots are equal
Root1=-1.0
Root2=-1.0
D:\1BM23CS148>javac QuadraticMain.java
```

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.

```
impact ejava. util . Scanner;
class Subject &
      int glade;
      int credit;
class Student ?
        String name;
        double supA;
        Subject [] subjects;
        Student () &
             subjects = new Subject[8];
for (int i=0; i<8; htt) {

subjects[1] = new Subject().
   Void getDetails (scanner sc)

§ system.out.println ("Enter USN;"

usn = sc.nextlinel);
        System. out-printin ("Enter norme".
          name = sc. next line ()
  void get Marks (scanner sc) {
          double totalScore = 0;
int totalCadub = 0;
```

```
System. out printle ("know marks for 8 subjects"
  for (int j. 0; j(8; j++)
 & system. out. println (" Enter marks for subject "+ 5+5
     int marks = sc. next Int ();
     System.out. printle ("Enter the credits for subjects
                       G+1)+ ": ");
          credits = sc. next Int ();
       int grade = (marks/10)+1;
       $ 16 (grade > 10) grade > 10;
       Subjects [j]. credits = credits;
       subjects [j]. grade - grade;
       totalswre + = grade * credits;
        fotal credits + = credits;
    SGPA = totalswre / fotalcoedets;
void diplay StrPA () 8
     System.out. Println ( "SCIPA of student "+ nan
                              ("+ usn+ ") " + 50
```

```
public class Student Mains &
   public state void main (string[] args ) ?
                                              18M23CS 148
    Scanner sc . new Scanner (syskem.in);
                                              Keerthand Je Bhat
    System out printly ("Enter the no of students")
                                              Enter marks for 8 subject ,
    int numStadunts . Schertint ();
                                              Ender marks for subject 1:
    sc. nerthine();
                                              know the credit for subject !
     Student [] students = new student [numstructual
                                              Enter marks for subject 2:
     Jorlant i = 0; ix num Students ; i+1)
                                              the the credit for subject a:
       Eystun.out peint in ["Entering details for s
                                              take the marks for subject 3:
     students (i) = new Student ();
       students [i], got betails (sc);
                                              Endu the credit for subject 3:
       students [i]. get Marks (se)
                                               Khohe the marks for subject 4:
       students [1]. display SGPA ();
                                               Enter the credit for subject "
      sc.close ).
                                               khole She
                                                          marks for subject 5
                                                           credits for subject s
                                               Kutu ma
                                                Endu marks for subject 6
                                                90
                                               Enter the
                                                Enter the marks for subject ?
```

Endu the marks for subject 8!

The the marks for subject 8!

The the credits for subject 8!

SGPA of student keerthana 11 Bhat (181123CS148):99

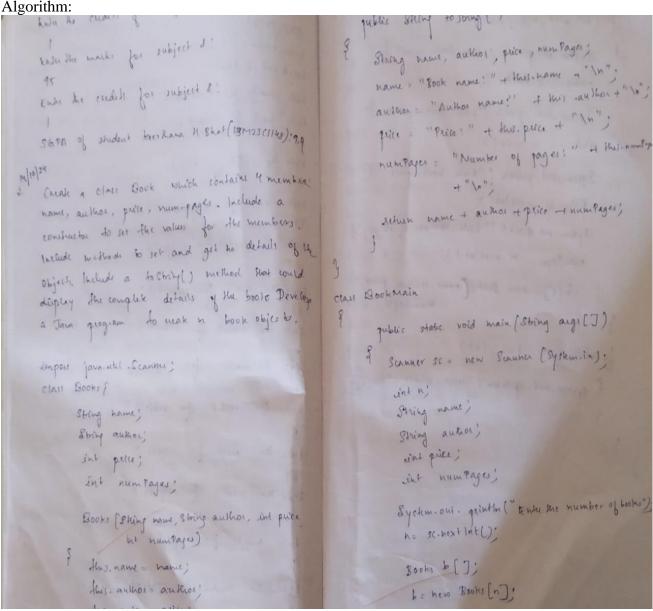
```
Code:
import java.util.Scanner;
class Subject {
  int grade;
  int credits;
}
class Student {
  String usn;
  String name;
  double SGPA;
  Subject[] subjects;
  Student() {
     subjects = new Subject[8];
     for (int i = 0; i < 8; i++) {
       subjects[i] = new Subject();
  }
  void getDetails(Scanner sc) {
     System.out.println("Enter USN:");
     usn = sc.nextLine();
     System.out.println("Enter name:");
     name = sc.nextLine();
  }
  void getMarks(Scanner sc) {
     double total Score = 0;
     int totalCredits = 0;
     System.out.println("Enter marks for 8 subjects:");
     for (int j = 0; j < 8; j++) {
       System.out.println("Enter marks for subject " + (j + 1) + ":");
       int marks = sc.nextInt();
       System.out.println("Enter the credits for subject " + (j + 1) + ":");
       int credits = sc.nextInt();
       int grade = (marks / 10) + 1; // Calculate grade based on marks
       if (grade > 10) grade = 10; // Cap grade at 10
       // Store the information in the subjects array
       subjects[j].credits = credits;
       subjects[j].grade = grade;
```

```
// Calculate score based on grade and credits
       totalScore += grade * credits;
       totalCredits += credits; // Accumulate total credits
    // Compute SGPA
     SGPA = totalScore / totalCredits;
  }
  void displaySGPA() {
     System.out.println("SGPA of student " + name + " (" + usn + "): " + SGPA);
}
public class StudentMains {
  public static void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     System.out.println("Enter the number of students:");
     int numStudents = sc.nextInt();
     sc.nextLine(); // Consume the newline
     Student[] students = new Student[numStudents];
     for (int i = 0; i < numStudents; i++) {
       System.out.println("Entering details for student " + (i + 1));
       students[i] = new Student();
       students[i].getDetails(sc);
       students[i].getMarks(sc);
       students[i].displaySGPA();
     sc.close(); // Close the scanner
  }
```

Output:

```
Microsoft Windows [Version 10.0.22000.1696]
(c) Microsoft Corporation. All rights reserved.
D:\>javac StudentMains.java
D:\>java StudentMains
Enter the number of students:
Entering details for student 1
Enter USN:
1BM23CS148
Enter name:
Keerthana H Bhat
Enter marks for 8 subjects:
Enter marks for subject 1:
Enter the credits for subject 1:
Enter marks for subject 2:
Enter the credits for subject 2:
Enter marks for subject 3:
Enter the credits for subject 3:
Enter marks for subject 4:
Enter the credits for subject 4:
Enter marks for subject 5:
Enter the credits for subject 5:
Enter marks for subject 6:
Enter the credits for subject 6:
Enter marks for subject 7:
Enter the credits for subject 7:
Enter marks for subject 8:
90
Enter the credits for subject 8:
SGPA of student Keerthana H Bhat (1BM23CS148): 9.6
D:\>
```

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.



```
for (int i=0) ich; ind)
                                                    DETPUT
  System , out printly ("Enter book name;");
                                                    Ender the number of books
   name sc. next();
                                                    Entu book name!
   System-out printle ("Enter author hame!");
                                                     Enla
 author: sc. next ()
   System. out. printle (" Ene book price: ");
                                                    OUTPUT!
                                                    Keuthana H Bhat! 18M28 CS 148
   Price = sc , next Int ();
                                                     Ender the number of books
    System out quint In [" Enter noumber of pages", )
     num?ages = se. next int ()
                                                     Enter book name!
      b[i] - new Books (name, author, price,
                                                     Javal
                            numPages );
                                                     Enter author name!
for (int i = 0; i < n; i+A)
                                                     Ensu book price!
                                                     150
 & system. out. grinten ("Book : delails:" +b[i])
                                                     Ewa number of page.
                                                      250
                                                      Enla book name:
                                                      Java2
                                                      Khou author name
                                                      Acha
                                                      Enter book price:
                                                      225
                                                      Kula number of gages
```

```
Book Defails! Book name: Java (

Author name: Kiran

Price: 150

Number of pages: 250

Book Defails: Book name: Java 2

Author name: Asha

Paice: 225

Number of pages: 275
```

```
Code:
import java.util.Scanner;
class Books{
       String name;
       String author;
       int price;
       int numPages;
       Books(String name, String author, int price, int numPages)
       {
       this.name = name;
       this.author = author;
       this.price = price;
       this.numPages = numPages;
       }
       public String toString()
       {
       String name, author, price, numPages;
       name = "Book name: " + this.name + "\n";
       author = "Author name: " + this.author + "\n";
       price = "Price: " + this.price + "\n";
       numPages = "Number of pages: " + this.numPages + "\n";
       return name + author + price + numPages;
       }
class BookMain
{
       public static void main(String args[])
```

```
{
       Scanner sc = new Scanner(System.in);
       int n;
       String name;
       String author;
       int price;
      int numPages;
       System.out.println("Keerthana H Bhat:1BM23CS148");
       System.out.println("Enter the number of books");
       n=sc.nextInt();
       Books b[];
       b = new Books[n];
       for(int i=0;i<n;i++)
              System.out.println("Enter book name:");
              name=sc.next();
              System.out.println("Enter author name:");
              author=sc.next();
              System.out.println("Enter book price:");
              price=sc.nextInt();
              System.out.println("Enter number of pages:");
              numPages=sc.nextInt();
              b[i] = new Books(name,author,price,numPages);
       for(int i=0;i<n;i++)
              System.out.println("Book Details:"+b[i]);
}
```

Output:

C:\Windows\System32\cmd.e X Microsoft Windows [Version 10.0.22631.4169] (c) Microsoft Corporation. All rights reserved. D:\1BM23CS148>javac BookMain.java D:\1BM23CS148>java BookMain Keerthana H Bhat:1BM23CS148 Enter the number of books 2 Enter book name: Java1 Enter author name: Kiran Enter book price: 150 Enter number of pages: Enter book name: Java2 Enter author name: Asha Enter book price: Enter number of pages: 275 Book Details:Book name: Java1 Author name: Kiran Price: 150 Number of pages: 250 Book Details:Book name: Java2 Author name: Asha Price: 225 Number of pages: 275 D:\1BM23CS148>

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.

4. Develop a Java gregiam to cuat an abilitation class hamed shape that contains two integers and an empty method named print Area and an empty method named print Area of the classes and circle such that each one of the classes and circle such that each one of the extends the class shape. Each one of the extends the crosses contain only the method print Area () that classes contain only the method print Area () that class shape the given shape. Jungost java will Scanner to given shape. Jungost java will Scanner to given shape. Jungost java will Scanner to given shape to double length, breadth, base, height, radius result; abstract void print Area (). Class Rectangle extends shape to void print Area (). Scanner so new Scanner (system In). Scanner so new Scanner (system In). Scanner so next Double (). breadth o so next Double (). breadth o so next Double (). Tesult semish threadth. System out print ("Area of Aretargle: "treatly	class Triangle extends Shape? Void paint Area () Scarker see new Scanner (systemin); System. out. quintin ("Enter dimensions of triangle"); base o see next Double (); height o see next Double (); result o 0.5 of base of height; System. out printin ("Area of triangle "+result), g class (cacle extends shape? void printiarial) Scanner see new Scanner (system.in); System. out. printin ("Enter radius of circle"); Radius = see next Double (); result. Mala. T = radius of circle" + result); System. out. printin ("Area of circle" + result); g class Main Class? publice state voice main (string args ()) Rectangle re new Rectaryle (); a print Area(); Triangle of hero Triangle ();
System. out printing	Triangle 1 = new Triangle (2)

```
OUTPUT: K Bhot! IBM23CS 148
Enter dimensions of sectangle

2 3
Asea of sectangle: 6.0
Enter dimensions of triangle.

2 4
Area of triangle: 4.0
Enter radius of circle 3
Area of circle 28.274333882308
```

```
Code:
import java.util.Scanner;
import java.lang.Math;
abstract class Shape{
       double length, breadth, base, height, radius, result;
       abstract void printArea();
}
class Rectangle extends Shape{
void printArea()
       Scanner sc=new Scanner(System.in);
       System.out.println("Enter dimensions of rectangle");
       length=sc.nextDouble();
       breadth=sc.nextDouble();
       result=length*breadth;
       System.out.println("Area of rectangle:"+result);
}
```

```
class Triangle extends Shape{
void printArea()
       Scanner sc=new Scanner(System.in);
       System.out.println("Enter dimensions of triangle");
       base=sc.nextDouble();
       height=sc.nextDouble();
       result=0.5*base*height;
       System.out.println("Area of triangle"+result);
class Circle extends Shape{
void printArea()
       Scanner sc=new Scanner(System.in);
       System.out.println("Enter radius of circle");
       radius=sc.nextDouble();
       result=Math.PI*radius*radius;
       System.out.println("Area of circle"+result);
class MainClass{
public static void main(String args[])
       System.out.println("Keerthana H Bhat:1BM23CS148");
       Rectangle r =new Rectangle();
       r.printArea();
       Triangle t=new Triangle();
       t.printArea();
       Circle c = new Circle();
       c.printArea();
}
```

```
Output:
Microsoft Windows [Version 10.0.22631.4169]
(c) Microsoft Corporation. All rights reserved.
 D:\1BM23CS148>javac MainClass.java
D:\1BM23CS148>java MainClass
Keerthana H Bhat:1BM23CS148
Enter dimensions of rectangle
2 3
Area of rectangle:6.0
Enter dimensions of triangle
2 4
Area of triangle4.0
Enter radius of circle
 Area of circle28.274333882308138
 D:\1BM23CS148>
```

Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called a 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 a 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 deposits from customers and update the balance.
- b)Display the balance.
- c)Compute and deposit interest
- d)Permit withdrawal and update the balance
- e) Check for the minimum balance, impose a penalty if necessary and update the balance.

Create a class Account that story customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make keem more specific to their signisements. tuclude the necessary methods in order to achieve the following tasks: a) Accept deposit from customer and update the balance b) Display the balance c) Compete and deposit interest d) Permit withdrawal and update the balance e) Check for the minimum balance, impose finalty of necessary and update the balance simport yava. util. Scanner) abstact class Account f String customerName; String account Number double balance public Account (8 tring customer Name, & tring account I this customer Name - customer Name : this account Number = account Number. this. balance = or 0.

```
public void deposit (double amount)?
                                                            public void willidian (double amount) !
                                                                of Camount to balance &
         balance to amount;
         System. our printle (" Deposited: " of amount)
                                                                      balance - = amount;
                                                                      Eystem. out. println (" Withdraw: " + amount);
  public double getBalance() {
            Returbalance;
                                                                    Bysken- out. printly ("Insufficient Junch
    public abstract void display Balance ();
                                                                      withdrawal of " + amount);
    perblic abstract void willdraw (double amount).
Class SavAcet extends Account &
                                                           class CurAcit extends Account 1
                                                              = private double minimum Balance
       double interest Rate;
        public SavAcct (String customer Name, String
                                                                private double service charge
                        accountnumber, double interestRate
                                                                public CurAcct (String customer Names
         Super (austomer Name, account Number);
                                                                 String account Number, double minimum Balance
            this interesticale : interesticale;
                                                                 double de service Charge ) }
                                                                   Super (customer Name, account Number);
gubic void compute And Deposit Interest () of
                                                                  this, minimum Balance a minimum Balance;
       double interest : balance & sinterest Rate / 100;
                                                               fair, service Change = service Charge;
        balance + = interest;
        System. out. printla ("Inderest . 6" et interest +
                                                             public void display Balance () &
                                                                  System-out-grantly ("Current Acidoral Ralance:"
                           " has been added to your
                           account ");
                                                                  check Minimum Balanco ()
passion void display Dalance () f
                                                            public void withdraw (double amount) }
      &yskm-out. painth ("Savings Account Balances
                                                                  16 (amount to balance)
                                   of barance );
```

```
String account Numbers sc. heat line ();
System.out. printin ("hallhours" of amount)
                                                                Account account = null'
 aneck Minimum Balance ();
                                                               eif (account Type, equals Ignore Case ("savings")) }
                                                                    & ystem. out qu'entln ("Enter interest rate")
 else
     system out quential "thoughtierent funds for
                                                                    double interestRate = 30. next Double U.
                                                                     account = new SavAcct ( customer Nane, account Number
private void check Minimum Balancel 1 ?
                                                                 else of (account Type equals Ignore Case ("current"))
     of Chalance ( minimum Balance) 3
                                                                & System. out. println ("Enter minimum balance");
           balance = service Change:
           System-out-println ("Service charge of"
                                                                    double min Balances Sc. heat Double ()
                                + service Eharge + *
                                                                   System.out. grintln ("Enter service change "").
                                " has been applied ");
                                                                    double service Charge = se next Double ()
                                                                    accounts new CurAcet (customer Norm, account Mumber)
public class Bank f
    public state void main (string[] args)
                                                                       System. out grintin (" Invalid account type")
   Bystom. out printle (" Name: Keerkana H. Bhat")
   Eysten. out. grintle ("USN: 18M23CS148");
   Beanner se new Scanner (system. in);
                                                               "white (frue) 3
   System and printly ("Ender the type of account Coursent or savings): ")
                                                                     System, out grindly (1 1. Deposit 1).
                                                                     System.our. printing ( 12. withdraw!).
  String account Type = sc. next Line ()
                                                                     System. out guind In ('3. Jusplay Balance").
   8 ystum. out. println (" Enter ourtomer hame!");
                                                                     if (account instance of Say Acot)
   String customer vame = 31. nexton ();
                                                                         System.ou guntly " Le . Compark and Deposit
   Bystem. out-grintle ("Enter occount number:").
```

```
System. out printly ("J. Exit");
                                                                System. out. quintly ("Exitory");
System. out. println [" Select an opton");
                                                                 ge. close ();
 int option = sc. next Ind ();
                                                                 achunt;
                                                          default. System. out print in ("Invalid choice")
 switch (option) ?
   - case (:
     System out, grintles ("Ender amount to
                     deposit: ");
            double deposit Amount = sc. next Double (),
            account . deposit (deposit Amount );
                                                      OUTPUT !
                                                       Enter the type of account (current or savings).
          buak;
                                                       burrent
            system out grindly ("Enter amount to
                                                        Enter customer hame!
                                withdraw").
             double withdraw Amount = se riext. Double ()
                                                        Keerhan
                                                        Enter account number:
              account withdraw (withdraw Amount);
                                                        Enter minimum balance!
              break )
                                                         10000
                                                         Enter service change!
              account. display Balance ()-
     cases:
              break;
                                                        1. Deposit
                                                         2. Withdraw
              eflacions instance & SavAcot)?
                                                         3. Desplay Balance
                   ([ SavAcit account), compute And
                                                         u. Exit
                                                      expedent an option!
               System.out. println ("Invalid option for
                                                         Enter amount to deposit:
                                                          25000
                enrient account ")
```

```
1. Deposit

2. Willadian

3. Display Balance

5. Exit

Select an option: 2

Enter amount to withdraw,

5000

Withdrew 5000.0

1. Deposit

2. Willidian

3. Display Balance

5 Set Enit

Select an option

3

Current Account Balance: 20000.0
```

```
Code:
import java.util.Scanner;
abstract class Account {
  String customerName;
  String accountNumber;
  double balance;
  public Account(String customerName, String accountNumber) {
    this.customerName = customerName;
    this.accountNumber = accountNumber;
    this.balance = 0.0;
  }
  public void deposit(double amount) {
    balance += amount;
    System.out.println("Deposited: " + amount);
  public double getBalance() {
    return balance;
  }
  public abstract void displayBalance();
  public abstract void withdraw(double amount);
class SavAcct extends Account {
  double interestRate;
  public SavAcct(String customerName, String accountNumber, double interestRate) {
     super(customerName, accountNumber);
    this.interestRate = interestRate;
  }
  public void computeAndDepositInterest() {
    double interest = balance * interestRate / 100;
    balance += interest;
    System.out.println("Interest of " + interest + " has been added to your account");
  }
  public void displayBalance() {
    System.out.println("Savings Account Balance: " + balance);
  public void withdraw(double amount) {
```

```
if (amount <= balance) {
       balance -= amount;
       System.out.println("Withdrew: " + amount);
       System.out.println("Insufficient funds for withdrawal of " + amount);
  }
}
class CurAcct extends Account {
  private double minimumBalance;
  private double serviceCharge;
  public CurAcct(String customerName, String accountNumber, double minimumBalance,
double serviceCharge) {
    super(customerName, accountNumber);
    this.minimumBalance = minimumBalance;
    this.serviceCharge = serviceCharge;
  }
  public void displayBalance() {
    System.out.println("Current Account Balance: " + balance);
    checkMinimumBalance();
  }
  public void withdraw(double amount) {
    if (amount <= balance) {
       balance -= amount;
       System.out.println("Withdrew " + amount);
       checkMinimumBalance();
     } else {
       System.out.println("Insufficient funds for withdrawal of " + amount);
  }
  private void checkMinimumBalance() {
    if (balance < minimumBalance) {
       balance -= serviceCharge;
       System.out.println("Service charge of " + serviceCharge + " has been applied");
  }
public class Bank {
  public static void main(String[] args) {
       System.out.println("Name:Keerthana H Bhat");
       System.out.println("USN:1BM23CS148");
```

```
Scanner sc = new Scanner(System.in);
     System.out.println("Enter the type of account (current or savings):");
    String accountType = sc.nextLine(); // Fixed variable name
    System.out.println("Enter customer name:");
    String customerName = sc.nextLine(); // Fixed variable name
     System.out.println("Enter account number:");
    String accountNumber = sc.nextLine();
     Account account = null;
    if (accountType.equalsIgnoreCase("savings")) {
       System.out.println("Enter interest rate:");
       double interestRate = sc.nextDouble();
       account = new SavAcct(customerName, accountNumber, interestRate);
     } else if (accountType.equalsIgnoreCase("current")) {
       System.out.println("Enter minimum balance:");
       double minBalance = sc.nextDouble();
       System.out.println("Enter service charge:");
       double serviceCharge = sc.nextDouble();
       account = new CurAcct(customerName, accountNumber, minBalance,
serviceCharge);
     } else {
       System.out.println("Invalid account type");
       return;
    while (true) {
       System.out.println("1. Deposit");
       System.out.println("2. Withdraw");
       System.out.println("3. Display Balance");
       if (account instanceof SavAcct) {
         System.out.println("4. Compute and Deposit Interest");
       System.out.println("5. Exit");
       System.out.println("Select an option:");
       int option = sc.nextInt();
       switch (option) {
         case 1:
            System.out.println("Enter amount to deposit:");
            double depositAmount = sc.nextDouble();
            account.deposit(depositAmount);
            break;
         case 2:
            System.out.println("Enter amount to withdraw:");
            double withdrawAmount = sc.nextDouble();
            account.withdraw(withdrawAmount);
            break:
```

```
case 3:
    account.displayBalance();
    break;
case 4:
    if (account instanceof SavAcct) {
        ((SavAcct) account).computeAndDepositInterest();
    } else {
        System.out.println("Invalid option for current account");
    }
    break;
case 5:
    System.out.println("Exiting");
    sc.close();
    return;
    default:
        System.out.println("Invalid option");
    }
}
Output:
```

```
Exiting the program.
String customerName;
String accountNumber;
String accountType;
double balance;
                                                                                                                                                                                                                                                                                                             D:\1BM23CS142>javac Bank.java
                                                                                                                                                                                                                                                                                                             D:\1BM23CS142>java Bank
                                                                                                                                                                                                                                                                                                             Enter customer name: Kashvi Agarwal
Enter account number: 1BM23CS142
Choose account type (savings/current): current
Account(String customerName, String accountNumber, String accountType) {
    this.accountNumber = accountNumber;
    this.accountType = accountType;
    this.balance = 0.0;
    \text{\text{\text{Normal}}}
                                                                                                                                                                                                                                                                                                            Menu:
1. Deposit
2. Withdraw
3. Display Balance
5. Exit
Choose an option: 1
Enter deposit amount: 1000
Deposited: 1000.0
Current Balance: 1000.0
did deposit(double amount) {
    balance += amount;
    System.out.println("Deposited: " + amount);
    displayBalance();
 }
void displayBalance() {
System.out.println("Current Balance: " + balance);
 }
double getBalance() {
return balance;
                                                                                                                                                                                                                                                                                                            nenu:
1. Deposit
2. Withdraw
3. Display Balance
5. Exit
Choose an option: 2
  abstract void withdraw(double amount);
}
class SavAcct extends Account {
   double interestRate;
   SavAcct(String customerName, String accountNumber, double interestRate) {
   super(customerName, accountNumber, "Savings Account");
   this.interestRate = interestRate;
                                                                                                                                                                                                                                                                                                            Enter withdrawal amount: 200
Withdrawn: 200.0
Service charge applied: 50.0
Current Balance: 750.0
void computeAndDepositInterest() {
double interest = balance * (interestRate / 100);
balance += interest;
System.out.println("Interest added: " + interest);
displayBalance();
                                                                                                                                                                                                                                                                                                              1. Deposit
2. Withdraw
3. Display Balance
                                                                                                                                                                                                                                                                                                             5. Exit
Choose an option: 3
Current Balance: 750.0

}

void withdraw(double amount) {
if (amount > balance) {
   System.out.println("Insufficient funds for withdrawal.");
} else {
   balance -= amount;
   System.out.println("Withdrawn: " + amount);
   displayBalance();
}

                                                                                                                                                                                                                                                                                                             1. Deposit
2. Withdraw
3. Display Balance
                                                                                                                                                                                                                                                                                                            5. Exit
Choose an option: 5
Exiting the program.
```

Create a package CIE which has two classes- Student and Internals. The class Student has members like usn, name, sem. The class Internals derived from Student 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.

```
Student - java
amport CIE. Internals;
                                                                  Import java. util- Scanner
                                                                  public class Student !
                                                                        qualic String use on new String ();
 class main &
   quality state void main (String args [])
                                                                         public Sting name - new String ()
         Internals internal Student = new Internals ()
                                                                          public int sems
         inderna Istudent usn = "IBM23CS 148";
                                                                     qublic void input student Details ()
          internal Student . name = " toer than H Bhat"
                                                                         Scanner se = new Scanner (Systemisn)
          internal student - sem = 3;
                                                                             usu = sc. nextline ( )5
                                                                              name = sc. next Line ();
          insernal Student injut (It mailes ().
                                                                              Sem = se- nextint ()
          internal Student, calculate Final Marks ()
           internal & trobent. display Final Marks ()
                                                                    gublic void display&tudent Details ()
         Exernals external student = new Externals ();
                                                                          System-out-paintle ("USN!" + usn)
                                                                           System-out printle ("Name!" + name)
            exernalstudent usn = 1818142365148".
            external Student-name - "Keerthana H Blat"
             External Student - seen = 3;
             external Student. input SEE marks ();
             external student, calculate Final Marks ()?
```

```
Externals jara
     Internals. javo
                                                       package SEE;
package CIE;
                                                        import CIE. Internals;
Import Java will scanner;
                                                        import (1E-student;
 queblic class Internals entends Soudent of
                                                        import java. wal. scanner
      public Int marke[] = new Int [8];
                                                        public class Externals extends Student?
       public vold singut (1E mailes (1)
                                                                public int marks[]. new int [5],
          Scanner sc = new Scanner ( system sn);
                                                                public int firetmanks[] = new int[5]
         System. out grintle ("Enter marks for 5 subjecting.
                                                                public Externals () }
       for lent 220; 165; 1+1)3
                                                                     marks = new lat [5];
            Fy Hem out part ("Enter marks for subject",
                                                                    final marks = new int [5]:
                               (1+1)+";").
                                                              public void inputstimaks ()?
            marks [1] = sc. nextInt L);
                                                              Scanner se = new Scanner (System (n);
                                                               System out printing "Enter SET marks for 5 subjects")
   quebac vad calculate Dinalmantes () }
                                                                for land 1=0 ; 1<5; 1+1)3
                                                                    System out. point ( * Enter marks for subject
                                                                                       (1+1)+11:11)
    public void displayfinal marks () }
                                                                     marks(i)= sc. next (n+();
           displayStudent retails()
           System.out. println [" (IE Final Muchs!").
                                                             public void calculate Final Marks () ?
           forlint 120 ; 100; 1++)
                                                                forling (=0; 105; i++)
                System. out printle ("Subject" + (A1)
                                                                   of finalmarks [1] = marks [1]; ]
                                       + 11: "+ marky[1]
                                                               public void display time ( ) ?
```

```
System.out.printh (" Final Marks for 5 subjects.
  fox ( that red; i < 5; 1+2) ?
         System.out print m (" Jubject" + (1+1)+ ": }
OUTPUT: -
Enter he number of students: 2
Enter details for student 1
USN 1 18M23C510148
Name: ABC
Semester ! 3
Enter details for 8 tudent: 1
USN: 18M23CS150
Name: XYZ
Semester: 3
      internal marks for 3 courses (for student 1)
 Ender get marker for 3 courses (for student 1)
 95 96 97
Enfa internal marks for 3 courses (for Student 2)
 41 42 43
Enter SEE marks for 3 courses (for Student 2)
 90 91 92.
 Final Marke:
 Student ! 1
 92.5 94
                   95.5
Student : 2
                 89.
     87.5
  8 6
```

```
Code:
Main class:
import CIE.Internals;
import SEE.Externals;
class Main {
  public static void main(String args[]) {
    Internals internalStudent = new Internals();
    internalStudent.usn = "1BM23CS148";
    internalStudent.name= "Keerthana H Bhat";
    internalStudent.sem=3;
    internalStudent.inputCIEmarks();
    internalStudent.calculateFinalMarks();
    internalStudent.displayFinalMarks();
    Externals externalStudent = new Externals();
        externalStudent.usn = "1BM23CS148";
    externalStudent.name = "Keerthana H Bhat";
    externalStudent.sem=3;
    externalStudent.inputSEEmarks();
    externalStudent.calculateFinalMarks();
    externalStudent.displayFinalMarks();
  }
In CIE package:
package CIE;
import java.util.Scanner;
public class Internals extends Student {
  public int marks[] = new int[5];
    public void inputCIEmarks() {
    Scanner sc = new Scanner(System.in);
```

```
System.out.println("Enter marks for 5 subjects:");
     for (int i = 0; i < 5; i++) {
       System.out.print("Enter marks for subject " + (i + 1) + ": ");
       marks[i] = sc.nextInt();
       }
       public void calculateFinalMarks() {
    public void displayFinalMarks() {
     displayStudentDetails();
     System.out.println("CIE Final Marks:");
     for (int i = 0; i < 5; i++) {
       System.out.println("Subject " + (i + 1) + ": " + marks[i]);
   }
In SEE Package:
package SEE;
import CIE.Internals;
import CIE.Student;
import java.util.Scanner;
public class Externals extends Student {
 public int marks[] = new int[5];
 public int finalMarks[] = new int[5];
  public Externals() {
    marks = new int[5];
    finalMarks = new int[5];
  }
    public void inputSEEmarks() {
Scanner sc = new Scanner(System.in);
```

```
System.out.println("Enter SEE marks for 5 subjects:");\\ for (int i = 0; i < 5; i++) { \\ System.out.print("Enter marks for subject " + (i + 1) + ": ");\\ marks[i] = sc.nextInt();\\ }\\ public void calculateFinalMarks() { \\ for (int i = 0; i < 5; i++) { \\ finalMarks[i] = marks[i];}\\ }\\ public void displayFinalMarks() { \\ displayStudentDetails();\\ System.out.println("Final Marks for 5 subjects:");\\ for (int i = 0; i < 5; i++) { \\ System.out.println("Subject " + (i + 1) + ": " + finalMarks[i]); // Print final marks }\\ }\\ }\\ }\\
```

Output:

```
D:\lBM23CS148>java Main
Enter marks for 5 subjects:
Enter marks for subject 1: 95
Enter marks for subject 2: 87
Enter marks for subject 3: 88
Enter marks for subject 4: 90
Enter marks for subject 5: 96
USN:1BM23CS148
Name:Keerthana H Bhat
Sem:3
CIE Final Marks:
Subject 1: 95
Subject 2: 87
Subject 3: 88
Subject 4: 90
Subject 5: 96
Enter SEE marks for 5 subjects:
Enter marks for subject 1: 75
Enter marks for subject 1: 75
Enter marks for subject 2: 89
Enter marks for subject 3: 99
Enter marks for subject 4: 67
Enter marks for subject 5: 87
USN:1BM23CS148
Name:Keerthana H Bhat
Sem:3
Final Marks for 5 subjects:
Subject 1: 75
Subject 2: 89
Subject 3: 99
Subject 4: 67
Subject 5: 87
```

Program 7

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

```
Program No 7.

1. White a Java program with taker and son classes that
demonstrate handling of exception in intersance time
   import java. util. & canner"
   class wrong Age extends Exception?

public wrong Age ()?

super ("Age Error");

gubere wrong Age (string Message)

gubere wrong Age (string Message)

guper (message); y
          property int bakerAge;
          public Father () theore wrong Age {
          Scanner 3 - new Scanner (system.ir);
System. out. println ("Encer Father's Age: ");
            father Age = sonextint()
            of (fasher bye < 0) }
                  throw new wrong Age ("Age cannot be negative")
    class son exhads taker J
                   prevate sint sonAge;

public son() throws wrong Age ?
                          super ()
                   Scanner s a new Scanner (system-in);
                   System. out. print In ("Enter son's age ").
                    sou Age = 9. hex fint();
```

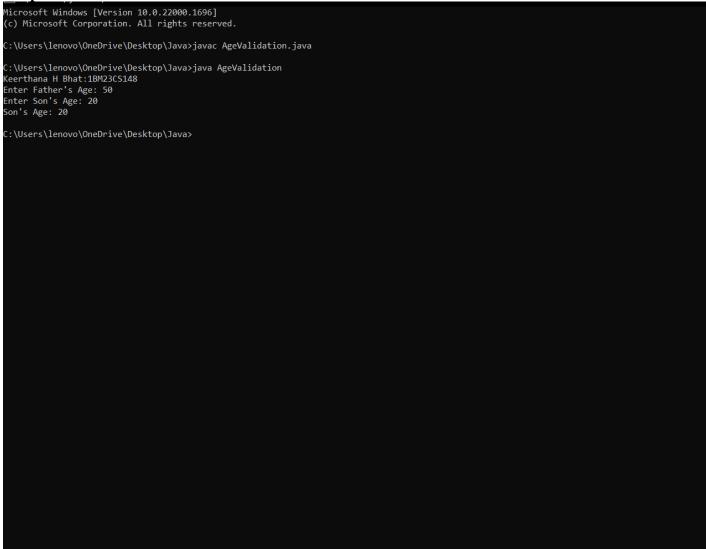
```
uf (son Age (0) {
        Shrow new Wroup Age ("Age cannot be negative")
of (son Age > father Age) &
     throw new Wrong Age (" Sou's age cannot be grahe
       than father's age ");
       void deiplay () {
        gystem.out. printla (" son's Age: " + son Age)
Public class Age Validation f
        gubber state void main (String [] args)
     & hyl
             Son son = new Son ();
             son-display().
          g catch (Wrong Age e)
           System-out println ("Exception": "+ e-getn
GUTPUT:
        Father's Age! 50
 Enfer
 Enter Souls Age! 20
 Son's Age 120.
```

Code:

```
import java.util.Scanner;
class WrongAge extends Exception {
  public WrongAge() {
    super("Age Error");
  public WrongAge(String message) {
    super(message);
  }
}
class Father {
  protected int fatherAge;
  public Father() throws WrongAge {
     Scanner s = new Scanner(System.in);
    System.out.print("Enter father's age: ");
    fatherAge = s.nextInt();
    if (fatherAge < 0) {
       throw new WrongAge("Age cannot be negative");
     }
  }
  public void display() {
    System.out.println("Father's age: " + fatherAge);
  }
class Son extends Father {
  private int sonAge;
  public Son() throws WrongAge {
     super();
     Scanner s = new Scanner(System.in);
    System.out.print("Enter son's age: ");
     sonAge = s.nextInt();
    if (sonAge >= fatherAge) {
       throw new WrongAge("Son's age cannot be greater than or equal to father's age");
    else if (sonAge < 0) {
       throw new WrongAge("Age cannot be negative");
```

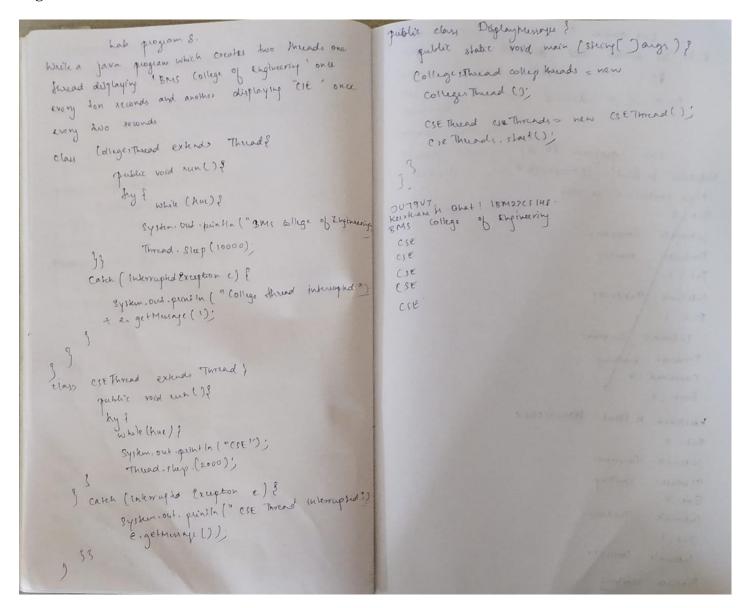
```
}
  public void display() {
    System.out.println("Son's age: " + sonAge);
       System.out.println("Father's age: " + fatherAge);
  }
}
public class ExceptionProgram {
  public static void main(String[] args) {
    try {
       Son son = new Son();
       son.display();
     } catch (WrongAge e) {
       System.out.println(e.getMessage());
finally{
System.out.println("Name: Keerthana H Bhat");
System.out.println("USN: 1BM23CS148");
  }
}
```

Output:



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.



```
Code:
class CollegeThread extends Thread {
  public void run() {
    try {
       while (true) {
         System.out.println("BMS College of Engineering");
         Thread.sleep(10000); // Sleep for 10 seconds
     } catch (InterruptedException e) {
       System.out.println("CollegeThread interrupted: " + e.getMessage());
  }
// Thread to display "CSE" every 2 seconds
class CSEThread extends Thread {
  public void run() {
    try {
       while (true) {
         System.out.println("CSE");
         Thread.sleep(2000); // Sleep for 2 seconds
     } catch (InterruptedException e) {
       System.out.println("CSEThread interrupted: " + e.getMessage());
  }
// Main class to run the threads
public class DisplayMessages {
  public static void main(String[] args) {
    // Create threads
       printf("Keerthana H Bhat:1BM23CS148");
    CollegeThread collegeThread = new CollegeThread();
    CSEThread cseThread = new CSEThread();
```

// Start threads

}

collegeThread.start();
cseThread.start();

Output:

```
Microsoft Windows [Version 10.0.22000.1696]
(c) Microsoft Corporation. All rights reserved.
C:\Users\lenovo\OneDrive\Desktop\Java>javac DisplayMessages.java
C:\Users\lenovo\OneDrive\Desktop\Java>java DisplayMessages
Keerthana H Bhat:1BM23CS148
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
```

Program 9

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

```
Lab program 9
                                                             Jeabel and lab = hew Jeabell);
write a program that creater a user interface to
                                                             1 brm. add (em);
perform integer divisions. The user enters 2 numbers
                                                              jom. add (jeab);
in he lext fields Num! and Num2. The discipron
                                                              jbru - add (ajtb);
of Nam! and Num 2 1, displayed in the Result
                                                               Hrm. add (bjtb)
field to when she divide button is chicked.
                                                              Jorm. add (button)
If Nam I'm Num 2 were not inleger, he program
                                                               Hrm. add (alab);
 would know a Numberformat Exception. Y Nume
                                                               jbrm. add (blab)
 were of the frequent would threw an Arithmetic
                                                               Jorn. add (any lab);
                                                               Action Listener 1 = new Action Listener () &
  exception in a metage dialogue box
                                                               public word action Performed (Action Event Oct) &
  forport javax, swity. +;
                                                              Systemout println ("Action event from a Lox field)
  import Java. ANt, * )
  import java. aut. event. or
                                                            ajty. Add Achonhishmer (1)
  class swing Demo ?
                                                             bith add Actionhistener (1);
   Sning Demo() ?
   Thrame jours new Jerame ("Divider App")
                                                             button add Action Lishner (new Action Lishner () )
    j frm. set Silze (275, 150);
                                                             public void action Reformed (Action Event out) ? by?
    ifrm. set Layout (new Flowlayout ())
                                                              int a = Integer parsetht (aj to get Textl));
    )frm-set Default Close Operation ( ) Frame EXIT_ON_close).
                                                              this bo Integer passe Intlajos get Tout (1)
    Tlabel 'jlab = new Jlabel (" Enter the divider and
                                                               int ans = a/b
                                                               alab-setText ["INA = 1/+a);
    J Textfield ofthe now Textfield (8)
                                                               blab - set Text ("InB = 1 16)
    Treatfield bitto new Treatfield(r)
                                                               andab. set Text ("In Ans = 1 + ans) }
                                                              Catch (Number Format Exaption e) }
    JButton button = new JButton (" (alculate")
                                                               alab. set Text (" ")
                                                               blab - set text (" ")
     JLabel error = new JLabel())
     Thatel alab: new Thatell)
                                                               ansles. get Text!" ")
                                                                ar set Text ("Enter Only Integers!"), ?
     Thabel blab = new Thabel()
```

```
catch ( Arithmetic Exception e) }
   salab-set Text (" ");
blab-set Text (" ");
    any lab. setText(" 1)
    en setText (" B should be non zero "); 3
jom. setvicible(+ ne); }
 public state void main (string angle)
& Swing Utilities. invoke holer (new Runnable () }
    public void rune ) ?
       new Swing Demo ()
```

Code:

import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
class SwingDemo{
SwingDemo(){

```
// create iframe container
JFrame ifrm = new JFrame("Divider App");
ifrm.setSize(275, 150);
ifrm.setLayout(new FlowLayout());
// to terminate on close
jfrm.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
// text label
JLabel jlab = new JLabel("Enter the divider and divident:");
// add text field for both numbers
JTextField aitf = new JTextField(8);
JTextField bitf = new JTextField(8);
// calc button
JButton button = new JButton("Calculate");
// labels
JLabel err = new JLabel();
JLabel alab = new JLabel();
JLabel blab = new JLabel();
JLabel anslab = new JLabel();
// add in order :)
ifrm.add(err); // to display error bois
jfrm.add(jlab);
jfrm.add(ajtf);
ifrm.add(bitf);
jfrm.add(button);
jfrm.add(alab);
ifrm.add(blab);
jfrm.add(anslab);
ActionListener l = new ActionListener() {
public void actionPerformed(ActionEvent evt) {
System.out.println("Action event from a text field"); }
};
ajtf.addActionListener(l);
bitf.addActionListener(l);
button.addActionListener(new ActionListener() {
public void actionPerformed(ActionEvent evt) { try{
int a = Integer.parseInt(ajtf.getText()); int b =
Integer.parseInt(bjtf.getText()); int ans = a/b;
alab.setText("\nA = " + a);
blab.setText("\nB = " + b);
anslab.setText("\nAns = "+ ans);
catch(NumberFormatException e){
alab.setText("");
blab.setText("");
anslab.setText("");
err.setText("Enter Only Integers!"); }
```

```
catch(ArithmeticException e){
alab.setText("");
blab.setText("");
anslab.setText("");
err.setText("B should be NON zero!"); }
});
// display frame
jfrm.setVisible(true);
public static void main(String args[]){ // create frame on event dispatching thread
SwingUtilities.invokeLater(new Runnable(){
public void run(){
new SwingDemo();
});
Output:
  Divider App
          Enter the divider and divident:
         10
                          5
         Calculate
                       A = 10 B = 5 Ans = 2
```

Program 10(a)

Demonstrate Inter process Communication

```
Demonstrate inter process Communication
100)
class a ?
  int n;
    hoolean value set - false;
  synchrowed in get 1) {
  while (I value set)
    System out prindln ("In Consumer waiting la").
   wait-(); )
    catch (interrupted Exception e) }
    System-out-println "Interrupted Exception caught"); 3
    System. out paintle (whot " In);
    value set = babe;
   System. out purith ("In Intimate Producer In")
   notyl);
   return n' 9
    synchronized void put (intn) &
    while (value let)
     fry }
     System out printly ("In Produce waiky In");
     wait (); 3
     catch (Interrupted Exception 1) &
    System.out printle ("Interrupted Exception cary he"); 3
    thes. h = h
      Valuelet = hue;
    System.out pein the (aput! "+ n)
    System. out printing "Indonvic Consumer In3)
```

```
monby(); 93
                                                             clay 4 }
class Producer implements Runnable ?
                                                                synchronized void foo (3 b) ?
                                                                  String hame : Thread. arrent Thread(). get Name
   99;
                                                                  System-out puntle (name + "enteredA foo").
   Froduces (Qq)+
     this-9=9;
                                                               My & Thread. sley (1000); 3
    new Thread (this, "Produce") . Start (): 3
                                                                 catch (Exception e) {
public roid runt );
                                                                     Systemiout. printle (" a interrupted"); 3
       fat 1=0;
                                                               System out printle ( were + "trying to call Bilest (1")
      while (ic15)?
                                                                 2. last (); 9
          9. put(1++); 317
                                                             word last 172
cles Conjumer implement Runnable?
                                                                    Sychem. out printle (" Inside A. Last"); 33
   Qq:
                                                              e LIM B1 synchronized void bon (A a)
  Conunci (Qq) {
     this. 9=9;
                                                                    Strit name . Therad : current Therad () get Name
    new Thread (M), "Consumer"), start (1: 1)
                                                                   gystem. out perhall (name + " entered g. bar.
 public void run() ?
       ins (00)
                                                              by ? Thead-sleep (1000); 3
       White (1015) }
             In1 = 9 get ();
                                                              calch (Exception e) ?
            System-on & println (" con uned: "Ar)
                                                                Pyskemout puntle ("B lateraphol"); }
             (+1) 337
                                                               Systemous point h (have a "trying to call A but()
  Ohn PCFixed !
                                                                a. last (); &
     public state void main (string ange D)
                                                            void (ast 1),
       Syskin. out. greatin (" Keerthane HBhat 1 181423C51248");
                                                                  System out printh ("Inside B. Lost"); 33
    a goneway
     new Produces (9)
                                                            class Dendlock impaments Runnable &
    new Consumer (7)
                                                                 A a = new A ();
  System out printly " our concool ( to shop )
                                                                 Bb; hewB();
```

```
int n;
boolean valueSet = false;
synchronized int get() {
  while(!valueSet)
```

Code: class Q {

try {

System.out.println("\nConsumer waiting\n");

```
wait();
} catch(InterruptedException e) {
System.out.println("InterruptedExceptioncaught");
}
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[]) {
System.out.println("Keerthana H Bhat:1BM23CS148");
Q q = new Q();
new Producer(q);
new Consumer(q);
System.out.println("Press Control-C to stop.");
}
}
```

Output:

```
Keerthana H Bhat:1BM23CS148
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
Put: 2
consumed:1
Intimate Consumer
Producer waiting
Got: 2
Intimate Producer
consumed:2
```

Program 10(b)

Demonstrate Deadlock

```
monly(); 93
                                                              clay A ?
                                                                 synchronized void foo (3 b) }
class Producer implements Runnoble ?
                                                                   Shing name : Thread aircut Thread () get Name
   99)
                                                                  System-out printle ( same + "entered foo");
    Fraduce (89)7
     Shir- 9=9;
                                                               My & Thread. clay (1000); }
    new Thread ( this, "Producer") . Start (); 3
                                                                  cotch (Exception e) {
public void aunt ) 5
                                                                      System.out. quintle (" a interrupted"); }
       ful 1'= 0;
                                                                System out puntly (name + "trying to call Bright (1")
      while (1215) ?
                                                                  1. Last (); 3
          9. put(1++); 31]
                                                              void last 172
Class Conjumer L'implements Runnable?
                                                                     System out printle (" Incide A. last"); 33
   Qq:
                                                              e hus 81 synchronized void bon ( a a )
   Comune (Qq) ?
     Juis - 9 = 9)
                                                                     Striff name = Thread: wwent Thread () get Name
    new Thread (M), "Consumer"), start (); of
                                                                    8 yelem out pet Ila (have + " entered 8 - ban "
 public void run() ?
       ins (20) while (1615) $
                                                               by 9 Thread-sleep (1000); 3
              141 x= 9 get ( );
                                                               calch (Exception e) ?
            System-on I println (" con und: "Ar)
                                                                 Euskemout puntla ["B lateruphol"); }
              (+1) 337
                                                                System. out quint be ( name + "brying to call a last )
  Ohn PeFixed }
                                                                 a. last (); &
     public state void main (string args (D)
                                                             void (ast 1),
       System. out. gentln1" Keerthane H Bhot 118423CS1248");
                                                                  System out printh ("Inside B. Last"); 33
    Qqonenqo:
     new Produces (9)
                                                             class Dendlock implements Runnoble &
    new Commen (7)
                                                                  1 a = new A();
   System out paintly " They Conchol ( to they )
                                                                  8 b , kews ();
```

```
Deadlock () }
  Thered . current mead () . set Name (11 main Thread 11) -
 Thread ( = new thread ( this, "Racing Thread > );
   f - start ();
   a. Lool 6);
   System.out. printing Back in man hued"), y
    public void xun() ?.
     5. bar(a);
         System out qu'arter ("Bach in situr thered")
public state void main ( string () augs) &
      System. out printing ("Kerr thora h Bhat! 18 M23CS MB)
         hen Dendlock ();
```

```
Code:
class A {
  // Synchronized method in class A
  synchronized void foo(B b) {
     String name = Thread.currentThread().getName();
     System.out.println(name + " entered A.foo");
     try {
       Thread.sleep(1000); // Simulate some work
     } catch (Exception e) {
       System.out.println("A Interrupted");
     System.out.println(name + " trying to call B.last()");
     b.last();
  }
  // Non-synchronized method in class A
  void last() {
     System.out.println("Inside A.last");
  }
}
class B {
  // Synchronized method in class B
  synchronized void bar(A a) {
     String name = Thread.currentThread().getName();
     System.out.println(name + " entered B.bar");
     try {
       Thread.sleep(1000); // Simulate some work
     } catch (Exception e) {
       System.out.println("B Interrupted");
     System.out.println(name + " trying to call A.last()");
     a.last();
  }
  // Non-synchronized method in class B
  void last() {
     System.out.println("Inside B.last");
  }
}
```

```
class Deadlock implements Runnable {
  A = new A();
  B b = new B();
  Deadlock() {
    // Set the name for the main thread
    Thread.currentThread().setName("MainThread");
    // Create and start a new thread
    Thread t = new Thread(this, "RacingThread");
    t.start();
    // Main thread calls A.foo and locks object 'a'
    a.foo(b);
    System.out.println("Back in main thread");
  }
  public void run() {
    // RacingThread calls B.bar and locks object 'b'
    b.bar(a);
    System.out.println("Back in other thread");
  }
  public static void main(String[] args) {
    System.out.println("Keerthana H Bhat: 1BM23CS148");
    new Deadlock(); // Trigger the deadlock scenario
  }
}
```

Microsoft Windows [Version 10.0.22000.1696]
(c) Microsoft Corporation. All rights reserved.

C:\Users\lenovo\OneDrive\Desktop\Java>javac Deadlock.java

C:\Users\lenovo\OneDrive\Desktop\Java>java Deadlock

Keerthana H Bhat: 1BM23CS148

RacingThread entered B.bar

MainThread entered A.foo

MainThread trying to call B.last()

Inside B.last

Back in main thread

RacingThread trying to call A.last()

Inside A.last

C:\Users\lenovo\OneDrive\Desktop\Java>

Back in other thread