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



B.M.S. COLLEGE OF ENGINEERING
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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 SAINITHIN(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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Github Link:

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

Program 1

Implement Quadratic Equation

```
You entered a float 8.5
6) Develop a java program that prints all
  real sol to the quadratic equation
 ax +bx+c = 0. Read in a, b, c and use
 the quadratic formula. If the discriminate
 b2- Hac is negative, display a message
 stating that there are no real solutions.
 import java, util, Scanner; - (d-)
 class Quadratic ( ) July tring two motife
    public static void main (String [ Targs ) {
    Scanner sc = new Scanner (system.in)
   double a, b, c, d, r1, r2;
 System. out , printfin ("Enter the co-efficients
 a = Sc, nextDouble(); b) trye atoM = 14
 System. out . printfln (" Enter the co-efficients of
 b = sc. nextDouble ();)
 System. out. printfln ("Ente the co-efficients of
 c=sc. next Double();
d= b*b-4*a*c;
```

```
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. printle ("Enter credits for subjec
2) Develop a Java program to create a class
  Student with members usn, name, an array
                                                                 gradepoints[i] = (marks[j]/10.0)+1;
  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 3GPA () (
   int(] credits = new int [4];
   double[] grade points = new double [4];
                                                                total = 0;
   double total = 0, credit_total = 0;
                                                               credit_total =0 : shall ) altall !
                                                               for (intj=0; j { 4; j ++) { ....
  Scanner sc = new Scanner ( System. in );
                                                                total + = gradepoints [j] + credits [j];
  word gets student Details () {
                                                                creditatotal += credits [j];
  System.out. println ( "Enter the name:");
  name = sc. nextline();
  System.out.println ("Enter USN: ");
                                                              SGPA = total / credit total;
                                                             void display()(
                                                                system.out. println ("Name: "+name):
 void get Marks () {
                                                                System.out. println ("USN: +usn);
      for (int j=0; j < 4; j++) {
                                                                System-outprintu("sgpA: "+sgpA);
         System.out. print In ("Enter"+ (j+1)+
        marks[j] = sc. next Int()
```

```
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 (); + 1,000 = (1) thing there
   Student (1 students = new Student (number of Students)
                                                       Enter 3 subject marks:
    for (int i=0; i < number of Students; i++) [.
                                                        Enter credit for subject 3;
     stulents[i] = new $tuden();
    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 * ("K C SAI NITHIN");
                                                        USN : 1234
                                                        SGPA: 9.0307
                                                        Enter name :
                                                        NITHIN
  Output ->
                                                        Enter USN :
 Enter number of students:
                                                         12345
                                                         Enter 1 Subject marks:
                                                         98
                                                         Enter credits for subject 1:
Enter USN:
                                                         Enter 2 Subject marks :
1234
Enter I subject marks:
```

```
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

```
3 (reale a class book which contains four members
 none, author, num 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 n book objects.
  import java. util. Scanner; = ) althing the most of
  class Book (
   Private String name good can = 2000d = ( ) dood
  Private String author:
Private int price; (++1: N2: 10+1+N1) of
  private int num Pager - whoire too motive
  public Book (String name, String author, int price,
            int numpages) (
    this name = name , the
    this author = author A") thing two material
     this. price = price; Other 2 = rolling printe
     this numbages = numbages; ) tring two water
  return "Book name: " + this name I in and
```

```
price + this price + " In" +
                                                     System. out printly ( " In Book Details: ");
                                                      for (int i = 0; i(n; i++) {
                                                           System. out println (books [i] to string ());
         en s = new Scamer (system.in)
  System out pointly ("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"+
                                                     Author: babar
 String name = s. next();
                                                    Number of pages: 1000
 System.out. print ("Author: ")
                                                     Enter details for book 2:
 String author = s. next ()
System.out. print ("Prile: ");
                                                     Price : 1000
int price = s.nex+ Int();
                                                     Number of pages: soo
System out print ("Number of pages: ").
int numbages = s. next Int()
```

```
Book Details:

Book name: history

Author name: baboar

Price: 100

Number of pages: 1000

Book name: science

Author name: neuton

Price: 1000

Number of pages: 500
```

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());
     }
```

Shape Area calculator

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

```
Shape rectangle = new Rectangle ()
   class Rectangle extends shape {
                                                 rectangle. printArea ();
   public Triangle ()
                                                 Shape triangle = new Triangle ()
    this . dimension = get Input ("Enter box of the
                                                 triangle . print Area ():
                                                 Shape circle = new Circle ();
                                               circle . print Area ();
 @ Overvide
 public void printArea()
  double area = 0.5 + dimension 1 + dimension2
                                              Output ->
    System out println ("Area of Triangle: "
                                              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 civele ()
                                               Enter height of the triangle: 40
     this dimension = get Input ("Enter radius of the
                                               Area of Triangle: 600.0
                                               Enter radius of the circle :10
Coverride
                                               Area of circle: 314.159...
 public void print Area () {
 double area = Math. PI * dimensional * diversional
                                                K C SAI NITHIN
 System.out. println ("Area of circle: "tarea);
                                               182365130
public class Shape Arca Calculor (
 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 clay
                                                   im port java. util. Scanner
                                                   class Account (
    Bank that maintains two kinds of account
                                                    String constoner Name
    for it's constomers, one called saving account and the
                                                   int account Type : double balance ;
   other current account. The savings account Provide
   compound intrest and withdrawl facilities but no
                                                    Account (String name, int acc Number, String acctgri)
   Cheque book facility. The current account
                                                        constance Name = name;
   provides cheque book facility but no intenst
                                                        a ceount Number : ace Number;
   Current account holders should also maintain
                                                        account Type = acc Type;
   a minimum balance and if the balance falls
                                                         balance = 0;
  below this level, a service change is imposed
                                                   Public void deposit (double amount)
  (reate a class Account that stores constomerue
  account number and type of account. From this
                                                        balance += amount;
                                                    System, out, println ("Deposited; " + amount + ".
  derive the classes Cur-acet and sav-occt to
  make them more specific to their requirements.
                                                          Updated balance: "+balance);
  Include the necessary methods in order to
                                                    Public void display Balance () (
 achieve and update the balance tasks
                                                         System.out. Println (" Account Balance: "+
a) Accept deposit from countown and update
  the balance.
                                                   public void withdraw (double amount) (
b) Display the balance.
                                                         System. out println (" This operation is
() Compute and deposit interest
                                                          specific to account type . " ); }
d) Permit withdrawl and update the balance
                                                                   out a regulation side
e) Check for the minimum balance, impose penalty
                                                    class Save Account extends Account of
  if necessary and update the balance.
                                                          double intrestRate = 0.04;
```

```
SavAccount (String nave, int accNumber) (
                                                         if (balonce ¿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 with drow (double amount) of
                         " + balance);
                                                          if (balance 7 = amount) (
                                                             balance -= amount ;
Coverride
public void withdraw (double amount) (
                                                         System.out. println ("withdrawn" + amount +"
    if (balonce >= amount) {
                                                                           updated bolance: "+ bolance).
                                                           CheckMinBalance();
          balance = amount };
  System, out, println ("withdrawn: "+ amount 4".
                                                           else
                      Updated balance : " + balance);
   y else (
                                                           System.out. printly ( " Insufficient balance.");
     System. out. Println ("Insufficient balonce")
                                                       Public class Bank (
Class CurAccount extends Account
    double minBalance = 500.0;
    double service charge = 50.0'
Curaccount (string name, int acc Number) {
  Super (nome, acc Number, "Current");
```

```
string acctype = sc. nent() .
  Public static void main (string (7 args)
                                                         if (acetype.equals ("saving")) (
     Scanner sc = new Scomer ( System in);
                                                           switch (chaice) (
    System.out. printly ("Enter customer name: ").
     String namesc. next ();
                                                           System out print (" Enter the deposit on
    System, out. printh ("Enter account number: ").
                                                             double deposit Amoun
    int accountnumber = sc. next Int();
                                                            double deposit Amount = sc. nent Double ();
    Sav Account savings Account = NEW Sav Account
                                                            saving Account . deposit (deposit Amout);
                                    ( name, accounting
   System out grintly ("Enter customer manie: ");
                                                            case 2:
                                                              System and print ("Enter the withdrawl amount:")
   String namel=sc.nent()
   System. out. frintln ("Enter account number:"):
                                                              double withdrawl Amount = sc next Double ():
                                                             Savings Account . withdraw (withdrawl A would)
   int account number 1=sc. next Int ();
                                                              break;
   Sav Account soving A count
   CarAccount current Account = new CurAccount
                                                          Case 3:
                                                            savings Account. compute Intrest ()
                                   ( name 1, account n
 while (true) {
                                                          Case you
  System.out.println ("In ... Henre ....");
                                                          System out . println ("customer nane: "+ saving Account.
  System out. printh ("I. Deposit in2. Withdraw ins.
                                                          suptem.out, printle ("Acout member: "
                                                                               Savings Account account Number)
                        Compute Interest for Savings
                                                          System.out. println ( "Type of Account: "+
                        Account In4. Display
                                                                              savings Account . account Type );
                       Account Details Ins. Enit");
                                                          Saving's Account. display Balance ();
System.out, print ("Enter the type of Account
                                                              break ;
                            ( soving / current):
```

```
System. out printly "Customer mane: " + current Account
  system.exit(0);
                                                                                       customer Name)
                                                    system. out println ("Account number: "+
   break;
                                                                      current Account, account Number)
default:
                                                    System out printly ("Type of Account: "+
    System.out. println ("Invalid choice,").
                                                                        current Account. account Type);
                                                     current Account displayBalance ();
                                                     break ;
  else if (act Type, equals ("current"))
                                                        System. exit(0);
   Switch (choice)
                                                        break;
   System.out. print ("Enter the deposit omount
                                                       default:
      double deposit Amout = sc . next Pouble ();
                                                          Septem out . println (" Invalid choice ")
     current Account deposit (deposit Amount);
     break;
                                                       else (
                                                        System.out println ("Invalid account type.")
    Systemout print ( "Enter He withdrawl amount: ")
    double withdraw[ Amount = sc. next Double ():
    current Account. Withdrow ( widnithd rowal Amount)
   break ;
      System-out-println ("corrent accounts do not com
    break; interest. ");
```

```
Output:
                                                         3. Compute Intrest for savings Account
   Enter westoner name
                                                          4. Display Account Details
                                                          5. Exit
  Enter customer name
                                                           Enter your choice: 3
  nithin
                                                           Enter the type of account (soving | current): soving
  Enter account number.
                                                           Interest added: 3600.0 . Updated balance: 93600.
  - - - Menu - - -
  1 - Deposit
                                                           1. Deposit
  2. Withdrow
                                                           2 Withdraw
  3. Compute Suterest for Savings Account
                                                           3. Compute Interest for Saving Account 4. Display Account Details
  4. 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 /werent); 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. De posit
 2. Withdraw
 3. Compute Interest for Saving
 4. Display Account Details
 Enter your choice : 1
 Enter the type of account (saving ) current); saving
Enter the deposit a most: 10000
Deposited: 10000.0 Updated balance: 190000.0
```

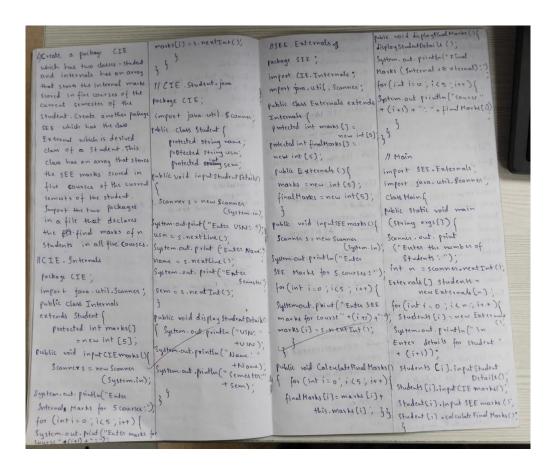
```
import java.util.Scanner;
class Account {
  String customerName;
  int accountNumber;
  String accountType;
  double balance;
  Account(String name, int accNumber, String accType) {
    customerName = name;
    accountNumber = accNumber;
    accountType = accType;
    balance = 0;
  }
  public void 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----");
       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



```
System. out. Private ("In Displaying Enter morks for course 2: 45
  final morn for all students: "); Enter marks for course 3: 43
  for (int i=0; i < n; i++) ( Enter marks for course 4: 3,
  System out println ("In Student Enter marks for courses: 4)
  +(+1)+":");
  Students [i] . display Final Marks (); Enter SEE Marks for co
                               Enter SEE Marks for course 2
                               Enter SEE Marks for course 3:
  Output ->
                               Enter SEE Marks for course 4: 00
                               Enter SEE Marks for Courses: 49
  Enter the no of students: 2
 Enter details for student 1
 Enter USN: 18M23C5130
 Enter Name: K C SAI NITHIN USN; 18M23CS130
 Enter Semester: 3 None: K C SAI NITHIN
 Enter marks for course 1: 46 Semester : 3
 Enter marks for course 2; 42 Final Harks (Internals + Extons)
 Enter marks for course 3: 47 course 1:86
                                Course 2: 90
 Enter marks for course 5: 39
                                courses: 76
                                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: 18423CS154
Enter SEE marks for course 4: 49 Semester: 3
                                Name: KISHORE CHANDRAN
Enter SEE marks for courses: 49 Final Marks (Internal + Extern
Enter details for student 2
                                course1:92
Entu USN : 18M23CS154
                                Coursez: 94
                                courses: 86
Enter Name: Kishore Chandra N
                                Course 4: 76
Enter semesta: 3
                                course 5: 96
Enter 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() {
```

System.out.println("Enter Internal Marks for 5 courses:");

System.out.print("Enter marks for course " + (i + 1) + ": ");

Scanner s = new Scanner(System.in);

for (int i = 0; i < 5; i++) {

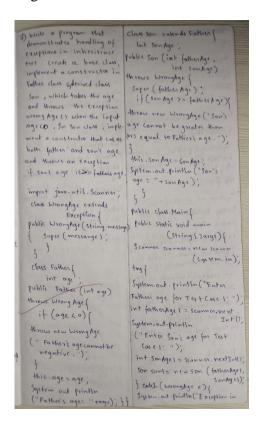
marks[i] = s.nextInt();

```
}
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



```
Output ->
Test casel: "+e.getMessage())
                                Enter Fathers age for Test (a
                                Fathers age: 40
                               Exception in Test case 1:
System. out. println (" \ Enter
Father's age for Test Case 2: "); Son's age cannot be greater than
int father Age 2 = scanner. next (or) equal to Father lage.
                                                                  ch
                   Int(); Enter Father's age for Test
Father father 2 = new Father (father Case 2;
3 cotch (WrongAge e) {
                                 Exception in Test Case 2:
 System.out.println ("Exception Father's age cannot be regative
in Test case 2: "+ e. gettlessage Enter Father's age for Test cases,
try f
                                 Enter son's age for Test Cases: T
System.out. println ("In
                                Fathers age: 56
Enter Fathers age for Test
                                 Son's age: 20
int father Age 3 = sconner. next
System.out. println ("Enter son's
age for Test coses: ");
 int sonAge 3 = Sconner nextInto.
 Son son 2 = new son ( father Age 3,
3 cotch (WrongAge e)
System out println ( Exception
in Test Case 3: "+ e.getMessage
 finally 1
   Scanner . close();
```

```
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());
     }
```

Multithreading

```
two threads, one thread displa-
ying "BMS College of Engineering
once every ten seconds and System.out. println ("Department
orother displaying "GE" once Thread interupted: "+e.gettermy
every two seconds.
class College Thread extends }}
Thread ( Public class Multi Thread Demo!
                           public static void main
                           (String () args) (
try {
while (true) f. College Thread college Thread=
                            new college Thread ();
System. out. println ("BMS
                            Department Thread department
 College of Engineering");
                            Thread = new Department Threado
Thread. Sleep (10000);
                             college Thread. start ();
3
3 Catch (Suterupted Exception e) Output -7
4 Novintln ("College BMS College of Engineering
                             department Thread start ();
 Thread interupted: "+
 e.getMessage());
                             CSE
                             CSE
                             BMS College of Engineering
 Public void run () {
                              CSE
  try (
                              CSE
  while (true) f
  System.out. println (" (SE");
                              CSE
   Thread. sleep (2000)
```

```
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 = num1/numz;
                                                                                                      Output ->
                                  Thabel num | Label =
 9) Write a program that creates
                                                                  result Field, set Text (String.
                                 new Jlabel ("Enter Num!: ").
   a user interface to perform
                                                                                                     1) Enter Num 1: 15
                                                                  value (result)); 4
                                 num ( Feild = new JTextField (10)
  integer divisions. The war
                                                                                                        Enter Numz: 0
                                                                  catch ( Number Format Exception
                                 J Label num 2 Label -
                                                                                                          Divide
  enters two numbers in the
                                                                                              ex) {
                                 new Jlabel ( " Enter Numz: ")
  text fields, Num1 and Num2.
                                                                                                        Result:
  The division of Num1 and Numz
                                  num2 Field = new J Tent Field (10),
                                                                 Joption Plane. Show Message Dioba
                                                                                                        Arithmetic Erro
  is displayed in the Result field
                                  divide Button = new J Button
                                                                  (frame, "Please enter valid integers."
                                                                                                           Connot divide b
  when the Divide button is clicked.
                                                  ("Divide");
                                                                  "Input Error", JoptionPlane.
  If Numi (01) Numz were not an
                                  Thatel resulthabel =
  in teger; the program would the
                                                                   Error-Message); 3
                                  new Jlobel ("Result: ");
                                                                                                      2) Enter Num 1: 5
  throw a Number Format Exception
                                  YesultField = new J. Text Field (10);
                                                                   Catch (Arithmetic Exception ex) (
                                                                                                         Enter Numz: 2
  If the Num 2 were zero the
                                                                                                               Divide
 Program would throw an Arith-
                                  result Feild eset Editable (false)
                                                                   Joptianpane-show Message Dialog
                                                                                                          Regult:
 metic Exception Display the
                                   frame add (num Label 1);
                                                                    ( frame, "Connet divide by zero.")
  exception in a message dialog
                                   frame add ( num 1 Feild );
                                                                                                           Input Error
                                                                    "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 add (divide Button):
  import java.out. event.
                                    frame add (result Label)
                                                                     Doption Plane. Show Message Dialog
                                                                                                       3) Enter Num! :
                    Action Event;
                                    fromeradd ( result Field);
  import java, aut. event, Action
                                                                    ( frame, "An error occured:"+
                                                                                                         Enter Numz: 1
                     Listener;
                                  divide Button, add Action Listner
                                                                       ex-getMessage (), "Error",
  public class Division APP of
                                                                                                              Divide
                                  (new Action Listner) &
                                                                                                          Result: 12
   private JFrame frame;
                                                                       JoptionPau. Error_Menage)
                                  Public void action Performed
   private JTent Field
                                  (Action Event e) f
   num / Feild, num 2 Field,
   result Field;
  Private J Button divide Button;
                                  string num text =
                                                                       frame, settissible (true)
  Public Division App () {
                                  num | Freld. get Tent ()
  from = new JFrame (" Integer
                                   String numz Text=
                     Division");
                                   mum2 Field.get Text();
  frame . set Lay out ( new Flowlay out
                                                                   public static void main
                                  int num = Integer, parsent
                                                                     (String () args) (
  frame . Setsize (300,200).
                                  (num 1 Tent);
 from set Default Close operation
                                                                          new Division APP ();
                                  int num = Integer a 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

```
Output ->
                                                              (onsumer ( Qq) (
                                 System.out. printh
   10) a) Write java
                                                                                              Pres Control-c to stop
                                ( " Interupted Exception
                                                                this . 1 = 9;
    for interprocess communication caught ");
                                                              new Thread (this, " Consumer")
                                                                                               Intimate Consumer
                                                               start ();
    continued, To avoid rolling
                                                                                                Producer waiting
                                 this . n = n;
    Java includes on cle gent
                                 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 (ills) &
    notify(), and notify All()
                                  System. Out. println("In
                                                                                                Intimate Consumor
                                                               int r=q.get();
    methods. These methods one
                                  Intimate (onsumer (nº):
                                                                                                 Producer waiting
                                                               System.out. Printer ("consumed."
    Implemented as final
                                   notify ():
                                                                                                 producer vaiting
    nethods in Object, so
                                                                                                 Consumedo
                                                                i++ ) many str. home
                                                                                                 Got: 1
     all classes have them.
                                   class Producer implements
                                                                   from the Heart was
                                                                                                  Intimate Consumor
  class & f
                                   Runnable f
                                                                                                  Consumed: 1
    intn ;
                                     Qq;
                                                                                                   put 2
                                                               class PC Fixed [
   boolean value set = false;
                                    Producer (Qq)1
                                                                                                    Intimate cousum
                                                                public static void main
   synchronized int get () {
                                    this. 9 = 9;
                                                                                                    produce waiting
   while (! valueset)
                                                                (String args []) [
                                     new Thread (this.
                                                                                                     Got: 2
                                                                Qq = new Q();
    try (
                                     "Produce"). start();
                                                                                                     Intimate produ
                                                                new producer (q):
                                      3, 3, + strait 10
   System. out. printhn (" In Consumer
                                                                                                     Consumer: 2
                                    public void run ()
                                                                 new Consumer (a);
   waiting (");
                                                                                                      Intimate cons
                                     int i = o
                                                                 System. out printly
  wait (); 3
                                                                                                      producer waiti
                                     While ( 1 (15)
                                                                 (" from Control - C to
  catch (Interrupt Exception e)
                                                                    Stop. ");
                                                                                                      Got: 3
                                     2. put (1++);
  System. out. printfn (" In
                                                                                                      Intimate pro
  In timate Producers (n");
                                                                                                       consumed: 3
   notify ();
                                                                                                     put:4
  return n;
                                                                                                        Intimate Co
                                                                                                        producer wa
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.");
}}
```

b) Deadlock

```
System. out. println
                                                                Deadlock () (
    10) 6
                                   (" guside A. last");
                                                               Threat. currentthread ().
    Dead lah
                                                               getName (" MainThread):
    A thread enters the
                                                                Threadat = new Thread
    monitor on object x and
                                  Class B (
                                                               (This, "RacingThread"):
                                   Synchronized void bon (A a)
   another thread enters the
                                                                 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 ") "
    method on x it will block
                                   (name + " contered B.bar")
    as expected
                                    try 5
                                                               public void runco (
                                    thread . sleep (1000)
                                                                b. ban (a);
                                    } 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. printin
                                                                 (String args [7) [
  Systems outsprintly ( no nec +
                                   (name + "trying to call
                                                                 new Deadlock ();
  "entered A. foo");
                                     A. last()"):
                                    a.last():
  Thread. sleep (1000)
                                                                                28/12
 I catch (Exception e) (
                                                                Output->
                                   void lost () [
 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 printle
                                                                Main Thread trying to call B. layte)
 "one + "trying to call B.lasto")"
                                                                 Inside Alast
                                     class Deadlock implements
 b. last O;
                                                                 Racing Thread trying to call A. last()
                                      Runnable (
                                                                  Back in main thread
void last ()
                                      A a = new A();
                                                                 Inside 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();

}}