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 **Tanmay (1BM23ME115)**, 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/tanmay-lang/Java-Lab-Programs

Program 1 Implement Quadratic Equation

```
Lab Program 1
 import java with scanner
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 b2-40c is regative,
display a megage stating that there are no real solutions.
imposit- java.
imposet jarq. util. scanner;
Jass quadratic of
       int a, b, c;
double 11, 12, d;
     void getd () of
           scanrex s = new Scannex (System. in);
           System. out. println (" Finter the weightients of a, b, c:");
           a = 5. hext Int ();
           b = 5 hextInt();
           G = S. nextInt ();
    void compute () of
          if (a == 0) {
                System. out println (" Not a quadratic equation");
               netwin;
          d = b + b - 4 + a + c;
```

```
if (d < 0) f
                     System. out println ("There are no near solutions.");
               else if (d = = 0) of
                   x1 = -b/(2.0 * a);
                   System out, perintln ("Roots are real and equal");
                   System. out. perinten (" Root 1 = Root 2 = " + 211);
             else 1
                 n1 = (-b + Math. sq. rt (d)) / (2.0 * a);
                 12 = (-b + - Math. sqnt(d))/(2.0 * a);
                 System. out. println (" Poots are real and distinct.");
                System. out. println ("Root 1 = " + 91 + ", Polt 2 = " + 912):
public class Pradratic Main (
        public static void main (String [] angs) of
                 Quadratic q = new quadratic();
                  9. getd ();
                  q. compute ();
                 System. out. println ("TANMAY");
                 System. out, println ("IBM23ME 115");
```

Output: Enter the coefficients of a, b, c: Roots are real and distinct. Poot 1 = -0.5, Root 2 = -1.0 JANMAY 18M23ME115

```
import java.util.Scanner;
class Quadratic {
  int a, b, c;
  double r1, r2, d;
  void getd() {
     Scanner s = new Scanner(System.in);
     System.out.println("Enter the coefficients of a, b, c:");
     a = s.nextInt();
     b = s.nextInt();
     c = s.nextInt();
  void compute() {
     if (a == 0) {
       System.out.println("Not a quadratic equation");
       return;
     d = b*b - 4*a*c;
     if (d < 0) {
       System.out.println("There are no real solutions.");
     else if (d == 0) {
       r1 = -b / (2.0 * a);
       System.out.println("Roots are real and equal.");
       System.out.println("Root1 = Root2 = " + r1);
     else {
       r1 = (-b + Math.sqrt(d)) / (2.0 * a);
       r2 = (-b - Math.sqrt(d)) / (2.0 * a);
       System.out.println("Roots are real and distinct.");
       System.out.println("Root1 = " + r1 + ", Root2 = " + r2);
```

```
public class QuadraticMain {
   public static void main(String[] args) {
      Quadratic q = new Quadratic();
      q.getd();
      q.compute();
      System.out.println("TANMAY");
      System.out.println("1BM23ME115");
   }
}
```

```
D:\1BM23ME115\Program 1>javac QuadraticMain.java

D:\1BM23ME115\Program 1>java QuadraticMain
Enter the coefficients of a, b, c:
2
3
1
Roots are real and distinct.
Root1 = -0.5, Root2 = -1.0
TANMAY
1BM23ME115
```

Program 2 SGPA Calculation

```
Lab Program - 2
  Develop a Java program to create a class Student with
  penber 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.
 import jara. util. scanner;
 class Subject of
      int subject Marks;
     int credits;
     int gende;
lass Student of
    Subject subject [];
    String name;
   Storing Huns
    double SGPA;
   Scannex s;
   Student () of
        subject = new Subject [9];
       for (int i=0; i<9; i++){
              subject [i] = new Subject ();
       s = new Scanner (System.in);
```

```
get Student Details () of
    System · out · print ("Enter your Name: ");
    hame = 5. hext ();
    System. out. print (" Enter your USN: ");
    ugn = 5. heat ();
get Narke () of
    for (int i = 0; i < 9; i++) f
        System. out. point ("Futer marky for subject" +
                                (i+1) + ": ");
         subject [i] . subject Marks = 5. pert ( );
         System. out. print (" Enter credits for subject" +
                               (i+1)+ ": ");
        subject [i] . credits = s. hect Int ();
        int marks = subject [i]. subject Marks;
        if (marks == 40) subject [i]: grade = 10;
   else if (marks 7=80) subject[i]-grade = 9;
        else if (marks 7= To) subject [i]. grade = 8;
        else if (marky 7=60) subject [i]. grade = T;
        elstif (marky 7 = 50) subject [i]. Grande = 6;
        else if (marky 7 = 40) subject [i]. grade = 5;
       else subject[i]. grade = 0;
```

```
compute SGPA () f
                                                                         Output
                           int effective Score = 0;
                                                                          Friter !
                           int total Gradite = 0;
                                                                          Fether 3
                           fox (inti=0; 1<9; 1++) {
                                                                          Enter
                                 effective score += (subject [i] · grade + subject[i]
                                                                           Enter
                               total (reditt += subject [i].
                                                                           Enter
                                                                            Ento
                        56PA = (deuble) effective Score / Lotal Cordite;
                                                                            Ent
                                                                             En
                                                                             Fin
public class Main of
       public static void main ( Strings any []) of
               student s1 = new Student ();
                 51. get Student Detaily ();
        51. get Marky ();
       st. compute SGPA();
         - System.out. posintln ("Name" + st. name);
         System. out. pointln ("USN: " + s1. usn);
         system. out. print In ("5GPA:" + 51.5GPA);
     System. out. println ("IBM23ME 115" - TANMAY");
```

Output: Fite your Name: Tanmay Enter your USN: IBM23ME115 Enter marks for subject 1: 95 subject [] Enter credity for subject 1: 4 Enter marks for subject 2: 92 Enter wedith for subject 2: 4 Enter tredit for subject 3: 87 Enter credits for subject 3: 3 Firter marks for subject 4: 76 Enter credits for subject 4: 3 Forter marks for subject 5: 81 Enter coredity for subject 5:3 Enter marks for subject 6: 96
"credit" " ": 2
Enter warts for subject 7: 98 11 credit for 11:1 Enter marks for subject 8; (00 11 credits 11. 11 : 1 Enter moute for subject 9; 93 Enter credits for subject 9: Nam: Tammay USN: 1BM 23 MEUS 56PA: 9:4545 45 45 4545 16M23 MEIIS - TANMAY

```
import java.util.Scanner;
class Subject {
  int subjectMarks;
  int credits;
  int grade;
}
class Student {
  Subject subject[];
  String name;
  String usn;
  double SGPA;
  Scanner s;
  Student() {
     subject = new Subject[9];
    for (int i = 0; i < 9; i++) {
       subject[i] = new Subject();
     s = new Scanner(System.in);
  void getStudentDetails() {
     System.out.print("Enter your Name: ");
     name = s.next();
    System.out.print("Enter your USN: ");
     usn = s.next();
  }
  void getMarks() {
     for (int i = 0; i < 9; i++) {
       System.out.print("Enter marks for subject " + (i + 1) + ": ");
       subject[i].subjectMarks = s.nextInt();
       System.out.print("Enter credits for subject " + (i + 1) + ": ");
       subject[i].credits = s.nextInt();
```

```
int marks = subject[i].subjectMarks;
       if (\text{marks} \ge 90) subject[i].grade = 10;
       else if (marks >= 80) subject[i].grade = 9;
       else if (marks >= 70) subject[i].grade = 8;
       else if (marks >= 60) subject[i].grade = 7;
       else if (marks >= 50) subject[i].grade = 6;
       else if (marks >= 40) subject[i].grade = 5;
       else subject[i].grade = 0;
  }
  void computeSGPA() {
     int effectiveScore = 0;
     int totalCredits = 0;
     for (int i = 0; i < 9; i++) {
       effectiveScore += (subject[i].grade * subject[i].credits);
       totalCredits += subject[i].credits;
     SGPA = (double) effectiveScore / totalCredits;
public class Main {
  public static void main(String args[]) {
     Student s1 = new Student();
     s1.getStudentDetails();
     s1.getMarks();
     s1.computeSGPA();
     System.out.println("Name: " + s1.name);
     System.out.println("USN: " + s1.usn);
     System.out.println("SGPA: " + s1.SGPA);
       System.out.println("1BM23ME115 - TANMAY");
  }
```

}

}

Output

```
D:\1BM23ME115\LAB-2>javac Main.java
D:\1BM23ME115\LAB-2>java Main
Enter your Name: Tanmay
Enter your USN: 1BM23ME115
Enter marks for subject 1: 95
Enter credits for subject 1: 4
Enter marks for subject 2: 92
Enter credits for subject 2: 4
Enter marks for subject 3: 87
Enter credits for subject 3: 3
Enter marks for subject 4: 76
Enter credits for subject 4: 3
Enter marks for subject 5: 81
Enter credits for subject 5: 3
Enter marks for subject 6: 96
Enter credits for subject 6: 2
Enter marks for subject 7: 98
Enter credits for subject 7: 1
Enter marks for subject 8: 100
Enter credits for subject 8: 1
Enter marks for subject 9: 93
Enter credits for subject 9: 1
Name: Tanmay
USN: 1BM23ME115
SGPA: 9.454545454545455
1BM23ME115 - TANMAY
```

Program 3 Create n book objects

```
Lab Program 3
 Create a class Book which contains four rembers ; rame, author, price.
num-pages. Include a contractor to set the values for the memba,
Include methods to set and get the details of the objects. Include
to string () method that could display the complete details of the
book. Develop a java program to create a book objects
imposet jova util scanner;
class Book 1
    private String rame, author;
    private double price;
    private int num Pages;
    public Book (String rame, String author, double price, int num Pagy)
          this name = hame;
         this, author = author;
         this. price = price;
         this num Pages = num Pages;
  @ Overouide
  public Storing to storing () of
     netwin "Book Detaily: In Name: " + "(InAuthor: " + author +
             "In Price: $" + price + "InPages:" + num Pages;
```

```
public days Book Demo f
                    public static void main (string [] orgs) {
29400
                            Scanner scanner = new Scanner (System. in);
mberg
lude q
                            System.out. print ("Finter the number of books:");
                           int n = scanner. next Int ();
                            scanner · nextline();
                           Book [] booky = new Book [n];
                           for (int i=0; i<n; i++) {
                                System. out. println ("In Enter details for Book"+ (i+1)+"),
                               system. out. print (" Name: ");
                                String name = scanner · nextline ();
                                System. eut. print ("Author: ");
94) 4
                               String author = scanner. next line ();
                               System. ent. pount (" Porice: ");
                               double price = scanner. next Double ();
                               System. out. print ("Pages: ");
                               int pager = scanner. next ();
                               scanner. nextline ();
                               books [i] = new Book (name, author, price, pager) };
                           System. out. println ("In Books Entered: ");
                           for (Book book: books) {
                                     System. out. print ln (book);
                           scanner. dose ();
```

Output: Develop Fater the number of books: 2 that Enter details for Book 1: print Ar Name & The Alchemist Circle Author: Paulo Coelho ove Price: 15.99 prin Pages: 208 Forter details for Book 2: imp Name: 1984 aly Author: George Prwell Price: 12.50 Pages: 328 Books Entered: Book Details: Name: The Alchemist Author: Paulo Coelho Price: \$15.99 Pages: 208 Book Details: Name: 1984 Author: George Drivell Price: \$ 12:50 (feet food t deal) as Pages: 328 of the se of the second of the second

```
import java.util.Scanner;
class Book {
  private String name, author;
  private double price;
  private int numPages;
  public Book(String name, String author, double price, int numPages) {
    this.name = name;
    this.author = author;
    this.price = price;
    this.numPages = numPages;
  }
  @Override
  public String toString() {
    return "Book Details:\nName: " + name + "\nAuthor: " + author + "\nPrice: $" + price +
"\nPages: " + numPages;
  }
public class BookDemo {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    System.out.print("Enter the number of books: ");
    int n = scanner.nextInt();
    scanner.nextLine(); // Consume newline
    Book[] books = new Book[n];
    for (int i = 0; i < n; i++) {
       System.out.println("\nEnter details for Book " + (i + 1) + ":");
       System.out.print("Name: ");
       String name = scanner.nextLine();
       System.out.print("Author: ");
       String author = scanner.nextLine();
       System.out.print("Price: ");
       double price = scanner.nextDouble();
       System.out.print("Pages: ");
       int pages = scanner.nextInt();
       scanner.nextLine(); // Consume newline
       books[i] = new Book(name, author, price, pages);
```

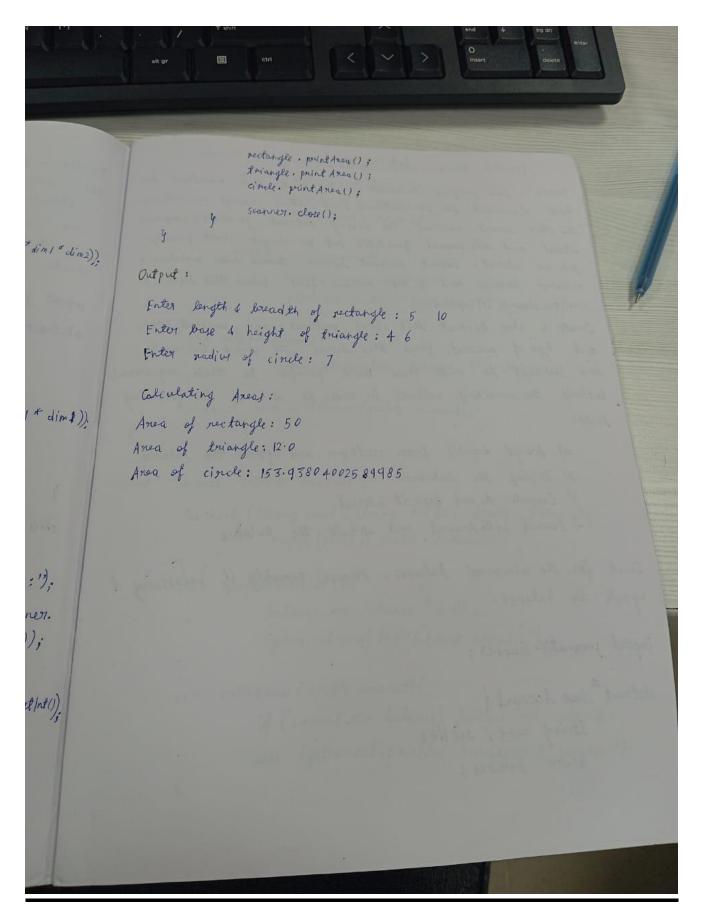
```
System.out.println("\nBooks Entered:");
for (Book book : books) {
    System.out.println(book);
}
scanner.close();
}
```

```
Enter the number of books: 2
Enter details for Book 1:
Name: The Alchemist
Author: Paulo Coelho
Price: 15.99
Pages: 208
Enter details for Book 2:
Name: 1984
Author: George Orwell
Price: 12.50
Pages: 328
Books Entered:
Book Details:
Name: The Alchemist
Author: Paulo Coelho
Price: $15.99
Pages: 208
Book Details:
Name: 1984
Author: George Orwell
Price: $12.50
Pages: 328
```

Print Area of Different Shapes

Lab Program 4 Develop a Java program to create an abstract closs named stape that contains two integers and an empty method named point Anea (). Provide three classes named poctangle, Triangle and Gircle such that each of the classes extends the class shape. Each one of the dayer contain, only the notherd pointAnea () that points the area of the given shape. import java. util. scanner; abstract class shape (int diml, dim2; Shape (int diml, intdim2) of this. dim 1 = dim 1; this dim 2 = dim 2; alytract void print Area (); class Rectangle extends shape of Rectangle (int length , int locadth) of super (length, breadth); roid point Agrea () { System. out. print ln ("Axea of Rectangle: "+ (dim 1 * dim 2));

```
clase Triangle extends Shape of
               Triangle (int base, int height) of
                        super ( bass, height);
              reid greatimeters of
              void print Area () &
                    System. out, println ("Area of Triargle:"+ (0.5 + dim1 + dim)).
                                                                                     Outpu
   closs cincle extends Shape of
            Cincle (int radius) of
                 super (reading, 0);
           void print Area () of
                System. out. println ("Asses of Circle: "+ (Math. PI * dim1 * dim1))
public class Shape Demod
     public static roid main (string [] angs) of
                Scanner scanner = new Scanner (system.in);
               System out println (" Enter length of Breadth of nectargle: ");
              Shape rectargle = rew Rectargle (scanner : rext | nt (), scanner.
                                                                       hereflat ());
            . System. out print (" Enter bose of height of triangle:");
             Shape triangle = new Toriangle (scanner. next nt (), scanner. next nt !);
            System. out. print (" Friter readily of circle:");
            Shape cincle = new cincle (scanner. next (nt());
```



```
import java.util.Scanner;
abstract class Shape {
  int dim1, dim2;
  Shape(int dim1, int dim2) {
     this.dim1 = dim1;
     this.dim2 = dim2;
  }
  abstract void printArea();
}
class Rectangle extends Shape {
  Rectangle(int length, int breadth) {
     super(length, breadth);
  }
  void printArea() {
    System.out.println("Area of Rectangle: " + (dim1 * dim2));
  }
}
class Triangle extends Shape {
  Triangle(int base, int height) {
     super(base, height);
  }
  void printArea() {
     System.out.println("Area of Triangle: " + (0.5 * dim1 * dim2));
  }
}
class Circle extends Shape {
  Circle(int radius) {
     super(radius, 0);
  }
  void printArea() {
     System.out.println("Area of Circle: " + (Math.PI * dim1 * dim1));
  }
}
```

```
public class ShapeDemo {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter length and breadth of the rectangle: ");
        Shape rectangle = new Rectangle(scanner.nextInt(), scanner.nextInt());

        System.out.print("Enter base and height of the triangle: ");
        Shape triangle = new Triangle(scanner.nextInt(), scanner.nextInt());

        System.out.print("Enter radius of the circle: ");
        Shape circle = new Circle(scanner.nextInt());

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

Output:

```
Enter length and breadth of the rectangle: 5 10
Enter base and height of the triangle: 4 6
Enter radius of the circle: 7

Calculating Areas:
Area of Rectangle: 50
Area of Triangle: 12.0
Area of Circle: 153.93804002589985
```

Program 5 Create a Class Bank

Lab Program 5.

Develop a Java program to create a clot Bunk. that maintains two finds of account for its customers, one called savings account any the other current account. The savings account provides compound the other current account. The savings account provides took facility interest and with drawal facilities but no obeque brook facilities just no obeque brook facilities put no interest. Current account holders should also maintain a put no interest. Current account holders should also maintain a put no interest and if the balance falls below this level, a revisite charge it imposed.

Create a closs Account that shores instomer rame, account name, and type of account. From this device the classes Cur-acct, and sov-acct to make them more specific to their requirement, and sov-acct to make them more specific to their requirement, Include the necessary nethods in order to achieve the following fashs:

- a) Accept deposit from customer and update the balance.
- b) Display the balance.
- c) Compute of and deposit interest.
- d) Permit with drawal and up date the balance

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

imposet java. util. Scanner;

abstract day Account of

String rame, aci No;

double balance;

```
Account ( string name , string acc No , double balance ) {
                    this name = hame;
                      this occ No = acc No;
                       this. bulance = balance;
         void deposit (double amount) of
                      balance += amount:
                    System. out. println ("Deposited: $" + amount);
         void display Balance () {
                     System. out. pointln ("Balance: 5" + balance);
        abstract void withdraw (double amount);
class SovAcct extends Account (
        Sav Acet (String name, String occ No, double balance)
                  super (name, acc No, balance);
       void compute Interest () of
                    balance += balance * 0.95;
                    System. out. print la (" Interest added. ");
       roid withdream (double amount) of
                   if (amount <= balance) balance -= amount;
                  else System. out. println ("Intufficient balance.");
```

```
Output:
            Current (String name, String acc No, doubt balance) of
     class Currect extends Account 1
                                                                              Exter custon
                    super ( name , acc No , balance);
                                                                              John
                                                                               Enter initi
                                                                               2000
           roid with draw (double amount) 1
                                                                               Enter
                   if (amount = balance) {
                                                                                Alice
                           balance -= amount :.
                                                                                Enter
                           if (balance < 1000) blance -= 50;
                                                                                1500
                 I else System. out. println (" Insufficient balance.");
                                                                                 Performi
                                                                                  Balance
                                                                                  Depos te
public class Bank 1
    public static void main (string 1) angs) (
                                                                                   Balance
             Scanner sc = new Scanner (System.in);
                                                                                   Interes
                                                                                    Balan
             System. out. print (" Firter pare & balance for Savings Account: ").
                                                                                    Wi tho
             San Acct sq = new & San Acct (sc. next (), "SADDI", sc. next Do wife )
                                                                                     Balar
            System. out. print ("Enter name & balance for Current Account:")
           (we Acct ca = pew Cws Acct (sc. next(), "CA 005", sc. heat Double ());
                                                                                      Per
                                                                                      Ba
          System. out. println ("In Savings Account Operations: ");
                                                                                       De
          5a. deposit (500);
          59. compute Interest ();
          Sa. withdraw (300);
          54. display Balance ();
         System. out. println (" In awvent Account Operation: ");
         ca. deposit (200);
         ca. withd naw (400);
         Ca. withdraw (1200); .
         ca, display Balance ();
        Sca close ();
```

```
Output:
         Ender customer name for the savings Account:
               initial balance for the Savings Account:
         Enter
         2000
         Enter customer name for the covert Account:
         Enter initial balance for the Current Account:
         1500
         Performing operations on Savings Account
         Balance: $ 2000.0
        Deposited: $500
         Balance: $ 2500.0
        Interest of $125.0 deposited
        Balance: $ 2625.0
        Withdrawn: $300
        Balance: $2325.0
le ());
        Performing operations on Current Account
        Balance: $ 1500.0
le ());
        Deposited: $200
        Balance: $ 1700.0
        Withd scaven: $ 400
        Balance: $ 1300.0
        Withdrawn: $1200
        Balance below minimum, peralty of $50.0 imposed.
        Withdrawn: $1200
        Balance: $58.0
```

```
import java.util.Scanner;
abstract class Account {
  String name, accNo;
  double balance;
  Account(String name, String accNo, double balance) {
    this.name = name;
    this.accNo = accNo;
    this.balance = balance;
  }
  void deposit(double amount) {
    balance += amount;
    System.out.println("Deposited: $" + amount);
  }
  void displayBalance() {
    System.out.println("Balance: $" + balance);
  }
  abstract void withdraw(double amount);
}
class SavAcct extends Account {
  SavAcct(String name, String accNo, double balance) {
    super(name, accNo, balance);
  }
  void computeInterest() {
    balance += balance * 0.05;
    System.out.println("Interest added.");
  }
  void withdraw(double amount) {
    if (amount <= balance) balance -= amount;
    else System.out.println("Insufficient balance.");
  }
```

```
}
class CurAcct extends Account {
  CurAcct(String name, String accNo, double balance) {
    super(name, accNo, balance);
  }
  void withdraw(double amount) {
    if (amount <= balance) {
       balance -= amount;
       if (balance < 1000) balance -= 50; // Penalty
     } else System.out.println("Insufficient balance.");
}
public class Bank {
  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);
    System.out.print("Enter name and balance for Savings Account: ");
    SavAcct sa = new SavAcct(sc.next(), "SA001", sc.nextDouble());
    System.out.print("Enter name and balance for Current Account: ");
    CurAcct ca = new CurAcct(sc.next(), "CA001", sc.nextDouble());
    System.out.println("\nSavings Account Operations:");
    sa.deposit(500);
    sa.computeInterest();
    sa.withdraw(300);
    sa.displayBalance();
    System.out.println("\nCurrent Account Operations:");
    ca.deposit(200);
    ca.withdraw(400);
    ca.withdraw(1200);
    ca.displayBalance();
    sc.close();
  }
}
```

Output:

```
Enter customer name for the Savings Account:
John
Enter initial balance for the Savings Account:
Enter customer name for the Current Account:
Alice
Enter initial balance for the Current Account:
1500
Performing operations on Savings Account
Balance: $2000.0
Deposited: $500
Balance: $2500.0
Interest of $125.0 deposited.
Balance: $2625.0
Withdrawn: $300
Balance: $2325.0
Performing operations on Current Account
Balance: $1500.0
Deposited: $200
Balance: $1700.0
Withdrawn: $400
Balance: $1300.0
Withdrawn: $1200
Balance below minimum, penalty of $50.0 imposed.
Withdrawn: $1200
Balance: $50.0
```

Program 6 Packages Algorithm:

```
Lab Program 6
      treate a package CIE which has two classes - personal and Interney
                                                                       package
      The class Poyonal has remboy like usn, name, sem. The class.
                                                                        inpost o
      Internal has an array that stones the internal marks scored
     fine cowages of the awvent semples of the student. Create onthe
                                                                        public
     puckage SEE which has the class External which is a derived
     day of Personal. This day has an array that stoney the
     SFE marks scored in fixe cowyes of the current semester of 2
    student. Inport the two packages in a file that declares the
    final marker of n students in all fixe cowyeg.
    CIE/ Intertals. Java
                                                                            Final
   package CIF;
                                                                            impor
  public class Internals of
                                                                             inpo
          public int[] marks = new int[5];
                                                                             pu
         public Internals (int [] marks) of
                system. out away copy (marks, 0, this marks, 0, 5);
CIE/Personal·jara
package EIF;
public class Personal of
       public String ush, name, sem;
      public Personal (storing usn, storing name, storing sem) {
             this. wn = wn;
            this. have = name;
            this sem = sem;
```

```
package SFF;
  import CIE. Personal;
  public class External extends Possonal of
         public int[] marks = new int[5];
         public Feternal (String wn, String name, String sem, int[] mosts)}
                  super (un, name, sem);
                 System. averageopy (marks, O, this marks, O, 5);
Final Marks. Java
imposet SEE. *;
inport java. util. Scanner;
public class Final Marks of
       public etatic void main (string [] ands) of
               Scanner sc = new Scanner (System in);
               System. out. print (" Enter the number of students: ");
               int n = sc. next (nt ();
               Faternal[] students = new External[n];
               int [] cie Marks = new int [5], see Marks = new int [5];
               for (int i = 0; i < n; i++) {
                    System. out. println ("Futer details for Student" + (i+1) + ":");
                    System. out . pount ("USN: ");
                   String un = sc. pext ();
                   System. out. print ("Name:");
                   String mand = sc. next ();
                   System. out. print (" Semy ter: ");
                   String sem = scinent tast ();
```

```
system. out. println ("Enter CIE marks for 5 cowy: ...
               for (int j= 0; j<5; j++) cie Marti[j] = sc. next (nt)
                                                                        Outpu
               System. out. println (" Enter SEE. morks for 5. cowses; in
                                                                        Enter
              fox (intj=0; j=5; j++) see Marty [j] = sc. next Int();
                                                                         Ente
                                                                          USN
              students [i] = new Faternal (win, name, sem, see Mark).
                                                                          Non
             System. arraycopy (cie Marks, O, students[i]. marks, 0,5).
                                                                           501
      - System. out-println ("In Final Marks of students:");
       for (int i=0; i=n; i++) {
           System.out.println ("Student"+ (i+1) +" - USN: "+
                                              students [i]. usn);
           system. out println ("Name:" + students[i]. name +",
                       Semester: "+ students[i]. sem);
          System. out. print ("Final Marks: ");
          for (int j=0; j=5; j++) of
               int final Marks = students[i] · marks[i] +
                                  (students [i] · marky [j] /2);
             System. out. print (final Marks + "");
    System. out. println ();
sc. close();
```

(·: 12) Output: 1nt(); Enter the number of students: \$ णड्य: 1). Enter details for Student 1: A(); USN: 18M23 ME115 Marky); Ware: Tanmey ,0,5). Somether: 3 Enter CIF tracks for 5 co weres: 18 20 15 19 17 Enter SEE marks for 5 cowyes: 40 38 45 42 39 Final Morps of Students: Student 1 - USN: IBM 23 ME 115 Name: Tanmay, semester: 3 Firal Marks: 38 39 37 40 36

```
package CIE;
public class Internals {
  public int[] marks = new int[5];
  public Internals(int[] marks) {
     System.arraycopy(marks, 0, this.marks, 0, 5);
  }
}
package CIE;
public class Personal {
  public String usn, name, sem;
  public Personal(String usn, String name, String sem) {
     this.usn = usn;
     this.name = name;
    this.sem = sem;
}
package SEE;
import CIE.Personal;
public class External extends Personal {
  public int[] marks = new int[5];
  public External(String usn, String name, String sem, int[] marks) {
     super(usn, name, sem);
     System.arraycopy(marks, 0, this.marks, 0, 5);
  }
}
import SEE.*;
import java.util.Scanner;
```

```
public class FinalMarks {
  public static void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     System.out.print("Enter the number of students: ");
     int n = sc.nextInt();
     External[] students = new External[n];
     int[] cieMarks = new int[5], seeMarks = new int[5];
     for (int i = 0; i < n; i++) {
       System.out.println("Enter details for Student " + (i + 1) + ":");
       System.out.print("USN: ");
       String usn = sc.next();
       System.out.print("Name: ");
       String name = sc.next();
       System.out.print("Semester: ");
       String sem = sc.next();
       System.out.println("Enter CIE marks for 5 courses:");
       for (int j = 0; j < 5; j++) cieMarks[j] = sc.nextInt();
       System.out.println("Enter SEE marks for 5 courses:");
       for (int j = 0; j < 5; j++) seeMarks[j] = sc.nextInt();
       students[i] = new External(usn, name, sem, seeMarks);
       System.arraycopy(cieMarks, 0, students[i].marks, 0, 5);
     System.out.println("\nFinal Marks of Students:");
     for (int i = 0; i < n; i++) {
       System.out.println("Student " + (i + 1) + " - USN: " + students[i].usn);
       System.out.println("Name: " + students[i].name + ", Semester: " + students[i].sem);
       System.out.print("Final Marks: ");
       for (int j = 0; j < 5; j++) {
          int finalMarks = students[i].marks[j] + (students[i].marks[j] / 2);
          System.out.print(finalMarks + " ");
       System.out.println();
```

Output:

```
> javac CIE/Personal.java CIE/Internals.java SEE/External.java FinalMarks.java
> java FinalMarks
Enter the number of students: 2
Enter details for Student 1:
USN: 1RV23CS001
Name: Alice
Semester: 5
Enter CIE marks for 5 courses:
18 20 15 19 17
Enter SEE marks for 5 courses:
40 38 45 42 39
Enter details for Student 2:
USN: 1RV23CS002
Name: Bob
Semester: 5
Enter CIE marks for 5 courses:
20 22 18 19 21
Enter SEE marks for 5 courses:
36 40 44 35 38
Final Marks of Students:
Student 1 - USN: 1RV23CS001
Name: Alice, Semester: 5
Final Marks: 38 39 37 40 36
Student 2 - USN: 1RV23CS002
Name: Bob, Semester: 5
Final Marks: 38 42 40 36 40
```

Program 7 Handling of Exceptions Algorithm:

```
Lab Program 7
       Write a program that demonstrates handling of exceptions in interesting
       inheritance tree. Create a base class called "Father" and
      derived class called "Son" which extends the bose class . In
      Father class, implement a constructor which take the age
      and throws the respection wrong Age() when the input age to
      Son day, implement a constructors that uses both father and
     son's age and thorows an exception if son's age is 7= full with
     age.
    class Wrong Age Exception extends Exception of
         public Wrong Age Exception (String message)
                     super (message);
  clay Father of
      int age i
      public Father (intage) throws Wrong Age Exception of
         if (age < 0) throw new Wrong Age Exception ("Father's age cannot be
                                                           regative. ");
       this, age = age;
class son extends Father of
     int son Age;
     public Son (int father Age, int son Age) therows Wrong Age Exceptions
            super (father Age);
           if (son Age 7= father Age) the now new Wrong Age Exception ("Son's ag
                           cannot be greater than ex equal to father's
                           age . ");
           this, son Age = son Age;
```

```
public class Exception Demo of
          public static void main (string [] angs) t
                   Father father = new father (40);
                   Son son = new Son (40, 20);
                   System. out. println ("Father's Age: "+ father age + ",
                                      Son't Age: " + son. son Age);
                 catch (Wrong Age Exception e) {
                 System. put. println ("Exception: "+ e. get Message ());
              fory of
                  Son invalid Son = new Son (30, 35);
              y catch (Wrong Age Exception e) {
                  System. out · print ln ("Exception: " + liget Message());
Output:
Forther's Age: 40, Son's Age: 20
Exception: Son's age cannot be greater than or equal to father'sage,
```

```
class WrongAgeException extends Exception {
  public WrongAgeException(String message) {
     super(message);
}
// Father class
class Father {
  int age;
  public Father(int age) throws WrongAgeException {
     if (age < 0)
       throw new WrongAgeException("Father's age cannot be negative.");
     this.age = age;
  }
// Son class that extends Father
class Son extends Father {
  int sonAge;
  public Son(int fatherAge, int sonAge) throws WrongAgeException {
     super(fatherAge); // Call the parent (Father) constructor
     if (sonAge >= fatherAge)
       throw new WrongAgeException("Son's age cannot be greater than or equal to father's age.");
     this.sonAge = sonAge;
public class ExceptionDemo {
  public static void main(String[] args) {
     System.out.println("TANMAY - 1BM23ME115");
     try {
       Father father = new Father(40); // Create a Father object
       Son son = new Son(40, 20); // Create a Son object
       System.out.println("Father's Age: " + father.age + ", Son's Age: " + son.sonAge);
       } catch (WrongAgeException e) {
       System.out.println("Exception: " + e.getMessage());
    try {
```

```
Son invalidSon = new Son(30, 35); // This will throw an exception
} catch (WrongAgeException e) {
    System.out.println("Exception: " + e.getMessage());
}
}
```

Output:

```
Microsoft Windows [Version 10.0.26100.2454]
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E:\LAB-7>javac ExceptionDemo.java

E:\LAB-7>java ExceptionDemo.java

TANMAY - 1BM23ME115

Father's Age: 40, Son's Age: 20

Exception: Son's age cannot be greater than or equal to father's age.

E:\LAB-7>
```

Program 8

Threads

Algorithm:

```
Lab Program 8
Write a program which creates two shreads, one storead display
"BMS college of Engineering" once except ten seconds and anos
displaying "CSE" once every two seconds.
class Nessage Thread extends Thread of
      private. String message;
      private int interval;
    public Mexage Thread (String mexage, int interval) of
            this. message = message;
            this interval = interval;
    @ Override
   public void oun() {
       day of
         while (true) of
             System. out. println (message);
             Three ad . sleep (interval # 1000);
     4 catch (Interrupted Exception e) of
           System. out. print in ("Thread interrupted.");
```

```
public closs Multi Thread Demos
                       public static void main ( String [7 args) {
splaying another
                              New Methode Thread ("BMS College of Engineering", 10). short();
                              rew Message Thread ("CSE", 2). start ():
           Output:
            ESE
           CSE
           CSE
           BMS college of Expirering
           CSE
           CSE
          CSE
          CSE
                  college of Engineering
          BMS
```

```
class MessageThread extends Thread {
  private String message;
  private int interval;
  public MessageThread(String message, int interval) {
    this.message = message;
    this.interval = interval;
  }
  @Override
  public void run() {
    try {
       while (true) {
         System.out.println(message + " - TANMAY");
         Thread.sleep(interval * 1000);
     } catch (InterruptedException e) {
       System.out.println("Thread interrupted.");
}
public class MultiThreadDemo {
  public static void main(String[] args) {
    new MessageThread("BMS College of Engineering", 10).start();
    new MessageThread("CSE", 2).start();
  }
}
```

Output

```
Microsoft Windows [Version 10.0.26100.2454]
(c) Microsoft Corporation. All rights reserved.

E:\LaB-8-java MultiThreadDemo.java

E:\LaB-8-java MultiThreadDemo.java

BMS College of Engineering - TANMAY
CSE - TANMAY
```

Program 9

SwingDemo

Algorithm:

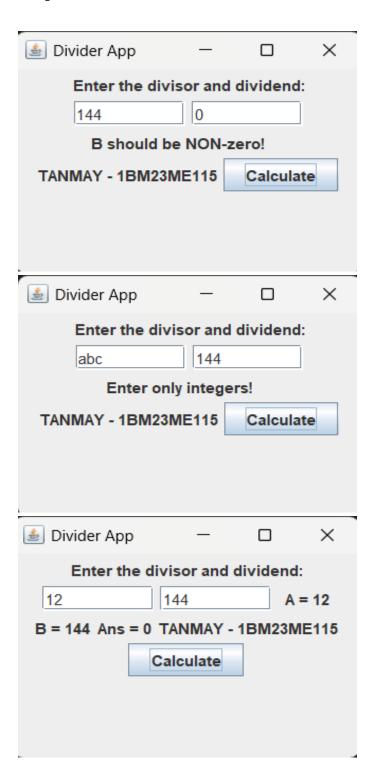
```
Lat Program 9
                                                                                   divide
          Write a program to create a user interfere to perform integral
          division. The user inters two numbers in test fields, Numle
          Nume is displayed in result field when the divide button is
         import javax . swing . *;
        imposed java ant. +;
        ingood your ant exent. Action Exent;
       import jara and event Action Listener;
       public class Division UI of
              public static roid main (string [] augs) of
                      Il France : france = rew IFrance ("Integer Division");
                  Inam. setsize (400, 200);
                  frame. set default ( JFname. Exit - On- close);
                 france at layout ( new Exit Layout (4, 2, 10, 10));
           I label label 1 = pew Slabel 1 (" Num 1: ");
            Textfield numfield = new J Textfield ();
  frame . add (label 1);
  frame. add ( num 1 Field);
 frame: add (tabel 2);
 frame. add ( num 2 Field);
frame. add ( negult Label);
frame. add (negult Field);
frame. add ( divide Button);
```

```
divide Button, add Action Listener (new Action Listener ()) of
           tory of
              int num = (nteger. parse(nt (num ( Field get Toot ());
              int num2 = Integer. parceInt (mm2 Field. get Text(1);
           Cotch & (Arithmetic Exception ex)
                       I option Plane. show wereage Dialogue, frame, set Menage (),
                             "Anotheretic From", Joption. even-muse);
     frare set visible (true);
   Output:
   Num 1 = 10
   Num 2 = 2
  Num 1 = 10
  Num2 = abc
  Please enter valid integers for Num 1 & Num2
  Num 1 = 10
  Num 2 = 0
Connot divide by zero.
```

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
class SwingDemo {
  SwingDemo() {
    JFrame jfrm = new JFrame("Divider App");
    jfrm.setSize(275, 200);
    jfrm.setLayout(new FlowLayout());
    jfrm.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    JLabel jlab = new JLabel("Enter the divisor and dividend:");
    JTextField ajtf = new JTextField(8);
    JTextField bitf = new JTextField(8);
    JLabel err = new JLabel();
    JLabel alab = new JLabel();
    JLabel blab = new JLabel();
    JLabel anslab = new JLabel();
    JLabel nameLabel = new JLabel("TANMAY - 1BM23ME115"); // Your name label
       // Add components in order
    jfrm.add(jlab);
    ifrm.add(ajtf);
    jfrm.add(bjtf);
    ifrm.add(err);
    ifrm.add(alab);
    jfrm.add(blab);
    ifrm.add(anslab);
    jfrm.add(nameLabel);
    JButton button = new JButton("Calculate");
    ifrm.add(button);
    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("A = " + a);
          blab.setText("B = " + b);
          anslab.setText("Ans = " + ans);
          err.setText("");
       } 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!");
  });
  jfrm.setVisible(true);
 public static void main(String args[]) {
  // Create frame on event dispatching thread
  SwingUtilities.invokeLater(new Runnable() {
    public void run() {
       new SwingDemo();
  });
}
```

Output



Program 10

Demonstrate Inter Process Communication & Deadlock

Algorithm:

```
Demonstrate Inter Process Communication & Dead block
     dass of
     boolean value Set = false;
    synchronized int get () of while (! value Set) of
           System. out. println ("In Consumer waiting \n");
           } catch (Inturup led Exception e) {
           System out printen (" Interrupted Exception caught");
          System. out. pointln (" Got:" + h);
         value set = false;
         System. out. println (" In Intimate Producer");
         notify ();
         networn h;
synchronized void put (int h) {
while (value set) of
    tony of
     System out println ("In Produce waiting In");
     wait ();
    y catch (Interrupted Exception e) {
    System. out . printle (" Put:" + n);
    System. out. println (" put: " +h);
    System out pointln ("In Intimate Consumer In");
   notify ();
```

```
class Producer implements furnable (
           991
           Produces (Dg) 1
           this q = q;
           New Thread (this, " produces"). start();
         public void gum (1)
             int i = 0;
             white (ic 15)
                                                                                    Out
              g.put (i++);
 class consumer implements furnable (
    99;
    Consumer (99) 1
       this g = q;
      pew Thread (this, " (ortunes"). start ();
public void sun () {
     inti=0;
     while (1<15) of
        int 8 = 9; get(1;
        System: outiprintln (" confund ;"+ 2);
        j+t
```

```
day PCFixed {
     posts public static void main (stain augus []) {
             Q g = new O[],
             rea Bodico (q);
             New Conjunus (q);
             System out pointly (" fresh Control . ( to stop");
    Output:
   aut:
  Put: 5
 Got, 5
                                                                      Deadlock
class A f
  synchronized void foo (BB) if
     Storing name =
      Thread · current Thread() · get Name ();
     System. out, pointly (have + " entered A. for ");
    fry (
       Thread. gleep (1000),
    7 catch (Exception e) {
     System out, print In (" A Intorrupted ");
```

```
System. out. println (name + " sryity to
                    b. last ();
                     System. ent. println (" Istill A Last: ");
     class B {
      synchronized void bar (Aa) f
          Treed . wount Thread (). get Name ();
          System out paintle (nore + " entered B. bas");
           Brend. deep (1000);
        7 cath (Exception a) {
          System. exposinten ("B Interrupted");
 System out printh (nam + "trying to call A last (1");
A. Sayt ();
void east 174
 System outoprintly ("Irride A. Papt");
```

```
clay Deadlock Implements Princette (
      A a = row A ();
      B b = new B ();
      hadlock (D1
           Novad. current Dread (). Jet Name (" Mais Thread!);
           Moread t = new Thread ( this, " facing Thread");
           +·sport();
            a. po(b); $
            System out print (" Back in main thread");
    public void rum () {
        6. b an (a);
       System our point In (" back in other thread");
        public static roid main (stary darge[]) {
           new readlock ();
Output:
Main Thoral extend Ar for
Pacing house entoud B- from
Main Thread - Grying to call B. last ()
Irriable A. Royt
Back in new Horeard
frig Fread trying to call A, Rost () }
Itide Ar lost &
 Back in other throoty
```

```
// Deadlock
class A {
  synchronized void foo(B b) {
     String name = Thread.currentThread().getName();
    System.out.println(name + " entered A.foo");
       Thread.sleep(1000); // Simulating some work
     } catch (Exception e) {
       System.out.println("A Interrupted");
    System.out.println(name + " trying to call B.last()");
    b.last(); // Deadlock occurs here
  synchronized void last() {
    System.out.println("Inside A.last");
  }
}
class B {
  synchronized void bar(A a) {
     String name = Thread.currentThread().getName();
    System.out.println(name + " entered B.bar");
       Thread.sleep(1000); // Simulating some work
     } catch (Exception e) {
       System.out.println("B Interrupted");
    System.out.println(name + " trying to call A.last()");
    a.last(); // Deadlock occurs here
  }
  synchronized void last() {
    System.out.println("Inside B.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); // get lock on A in this thread
     System.out.println("Back in main thread");
  }
  public void run() {
     b.bar(a); // get lock on B in other thread
     System.out.println("Back in other thread");
  }
  public static void main(String args[]) {
     System.out.println("TANMAY 1BM23ME115");
     new Deadlock();
}
// IPC
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++;
}

public class PCFixed {
 public static void main(String args[]) {
    System.out.println("TANMAY 1BM23ME115");
    Q q = new Q();
    new Producer(q);
    new Consumer(q);
    System.out.println("Press Control-C to stop.");
}
```

```
Microsoft Windows [Version 10.0.26100.2454]
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E:\LAB-10>javac Deadlock.java

E:\LAB-10>java Deadlock.java

TANMAY 1BM23ME115

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

MainThread trying to call B.last()
```

Microsoft Windows [Version 10.0.26100.2454]
(c) Microsoft Corporation. All rights reserved.

E:\LAB-10\IPC>javac PCFixed.java

E:\LAB-10\IPC>java PCFixed.java

TANMAY 1BM23ME115
Put: 0
Press Control-C to stop.

Intimate Consumer

Producer waiting

Got: 0

Intimate Producer

Put: 1

Intimate Consumer

Producer waiting

Consumed: 0

Got: 1

Intimate Producer

Consumed: 1 Put: 2

Intimate Consumer

Producer waiting

Got: 2

Intimate Producer

Consumed: 2

Put: 3

Intimate Consumer

Producer waiting

Got: 3

Intimate Producer

Consumed: 3

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