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

B.M.S. COLLEGE OF ENGINEERING
(Autonomous Institution under VTU)
BENGALURU-560019
Aug-2025 to Jan-2026

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CERTIFICATE

This is to certify that the Lab work entitled "Object Oriented Java Programming (23CS3PCOOJ)" carried out by **Saachi R Katti (1BF24CS259),** who is bonafide student of **B.M.S. College of Engineering.** It is in partial fulfilment 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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Program 1: Implement Quadratic Equation

CODE:

```java
package lab2;
import java.lang.Math;
import java.util.Scanner;

class quadratic {
    Run | Debug
    public static void main(String args[]){
        int a,b,c;
        Scanner in = new Scanner(System.in);
        System.out.println(x: "Enter value of a : ");
        a = in.nextInt();
        System.out.println(x: "Enter value of b : ");
        b = in.nextInt();
        System.out.println(x: "Enter value of c : ");
        c = in.nextInt();
        if (a == 0){
            System.out.println(x: "Not a qudratic equation");
            System.out.println(x: "Enter new value of a : ");
            a = in.nextInt();
        }
        else{
            int d = b*b - 4*a*c;
            if(d == 0){
                int r1 = (-b)/(2*a);
                System.out.println(x: "Roots are real and equal : ");
                System.out.println(r1);
            }
            else if(d>0){
                double r1 = ((-b) + (Math.sqrt(d)))/(double)(2*a);
                double r2 = ((-b) - (Math.sqrt(d)))/(double)(2*a);
                System.out.println(r1);
                System.out.println(r2);
            }
            else if(d<0){
                System.out.println(x: "Roots are imaginary");
                int r1 = (-b)/(2*a);
                double r2 = Math.sqrt(-d)/(2*a);
                System.out.println(r1);
                System.out.println(r2);
            }
        }
    }
}
```

OUTPUT:

```
PS C:\lab program> java quadratic
Enter value of a :
1
Enter value of b :
2
Enter value of c :
1
Roots are real and equal : -1
PS C:\lab program> java quadratic
Enter value of a :
4
Enter value of b :
5
Enter value of c :
6
Roots are imaginary:
-0.625 + 1.0532687216470449i
-0.625 - 1.0532687216470449i
PS C:\lab program> java quadratic
Enter value of a :
1
Enter value of b :
4
Enter value of c :
3
The roots are real and distinct
-1.0
-3.0
```

Program 2: Calculate SGPA

CODE:

```java
import java.util.Scanner;

class student{
    String usn;
    String name;
    int n;
    int credits[];
    int marks[];

    void acceptDetails(){
        Scanner sc = new Scanner(System.in);
        System.out.print(s: "Enter USN : ");
        usn = sc.nextLine();
        System.out.print(s: "Enter Name   : ");
        name = sc.nextLine();

        System.out.print(s: "Enter number of subjects : ");
        n = sc.nextInt();

        credits = new int[n];
        marks = new int[n];

        for(int i=0 ; i<n;i++){
            System.out.print("Enter the credits for subject" + (i+1) +": ");
            credits[i] = sc.nextInt();
            System.out.print("Enter the marks for subject" +(i+1) + ": ");
            marks[i] = sc.nextInt();
        }
    }
```

```java
double CalculateSGPA(){
    double TotalCredits = 0;
    double TotalPoints = 0;
    for(int i = 0;i<n;i++){
        int gradepoints;
        if(marks[i] >= 90){
            gradepoints = 10;
        }
        else if(marks[i] >= 80){
            gradepoints = 9;
        }
        else if(marks[i] >= 70){
            gradepoints = 8;
        }
        else if(marks[i] >= 60){
            gradepoints = 7;
        }
        else if(marks[i] >= 50){
            gradepoints = 6;
        }
        else if(marks[i] >= 40){
            gradepoints = 5;
        }
        else{
            gradepoints = 0;
        }

        TotalPoints += gradepoints * credits[i];
        TotalCredits += credits[i];
    }
    return TotalPoints/TotalCredits;
}
void displayDetails(int studentNumber){
    System.out.println(x: "\n--- Student Details ---");
    System.out.println("USN  : " + usn);
    System.out.println("Name : " + name);
    System.out.println(x: "\nSubject-wise details of student");
    for (int i = 0; i < n; i++) {
        System.out.println("Subject " + (i + 1) + ": Marks = " + marks[i] + ", Credits = " + credits[i]);
    }

    System.out.printf(format: "\nSGPA: %.2f\n", CalculateSGPA());
}
```

```java
public class SGPA {
    Run | Debug
    public static void main(String args[]){
        student s = new student();
        int totalStudents = 2;
        student[] students = new student[totalStudents];

        for (int i = 0; i < totalStudents; i++) {
            System.out.println("\nEnter details for student " + (i + 1) + ":");
            students[i] = new student();
            students[i].acceptDetails();
        }

        for (int i = 0; i < totalStudents; i++) {
            students[i].displayDetails(i + 1);
        }


    }
}
```

OUTPUT:

```
Enter Name   : SAACHI
Enter number of subjects : 7
Enter the credits for subject1: 3
Enter the marks for subject1: 90
Enter the credits for subject2: 3
Enter the marks for subject2: 90
Enter the credits for subject3: 4
Enter the marks for subject3: 99
Enter the credits for subject4: 4
Enter the marks for subject4: 91
Enter the credits for subject5: 1
Enter the marks for subject5: 77
Enter the credits for subject6: 1
Enter the marks for subject6: 78
Enter the credits for subject7: 1
Enter the marks for subject7: 80

Enter details for student 2:
Enter USN : 2
Enter Name   : ABC
Enter number of subjects : 7
Enter the credits for subject1: 4
Enter the marks for subject1: 90
Enter the credits for subject2: 4
Enter the marks for subject2: 90
Enter the credits for subject3: 3
Enter the marks for subject3: 80
Enter the credits for subject4: 3
Enter the marks for subject4: 90
Enter the credits for subject5: 1
Enter the marks for subject5: 71
Enter the credits for subject6: 1
Enter the marks for subject6: 77
Enter the credits for subject7: 1
Enter the marks for subject7: 80

--- Student Details ---
USN  : 1
Name : SAACHI

Subject-wise details of student
Subject 1: Marks = 90, Credits = 3
Subject 2: Marks = 90, Credits = 3
Subject 3: Marks = 99, Credits = 4
Subject 4: Marks = 91, Credits = 4
Subject 5: Marks = 77, Credits = 1
Subject 6: Marks = 78, Credits = 1
Subject 7: Marks = 80, Credits = 1

SGPA: 9.71
```

```
SGPA: 9.71

--- Student Details ---
USN  : 2
Name : ABC

Subject-wise details of student
Subject 1: Marks = 90, Credits = 4
Subject 2: Marks = 90, Credits = 4
Subject 3: Marks = 80, Credits = 3
Subject 4: Marks = 90, Credits = 3
Subject 5: Marks = 71, Credits = 1
Subject 6: Marks = 77, Credits = 1
Subject 7: Marks = 80, Credits = 1

SGPA: 9.53
```

CODE:

```java
import java.util.Scanner;

class Book {
    String name;
    String author;
    int price;
    int num_pages;

    Book(String name, String author, int price, int num_pages) {
        this.name = name;
        this.author = author;
        this.price = price;
        this.num_pages = num_pages;
    }

    public String toString() {
        String name, author, price, num_pages;

        name = "Book name: " + this.name + "\n";

        author = "Author name: " + this.author + "\n";

        price = "Price: " + this.price + "\n";

        num_pages = "Number of pages: " + this.num_pages + "\n";

        return name + author + price + num_pages;
    }
}
```

```java
public class Demo {
    Run | Debug
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print(s: "Enter number of books : ");
        int n = sc.nextInt();
        sc.nextLine();

        Book[] books = new Book[n];

        for (int i = 0; i < n; i++) {
            System.out.println(x: "\nEnter the name of book: ");
            String name = sc.nextLine();

            System.out.println(x: "Enter the author of the book: ");
            String author = sc.nextLine();

            System.out.println(x: "Enter price of book: ");
            int price = sc.nextInt();
            sc.nextLine();

            System.out.println(x: "Enter the number of pages: ");
            int num_pages = sc.nextInt();
            sc.nextLine();

            books[i] = new Book(name, author, price, num_pages);
        }

        System.out.println(x: "\nBooks entered:");
        for (int i = 0; i < books.length; i++) {
            System.out.println(x: "--------------------");
            System.out.println(books[i]);
        }

        sc.close();
    }
}
```

OUTPUT:

```
sers\x5cAdmin\x5cAppData\x5cRoaming\x5cCode\x5cUser\x5cworkspaceS
-036f-4967-a440-cd816a3fe649Enter number of books : 2

Enter the name of book:
Palace of illusions
Enter the author of the book:
chitra banerjee
Enter price of book:
300
Enter the number of pages:
300

Enter the name of book:
Hello world
Enter the author of the book:
abc
Enter price of book:
300
Enter the number of pages:
300

Books entered:
-------------------
Book name: Palace of illusions
Author name: chitra banerjee
Price: 300
Number of pages: 300

--------------------
Book name: Hello world
Author name: abc
Price: 300
Number of pages: 300
```

Program 4: Abstract Class

CODE:

```java
import java.util.Scanner;
class InputScanner{
    Scanner sc= new Scanner(System.in);
}
abstract class Shape extends InputScanner{
    int dim1, dim2;
    double Area;
    abstract void getinput();
    abstract void printArea();
}
class Rectangle extends Shape{
    void getinput(){
        System.out.println("Enter the dimensions of the Rectangle (length and breadth):");
        dim1=sc.nextInt();
        dim2=sc.nextInt();
    }
    void printArea(){
        Area=(double)dim1*dim2;
        System.out.println("Area of Rectangle: "+ Area);
    }
}
class Triangle extends Shape{
    void getinput(){
        System.out.println("Enter the dimensions of the Triangle (Base and Height):");
        dim1=sc.nextInt();
        dim2=sc.nextInt();
    }
```

```java
    void printArea(){
        Area=(double)0.5*dim1*dim2;
        System.out.println("Area of Triangle: "+ Area);
    }
}class Circle extends Shape{
    void getinput(){
        System.out.println("Enter the dimensions of the Circle (Radius):");
        dim1=sc.nextInt();
    }
    void printArea(){
        Area=(double)Math.PI*dim1*dim1;
        System.out.println("Area of Circle: "+ Area);
    }
}
public class AbstractclassDemo {
    Run | Debug | Run main | Debug main
    public static void main(String[] args) {
        Rectangle r= new Rectangle();
        r.getinput();
        Triangle t= new Triangle();
        t.getinput();
        Circle c= new Circle();
        c.getinput();

        r.printArea();
        t.printArea();
        c.printArea();
```

OUTPUT:

```
Enter the dimensions of the Rectangle (length and breadth):
2 4
Enter the dimensions of the Triangle (Base and Height):
1 2
Enter the dimensions of the Circle (Radius):
2
Area of Rectangle: 8.0
Area of Triangle: 1.0
Area of Circle: 12.566370614359172
```

Program 5: Bank Management

CODE:

```java
import java.util.Scanner;

abstract class Bank {
    abstract void deposit();
    abstract void withdrawal();
    abstract void displayDetails();
}

class Accounts extends Bank {
    String cust_name, type_of_account;
    int acc_no;
    double balance = 0;

    public Accounts(String name, int acc_no, String type) {
        this.cust_name = name;
        this.acc_no = acc_no;
        this.type_of_account = type;
    }

    void deposit() {
        Scanner s = new Scanner(System.in);
        System.out.print(s: "Enter the deposit amount: ");
        double deposit = s.nextDouble();
        balance += deposit;
        System.out.println("Deposited: " + deposit + ". Updated balance: " + balance);
    }

    void withdrawal() {
        Scanner s = new Scanner(System.in);
        System.out.print(s: "Enter the withdrawal amount: ");
        double amount = s.nextDouble();
        if (amount > balance) {
            System.out.println(x: "Insufficient balance!");
        } else {
            balance -= amount;
            System.out.println("Withdrawn: " + amount + ". Updated balance: " + balance);
        }
    }

    void displayDetails() {
        System.out.println("Customer name: " + cust_name);
        System.out.println("Account number: " + acc_no);
        System.out.println("Type of Account: " + type_of_account);
        System.out.println("Account Balance: " + balance);
    }
}
```

```java
class Sav_acc extends Accounts {
    public Sav_acc(String name, int acc_no) {
        super(name, acc_no, type: "Saving");
    }

    void Interest() {
        if (balance <= 0) {
            System.out.println(x: "No interest applicable. Balance is 0.");
            return;
        }
        Scanner s = new Scanner(System.in);
        System.out.print(s: "Enter the time period (in years): ");
        int year = s.nextInt();
        double interest = (balance * year * 2.0) / 100;
        balance += interest;
        System.out.println("Interest added: " + interest + ". Updated balance: " + balance);
    }
}

class Cur_acc extends Accounts {
    public Cur_acc(String name, int acc_no) {
        super(name, acc_no, type: "Current");
    }
}
```

```java
public class BankDemo {
    Run | Debug
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print(s: "Enter customer name for Savings Account: ");
        String name1 = sc.nextLine();
        System.out.print(s: "Enter account number: ");
        int acc1 = sc.nextInt();
        sc.nextLine();

        System.out.print(s: "Enter customer name for Current Account: ");
        String name2 = sc.nextLine();
        System.out.print(s: "Enter account number: ");
        int acc2 = sc.nextInt();
        sc.nextLine();

        Sav_acc s = new Sav_acc(name1, acc1);
        Cur_acc c = new Cur_acc(name2, acc2);
```

```java
    int choice;
    do {
        System.out.println(x: "\n======MENU======");
        System.out.println(x: "1. Deposit");
        System.out.println(x: "2. Withdraw");
        System.out.println(x: "3. Compute Interest for Savings Account");
        System.out.println(x: "4. Display Account Details");
        System.out.println(x: "5. Exit");
        System.out.print(s: "Enter your choice: ");
        while (!sc.hasNextInt()) sc.next(); // handle invalid input
        choice = sc.nextInt();
        sc.nextLine(); // clear buffer

        if (choice == 5) {
            System.out.println(x: "Exiting...");
            break;
        }

        System.out.print(s: "Enter the type of account (saving/current): ");
        String type = sc.nextLine().trim();

        switch (choice) {
            case 1:
                if (type.equalsIgnoreCase(anotherString: "saving")) {
                    s.deposit();
                } else if (type.equalsIgnoreCase(anotherString: "current")) {
                    c.deposit();
                } else {
                    System.out.println(x: "Invalid account type!");
                }
                break;

            case 2:
                if (type.equalsIgnoreCase(anotherString: "saving")) {
                    s.withdrawal();
                } else if (type.equalsIgnoreCase(anotherString: "current")) {
                    c.withdrawal();
                } else {
                    System.out.println(x: "Invalid account type!");
                }
                break;
```

```java
        case 3:
            if (type.equalsIgnoreCase(anotherString: "saving")) {
                s.Interest();
            } else {
                System.out.println(x: "Interest cannot be computed for Current Account!");
            }
            break;

        case 4:
            if (type.equalsIgnoreCase(anotherString: "saving")) {
                s.displayDetails();
            } else if (type.equalsIgnoreCase(anotherString: "current")) {
                c.displayDetails();
            } else {
                System.out.println(x: "Invalid account type!");
            }
            break;

        default:
            System.out.println(x: "Invalid choice!");
    }

} while (choice != 5);
    }
}
```

OUTPUT:

```
321Enter customer name for Savings Account: abc
Enter account number: 101
Enter customer name for Current Account: cdf
Enter account number: 102

======MENU======
1. Deposit
2. Withdraw
3. Compute Interest for Savings Account
4. Display Account Details
5. Exit
Enter your choice: 1
Enter the type of account (saving/current): saving
Enter the deposit amount: 1000
Deposited: 1000.0. Updated balance: 1000.0

======MENU======
1. Deposit
2. Withdraw
3. Compute Interest for Savings Account
4. Display Account Details
5. Exit
Enter your choice: 2
Enter the type of account (saving/current): saving
Enter the withdrawal amount: 200
Withdrawn: 200.0. Updated balance: 800.0

======MENU======
1. Deposit
2. Withdraw
3. Compute Interest for Savings Account
4. Display Account Details
5. Exit
Enter your choice: 3
Enter the type of account (saving/current): saving
Enter the time period (in years): 5
Interest added: 80.0. Updated balance: 880.0
```

```
======MENU======
1. Deposit
2. Withdraw
3. Compute Interest for Savings Account
4. Display Account Details
5. Exit
Enter your choice: 4
Enter the type of account (saving/current): saving
Customer name: abc
Account number: 101
Type of Account: Saving
Account Balance: 880.0

======MENU======
1. Deposit
2. Withdraw
3. Compute Interest for Savings Account
4. Display Account Details
5. Exit
Enter your choice: 5
Exiting...
```

Program 6: Packages

CODE:

PACKAGES\CIE\Internals.java

```java
package PACKAGE.src.CIE;

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

    public Internals(int var1, String var2, int var3, int[] var4) {
        super(var1, var3, var2);

        for(int var5 = 0; var5 < 5; ++var5) {
            this.Marks[var5] = var4[var5];
        }

    }
}
```

PACKAGES\CIE\Student.java

```java
package PACKAGE.src.CIE;

public class Student {
    public int usn,sem;
    public String name;

    public Student(int usn, int sem,String name){
        this.usn = usn;
        this.name = name;
        this.sem = sem;
    }
}
```

PACKAGES\SEE\Externals.java

```java
package PACKAGE.src.SEE;
import PACKAGE.src.CIE.Student;
public class Externals extends Student{
    public int seeMarks[] = new int[5];

    public Externals(int usn,String name,int sem,int marks[]){
        super(usn,sem,name);
        for(int i=0;i<5;i++){
            seeMarks[i] = marks[i];
        }
    }
}
```

PACKAGES\App.java

```java
package PACKAGE.src;

import java.util.Scanner;
import PACKAGE.src.CIE.*;
import PACKAGE.src.SEE.*;

public class App {
    Run | Debug
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.println(x: "Enter number of Students");
        int n = sc.nextInt();

        Internals internal[] = new Internals[n];
        Externals external[] = new Externals[n];

        for (int i = 0; i < n; i++) {
            System.out.println("\nEnter Student " + (i + 1) + " Details");

            System.out.print(s: "Enter USN: ");
            int usn = sc.nextInt();

            System.out.print(s: "Enter Name: ");
            String name = sc.next();

            System.out.print(s: "Enter Semester: ");
            int sem = sc.nextInt();

            int im[] = new int[5];
            int em[] = new int[5];

            System.out.println(x: "Enter 5 Internal Marks:");
            for (int j = 0; j < 5; j++) im[j] = sc.nextInt();

            System.out.println(x: "Enter 5 SEE Marks:");
            for (int j = 0; j < 5; j++) em[j] = sc.nextInt();

            internal[i] = new Internals(usn, name, sem, im);
            external[i] = new Externals(usn, name, sem, em);
        }
```

```
        System.out.println(x: "\nFINAL MARKS");
        for (int i = 0; i < n; i++) {
            System.out.println("\nStudent: " + internal[i].name + " (" + internal[i].usn + ")");
            for (int j = 0; j < 5; j++) {
                int finalMarks = internal[i].Marks[j] + (external[i].seeMarks[j] / 2);
                System.out.println("Course " + (j + 1) + ": " + finalMarks);
            }
        }

        sc.close();
    }
}
```

OUTPUT:

```
● PS C:\1BF24CS259> java "PACKAGE\src\App.java"
  Enter number of Students
  2

  Enter Student 1 Details
  Enter USN: 1
  Enter Name: abc
  Enter Semester: 3
  Enter 5 Internal Marks:
  38
  37
  35
  36
  40
  Enter 5 SEE Marks:
  98
  95
  96
  97
  94

  Enter Student 2 Details
  Enter USN: 2
  Enter Name: cdf
  Enter Semester: 3
  Enter 5 Internal Marks:
  32
  31
  35
  36
  37
```

```
  Enter 5 SEE Marks:
  92
  90
  96
  97
  98

  FINAL MARKS

  Student: abc (1)
  Course 1: 87
  Course 2: 84
  Course 3: 83
  Course 4: 84
  Course 5: 87

  Student: cdf (2)
  Course 1: 78
  Course 2: 76
  Course 3: 83
  Course 4: 84
  Course 5: 86
```

Program 7: Exceptions

CODE:

```java
import java.util.Scanner;

class WrongAge extends Exception{
    public WrongAge(){
        super("Age Error!");
    }
    public WrongAge(String message){
        super(message);
    }


}
class InputScanner{
    Scanner s = new Scanner(System.in);
}
class Father extends InputScanner{
    protected int FatherAge;
    public Father() throws WrongAge{
        System.out.println("Enter father's Age: ");
        FatherAge=s.nextInt();
        if (FatherAge<0){
            throw new WrongAge("Age cannot be negative!");
        }

    }
    public void display(){
        System.out.println("Father's Age: "+ FatherAge);
    }
```

```java
class Son extends Father{
    protected int SonAge;
    public Son() throws WrongAge{
        super();
        System.out.println("Enter son's age: ");
        SonAge= s.nextInt();
        if(SonAge<0){
            throw new WrongAge("Age cannot be negative!");
        }
        if(SonAge>=FatherAge){
            throw new WrongAge("Son's age cannot be greater than or equal to father's age!!");
        }

    }
    public void display(){
        super.display();
        System.out.println("Son's Age: "+ SonAge);
    }
}
```

```java
public class ageexception {
    Run | Debug | Run main | Debug main
    public static void main(String args[]){
        try {
            Son son= new Son();
            son.display();
        } catch (WrongAge e) {
            System.out.println("Error: "+ e.getMessage());
        }catch(Exception e){
            System.out.println("Unexpected Error: "+ e.getMessage());
        }
    }
}
```

OUTPUT:

```
Enter father's Age:
31
Enter son's age:
35
Error: Son's age cannot be greater than or equal to father's age!!
PS C:\OOJ> java ageexception
Enter father's Age:
-21
Error: Age cannot be negative!
PS C:\OOJ>
```

Program 8: Multi-Threading

CODE:

```java
class NewThread1 extends Thread{

    public void run(){


        for(int i=1; i<=5; i++){
            System.out.println("BMS College of Engineering "+i);
            try{

                Thread.sleep(10000);
            }catch (InterruptedException e) {
                System.out.println("Interrupt!!!");
            }

        }
    }
}
class NewThread2 extends Thread{

    public void run(){
        for(int i=1; i<=5; i++){
            System.out.println("CSE "+i);
            try{
                Thread.sleep(2000);
            } catch (InterruptedException e) {
            System.out.println("Interrupt!!!");
            }
        }
    }
}
```

```java
public class ThreadProgram1 {
    Run | Debug | Run main | Debug main
    public static void main (String args[]){
        NewThread1 n1= new NewThread1();
        NewThread2 n2= new NewThread2();
        n1.start();
        n2.start();
    }
}
```

OUTPUT:

```
BMS College of Engineering 1
CSE 1
CSE 2
CSE 3
CSE 4
CSE 5
BMS College of Engineering 2
BMS College of Engineering 3
BMS College of Engineering 4
BMS College of Engineering 5
PS C:\OOJ>
```