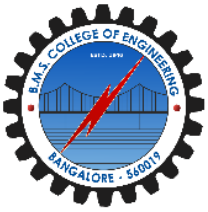
B.M.S. COLLEGE OF ENGINEERING
Basavanagudi, Bengaluru- 560019
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



LABORATORY RECORD

ON

Object Oriented Java Programming
(23CS3PCOOJ)

Submitted By :
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1BM22CS066

In partial fulfilment of
BACHELOR OF ENGINEERING
In
COMPUTER SCIENCE AND ENGINEERING
2023-24

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LABORATORY PROGRAM -1

Develop a Java program that prints all real solutions to the quadratic equation ax2+bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 - 4ac is negative, display a message stating that there are no real solutions.

```
import java.util.*;

class QuadraticEquationSolver {
    double a, b, c;

    QuadraticEquationSolver(double a, double b, double c) {
        this.a = a;
        this.b = b;
        this.c = c;
    }

    void takeInput() {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter the coefficients (a, b, c) of the quadratic equation:");
        System.out.print("a: ");
        this.a = scanner.nextDouble();
        System.out.print("b: ");
        this.b = scanner.nextDouble();
        System.out.print("c: ");
        this.c = scanner.nextDouble();
```

```
    }

    void calculateRoots() {
        double discriminant = b * b - 4 * a * c;

        if (discriminant > 0) {
            double root1 = (-b + Math.sqrt(discriminant)) / (2 * a);
            double root2 = (-b - Math.sqrt(discriminant)) / (2 * a);
            System.out.println("Real Solutions:");
            System.out.println("Root 1: " + root1);
            System.out.println("Root 2: " + root2);
        } else if (discriminant == 0) {
            double root = -b / (2 * a);
            System.out.println("Real Solution:");
            System.out.println("Root: " + root);
        } else {
            System.out.println("No real solutions exist.");
        }
    }
}

public class Quad {
    public static void main(String[] args) {
        QuadraticEquationSolver solver = new QuadraticEquationSolver(0,
0, 0);
        solver.takeInput();
        solver.calculateRoots();
    }
```

}

OUTPUT:

```
C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)>java Quad
Enter the coefficients (a, b, c) of the quadratic equation:
a: 9
b: 3
c: 7
No real solutions exist.

C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)>javac Quad.java

C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)>java Quad
Enter the coefficients (a, b, c) of the quadratic equation:
a: 1
b: 2
c: 1
Real Solution:
Root: -1.0
```

LABORATORY PROGRAM – 2

Develop a Java program to create a class Student with members usn, name, an array credits and an array marks. Include methods to accept and display details and a method to calculate SGPA of a student.

```
import java.util.*;

class Student {
    String USN;
    String name;
    int[] marks = new int[6]; // Assuming 6 subjects

    // Method to accept student details and marks
    void acceptDetails() {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter USN:");
        USN = scanner.nextLine();
        System.out.println("Enter name:");
        name = scanner.nextLine();
        System.out.println("Enter marks for 6 subjects:");
        for (int i = 0; i < 6; i++) {
            System.out.print("Subject " + (i + 1) + " marks: ");
            marks[i] = scanner.nextInt();
        }
    }

    // Method to calculate percentage
    double calculatePercentage() {
        int totalMarks = 0;
        for (int mark : marks) {
            totalMarks += mark;
        }
        return (double) totalMarks / 6;
    }

    // Method to display student details
    void displayDetails() {
```

```
        System.out.println("USN: " + USN);
        System.out.println("Name: " + name);
        System.out.println("Marks:");
        for (int i = 0; i < 6; i++) {
            System.out.println("Subject " + (i + 1) + ": " + marks[i]);
        }
        System.out.println("Percentage: " + calculatePercentage() + "%");
    }
}

public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the number of students: ");
        int numStudents = scanner.nextInt();
        Student[] students = new Student[numStudents];

        // Accept details for each student
        for (int i = 0; i < numStudents; i++) {
            System.out.println("Enter details for student " + (i + 1) + ":");
            students[i] = new Student();
            students[i].acceptDetails();
        }

        // Display details for each student
        System.out.println("\nDetails of all students:");
        for (int i = 0; i < numStudents; i++) {
            System.out.println("\nDetails of student " + (i + 1) + ":");
            students[i].displayDetails();
        }
    }
}
```

OUTPUT:

```
C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)
Enter the number of students: 2
Enter details for student 1:
Enter USN:
1BM22CS066
Enter name:
Bhanoday K
Enter marks for 6 subjects:
Subject 1 marks: 99
Subject 2 marks: 90
Subject 3 marks: 100
Subject 4 marks: 97
Subject 5 marks: 85
Subject 6 marks: 96
Enter details for student 2:
Enter USN:
Allu Arjun
Enter name:
1BM22CS199
Enter marks for 6 subjects:
Subject 1 marks: 89
Subject 2 marks: 90
Subject 3 marks: 99
Subject 4 marks: 92
Subject 5 marks: 91
Subject 6 marks: 100
```

```
Details of all students:

Details of student 1:
USN: 1BM22CS066
Name: Bhanoday K
Marks:
Subject 1: 99
Subject 2: 90
Subject 3: 100
Subject 4: 97
Subject 5: 85
Subject 6: 96
Percentage: 94.5%

Details of student 2:
USN: Allu Arjun
Name: 1BM22CS199
Marks:
Subject 1: 89
Subject 2: 90
Subject 3: 99
Subject 4: 92
Subject 5: 91
Subject 6: 100
Percentage: 93.5%
```

LABORATORY PROGRAM - 3

Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea( ). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.

```
abstract class Shape {
    protected int dimension1;
    protected int dimension2;

    public Shape(int dimension1, int dimension2) {
        this.dimension1 = dimension1;
        this.dimension2 = dimension2;
    }

    public abstract void printArea();
}

class Rectangle extends Shape {
    public Rectangle(int length, int width) {
        super(length, width);
    }

    @Override
    public void printArea() {
        int area = dimension1 * dimension2;
        System.out.println("Area of Rectangle: " + area);
```

```
    }
}

class Triangle extends Shape {
    public Triangle(int base, int height) {
        super(base, height);
    }

    @Override
    public void printArea() {
        double area = 0.5 * dimension1 * dimension2;
        System.out.println("Area of Triangle: " + area);
    }
}

class Circle extends Shape {
    public Circle(int radius) {
        super(radius, 0);
    }

    @Override
    public void printArea() {
        double area = Math.PI * dimension1 * dimension1;
        System.out.println("Area of Circle: " + area);
    }
}
```

```
public class ShapeResult {
    public static void main(String[] args) {
        Rectangle rectangle = new Rectangle(5, 10);
        rectangle.printArea();

        Triangle triangle = new Triangle(4, 6);
        triangle.printArea();

        Circle circle = new Circle(3);
        circle.printArea();
    }
}
```

OUTPUT:

```
C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)>java ShapeResult
Area of Rectangle: 50
Area of Triangle: 12.0
Area of Circle: 28.274333882308138
```

LABORATORY PROGRAM – 4

Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed. Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks:
a) Accept deposit from customer and update the balance.
b) Display the balance.
c) Compute and deposit interest d)
Permit withdrawal and update the balance Check for the minimum balance, impose penalty if necessary and update the balance

```
import java.util.Scanner;
class account{
    boolean check;
    String name;
    long accno;
    String acctype;
    double bal;
    Scanner sc = new Scanner(System.in);
    account(String name, long accno, String acctype, double bal, boolean
cheque)
    {
        this.name = name;
        this.accno=accno;
        this.acctype= acctype;
        this.bal= bal;
        this.check = cheque;
```

```
    }

    void Dep (){
        System.out.println("Enter amount to be deposited");
        double amt=sc.nextDouble();
        bal += amt;
    }
    void Displaybal() {
        System.out.println("Balance: " + bal);
    }
    public void interest()
    {
        System.out.println("Enter rate: ");
        Double rate=sc.nextDouble();
        if ("Savings". equals (acctype))
        {
            double interest=bal*(rate/100);
            bal += interest;
        }
    }
    public void withdraw () {
        System.out.println("Enter amount the be withdrawn");
        double amt=sc.nextDouble();
        if (amt <= bal){
            bal-=amt;
        }
        else{
            System.out.println("Insufficient funds");
        }
    }
}

class savacc extends account{
    public savacc(String name, long accno, double bal, boolean cheque)
    {
        super(name, accno, "Savings", bal, cheque);
```

```
 }
}

class curracct extends account{
    double minbal;
    double serv;
    public curracct(String name, long accno, double bal, double minbal,
double serv, boolean cheque)
    {
        super(name, accno, "current", bal, cheque);
        this.minbal=minbal;
        this.serv=serv;
    }
    public void withdraw() {
        System.out.println("Enter amt to be withdrawn");
        double amt=sc.nextDouble();
        if (amt<= bal-minbal) {
            bal-=amt;
        }
        else{
            System.out.println("Insufficient funds");
        }
    }
    public void check() {
        if (bal > minbal) {
            bal -= serv;
            System.out.println("Service charges applied");
        }
    }
}

class bank{

    public static void main(String[] args) {
        System.out.println("USN:1BM22CS066");
        System.out.println("Name: Bhanoday Kurma");
```

```
        savacc s = new savacc ("joseph",123456,10000.0,false);
        curracct c= new curracct ("John Mike",938462,20000.0,500.0,
50.0,true);
        System.out.println("Savings Acc");
        s.Displaybal();
        s.Dep();
        s.Displaybal();
        s.interest();
        s.Displaybal();
        s.withdraw();
        s.Displaybal();
        System.out.println("current acc");
        c.Displaybal();
        c.Dep();
        c.Displaybal();
        c.withdraw();
        c.Displaybal();
        c.check();
        c.Displaybal();
    }
}
```

OUTPUT :

```
C:\Users\user>java Bank
Enter name for savings account:
John Doe
Enter account number for savings account:
123456
Enter name for current account:
Jane Smith
Enter account number for current account:
654321
Enter amount to deposit into savings account:
5000
Deposit of 5000.0 successful.
Current balance: 5000.0
Enter amount to deposit into current account:
3000
Deposit of 3000.0 successful.
Current balance: 3000.0
Enter amount to withdraw from savings account:
2000
Withdrawal of 2000.0 successful.
Current balance: 3000.0
Enter amount to withdraw from current account:
4000
Insufficient balance for withdrawal. Service charge of 50.0 will be applied.
Current balance: 2950.0
```

LABORATORY PROGRAM - 5

Write a program which creates two threads, one thread displaying “BMS College of Engineering” once every ten seconds and another displaying “CSE” once every two seconds.

```
class MessageThread extends Thread {
    private String message;
    private int interval;

    public MessageThread(String message, int interval) {
        this.message = message;
        this.interval = interval;
    }

    public void run() {
        try {
            while (true) {
                System.out.println(message);
                Thread.sleep(interval);
            }
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
    }
}

public class Main {
```

```
    public static void main(String[] args) {
        // Creating and starting threads
        Thread thread1 = new MessageThread("BMS College of Engineering", 10000); // 10 seconds
        Thread thread2 = new MessageThread("CSE", 2000); // 2 seconds
        thread1.start();
        thread2.start();
    }
}
```

OUTPUT:

```
C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)>java T1
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
```

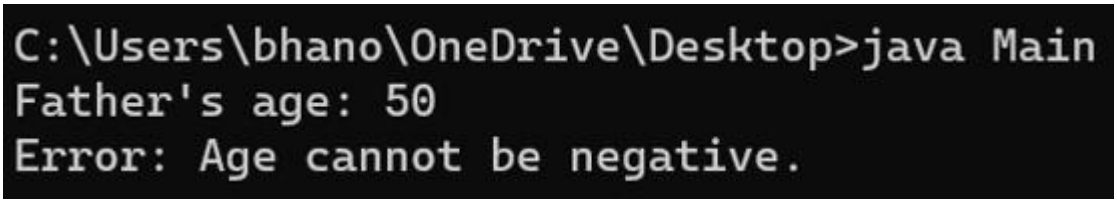
LABORATORY PROGRAM - 6

Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called “Father” and derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge( ) when the input age=father’s age.

```
// Custom Exception Class
class WrongAge extends Exception {
    public WrongAge() {
        super("Age cannot be negative.");
    }
}

// Base class
class Father {
    int age;

    public Father(int age) throws WrongAge {
        if (age < 0) {
            throw new WrongAge();
        }
        this.age = age;
    }
}

// Derived class
class Son extends Father {
    int sonAge;
```

```
    public Son(int fatherAge, int sonAge) throws WrongAge {
        super(fatherAge);
        if (sonAge >= fatherAge) {
            throw new WrongAge();
        }
        this.sonAge = sonAge;
    }
}

// Main class
public class Main {
    public static void main(String[] args) {
        try {
            Father father = new Father(50);
            System.out.println("Father's age: " + father.age);

            // This will throw an exception because son's age is greater than or equal to father's age
            Son son = new Son(50, 55);
            System.out.println("Son's age: " + son.sonAge);
        } catch (WrongAge e) {
            System.out.println("Error: " + e.getMessage());
        }
    }
}
```

OUTPUT:


C:\Users\bhano\OneDrive\Desktop>java Main
Father's age: 50
Error: Age cannot be negative.

LABORATORY PROGRAM - 7

Create a class Book which contains four members: name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects. Include a toString( ) method that could display the complete details of the book. Develop a Java program to create n book objects.

```
import java.util.Scanner;

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

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

    public String getName() {
        return name;
    }

    public String getAuthor() {
        return author;
    }

    public double getPrice() {
        return price;
    }

    public int getNumPages() {
        return num_pages;
    }

    // Setter methods
```

```
    public void setName(String name) {
        this.name = name;
    }

    public void setAuthor(String author) {
        this.author = author;
    }

    public void setPrice(double price) {
        this.price = price;
    }

    public void setNumPages(int num_pages) {
        this.num_pages = num_pages;
    }

    @Override
    public String toString() {
        return "Book Details: \nName: " + name + "\nAuthor: " + author + "\nPrice: $"
+ price + "\nNumber of Pages: " + num_pages;
    }
}

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

        System.out.print("Enter the number of books: ");
        int n = scanner.nextInt();

        Book[] books = new Book[n];

        for (int i = 0; i < n; i++) {
            System.out.println("\nEnter details for Book " + (i + 1) + ":");
            scanner.nextLine(); // Consume newline
            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("Number of Pages: ");
            int num_pages = scanner.nextInt();

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

        System.out.println("\nDetails of all books:");
        for (int i = 0; i < n; i++) {
            System.out.println("\nBook " + (i + 1) + ":");
            System.out.println(books[i]);
        }

        scanner.close();
    }
}
```

OUTPUT:

```
C:\Users\bhano\OneDrive\Desktop\Bhanoday(1BM22CS066)>java BookTest
Enter the number of books: 3

Enter details for Book 1:
Name: To Kill A MockingBird
Author: Harper Lee
Price: 400
Number of Pages: 281

Enter details for Book 2:
Name: The Catcher in the Rye
Author: J.D Salinger
Price: 380
Number of Pages: 328

Enter details for Book 3:
Name: The Lord Of Rings
Author: J.R.R Tolkien
Price: 1000
Number of Pages: 1200
```

```
Details of all books:

Book 1:
Book Details:
Name: To Kill A MockingBird
Author: Harper Lee
Price: $400.0
Number of Pages: 281

Book 2:
Book Details:
Name: The Catcher in the Rye
Author: J.D Salinger
Price: $380.0
Number of Pages: 328

Book 3:
Book Details:
Name: The Lord Of Rings
Author: J.R.R Tolkien
Price: $1000.0
Number of Pages: 1200
```

LABORATORY PROGRAM - 8

Create a package CIE which has two classes- Student and Internals. The class Personal has members like usn, name, sem. The class internals has an array that stores the internal marks scored in five courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Student. This class has an array that stores the SEE marks scored in five courses of the current semester of the student. Import the two packages in a file that declares the final marks of n students in all five courses

```
package CIE;


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

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


public class Internals {
    public int[] internalMarks;

    public Internals(int[] internalMarks) {
```

```
        this.internalMarks = internalMarks;
    }
}
package SEE;
import CIE.Student;

public class External extends Student {
    public int[] externalMarks;

    public External(String usn, String name, int sem, int[] externalMarks) {
        super(usn, name, sem);
        this.externalMarks = externalMarks;
    }
}
import CIE.Student;
import CIE.Internals;
import SEE.External;

import java.util.Scanner;

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

        System.out.print("Enter the number of students: ");
        int n = scanner.nextInt();
```

```
        Student[] students = new Student[n];
        int[][] finalMarks = new int[n][5];
        for (int i = 0; i < n; i++) {
            System.out.println("\nEnter details for Student " + (i + 1) + ":");
            scanner.nextLine(); // Consume newline
            System.out.print("USN: ");
            String usn = scanner.nextLine();
            System.out.print("Name: ");
            String name = scanner.nextLine();
            System.out.print("Semester: ");
            int sem = scanner.nextInt();

            System.out.println("Enter Internal marks for Student " + (i + 1) +
":");
            int[] internalMarks = new int[5];
            for (int j = 0; j < 5; j++) {
                System.out.print("Internal marks for Course " + (j + 1) + ": ");
                internalMarks[j] = scanner.nextInt();
            }

           System.out.println("Enter External marks for Student " + (i + 1) +
":");
            int[] externalMarks = new int[5];
            for (int j = 0; j < 5; j++) {
                System.out.print("External marks for Course " + (j + 1) + ": ");
                externalMarks[j] = scanner.nextInt();
            }
```

```
            students[i] = new External(usn, name, sem, externalMarks);


            for (int j = 0; j < 5; j++) {
                finalMarks[i][j] = internalMarks[j] + externalMarks[j];
            }
        }


        System.out.println("\nFinal Marks of all Students:");
        for (int i = 0; i < n; i++) {
            System.out.println("\nStudent " + (i + 1) + " - USN: " +
students[i].usn + ", Name: " + students[i].name + ", Semester: " +
students[i].sem);
            System.out.println("Final Marks:");
            for (int j = 0; j < 5; j++) {
                System.out.println("Course " + (j + 1) + ": " + finalMarks[i][j]);
            }
        }


        scanner.close();
    }
}
```

OUTPUT:

```
Enter the number of students: 3

Enter details for Student 1:
USN: 1BM22IS089
Name: Naruto Uzumaki
Semester: 3
Enter Internal marks for Student 1:
Internal marks for Course 1: 45
Internal marks for Course 2: 46
Internal marks for Course 3: 41
Internal marks for Course 4: 38
Internal marks for Course 5: 40
Enter External marks for Student 1:
External marks for Course 1: 90
External marks for Course 2: 98
External marks for Course 3: 96
External marks for Course 4: 80
External marks for Course 5: 86

Enter details for Student 2:
USN: 1BM22ME123
Name: Sasuke Uchicha
Semester: 4
Enter Internal marks for Student 2:
Internal marks for Course 1: 43
Internal marks for Course 2: 42
Internal marks for Course 3: 48
Internal marks for Course 4: 47
Internal marks for Course 5: 49
```

```
Enter External marks for Student 2:
External marks for Course 1: 98
External marks for Course 2: 97
External marks for Course 3: 91
External marks for Course 4: 92
External marks for Course 5: 99

Enter details for Student 3:
USN: 1BM22IS081
Name: Sakura Haruno
Semester: 3
Enter Internal marks for Student 3:
Internal marks for Course 1: 43
Internal marks for Course 2: 44
Internal marks for Course 3: 48
Internal marks for Course 4: 50
Internal marks for Course 5: 49
Enter External marks for Student 3:
External marks for Course 1: 99
External marks for Course 2: 93
External marks for Course 3: 91
External marks for Course 4: 97
External marks for Course 5: 100
```

```
Final Marks of all Students:

Student 1 - USN: 1BM22CS077, Name: Naruto Uzumaki, Semester: 3
Final Marks:
Course 1: 88
Course 2: 85
Course 3: 77
Course 4: 84
Course 5: 96

Student 2 - USN: 1BM22IS061, Name: Sasuke Uchicha, Semester: 3
Final Marks:
Course 1: 88
Course 2: 94
Course 3: 98
Course 4: 82
Course 5: 82

Student 3 - USN: 1BM22CS089, Name: Sakura Haruno, Semester: 3
Final Marks:
Course 1: 86
Course 2: 93
Course 3: 96
Course 4: 94
Course 5: 80
```