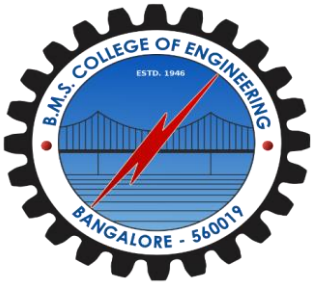
B.M.S. COLLEGE OF ENGINEERING

(Autonomous College Affiliated to Visvesvaraya Technological University, Belgaum)
Bull Temple Road, Basavanagudi, Bengaluru – 560019



LAB REPORT

On

Object Oriented Java Programming

(23CS3PCOOJ)

Submitted By:

Dipesh Sah

1BM22CS092

In partial fulfilment of

BACHELOR OF ENGINEERING

In

COMPUTER SCIENCE AND ENGINEERING

2023-24

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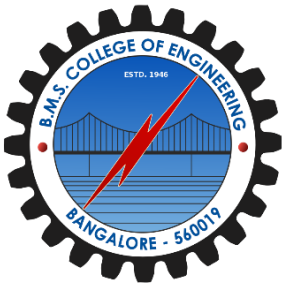

Department of

Computer Science & Engineering (CSE)

CERTIFICATE

This is to certify that the Lab work entitled "Object Oriented Programming in Java (23CS3PCOOJ)" conducted by **Dipesh Sah (1BM22CS092)** who is bonafide student at **B.M.S. College of Engineering**. It is in satisfactory fulfilment for the award of **Bachelor of Engineering in Computer Science and Engineering** during the odd semester in the academic year 2023-24. The Lab report has been approved as it satisfies the academic requirements in respect of Object-Oriented Programming in Java (22CS3PCOOJ) work prescribed for the said degree.

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1BM22CS092

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PROGRAM 1:

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 discriminant $b^2 -4ac$ is negative, display a message stating that there are no real solutions.

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

class quadratic
{
public static void main(String agrs[])
 {
    System.out.println("Name: Dipesh Sah");
    System.out.println("USN: 1BM22CS092");
    int a,b,c;
    System.out.println("Enter the values of a,b,c respectively:- \n");
    Scanner s1= new Scanner(System.in);
    a = s1.nextInt();
    b = s1.nextInt();
    c = s1.nextInt();
    double d= b*b - 4*a*c ;
    System.out.println("a = " + a +" b = " + b +" c = " + c);
    if(a==0) {System.out.println("not a quadratic equation");}
    else if( d>0)
    {
      System.out.println("The equation has two real and different solutions");
      double r1=(-b + Math.sqrt(d))/(2*a);
      double r2=(-b - Math.sqrt(d))/(2*a);
      System.out.println("r1 = " + r1);
      System.out.println("r2 = " + r2);
    }

   else if(d==0)
    {
      System.out.println("The equation has real and equal solutions");
      double r1= -b/(2*a);
      double r2= -b/(2*a);
      System.out.println("r1 = " + r1);
      System.out.println("r2 = " + r2);
    }

   else if(d<0)
    {
     System.out.println("The equation has unreal solutions");
    }
 }
}
```

OUTPUT:

```
Output                                                    Clear

java -cp /tmp/eQqmmhZvNa quadratic

Name: Dipesh Sah
USN: 1BM22CS092
Enter the values of a,b,c respectively:-

1 -3 2
a = 1 b = -3 c = 2
The equation has two real and different solutions
r1 = 2.0
r2 = 1.0
```

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 the percentage of a student.

```
import java.util.Scanner;

class Student {
    String usn;
    String name;
    int marks[] = new int[6];

    void Details() {
        Scanner s = new Scanner(System.in);
        System.out.println("Enter USN:");
        usn = s.next();
        System.out.println("Enter Name:");
        name = s.next();
        System.out.println("Enter marks for 6 subjects:");
        for (int i = 0; i < 6; i++) {
            System.out.print("Subject " + (i + 1) + ": ");
```

```
            marks[i] = s.nextInt();
        }
    }
    double percentage() {
        int total = 0;
        for (int i = 0; i < 6; i++) {
            total += marks[i];
        }
        double p = total / 6;
        return p;
    }

    void display() {
        System.out.println("\nStudent Details:");
        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: " + percentage() + "%");
    }
}

class Lab1student {
    public static void main(String args[]) {
        Scanner s = new Scanner(System.in);
        System.out.println("Name: Dipesh Sah");
        System.out.println("USN: 1BM22CS092");
        System.out.print("Enter the number of students: ");
        int n = s.nextInt();
        Student[] students = new Student[n];
        for (int i = 0; i < n; i++) {
            students[i] = new Student();
            System.out.println("\nEnter details for Student " + (i + 1) + ":");
            students[i].Details();
        }
        for (Student student : students) {
            student.display();
        }
    }
}
```

OUTPUT:

```
Output
java -cp /tmp/hOQQaws5G1 Lab4student
Name: Dipesh Sah
USN: 1BM22CS092
Enter the number of students: 2

Enter details for Student 1:
Enter USN:
1BM22CS092
Enter Name:
Dipesh
Enter marks for 6 subjects:
Subject 1: 68
Subject 2: 98
Subject 3: 84
Subject 4: 78
Subject 5: 89
Subject 6: 92

Enter details for Student 2:
Enter USN:
1BM22CS109
Enter Name:
Harsh
Enter marks for 6 subjects:
Subject 1: 97
Subject 2: 94
Subject 3: 89
Subject 4: 81
Subject 5: 67
Subject 6: 82
```

```
Output
Subject 1: 97
Subject 2: 94
Subject 3: 89
Subject 4: 81
Subject 5: 67
Subject 6: 82

Student Details:
USN: 1BM22CS092
Name: Dipesh
Marks:
Subject 1: 68
Subject 2: 98
Subject 3: 84
Subject 4: 78
Subject 5: 89
Subject 6: 92
Percentage: 84.0%

Student Details:
USN: 1BM22CS109
Name: Harsh
Marks:
Subject 1: 97
Subject 2: 94
Subject 3: 89
Subject 4: 81
Subject 5: 67
Subject 6: 82
Percentage: 85.0%
```

PROGRAM 3:

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 Books {
   String Name;
   String Author;
   int price;
   int numPages;

   Books(String Name, String Author, int price, int numPages) {
      this.Name = Name;
      this.Author = Author;
      this.numPages = numPages;
      this.price = price;
   }

   public String toString() {
      String name, Author, price, numPages;
      name = "Book name: " + this.Name + "\n";
      Author = "Author name: " + this.Author + "\n";
      numPages = "Number of pages: " + this.numPages + "\n";
      price = "Price: " + this.price + "\n";
      return name + Author + numPages + price;
   }
}

class BooksMain {
   public static void main(String[] args) {
      Scanner s = new Scanner(System.in);
      int n;
      String Name;
      String Author;
      int price;
      int numPages;
      System.out.println("Name: Dipesh Sah");
      System.out.println("USN: 1BM22CS092");
      System.out.println("Enter the number of books:-");
      n = s.nextInt();
      Books b[] = new Books[n];

      for (int i = 0; i < n; i++) {
```

```
            System.out.println("Book " + (i + 1) + " Details: ");
            System.out.println("Enter name of book: ");
            Name = s.next();
            System.out.println("Enter name of Author: ");
            Author = s.next();
            System.out.println("Enter price: ");
            price = s.nextInt();
            System.out.println("Enter number of Pages: ");
            numPages = s.nextInt();

            b[i] = new Books(Name, Author, price, numPages);
        }

        for (int i = 0; i < n; i++) {
            System.out.println("\nDetails of Book " + (i + 1) + "\n");
            System.out.println(b[i].toString());
        }
    }
}
```

OUTPUT:

Output

```
java -cp /tmp/h0QQaws5G1 BooksMain
Name: Dipesh Sah
USN: 1BM22CS092
Enter the number of books:-
2
Book 1 Details:
Enter name of book:
Java_Programming
Enter name of Author:
Shravya_AR
Enter price:
345
Enter number of Pages:
228
Book 2 Details:
Enter name of book:
Discrete_Mathematics
Enter name of Author:
Chaitra_V
Enter price:
295
Enter number of Pages:
286

Details of Book 1
```

```
Details of Book 1

Book name: Java_Programming
Author name: Shravya_AR
Number of pages: 228
Price: 345


Details of Book 2

Book name: Discrete_Mathematics
Author name: Chaitra_V
Number of pages: 286
Price: 295
```

PROGRAM 4:

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);
   }

   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);
    }

    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);
    }

    public void printArea() {
        double area = 3.14 * dimension1 * dimension1;
        System.out.println("Area of Circle: " + area);
    }
}

public class ShapeMain {
    public static void main(String[] args) {
        System.out.println("Name: Dipesh Sah");
        System.out.println("USN: 1BM22CS092");

        Rectangle rectangle = new Rectangle(12, 7);
        rectangle.printArea();

        Triangle triangle = new Triangle(13, 9);
        triangle.printArea();

        Circle circle = new Circle(16);
        circle.printArea();
    }
}
```

OUTPUT:

```
Output

Name: Dipesh Sah
USN: 1BM22CS092
Area of Rectangle: 84
Area of Triangle: 58.5
Area of Circle: 804.16
```

PROGRAM 5:

Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called a savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides a cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods to achieve the following tasks:

a) Accept deposits from customers and update the balance.
b) Display the balance.
c) Compute and deposit interest.
d) Permit withdrawal and update the balance.
Check for the minimum balance, impose a penalty if necessary and update the balance.

```
class Bank {
    public static void main(String[] args) {
        SavingsAccount savingsAccount = new SavingsAccount("John Doe", "SA1001");
        CurrentAccount currentAccount = new CurrentAccount("Jane Smith", "CA2002");

        System.out.println("Name: Dipesh Sah");
        System.out.println("USN: 1BM22CS092");

        savingsAccount.deposit(5000);
        savingsAccount.displayBalance();
        savingsAccount.computeInterest();
        savingsAccount.displayBalance();
        savingsAccount.withdraw(2000);
        savingsAccount.displayBalance();

        currentAccount.deposit(8000);
        currentAccount.displayBalance();
        currentAccount.withdraw(5000);
        currentAccount.displayBalance();
    }
}

class Account {
    protected String customerName;
    protected String accountNumber;
    protected double balance;
```

```
    public Account(String customerName, String accountNumber) {
        this.customerName = customerName;
        this.accountNumber = accountNumber;
        this.balance = 0;
    }

    public void deposit(double amount) {
        balance += amount;
        System.out.println("Deposit of " + amount + " successful");
    }

    public void displayBalance() {
        System.out.println("Account Number: " + accountNumber + "\nBalance: " + balance);
    }
}

class SavingsAccount extends Account {
    public SavingsAccount(String customerName, String accountNumber) {
        super(customerName, accountNumber);
    }

    public void computeInterest() {
        double interestRate = 0.05;
        double interest = balance * interestRate;
        balance += interest;
        System.out.println("Interest of " + interest + " computed and added to the balance.");
    }

    public void withdraw(double amount) {
        if (balance >= amount) {
            balance -= amount;
            System.out.println("Withdrawal of " + amount + " successful");
        } else {
            System.out.println("Insufficient funds for withdrawal");
        }
    }
}

class CurrentAccount extends Account {
    private double minimumBalance = 1000;

    public CurrentAccount(String customerName, String accountNumber) {
        super(customerName, accountNumber);
    }
```

```
    public void withdraw(double amount) {
        if (balance - amount >= minimumBalance) {
            balance -= amount;
            System.out.println("Withdrawal of " + amount + " successful.");
        } else {
            System.out.println("Insufficient funds. Service charge applied.");
            imposeServiceCharge();
        }
    }

    private void imposeServiceCharge() {
        double serviceCharge = 20;
        balance -= serviceCharge;
        System.out.println("Service charge of " + serviceCharge + " imposed.");
    }
}
```

OUTPUT:

Output

```
java -cp /tmp/h0QQaws5G1 Bank
Name: Dipesh Sah
USN: 1BM22CS092
Deposit of 5000.0 successful
Account Number: SA1001
Balance: 5000.0
Interest of 250.0 computed and added to the balance.
Account Number: SA1001
Balance: 5250.0
Withdrawal of 2000.0 successful
Account Number: SA1001
Balance: 3250.0
Deposit of 8000.0 successful
Account Number: CA2002
Balance: 8000.0
Withdrawal of 5000.0 successful.
Account Number: CA2002
Balance: 3000.0
```

PROGRAM 6:

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.

```
// Cie folder: Internals
package cie;

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

// Student class
package cie;

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

// See folder: External
package see;

import cie.Student;

public class External extends Student {
    public int[] seemarks = new int[5];
}

// Main class
import cie.Internals;
import see.External;
import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        System.out.println("Name: Dipesh Sah");
```

```
System.out.println("USN: 1BM22CS092");
System.out.println("Enter the number of students");
Scanner input = new Scanner(System.in);
int n = input.nextInt();

Internals[] s1 = new Internals[n];
External[] s2 = new External[n];
int[] finalcie = new int[n];
int[] finalsee = new int[n];

for (int i = 0; i < n; i++) {
   s1[i] = new Internals();
   System.out.println("Enter the name");
   s1[i].name = input.next();
   System.out.println("Enter the usn");
   s1[i].usn = input.next();
   System.out.println("Enter the sem");
   s1[i].sem = input.nextInt();
   System.out.println("Enter the marks of 5 subjects");
   for (int j = 0; j < 5; j++) {
      s1[i].marks[j] = input.nextInt();
      finalcie[i] += s1[i].marks[j];
   }
}

for (int i = 0; i < n; i++) {
   s2[i] = new External();
   System.out.println("Enter the name");
   s2[i].name = input.next();
   System.out.println("Enter the usn");
   s2[i].usn = input.next();
   System.out.println("Enter the sem");
   s2[i].sem = input.nextInt();
   System.out.println("Enter the marks of 5 subjects");
   for (int j = 0; j < 5; j++) {
      s2[i].seemarks[j] = input.nextInt();
      finalsee[i] += s2[i].seemarks[j];
   }
}

System.out.println("Final marks:");
for (int i = 0; i < n; i++) {
   System.out.println("Name: " + s1[i].name + " USN: " + s1[i].usn + " Sem: " + s1[i].sem);
   System.out.println("Internal marks: " + finalcie[i]);
```

```
            System.out.println("External marks: " + finalsee[i]);
            System.out.println("Total marks: " + (finalcie[i] + finalsee[i]));
        }
    }
}
```

OUTPUT:

Output

```
Name: Dipesh Sah
USN: 1BM22CS092
Enter the number of students: 2

Enter details for Student 1:
Enter the name: John
Enter the USN: 1BM21CS201
Enter the semester: 3
Enter the marks of 5 subjects:
90 85 75 80 95

Enter details for Student 2:
Enter the name: Alice
Enter the USN: 1BM21CS102
Enter the semester: 3
Enter the marks of 5 subjects:
85 80 70 75 90

Final marks:
Name: John USN: 1BM21CS201 Sem: 3
Internal marks: 425
External marks: 0
Total marks: 425

Name: Alice USN: 1BM21CS102 Sem: 3
Internal marks: 400
External marks: 0
Total marks: 400
```

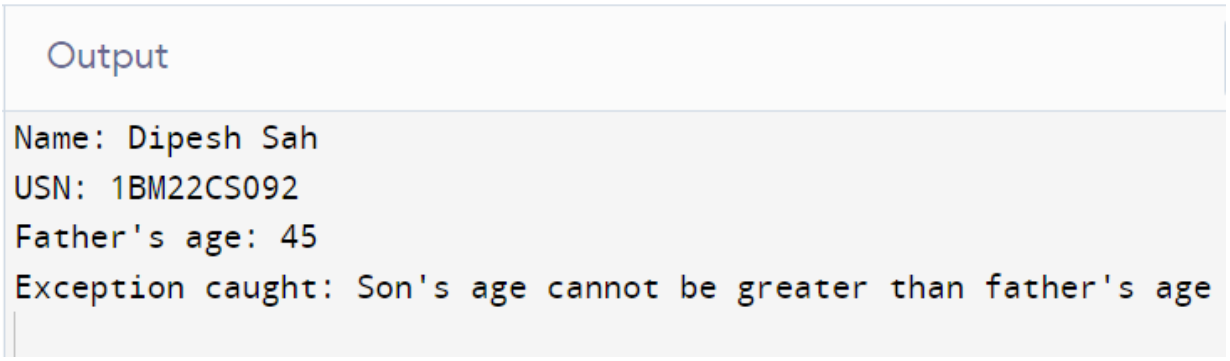
PROGRAM 7:

Write a program that demonstrates handling of exceptions in inheritance trees. 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<0. In Son class, implement a constructor that cases both father and son’s age and throws an exception if son’s age is >father’s age.

```
class WrongAge extends Exception {
    public WrongAge(String message) {
        super(message);
    }
}

class Father {
    int age;

    public Father(int age) throws WrongAge {
        if (age < 0) {
            throw new WrongAge("Father's age cannot be negative");
        }
        this.age = age;
    }

    public int getAge() {
        return age;
    }
}

class Son extends Father {
    int sonAge;

    public Son(int fatherAge, int sonAge) throws WrongAge {
        super(fatherAge);
        if (sonAge >= fatherAge) {
            throw new WrongAge("Son's age cannot be greater than father's age");
        }
        this.sonAge = sonAge;
    }

    public int getSonAge() {
        return sonAge;
    }
```

```
}

public class Main {
    public static void main(String[] args) {
        try {
            System.out.println("Name: Dipesh Sah");
            System.out.println("USN: 1BM22CS092");
            Father father = new Father(45);
            System.out.println("Father's age: " + father.getAge());

            Son son = new Son(45, 50); // This will throw an exception
            System.out.println("Son's age: " + son.getSonAge());
        } catch (WrongAge e) {
            System.out.println("Exception caught: " + e.getMessage());
        }
    }
}
```

OUTPUT:



PROGRAM 8:

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

```
class DispMessage extends Thread {
    String message;
    int interval; // Interval in milliseconds

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

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

public class Main {
    public static void main(String[] args) {
        System.out.println("Name: Dipesh Sah");
        System.out.println("USN: 1BM22CS092");

        DispMessage bmsThread = new DispMessage("BMS College of Engineering", 10000);
        DispMessage cseThread = new DispMessage("CSE", 2000);

        bmsThread.start();
        cseThread.start();
    }
}
```

OUTPUT:

Output

```
Name: Dipesh Sah
USN: 1BM22CS092
CSE
CSE
BMS College of Engineering
CSE
CSE
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
CSE
BMS College of Engineering
```

Output

```
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
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CSE
CSE
...
```