VISVESVARAYA TECHNOLOGICAL UNIVERSITY, JNANASANGAMA, BELGAUM - 590014, KARNATAKA

LABORATORY RECORD

ON

Object Oriented Java Programming

(23CS3PCOOJ) *Submitted by*

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

```java
import java.util.Scanner;
import java.lang.Math;
class Quad
{
        double Disc(double a,double b,double c)
        {
                return b*b-4*a*c;
        }
        void roots(double a,double b, double c)
        {
                double D = Disc(a,b,c);
                if (D<0)
                {
                        double realPart = -b/(2*a);
                        double imaginaryPart = Math.sqrt(Math.abs(D))/(2*a);
                        System.out.println("The Quadratic Equation has Conjugate Imaginary
                        roots:");
                        System.out.printf("Root 1: %.5f + %.5fi%n",realPart,imaginaryPart);
                        System.out.printf("Root 2: %.5f - %.5fi%n",realPart,imaginaryPart);
    }
                else if (D>0)
                {
                        System.out.println("The Quadratic Equation has Two Distinct Real Roots:");
                        double r1=(-b+Math.sqrt(D))/(2*a);
                        double r2=(-b-Math.sqrt(D))/(2*a);
                        System.out.printf("Root 1: %.5f%n",r1);
                        System.out.printf("Root 2: %.5f%n", r2);
                }
                else
                {
                        System.out.println("The Quadratic Equation has Equal and Real Root:");
                        double r1=(-b)/(2*a);
                        System.out.printf("Both Root 1 and Root 2: %.5f%n",r1);
                }}}
class QuadEqn
 {
        public static void main(String sx[])
```

```java
{       System.out.println("Name: "+"Dinesh Kumar G"+"\n"+"Usn: "+"1BM22CS091");
    Scanner S1 = new Scanner(System.in);
        System.out.println("Enter the Coefficients of Quadratic Equation : ");
        double a = S1.nextDouble();
        double b = S1.nextDouble();
        double c = S1.nextDouble();
        if (a==0)
        {
            System.out.println("Since the Coefficient of x^2 is Zero, it's not a Quadratic
            Equation");
        }
        else
        {
            Quad quadratic=new Quad();
            quadratic.Disc(a,b,c);
            quadratic.roots(a,b,c);
        }
        } }
```

OUTPUT

```
C:\Users\ramesh\Desktop>javac QuadEqn.java

C:\Users\ramesh\Desktop>java QuadEqn
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter the Coefficients of Quadratic Equation :
23
24
26
The Quadratic Equation has Conjugate Imaginary roots
Root 1: -0.52174 + 0.92640i
Root 2: -0.52174 - 0.92640i

C:\Users\ramesh\Desktop>java QuadEqn
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter the Coefficients of Quadratic Equation :
1
2
1
The Quadratic Equation has Equal and Real Root:
Both Root 1 and Root 2: -1.00000

C:\Users\ramesh\Desktop>java QuadEqn
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter the Coefficients of Quadratic Equation :
6
8
0
The Quadratic Equation has Two Distinct Real Roots:
Root 1: 0.00000
Root 2: -1.33333

C:\Users\ramesh\Desktop>_
```

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.

```java
import java.util.Scanner;

class Student
{
    String usn;
    String name;
    int[] credits;
    int[] marks;

    public void acceptDetails() {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter USN: ");
        usn = sc.nextLine();
        System.out.println("Enter Name: ");
        name = sc.nextLine();
        System.out.println("Enter number of subjects: ");
        int n = sc.nextInt();
        credits = new int[n];
        marks = new int[n];
        for (int i = 0; i < n; i++) {
            System.out.println("Enter credits for subject " + (i + 1) + ": ");
            credits[i] = sc.nextInt();
            System.out.println("Enter marks for subject " + (i + 1) + ": ");
            marks[i] = sc.nextInt();
        }
    }

    public void displayDetails() {
        System.out.println("USN: " + usn);
        System.out.println("Name: " + name);
        System.out.println("Marks: ");
        for (int i = 0; i < marks.length; i++) {
            System.out.println("Subject " + (i + 1) + ": " + marks[i]);
        }
        System.out.println("Credits: ");
        for (int i = 0; i < credits.length; i++) {
            System.out.println("Subject " + (i + 1) + ": " + credits[i]);
        }
    }

    public double calculateSGPA() {
```

```java
        double totalGrade = 0;
        int totalCredit = 0;
        for (int i = 0; i < credits.length; i++) {
            totalGrade += getGrade(marks[i]) * credits[i];
            totalCredit += credits[i];
        }
        return totalGrade / totalCredit;
    }

    private double getGrade(int marks) {
        if (marks >= 90) {
            return 10;
        } else if (marks >= 80) {
            return 9;
        } else if (marks >= 70) {
            return 8;
        } else if (marks >= 60) {
            return 7;
        } else if (marks >= 50) {
            return 6;
        } else if (marks >= 40) {
            return 5;
        } else {
            return 0;
        }
    }

    public static void main(String[] args) {
    Student student = new
        Student();

     System.out.println("Name: "+"Dinesh
            Kumar G"+"\n"+"Usn:
            "+"1BM22CS091");

    student.acceptDetails();
        student.displayDetails();
        System.out.println("SGPA: " + student.calculateSGPA());
    }
}
```

```
C:\Users\ramesh\Desktop>javac Student.java

C:\Users\ramesh\Desktop>java Student
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter USN:
1BM22CS091
Enter Name:
Dinesh Kumar G
Enter number of subjects:
3
Enter credits for subject 1:
4
Enter marks for subject 1:
97
Enter credits for subject 2:
3
Enter marks for subject 2:
98
Enter credits for subject 3:
2
Enter marks for subject 3:
99
USN: 1BM22CS091
Name: Dinesh Kumar G
Marks:
Subject 1: 97
Subject 2: 98
Subject 3: 99
Credits:
Subject 1: 4
Subject 2: 3
Subject 3: 2
SGPA: 10.0
```

LABORATORY 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.

```java
import java.util.Scanner;

class Book
{
    String name;
    String author;
    double price;
    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 void setName(String name)
    {
        this.name = name;
    }

    public String getName()
    {
        return name;
    }

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

    public String getAuthor()
    {
        return author;
    }

    public void setPrice(double price)
    {
```

```java
      this.price = price;
   }

   public double getPrice()
   {
      return price;
   }

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

   public int getNumPages()
   {
      return num_pages;
   }

   public String toString()
   {
      return "Name: " + name + "\nAuthor: " + author + "\nPrice: " + price + "\nNumber of Pages: " +
num_pages;
   }

   public static void main(String[] args)
   {   System.out.println("Name: "+"Dinesh Kumar G"+"\n"+"Usn: "+"1BM22CS091");
      Scanner sc = new Scanner(System.in);
      System.out.println("Enter the number of books: ");
      int n = sc.nextInt();
      Book[] books = new Book[n];
      for (int i = 0; i < n; i++){
         System.out.println("Enter details for book " + (i + 1) + ":");
         System.out.println("Enter name: ");
         String name = sc.next();
         System.out.println("Enter author: ");
         String author = sc.next();
         System.out.println("Enter price: ");
         double price = sc.nextDouble();
         System.out.println("Enter number of pages: ");
         int num_pages = sc.nextInt();
         books[i] = new Book(name, author, price, num_pages);
      }
      for (int i = 0; i < n; i++){
         System.out.println("Details of book " + (i + 1) + ":");
         System.out.println(books[i].toString());
      }
   }
}
```

```
C:\Users\ramesh\Desktop>javac Book.java

C:\Users\ramesh\Desktop>java Book
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter the number of books:
2
Enter details for book 1:
Enter name:
Avatar
Enter author:
Kishimoto
Enter price:
1200
Enter number of pages:
1500
Enter details for book 2:
Enter name:
Naruto
Enter author:
James
Enter price:
999
Enter number of pages:
700
Details of book 1:
Name: Avatar
Author: Kishimoto
Price: 1200.0
Number of Pages: 1500
Details of book 2:
Name: Naruto
Author: James
Price: 999.0
Number of Pages: 700
```

LABORATORY 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.

```java
import java.util.Scanner;

abstract class Shape
{
        abstract void printArea();
        int length,breadth;
}

class Rectangle extends Shape
{
        Rectangle(int l,int b)
        {
                length=l;
                breadth=b;
        }

        void printArea()
        {
                int area=length*breadth;
                System.out.println("Area of Rectangle is "+area);
        }
}

class Triangle extends Shape
{
        Triangle(int l,int b)
        {
                length=l;
                breadth=b;
        }

        void printArea()
        {
                double area=0.5*length*breadth;
                System.out.println("Area of Triangle is "+area);
        }
}

class Circle extends Shape
```

```java
        {
                Circle(int r)
                {
                        length=r;
                }

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

class Display
{
        public static void main(String sx[])
        {       System.out.println("Name: "+"Dinesh Kumar G"+"\n"+"Usn: "+"1BM22CS091");
                Scanner s1=new Scanner(System.in);
                Rectangle r1=new Rectangle(0,0);
                System.out.println("Enter the Length and Breadth of Rectangle, to get it's Area: ");
                int l=s1.nextInt();
                int b=s1.nextInt();
                r1=new Rectangle(l,b);
                r1.printArea();
                Triangle t1=new Triangle(0,0);
                System.out.println("Enter the base and height of triangle, to get it's Area: ");
                int bs=s1.nextInt();
                int h=s1.nextInt();
                t1=new Triangle(bs,h);
                t1.printArea();
                Circle c1=new Circle(0);
                System.out.println("Enter the Radius of Circle, to get it's Area: ");
                int r=s1.nextInt();
                c1=new Circle(r);
                c1.printArea();

        }
}
```

```
C:\Users\ramesh\Desktop>javac Display.java

C:\Users\ramesh\Desktop>java Display
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter the Length and Breadth of Rectangle, to get its Area:
2
3
Area of Rectangle is 6
Enter the base and height of triangle, to get its Area:
2
4
Area of Triangle is 4.0
Enter the Radius of Circle, to get its Area:
2
Area of Circle is 12.56
```

LABORATORY PROGRAM - 5

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.

e) Accept deposit from customer and update the balance.
f) Display the balance.
g) Compute and deposit interest
h) Permit withdrawal and update the balance
Check for the minimum balance, impose penalty if necessary and update the balance.

```java
import java.util.Scanner;

class Account
{
    String customerName;
    long accountNumber;
    String accountType;
    double balance;

    public Account(String customerName, long accountNumber, String accountType, double balance)
        {
        this.customerName = customerName;
        this.accountNumber = accountNumber;
        this.accountType = accountType;
        this.balance = balance;
    }

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

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


        System.out.println("Customer Name: " + customerName);
        System.out.println("Account Type: " + accountType);
        System.out.println("Balance: " + balance);
    }
}

class SavAcct extends Account
{
    public SavAcct(String customerName, long accountNumber, double balance)
        {
        super(customerName, accountNumber, "Savings", balance);
    }

    public void computeAndDepositInterest(double rate)
        {
        double interest = balance * rate / 100;
        balance += interest;
        System.out.println("Interest computed and deposited. Updated balance: " + balance);
    }
```

```java
    public void withdraw(double amount)
        {
    if (amount <= balance)
                {
        balance -= amount;
        System.out.println("Withdrawal successful. Updated balance: " + balance);
    }
                else
                {
        System.out.println("Insufficient funds. Withdrawal failed.");
    }
  }
}

class CurrAcct extends Account
{
   double minimumBalance;
   double serviceCharge;

   public  CurrAcct(String customerName,  long  accountNumber,  double  balance,  double
minimumBalance, double serviceCharge)
        {
     super(customerName, accountNumber, "Current", balance);
     this.minimumBalance = minimumBalance;
     this.serviceCharge = serviceCharge;
  }

        private void checkMinimumBalance(){
     if (balance < minimumBalance)
                {
        balance -= serviceCharge;
        System.out.println("Minimum balance not maintained. Service charge imposed. Updated
balance: " + balance);
    }
  }

   public void withdraw(double amount)
        {
    if (amount <= balance)
                {
        balance -= amount;
        System.out.println("Withdrawal successful. Updated balance: " + balance);
        checkMinimumBalance();
    }
                else
                {
        System.out.println("Insufficient funds. Withdrawal failed.");
    }
```

```java
        }
}

public class Bank
{
    public static void main(String[] args)
        { System.out.println("Name: "+"Dinesh Kumar G"+"\n"+"Usn: "+"1BM22CS091");

        Scanner s1 = new Scanner(System.in);

        System.out.print("Enter customer name for Savings Account: ");
        String SCN = s1.nextLine();
        System.out.print("Enter account number for Savings Account: ");
        long SAN = s1.nextLong();
        System.out.print("Enter initial balance for Savings Account: ");
        double SIB = s1.nextDouble();
        SavAcct SA = new SavAcct(SCN, SAN, SIB);

        System.out.print("Enter customer name for Current Account: ");
        String CCN = s1.next();
        System.out.print("Enter account number for Current Account: ");
        long CAN = s1.nextLong();
        System.out.print("Enter initial balance for Current Account: ");
        double CIB = s1.nextDouble();
        System.out.print("Enter minimum balance for Current Account: ");
        double MB = s1.nextDouble();
        System.out.print("Enter service charge for Current Account: ");
        double SC = s1.nextDouble();


         CurrAcct CA = new CurrAcct(CCN, CAN, CIB, MB, SC);


        System.out.print("Enter deposit amount for Savings Account: ");
        double SDA = s1.nextDouble();
        SA.deposit(SDA);

        System.out.print("Enter interest rate for Savings Account: ");
        double SIR = s1.nextDouble();
        SA.computeAndDepositInterest(SIR);

        System.out.print("Enter withdrawal amount for Savings Account: ");
        double SWA = s1.nextDouble();
        SA.withdraw(SWA);

        System.out.print("Enter deposit amount for Current Account: ");
        double CDA = s1.nextDouble();
        CA.deposit(CDA);
```

```
            System.out.print("Enter withdrawal amount for Current Account: ");
            double CWA = s1.nextDouble();
            CA.withdraw(CWA);


            System.out.println("\nFinal Balances:");
            System.out.println("Savings Account:");
            SA.displayBalance();

            System.out.println("\nCurrent Account:");
            CA.displayBalance();

        }
    }
```

```
C:\Users\ramesh\Desktop>javac Bank.java

C:\Users\ramesh\Desktop>java Bank
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter customer name for Savings Account: Ram
Enter account number for Savings Account: 2324
Enter initial balance for Savings Account: 5000
Enter customer name for Current Account: Ram
Enter account number for Current Account: 2324
Enter initial balance for Current Account: 6000
Enter minimum balance for Current Account: 1000
Enter service charge for Current Account: 100
Enter deposit amount for Savings Account: 2000
Deposit successful. Updated balance: 7000.0
Enter interest rate for Savings Account: 2
Interest computed and deposited. Updated balance: 7140.0
Enter withdrawal amount for Savings Account: 500
Withdrawal successful. Updated balance: 6640.0
Enter deposit amount for Current Account: 1000
Deposit successful. Updated balance: 7000.0
Enter withdrawal amount for Current Account: 750
Withdrawal successful. Updated balance: 6250.0

Final Balances:
Savings Account:
Account Number: 2324
Customer Name: Ram
Account Type: Savings
Balance: 6640.0

Current Account:
Account Number: 2324
Customer Name: Ram
Account Type: Current
Balance: 6250.0
```

LABORATORY PROGRAM - 6

Create a package CIE which has two classes- Student and Internals. The class Student has members like usn, name, sem. The class internals which is a derived class of Student and 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.

1. Create a folder CIE and save the programs Student.java and Internals.java within it.
2. Create a folder SEE and save the program External.java within it.
3. Save the Main program outside these two folders.
4. Compile Main.java and Execute the Main.class

Program:--

Student.java(Inside CIE Folder)

```java
package CIE;

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

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

    // Getter and Setter methods
    public String getUsn() {
        return usn;
    }
    public void setUsn(String usn) {
        this.usn = usn;
    }
```

```java
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public int getSem() {
        return sem;
    }

    public void setSem(int sem) {
        this.sem = sem;
    }
}
```

Internals.java(Inside CIE Folder)

Program:--

```java
package CIE;

public class Internals extends Student {
    private int[] internalMarks;

    // Constructor
    public Internals(String usn, String name, int sem, int[] internalMarks) {
        super(usn, name, sem);
        this.internalMarks = internalMarks;
    }

    // Getter and Setter method for internalMarks
    public int[] getInternalMarks() {
        return internalMarks;
    }

    public void setInternalMarks(int[] internalMarks) {
        this.internalMarks = internalMarks;
    }
}
```

External.java(Inside SEE Folder)

Program:--

```java
package SEE;

import CIE.Student;

public class External extends Student {
    private int[] seeMarks;

    // Constructor
    public External(String usn, String name, int sem, int[] seeMarks) {
        super(usn, name, sem);
        this.seeMarks = seeMarks;
    }

    // Getter and Setter method for seeMarks
    public int[] getSeeMarks() {
        return seeMarks;
    }

    public void setSeeMarks(int[] seeMarks) {
        this.seeMarks = seeMarks;
    }
}
```

Main.java(Outside these two folders)
Program:--

```java
import CIE.Internals;
import SEE.External;
import java.util.Scanner;

public class Main {
    public static void main(String[] args)
    {
    System.out.println("Name: "+"Dinesh Kumar G"+"\n"+"Usn: "+"1BM22CS091");
        Scanner scanner = new Scanner(System.in);

        int n = 2; // set to 2 for two students
```

```java
        // Arrays to store CIE and SEE students
        Internals[] cieStudents = new Internals[n];
        External[] seeStudents = new External[n];

        // Input details for CIE students
        for (int i = 0; i < n; i++)
    {

            System.out.println("Enter details for CIE student " + (i + 1));
            System.out.print("USN: ");
            String usn = scanner.next();
            System.out.print("Name: ");
            String name = scanner.next();
            System.out.print("Semester: ");
            int sem = scanner.nextInt();
            // Input internal marks for 5 courses
            int[] internalMarks = new int[5];
            System.out.println("Enter internal marks for 5 courses:");
            for (int j = 0; j < 5; j++)
    {

                System.out.print("Course " + (j + 1) + ": ");
                internalMarks[j] = scanner.nextInt();
            }

            // Create CIE student object
            cieStudents[i] = new Internals(usn, name, sem, internalMarks);
        }

        // Input details for SEE students
        for (int i = 0; i < n; i++) {
            System.out.println("\nEnter details for SEE student " + (i + 1));
            System.out.print("USN: ");
            String usn = scanner.next();
            System.out.print("Name: ");
            String name = scanner.next();
            System.out.print("Semester: ");
            int sem = scanner.nextInt();

            // Input SEE marks for 5 courses
            int[] seeMarks = new int[5];
            System.out.println("Enter SEE marks for 5 courses:");
            for (int j = 0; j < 5; j++)
```

```java
        {
            System.out.print("Course " + (j + 1) + ": ");
            seeMarks[j] = scanner.nextInt();
        }

        // Create SEE student object
        seeStudents[i] = new External(usn, name, sem, seeMarks);
    }

    // Display student details, internal marks, and final marks
    for (int i = 0; i < n; i++) {
        System.out.println("\nStudent: " + cieStudents[i].getName());
        System.out.println("USN: " + cieStudents[i].getUsn());
        System.out.println("Semester: " + cieStudents[i].getSem());

        // Display internal marks
        System.out.print("Internal Marks: ");
        for (int j = 0; j < 5; j++) {
            System.out.print(cieStudents[i].getInternalMarks()[j] + " ");
        }

        // Assuming you have some logic to calculate final marks
        int[] finalMarks = cieStudents[i].getInternalMarks();

        System.out.println("\nFinal Marks: ");
        for (int j = 0; j < 5; j++) {
            System.out.println("Course " + (j + 1) + ": " + finalMarks[j]);
        }
        System.out.println("--------------------------");
    }

    // Close the scanner
    scanner.close();
    }
}
```

```
C:\Users\ramesh\Desktop>java Main
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter details for CIE student 1
USN: 1BM22CS091
Name: Dineshkumar
Semester: 3
Enter internal marks for 5 courses:
Course 1: 34
Course 2: 35
Course 3: 36
Course 4: 37
Course 5: 38
Enter details for CIE student 2
USN: 1BM22CS078
Name: Aditya
Semester: 3
Enter internal marks for 5 courses:
Course 1: 37
Course 2: 38
Course 3: 39
Course 4: 40
Course 5: 36

Enter details for SEE student 1
USN: 1BM22CS091
Name: Dineshkumar
Semester: 3
Enter SEE marks for 5 courses:
Course 1: 98
Course 2: 97
Course 3: 96
Course 4: 95
Course 5: 94
```

```
Enter details for SEE student 2
USN: 1BM22CS078
Name: Aditya
Semester: 3
Enter SEE marks for 5 courses:
Course 1: 89
Course 2: 90
Course 3: 94
Course 4: 93
Course 5: 98

Student: Dineshkumar
USN: 1BM22CS091
Semester: 3
Internal Marks: 34 35 36 37 38
Final Marks:
Course 1: 34
Course 2: 35
Course 3: 36
Course 4: 37
Course 5: 38
***********          ***************

Student: Aditya
USN: 1BM22CS078
Semester: 3
Internal Marks: 37 38 39 40 36
Final Marks:
Course 1: 37
Course 2: 38
Course 3: 39
Course 4: 40
Course 5: 36
***********          ***************
```

Laboratory Program – 7

07) 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<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.

```java
import java.util.Scanner;

class WrongAge extends Exception {
    public WrongAge() {
        super("Invalid age!");
    }
}
```

```java
class Father {
   private int age;

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

   public int getAge() {
      return age;
   }
}

class Son extends Father {
   private int sonAge;

   public Son(int fatherAge, int sonAge) throws WrongAge {
      super(fatherAge);


      if (sonAge >= fatherAge) {
         throw new WrongAge();
      }
      this.sonAge = sonAge;
   }

   public int getSonAge() {
      return sonAge;
   }
}

public class WrongAgeExceptionProgram{
   public static void main(String[] args)
   {
      System.out.println("Name: "+"Dinesh  Kumar  G"+"\n"+"Usn:  "+"1BM22CS091");
Scanner scanner = new Scanner(System.in);

      try {
         System.out.print("Enter father's age: ");
```

```java
        int fatherAge = scanner.nextInt();

        System.out.print("Enter son's age: ");
        int sonAge = scanner.nextInt();

        Father father = new Father(fatherAge);
        System.out.println("Father's age: " + father.getAge());

        Son son = new Son(fatherAge, sonAge);
        System.out.println("Son's age: " + son.getSonAge());
    } catch (WrongAge e) {
        System.out.println(e.getMessage());
    } catch (Exception e) {
        System.out.println("Invalid input-------.");
    } finally {
        scanner.close();
    }
  }
}
```

```
C:\Users\ramesh\Desktop>javac WrongAgeExceptionProgram.java

C:\Users\ramesh\Desktop>java WrongAgeExceptionProgram
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter father's age: 25
Enter son's age: 26
Father's age: 25
son's age should be less than father's!

C:\Users\ramesh\Desktop>java WrongAgeExceptionProgram
Name: Dinesh Kumar G
Usn: 1BM22CS091
Enter father's age: 35
Enter son's age: 26
Father's age: 35
Son's age: 26
```

LABORATORY 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.

```java
class BMSThread implements Runnable {
   public void run() {
      while (true) {
         try {
            System.out.println("BMS College of Engineering");
            Thread.sleep(10000);
         } catch (InterruptedException ie) {
            System.out.println("BMSThread is Interrupted");
         }
      }
   }
}

class CSEThread implements Runnable {
   public void run() {
      while (true) {
         try {
            System.out.println("CSE");
            Thread.sleep(2000);
         } catch (InterruptedException ie) {
            System.out.println("CSEThread is Interrupted");
         }
      }
   }
}

public class Multi_Threading {
   public static void main(String[] args) {
 System.out.println("Name: "+"Dinesh Kumar G"+"\n"+"Usn: "+"1BM22CS091");
      Thread bms = new Thread(new BMSThread());
      Thread cse = new Thread(new CSEThread());

      // Start both threads
      bms.start();
      cse.start();
   }
}
```

```
C:\Users\ramesh\Desktop>javac Multi_Threading.java

C:\Users\ramesh\Desktop>java Multi_Threading
Name: Dinesh Kumar G
Usn: 1BM22CS091
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
```