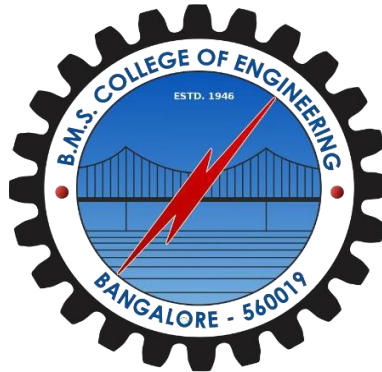# B.M.S. College of Engineering

(Autonomous College Affiliated to Visvesvaraya Technological University, Belgaum)

Bull Temple Road, Basavanagudi, Bengaluru – 560019

Department of

Computer Science & Engineering (CSE)

Lab Programs Report

Course Title: Object Oriented Java Programming
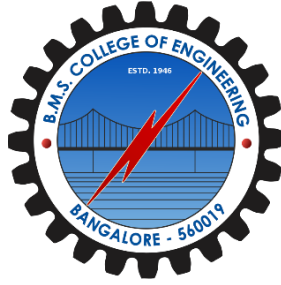
Course Code: 23CS3PCOOJ

BY

Deekshith B (1BM22CS082)

B.M.S. College of Engineering

(Autonomous College Affiliated to Visvesvaraya Technological University, Belgaum)

Bull Temple Road, Basavanagudi, Bengaluru – 560019

Department of
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CERTIFICATE

This is to certify that the report on "**Java Lab Programs**" has been carried out by **Deekshith B** bearing USN **1BM22CS082** as a part of AAT for the course **Object Oriented Java Programming** with course code **23CS3PCOOJ**, Computer Science and Engineering from Visvesvaraya Technological University, Belgaum during the year 2023–24. It is certified that all corrections/suggestions indicated for Internal Assessments have been incorporated in the report.

Deekshith B   **Shravya AR**
1BM22CS082   Assistant Professor
                                                                      Department of CSE
                                                                      BMSCE, Bengaluru-19

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LAB 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.

CODE

```java
import java.util.Scanner;

class Quadratic {
    int a, b, c;
    double r1, r2, d;

    void input() {
        Scanner s = new Scanner(System.in);
        System.out.println("Enter the coefficients of a, b, c");
        a = s.nextInt();
        b = s.nextInt();
        c = s.nextInt();
    }

    void compute() {
        while (a == 0) {
            System.out.println("Not a quadratic equation");
            System.out.println("Enter a non-zero value for a");
            Scanner s = new Scanner(System.in);
            a = s.nextInt();
        }

        d = b * b - 4 * a * c;

        if (d == 0) {
            r1 = -b / (2.0 * a);
            System.out.println("Roots are real and equal");
            System.out.println("Root1 = Root2 = " + r1);
        } else if (d > 0) {
            r1 = (-b + Math.sqrt(d)) / (2.0 * a);
            r2 = (-b - Math.sqrt(d)) / (2.0 * a);
            System.out.println("Roots are real and distinct");
            System.out.println("Root1 = " + r1 + ", Root2 = " + r2);
        } else if (d < 0) {
            System.out.println("Roots are imaginary");
            r1 = -b / (2.0 * a);
            r2 = Math.sqrt(Math.abs(d)) / (2.0 * a);
            System.out.println("Roots = " + r1 + " i" + r2);
            System.out.println("Roots = " + r1 + " - i" + r2);
        }
    }
}
```

```
class QuadraticMain {
    public static void main(String[] args) {
        Quadratic q = new Quadratic();
        q.input();
        q.compute();
    }
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac QuadraticMain.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java QuadraticMain
Enter the coefficients of a, b, c
1
1
1
Roots are imaginary
Roots = -0.5 + i0.8660254037844386
Roots = -0.5 - i0.8660254037844386

C:\Users\Deekshith B\OneDrive\Desktop\project>javac QuadraticMain.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java QuadraticMain
Enter the coefficients of a, b, c
2
4
1
Roots are real and distinct
Root1 = -0.2928932188134524, Root2 = -1.7071067811865475
```

Lab 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 percentage of a student.

CODE

```java
import java.util.Scanner;
class Student
{
    String usn,name;
    int n;
    int c[],m[];
    void acc()
    {
        Scanner s1 = new Scanner(System.in);
        System.out.println("Enter the usn of the student : ");
        usn = s1.nextLine();
        System.out.println("Enter the name of the student : ");
        name = s1.nextLine();
        System.out.println("Enter the number of subjects : ");
        n = s1.nextInt();
        c = new int[n];
        m = new int [n];
        for(int i=0;i<n;i++)
        {
            System.out.println("Enter the number of credits of subject " + (i+1) + " : ");
            c[i]=s1.nextInt();
            System.out.println("Enter the marks of subject " + (i+1) +" : ");
            m[i]=s1.nextInt();
        }
    }
    int gp(int marks)
    {
        if(marks>=90)
            return 10;
        else if (marks>= 80)
            return 9;
        else if (marks>=70)
            return 8;
```

```java
        else if (marks>=60)
            return 7;
        else if (marks>=50)
            return 6;
        else
            return 0;
    }
    double sgpa()
    {
        int tc = 0,sum=0;
        for(int i=0;i<n;i++)
        {
            tc = tc + c[i];
            sum = sum + gp(m[i]) * c[i];
        }
        return (sum/tc);
    }
    void disp()
    {
        System.out.println("USN = "+usn);
        System.out.println("NAME = "+name);
    }
}
class Main
{
    public static void main(String args[])
    {
        Student s = new Student();
        s.acc();
        s.disp();
        System.out.println("The SGPA = " +s.sgpa());
    }
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac Main.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java Main
Enter the usn of the student :
1BM22CS082
Enter the name of the student :
Deekshith B
Enter the number of subjects :
4
Enter the number of credits of subject 1 :

3
Enter the marks of subject 1 :
91
Enter the number of credits of subject 2 :
4
Enter the marks of subject 2 :
87
Enter the number of credits of subject 3 :
2
Enter the marks of subject 3 :
77
Enter the number of credits of subject 4 :
1
Enter the marks of subject 4 :
100
USN = 1BM22CS082
NAME = Deekshith B
The SGPA = 9.0

C:\Users\Deekshith B\OneDrive\Desktop\project>
```

Lab 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

CODE

```java
import java.util.Scanner;

class Books
{

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

Scanner input=new Scanner(System.in);

Books(){}

void accept()
{
System.out.print("Enter name of book: ");
name=input.nextLine();
System.out.print("Enter name of author: ");
author=input.nextLine();
System.out.print("Enter price of the book: ");
price=input.nextInt();
System.out.print("Enter no. of pages in the book: ");
num_pages=input.nextInt();
System.out.print("\n");
}

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

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

}

class BookRun
{

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

/*String name,author;
int price,num_pages;*/
System.out.print("Enter number of books: ");
int n=input.nextInt();
/*input.nextLine();*/
System.out.print("\n");

Books[] book=new Books[n];

for(int i=0;i<n;i++)
{
System.out.println("Book " + (i+1) + ": ");

book[i]=new Books();
book[i].accept();
}

for(int i=0;i<n;i++)
{
System.out.println("Book " + (i+1) + ":\n" + book[i] + "\n");
}


input.close();

}

}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac BookRun.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java BookRun
Enter number of books: 2

Book 1:
Enter name of book: Java1
Enter name of author: Deekshith B
Enter price of the book: 290
Enter no. of pages in the book: 290

Book 2:
Enter name of book: Java2
Enter name of author: Dixit
Enter price of the book: 300
Enter no. of pages in the book: 300

Book 1:
Book name: Java1
Author name: Deekshith B
Price: 290 Rs
Number of pages: 290 pages


Book 2:
Book name: Java2
Author name: Dixit
Price: 300 Rs
Number of pages: 300 pages
```

Lab 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

CODE

```java
import java.util.Scanner;

abstract class Shape
{
double x,y;
Shape(double x,double y)
{
this.x=x;
this.y=y;
}
abstract void printArea();
}

class Rectangle extends Shape
{
Rectangle(double x,double y)
{
super(x,y);
}
void printArea()
{
System.out.println("Area of Rectangle: " + (x*y) + " square units\n");
}
}

class Triangle extends Shape
{
Triangle(double x,double y)
{
super(x,y);
}
void printArea()
{
System.out.println("Area of Triangle: " + (0.5*x*y) + " square units\n");
}
}
```

```java
class Circle extends Shape
{
Circle(double x)
{
super(x,0);
}
void printArea()
{
System.out.println("Area of Circle: " + (3.14*x*x) + " square units\n");
}
}


class ShapeRun
{
public static void main(String[] args)
{
double x,y;
Scanner input=new Scanner(System.in);
System.out.println("Enter length and width of Rectangle: ");
x=input.nextDouble();
y=input.nextDouble();
Rectangle rectangle=new Rectangle(x,y);
rectangle.printArea();

System.out.println("Enter height and base of Triangle: ");
x=input.nextDouble();
y=input.nextDouble();
Triangle triangle=new Triangle(x,y);
triangle.printArea();

System.out.println("Enter radius of Circle: ");
x=input.nextDouble();
Circle circle=new Circle(x);
circle.printArea();

input.close();
}
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac ShapeRun.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java ShapeRun
Enter length and width of Rectangle:
10
5
Area of Rectangle: 50.0 square units

Enter height and base of Triangle:
10
5
Area of Triangle: 25.0 square units

Enter radius of Circle:
10
Area of Circle: 314.0 square units


C:\Users\Deekshith B\OneDrive\Desktop\project>
```

Lab 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.

CODE

```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);
```

```java
        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);
    }

    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);
```

```java
        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.");
        }
    }
}

class Bank
{
    public static void main(String[] args)
{
        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);
```

```java
        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();

    }
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac bank.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java bank
Error: Could not find or load main class bank
Caused by: java.lang.NoClassDefFoundError: bank (wrong name: Bank)

C:\Users\Deekshith B\OneDrive\Desktop\project>javac Bank.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java Bank
Enter customer name for Savings Account: Deekshith
Enter account number for Savings Account: 100
Enter initial balance for Savings Account: 1000
Enter customer name for Current Account: Dixit
Enter account number for Current Account: 101
Enter initial balance for Current Account: 1001
Enter minimum balance for Current Account: 200
Enter service charge for Current Account: 1
Enter deposit amount for Savings Account: 300
Deposit successful. Updated balance: 1300.0
Enter interest rate for Savings Account: 1
Interest computed and deposited. Updated balance: 1313.0
Enter withdrawal amount for Savings Account: 313
Withdrawal successful. Updated balance: 1000.0
Enter deposit amount for Current Account: 400
Deposit successful. Updated balance: 1401.0
Enter withdrawal amount for Current Account: 200
Withdrawal successful. Updated balance: 1201.0

Final Balances:
Savings Account:
Account Number: 100
Customer Name: Deekshith
Account Type: Savings
Balance: 1000.0

Current Account:
Account Number: 101
Customer Name: Dixit
Account Type: Current
Balance: 1201.0
```

Lab 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.

CODE

```
package  CIE;
public class student
{
public String usn,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 extends student
{
public int m[]=new int[5];
public Internals(String usn,String name,int sem,int[] m)
{super(usn,name,sem);
this.m=m;
}
}

package SEE;
import CIE.student;
public class Externals extends student
{
public int sm[]=new int[5];
public Externals(String usn,String name,int sem,int[] sm)
{super(usn,name,sem);
this.sm=sm;
}
}

import java.util.*;
import CIE.student;
```

```java
import CIE.Internals;
import SEE.*;
public class Main
{
public static void main(String args[])
{
int fm=0;
Scanner in=new Scanner(System.in);
System.out.print("Enter no. of students: ");
int n=in.nextInt();
Internals []im=new Internals[n];
Externals []em=new Externals[n];
student []stu=new student[n];
for(int i=0;i<n;i++)
{
System.out.print("\nEnter details of student "+(i+1)+": ");
System.out.print("\nEnter name: ");
in.nextLine();
String name=in.nextLine();
System.out.print("Enter usn: ");
String usn=in.nextLine();
System.out.print("Enter semester: ");
int sem=in.nextInt();
int []imarks=new int[5];
int []emarks=new int[5];
System.out.print("Enter marks details: ");
for(int j=0;j<5;j++)
{
System.out.print("Enter internal marks for course"+(j+1)+": ");
imarks[j]=in.nextInt();
System.out.print("Enter see marks for course"+(j+1)+": ");
emarks[j]=in.nextInt();
}
stu[i]=new  student(usn,name,sem);
im[i]=new Internals(usn,name,sem,imarks);
em[i]=new Externals(usn,name,sem,emarks);
}
System.out.print("Final marks details: ");
for(int i=0;i<n;i++)
{
System.out.println("Student"+(i+1)+": ");
System.out.println("Name: "+stu[i].name);
System.out.println("USN: "+stu[i].usn);
System.out.println("Semester: "+stu[i].sem);
```

```
for(int j=0;j<5;j++)
{
fm+=im[i].m[j]+em[i].sm[j];
System.out.println("Final marks of course"+(j+1)+":"+fm);
fm=0;
}
System.out.println();
}
}
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\Lab6>javac CIE/Internals.java

C:\Users\Deekshith B\OneDrive\Desktop\Lab6>javac CIE/Student.java

C:\Users\Deekshith B\OneDrive\Desktop\Lab6>javac SEE/External.java

C:\Users\Deekshith B\OneDrive\Desktop\Lab6>javac FinalMarks.java

C:\Users\Deekshith B\OneDrive\Desktop\Lab6>java FinalMarks
Deekshith B
1BM22CS082
Enter the number of students:
1
Enter details of Student 1
Enter USN:
1BM22CS082
Enter Name:
Deekshith B
Enter Semester:
3
Enter Internal Marks for 5 courses:
Enter Internal Marks for Course 1:
45
Enter Internal Marks for Course 2:
46
Enter Internal Marks for Course 3:
47
Enter Internal Marks for Course 4:
48
Enter Internal Marks for Course 5:
49
Enter SEE Marks for Student 1
Enter SEE Marks for Course 1:
88
Enter SEE Marks for Course 2:
89
Enter SEE Marks for Course 3:
90
Enter SEE Marks for Course 4:
91
Enter SEE Marks for Course 5:

92

Final Marks of Students:
Student 1 : USN: 1BM22CS082
Name: Deekshith B
Semester: 3
Subject 1: 89.0

Subject 2: 90.5

Subject 3: 92.0

Subject 4: 93.5

Subject 5: 95.0
```

Lab program 7

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.

CODE

```java
import java.util.Scanner;
class WrongAge extends Exception {
    public WrongAge(String message) {
        super(message);
    }
}


class Father {
    private int age;

    public Father(int age) throws WrongAge {
        if (age < 0) {
            throw new WrongAge("Age cannot be negative");
        }
        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("Son's age should be less than Father's age");
        }
```

```java
            this.sonAge = sonAge;
    }

    public int getSonAge() {
        return sonAge;
    }
}

public class ExceptH {
    public static void main(String[] args) {
        try {
            Father father = new Father(40);

            Son son = new Son(father.getAge(), 56);

            System.out.println("Father's age: " + father.getAge());
            System.out.println("Son's age: " + son.getSonAge());
        } catch (WrongAge e) {
            System.err.println("Exception: " + e.getMessage());
        }
    }
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac ExceptH.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java ExceptH
Exception: Son's age should be less than Father's age

C:\Users\Deekshith B\OneDrive\Desktop\project>
```

Lab 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.

CODE

```java
  public void run() {
    try {
     while (true) {
       System.out.println("BMS College of Engineering");
       Thread.sleep(10000);
     }
    } catch (InterruptedException e) {
      System.out.println("There is an interruption occured");
    }
  }
}

class CSE implements Runnable {
  public void run() {
    try {
     while (true) {
       System.out.println("CSE");
       Thread.sleep(2000);
     }
    } catch (InterruptedException e) {
      System.out.println("There is an interruption occured");
    }
  }
}
public class Main {
  public static void main(String[] args) {
    BMS bms = new BMS();
    Thread t1 = new Thread(bms);
    t1.start();

    CSE cse = new CSE();
    Thread t2 = new Thread(cse);
    t2.start();
  }
}
```

```java
class display implements Runnable
{
String message;
int interval;
public display(String message, int interval)
{this.message=message;
this.interval=interval;
}
@Override
public void run()
{try
{while(true)
{System.out.println(message);
Thread.sleep(interval);
}
}
catch(InterruptedException e)
{
System.out.println(e);
}
}
}

class displayrun
{
public static void main(String args[])
{
Thread t1=new Thread (new display("BMSCE",10000));
t1.start();
Thread t2=new Thread(new display("CSE",2000));
t2.start();
}
}
```

OUTPUT

```
C:\Users\Deekshith B\OneDrive\Desktop\project>javac Mainn.java

C:\Users\Deekshith B\OneDrive\Desktop\project>java Mainn
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
```

THANKYOU