B.M.S. College of Engineering
(Autonomous Institution affiliated to VTU, Belagavi)

Department of Computer Science and Engineering

LAB REPORT

OBJECT ORIENTED JAVAPROGRAMMING REPORT

23CS3PCOOJ

(December 2023-March 2024)

B.M.S. College of Engineering
Department of Computer Science and Engineering

Laboratory Certificate

This is to certify that **Ganesh Venkatraman Bhandari** has satisfactorilycompleted the course of Experiments in Practical **OBJECT ORIENTED JAVA PROGRAMMING** prescribed by the Department during the odd semester(3rd sem) 2023-24.

Name of the Candidate: **Ganesh Venkatraman Bhandari** USN

No.: **1BM22CS098**   Semester: **III** Section: **B**

Marks	
Max. Marks	Obtained
10	
Marks in Words	

Signature of the staff in-charge   **Head of the Department**
Date

1.Write program to find the quadratic equation given its roots

```java
import java.util.Scanner;

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

    void getd() {
        Scanner s = new Scanner(System.in);
        System.out.println("Enter the values 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 of a");
            Scanner s = new Scanner(System.in);
            a = s.nextInt();
        }
        d = (b * b) - (4 * a * c);
        if (d == 0) {
            r1 = -b / (2 * (double) a);
            System.out.println("Roots are real and equal");
            System.out.println("Roots are Root1=Root2=" + r1);
        } else if (d > 0) {
            r1 = (-b + Math.sqrt(d)) / (2 * (double) a);
            r2 = (-b - Math.sqrt(d)) / (2 * (double) a);
            System.out.println("Roots are real and distinct");
            System.out.println("Roots are Root1=" + r1 + " and Root2=" + r2);
        } else {
            r1 = -b / (2 * (double) a);
            r2 = Math.sqrt(Math.abs(d)) / (2 * (double) a);
            System.out.println("Roots are imaginary and Root1=" + r1
                    + "+i" + r2 + " and Root2=" + r1 + "-i" + r2);
        }
    }
}

class QuadraticMain {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");
```

```
        quadratic q = new quadratic();
        q.getd();
        q.compute();
    }
}
```

OutPut :

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the values of a, b, c
1 2 1
Roots are real and equal
Roots are Root1=Root2=-1.0
```

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the values of a, b, c
1 -3 2
Roots are real and distinct
Roots are Root1=2.0 and  Root2=1.0
```

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the values of a, b, c
2 4 5
Roots are imaginary and Root1=-1.0+i1.224744871391589 and Root2=-1.0-i1.224744871391589
```

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the values of a, b, c
0 2 5
Not a quadratic equation
Enter a non-zero value of a
```

2. Create a class Book that contains four members: name, author, price, and num_pages. Include a constructor to set thevalues 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 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.price = price;
        this.numPages = numPages;
    }

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

class booksMain {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");

        Scanner s = new Scanner(System.in);
        int n;
        String name;
        String author;
        int price;
        int numPages;

        System.out.println("Enter the number of books:");
        n = s.nextInt();

        books[] b;
        b = new books[n];

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

```java
        System.out.println("Book " + (i + 1) + ":");
        System.out.println("Enter the book name");
        s.nextLine(); // Consume newline left by previous nextInt()

        name = s.nextLine();
        System.out.println("Enter the author");
        author = s.nextLine();
        System.out.println("Enter the price");
        price = s.nextInt();
        System.out.println("Enter the number of pages");
        numPages = s.nextInt();

        b[i] = new books(name, author, price, numPages);
    }

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

Output :

```
2
Book 1:
Enter the book name
Ramayan
Enter the author
Valmiki
Enter the price
1000
Enter the number of pages
1500
Book 2:
Enter the book name
Mahabharata
Enter the author
Vyasa
Enter the price
2000
Enter the number of pages
1900
Book 1
Book Name: Ramayan
Author Name: Valmiki
Book Price: 1000
Number of pages: 1500

Book 2
Book Name: Mahabharata
Author Name: Vyasa
Book Price: 2000
Number of pages: 1900
```

3. Write a Java program to create a class Student with members USN, name, marks(6 subjects). Include methods to accept student details and marks, Also include a method to calculate the percentage and display appropriate details. (Array of studentobject to be created).

```java
import java.util.Scanner;

class student {
    String USN;
    String name;
    int marks[] = new int[6];
    float percentage = 0;

    void getd(int i) {
        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 Student " + (i+1) + " Marks");
        for (int j = 0; j < 6; j++) {
            System.out.println("Enter Marks of Subject " + (j+1) + ":");
            marks[j] = s.nextInt();
            percentage += marks[j];
        }
    }

    void calculatePercentage(int i) {
        percentage = (percentage / 6);
        System.out.println("Percentage of student " + (i+1) + " = " + percentage + "%");
    }
}
class studentMain {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");
        System.out.println("Enter the number of Students");
        Scanner sc = new Scanner(System.in);
        int n = sc.nextInt();
        student s[] = new student[n];
        for (int i = 0; i < n; i++) {
            s[i] = new student();
            s[i].getd(i);
        }
        for (int i = 0; i < n; i++) {
            s[i].calculatePercentage(i); }    }      }
```

Output:

```
Enter Name:
ABC
Enter Student1 Marks
Enter Marks of Subject1:
99
Enter Marks of Subject2:
100
Enter Marks of Subject3:
98
Enter Marks of Subject4:
95
Enter Marks of Subject5:
90
Enter Marks of Subject6:
97
Enter USN:
1BM22CS002
Enter Name:
XYZ
Enter Student2 Marks
Enter Marks of Subject1:
98
Enter Marks of Subject2:
89
Enter Marks of Subject3:
90
Enter Marks of Subject4:
85
Enter Marks of Subject5:
93
Enter Marks of Subject6:
91
Percentage of student1=96.5%
Percentage of student2=91.0%
```

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 the method printArea( )that prints the area of the given shape.

```java
import java.util.Scanner;

abstract class shape {
    int dim1;
    int dim2;

    shape(int dim1, int dim2) {
        this.dim1 = dim1;
        this.dim2 = dim2;
    }
    abstract void printArea();
}

class rectangle extends shape {
    rectangle(int length, int breadth) {
        super(length, breadth);
    }
    void printArea() {
        double area = dim1 * dim2;
        System.out.println("Area of rectangle = " + area);
    }
}

class triangle extends shape {
    triangle(int height, int base) {
        super(height, base);
    }
    void printArea() {
        double area = 0.5 * dim1 * dim2;
        System.out.println("Area of triangle = " + area);
    }
}

class circle extends shape {
    circle(int radius) {
        super(radius, 0);
    }
    void printArea() {
        double area = Math.PI * dim1 * dim1;
        System.out.println("Area of circle = " + area);  }   }
```

```java
public class AbstractMain {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");

        Scanner s = new Scanner(System.in);

        System.out.println("Enter the length and breadth of the rectangle");
        int l = s.nextInt();
        int b = s.nextInt();

        rectangle re = new rectangle(l, b);
        re.printArea();

        System.out.println("Enter base and height of the triangle");
        int ba = s.nextInt();
        int h = s.nextInt();

        triangle t = new triangle(h, ba);
        t.printArea();

        System.out.println("Enter the radius of the circle");
        int r = s.nextInt();

        circle c = new circle(r);
        c.printArea();
    }
}
```

Output :

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the length and breadth of the rectangle
4
4
Area of rectangle = 16.0
Enter base and height of the triangle
4
6
Area of triangle = 12.0
Enter the radius of the circle
8
Area of circle = 201.06192982974676
```

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:

- **Accept deposit from customer and update the balance.**
- **Display the balance.**
- **Compute and deposit interest**
- **Permit withdrawal and update the balance**
Check for the minimum balance, impose penalty if necessaryand update the balance.

```java
import java.util.Scanner;

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

    Account(String name, int number, String type, double initialBalance) {
        customerName = name;
        accountNumber = number;
        accountType = type;
        balance = initialBalance;
    }

    void deposit(double amount) {
        if (amount > 0) {
            balance += amount;
            System.out.println("Deposit of INR " + amount + " successful");
        } else {
            System.out.println("Invalid deposit amount. Please enter a positive value.");
        }
    }

    void displayBalance() {
        System.out.println("Account Number: " + accountNumber);
        System.out.println("Customer Name: " + customerName);
        System.out.println("Account Type: " + accountType);
```

```java
        System.out.println("Balance: INR " + balance);
    }

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

    void checkMinimumBalance(double minBalance, double serviceCharge) {
    }
}

class SavAcct extends Account {
    double interestRate = 0.05;

    SavAcct(String name, int number, String type, double initialBalance) {
        super(name, number, type, initialBalance);
    }

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

class CurAcct extends Account {
    double minBalance = 1000;
    double serviceCharge = 50;

    CurAcct(String name, int number, String type, double initialBalance) {
        super(name, number, type, initialBalance);
    }

    void checkMinimumBalance(double minBalance, double serviceCharge) {
        if (balance < minBalance) {
            System.out.println("Service charge of INR " + serviceCharge + " imposed");
            balance -= serviceCharge;
        }
    }    }
```

```java
public class Bank {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the number of users: ");
        int numUsers = scanner.nextInt();
        Account[] accounts = new Account[numUsers];

        for (int i = 0; i < numUsers; i++) {
            System.out.println("\nUser " + (i + 1));
            System.out.print("Enter customer name: ");
            scanner.nextLine();
            String name = scanner.nextLine();
            System.out.print("Enter account number: ");
            int accNumber = scanner.nextInt();
            System.out.print("Enter initial deposit amount: INR ");
            double initialDeposit = scanner.nextDouble();
            System.out.print("Enter account type (Savings/Current): ");
            scanner.nextLine();
            String accType = scanner.nextLine();

            if (accType.equalsIgnoreCase("Savings")) {
                accounts[i] = new SavAcct(name, accNumber, accType, initialDeposit);
            } else if (accType.equalsIgnoreCase("Current")) {
                accounts[i] = new CurAcct(name, accNumber, accType, initialDeposit);
            } else {
                System.out.println("Invalid account type entered. Defaulting to Account.");
                accounts[i] = new Account(name, accNumber, "Account", initialDeposit);
            }
        }

        boolean exit = false;
        while (!exit) {
            System.out.println("\nChoose an option:");
            System.out.println("1. Deposit");
            System.out.println("2. Withdraw");
            System.out.println("3. Display Balance");
            System.out.println("4. Compute Interest (Savings only)");
            System.out.println("5. Exit");
            System.out.print("Enter your choice: ");
            while (!scanner.hasNextInt()) {
                System.out.println("Invalid input. Please enter a number.");
                scanner.next();
            }
            int choice = scanner.nextInt();
```

```java
        switch (choice) {
            case 1:
                System.out.print("Enter account number: ");
                int accNum = scanner.nextInt();
                System.out.print("Enter deposit amount: INR ");
                double depositAmount = scanner.nextDouble();
                for (Account acc : accounts) {
                    if (acc.accountNumber == accNum) {
                        acc.deposit(depositAmount);
                    }
                }
                break;
            case 2:
                System.out.print("Enter account number: ");
                accNum = scanner.nextInt();
                System.out.print("Enter withdrawal amount: INR ");
                double withdrawAmount = scanner.nextDouble();
                for (Account acc : accounts) {
                    if (acc.accountNumber == accNum) {
                        acc.withdraw(withdrawAmount);
                    }
                }
                break;
            case 3:
                System.out.print("Enter account number: ");
                accNum = scanner.nextInt();
                for (Account acc : accounts) {
                    if (acc.accountNumber == accNum) {
                        acc.displayBalance();
                    }
                }
                break;
            case 4:
                System.out.print("Enter account number (for Savings account): ");
                accNum = scanner.nextInt();
                for (Account acc : accounts) {
                    if (acc.accountNumber == accNum && acc instanceof SavAcct) {
                        ((SavAcct) acc).computeInterest();
                    }
                }
                break;
            case 5:     exit = true;
                        break;
            default:   System.out.println("Invalid choice. Please enter a valid option.");
        }
    }   }
```

Output :

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the number of users: 2

User 1
Enter customer name: ABC
Enter account number: 123456789
Enter initial deposit amount: INR 20000
Enter account type (Savings/Current): SAVINGS

User 2
Enter customer name: XYZ

Enter account number: 987654321
Enter initial deposit amount: INR 50000
Enter account type (Savings/Current): CURRENT

Choose an option:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest (Savings only)
5. Exit
Enter your choice: 1
Enter account number: 123456789
Enter deposit amount: INR 40000
Deposit of INR 40000.0 successful

Choose an option:
1. Deposit
2. Withdraw
3. Display Balance
4. Compute Interest (Savings only)
5. Exit
Enter your choice: 2
Enter account number: 987654321
Enter withdrawal amount: INR 10000
Withdrawal of INR 10000.0 successful
```

6. Create a package CIE which has two classes- Student and Internals. The class Student has members like usn, name, sem. The class internals derived from student has an array that storesthe internal marks scored in five courses of the current semesterof 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.

- **Create a folder CIE and save the programs Student.java andInternals.java within it.**
- **Create a folder SEE and save the program External.javawithin it.**
- **Save the Main program outside these two folders.**
- **Compile Main.java and Execute the Main.class**

```java
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;
    }
}
```

```java
package CIE;

public class internals extends student {
    public int[] internalMarks;

    public internals(String usn, String name, int sem, int[] internalMarks) {
        super(usn, name, sem);
        this.internalMarks = internalMarks;
    }
}
```

```java
package SEE;

import CIE.student;

public class externals extends student {
    public int[] seeMarks;

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


// MAIN

import CIE.internals;
import SEE.externals;
import java.util.Scanner;

public class main1 {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");

        Scanner scanner = new Scanner(System.in);

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

        internals[] cieStudents = new internals[n];
        externals[] seeStudents = new externals[n];

        for (int i = 0; i < n; i++) {
            System.out.println("Enter details for CIE of 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();

            int[] cieMarks = new int[5];
            System.out.print("Enter CIE marks for 5 courses: ");
            for (int j = 0; j < 5; j++) {
```

```java
            cieMarks[j] = scanner.nextInt();
        }

        cieStudents[i] = new internals(usn, name, sem, cieMarks);
    }

    for (int i = 0; i < n; i++) {
        System.out.println("Enter details for SEE of 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();

        int[] seeMarks = new int[5];
        System.out.print("Enter SEE marks for 5 courses: ");
        for (int j = 0; j < 5; j++) {
            seeMarks[j] = scanner.nextInt();
        }

        seeStudents[i] = new externals(usn, name, sem, seeMarks);
    }

    System.out.println("\nFinal Marks of Students:");
    for (int i = 0; i < n; i++) {
        System.out.println("\nDetails of Student " + (i + 1));
        System.out.println("USN: " + cieStudents[i].usn);
        System.out.println("Name: " + cieStudents[i].name);
        System.out.println("Semester: " + cieStudents[i].sem);
        System.out.println("CIE Marks: ");
        for (int j = 0; j < 5; j++) {
            System.out.print(cieStudents[i].internalMarks[j] + " ");
        }
        System.out.println("\nSEE Marks: ");
        for (int j = 0; j < 5; j++) {
            System.out.print(seeStudents[i].seeMarks[j] + " ");
        }
    }
  }
}
```

Output:

```
Ganesh Venkatraman Bhandari
1BM22CS098
Enter the number of students: 2
Enter details for CIE of student 1
USN: 1BM22CS001
Name: ABC
Semester: 2
Enter CIE marks for 5 courses: 45 47 49 50 50
Enter details for CIE of student 2
USN: 1BM22CS003
Name: XYZ
Semester: 2
Enter CIE marks for 5 courses: 45 43 47 48 48
Enter details for SEE of student 1
USN: 1BM22CS001
Name: ABC
Semester: 2
Enter SEE marks for 5 courses: 90 98 95 85 89
Enter details for SEE of student 2
USN: 1BM22CS003
Name: XYZ
Semester: 2
Enter SEE marks for 5 courses: 90 85 83 81 84
```

```
Final Marks of Students:

Details of Student 1
USN: 1BM22CS001
Name: ABC
Semester: 2
CIE Marks:
45 47 49 50 50
SEE Marks:
90 98 95 85 89
Details of Student 2
USN: 1BM22CS003
Name: XYZ
Semester: 2
CIE Marks:
45 43 47 48 48
SEE Marks:
90 85 83 81 84
```

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 Sonclass, implement a constructor that cases both father and son's age and throws an exception if son's age is >=father's age.

```java
class WrongAgeException extends Exception {
    WrongAgeException(String message) {
        super(message);
    }
}

class Father {
    private int age;

    public Father(int age) throws WrongAgeException {
        if (age < 0) {
            throw new WrongAgeException("Father's 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 WrongAgeException {
        super(fatherAge);

        if (sonAge >= fatherAge) {
            throw new WrongAgeException("Son's age should be less than Father's age");
        }

        this.sonAge = sonAge;
    }

    public int getSonAge() {
        return sonAge;
    }
}

public class InheritanceExceptionDemo {
```
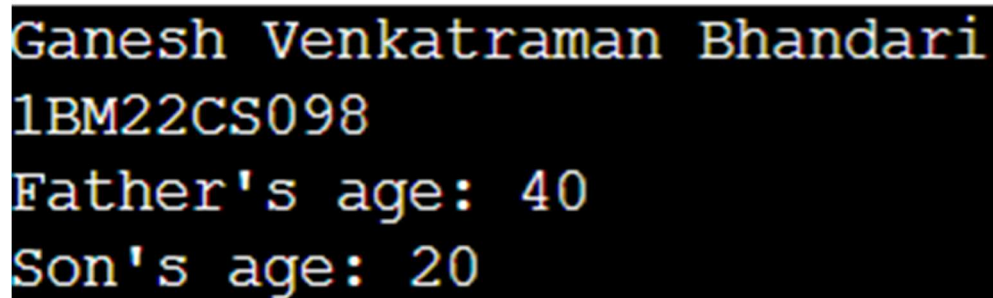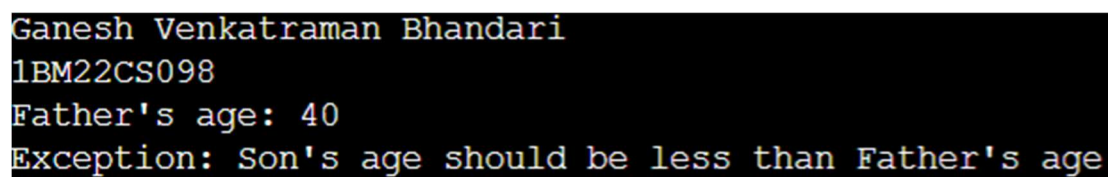
```java
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");

        try {
            Father father = new Father(40);
            System.out.println("Father's age: " + father.getAge());

            Son son = new Son(40, 20);
            System.out.println("Son's age: " + son.getSonAge());
        } catch (WrongAgeException e) {
            System.out.println("Exception: " + e.getMessage());
        }
    }
}
```

Output ;

```
Ganesh Venkatraman Bhandari
1BM22CS098
Father's age: 40
Son's age: 20
```

```
Ganesh Venkatraman Bhandari
1BM22CS098
Father's age: 40
Exception: Son's age should be less than Father's age
```

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 DisplayThread extends Thread {
    private String message;
    private int intervalMillis;
    private int iterations;

    public DisplayThread(String message, int intervalMillis, int iterations) {
        this.message = message;
        this.intervalMillis = intervalMillis;
        this.iterations = iterations;
    }

    public void run() {
        for (int i = 0; i < iterations; i++) {
            try {
                System.out.println(message);
                Thread.sleep(intervalMillis);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}

public class DisplayProgram {
    public static void main(String[] args) {
        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");
```

```java
        DisplayThread thread1 = new DisplayThread("BMS College of Engineering", 10000, 3);
        DisplayThread thread2 = new DisplayThread("CSE", 2000, 15);


        System.out.println("Ganesh Venkatraman Bhandari");
        System.out.println("1BM22CS098");


        thread1.start();
        thread2.start();
    }
}
```

Output :

```
Ganesh Venkatraman Bhandari
1BM22CS098
Ganesh Venkatraman Bhandari
1BM22CS098
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
```