1) Quadratic Equations:

```
import java.util.Scanner;


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


  // Input coefficients a, b, and c
  System.out.println("Enter the coefficients of the quadra c equation (ax^2 + bx + c = 0):");
System.out.print("a: ");
 double a = scanner.nextDouble();
System.out.print("b: ");
double b = scanner.nextDouble();
System.out.print("c: ");
double c = scanner.nextDouble();
// Calculate the discriminant
 double discriminant = b * b - 4 * a * c;
 // Check if there are real solu ons
 if (discriminant > 0) {
// Two real solu ons
double root1 = (-b + Math.sqrt(discriminant)) / (2 * a);
double root2 = (-b - Math.sqrt(discriminant)) / (2 * a);
System.out.println("Two real solutions exist:");
 System.out.println("Root 1: " + root1);
System.out.println("Root 2: " + root2);
 } else if (discriminant == 0) {
// One real solution
  double root = -b / (2 * a);
  System.out.println("One real solu on exists:");
  System.out.println("Root: " + root);
   }
else {
  // No real solutions
```

```
            System.out.println("No real solutions exist.");
        }
 scanner.close();
    }
}
```

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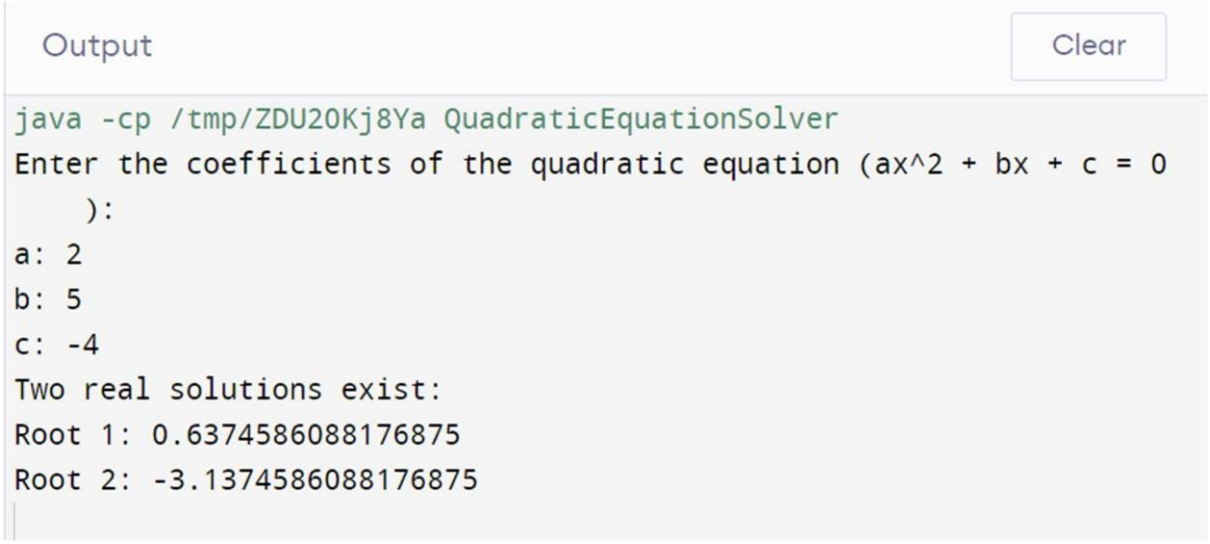
Output:



2) STUDENT CLASS

```
import java.util.Scanner;


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

```
    // Constructor
 public Student(String usn, String name, int numSubjects) {
this.usn = usn;
this.name = name;
this.credits = new int[numSubjects];
this.marks = new int[numSubjects];
    }
// Method to accept details of the student
public void acceptDetails(Scanner scanner) {
 System.out.println("Enter details for student " + name + ":");
System.out.print("Enter USN: ");
this.usn = scanner.next();
 System.out.print("Enter Name: ");
 this.name = scanner.next();
System.out.println("Enter details for each subject:");
 for (int i = 0; i < credits.length; i++) {
System.out.print("Enter credits for subject " + (i + 1) + ": ");
this.credits[i] = scanner.nextInt();
System.out.print("Enter marks for subject " + (i + 1) + ": ");
this.marks[i] = scanner.nextInt();
        }
    }

    // Method to display details of the student
public void displayDetails() {
        System.out.println("USN: " + this.usn);
        System.out.println("Name: " + this.name);
System.out.println("Subject-wise details:");
for (int i = 0; i < credits.length; i++) {
            System.out.println("Subject " + (i + 1) + ": Credits - " + credits[i] + ", Marks - " + marks[i]);         }
    }
```

```
    // Method to calculate SGPA of the student     public double
calculateSGPA() {
int totalCredits = 0;
double totalGradePoints = 0.0;
for (int i = 0; i < credits.length; i++)
{ totalCredits += credits[i];
totalGradePoints +=calculateGradePoints(marks[i]) * credits[i];
}
        return totalGradePoints / totalCredits;
    }
    // Helper method to calculate grade points based on marks
 private double calculateGradePoints(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 class Main {public static void
main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        // Accept details of the student
        System.out.print("Enter the number of subjects: ");
int numSubjects = scanner.nextInt();
        Student student = new Student("", "", numSubjects);
student.acceptDetails(scanner);

        // Display details of the student
```

```
        System.out.println("\nDetails of the student:");
student.displayDetails();

        // Calculate and display SGPA
double sgpa = student.calculateSGPA();
        System.out.println("\nSGPA: " + sgpa);

        scanner.close();
    }
}
```

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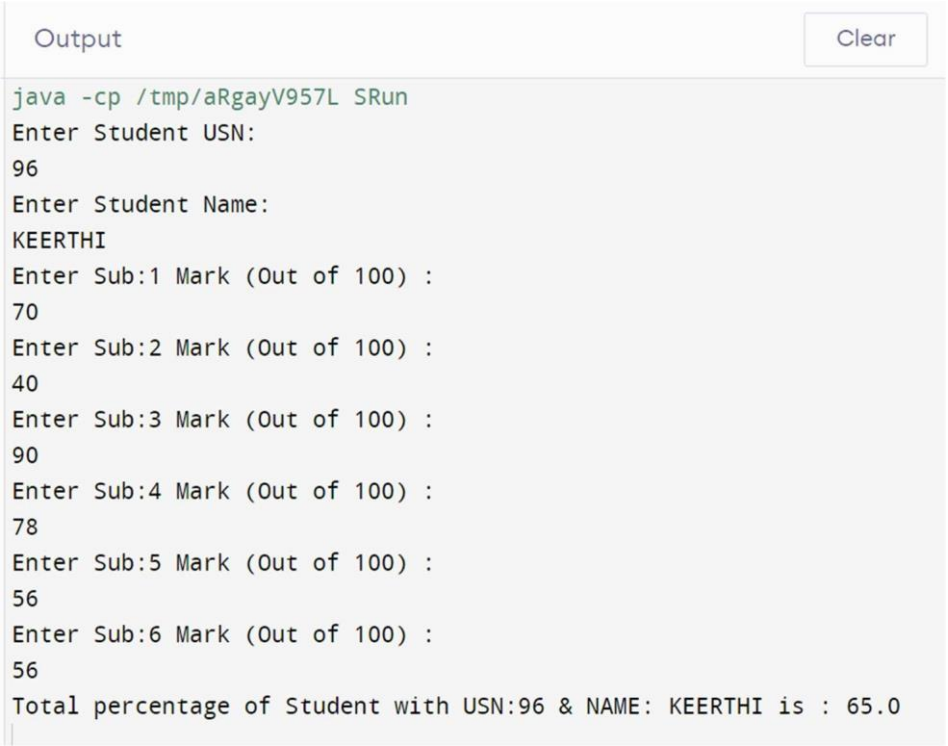
OUTPUT:



3) BOOK CLASS

```
import java.util.Scanner;
```

```
class Book {     private
String name;     private
String author;     private
double price;     private
int numPages;

   // Constructor to set the values for the members     public Book(String
name, String author, double price, int numPages) {         this.name =
name;         this.author = author;         this.price = price;
this.numPages = numPages;
   }

   // Se er methods     public void
setName(String name) {
this.name = name;
   }

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

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

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

   // Ge er methods     public
String       getName()       {
return name;
   }
```

```
    public String getAuthor() {
return author;
    }

    public double getPrice() {
return price;
    }

    public int getNumPages() {
return numPages;
    }

    // toString method to display complete details of the book
public String toString() {
        return "Book Details:\nName: " + name + "\nAuthor: " + author + "\nPrice: $" + price + "\nNumber of
Pages: " + numPages;
    }
}

public class Main {     public sta c void
main(String[] args) {
        Scanner scanner = new Scanner(System.in);

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

        // Create an array to hold n book objects
        Book[] books = new Book[n];

        // Input details for each book
for (int i = 0; i < n; i++) {
            System.out.println("\nEnter details for Book " + (i + 1) + ":");
```

```
            System.out.print("Name: ");
            String name = scanner.next();
            System.out.print("Author: ");
            String author = scanner.next();
System.out.print("Price: $");             double
price = scanner.nextDouble();
System.out.print("Number of Pages: ");
int numPages = scanner.nextInt();

            // Create a new Book object with the input details
books[i] = new Book(name, author, price, numPages);
        }

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

        scanner.close();
    }
}
```

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Output

```
java -cp /tmp/pw1qEJZRkF BRun
Enter the number of books:
2
Books 1:
Enter name of the book: JAVA

Enter Author: MR.JOHN

Enter price: 1800

Enter number of pages: 1000
Books 2:
Enter name of the book: COA

Enter Author: DR.UMADEVI

Enter price: 1200

Enter number of pages: 1100
Book: 1
Book Name : JAVA
Author Name : MR.JOHN
Price : 1800
Number of Pages : 1000

Book: 2
Book Name : COA
Author Name : DR.UMADEVI
Price : 1200
Number of Pages : 1100
```

4) SHAPE CLASS

```
abstract class Shape {
public int side1, side2;
abstract void printArea();
```

```
}


class Rectangle extends Shape {
Rectangle(int length, int breadth) {
this.side1 = length;        this.side2 =
breadth;
   }
   void printArea() {
      System.out.println("The Area of Rectangle : " + (side1 * side2));
   }
}

class Triangle extends Shape {
Triangle(int base, int height) {
this.side1 = base;
this.side2 = height;
   }
   void printArea() {
      System.out.println("The Area of Triangle : " + (0.5 * side1 * side2));
   }
}

class Circle extends Shape {
Circle(int rad) {        this.side1
= this.side2 = rad;
   }
   void printArea() {
      System.out.println("The Area of Circle : " + (3.14 * side1 * side2));
   }
}
```

```
class SRun{     public sta c void
main(String[] args) {
        Rectangle r = new Rectangle(10, 10);
        Triangle t = new Triangle(5, 10);
        Circle c = new Circle(5);

        r.printArea();
        t.printArea();
        c.printArea();
    }
}
```

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```
Output                                                    Clear
java -cp /tmp/pw1qEJZRkF SRun
The Area of Rectangle : 100
The Area of Triangle : 25.0
The Area of Circle : 78.5
```

5) BANK CLASS

```
import java.u l.Scanner;

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

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

    abstract void deposit(double amount);

    abstract void displayBalance();

    abstract void computeInterest();

    abstract void withdraw(double amount);
}

class SavingsAccount extends Account {
    SavingsAccount(String customerName, int accountNumber, String accountType, double balance) {
super(customerName, accountNumber, accountType, balance);
    }

    void deposit(double amount) {
balance += amount;
        System.out.println("Amount deposited: " + amount);
    }

    void displayBalance() {
        System.out.println("Balance: " + balance);
    }
    void computeInterest() {         double
interestRate = 0.05;         double interest =
balance * interestRate;         balance +=
interest;
        System.out.println("Interest added: " + interest);
    }
```

```
    void withdraw(double amount) {
if (balance < amount) {
            System.out.println("Insufficient balance");
        } else {
balance -= amount;
            System.out.println("Amount withdrawn: " + amount);
        }
    }
}

class CurrentAccount extends Account {
double minimumBalance = 1000;
double serviceCharge = 50;

    CurrentAccount(String customerName, int accountNumber, String accountType, double balance) {
super(customerName, accountNumber, accountType, balance);
    }

    void deposit(double amount) {
balance += amount;
        System.out.println("Amount deposited: " + amount);
    }

    void displayBalance() {
        System.out.println("Balance: " + balance);
    }

    void computeInterest() {
        System.out.println("Current account does not earn interest");
    }
```

```
    void withdraw(double amount) {         if
(balance - amount < minimumBalance) {
System.out.println("Insufficient balance");
balance -= serviceCharge;
            System.out.println("Service charge: " + serviceCharge);
        } else {
balance -= amount;
            System.out.println("Amount withdrawn: " + amount);
        }
    }
}

class Brun {     public sta c void
main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter customer name: ");
        String customerName = sc.nextLine();

        System.out.print("Enter account number: ");
int accountNumber = sc.nextInt();

        System.out.print("Enter account type (savings/current): ");
        String accountType = sc.next();

        System.out.print("Enter ini al balance: ");
double balance = sc.nextDouble();
System.out.println("\n");

        Account account;         if (accountType.equals("savings")) {             account = new
SavingsAccount(customerName, accountNumber, accountType, balance);
        } else {
```

```
            account = new CurrentAccount(customerName, accountNumber, accountType, balance);
        }

        while (true) {
            System.out.println("\n1. Deposit");
            System.out.println("2. Display balance");
            System.out.println("3. Compute interest");
            System.out.println("4. Withdraw");
            System.out.println("5. Exit\n");

            System.out.print("Enter choice: ");
int choice = sc.nextInt();

            switch (choice) {
case 1:
                System.out.print("\nEnter amount to deposit: ");
double amount = sc.nextDouble();
account.deposit(amount);
                break;
case 2:
                account.displayBalance();
                break;
case 3:
                account.computeInterest();
                break;
case 4:
                System.out.print("\nEnter amount to withdraw: ");
                amount = sc.nextDouble();
account.withdraw(amount);
                break;
case 5:
sc.close();
```

```
System.exit(0);
break;                default:
                System.out.println("\nInvalid choice");
        }
    }
  }
}
```

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Output Clear

```
java -cp /tmp/pw1qEJZRkF Brun
Enter customer name: KEERTHI
Enter account number: 12345
Enter account type (savings/current): SAVINGS
Enter initial balance: 20000



1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit

Enter choice: 2
Balance: 20000.0

1. Deposit
2. Display balance
3. Compute interest
```

```
Enter choice: 1

Enter amount to deposit: 500
Amount deposited: 500.0

1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit

Enter choice: 3
Current account does not earn interest

1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
```

```
Enter choice: 4

Enter amount to withdraw: 10000
Amount withdrawn: 10000.0

1. Deposit
2. Display balance
3. Compute interest
4. Withdraw
5. Exit
```

4) STUDENTS MARKS

// File: CIE/Student.java

package CIE;

public class Student {

```
    protected String usn;
protected String name;
protected int sem;

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



// File: CIE/Internals.java
package CIE;

public class Internals extends Student {
protected int[] internalMarks = new int[5];

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

//                          File:
SEE/External.java
package    SEE;    import
CIE.*;

public class External extends Student {
protected int[] externalMarks = new int[5];

    public External(String usn, String name, int sem, int[] externalMarks) {
super(usn, name, sem);

        this.externalMarks = externalMarks;
```

```
    }
}

// File: Main.java
import CIE.*;
import SEE.*;

public class Main {     public sta c void
main(String[] args) {
        // Example usage
        // Internal marks for student 1         int[]
internalMarks1 = {80, 75, 85, 90, 88};
        Internals student1Internal = new Internals("1MS16CS001", "Alice", 3, internalMarks1);

        // External marks for student 1         int[]
externalMarks1 = {70, 68, 75, 80, 72};
        External student1External = new External("1MS16CS001", "Alice", 3, externalMarks1);

        // Display final marks for student 1
        System.out.println("Student 1 Final Marks:");
        for (int i = 0; i < 5; i++) {
            int finalMarks = student1Internal.internalMarks[i] + student1External.externalMarks[i];
System.out.println("Course " + (i + 1) + ": " + finalMarks);
        }
    }
}
```

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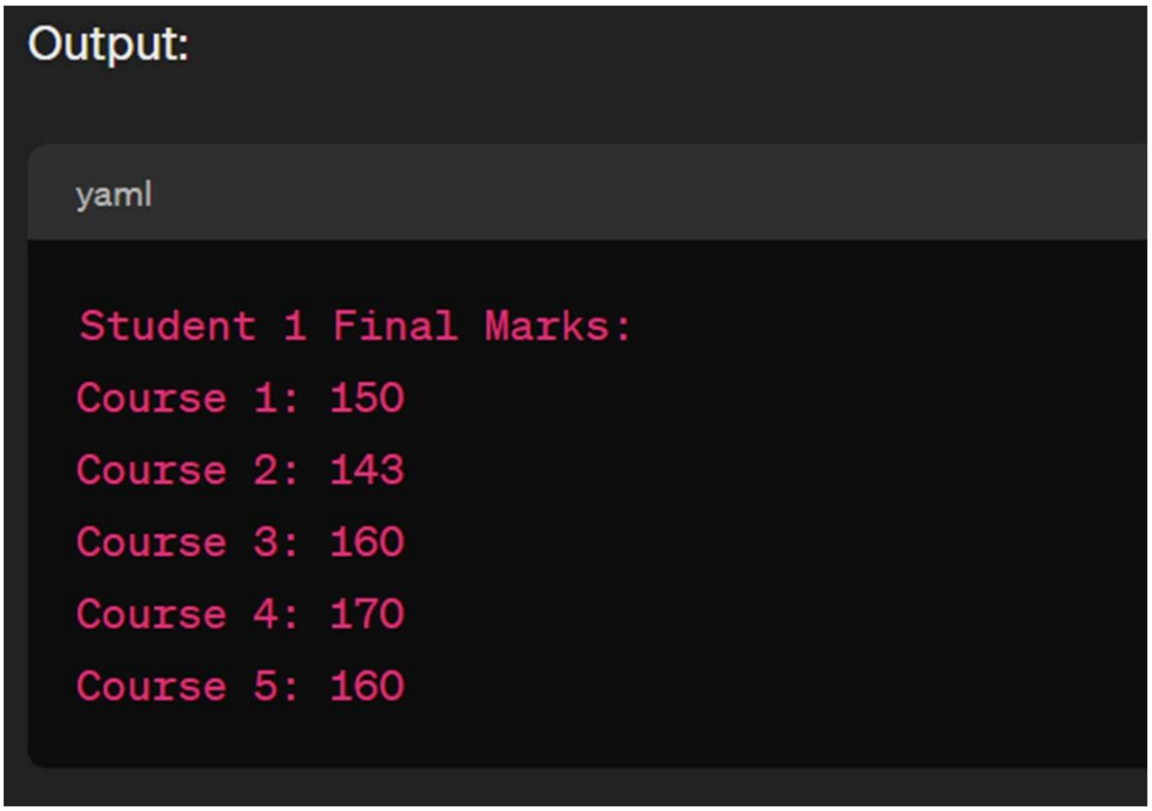
OUTPUT:



6) EXCEPTIONAL HANDLING

```
import java.u l.Scanner;


class WrongAge extends Excep on {
public WrongAge() {
super("Invalid age!");
    }
}


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 EMain{     public sta c void
main(String[] args) {
        Scanner scanner = new Scanner(System.in);
         try
{
            System.out.print("Enter father's age: ");
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 (Excep on e) {
            System.out.println("Invalid input.");
        } finally {
scanner.close();
        }
    }
```

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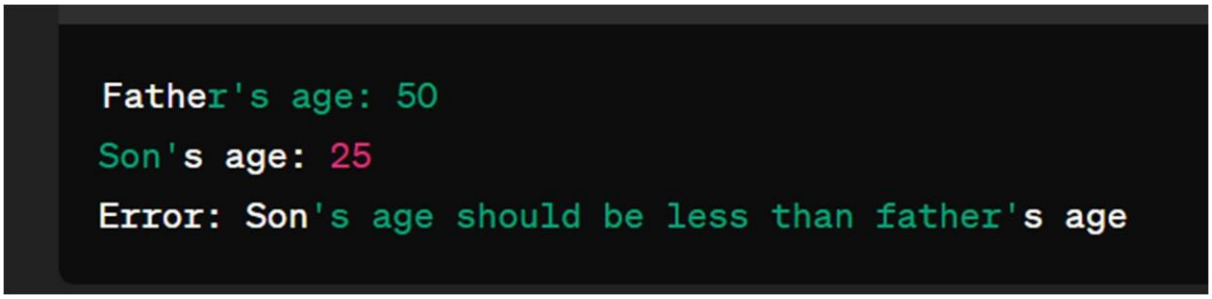
OUTPUT:



8) MULTI-THREADING

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

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

   public void run() {
      try {            for(int i =
0; i < 5; i++) {
            System.out.println(message);
            Thread.sleep(interval * 1000);
         }
      } catch (InterruptedExcep on e) {
         e.printStackTrace();
      }
   }
}

class ThreadDemo {     public sta c void
main(String[] args) {
      DisplayThread thread1 = new DisplayThread("BMS College of Engineering", 10);
      thread1.start();

      DisplayThread thread2 = new DisplayThread("CSE", 2);
thread2.start();
   }
}
```

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Output

```
java -cp /tmp/fwatUdZmmH ThreadDemo
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
BMS College of Engineering
```

THANK YOU