Date __/__/__
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Lab 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.

```
import java.util.Scanner;
class QuadraticEquation
{  public static void main(String x[])
{  Scanner input = new Scanner(System.in);
   System.out.println("Enter the value of the
   coefficients\n Enter the value of a: ");
   double a = input.nextDouble();
   System.out.println("Enter the value of b: ");
   double b = input.nextDouble();
   System.out.println("Enter the value of c: ");
   double c = input.nextDouble();
   double d = b*b - 4.0*a*c;
   if (a==0) { System.out.println("The value
    of a can't be 0"); }
   else {  if (d>0.0) }
            { double r1= (-b+Math.sqrt(d))/(2.0*a);
              double r2 = (-b-Math.sqrt(d))/(2.0*a);
              System.out.println("The roots are
              real and distinct and are "+r1+"
              and "+r2);
            }
   else if (d==0.0)
    {  double r1 = -b/(2.0*a);
System.out.println("The roots are real and equal
 and are "+r1+" and "+r1);
}
```

```
else {  double r1 = (-b/(2.0*a));
        double r2 = (+Math.sqrt(Math.abs(d))/(2.0*a));
        double r3 = (-Math.sqrt(Math.abs(d))/(2.0*a));
        System.out.println("The roots are imaginary and are "+r1+"+"+r2+"i" and "+r1+"+"+r3+"i");
    }
}
```

1) Quadratic Equation Ex output.

→ Enter the value of the coefficients
Enter the value of a: 1
Enter the value of b: 1
Enter the value of c: 1
The roots are imaginary and are -0.5 + i0.8660254037844386 and -0.5 - i0.8660254037844386

→ Enter the value of the coefficients:
Enter the value of a: 4
Enter the value of b: -4
Enter the value of c: 1
The roots are real and equal and are 0.5 and 0.5

→ Enter the value of the coefficients
Enter the value of a: 1
Enter the value of b: 4
Enter the value of c: 3
The roots are real and distinct and are -1.0 and -3.0

→ Enter the value of the coefficients
Enter the value of a: 0
Enter the value of b: 2
Enter the value of c:
The value of x can't be 0

```
Enter the value of the coefficients
 Enter the value of a:
1
Enter the value of b:
1
Enter the value of c:
1
The roots are imaginary and are -0.5 +i0.8660254037844386 and -0.5 -i0.8660254037844386

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java QuadraticEquation
Enter the value of the coefficients
 Enter the value of a:
4
Enter the value of b:
-4
Enter the value of c:
1
The roots are real and equal and are 0.5 and 0.5

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java QuadraticEquation
Enter the value of the coefficients
 Enter the value of a:
1
Enter the value of b:
4
Enter the value of c:
3
The roots are real and distinct and are -1.0 and -3.0
```

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Lab Program 2:

Develop a Java program to create a class Student with members USN, name, an array marks. Include methods to accept and display details and a method to calculate SGPA of a student.

```
import java.util.Scanner;
class methods{
    String USN;
    String name;
    int[] credits = new int[9];
    int[] marks = new int[9];
    int i=0;
    int gp;
    double sgpa;
    void o
Void accept(){
        Scanner ss= new Scanner(System.in);
        USN = ss.next();
        name = ss.next();
    for(i=0; i<9; i++)
      { System.out.println("Enter marks for subject"
                          +(i+1)+":");
          marks[i]= ss.nextInt();}
    for(i=0; i<9; i++){System.out.println
      ("Enter credits of subject "+(i+1)+":");
      credits[i] = ss.nextInt();}
    }
Void display(){
    System.out.println("USN:"+USN+"\nName:"
                       +name+"\n");
    for(i=0; i<9; i++){System.out.println
      ("marks:"+marks[i]+" credits:"+credits[i]+"\n");}
}
```

```
void gradepoint() {
    for (i=0; i<9; i++)
{   if (marks[i] >=90 && marks[i] <=100) gp = 10;
    else if (marks[i] >=80 && marks[i] <=89) gp = 9;
    else if (marks[i] >=70 && marks[i] <=79) gp = 8;
    else if (marks[i] >=60 && marks[i] <=69) gp = 7;
    else if (marks[i] >=55 && marks[i] <=59) gp = 6;
    else if (marks[i] >=50 && marks[i] <=54) gp = 5;
    else if (marks[i] >=40 && marks[i] <=49) gp = 4;
    else if (marks[i] >
    else { gp = 0; System.out.println("subject failed"); }
    sgpa = sgpa + ((credits[i]) * gp);
    sgpa = sgpa + 20
    System.out.println("your sgpa is: " + sgpa);
}
}

class main {
    public static void main(String s[])
    {
        methods m = new methods();
        m.accept();
        m.display();
        m.gradepoint();
    }
}
```

```
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java main
Enter your USN and name
1bm21cs005
aditi
Enter marks for subject 1:
92
Enter marks for subject 2:
96
Enter marks for subject 3:
97
Enter marks for subject 4:
83
Enter marks for subject 5:
99
Enter marks for subject 6:
70
Enter marks for subject 7:
92
Enter marks for subject 8:
91
Enter marks for subject 9:
88
Enter credits for subject 1:
3
Enter credits for subject 2:
4
Enter credits for subject 3:
1
Enter credits for subject 4:
3
Enter credits for subject 5:
1
Enter credits for subject 6:
3
Enter credits for subject 7:
1
Enter credits for subject 8:
3
Enter credits for subject 9:
1
USN: 1bm21cs005
Name :aditi
```

```
Marks: 92 Credits: 3

Marks: 96 Credits: 4

Marks: 97 Credits: 1

Marks: 83 Credits: 3

Marks: 99 Credits: 1

Marks: 70 Credits: 3

Marks: 92 Credits: 1

Marks: 91 Credits: 3

Marks: 88 Credits: 1

Your sgpa is: 9.5
```

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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

```
import java.util.*
class book {
        String author;
        String name;
        int price;
        int num_pages;
    book() { }
    book (String n, String a, int p, int num) {
      name = n;
      author = a;
      price = p;
      num_pages = num;
      }
    void getd() {
    Scanner ss = new Scanner(System.in);
    System.out.println("Enter the name of the book: ");
    name = ss.next();
    System.out.println("Enter the author of the book: ");
    author = ss.next();
    System.out.println("enter the price of the book: ");
    price = ss.nextInt();
    System.out.println("Enter the numbe of pages of book: ");
    num_pages = ss.nextInt();
    }
```

```
public String toString() {
    String S: "Name: "+name+" \n Author: "+author+" \n Price: "
            +price+" \n Number of pages: "+num_pages;
    return S;
    }
}

class main {
    public static void main (String xx[]) {
        int x;
        Scanner ss: new Scanner (System.in);
        System.out.println ("How many books do you
            want to store!");
        x = ss.nextInt();
        book b[] = new book[x];
    for (int i=0; i<x; i++) {
            b[i]= new book();
        System.out.println ("Enter book "+(i+1)+"
                details: ");
    }
for (int i=0; i<x; i++)
    {
        System.out.println("Book "+(i+1)+"details: ");
        System.out.println(b[i]);
    }
}
}
```

```
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java main
How many books do you want to store?
2
Enter book 1 details:
Enter the name of the book:
Mockingjay
Enter the author of the book:
Suzanne
Enter the price of the book:
500
Enter the number of pages of the book:
390
Enter book 2 details:
Enter the name of the book:
Twilight
Enter the author of the book:
Stephenie
Enter the price of the book:
330
Enter the number of pages of the book:
500
Book 1 details:
Name: Mockingjay
Author: Suzanne
Price: 500
Number of pages: 390
Book 2 details:
Name: Twilight
Author: Stephenie
Price: 330
Number of pages: 500
```

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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.

```
import java.util.Scanner;
abstract class Shape
{    int a, b;
     abstract void printArea();
     Void set()
     {    Scanner SS = new scanner(System.in);
          System.out.println("Enter the height and breadth: ");
          a = SS.nextInt();
          b = SS.nextInt();
     }
}
Class Rectangle extends Shape
{    Void printArea(){
     { System.out.println("The area of Rectangle is: "+(a*b)); }
}
Class Triangle extends Shape
{    Void printArea() {
     System.out.println("The area of Triangle is: "+(a*b*1/2));
}
Class Circle extends Shape
{    Void printArea()
     {    Scanner SS = new Scanner(System.in);
          System.out.println("Enter the radius: ");
          a = SS.nextInt();
```

```
        System.out.println("the area of circle is : " + (3.14 * a * a));
    }
}
class Main_Abstract
{
    public static void main(String xx[])
    {
        Rectangle R1 = new Rectangle();
        R1.set();
        R1.printArea();
        Triangle T1 = new Triangle();
        T1.set();
        T1.printArea();
        Circle C1 = new Circle();
        C1.printArea();
    }
}
```

```
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java Main_Abstract
Enter The height and breadth:
4 4
The area of Rectangle is: 16
Enter The height and breadth:
4 4
The area of Triangle is: 8
Enter the radius:
4
The area of Circle is: 50.24

C:\Users\Aditi Suhrut\Documents\Aditi\Java>
```

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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 provids compound intrest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no intrest Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge ~~should be~~ is inposed.

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 balance.
b) Display the balance
c) compute and deposit intrest
d) Permit withdrawal and update the balance
Check for the minimum balance, impose penalty if necessary and update the balance.

```
import java.util.Scanner;
abstract class Account
{   String name = new String();
    int accno;
    String choice;
    double bal, dep, with, min = 500, tran, ci, r, n, t, p, q;
    abstract void type(char s);
    Scanner ss = new Scanner(System.in);
    void set()
    {   System.out.println("Enter your account number");
```

```
accno = ss.nextInt();
System.out.println("Enter your Balance: ");
bal1 = ss.nextDouble();
}
void put()
{   System.out.println("Your balance is now: "+bal);
}
}
class cur_acct extends Account
{
  void type(char s)
{ if(character.compare(s,'c')) System.out.println("
  This is your current account");
}
double cqbdeposit()
{ System.out.println("Enter the amount transffered
  to your account: ");
  dep = ss.nextDouble();
  bal = bal+dep;
  return bal;
}
double cstransfer()
{ system.out.println("Enter the amount to be
  transfered: ");
  tran = ss.nextDouble();
  if ((bal-tran) < min)
{ System.out.println("This transaction will cost a
penalty of Rs50 as balance will go below minimum. In
Do you want to go ahead with the transaction Y or
N"); choice = ss.next();
if (choice.equalsIgnoreCase("y")) { bal = bal-tran-50;}
else{system.out.println("Cancelling transaction");}
}
```

```
        else bal = bal - tran;
        return bal;
    }
}
class Sav_acct extends Account
{   void type(char s)
    {   if (Character.compare(s, 'S'))
        System.out.println("This is your Savings
            Account");  }
    double deposit()
    {   System.out.println("Enter the amount transfered
        to your account: "); dep = ss.nextDouble();
        bal = bal + dep;
        return bal;
    }
    double withdraw()
    {   System.out.println("Enter the amount to be
        withdrawed: "); with = ss.nextDouble();
        if ((bal - with) > min) { bal = bal - with; }
        else { System.out.println("Insufficient balance");
        } return bal; }
    double compoundinterest()
    {   System.out.println("Enter interest rate:");
        r = ss.nextDouble(); System.out.println("Enter
        no. of times interest offered per time period"); n = ss.nextDouble();
        System.out.println("enter the time period:");
        t = ss.nextInt(); p = (1+(r/n)); q = n*t;
        CI = bal * Math.pow(p, q); bal = bal + CI;
        return bal; }
}
class MainBank {
{   public static void main(String args[])
```

```
{ Scanner ss = new Scanner(System.in);
System.out.println("Enter type 1. Current Account 2. Saving account");
int ch, k;
char x;
ch = ss.nextInt();
if (ch == 1) {   x = 'c';
                 Cur_act c1 = new Cur_act();
                 c1.type(x); c1.set();
System.out.println("Transfer to 1. Your 2. Different");
k = ss.nextInt(); if (k == 1) c1.cabdeposit();
if (k == 2) c1.cb transfer();
c1.put();
}
if (ch == 2)
{   x = 's';
Sav_acct s1 = new Sav_act();
s1.type(x);
s1.set();
System.out.println("Do you want to
                    1. Deposit 2. withdra
                    3 compoundInstrst");
k = ss.nextInt();
if (k == 1)
s1.deposit();
if (k == 2)
s1.withdraw();
if (k == 3)
s1.compoundintrst();
s1.put();
}
}
```

```
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java MainBank
Enter the type of account to be created
1.Current Account
2.Savings Account
1
Enter your account number:
Enter your balance:
1000
1000
Do you want to transfer to 1.Your account or a 2.Different account?
2
Enter the amount to be transfered:
700
This transaction will cost a penalty of Rs.50 as the balance will go below minimun.
Do you want to go ahead with the transaction?Y or N
y
Your balance is now: 250.0

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java MainBank
Enter the type of account to be created
1.Current Account
2.Savings Account
2
Enter your account number:
Enter your balance:
1000
1000
Do you want to transfer to 1.Deposit or a 2.Withdraw or get 3.Compound Intrest?
3
Enter the intrest rate:
50
Enter number of times intrest applied per time period:
2
Enter the time period:
1
Your balance is now: 677000.0
```

```
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java MainBank
Enter the type of account to be created
1.Current Account
2.Savings Account
2
Enter your account number:
Enter your balance:
1000
1000
Do you want to transfer to 1.Deposit or a 2.Withdraw or get 3.Compound Intrest?
1
Enter the amount transfered to your account:
20
Your balance is now: 1020.0
```

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Lab Program 6

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 & 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 exception if Son's age >= father's age.

```
import java.util.Scanner;
class nozerosage extends Exception
{ public String toString()
    { return "Age cannot be lesser than zero";}
    }
}
class notlessthanfather extends Exception
{ public String toString()
    { return "Age cannot be less than father";}
    }
{
Class Father
{ int age;
    Father() {Scanner SS= new Scanner(System.in);
     System.out.println("Enter age of Father:");
     age = SS.nextInt();}
    void checkage() throws nozerosage
    { if(age<0) {throw new nozerosage();}
      else System.out.println("The age of the
       father is "+age);
    }
}
```

```
class Son extends Father
{
    int age1;
    Son() { Scanner SS = new Scanner(System.in);
    System.out.println("Enter the age of the son:");
    age1 = SS.nextInt(); }
    void checkAge1() throws notlessthanfather, negage
    { if (age1 < 0) { throw new negage(); }
      if (age1 >= age) { throw new notlessthanfather(); }
      else System.out.println("The age of the father is"
      + age + " and Son is" + age1);
    }
}
class mainage
{ public static void main(String xx[])
  { Father f1 = new Father();
    try { f1.checkAge(); }
    catch (nozeroage ae) { System.out.println(ae); }
    Son S1 = new Son();
    try { S1.checkAge(); S1.checkAge1(); }
    catch (nozeroage ae) { System.out.println(ae); }
    catch (notlessthafater me) { System.out.println(me); }
  }
}
```

OUTPUT:

Enter the age of the father: -1
Aage cannot be less than zero
Enter the age of the father:
30
The age of the father is: 30
The age of the father is 30 and son is: 12

Enter the age of the father : 90
The age of the father is : 90
Enter the age of the son : -7
The age of father is : 34
Age cannot be less than zero

Enter the age of the father : 50
The age of the father : 50
Enter age of father : 50
Enter age of son : 32
The age of father : 50
The age of father : 50 and son : 32

Enter the age of father : -2
Age cannot be lesser than zero
Enter the age of the father : -2
Enter the age of the son : 3
Age cannot be lesser than zero

Enter the age of the father : 50
The Age of the father : 50
Enter the age of the father : 50
Enter the age of the son : 60
The age of the father is : 50
Age cannot be lesser than father

Command Prompt

```
Enter the age of the father:
-1
Age cannot be lesser than zero
Enter the age of the father:
34
Enter the age of the son:
12
The age of the father is: 34
The age of the father is: 34 and son is: 12

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainage
Enter the age of the father:
40
The age of the father is: 40
Enter the age of the father:
34
Enter the age of the son:
-7
The age of the father is: 34
Age cannot be lesser than zero

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainage
Enter the age of the father:
50
The age of the father is: 50
Enter the age of the father:
50
Enter the age of the son:
32
The age of the father is: 50
The age of the father is: 50 and son is: 32

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainage
Enter the age of the father:
34
The age of the father is: 34
Enter the age of the father:
34
Enter the age of the son:
-7
The age of the father is: 34
Age cannot be lesser than zero
```

Command Prompt

```
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainage
Enter the age of the father:
-2
Age cannot be lesser than zero
Enter the age of the father:
-2
Enter the age of the son:
3
Age cannot be lesser than zero

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainage
Enter the age of the father:
50
The age of the father is: 50
Enter the age of the father:
50
Enter the age of the son:
60
The age of the father is: 50
Age cannot be lesser than father

C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainage
Enter the age of the father:
-1
Age cannot be lesser than zero
Enter the age of the father:
-1
Enter the age of the son:
-2
Age cannot be lesser than zero
```

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Lab Program 7

The program to be executed for evaluation in today's lab

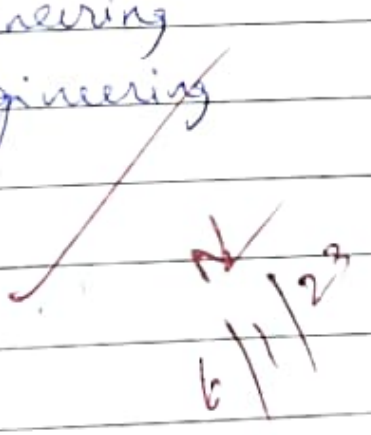
Write a program which creates two threads, one thread displaying "BMS college of Engineering" once every ten seconds and another displaying "CSE one every two seconds.

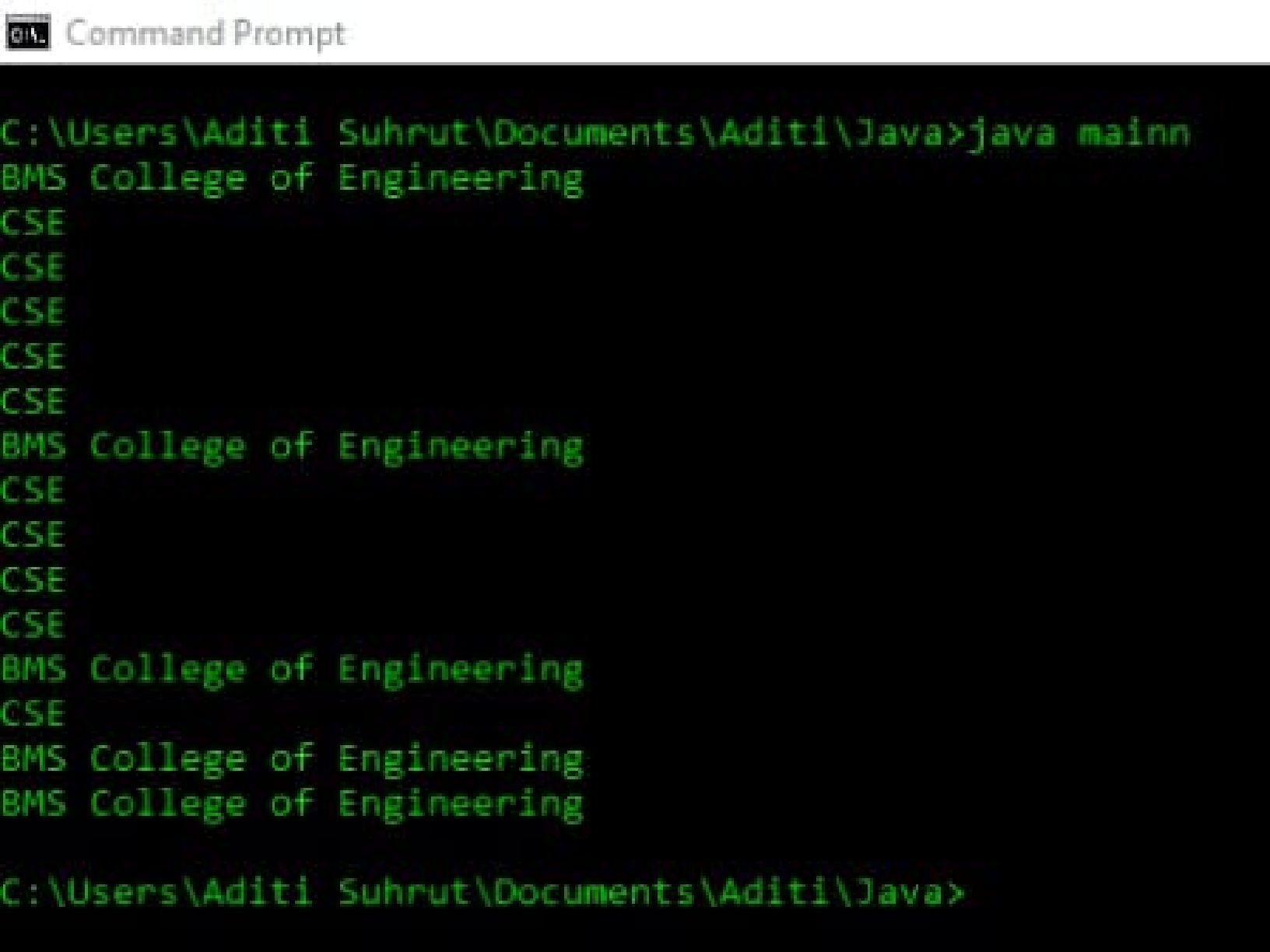
```
import java.util.Scanner;
class BMS extends Thread
{   int i=0;
    public void run()
    {   for(i=0;i<5;i++)
        {   try {System.out.println("BMS
                college of Engineering");
                sleep(10000);}
            catch(InterruptedException ie)
            {System.out.println("Interrupted");}
        }
}
class CSE extends Thread
{   int i=0;
    public void run()
    {   for(i=0;i<10;i++)
        {try {system.out.println("CSE");
              sleep(2000);}
        catch(InterruptedException ie)
        {system.out.println("Interrupted");}}
    }
}
```

```
class mainn
{   public static void main (String xx[])
    {       BMS b1 = new BMS();
            CSE c1 = new CSE();
             b1.start();
             c1.start();
    }
}
```

OUTPUT:

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




Command Prompt
C:\Users\Aditi Suhrut\Documents\Aditi\Java>java mainn
BMS College of Engineering
CSE
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
CSE
CSE
CSE
BMS College of Engineering
CSE
BMS College of Engineering
BMS College of Engineering
C:\Users\Aditi Suhrut\Documents\Aditi\Java>

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Lab program 8

Create a package CIE which has 2 classes - student and Internals. Student class 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 2 packages in a file that declares the final marks of n students in all five courses

```
package cie;
import java.util.Scanner;
public class student
  {   public String usn = new String();
      public String name = new String();
      public int sem;
      public void accept()
      {  Scanner ss = new Scanner(System.in);
         System.out.println("Enter your USN: ");
         usn = ss.next();
         System.out.println("Enter your name: ");
         name = ss.next();
         System.out.println("enter your semester: ");
         sem = ss.nextInt();
      }
}
```

```
package cie;
import java.util.Scanner;
public class internals extends student
{ public int cmarks[] = new int[5];
  public int i;
  public void accept1()
  { Scanner ss = new Scanner(System.in);
    System.out.println("Enter your CIE marks
                        of 5 subjects:");
    for(i=0;i<5;i++)
    { cmarks[i] = ss.nextInt();
    }
  }
}

package see;
import cie.internals;
import java.util.Scanner;
public class externals extends internals
{   public int smarks[] = new int[5];
    public int j;
    public void accept2()
    { Scanner ss = new Scanner(System.in);
      System.out.println("Enter your SEE marks
                          of 5 subjects:");
      for(j=0;j<5;j++)
      { smarks[j] = ss.nextInt();
      }
    }
    public String toString()
    { String s = "USN: "+usn+"\n Name: "+name+
                 "\n Sem: "+sem;
      return s;
    }
}
```

```
import cie. Student;
import cie. internals;
Import see. externals;
Import java.util. Scanner;
public static void ma
public class finalmarks
{ public static void main(String xx[])
  { int studs, k, f;
    int fmarks [ ] = new int [5];
    Scanner s1 = new Scanner(System.in);
    System.out.println("Enter the number of
                        students: ");
    Studs = s1.nextInt();
    Externals e[] = new externals[studs];
    system.out.println("Enter both cie and see
                        marks out of 50");
    for (k=0; k<studs; k++)
    {  e[k] = new externals();
       e[k].accept();
       e[k].accept1();
       e[k].accept2();
       for (f=0; f<5; f++)
       fmarks[f] = e[k].cmarks[f] +
                   e[k].smarks[f];
       System.out.println("Student" + (k+1)+"
                           details: ");
       System.out.println(e[k]);
       for (f=0; f<5; f++)
       System.out.println("\n Final Marks:"
                          + fmarks[f]);
    }
  }
}
```

```
Enter the number of students:
2
Enter both cie and see marks out of 50
Enter your USN:
1BM21CS005
Enter your name:
Aditi
Enter your semester:
3
Enter your CIE marks of 5 subjects:
47 48 49 50 35
Enter your SEE marks of 5 subjects:
44 46 40 50 29
Student 1 details:
USN: 1BM21CS005
Name: Aditi
Sem: 3

Final Marks: 91

Final Marks: 94

Final Marks: 89

Final Marks: 100

Final Marks: 64
Enter your USN:
1BM21CS999
Enter your name:
ZZZZZ
Enter your semester:
3
```

```
Enter your CIE marks of 5 subjects:
20 49 45 0 49
Enter your SEE marks of 5 subjects:
50 43 45 50 44
Student 2 details:
USN: 1BM21CS999
Name: ZZZZZ
Sem: 3

Final Marks: 70

Final Marks: 92

Final Marks: 90

Final Marks: 50

Final Marks: 93
```