VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

On

OBJECT ORIENTED JAVA PROGRAMMING

Submitted by

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in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING
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B. M. S. College of Engineering,
Bull Temple Road, Bangalore 560019
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Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled **"OBJECT ORIENTED JAVA PROGRAMMING"** carried out by **JYOTHIKA C N(1BM21CS083)**, who is bonafide student of **B. M. S. College of Engineering**. It is in partial fulfilment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022-23. The Lab report has been approved as it satisfies the academic requirements in respect of Object-Oriented Java Programming Lab - **(21CS3PCOOJ)** work prescribed for the said degree.

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Associate Professor   Professor and Head
Department of CSE   Department of CSE
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Index Sheet

Course outcomes:

CO1	Apply the knowledge of Java concepts to find the solution for a given problem
CO2	Analyse the given Java application for correctness/functionalities.
CO3	Develop Java programs / applications for a given requirement.
CO4	Conduct practical experiments for demonstrating features of Java.

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.

```java
import java.util.*;
import java.math.*;
class Discriminant
{
        double a,b,c;
        Discriminant(double x,double y,double z)
        {
                a=x;
                b=y;
                c=z;
        }
        double discr()
        {
                return(b*b-4*a*c);
        }
}
class Quadratic
{
        public static void main(String args[])
        {
                Scanner sc= new Scanner(System.in);
                double a,b,c;
                double r1,r2;
                System.out.println("Enter the coefficient of x^2");
                a=sc.nextDouble();
                System.out.println("Enter the coefficient of x");
                b=sc.nextDouble();
                System.out.println("Enter the constant");
                c=sc.nextDouble();
                if(a==0)
                {
                        System.out.println("Entered equation is not quadratic!!!!");
                }
                else
                {
                        Discriminant d=new Discriminant(a,b,c);
                        if (d.discr()>0)
                        {
                                r1=(-b+Math.sqrt(d.discr()))/(2*a);
```

```java
                                r2=(-b-Math.sqrt(d.discr()))/(2*a);
                                System.out.println("Roots are Distinct and real: r1="+r1+"
r2="+r2);
                        }
                        else if(d.discr()<0)
                        {
                                r1=-b/(2*a);
                                r2=(Math.sqrt(Math.abs(d.discr())))/(2*a);
                                System.out.println("Roots are complex : r1= "+r1+"+i"+r2+"
r2="+r1+"-i"+r2);
                        }
                        else
                        {
                                r1=-b/(2*a);
                                System.out.println("Roots are equal: r1=r2="+r1);
                        }
                }
        }
}
```

Output:

```
Command Prompt

C:\Users\Jyothika\Documents>cd JAVA

C:\Users\Jyothika\Documents\JAVA>javac Quadratic.java

C:\Users\Jyothika\Documents\JAVA>java Quadratic
Enter the coefficient of x^2
1
Enter the coefficient of x
-2
Enter the constant
1
Roots are equal: r1=r2=1.0

C:\Users\Jyothika\Documents\JAVA>java Quadratic
Enter the coefficient of x^2
1
Enter the coefficient of x
1
Enter the constant
1
Roots are complex : r1= -0.5+i0.8660254037844386 r2=-0.5-i0.8660254037844386

C:\Users\Jyothika\Documents\JAVA>java Quadratic
Enter the coefficient of x^2
1
Enter the coefficient of x
3
Enter the constant
2
Roots are Distinct and real: r1=-1.0 r2=-2.0

C:\Users\Jyothika\Documents\JAVA>java Quadratic
Enter the coefficient of x^2
0
Enter the coefficient of x
1
Enter the constant
4
Entered equation is not quadratic!!!!

C:\Users\Jyothika\Documents\JAVA>
```

Lab Program 2:

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

```java
import java.util.*;
class Student
{
   String USN;
   String name;
   int credits[]=new int[20];
   double tot,sgpa;
   int c,i;
   int marks[]=new int[20];
   int p[]=new int[20];
   void input()
   {
     Scanner sc=new Scanner(System.in);
     System.out.println("Enter student's USN :");
     USN=sc.next();
     System.out.println("Enter student's name :");
     name=sc.next();
     System.out.println("Enter total number of courses :");
     c=sc.nextInt();
     System.out.println("Enter total number of credits :");
     tot=sc.nextDouble();
     System.out.println("Enter marks and credits :");
     for(i=0;i<c;i++)
     {
        System.out.print("Enter number of credits for course  "+(i+1)+" :");
        credits[i]=sc.nextInt();
        System.out.print("Enter marks for course "+(i+1)+" :");
        marks[i]=sc.nextInt();
          }
   }
   double calculate()
   {

     for(i=0;i<c;i++)
     {
        if(marks[i]<=100 && marks[i]>=90)
           p[i]=10;
        else if(marks[i]<90 && marks[i]>=80)
           p[i]=9;
```

```java
            else if(marks[i]<80 && marks[i]>=70)
                p[i]=8;
            else if(marks[i]<70 && marks[i]>=60)
                p[i]=7;
            else if(marks[i]<60 && marks[i]>=55)
                p[i]=6;
            else if(marks[i]<55 && marks[i]>=50)
                p[i]=5;
                    else if(marks[i]<50 && marks[i]>=40)
                            p[i]=4;
            else
                p[i]=0;

        }
        double total=0.0;


        for(i=0;i<c;i++)
        {
            total+=credits[i]*p[i];
        }
            sgpa=total/tot;
        return (sgpa);
    }
    void display()
    {
        System.out.println("USN :"+USN);
        System.out.println("Name :"+name);
        System.out.println("SGPA :"+calculate());
    }

}
class SGPA
{
    public static void main(String args[])
    {
        Student s1=new Student();
        s1.input();
        s1.display();
        Student s2=new Student();
        s2.input();
        s2.display();


    }
}
```
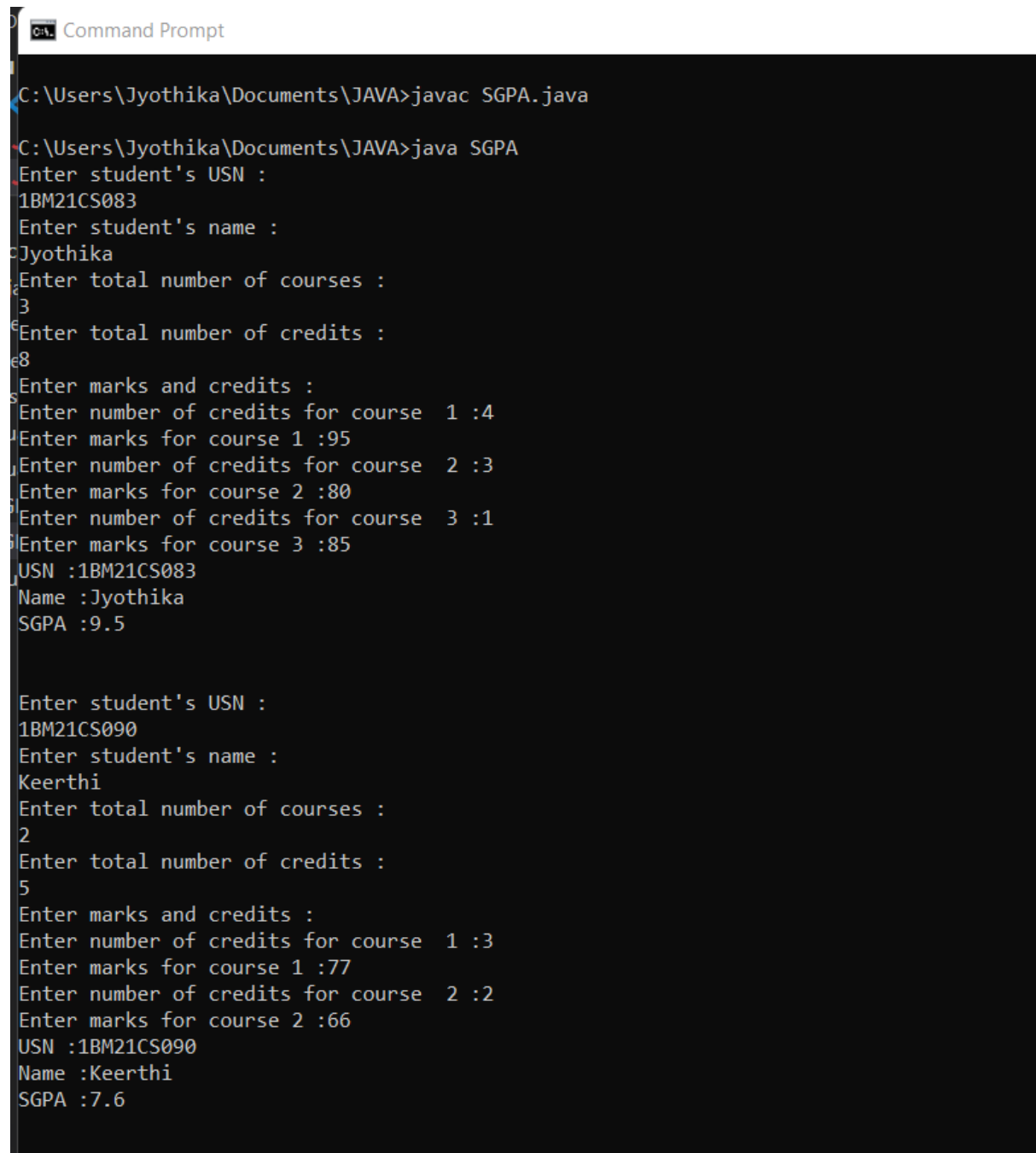
Output:

```
C:\Users\Jyothika\Documents\JAVA>javac SGPA.java

C:\Users\Jyothika\Documents\JAVA>java SGPA
Enter student's USN :
1BM21CS083
Enter student's name :
Jyothika
Enter total number of courses :
3
Enter total number of credits :
8
Enter marks and credits :
Enter number of credits for course  1 :4
Enter marks for course 1 :95
Enter number of credits for course  2 :3
Enter marks for course 2 :80
Enter number of credits for course  3 :1
Enter marks for course 3 :85
USN :1BM21CS083
Name :Jyothika
SGPA :9.5


Enter student's USN :
1BM21CS090
Enter student's name :
Keerthi
Enter total number of courses :
2
Enter total number of credits :
5
Enter marks and credits :
Enter number of credits for course  1 :3
Enter marks for course 1 :77
Enter number of credits for course  2 :2
Enter marks for course 2 :66
USN :1BM21CS090
Name :Keerthi
SGPA :7.6
```

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.

```java
import java.util.*;
class Book
{
    String name;
    String author;
    int price;
    int num_pages;
    Book(String n,String a,int p,int no)
    {
        name=n;
        author=a;
        price=p;
        num_pages=no;

    }
    public String toString()
    {
        return name+"\t\t"+author+"\t\t"+price+"\t\t"+num_pages+"\n";
    }
}
class Book_details
{
    public static void main(String args[])
    {
        Scanner sc=new Scanner(System.in);
        int count;
        System.out.println("Enter the total number of books");
        count=sc.nextInt();
        Book b[]=new Book[count];
        String n,a;
        int p,no;

        for(int i=0;i<count;i++)
        {
            System.out.println("Enter the details");
            System.out.println("Enter the book title");
            n=sc.next();
            System.out.println("Enter the author's name");
```
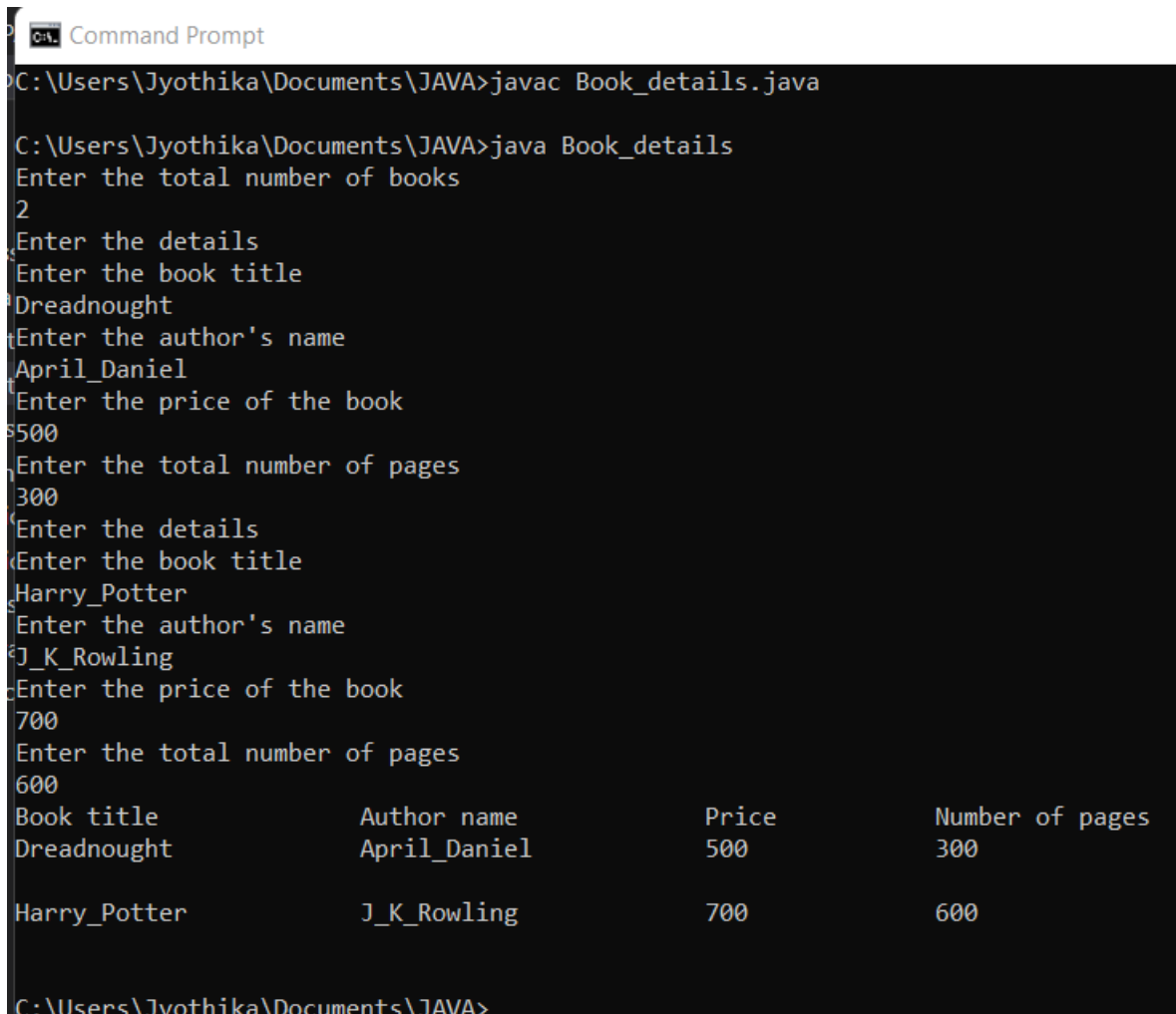
```java
            a=sc.next();
            System.out.println("Enter the price of the book");
            p=sc.nextInt();
            System.out.println("Enter the total number of pages");
            no=sc.nextInt();
            b[i]=new Book(n,a,p,no);
        }
            System.out.println("Book title\tAuthor name\tPrice\tNumber of pages");
        for(int i=0;i<count;i++)
        {
            System.out.println(b[i]);
        }
    }
}
```

Output:

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.

```java
import java.util.*;
abstract class Shape
{
   int a,b;
   abstract void printArea();
}
class Rectangle extends Shape
{
   void get_data(int l,int h)
   {
     a=l;
     b=h;
   }
   void printArea()
   {
     System.out.println("Area of Rectangle= "+a*b);
   }
}
class Triangle extends Shape
{
   void get_data(int l,int h)
   {
     a=l;
     b=h;
   }
   void printArea()
   {
     System.out.println("Area of Triangle= "+0.5*a*b);
   }
}
class Circle extends Shape
{
   void get_data(int r)
   {
     a=r;
   }
   void printArea()
   {
```

```java
            System.out.println("Area of Circle= "+3.14*a*a);
    }
}
class Abst
{
    public static void main(String args[])
    {
        Scanner sc=new Scanner(System.in);
        int a,b,choice;
        Rectangle r= new Rectangle();
        Triangle t= new Triangle();
        Circle c=new Circle();
        System.out.println("1.Rectangle\n 2.Triangle\n 3.Circle\n 4.Exit");
        System.out.println("Enter your choice");
        choice=sc.nextInt();
        switch(choice)
        {
            case 1:System.out.println("Enter length and breadth :");
                    a=sc.nextInt();
                    b=sc.nextInt();
                    r.get_data(a,b);
                    r.printArea();
                    break;
            case 2:System.out.println("Enter base and height :");
                    a=sc.nextInt();
                    b=sc.nextInt();
                    t.get_data(a,b);
                    t.printArea();
                    break;
            case 3:System.out.println("Enter radius :");
                    a=sc.nextInt();
                    c.get_data(a);
                    c.printArea();
                    break;
            default: System.out.println("Invalid choice!!!");

        }


    }
}
```

Output:

```
Command Prompt

C:\Users\Jyothika\Documents\JAVA>javac Abst.java

C:\Users\Jyothika\Documents\JAVA>java Abst
1.Rectangle
 2.Triangle
 3.Circle
 4.Exit
Enter your choice
1
Enter length and breadth :
2
6
Area of Rectangle= 12

C:\Users\Jyothika\Documents\JAVA>java Abst
1.Rectangle
 2.Triangle
 3.Circle
 4.Exit
Enter your choice
2
Enter base and height :
10
5
Area of Triangle= 25.0

C:\Users\Jyothika\Documents\JAVA>java Abst
1.Rectangle
 2.Triangle
 3.Circle
 4.Exit
Enter your choice
3
Enter radius :
5
Area of Circle= 78.5

C:\Users\Jyothika\Documents\JAVA>java Abst
1.Rectangle
 2.Triangle
 3.Circle
 4.Exit
Enter your choice
4
Invalid choice!!!
```

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.

```java
import java.util.Scanner;
import java.math.*;
class Account
{
        String cust_name;
        String accno;
        String type;
        double balance;
        double amt;
        Scanner sc=new Scanner(System.in);
        void get_values()
        {

                System.out.println("Enter customer name");
                cust_name=sc.next();
                System.out.println("Enter account number");
                accno=sc.next();
                System.out.println("Enter initial balance  minimum amt :1000");
                balance=sc.nextDouble();
        }
        void depo()
        {
                System.out.println("Enter amount to be deposited");
                amt=sc.nextDouble();
                balance+=amt;
```

```java
                    System.out.println("Balance="+balance);
            }
            void withdraw()
            {
                    System.out.println("Enter amount to be withdrawn");
                    amt=sc.nextDouble();
                    if(balance<=amt)
                            System.out.println("Cannot withdraw");
                    else
                            balance-=amt;
                    System.out.println("Balance="+balance);
            }

            void display_bal()
            {
                    System.out.println("customer name="+cust_name);
                    System.out.println("Account number="+accno);
                    System.out.println("type="+type);
                    if(balance<1000)
                    {
                            System.out.println("Below minimum balance");
                            balance=balance-100;
                    }
                    System.out.println("Balance="+balance);
                    System.out.println("\n");
            }
}
class Cur_acct extends Account
{
            Cur_acct()
            {
                    type="Current_account";
            }
            void issue()
            {
                    System.out.println("Cheque book issued");
            }

}
class Sav_acct extends Account
{
            Sav_acct()
            {
                    type="Savings_account";
            }
            void interest()
```

```java
		{
			Scanner sc=new Scanner(System.in);
			System.out.println("Enter rate of interest, time period");
			double r=sc.nextDouble();
			double t=sc.nextDouble();
			double n=2;
			balance=balance*(Math.pow((1+r/n),(n*t)));
		}
}
class Bank
{
	public static void main(String args[])
	{
		Scanner sc=new Scanner(System.in);
		int type;
		System.out.println("Enter the type of account you want to create, 1 for saving
and 2 for current account");
		type=sc.nextInt();
		if(type==1)
		{
			Sav_acct s1=new Sav_acct();
			s1.get_values();
			int c;

			while(true)
			{

	System.out.println("1.Deposit\n2.Display\n3.Withdraw\n4.Interest\n5.Exit");
				System.out.println("Enter your choice");
				c=sc.nextInt();
				switch(c)
				{
					case 1:s1.depo();
						break;
					case 2:s1.display_bal();
						break;
					case 3:s1.withdraw();
						break;
					case 4:s1.interest();
						break;
					default:System.exit(0);
				}
			}
		}
		else if(type==2)
		{
```

```java
                    Cur_acct c1=new Cur_acct();
                    c1.get_values();
                    int c;

                    while(true)
                    {

        System.out.println("1.Deposit\n2.Display\n3.Withdraw\n4.Issue cheque
book\n5.Exit");
                            System.out.println("Enter your choice");
                            c=sc.nextInt();
                            switch(c)
                            {
                                    case 1:c1.depo();
                                            break;
                                    case 2:c1.display_bal();
                                            break;
                                    case 3:c1.withdraw();
                                            break;
                                    case 4:c1.issue();
                                            break;
                                    default:System.exit(0);
                            }
                    }
            }
            else
                    System.out.println("Invalid choice");
    }
}
```

Output:

```
C:\Users\Jyothika\Documents\JAVA>java Bank
Enter the type of account you want to create, 1 for saving and 2 for current account
1
Enter customer name
Sam
Enter account number
123456
Enter initial balance  minimum amt :1000
10000
1.Deposit
2.Display
3.Withdraw
4.Interest
5.Exit
Enter your choice
3
Enter amount to be withdrawn
200
Balance=9800.0
1.Deposit
2.Display
3.Withdraw
4.Interest
5.Exit
Enter your choice
1
Enter amount to be deposited
5000
Balance=14800.0
1.Deposit
2.Display
3.Withdraw
4.Interest
5.Exit
Enter your choice
5
```

```
C:\Users\Jyothika\Documents\JAVA>java Bank
Enter the type of account you want to create, 1 for saving and 2 for current account
2
Enter customer name
George
Enter account number
456789
Enter initial balance  minimum amt :1000
100000
1.Deposit
2.Display
3.Withdraw
4.Issue cheque book
5.Exit
Enter your choice
4
Cheque book issued
1.Deposit
2.Display
3.Withdraw
4.Issue cheque book
5.Exit
Enter your choice
3
Enter amount to be withdrawn
50000
Balance=50000.0
1.Deposit
2.Display
3.Withdraw
4.Issue cheque book
5.Exit
Enter your choice
2
customer name=George
Account number=456789
type=Current_account
Balance=50000.0


1.Deposit
2.Display
3.Withdraw
4.Issue cheque book
5.Exit
Enter your choice
5
```

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 and throws the exception WrongAge( ) when the input age=father's age.

```java
import java.util.Scanner;
class WrongAge extends Exception
{
                private String detail;
                WrongAge(String a)
                {
                      detail=a;
                }
                public String toString()
                {
                      return "WrongAge [" +detail +"]";
                }
}
class Father
{
                int father_age;
                Father(int a)
                {
                      father_age=a;
                }
}
class Son extends Father
{
                int son_age;
                Son(int a,int b)
                {
                      super(a);
                      son_age=b;
                      try
                      {
                            if(son_age<=0 || father_age<=0)
                            {
                                  throw new WrongAge("Son's age or Father's age is less
than zero");
                            }
                            if(father_age<=son_age)
                            {
                                  throw new WrongAge("Father's age is less than Son's
age");
                            }
```

```java
                                    else
                                            System.out.println("Entered age is valid");
                            }
                            catch(WrongAge e)
                            {
                                    System.out.println("Caught "+e);
                            }
                    }
}
class Age
{
                public static void main(String args[])
                {
                        Scanner sc=new Scanner(System.in);
                        System.out.println("Enter Father's age and Son's age");
                        int fa=sc.nextInt();
                        int sa=sc.nextInt();
                        Son ob=new Son(fa,sa);
                }
}
```

Output:

```
C:\Users\Jyothika\Documents\JAVA>javac Age.java

C:\Users\Jyothika\Documents\JAVA>java Age
Enter Father's age and Son's age
-25
20
Caught WrongAge [Son's age or Father's age is less than zero]

C:\Users\Jyothika\Documents\JAVA>java Age
Enter Father's age and Son's age
20
40
Caught WrongAge [Father's age is less than Son's age]

C:\Users\Jyothika\Documents\JAVA>java Age
Enter Father's age and Son's age
40
20
Entered age is valid
```

Lab Program 7:

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 Call implements Runnable
{
        String a;
        int x,time;
        Thread t;
        Call(String tn,int ti,int ex)
        {
          a=tn;
          x=ex;
          time=ti;
          t=new Thread(this,a);
          t.start();
        }
        public void run()
        {
          try{
                  for(int i=0;i<x ;i++)
                  {
                          System.out.println(a);
                          Thread.sleep(time);
                  }
             }
          catch(InterruptedException ie)
          {
                  System.out.println("Inturrupted ");
          }
        }
}

class Lab8
{
public static void main(String xx[])
{
        new Call("BMS College of Enginnering",10000,2);
        new Call("CSE",2000,10);
}
}
```
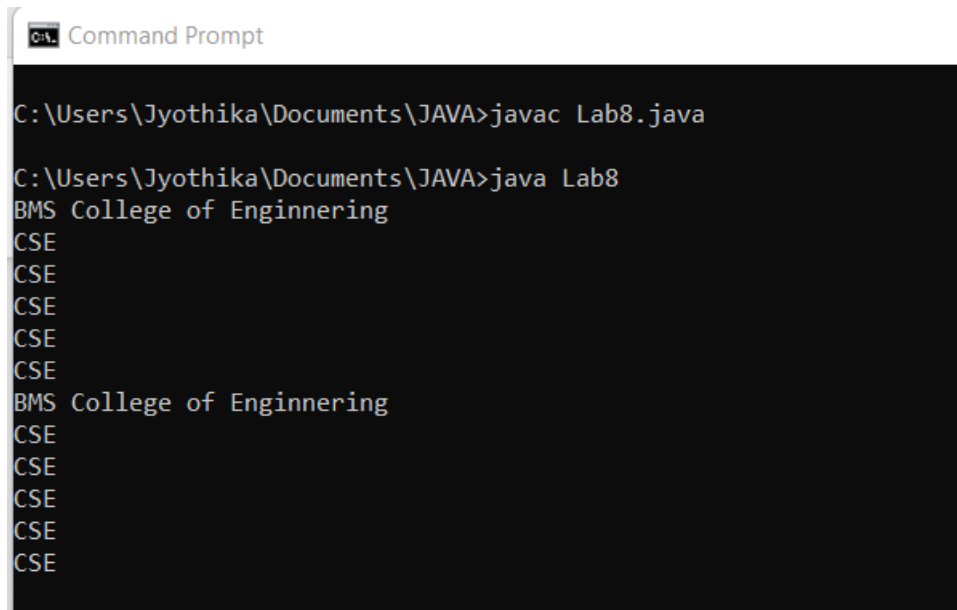
Output:

```
Command Prompt

C:\Users\Jyothika\Documents\JAVA>javac Lab8.java

C:\Users\Jyothika\Documents\JAVA>java Lab8
BMS College of Enginnering
CSE
CSE
CSE
CSE
CSE
BMS College of Enginnering
CSE
CSE
CSE
CSE
CSE
```