PROGRAM 17 :

Create a Graphics package that has classes and interfaces for figures Rectangle, Triangle, Square and Circle. Test the package by finding the area of these figures.

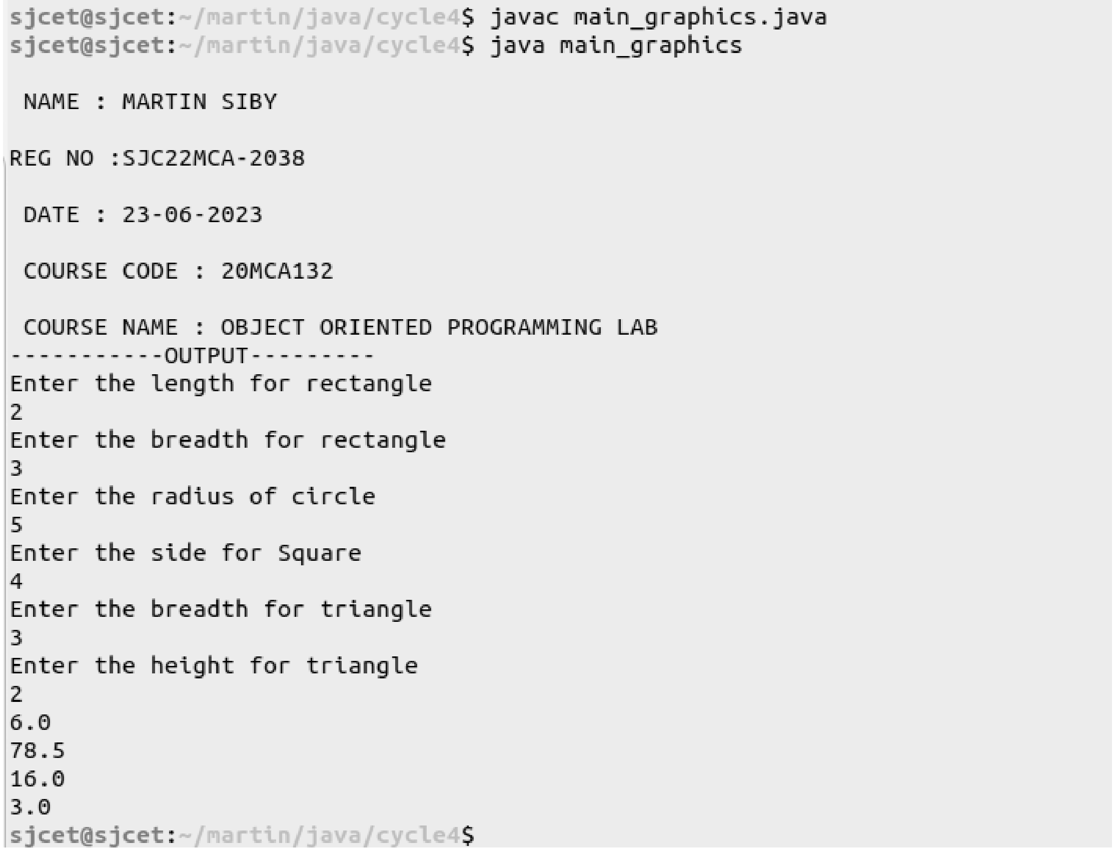
CODE :

```
import package_graphics.*;
import java.util.*;
public class main_graphics {
public static void main(String []args){
package_graphics testObj = new package_graphics();
int l,h,r,a,c,d;
Scanner s=new Scanner(System.in);
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Enter the length for rectangle");
l=s.nextInt();
System.out.println("Enter the breadth for rectangle");
h=s.nextInt();
System.out.println("Enter the radius of circle");
r=s.nextInt();
System.out.println("Enter the side for Square");
a=s.nextInt();
System.out.println("Enter the breadth for triangle");
c=s.nextInt();
System.out.println("Enter the height for triangle");
d=s.nextInt();
System.out.println(testObj.recArea(l,h));
System.out.println(testObj.cirArea(r));
System.out.println(testObj.squArea(a));
System.out.println(testObj.triArea(c,d));
   }
}
```

package_graphics

```
package package_graphics;
interface interface_graphics{
public float recArea(int l, int h);
public float cirArea(int r);
public float squArea(int a);
public float triArea(int l, int h);
}
public class package_graphics implements interface_graphics {
public float recArea(int l, int h){
return l*h;
}
public float cirArea(int r){
return r*r*(float)3.14;
}
public float squArea(int a){
return a*a;
}
public float triArea(int l, int h){
return l*h*(float)(.5);
    }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac main_graphics.java
sjcet@sjcet:~/martin/java/cycle4$ java main_graphics

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-----------OUTPUT---------
Enter the length for rectangle
2
Enter the breadth for rectangle
3
Enter the radius of circle
5
Enter the side for Square
4
Enter the breadth for triangle
3
Enter the height for triangle
2
6.0
78.5
16.0
3.0
sjcet@sjcet:~/martin/java/cycle4$
```

PROGRAM 18 :

Create an Arithmetic package that has classes and interfaces for the 4 basic arithmetic operations. Test the package by implementing all operations on two given numbers

CODE :

```
import arithmetic.*;
public class Arithmetic_opt {
public static void main(String[] args) {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
double num1 = 10;
double num2 = 5;
Arithmetic addition = new Addition();
double sum = addition.calculate(num1, num2);
System.out.println("Sum: " + sum);
Arithmetic subtraction = new Subtraction();
double difference = subtraction.calculate(num1, num2);
System.out.println("Difference: " + difference);
Arithmetic multiplication = new Multiplication();
double product = multiplication.calculate(num1, num2);
System.out.println("Product: " + product);
Arithmetic division = new Division();
double quotient = division.calculate(num1, num2);
System.out.println("Quotient: " + quotient);
    }
}
```

Arithmetic

```
package arithmetic;
public interface Arithmetic {
double calculate(double a, double b);
}
```

Addition package

```
package arithmetic;
public class Addition implements Arithmetic {
public double calculate(double a, double b) {
return a + b;
    }
}
```

Subtraction package

```
package arithmetic;
public class Subtraction implements Arithmetic {
public double calculate(double a, double b) {
return a - b;
    }
}
```

Division package

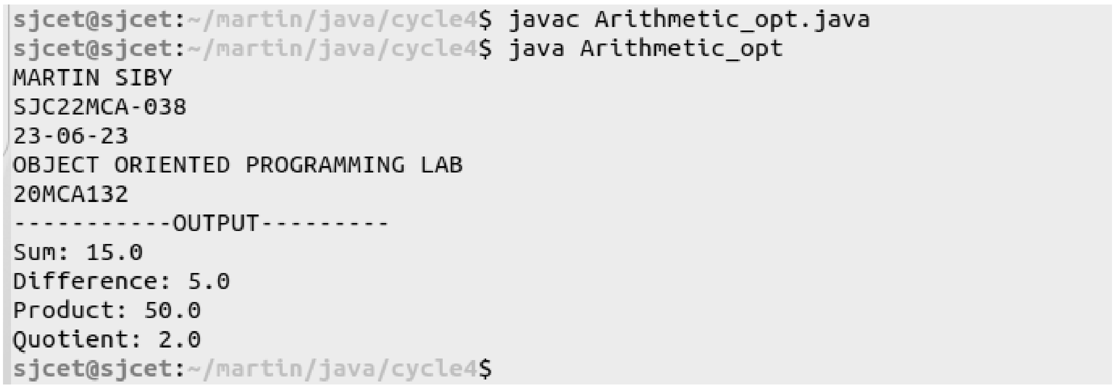
```
package arithmetic;
public class Division implements Arithmetic {
public double calculate(double a, double b) {
if (b != 0) {
return a / b;
} else {
throw new ArithmeticException("Cannot divide by zero");
```

```
        }
    }
}
```

Multiplication package

```
package arithmetic;
public class Multiplication implements Arithmetic {
public double calculate(double a, double b) {
return a * b;
    }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac Arithmetic_opt.java
sjcet@sjcet:~/martin/java/cycle4$ java Arithmetic_opt
MARTIN SIBY
SJC22MCA-038
23-06-23
OBJECT ORIENTED PROGRAMMING LAB
20MCA132
-----------OUTPUT---------
Sum: 15.0
Difference: 5.0
Product: 50.0
Quotient: 2.0
sjcet@sjcet:~/martin/java/cycle4$
```

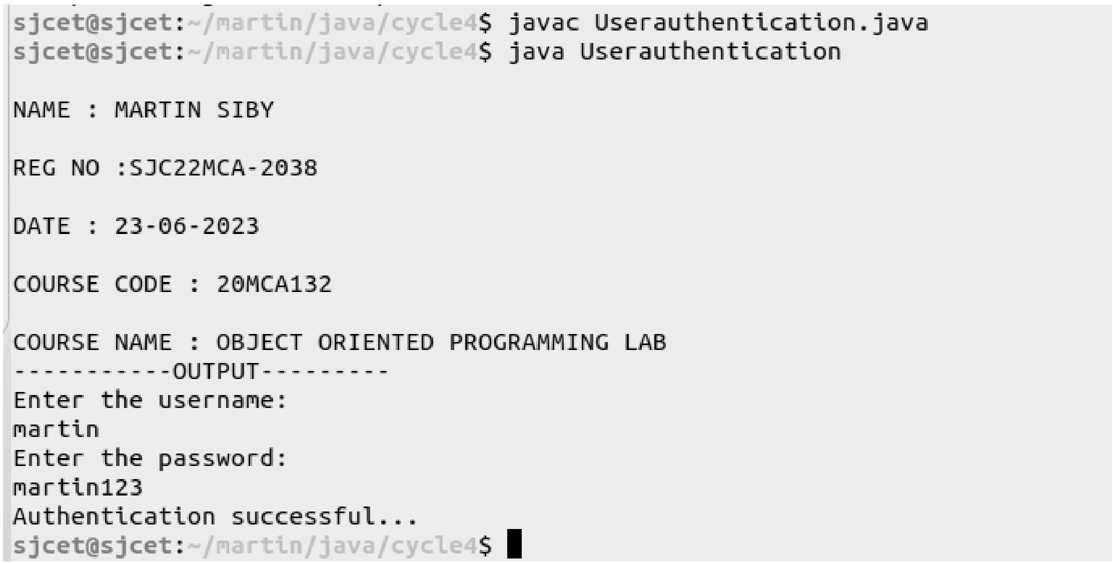
PROGRAM 19 :

Write a user defined exception class to authenticate the user name and password.

CODE :

```
import java.util.Scanner;
class authException extends Exception
{
public authException(String s) {
super(s);
}
}
public class Userauthentication
{
public static void main(String[] args) {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
String username = "martin";
String passcode = "martin123";
String user_name,password;
Scanner sc = new Scanner(System.in);
try
{
System.out.println("-----------OUTPUT---------");
System.out.println("Enter the username:");
user_name = sc.nextLine();
System.out.println("Enter the password:");
password = sc.nextLine();
if(username.equals(user_name) && passcode.equals(password))
{
System.out.println("Authentication successful...");
}
else
throw new authException("Invalid user credentials");
}
catch(authException e)
{
System.out.println("Exception caught "+e);
}
}
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac Userauthentication.java
sjcet@sjcet:~/martin/java/cycle4$ java Userauthentication

NAME : MARTIN SIBY

REG NO :SJC22MCA-2038

DATE : 23-06-2023

COURSE CODE : 20MCA132

COURSE NAME : OBJECT ORIENTED PROGRAMMING LAB
-----------OUTPUT---------
Enter the username:
martin
Enter the password:
martin123
Authentication successful...
sjcet@sjcet:~/martin/java/cycle4$ 
```

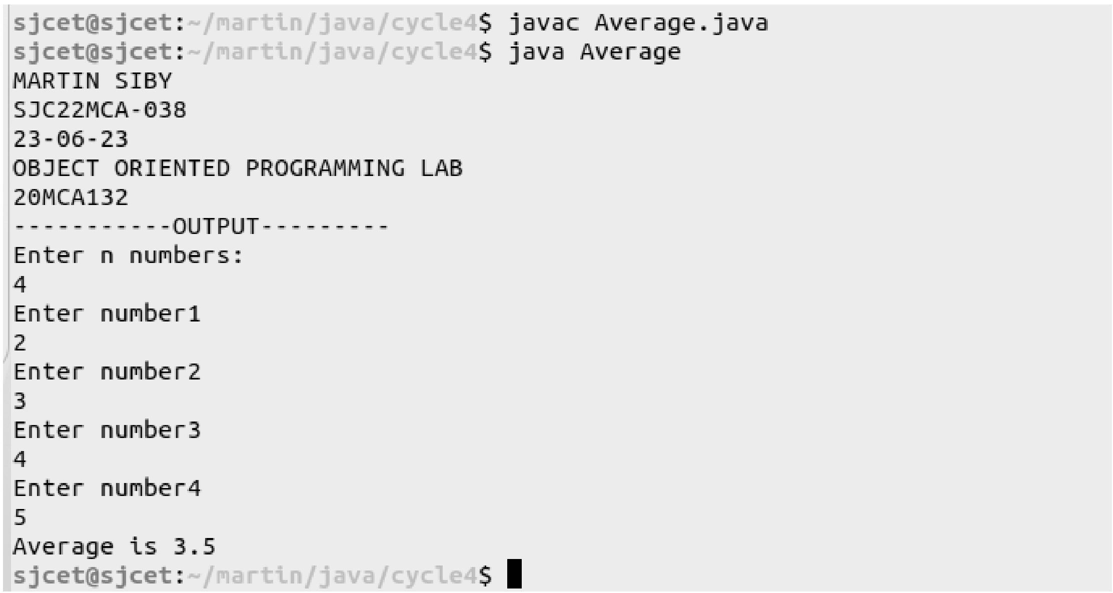
PROGRAM 20 :

Find the average of N positive integers, raising a user defined exception for each negative input.

CODE :

```
import java.util.Scanner;
class NegException extends Exception
{
public NegException(String s)
{
super(s);
}
}
public class Average {
public static void main(String[] args)
{
int i;
double sum=0,avg=0;
Scanner sc=new Scanner(System.in);
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Enter n numbers:");
int n=sc.nextInt();
for(i=1;i<=n;i++)
{
try
{
System.out.println("Enter number"+i);
int a=sc.nextInt();
if(a<0)
{
i--;
throw new NegException("Negative numbers not allowed,Try again");
}
else
{
sum=sum+a;
}
}
catch(NegException e)
{
System.out.println("NEGETIVE EXCEPTION OCCURED:"+e);
}
}
avg=sum/n;
System.out.println("Average is "+avg);
sc.close();
}
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac Average.java
sjcet@sjcet:~/martin/java/cycle4$ java Average
MARTIN SIBY
SJC22MCA-038
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20MCA132
-----------OUTPUT---------
Enter n numbers:
4
Enter number1
2
Enter number2
3
Enter number3
4
Enter number4
5
Average is 3.5
sjcet@sjcet:~/martin/java/cycle4$ 
```

PROGRAM 21 :

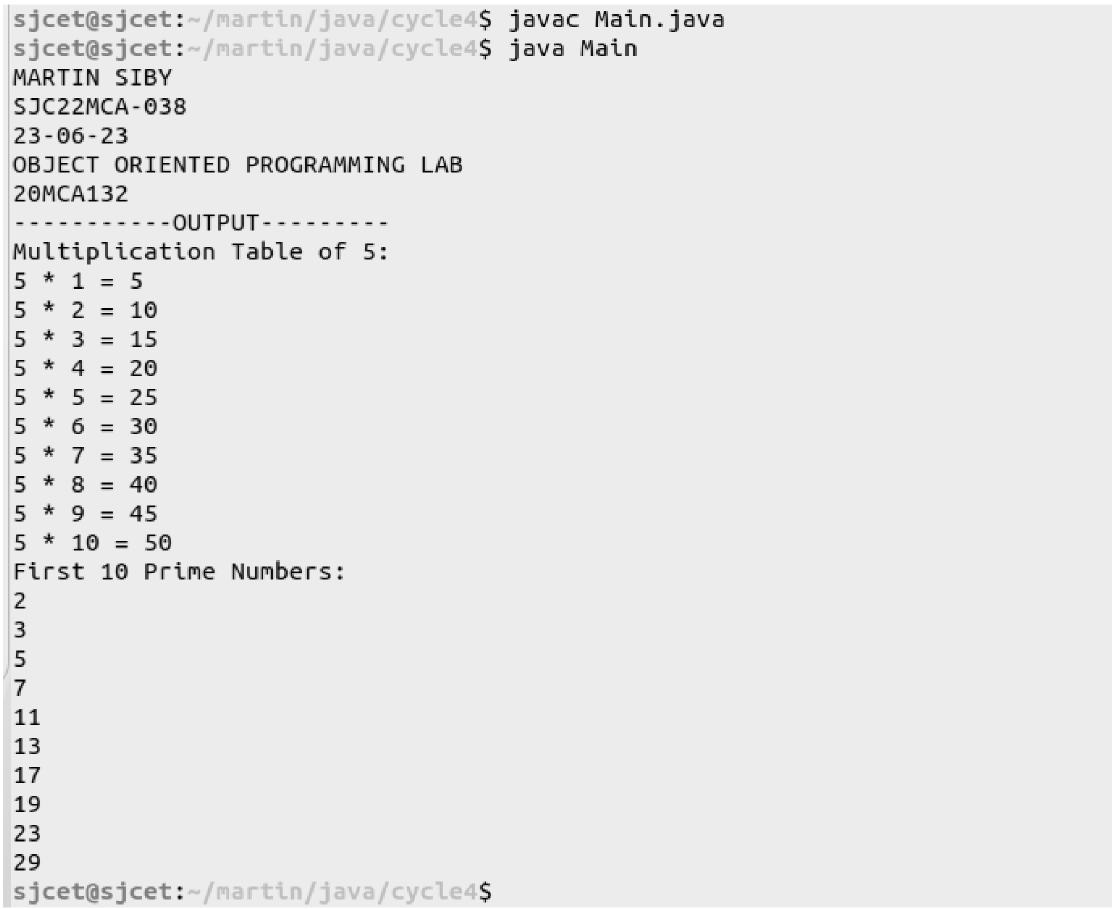
Define 2 classes; one for generating multiplication table of 5 and other for displaying first N prime numbers. Implement using threads. (Thread class)

CODE :

```
class MultiplicationTableThread extends Thread {
@Override
public void run() {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Multiplication Table of 5:");
for (int i = 1; i <= 10; i++) {
System.out.println("5 * " + i + " = " + (5 * i));
        }
new PrimeNumbersThread(10).start();
    }
}
class PrimeNumbersThread extends Thread {
private int count;
public PrimeNumbersThread(int count) {
this.count = count;
    }
@Override
public void run() {
System.out.println("First " + count + " Prime Numbers:");
int num = 2;
int primeCount = 0;

while (primeCount < count) {
if (isPrime(num)) {
System.out.println(num);
primeCount++;
}
num++;
  }
}
private boolean isPrime(int number) {
if (number < 2) {
return false;
}
for (int i = 2; i <= Math.sqrt(number); i++) {
if (number % i == 0) {
            return false;
        }
     }
     return true;
  }
}
public class Main {
  public static void main(String[] args) {
     new MultiplicationTableThread().start();
  }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac Main.java
sjcet@sjcet:~/martin/java/cycle4$ java Main
MARTIN SIBY
SJC22MCA-038
23-06-23
OBJECT ORIENTED PROGRAMMING LAB
20MCA132
-----------OUTPUT---------
Multiplication Table of 5:
5 * 1 = 5
5 * 2 = 10
5 * 3 = 15
5 * 4 = 20
5 * 5 = 25
5 * 6 = 30
5 * 7 = 35
5 * 8 = 40
5 * 9 = 45
5 * 10 = 50
First 10 Prime Numbers:
2
3
5
7
11
13
17
19
23
29
sjcet@sjcet:~/martin/java/cycle4$
```

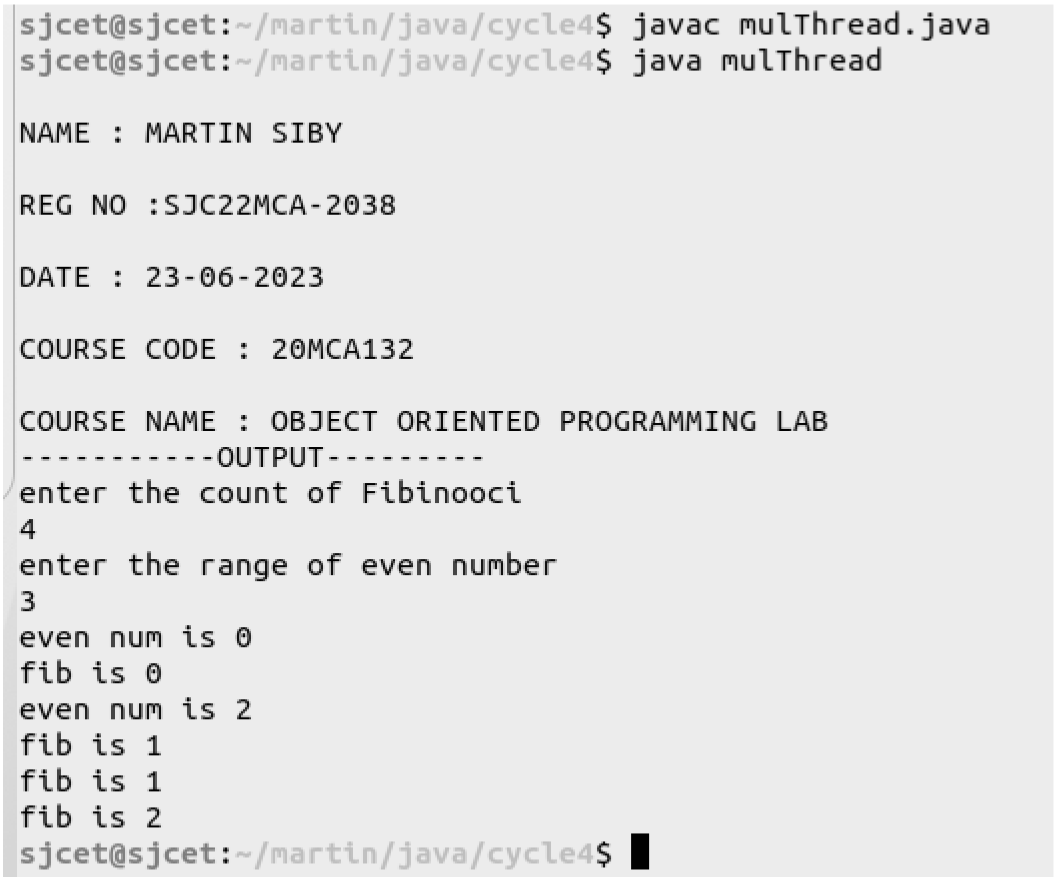
PROGRAM 22

Define 2 classes; one for generating Fibonacci numbers and other for displaying even numbers in a given range. Implement using threads. (Runnable Interface)

CODE :

```
import java.util.Scanner;
class Fib extends Thread{
int f,n1=0,n2=1,n3;
Fib(int c){
this.f=c;
}
public void run(){
System.out.println("fib is "+n1);
System.out.println("fib is "+n2);
for(int i=2;i<this.f;++i) {
n3=n1+n2;
System.out.println("fib is "+n3);
n1=n2;
n2=n3;
}
}
}
class even extends Thread{
int range;
even(int range){
this.range=range;
}
public void run(){
for(int i=0;i<this.range;i++){
if(i%2==0){
System.out.println("even num is "+i);
}
}
}
}
public class mulThread {
public static void main(String [] args){
int c,range;
Scanner sc=new Scanner(System.in);
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("enter the count of Fibinooci");
c=sc.nextInt();
Fib fi=new Fib(c);
System.out.println("enter the range of even number");
range=sc.nextInt();
even ev = new even(range);
fi.start();
ev.start();
}
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac mulThread.java
sjcet@sjcet:~/martin/java/cycle4$ java mulThread

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REG NO :SJC22MCA-2038

DATE : 23-06-2023

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-----------OUTPUT---------
enter the count of Fibinooci
4
enter the range of even number
3
even num is 0
fib is 0
even num is 2
fib is 1
fib is 1
fib is 2
sjcet@sjcet:~/martin/java/cycle4$ 
```

PROGRAM 23 :

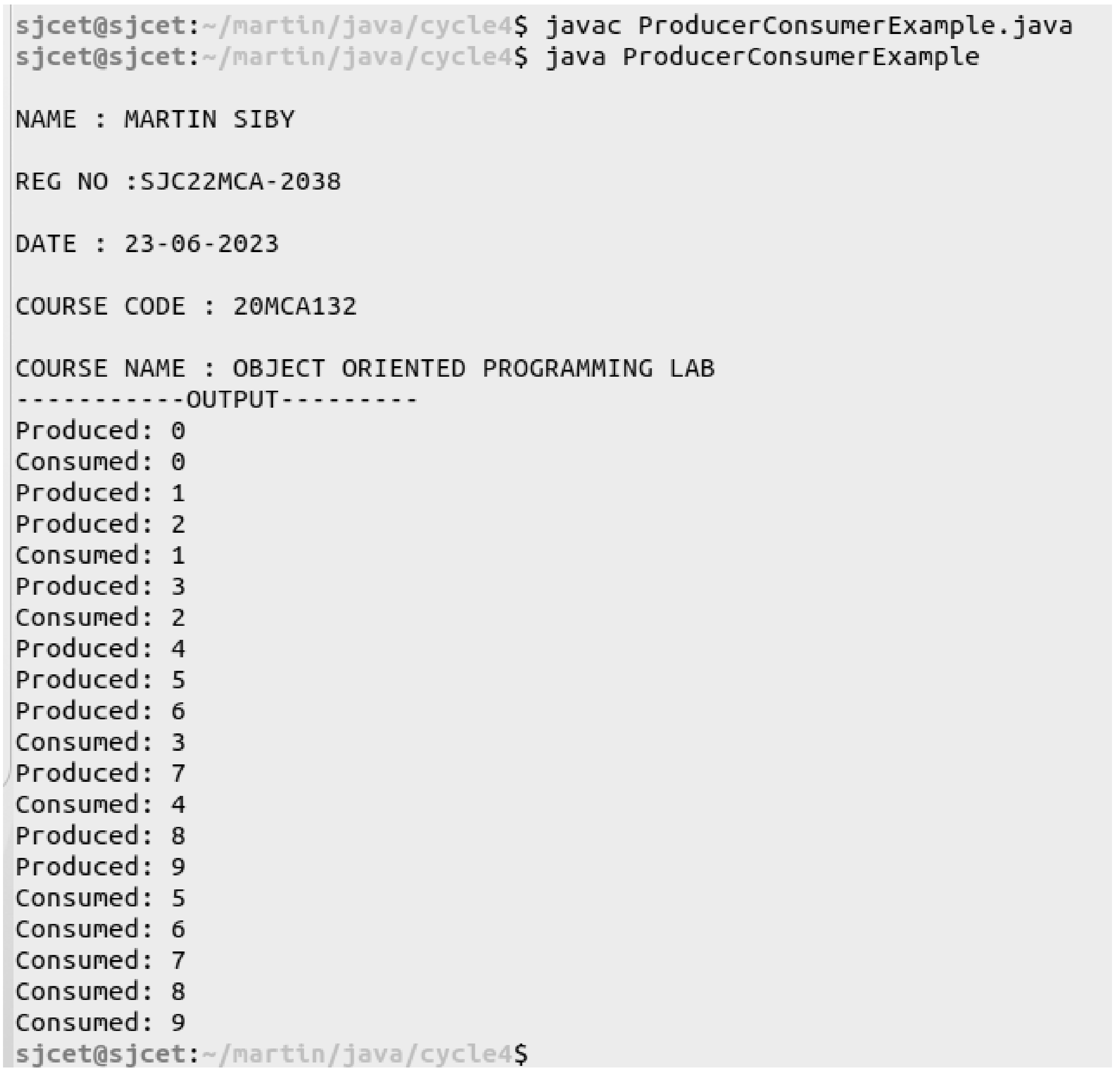
Producer/Consumer using ITC

CODE :

```
import java.util.LinkedList;

class Buffer {
    private LinkedList<Integer> buffer;
    private int capacity;
    public Buffer(int capacity) {
        this.buffer = new LinkedList<>();
        this.capacity = capacity;
    }
    public void produce(int value) throws InterruptedException {
        synchronized (this) {
            while (buffer.size() == capacity) {
                wait();
            }
            buffer.add(value);
            System.out.println("Produced: " + value);
            notifyAll();
        }
    }
    public void consume() throws InterruptedException {
        synchronized (this) {
            while (buffer.isEmpty()) {
                wait();
            }
            int value = buffer.removeFirst();
            System.out.println("Consumed: " + value);
            notifyAll();
        }
    }
}
class Producer implements Runnable {
    private Buffer buffer;
    private int numProductions;
    public Producer(Buffer buffer, int numProductions) {
        this.buffer = buffer;
        this.numProductions = numProductions;
    }
    @Override
    public void run() {
        for (int i = 0; i < numProductions; i++) {
            try {
                buffer.produce(i);
                Thread.sleep(1000); // Simulate production time
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}
class Consumer implements Runnable {
    private Buffer buffer;
    private int numConsumptions;
    public Consumer(Buffer buffer, int numConsumptions) {
        this.buffer = buffer;
        this.numConsumptions = numConsumptions;
    }
    @Override
    public void run() {
        for (int i = 0; i < numConsumptions; i++) {
            try {
                buffer.consume();
                Thread.sleep(2000); // Simulate consumption time
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}
public class ProducerConsumerExample {
public static void main(String[] args) {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
        Buffer buffer = new Buffer(5);
        int numProductions = 10;
        int numConsumptions = 10;
Producer producer = new Producer(buffer, numProductions);
Consumer consumer = new Consumer(buffer, numConsumptions);
Thread producerThread = new Thread(producer);
Thread consumerThread = new Thread(consumer);
        producerThread.start();
        consumerThread.start();
    }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac ProducerConsumerExample.java
sjcet@sjcet:~/martin/java/cycle4$ java ProducerConsumerExample

NAME : MARTIN SIBY

REG NO :SJC22MCA-2038

DATE : 23-06-2023

COURSE CODE : 20MCA132

COURSE NAME : OBJECT ORIENTED PROGRAMMING LAB
-----------OUTPUT---------
Produced: 0
Consumed: 0
Produced: 1
Produced: 2
Consumed: 1
Produced: 3
Consumed: 2
Produced: 4
Produced: 5
Produced: 6
Consumed: 3
Produced: 7
Consumed: 4
Produced: 8
Produced: 9
Consumed: 5
Consumed: 6
Consumed: 7
Consumed: 8
Consumed: 9
sjcet@sjcet:~/martin/java/cycle4$
```

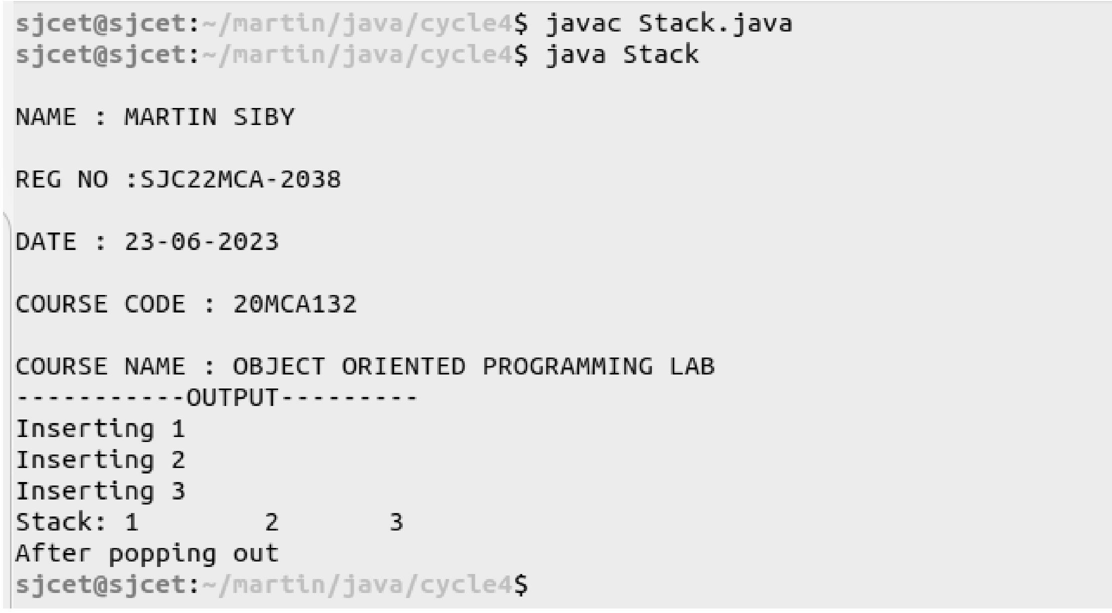
PROGRAM 24 :

Program to create a generic stack and do the Push and Pop operations.

CODE :

```
class Stack {
private int arr[];
private int top;
private int capacity;
Stack(int size) {
arr = new int[size];
capacity = size;
top = -1;
}
public void push(int x) {
if (isFull()) {
System.out.println("Stack OverFlow");
System.exit(1);
}
System.out.println("Inserting " + x);
arr[++top] = x;
}
public int pop() {
if (isEmpty()) {
System.out.println("STACK EMPTY");
System.exit(1);
}
return arr[top--];
}
public int getSize() {
return top + 1;
}
public Boolean isEmpty() {
return top == -1;
}
public Boolean isFull() {
return top == capacity - 1;
}
public void printStack() {
for (int i = 0; i <= top; i++) {
System.out.print(arr[i] + "\t");
}
}
public static void main(String[] args) {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 23-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
Stack stack = new Stack(5);
stack.push(1);
stack.push(2);
stack.push(3);
System.out.print("Stack: ");
stack.printStack();
stack.pop();
System.out.println("\nAfter popping out\n");
stack.printStack();
System.out.println("\n");
}
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac Stack.java
sjcet@sjcet:~/martin/java/cycle4$ java Stack

NAME : MARTIN SIBY

REG NO :SJC22MCA-2038

DATE : 23-06-2023

COURSE CODE : 20MCA132

COURSE NAME : OBJECT ORIENTED PROGRAMMING LAB
-----------OUTPUT---------
Inserting 1
Inserting 2
Inserting 3
Stack: 1        2       3
After popping out
sjcet@sjcet:~/martin/java/cycle4$
```

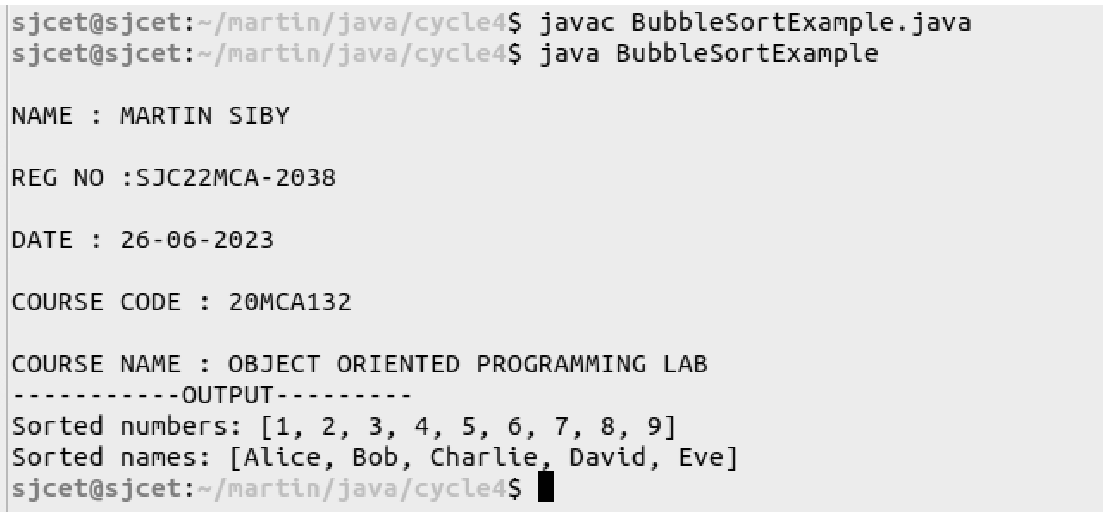
PROGRAM 25

Using generic method perform Bubble sort.

CODE :

```
import java.util.Arrays;
public class BubbleSortExample {
    public static <T extends Comparable<T>> void bubbleSort(T[] array) {
        int n = array.length;
        for (int i = 0; i < n - 1; i++) {
            for (int j = 0; j < n - i - 1; j++) {
                if (array[j].compareTo(array[j + 1]) > 0)
                    T temp = array[j];
                    array[j] = array[j + 1];
                    array[j + 1] = temp;
                }
            }
        }
    }
    public static void main(String[] args) {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 26-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
        Integer[] numbers = {4, 2, 6, 1, 9, 3, 8, 5, 7};
        bubbleSort(numbers);
        System.out.println("Sorted numbers: " + Arrays.toString(numbers));
        String[] names = {"Alice", "Bob", "Charlie", "David", "Eve"};
        bubbleSort(names);
        System.out.println("Sorted names: " + Arrays.toString(names));
    }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac BubbleSortExample.java
sjcet@sjcet:~/martin/java/cycle4$ java BubbleSortExample

NAME : MARTIN SIBY

REG NO :SJC22MCA-2038

DATE : 26-06-2023

COURSE CODE : 20MCA132

COURSE NAME : OBJECT ORIENTED PROGRAMMING LAB
-----------OUTPUT---------
Sorted numbers: [1, 2, 3, 4, 5, 6, 7, 8, 9]
Sorted names: [Alice, Bob, Charlie, David, Eve]
sjcet@sjcet:~/martin/java/cycle4$ 
```

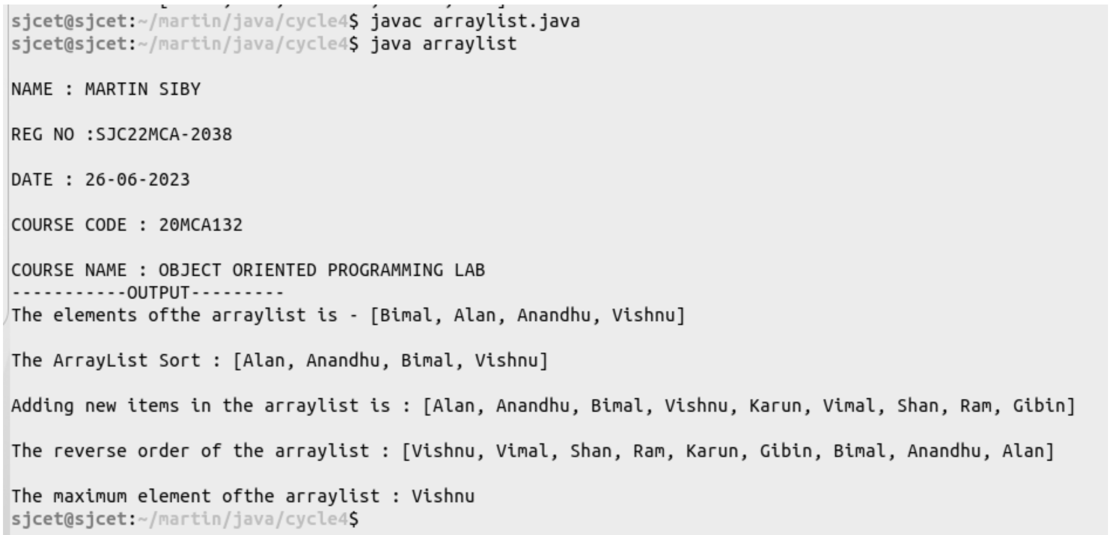
PROGRAM 26

Maintain a list of Strings using ArrayList from collection framework, perform built-in operations.

CODE :

```
import java.util.*;
public class arraylist{
public static void main(String[] args) {
ArrayList<String> arrayList= new ArrayList<>();
arrayList.add("Bimal");
arrayList.add("Alan");
arrayList.add("Anandhu");
arrayList.add("Vishnu");
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 26-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("The elements ofthe arraylist is - "+arrayList);
Collections.sort(arrayList);
System.out.println("\nThe ArrayList Sort : "+arrayList);
Collections.addAll(arrayList,"Karun","Vimal","Shan","Ram","Gibin");
System.out.println("\nAdding new items in the arraylist is : "+arrayList);
Collections.sort(arrayList, Collections.reverseOrder());
System.out.println("\nThe reverse order of the arraylist : "+arrayList);
System.out.println("maximum element of arraylist : "+Collections.max(arrayList));
}
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac arraylist.java
sjcet@sjcet:~/martin/java/cycle4$ java arraylist

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-----------OUTPUT---------
The elements ofthe arraylist is - [Bimal, Alan, Anandhu, Vishnu]

The ArrayList Sort : [Alan, Anandhu, Bimal, Vishnu]

Adding new items in the arraylist is : [Alan, Anandhu, Bimal, Vishnu, Karun, Vimal, Shan, Ram, Gibin]

The reverse order of the arraylist : [Vishnu, Vimal, Shan, Ram, Karun, Gibin, Bimal, Anandhu, Alan]

The maximum element ofthe arraylist : Vishnu
sjcet@sjcet:~/martin/java/cycle4$
```

PROGRAM 27

Program to remove all the elements from a linked list

CODE :

```
import java.util.LinkedList;

public class LinkedListRemoveAllExample {
    public static void main(String[] args) {
        LinkedList<String> linkedList = new LinkedList<>();
        linkedList.add("Apple");
        linkedList.add("Banana");
        linkedList.add("Orange");
        linkedList.add("Mango");
System.out.println("\n NAME : MARTIN SIBY ");
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System.out.println("-----------OUTPUT---------");
System.out.println("Original linked list: " + linkedList);
linkedList.clear();
System.out.println("Linked list after removing all elements: " + linkedList);
    }
}
```
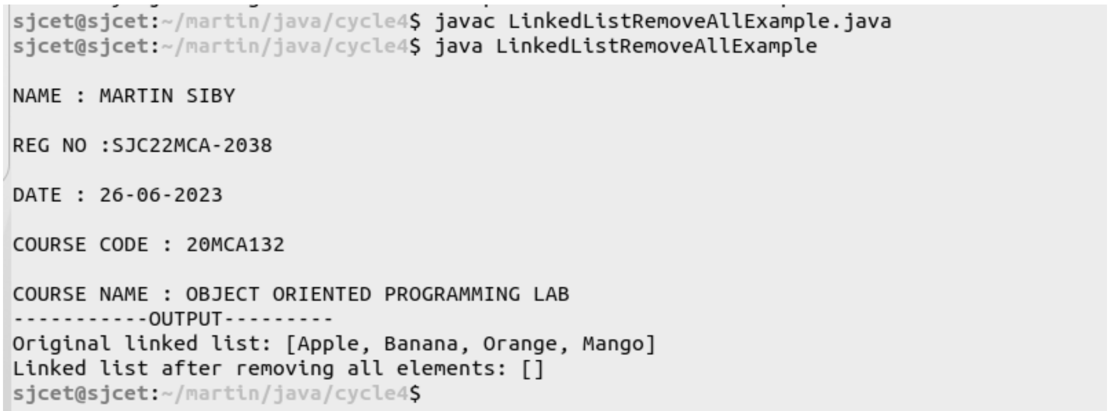

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac LinkedListRemoveAllExample.java
sjcet@sjcet:~/martin/java/cycle4$ java LinkedListRemoveAllExample

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-----------OUTPUT---------
Original linked list: [Apple, Banana, Orange, Mango]
Linked list after removing all elements: []
sjcet@sjcet:~/martin/java/cycle4$
```

PROGRAM 28

Program to remove an object from the Stack when the position is passed as parameter.

CODE :

```
import java.util.Stack;
public class StackRemoveElementExample {
    public static void main(String[] args) {
        Stack<String> stack = new Stack<>();
        stack.push("Apple");
        stack.push("Banana");
        stack.push("Orange");
        stack.push("Mango");
System.out.println("\n NAME : MARTIN SIBY ");
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System.out.println("\n DATE : 26-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Stack elements: " + stack);
        int positionToRemove = 2;
        removeElement(stack, positionToRemove);
        System.out.println("Stack after removal: " + stack);
    }
public static void removeElement(Stack<String>stack,int position){
   if(stack.isEmpty() || position <= 0 || position > stack.size())
    {
       System.out.println("Invalid position or stack is empty.");
```
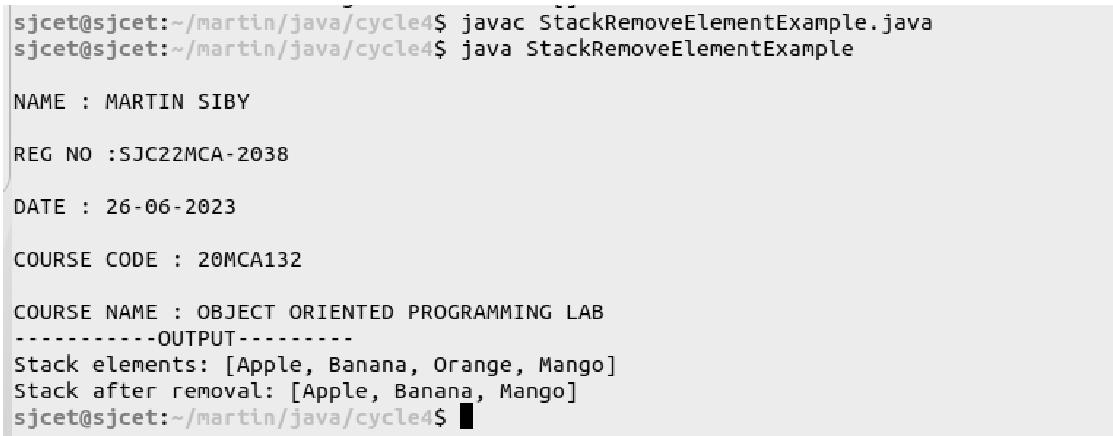

```
        return;
      }

        Stack<String> tempStack = new Stack<>();
        for (int i = 1; i < position; i++) {
        tempStack.push(stack.pop());
        }
        stack.pop();
        while (!tempStack.isEmpty()) {
            stack.push(tempStack.pop());
        }
    }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac StackRemoveElementExample.java
sjcet@sjcet:~/martin/java/cycle4$ java StackRemoveElementExample

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-----------OUTPUT---------
Stack elements: [Apple, Banana, Orange, Mango]
Stack after removal: [Apple, Banana, Mango]
sjcet@sjcet:~/martin/java/cycle4$ 
```

PROGRAM 29

Program to demonstrate the creation of queue object using the PriorityQueue class

CODE :

```
import java.util.PriorityQueue;
import java.util.Queue;
public class PriorityQueueExample {
    public static void main(String[] args) {
        Queue<Integer> queue = new PriorityQueue<>();
        queue.offer(5);
        queue.offer(2);
        queue.offer(8);
        queue.offer(1);
System.out.println("\n NAME : MARTIN SIBY ");
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System.out.println("\n DATE : 26-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Queue elements: " + queue);
        while (!queue.isEmpty()) {
            int element = queue.poll();
            System.out.println("Removed element: " + element);
        }
    }
}
```
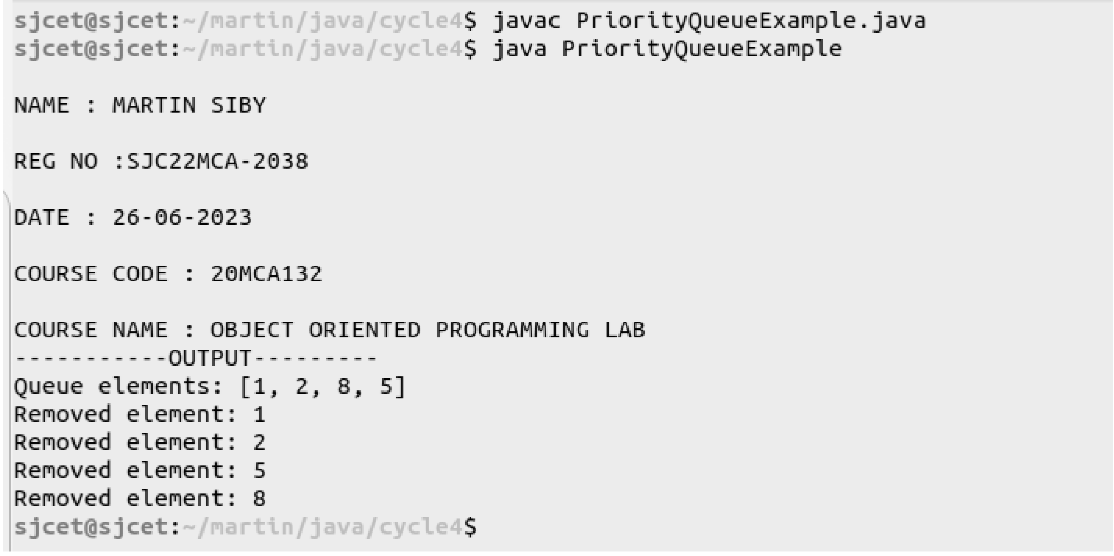

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac PriorityQueueExample.java
sjcet@sjcet:~/martin/java/cycle4$ java PriorityQueueExample

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-----------OUTPUT---------
Queue elements: [1, 2, 8, 5]
Removed element: 1
Removed element: 2
Removed element: 5
Removed element: 8
sjcet@sjcet:~/martin/java/cycle4$
```

PROGRAM 30

Program to demonstrate the addition and deletion of elements in deque

CODE :

```
import java.util.*;
class deque
{
public static void main(String[] args)
{
Deque<String> deque = new LinkedList<String>();
deque.add("Java");
deque.addFirst("Python");
deque.addLast("Datastructure");
deque.push("Web-programming");
deque.offer("Networking");
deque.offerFirst("DBMS");
System.out.println("\n NAME : MARTIN SIBY ");
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System.out.println("\n DATE : 27-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println(deque + "\n");
deque.removeFirst();
deque.removeLast();
System.out.println("Deque after removing " + "first and last: " + deque);
}
}
```
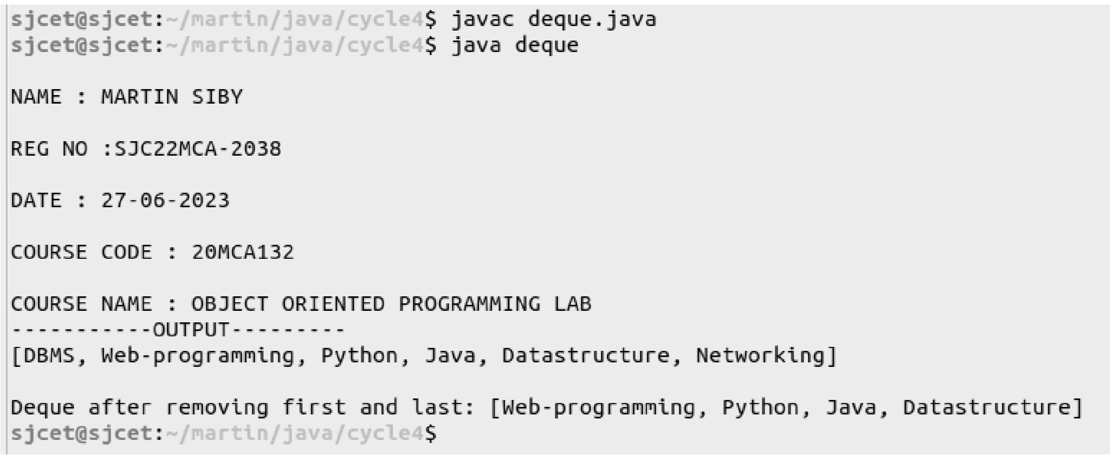

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac deque.java
sjcet@sjcet:~/martin/java/cycle4$ java deque

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-----------OUTPUT---------
[DBMS, Web-programming, Python, Java, Datastructure, Networking]

Deque after removing first and last: [Web-programming, Python, Java, Datastructure]
sjcet@sjcet:~/martin/java/cycle4$
```

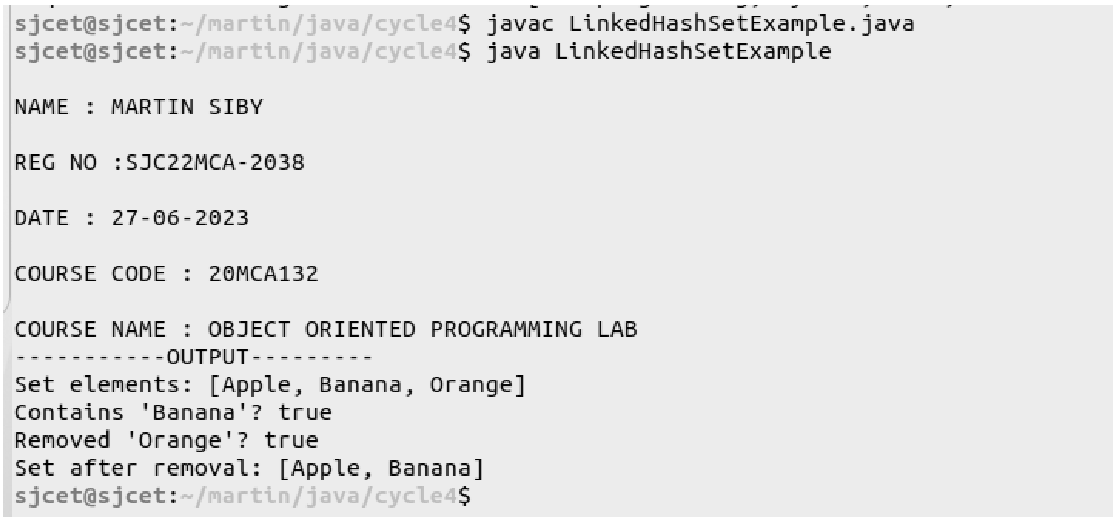
PROGRAM 31

Program to demonstrate the creation of Set object using the LinkedHashset class.

CODE :

```
import java.util.LinkedHashSet;
import java.util.Set;
public class LinkedHashSetExample {
    public static void main(String[] args) {
        Set<String> set = new LinkedHashSet<>();
        set.add("Apple");
        set.add("Banana");
        set.add("Orange");
        set.add("Apple");
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 27-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Set elements: " + set);
boolean containsBanana = set.contains("Banana");
System.out.println("Contains 'Banana'? " + containsBanana);
boolean removedOrange = set.remove("Orange");
System.out.println("Removed 'Orange'? " + removedOrange);
System.out.println("Set after removal: " + set);
    }
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac LinkedHashSetExample.java
sjcet@sjcet:~/martin/java/cycle4$ java LinkedHashSetExample

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-----------OUTPUT---------
Set elements: [Apple, Banana, Orange]
Contains 'Banana'? true
Removed 'Orange'? true
Set after removal: [Apple, Banana]
sjcet@sjcet:~/martin/java/cycle4$
```

PROGRAM 32

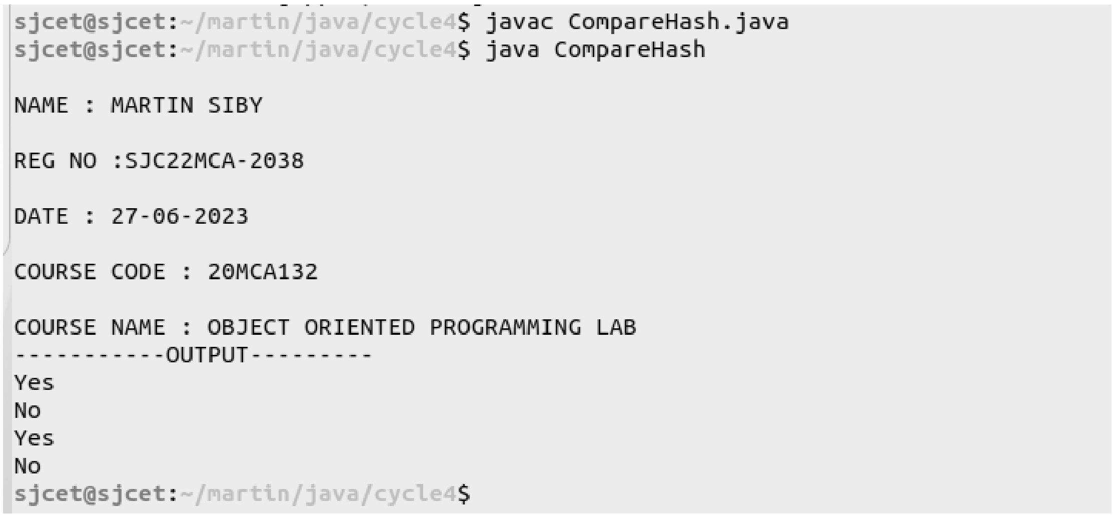
Write a Java program to compare two hash set

CODE :

```
import java.util.*;
public class CompareHash {
public static void main(String[] args) {
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 27-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
HashSet<String> h_set = new HashSet<String>();
h_set.add("Red");
h_set.add("Green");
h_set.add("Black");
h_set.add("White");
HashSet<String>h_set2 = new HashSet<String>();
h_set2.add("Red");
h_set2.add("Pink");
h_set2.add("Black");
h_set2.add("Orange");
HashSet<String>result_set = new HashSet<String>();
for (String element : h_set){
```

```
System.out.println(h_set2.contains(element) ? "Yes" : "No");
}
}
}
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac CompareHash.java
sjcet@sjcet:~/martin/java/cycle4$ java CompareHash

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-----------OUTPUT---------
Yes
No
Yes
No
sjcet@sjcet:~/martin/java/cycle4$
```

PROGRAM 33

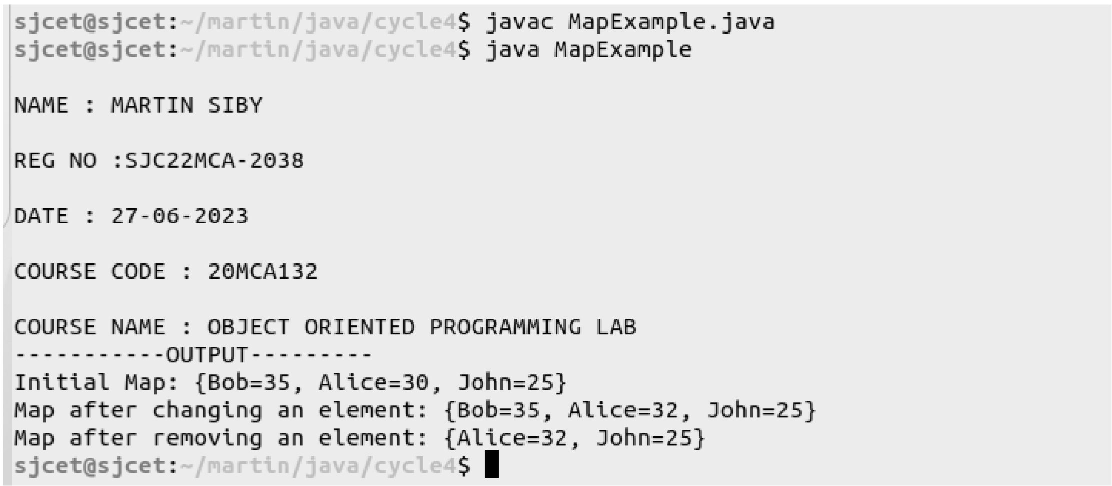
Program to demonstrate the working of Map interface by adding, changing and removing elements.

CODE :

```
import java.util.HashMap;
import java.util.Map;
public class MapExample
{
    public static void main(String[] args)
    {
        Map<String, Integer> map = new HashMap<>();
        map.put("John", 25);
        map.put("Alice", 30);
        map.put("Bob", 35);
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 27-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("Initial Map: " + map);
        map.put("Alice", 32);
        System.out.println("Map after changing an element: " + map);
        map.remove("Bob");
        System.out.println("Map after removing an element: " + map);
    }

 }
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac MapExample.java
sjcet@sjcet:~/martin/java/cycle4$ java MapExample

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DATE : 27-06-2023

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-----------OUTPUT---------
Initial Map: {Bob=35, Alice=30, John=25}
Map after changing an element: {Bob=35, Alice=32, John=25}
Map after removing an element: {Alice=32, John=25}
sjcet@sjcet:~/martin/java/cycle4$ 
```

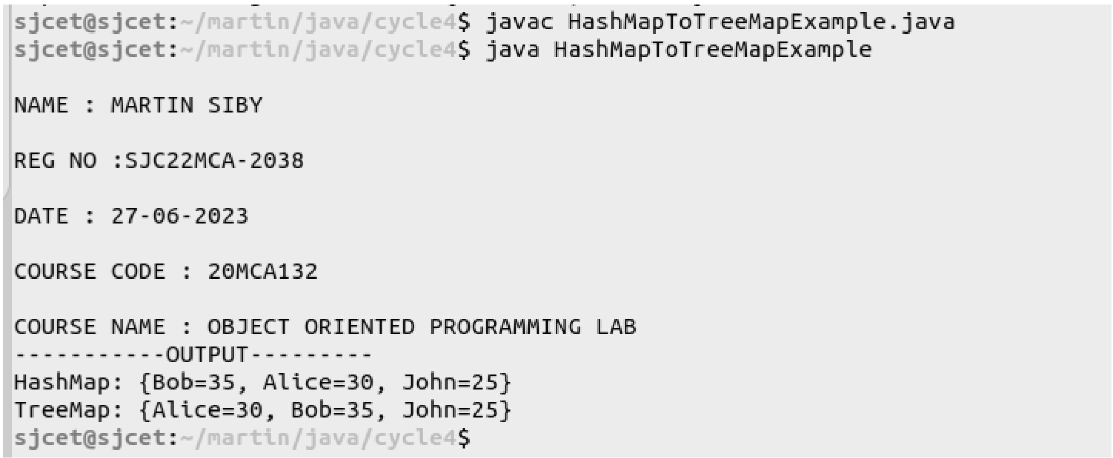
PROGRAM 34

Program to Convert HashMap to TreeMap

CODE :

```
import java.util.HashMap;
import java.util.Map;
import java.util.TreeMap;
public class HashMapToTreeMapExample {
    public static void main(String[] args) {
        Map<String, Integer> hashMap = new HashMap<>();
        hashMap.put("John", 25);
        hashMap.put("Alice", 30);
        hashMap.put("Bob", 35);
        Map<String, Integer> treeMap = new TreeMap<>(hashMap);
System.out.println("\n NAME : MARTIN SIBY ");
System.out.println("\nREG NO :SJC22MCA-2038");
System.out.println("\n DATE : 27-06-2023");
System.out.println("\n COURSE CODE : 20MCA132");
System.out.println("\n COURSE NAME : OBJECT ORIENTED PROGRAMMING
LAB");
System.out.println("-----------OUTPUT---------");
System.out.println("HashMap: " + hashMap);
System.out.println("TreeMap: " + treeMap);
 }     }
```

OUTPUT :



```
sjcet@sjcet:~/martin/java/cycle4$ javac HashMapToTreeMapExample.java
sjcet@sjcet:~/martin/java/cycle4$ java HashMapToTreeMapExample

NAME : MARTIN SIBY

REG NO :SJC22MCA-2038

DATE : 27-06-2023

COURSE CODE : 20MCA132

COURSE NAME : OBJECT ORIENTED PROGRAMMING LAB
-----------OUTPUT---------
HashMap: {Bob=35, Alice=30, John=25}
TreeMap: {Alice=30, Bob=35, John=25}
sjcet@sjcet:~/martin/java/cycle4$
```