LAB CYCLE - 4

1. 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

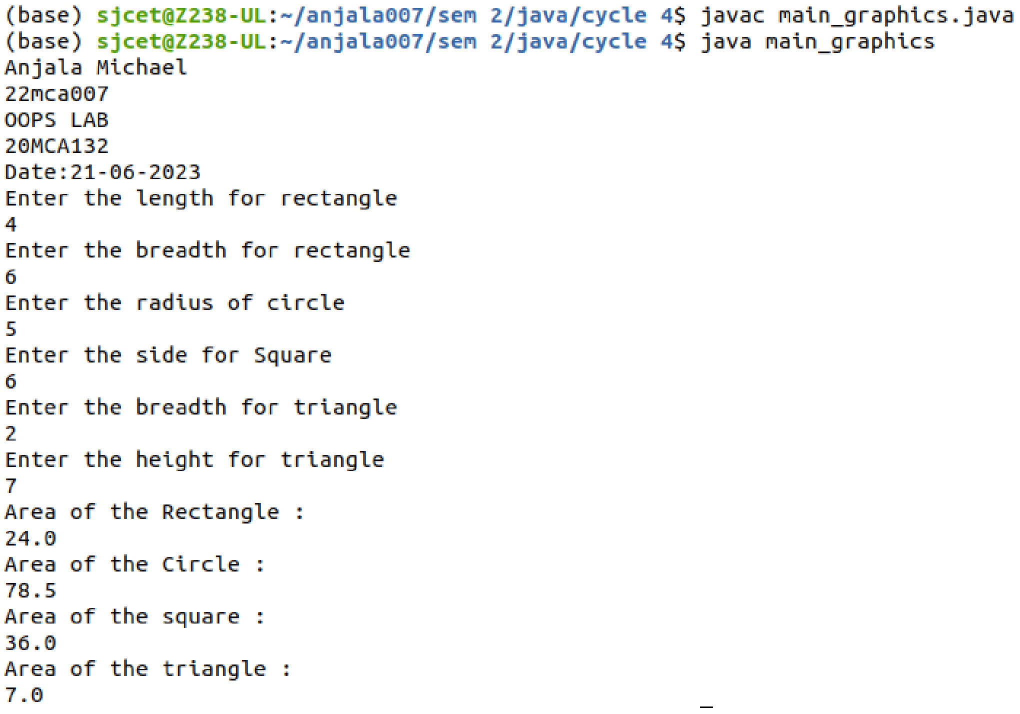
main_graphics.java

```
import package_graphics.*;
import java.util.*;
public class main_graphics {
   public static void main(String []args){
  System.out.println("Anjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:21-06-2023");
      package_graphics testObj = new package_graphics();
      int l,h,r,a,c,d;
      Scanner s=new Scanner(System.in);
      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.java

```
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){
          System.out.println("Area of the Rectangle : ");
           return l*h;
   }
   public float cirArea(int r){
            System.out.println("Area of the Circle : ");
             return r*r*(float)3.14;
   }
   public float squArea(int a){
                      System.out.println("Area of the square : ");
      return a*a;
   }
   public float triArea(int l, int h){
      System.out.println("Area of the triangle : ");
      return l*h*(float)(.5);
   }
}
```

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/cycle 4$ javac main_graphics.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/cycle 4$ java main_graphics
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Enter the length for rectangle
4
Enter the breadth for rectangle
6
Enter the radius of circle
5
Enter the side for Square
6
Enter the breadth for triangle
2
Enter the height for triangle
7
Area of the Rectangle :
24.0
Area of the Circle :
78.5
Area of the square :
36.0
Area of the triangle :
7.0
```

2. 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

Arithmetic_opt.java

```
import Arithmetic.*;
public class Arithmetic_opt{
   public static void main(String[] args) {
     System.out.println("\nAnjala Michael\n22mca007\nOOPS
LAB\n20MCA132\nDate:21-06-2023");
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.java

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

Subtraction.java

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

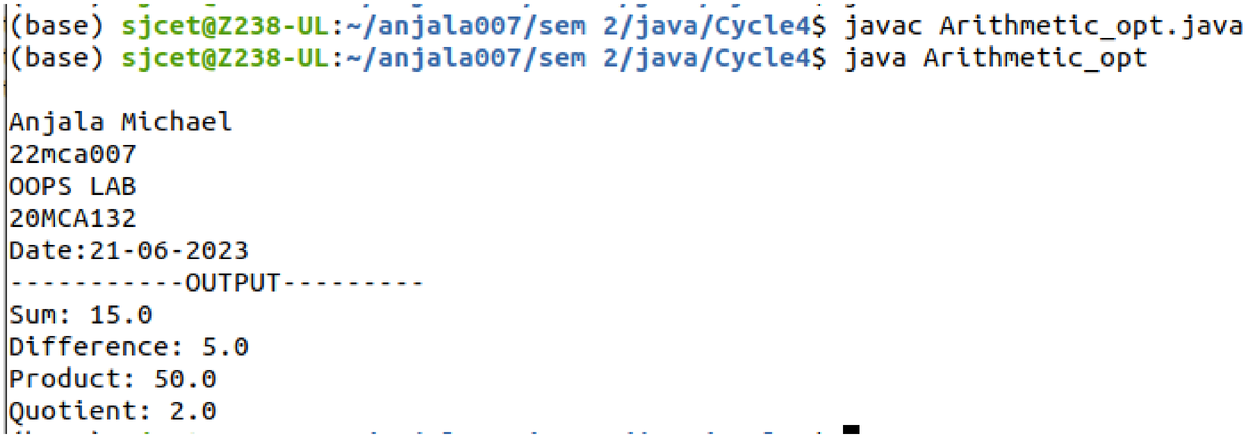
Multiplication.java

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

Division.java

```
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");
            }
    }
}
```

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac Arithmetic_opt.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java Arithmetic_opt

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-----------OUTPUT---------
Sum: 15.0
Difference: 5.0
Product: 50.0
Quotient: 2.0
```

3. 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("Anjala Michael\n22mca007\nOOPS
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                        String username = "student";
                        String passcode = "student123";
                        String user_name,password;
                        Scanner sc = new Scanner(System.in);
                        try{
            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);
             }
     }
}
```
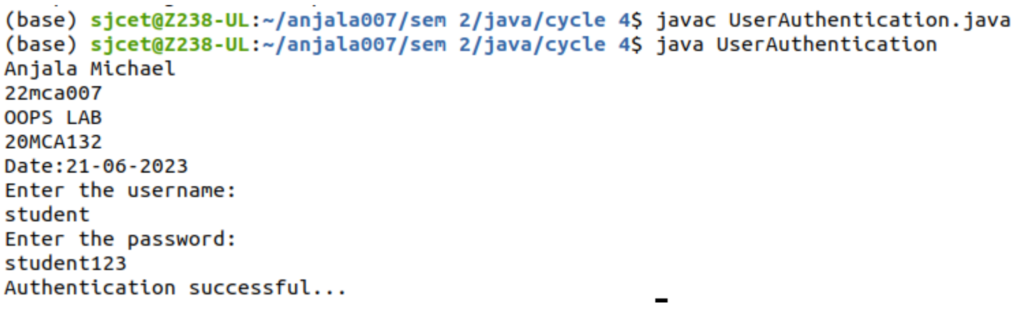

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/cycle 4$ javac UserAuthentication.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/cycle 4$ java UserAuthentication
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Date:21-06-2023
Enter the username:
student
Enter the password:
student123
Authentication successful...
```

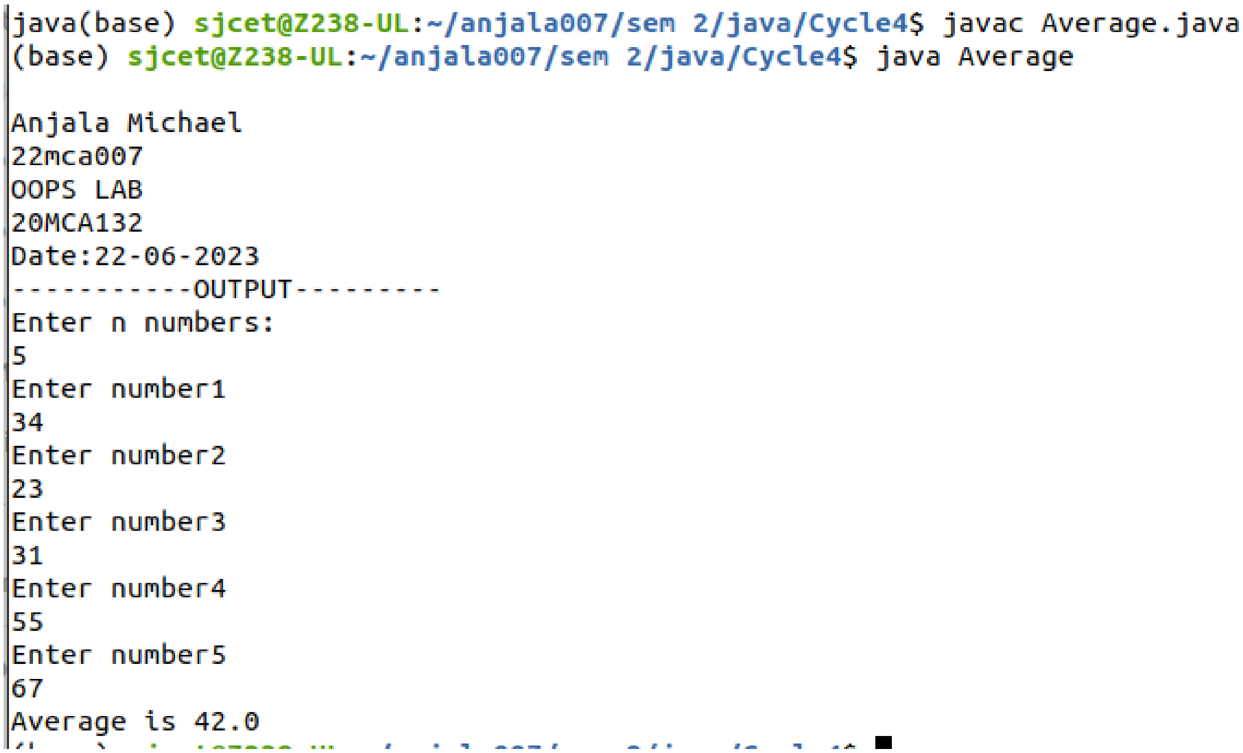
4. Find the average of N positive integers, raising a user defined exception for each negative input.

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("\nAnjala Michael\n22mca007\nOOPS
        LAB\n20MCA132\nDate:22-06-2023");
            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



```
java(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac Average.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java Average

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-----------OUTPUT---------
Enter n numbers:
5
Enter number1
34
Enter number2
23
Enter number3
31
Enter number4
55
Enter number5
67
Average is 42.0
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$
```

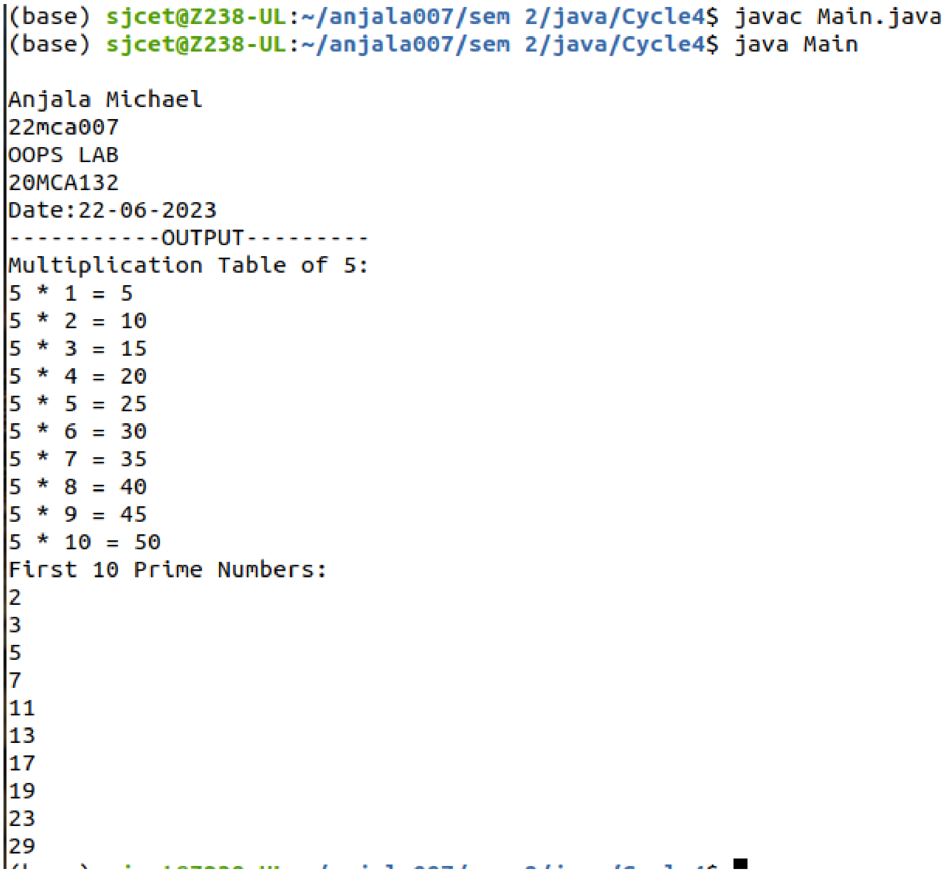
5. Define 2 classes; one for generating a multiplication table of 5 and other for displaying first N prime numbers. Implement using threads. (Thread class)

CODE

```
class MultiplicationTableThread extends Thread {
    @Override
    public void run(){
System.out.println("\nAnjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:22-06-2023");
 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



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac Main.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java Main

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-----------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
```
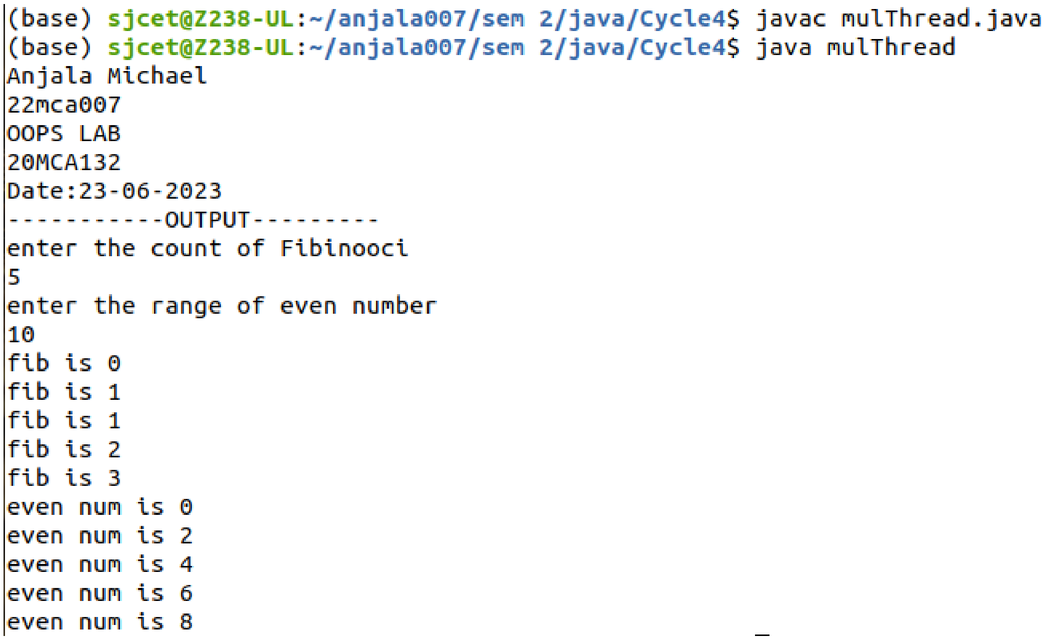

6. Define 2 classes; one for generating Fibonacci numbers and other for displaying even numbers in a given range. Implement using threads. (Runnable Interface)

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("Anjala Michael\n22mca007\nOOPS
LAB\n20MCA132\nDate:23-06-2023");
                        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



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac mulThread.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java mulThread
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-----------OUTPUT---------
enter the count of Fibinooci
5
enter the range of even number
10
fib is 0
fib is 1
fib is 1
fib is 2
fib is 3
even num is 0
even num is 2
even num is 4
even num is 6
even num is 8
```

7. Producer/Consumer using ITC

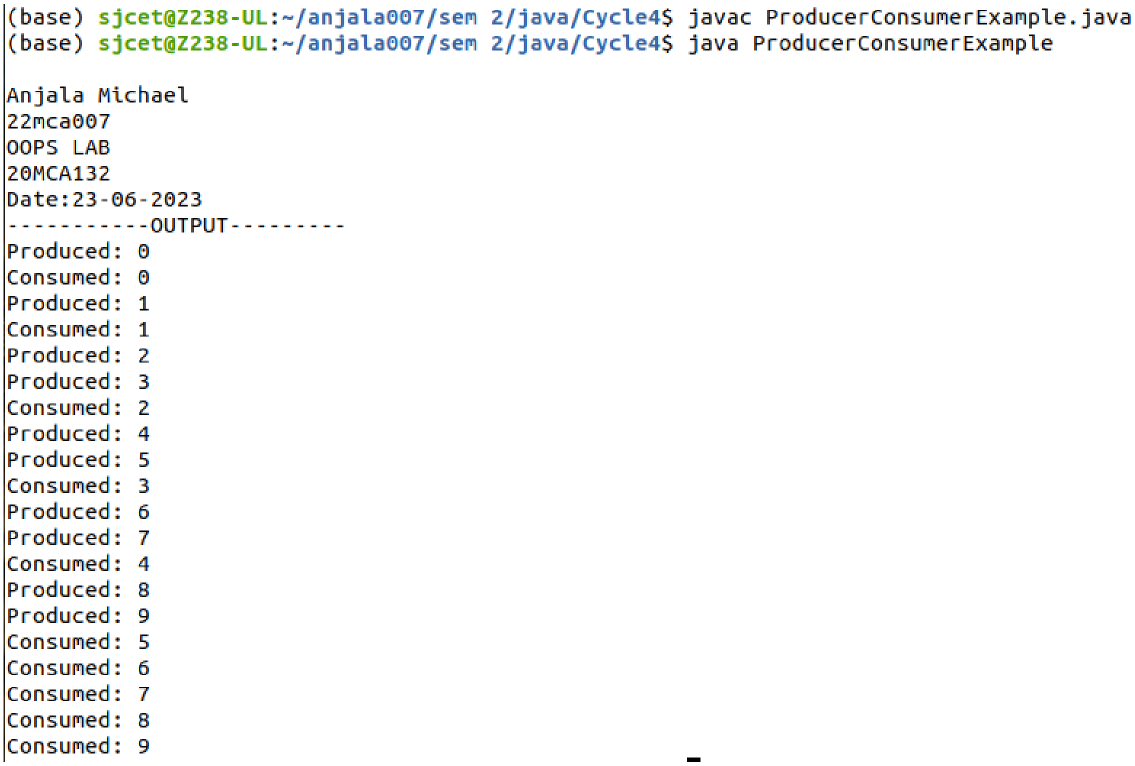
CODE

```
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("\nAnjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:23-06-
2023");
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



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac ProducerConsumerExample.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java ProducerConsumerExample

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-----------OUTPUT---------
Produced: 0
Consumed: 0
Produced: 1
Consumed: 1
Produced: 2
Produced: 3
Consumed: 2
Produced: 4
Produced: 5
Consumed: 3
Produced: 6
Produced: 7
Consumed: 4
Produced: 8
Produced: 9
Consumed: 5
Consumed: 6
Consumed: 7
Consumed: 8
Consumed: 9
```

8. 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] + "\n");
    }   }
    public static void main(String[] args){
```

```
                System.out.println("\nAnjala Michael\n22mca007\nOOPS
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                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");
                stack.printStack();
}        }
```
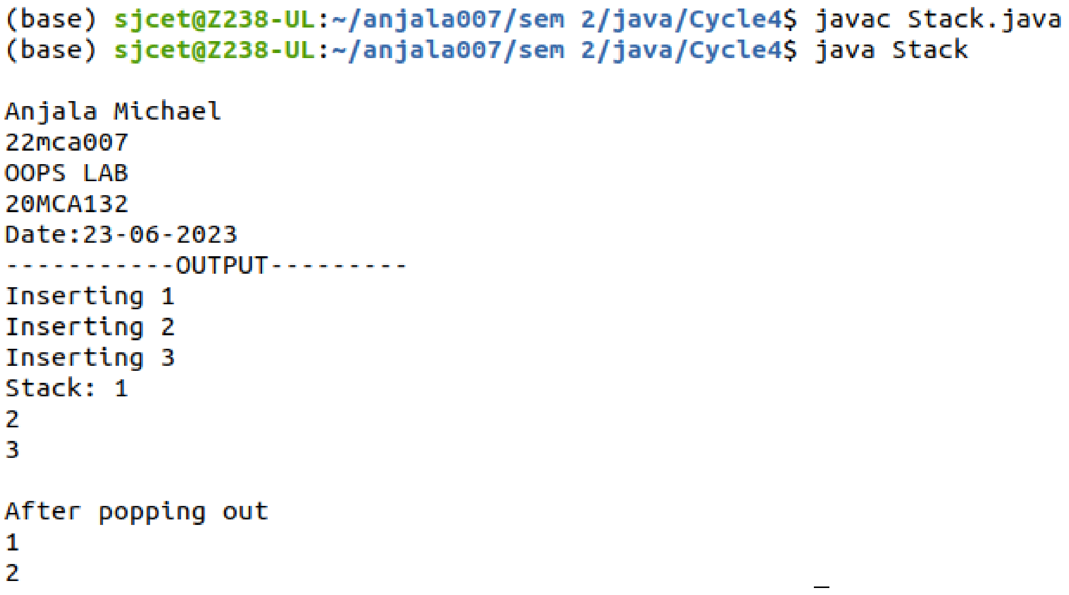

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac Stack.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java Stack

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Date:23-06-2023
-----------OUTPUT---------
Inserting 1
Inserting 2
Inserting 3
Stack: 1
2
3

After popping out
1
2
```
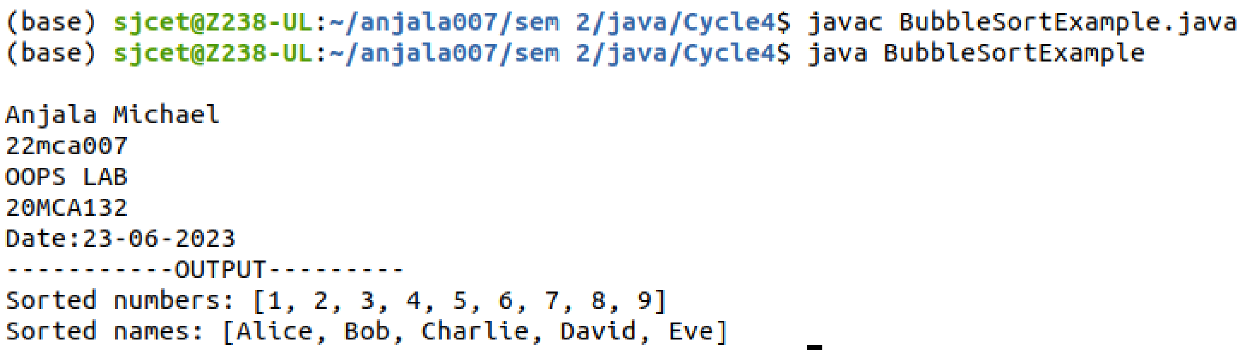

9. Using a generic method, perform Bubble sort.

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("\nAnjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:23-06-2023");
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



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac BubbleSortExample.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java BubbleSortExample

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-----------OUTPUT---------
Sorted numbers: [1, 2, 3, 4, 5, 6, 7, 8, 9]
Sorted names: [Alice, Bob, Charlie, David, Eve]
```
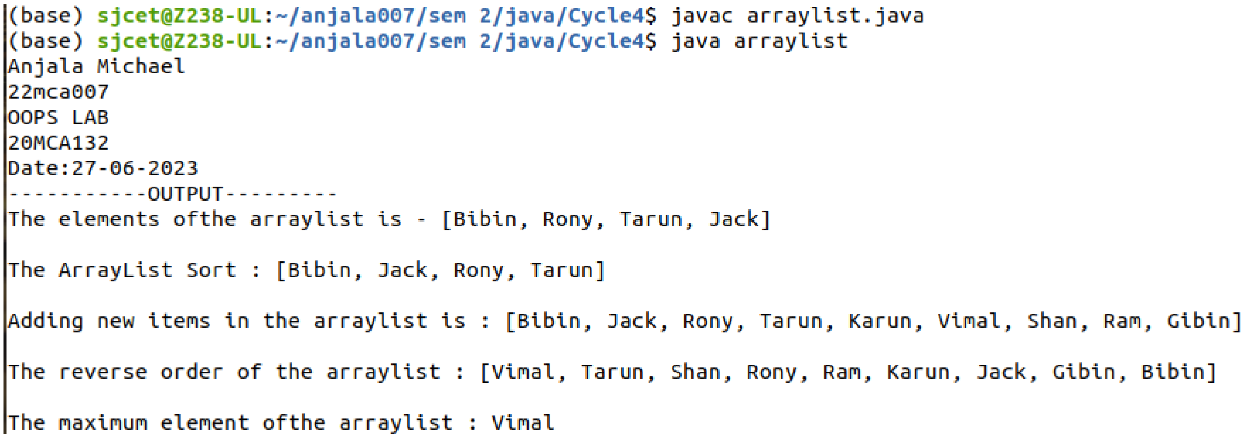

10. Maintain a list of Strings using ArrayList from the collection framework, perform built-in operations.

CODE

```
import java.util.*;
        public class arraylist{
                public static void main(String[] args) {
                        ArrayList<String> arrayList= new ArrayList<>();
                        arrayList.add("Bibin");
                        arrayList.add("Rony");
                        arrayList.add("Tarun");
                        arrayList.add("Jack");
                        System.out.println("Anjala Michael\n22mca007\nOOPS 
LAB\n20MCA132\nDate:27-06-2023");
                        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("\nThe maximum element ofthe arraylist : 
"+Collections.max(arrayList));
                }
        }
```

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac arraylist.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java arraylist
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Date:27-06-2023
-----------OUTPUT---------
The elements ofthe arraylist is - [Bibin, Rony, Tarun, Jack]

The ArrayList Sort : [Bibin, Jack, Rony, Tarun]

Adding new items in the arraylist is : [Bibin, Jack, Rony, Tarun, Karun, Vimal, Shan, Ram, Gibin]

The reverse order of the arraylist : [Vimal, Tarun, Shan, Rony, Ram, Karun, Jack, Gibin, Bibin]

The maximum element ofthe arraylist : Vimal
```
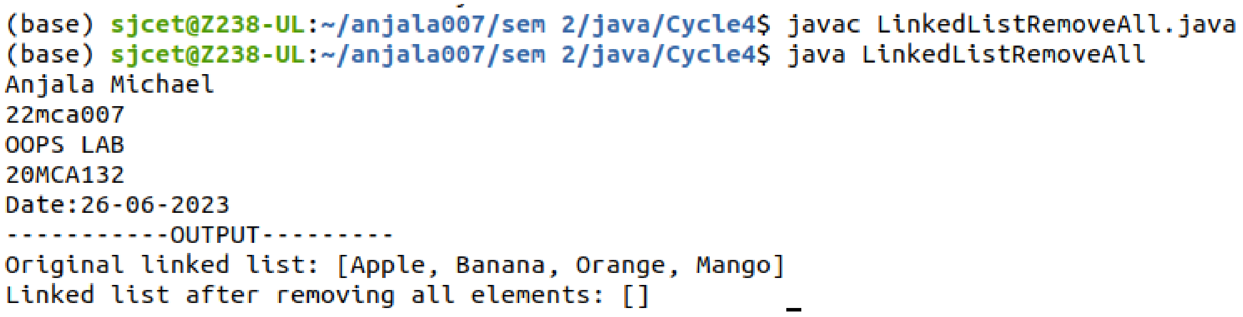

11. Program to remove all the elements from a linked list

CODE

```
import java.util.LinkedList;
public class LinkedListRemoveAll{
   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("Anjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:26-
06-2023");
         System.out.println("-----------OUTPUT---------");
      System.out.println("Original linked list: " + linkedList);
           linkedList.clear();
      System.out.println("Linked list after removing all elements: " + linkedList);
   }
}
```

OUTPUT



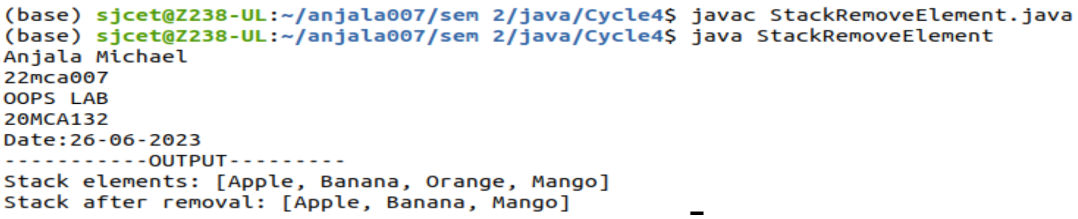
```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac LinkedListRemoveAll.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java LinkedListRemoveAll
Anjala Michael
22mca007
OOPS LAB
20MCA132
Date:26-06-2023
-----------OUTPUT---------
Original linked list: [Apple, Banana, Orange, Mango]
Linked list after removing all elements: []
```

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

CODE

```
import java.util.Stack;
public class StackRemoveElement{
   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("Anjala Michael\n22mca007\nOOPS
LAB\n20MCA132\nDate:26-06-2023");
System.out.println("-----------OUTPUT---------");
      System.out.println("Stack elements: " + stack);
      int positionToRemove = 2; // Position starts from 1
      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



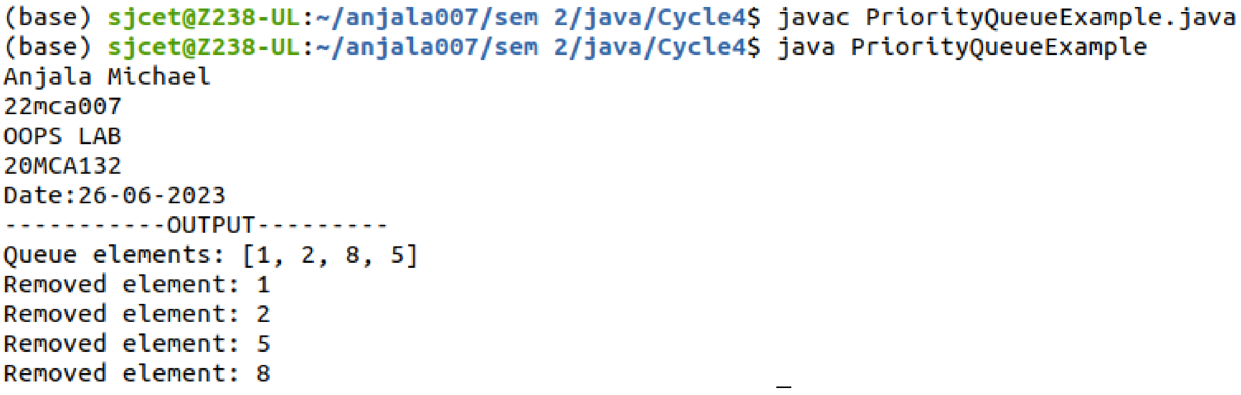
```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac StackRemoveElement.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java StackRemoveElement
Anjala Michael
22mca007
OOPS LAB
20MCA132
Date:26-06-2023
-----------OUTPUT---------
Stack elements: [Apple, Banana, Orange, Mango]
Stack after removal: [Apple, Banana, Mango]
```

13. 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("Anjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:26-06-2023");
System.out.println("-----------OUTPUT---------");
      System.out.println("Queue elements: " + queue);
      while (!queue.isEmpty()) {
         int element = queue.poll();
         System.out.println("Removed element: " + element);
      }
   }
}
```

OUTPUT



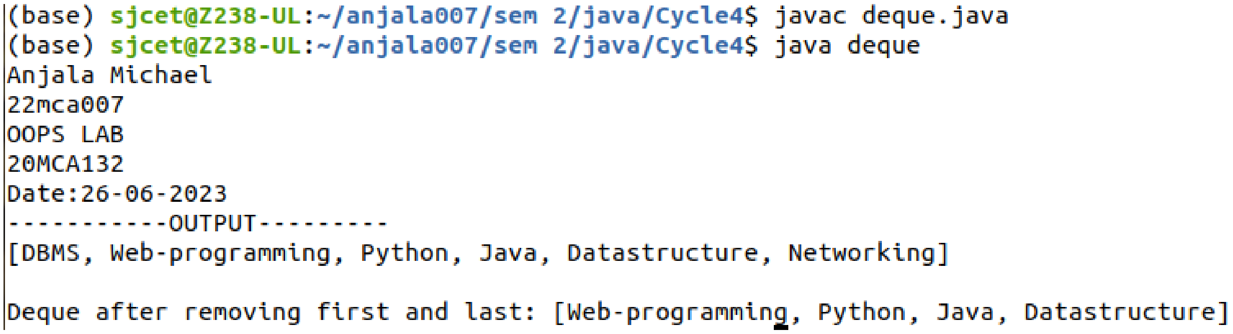
```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac PriorityQueueExample.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java PriorityQueueExample
Anjala Michael
22mca007
OOPS LAB
20MCA132
Date:26-06-2023
-----------OUTPUT---------
Queue elements: [1, 2, 8, 5]
Removed element: 1
Removed element: 2
Removed element: 5
Removed element: 8
```

14. 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("Anjala Michael\n22mca007\nOOPS
LAB\n20MCA132\nDate:26-06-2023");
                System.out.println("-----------OUTPUT---------");
                System.out.println(deque + "\n");
                deque.removeFirst();
                deque.removeLast();
                System.out.println("Deque after removing " + "first and last: " + deque);
        }
}
```

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac deque.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java deque
Anjala Michael
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20MCA132
Date:26-06-2023
-----------OUTPUT---------
[DBMS, Web-programming, Python, Java, Datastructure, Networking]

Deque after removing first and last: [Web-programming, Python, Java, Datastructure]
```
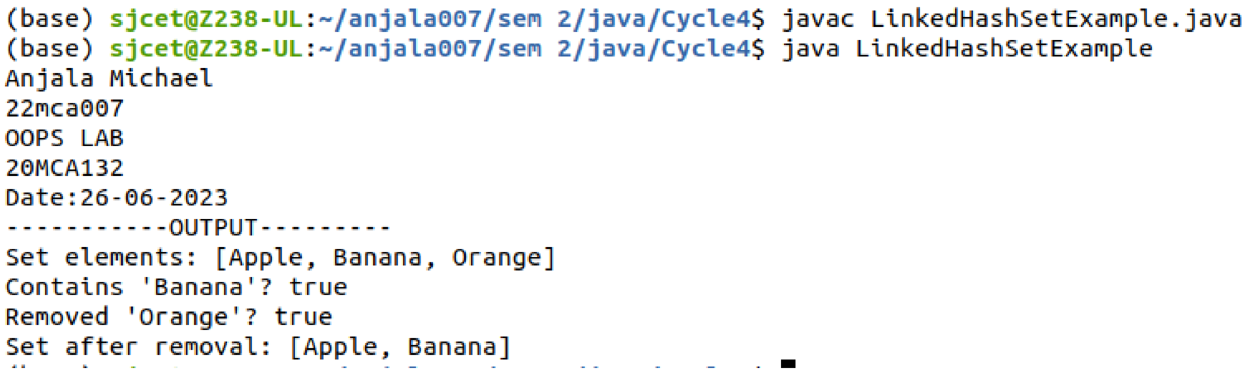

15. Program to demonstrate the creation of Set object using the LinkedHashset class.

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"); // Adding a duplicate element
        System.out.println("Anjala Michael\n22mca007\nOOPS LAB\n20MCA132\nDate:26-06-
2023");
            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



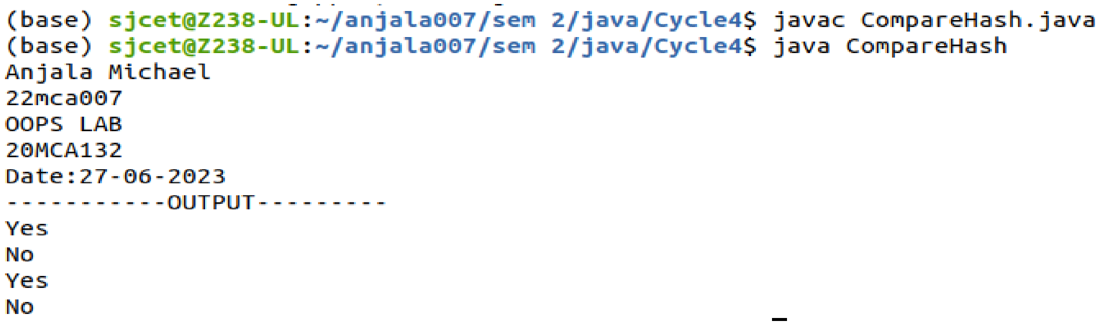
```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac LinkedHashSetExample.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java LinkedHashSetExample
Anjala Michael
22mca007
OOPS LAB
20MCA132
Date:26-06-2023
-----------OUTPUT---------
Set elements: [Apple, Banana, Orange]
Contains 'Banana'? true
Removed 'Orange'? true
Set after removal: [Apple, Banana]
```

16. 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("Anjala Michael\n22mca007\nOOPS 
LAB\n20MCA132\nDate:27-06-2023");
                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



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac CompareHash.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java CompareHash
Anjala Michael
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OOPS LAB
20MCA132
Date:27-06-2023
-----------OUTPUT---------
Yes
No
Yes
No
```
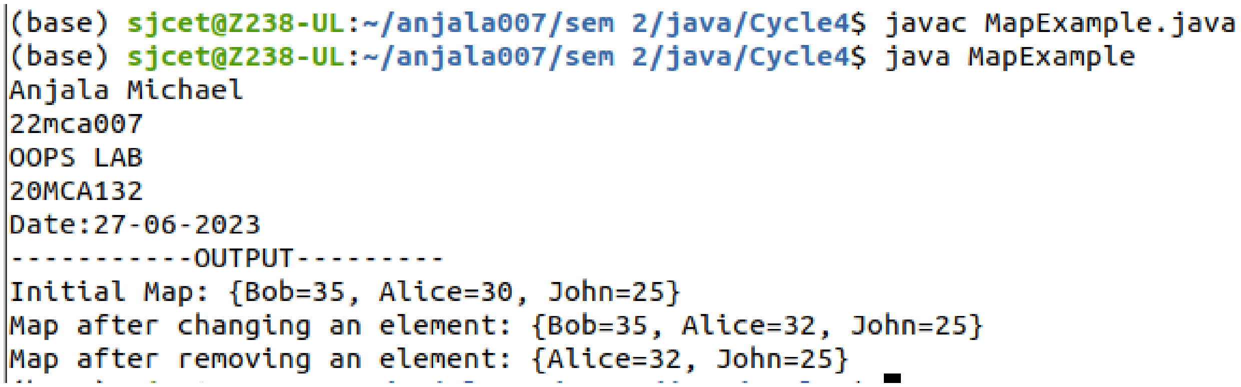

17. Program to demonstrate the working of Map interface by adding, changing and removing elements.

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("AnjalaMichael\n22mca007\nOOPS LAB\n20MCA132\nDate:27-06-2023");
         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



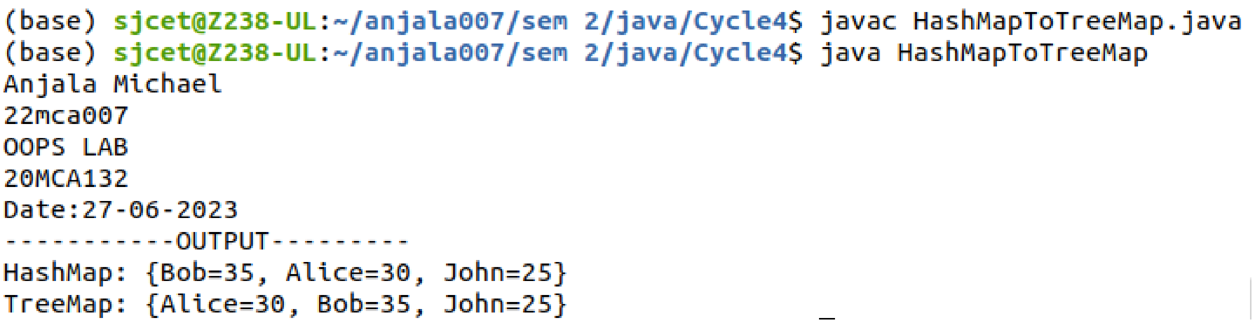
```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac MapExample.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java MapExample
Anjala Michael
22mca007
OOPS LAB
20MCA132
Date:27-06-2023
-----------OUTPUT---------
Initial Map: {Bob=35, Alice=30, John=25}
Map after changing an element: {Bob=35, Alice=32, John=25}
Map after removing an element: {Alice=32, John=25}
```

18. Program to Convert HashMap to TreeMap

CODE

```
import java.util.HashMap;
import java.util.Map;
import java.util.TreeMap;
public class HashMapToTreeMap{
    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("Anjala Michael\n22mca007\nOOPS
LAB\n20MCA132\nDate:27-06-2023");
            System.out.println("-----------OUTPUT---------");
        System.out.println("HashMap: " + hashMap);
        System.out.println("TreeMap: " + treeMap);
    }
}
```

OUTPUT



```
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ javac HashMapToTreeMap.java
(base) sjcet@Z238-UL:~/anjala007/sem 2/java/Cycle4$ java HashMapToTreeMap
Anjala Michael
22mca007
OOPS LAB
20MCA132
Date:27-06-2023
-----------OUTPUT---------
HashMap: {Bob=35, Alice=30, John=25}
TreeMap: {Alice=30, Bob=35, John=25}
```