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("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:16/06/2023\n\n");
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(" Area of rectangle= "+testObj.recArea(l,h));
            System.out.println(" Area of circle= "+testObj.cirArea(r));
            System.out.println(" Area of square= "+testObj.squArea(a));
            System.out.println(" Area of triangle= "+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){
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:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/S1$ javac main_graphics.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/S1$ java main_graphics

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:16/06/2023


Enter the length for rectangle
4
Enter the breadth for rectangle
5
Enter the radius of circle
7
Enter the side for Square
8
Enter the breadth for triangle
3
Enter the height for triangle
4
 Area of rectangle= 20.0
 Area of circle= 153.86
 Area of square= 64.0
 Area of triangle= 6.0
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/S1$
```

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:

ArithmeticMain.java

```
import arithmetic.ArithmeticOperations;
import java.util.Scanner;

public class ArithmeticMain {
    public static void main(String[] args) {
        System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");
        ArithmeticOperations operations = new ArithmeticOperations();

       Scanner scanner = new Scanner(System.in);

        System.out.print("Enter the first number: ");
        double num1 = scanner.nextDouble();

        System.out.print("Enter the second number: ");
        double num2 = scanner.nextDouble();

        System.out.println("Addition: " + operations.add(num1, num2));
        System.out.println("Subtraction: " + operations.subtract(num1, num2));
        System.out.println("Multiplication: " + operations.multiply(num1, num2));
        System.out.println("Division: " + operations.divide(num1, num2));

    }
}
```

ArithmeticOperations.java

```
package arithmetic;
public class ArithmeticOperations implements Addition, Subtraction, Multiplication, Division {
    @Override
    public double add(double num1, double num2) {
        return num1 + num2;
    }

    @Override
    public double subtract(double num1, double num2) {
        return num1 - num2;
    }

    @Override
    public double multiply(double num1, double num2) {
        return num1 * num2;
    }

    @Override
    public double divide(double num1, double num2) {
        if (num2 == 0) {
            throw new ArithmeticException("Division by zero error!");
        }
        return num1 / num2;
    }
}
```

Addition.java

```
package arithmetic;
public interface Addition {
```

```
    public double add(double num1, double num2);
}
```

Division.java

```
package arithmetic;
public interface Division {
    public double divide(double num1, double num2);
}
```

Multiplication.java

```
package arithmetic;
public interface Multiplication {
    public double multiply(double num1, double num2);
}
```

Subtraction.java

```
package arithmetic;
public interface Subtraction {
    public double subtract(double num1, double num2);
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q2$ javac ArithmeticMain.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q2$ java ArithmeticMain

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


Enter the first number: 35
Enter the second number: 23
Addition: 58.0
Subtraction: 12.0
Multiplication: 805.0
Division: 1.5217391304347827
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q2$
```

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("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");

     String username = "mca";
     String passcode = "mca123";
     String user_name,password;
     Scanner sc = new Scanner(System.in);
     try
     {
       System.out.println("Enter username: ");
       user_name = sc.nextLine();

       System.out.println("Enter 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:~/christinmca22/JAVA/CYCLE 4/Q3$ javac Userauthentication.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q3$ java Userauthentication

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


Enter username:
mca
Enter password:
mca123
Authentication successful...
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q3$ java Userauthentication

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


Enter username:
mca
Enter password:
mca
Exception caught authException: Invalid user credentials
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q3$
```

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){
     System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");

      int i;
      double sum=0,avg=0;
      Scanner sc=new Scanner(System.in);
      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:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q4$ javac average.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q4$ java average

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


Enter n numbers:
4
Enter number1
23
Enter number2
34
Enter number3
45
Enter number4
55
Average is 39.25
```

5. 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 MultiplicationTable implements Runnable {
    @Override
    public void run() {
        System.out.println("Multiplication Table of 5:");
        for (int i = 1; i <= 10; i++) {
            System.out.println("5 * " + i + " = " + (5 * i));
        }
    }
}

class PrimeNumbers implements Runnable {
    @Override
    public void run() {
        System.out.println("First 10 Prime Numbers:");
        int count = 0;
        int num = 2;
        while (count < 10) {
            if (isPrime(num)) {
                System.out.println(num + " ");
                count++;
            }
            num++;
        }
        System.out.println();
    }
```

```
    private boolean isPrime(int num) {
        if (num < 2) {
            return false;
        }
        for (int i = 2; i <= Math.sqrt(num); i++) {
            if (num % i == 0) {
                return false;
            }
        }
        return true;
    }
}

public class MainThread {
    public static void main(String[] args) {
        System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code
and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");
        MultiplicationTable multiplicationTable = new MultiplicationTable();
        PrimeNumbers primeNumbers = new PrimeNumbers();

        Thread thread1 = new Thread(multiplicationTable);
        Thread thread2 = new Thread(primeNumbers);

        thread1.start();
        try {
            thread1.join();
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        thread2.start();
    }
```

}

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q5$ javac MainThread.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q5$ java MainThread

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


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

(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q5$
```

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 Fibonacci implements Runnable {
    private int count;

    public Fibonacci(int count) {
        this.count = count;
    }

    @Override
    public void run() {
        System.out.println("Fibonacci numbers:");
        int num1 = 0;
        int num2 = 1;
        System.out.println(num1);
        System.out.println(num2);

        for (int i = 2; i < count; i++) {
            int fib = num1 + num2;
            System.out.println(fib);
            num1 = num2;
            num2 = fib;
        }
    }
}
```

```
class EvenNumber implements Runnable {
    private int start;
    private int end;

    public EvenNumber(int start, int end) {
        this.start = start;
        this.end = end;
    }

    @Override
    public void run() {
        System.out.println("Even numbers from " + start + " to " + end + ":");
        for (int i = start; i <= end; i++) {
            if (i % 2 == 0) {
                System.out.println(i);
            }
        }
    }
}

public class multiThread {
    public static void main(String[] args) {

        System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code
and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");


            Scanner scanner = new Scanner(System.in);

        System.out.print("Enter the count of Fibonacci numbers: ");
        int fibonacciCount = scanner.nextInt();
```

```
        System.out.print("Enter the start of the range for even numbers: ");
        int start = scanner.nextInt();
        System.out.print("Enter the end of the range for even numbers: ");
        int end = scanner.nextInt();
        scanner.close();

        Thread fibonacciThread = new Thread(new Fibonacci(fibonacciCount));
        Thread evenNumberThread = new Thread(new EvenNumber(start, end));

        fibonacciThread.start();
        evenNumberThread.start();
    }
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q6$ javac multiThread.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q6$ java multiThread

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


Enter the count of Fibonacci numbers: 6
Enter the start of the range for even numbers: 2
Enter the end of the range for even numbers: 9
Fibonacci numbers:
0
1
1
2
3
5
Even numbers from 2 to 9:
2
4
6
8
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q6$
```

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 ProducerConsumerITC {
    public static void main(String[] args) {
          System.out.println("\nName:Christin  Benny\nReg  No:22MCA021\nCourse  Code
and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");
        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:~/christinmca22/JAVA/CYCLE 4/Q7$ javac ProducerConsumerITC.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q7$ java ProducerConsumerITC

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:23/06/2023


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
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q7$
```

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] + "\t");
}
}
public static void main(String[] args) {
System.out.println("\nName : Christin Benny\nReg No: 22MCA021\nCourse Code and Name : 20MCA132,Object Oriented Programming Lab\nDate : 27/06/2023\n\n");
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:~/Christin/java/cycle4$ javac Stack.java
sjcet@sjcet:~/Christin/java/cycle4$ java Stack

Name : Christin Benny
Reg No: 22MCA021
Course Code and Name : 20MCA132,Object Oriented Programming Lab
Date : 27/06/2023


----------OUTPUT---------
Inserting 1
Inserting 2
Inserting 3
Stack: 1        2       3
After popping out

1       2

sjcet@sjcet:~/Christin/java/cycle4$
```

9. Using generic method perform Bubble sort.

CODE:

```
import java.util.Arrays;

public class BubbleSort {
    public static <T extends Comparable<T>> void bubbleSort(T[] arr) {
        int n = arr.length;
        for (int i = 0; i < n - 1; i++) {
            for (int j = 0; j < n - i - 1; j++) {
                if (arr[j].compareTo(arr[j + 1]) > 0) {
                    // Swap arr[j] and arr[j + 1]
                    T temp = arr[j];
                    arr[j] = arr[j + 1];
                    arr[j + 1] = temp;
                }
            }
        }
    }

    public static void main(String[] args) {
          System.out.println("\nName:Christin  Benny\nReg  No:22MCA021\nCourse  Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:27/06/2023\n\n");
        Integer[] numbers = { 4, 2, 9, 6, 23, 12, 34, 0, 1 };
        String[] names = { "John", "Alice", "Bob", "Diana", "Carol" };

        System.out.println("Before sorting: " + Arrays.toString(numbers));
        bubbleSort(numbers);
        System.out.println("After sorting: " + Arrays.toString(numbers));
```

```
        System.out.println("Before sorting: " + Arrays.toString(names));
        bubbleSort(names);
        System.out.println("After sorting: " + Arrays.toString(names));
    }
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q9$ javac BubbleSort.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q9$ java BubbleSort

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:27/06/2023


Before sorting: [4, 2, 9, 6, 23, 12, 34, 0, 1]
After sorting: [0, 1, 2, 4, 6, 9, 12, 23, 34]
Before sorting: [John, Alice, Bob, Diana, Carol]
After sorting: [Alice, Bob, Carol, Diana, John]
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q9$
```

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

CODE:

```
import java.util.ArrayList;
import java.util.Collections;
import java.util.List;

public class ArrayListExample {
   public static void main(String[] args) {
   System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:27/06/2023\n\n");
       List<String> stringList = new ArrayList<>();

       stringList.add("Apple");
       stringList.add("Banana");
       stringList.add("Orange");
       stringList.add("Mango");

       System.out.println("Original List: " + stringList);

       String firstElement = stringList.get(0);
       System.out.println("First Element: " + firstElement);

       stringList.set(1, "Grapes");
       System.out.println("Modified List: " + stringList);

       boolean containsMango = stringList.contains("Mango");
       System.out.println("Contains Mango? " + containsMango);
```

```
        stringList.remove("Orange");
        System.out.println("List after removing Orange: " + stringList);

        Collections.sort(stringList);
        System.out.println("Sorted List: " + stringList);

        Collections.reverse(stringList);
        System.out.println("Reversed List: " + stringList);

        int size = stringList.size();
        System.out.println("Size of the list: " + size);

        stringList.clear();
        System.out.println("List after clearing: " + stringList);
    }
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q10$ javac ArrayListExample.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q10$ java ArrayListExample

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:27/06/2023


Original List: [Apple, Banana, Orange, Mango]
First Element: Apple
Modified List: [Apple, Grapes, Orange, Mango]
Contains Mango? true
List after removing Orange: [Apple, Grapes, Mango]
Sorted List: [Apple, Grapes, Mango]
Reversed List: [Mango, Grapes, Apple]
Size of the list: 3
List after clearing: []
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q10$
```

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

CODE:

```
import java.util.Scanner;

public class LinkedListDemo {
    private Node head;

    private class Node {
        String data;
        Node next;

        Node(String data) {
            this.data = data;
            this.next = null;
        }
    }

    public void add(String data) {
        Node newNode = new Node(data);

        if (head == null) {
            head = newNode;
        } else {
            Node currentNode = head;
            while (currentNode.next != null) {
                currentNode = currentNode.next;
            }
            currentNode.next = newNode;
        }
```

```
    }

    public void removeAll() {
        head = null;
    }

    public void display() {
        Node currentNode = head;
        while (currentNode != null) {
            System.out.print(currentNode.data + " ");
            currentNode = currentNode.next;
        }
        System.out.println();
    }

    public static void main(String[] args) {
          System.out.println("\nName:Christin  Benny\nReg  No:22MCA021\nCourse  Code
and Name: 20MCA132, Object Oriented Programming Lab\nDate:23/06/2023\n\n");
        LinkedListDemo linkedList = new LinkedListDemo();
        Scanner scanner = new Scanner(System.in);

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

        System.out.println("Enter the elements:");
        for (int i = 0; i < numElements; i++) {
            String element = scanner.next();
            linkedList.add(element);
        }

        System.out.println("Linked List before removal:");
```

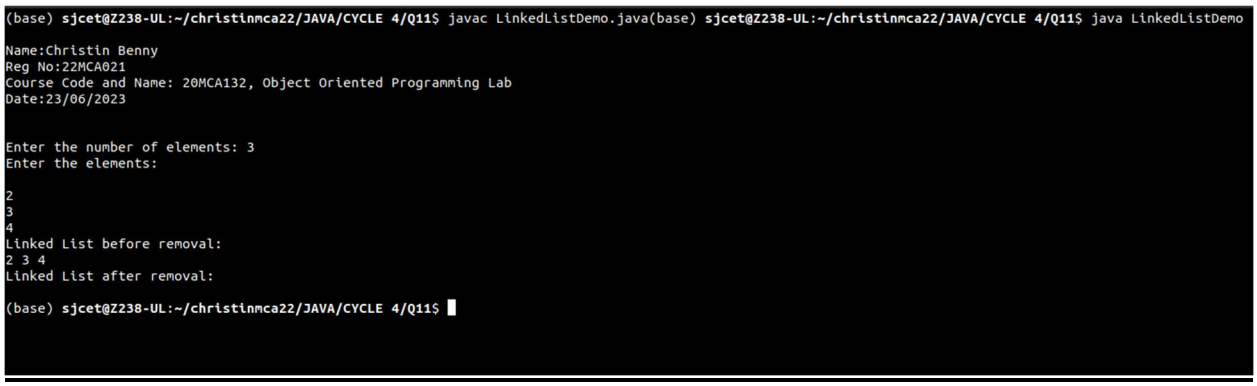
```
        linkedList.display();

        linkedList.removeAll();

        System.out.println("Linked List after removal:");
        linkedList.display();

        scanner.close();
    }
}
```

OUTPUT:



12. 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) {
        System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:27/06/2023\n\n");

        Stack<String> stack = new Stack<>();



        stack.push("Apple");
        stack.push("Banana");
        stack.push("Orange");
        stack.push("Mango");

       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:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q12$ javac StackRemoveElementExample.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q12$ java StackRemoveElementExample

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:27/06/2023


Stack elements: [Apple, Banana, Orange, Mango]
Stack after removal: [Apple, Banana, Mango]
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q12$
```

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("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:27/06/2023\n\n");
        System.out.println("Queue elements: " + queue);

        while (!queue.isEmpty()) {
            int element = queue.poll();
            System.out.println("Removed element: " + element);
        }
    }
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q9$ javac BubbleSort.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q9$ java BubbleSort

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:27/06/2023


Before sorting: [4, 2, 9, 6, 23, 12, 34, 0, 1]
After sorting: [0, 1, 2, 4, 6, 9, 12, 23, 34]
Before sorting: [John, Alice, Bob, Diana, Carol]
After sorting: [Alice, Bob, Carol, Diana, John]
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q9$
```

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("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:27/06/2023\n\n");
System.out.println(deque + "\n");
deque.removeFirst();
deque.removeLast();
System.out.println("Deque after removing " + "first and last: " + deque);
}
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q14$ javac deque.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q14$ java deque

Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:27/06/2023


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

Deque after removing first and last: [Web-programming, Python, Java, Datastructure]
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q14$
```

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) {
        // Create a LinkedHashSet
        Set<String> set = new LinkedHashSet<>();

        // Add elements to the set
        set.add("Apple");
        set.add("Banana");
        set.add("Orange");
        set.add("Apple"); // Adding a duplicate element

        // Print the set
        System.out.println("\nName:Christin Benny\nReg No:22MCA021\nCourse Code and Name: 20MCA132, Object Oriented Programming Lab\nDate:27/06/2023\n\n");
        System.out.println("Set elements: " + set);

        // Check if an element exists in the set
        boolean containsBanana = set.contains("Banana");
        System.out.println("Contains 'Banana'? " + containsBanana);

        // Remove an element from the set
        boolean removedOrange = set.remove("Orange");
        System.out.println("Removed 'Orange'? " + removedOrange);
```

```
        // Print the set after removal
        System.out.println("Set after removal: " + set);
    }
}
```

OUTPUT:

```
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q15$ javac LinkedHashSetExample.java
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q15$ java LinkedHashSetExample
Name:Christin Benny
Reg No:22MCA021
Course Code and Name: 20MCA132, Object Oriented Programming Lab
Date:27/06/2023


Set elements: [Apple, Banana, Orange]
Contains 'Banana'? true
Removed 'Orange'? true
Set after removal: [Apple, Banana]
(base) sjcet@Z238-UL:~/christinmca22/JAVA/CYCLE 4/Q15$
```

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("\nName : Christin Benny\nReg No: 22MCA021\nCourse Code and Name : 20MCA132,Object Oriented Programming Lab\nDate : 27/06/2023\n\n");
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:~/Christin/java/cycle4$ javac CompareHash.java
sjcet@sjcet:~/Christin/java/cycle4$ java CompareHash

Name : Christin Benny
Reg No: 22MCA021
Course Code and Name : 20MCA132,Object Oriented Programming Lab
Date : 27/06/2023


Yes
No
Yes
No
sjcet@sjcet:~/Christin/java/cycle4$
```

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) {
        // Create a new HashMap
        Map<String, Integer> map = new HashMap<>();

        // Add elements to the map
        map.put("John", 25);
        map.put("Alice", 30);
        map.put("Bob", 35);

        // Print the initial map
System.out.println("\nName : Christin Benny\nReg No: 22MCA021\nCourse Code and Name : 20MCA132,Object Oriented Programming Lab\nDate : 27/06/2023\n\n");


        System.out.println("Initial Map: " + map);

        // Changing an element
        map.put("Alice", 32);

        // Print the map after changing an element
        System.out.println("Map after changing an element: " + map);
```

```
        // Removing an element
        map.remove("Bob");

        // Print the map after removing an element
        System.out.println("Map after removing an element: " + map);
    }
}
```

OUTPUT:

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

Name : Christin Benny
Reg No: 22MCA021
Course Code and Name : 20MCA132,Object Oriented Programming Lab
Date : 27/06/2023


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:~/Christin/java/cycle4$
```

18. 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) {
        // Create a HashMap
        Map<String, Integer> hashMap = new HashMap<>();
        hashMap.put("John", 25);
        hashMap.put("Alice", 30);
        hashMap.put("Bob", 35);

        // Convert HashMap to TreeMap
        Map<String, Integer> treeMap = new TreeMap<>(hashMap);

        // Print the HashMap
System.out.println("\nName : Christin Benny\nReg No: 22MCA021\nCourse Code and Name : 20MCA132,Object Oriented Programming Lab\nDate : 27/06/2023\n\n");
        System.out.println("HashMap: " + hashMap);

        // Print the TreeMap
        System.out.println("TreeMap: " + treeMap);
    }
}
```

OUTPUT:

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

Name : Christin Benny
Reg No: 22MCA021
Course Code and Name : 20MCA132,Object Oriented Programming Lab
Date : 27/06/2023


HashMap: {Bob=35, Alice=30, John=25}
TreeMap: {Alice=30, Bob=35, John=25}
sjcet@sjcet:~/Christin/java/cycle4$
```