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:-

```
import package_graphics.*;
import java.util.Scanner;
public class Q1
 {
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("Name: ASWATHY CHANDRAN ");

System.out.println("Reg. No: SJC22MCA-2016");

System.out.println("Date: 22/06/2023");

System.out.println("Course code: 20MCA132");
System.out.println();
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));
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q1.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q1
Name: ASWATHY CHANDRAN
Reg. No: SJC22MCA-2016
Date: 22/06/2023
Course code: 20MCA132

Enter the length for rectangle
32
Enter the breadth for rectangle
3
Enter the radius of circle
6
Enter the side for Square
7
Enter the breadth for triangle
8
Enter the height for triangle
9
Area of rectangle=96.0
Area of circle=113.04
Area of square=49.0
Area of triangle=36.0
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

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:-

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

public class ArithmeticMain {
   public static void main(String[] args) {
   System.out.println("\nName:ASWATHY CHANDRAN\nReg No:22MCA016\nCourse Code
and Name: 20MCA132  OBJECT ORIENTED PROGRAMMING LAB\nDate:27/06/2023\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));

   }
}
```

Multiplication.java

```
package arithmetic;

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

Addition.java

```
package arithmetic;

public interface Addition {
   public double add(double num1, double num2);
```

```
}
```

Division

```
package arithmetic;

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

Subtraction

```
package arithmetic;

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

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac ArithmeticMain.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java ArithmeticMain

Name:ASWATHY CHANDRAN
Reg No:22MCA016
Course Code and Name: 20MCA132  OBJECT ORIENTED PROGRAMMING LAB
Date:27/06/2023


Enter the first number: 6
Enter the second number: 8
Addition: 14.0
Subtraction: -2.0
Multiplication: 48.0
Division: 0.75
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

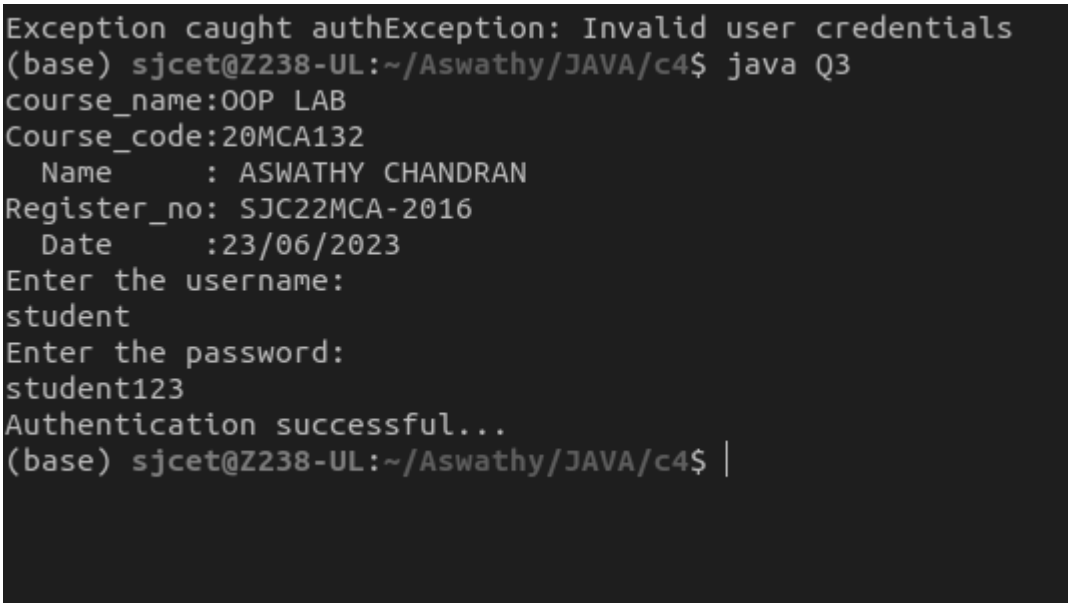
3. Write a user defined exception class to authenticate the user name and password

CODE:-

```
import java.util.Scanner;

class authException extends Exception
{

public authException(String s) {
super(s);
}

}
public class Q3
{
public static void main(String[] args) {
   System.out.println("course_name:OOP LAB");
   System.out.println("Course_code:20MCA132");
   System.out.println("  Name     : ASWATHY CHANDRAN");
   System.out.println("Register_no: SJC22MCA-2016");
   System.out.println("  Date     :23/06/2023");
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


Exception caught authException: Invalid user credentials
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q3
course_name:OOP LAB
Course_code:20MCA132
Name : ASWATHY CHANDRAN
Register_no: SJC22MCA-2016
Date :23/06/2023
Enter the username:
student
Enter the password:
student123
Authentication successful...
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$

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 Q4 {
public static void main(String[] args)
{
  System.out.println("course_name:OOP LAB");
  System.out.println("Course_code:20MCA132");
  System.out.println("  Name     : ASWATHY CHANDRAN");
  System.out.println("Register_no: SJC22MCA-2016");
  System.out.println("  Date     :23/06/2023");
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:~/Aswathy/JAVA/c4$ java Q4
course_name:OOP LAB
Course_code:20MCA132
  Name      : ASWATHY CHANDRAN
Register_no: SJC22MCA-2016
  Date      :23/06/2023
Enter n numbers:
2
Enter number1
3
Enter number2
6
Average is 4.5
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

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:-

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

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

class PrimeNumber implements Runnable {
    private int count;

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

    @Override
    public void run() {
        System.out.println("First " + count + " prime numbers:");
        List<Integer> primeNumbers = new ArrayList<>();
        int num = 2;
        while (primeNumbers.size() < count) {
            if (isPrime(num)) {
                primeNumbers.add(num);
            }
            num++;
        }

        for (int prime : primeNumbers) {
            System.out.println(prime);
        }
    }

    private boolean isPrime(int number) {
        if (number <= 1)
```

```
    return false;
        }

        for (int i = 2; i <= Math.sqrt(number); i++) {
            if (number % i == 0) {
                return false;
            }
        }

        return true;
    }
}

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

        System.out.println("Name: ASWATHY CHANDRAN");
System.out.println("Addmission_no: 22MCA016");
System.out.println("Course ID & Code : OOP LAB, 20MCA132");
System.out.println("Date: 23/06/2023");
System.out.println("_____0.____\n");


        Thread multiplicationTableThread = new Thread(new TableGenerator());
        Thread primeNumberThread = new Thread(new PrimeNumber(10));

        multiplicationTableThread.start();
        primeNumberThread.start();
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA$ java result
ASWATHY CHANDRAN
22mca016
OOPS LAB
20MCA132
Date:15-06-2023

Enter the Sports Details of Student

 Sport:
CRICKET

 Sport Rating  out of 10:
9

Enter the Sports Details of Student

 Academic Grade:
A

 Overall percentage:
90

Sports Details of Student
Sport :CRICKET
Rating :9

Academic Details of Student
Academic Grade :A
Overall percentage :90.0
(base) sjcet@Z238-UL:~/Aswathy/JAVA$
```

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 Q6 {
public static void main(String [] args){
   System.out.println("course_name:OOP LAB");
   System.out.println("Course_code:20MCA132");
   System.out.println("  Name     : ASWATHY CHANDRAN");
   System.out.println("Register_no: SJC22MCA-2016");
   System.out.println("  Date     :23/06/2023");
int c,range;
Scanner sc=new Scanner(System.in);
```

```
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();


}
```

```
ASWATHY CHANDRAN
22MCA016
OOPS LAB
20MCA132
Date:15-06-2023

1.Circle
2.Rectangle
3.exit
Enter your choice:
1
Enter the radius of the circle:
6
Area of the circle: 113.03999999999999
Perimeter of the circle: 37.68
ASWATHY CHANDRAN
22MCA016
OOPS LAB
20MCA132
Date:15-06-2023

1.Circle
2.Rectangle
3.exit
Enter your choice:
2
Enter the length of the rectangle:
3
Enter the breadth of the rectangle:
3
Area of a rectangle: 9.0
Perimeter of a rectangle: 12.0
ASWATHY CHANDRAN
22MCA016
OOPS LAB
20MCA132
Date:15-06-2023

1.Circle
2.Rectangle
3.exit
Enter your choice:
3
Exited...
(base) sjcet@Z238-UL:~/Aswathy/JAVA$
```

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);
            } 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);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}

public class ProducerConsumerITC {
    public static void main(String[] args) {
    System.out.println(" Name:ASWATHY CHANDRAN Reg No:22MCA016 course Code and
Name: 20MCA132  Date:26/06/2023");
        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:~/Aswathy/JAVA$ javac C3_Q7.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA$ java C3_Q7
ASWATHY CHANDRAN
22MCA016
OOPS LAB
20MCA132
Date:15-06-2023
Order no. #176282
Enter the date:
15/06/2023
Enter how many products are there:
2

Enter product id:
01
Enter product name:
PEN
Enter the Quantity:
2
Enter the unit price:
5

Enter product id:
001
Enter product name:
PENCIL
Enter the Quantity:
3
Enter the unit price:
10
Date:15/06/2023
Product Id      Name       Quantity        unit price    Total
-------------------------------------------------------------
01              PEN             2               5.0     10.0
001             PENCIL          3               10.0    30.0
-------------------------------------------------------------
                        Net.Amount      40.0
(base) sjcet@Z238-UL:~/Aswathy/JAVA$
```

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

CODE:-

```
import java.util.Scanner;
public class Stackop {
   int top=-1,ch,item,i;
   int a[] = new int[10];
   Scanner sc = new Scanner(System.in);
   public static void main(String[] args) {
     Stackop  obj = new Stackop ();
      obj.stack();
      }

   public void stack(){
   System.out.println("ASWATHY CHANDRAN 22MCA016 26-06-2023");
    System.out.println("Enter the size of the array:");
         int N=sc.nextInt();

      while(ch<3) {

         System.out.println("\t Choose : ");
         System.out.println("\n 1.push \n 2.pop \n 3.exit \n");
         System.out.println("\n Enter your choice:");
         ch=sc.nextInt();
      switch(ch){
      case 1:
         System.out.println("Enter the element to be inserted:");
         item=sc.nextInt();
         if(top==N-1) {
            System.out.println("stack overflow!");
         }
         else {
            top++;
            a[top]=item;
         }
         break;
      case 2:
         if(top==-1) {
            System.out.println("stack is empty");
         }
         else {
            item=a[top];
            top--;
```

```
            System.out.println("deleted element is:" +item);
          }
          break;
       case 3 : break;
       default : System.out.println("\n Invalid choice");
       }
       if(top < 0){
       System.out.println("\n stack is empty");
         }
       else{
       System.out.println("\n stack is \n");
       for(i=top;i>=0;i--){
       System.out.println(a[i]);
             }
        }
       }
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Stackop
ASWATHY CHANDRAN 22MCA016 26-06-2023
Enter the size of the array:
1
         Choose :

 1.push
 2.pop
 3.exit


 Enter your choice:
1
Enter the element to be inserted:
10

 stack is

10
         Choose :

 1.push
 2.pop
 3.exit


 Enter your choice:
2
deleted element is:10

 stack is empty
         Choose :

 1.push
 2.pop
 3.exit


 Enter your choice:
3

 stack is empty
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

9. Using generic method perform Bubble sort.

CODE:-

```
import java.util.Arrays;
import java.util.Scanner;

public class Q9{
   public static void main(String[] args) {
      Scanner scanner = new Scanner(System.in);
      System.out.println("ASWATHY CHANDRAN");
      System.out.println("SJC22MCA-2016");
      System.out.println("27 June 2023");
      System.out.print("Enter the size of the array: ");
      int size = scanner.nextInt();

      int[] array = new int[size];
      System.out.println("Enter the elements of the array:");
      for (int i = 0; i < size; i++) {
         array[i] = scanner.nextInt();
      }

      System.out.print("Enter 'A' for ascending order or 'D' for descending order: ");
      String order = scanner.next().toUpperCase();

      System.out.println("Before sorting: " + Arrays.toString(array));

      if (order.equals("A")) {
         bubbleSortAscending(array);
         System.out.println("After sorting in ascending order: " + Arrays.toString(array));
      } else if (order.equals("D")) {
         bubbleSortDescending(array);
         System.out.println("After sorting in descending order: " + Arrays.toString(array));
      } else {
         System.out.println("Invalid choice. Please enter 'A' or 'D' for the order.");
      }

      scanner.close();
   }

   public static void bubbleSortAscending(int[] 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] > array[j + 1]) {
                    // Swap array[j] and array[j+1]
                    int temp = array[j];
                    array[j] = array[j + 1];
                    array[j + 1] = temp;
                }
            }
        }
    }

    public static void bubbleSortDescending(int[] 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] < array[j + 1]) {
                    // Swap array[j] and array[j+1]
                    int temp = array[j];
                    array[j] = array[j + 1];
                    array[j + 1] = temp;
                }
            }
        }
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q9.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q9
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the size of the array: 2
Enter the elements of the array:
3
4
Enter 'A' for ascending order or 'D' for descending order: A
Before sorting: [3, 4]
After sorting in ascending order: [3, 4]
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

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;
import java.util.Scanner;

public class Q10 {
   public static void main(String[] args) {
      // Create an ArrayList to store strings
      List<String> stringList = new ArrayList<>();

      Scanner scanner = new Scanner(System.in);
      System.out.println("ASWATHY CHANDRAN");
      System.out.println("SJC22MCA-2016");
      System.out.println("27 June 2023");
      System.out.print("Enter the number of strings to add: ");
      int numStrings = scanner.nextInt();
      scanner.nextLine(); // Consume the newline character

      // Add elements to the list based on user input
      for (int i = 0; i < numStrings; i++) {
         System.out.print("Enter string #" + (i + 1) + ": ");
         String input = scanner.nextLine();
         stringList.add(input);
      }

      // Display the elements in the list
      System.out.println("Original list: " + stringList);

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

      // Check if the list is empty
      boolean isEmpty = stringList.isEmpty();
      System.out.println("Is the list empty? " + isEmpty);

      // Access elements by index
      String firstElement = stringList.get(0);
      String lastElement = stringList.get(size - 1);
```

```
        System.out.println("First element: " + firstElement);
        System.out.println("Last element: " + lastElement);

        // Sort the list in ascending order
        Collections.sort(stringList);
        System.out.println("List after sorting in ascending order: " + stringList);

        // Check if an element exists in the list
        System.out.print("Enter a string to check if it exists in the list: ");
        String searchString = scanner.nextLine();
        boolean containsString = stringList.contains(searchString);
        System.out.println("Does the list contain '" + searchString + "'? " + containsString);

        // Remove an element from the list
        System.out.print("Enter a string to remove from the list: ");
        String removeString = scanner.nextLine();
        boolean removed = stringList.remove(removeString);
        System.out.println("Element '" + removeString + "' removed? " + removed);
        System.out.println("List after removing an element: " + stringList);

        // Clear the list
        stringList.clear();
        System.out.println("List after clearing all elements: " + stringList);

        scanner.close();
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q10.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q10
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the number of strings to add: 2
Enter string #1: ASWATHY
Enter string #2: CHANDRAN
Original list: [ASWATHY, CHANDRAN]
Size of the list: 2
Is the list empty? false
First element: ASWATHY
Last element: CHANDRAN
List after sorting in ascending order: [ASWATHY, CHANDRAN]
Enter a string to check if it exists in the list: ASWATHY
Does the list contain 'ASWATHY'? true
Enter a string to remove from the list: CHANDRAN
Element 'CHANDRAN' removed? true
List after removing an element: [ASWATHY]
List after clearing all elements: []
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

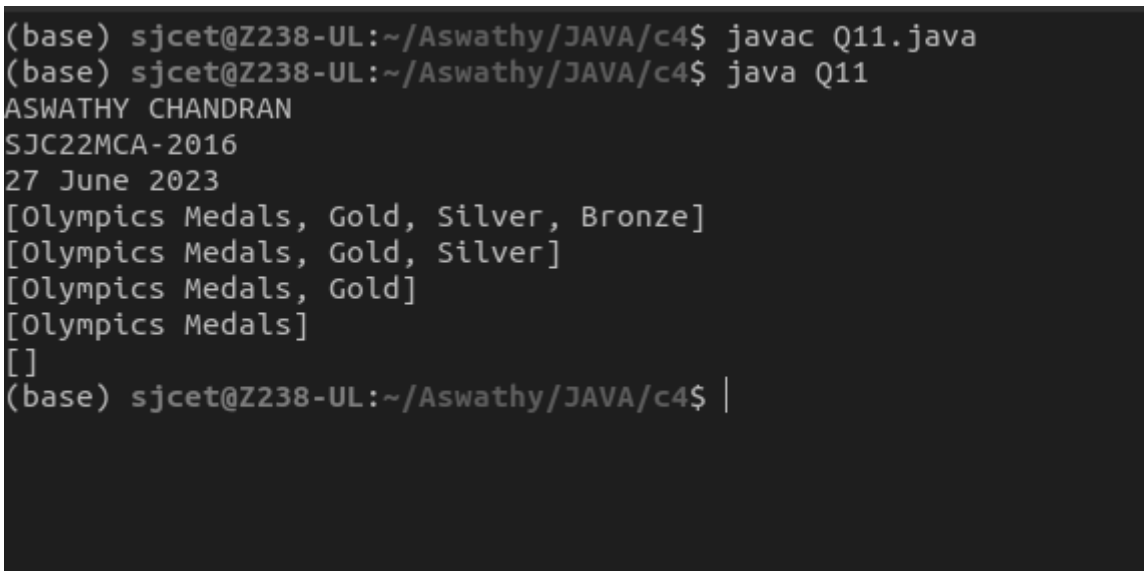
11. Program to remove all the elements from a linked list

CODE:-

```
import java.util.*;


public class Q11 {
    public static  void main(String[] args){
        System.out.println("ASWATHY CHANDRAN");
        System.out.println("SJC22MCA-2016");
        System.out.println("27 June 2023");
        LinkedList<String> L=new LinkedList<>();
        L.add("Gold");
        L.add("Silver");
        L.add("Bronze");
        L.add(0,"Olympics Medals");
        System.out.println(L);
        L.remove("Bronze");
        System.out.println(L);
        L.remove(2);
        System.out.println(L);
        L.removeLast();
        System.out.println(L);
        L.removeFirst();
        System.out.println(L);
```

```
    }

}
```

OUTPUT


(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q11.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q11
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
[Olympics Medals, Gold, Silver, Bronze]
[Olympics Medals, Gold, Silver]
[Olympics Medals, Gold]
[Olympics Medals]
[]
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$

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

CODE:-

```
import java.util.Stack;

public class Q12 {
    public static void removeElementAtPosition(Stack<String> stack, int position) {
        if (position >= 1 && position <= stack.size()) {
            Stack<String> tempStack = new Stack<>();

            // Remove elements from the original stack until the desired position is reached
            for (int i = 1; i < position; i++) {
                tempStack.push(stack.pop());
            }

            // Remove the element at the desired position
            stack.pop();

            // Restore the remaining elements back to the original stack
            while (!tempStack.isEmpty()) {
                stack.push(tempStack.pop());
            }

            System.out.println("Element at position " + position + " removed successfully.");
```

```
        } else {
            System.out.println("Invalid position. Please provide a valid position within the stack range.");
        }
    }

    public static void main(String[] args) {

        System.out.println("ASWATHY CHANDRAN");
        System.out.println("SJC22MCA-2016");
        System.out.println("27 June 2023");
        Stack<String> stack = new Stack<>();
        stack.push("Element 1");
        stack.push("Element 2");
        stack.push("Element 3");
        stack.push("Element 4");
        stack.push("Element 5");

        int positionToRemove = 3;

        System.out.println("Before removal: " + stack);
        removeElementAtPosition(stack, positionToRemove);
        System.out.println("After removal: " + stack);
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q12.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q12
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Before removal: [Element 1, Element 2, Element 3, Element 4, Element 5]
Element at position 3 removed successfully.
After removal: [Element 1, Element 2, Element 4, Element 5]
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

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

CODE:-

```
import java.util.PriorityQueue;
import java.util.Scanner;

public class Q13{
   public static void main(String[] args) {

      System.out.println("ASWATHY CHANDRAN");
      System.out.println("SJC22MCA-2016");
      System.out.println("27 June 2023");
      Scanner scanner = new Scanner(System.in);

      // Create an empty priority queue
      PriorityQueue<Integer> queue = new PriorityQueue<>();

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

      // Prompt the user to enter elements and add them to the queue
      System.out.println("Enter the elements:");
      for (int i = 0; i < numElements; i++) {
         int element = scanner.nextInt();
         queue.offer(element);
```

```
        }

        System.out.println("Queue elements:");

        // Print and remove elements from the queue until it becomes empty
        while (!queue.isEmpty()) {
            System.out.println(queue.poll());
        }

        scanner.close();
    }
}
```

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q13.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q13
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the number of elements to add: 3
Enter the elements:
2
5
8
Queue elements:
2
5
8
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q14.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q14
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 1
Enter the element to add at the front: 10
Element added at the front.
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 2
Enter the element to add at the end: 100
Element added at the end.
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 3
Element removed from the front: 10
1. Add element at the front
```

14. Program to demonstrate the addition and deletion of elements in deque

CODE:-

```
import java.util.Deque;
import java.util.LinkedList;
import java.util.Scanner;

public class Q14 {
    public static void main(String[] args) {
        Deque<Integer> deque = new LinkedList<>();

        Scanner scanner = new Scanner(System.in);
        System.out.println("ASWATHY CHANDRAN");
   System.out.println("SJC22MCA-2016");
   System.out.println("27 June 2023");
        while (true) {
            System.out.println("1. Add element at the front");
            System.out.println("2. Add element at the end");
            System.out.println("3. Remove element from the front");
            System.out.println("4. Remove element from the end");
            System.out.println("5. Print elements in the deque");
            System.out.println("6. Exit");
            System.out.print("Enter your choice: ");
            int choice = scanner.nextInt();
```

```
switch (choice) {
    case 1:
        System.out.print("Enter the element to add at the front: ");
        int elementFront = scanner.nextInt();
        deque.addFirst(elementFront);
        System.out.println("Element added at the front.");
        break;
    case 2:
        System.out.print("Enter the element to add at the end: ");
        int elementEnd = scanner.nextInt();
        deque.addLast(elementEnd);
        System.out.println("Element added at the end.");
        break;
    case 3:
        if (!deque.isEmpty()) {
            int removedFront = deque.removeFirst();
            System.out.println("Element removed from the front: " + removedFront);
        } else {
            System.out.println("Deque is empty. No element to remove from the front.");
        }
        break;
    case 4:
        if (!deque.isEmpty()) {
            int removedEnd = deque.removeLast();
            System.out.println("Element removed from the end: " + removedEnd);
        } else {
```

```
                System.out.println("Deque is empty. No element to remove from the end.");
            }
            break;
        case 5:
            System.out.println("Elements in the deque:");
            for (int element : deque) {
                System.out.println(element);
            }
            break;
        case 6:
            System.out.println("Exiting the program.");
            scanner.close();
            System.exit(0);
        default:
            System.out.println("Invalid choice. Please try again.");
      }
    }
  }
}
```

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q14.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q14
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 1
Enter the element to add at the front: 10
Element added at the front.
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 2
Enter the element to add at the end: 100
Element added at the end.
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 3
Element removed from the front: 10
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
6. Exit
Enter your choice: 5
Elements in the deque:
100
1. Add element at the front
2. Add element at the end
3. Remove element from the front
4. Remove element from the end
5. Print elements in the deque
```

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

CODE:-

```
import java.util.LinkedHashSet;
import java.util.Scanner;
import java.util.Set;

public class Q15 {
    public static void main(String[] args) {
        Set<Integer> set = new LinkedHashSet<>();

        Scanner scanner = new Scanner(System.in);
         System.out.println("ASWATHY CHANDRAN");
   System.out.println("SJC22MCA-2016");
   System.out.println("27 June 2023");

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

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

```
        System.out.println("Elements in the set:");
        for (int element : set) {
            System.out.println(element);
        }

        scanner.close();
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q15.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q15
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the number of elements to add: 3
Enter the elements:
3
4
7
Elements in the set:
3
4
7
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

16. Write a Java program to compare two hash set.

CODE:-

```
import java.util.HashSet;
import java.util.Scanner;
import java.util.Set;

public class Q16 {
    public static void main(String[] args) {
        Set<Integer> set1 = new HashSet<>();
        Set<Integer> set2 = new HashSet<>();

        Scanner scanner = new Scanner(System.in);

        // Input for Set 1
        System.out.println("ASWATHY CHANDRAN");
   System.out.println("SJC22MCA-2016");
   System.out.println("27 June 2023");
        System.out.print("Enter the number of elements in Set 1: ");
        int numElements1 = scanner.nextInt();
        System.out.println("Enter the elements for Set 1:");
        for (int i = 0; i < numElements1; i++) {
            int element = scanner.nextInt();
            set1.add(element);
        }
```

```
        // Input for Set 2
        System.out.print("Enter the number of elements in Set 2: ");
        int numElements2 = scanner.nextInt();
        System.out.println("Enter the elements for Set 2:");
        for (int i = 0; i < numElements2; i++) {
            int element = scanner.nextInt();
            set2.add(element);
        }

        // Comparison
        boolean isEqual = set1.equals(set2);

        // Output
        System.out.println("Set 1: " + set1);
        System.out.println("Set 2: " + set2);
        if (isEqual) {
            System.out.println("Set 1 and Set 2 are equal.");
        } else {
            System.out.println("Set 1 and Set 2 are not equal.");
        }

        scanner.close();
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q16.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q16
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the number of elements in Set 1: 2
Enter the elements for Set 1:
2
4
Enter the number of elements in Set 2: 2
Enter the elements for Set 2:
8
9
Set 1: [2, 4]
Set 2: [8, 9]
Set 1 and Set 2 are not equal.
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

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

CODE:-

```
import java.util.HashMap;
import java.util.Map;
import java.util.Scanner;

public class Q17{
    public static void main(String[] args) {
        Map<String, Integer> map = new HashMap<>();

        Scanner scanner = new Scanner(System.in);

        // Adding elements to the map
        System.out.println("ASWATHY CHANDRAN");
   System.out.println("SJC22MCA-2016");
   System.out.println("27 June 2023");
        System.out.print("Enter the number of elements to add: ");
        int numElements = scanner.nextInt();
        scanner.nextLine(); // Consume the newline character

        System.out.println("Enter the elements (key-value pairs):");
        for (int i = 0; i < numElements; i++) {
            String key = scanner.nextLine();
```

```
        int value = scanner.nextInt();
        scanner.nextLine(); // Consume the newline character
        map.put(key, value);
    }

    // Printing the initial map
    System.out.println("Initial Map:");
    printMap(map);

    // Changing an element
    System.out.print("Enter the key to change the value: ");
    String keyToChange = scanner.nextLine();
    if (map.containsKey(keyToChange)) {
        System.out.print("Enter the new value: ");
        int newValue = scanner.nextInt();
        scanner.nextLine(); // Consume the newline character
        map.put(keyToChange, newValue);
        System.out.println("Value changed successfully.");
    } else {
        System.out.println("Key not found in the map.");
    }

    // Removing an element
    System.out.print("Enter the key to remove the element: ");
    String keyToRemove = scanner.nextLine();
    if (map.containsKey(keyToRemove)) {
```

```
            map.remove(keyToRemove);
            System.out.println("Element removed successfully.");
        } else {
            System.out.println("Key not found in the map.");
        }

        // Printing the final map
        System.out.println("Final Map:");
        printMap(map);

        scanner.close();
    }

    private static void printMap(Map<String, Integer> map) {
        for (Map.Entry<String, Integer> entry : map.entrySet()) {
            System.out.println("Key: " + entry.getKey() + ", Value: " + entry.getValue());
        }
        System.out.println();
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q17.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q17
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the number of elements to add: 2
Enter the elements (key-value pairs):
2
4
6
7
Initial Map:
Key: 2, Value: 4
Key: 6, Value: 7

Enter the key to change the value: 2
Enter the new value: 9
Value changed successfully.
Enter the key to remove the element: 7
Key not found in the map.
Final Map:
Key: 2, Value: 9
Key: 6, Value: 7

(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```

18. Program to Convert HashMap to TreeMap

CODE

```
import java.util.HashMap;
import java.util.Map;
import java.util.Scanner;
import java.util.TreeMap;

public class Q18{
    public static void main(String[] args) {
        Map<String, Integer> hashMap = new HashMap<>();

        Scanner scanner = new Scanner(System.in);

        // Adding elements to the HashMap
        System.out.print("Enter the number of elements to add: ");
        int numElements = scanner.nextInt();
        scanner.nextLine(); // Consume the newline character
        System.out.println("ASWATHY CHANDRAN");
   System.out.println("SJC22MCA-2016");
   System.out.println("27 June 2023");
        System.out.println("Enter the elements (key-value pairs):");
        for (int i = 0; i < numElements; i++) {
            String key = scanner.nextLine();
            int value = scanner.nextInt();
```

```
            scanner.nextLine(); // Consume the newline character
            hashMap.put(key, value);
        }

        // Printing the initial HashMap
        System.out.println("Initial HashMap:");
        printMap(hashMap);

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

        // Printing the final TreeMap
        System.out.println("Final TreeMap:");
        printMap(treeMap);

        scanner.close();
    }

    private static void printMap(Map<String, Integer> map) {
        for (Map.Entry<String, Integer> entry : map.entrySet()) {
            System.out.println("Key: " + entry.getKey() + ", Value: " + entry.getValue());
        }
        System.out.println();
    }
}
```

OUTPUT

```
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ javac Q18.java
(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$ java Q18
Enter the number of elements to add: 3
ASWATHY CHANDRAN
SJC22MCA-2016
27 June 2023
Enter the elements (key-value pairs):
2
4
8
9
3
5
Initial HashMap:
Key: 2, Value: 4
Key: 3, Value: 5
Key: 8, Value: 9

Final TreeMap:
Key: 2, Value: 4
Key: 3, Value: 5
Key: 8, Value: 9

(base) sjcet@Z238-UL:~/Aswathy/JAVA/c4$
```