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

Program:

Area.java

```
package graphics;
import graphics.circle;
import graphics.rectangle;
import graphics.square;
import graphics.triangle;
import java.util.Scanner;

public class Area
{
   public static void main(String[] args)
   {
      Scanner sc = new Scanner(System.in);
      System.out.println("PONNU AUGUSTINE   23MCA044  15/04/24");
      int choice;
      circle obj1 = new circle();
      rectangle obj2 = new rectangle();
      square obj3 = new square();
      triangle obj4 = new triangle();
      do
      {
            System.out.println("Choose any    1)Circle   2)Rectangle   3)Square  4)Triangle
5)EXIT");
            choice = sc.nextInt();
            switch (choice)
            {
               case 1:
                  obj1.area();
                  break;
               case 2:
                  obj2.area();
                  break;
               case 3:
                  obj3.area();
                  break;
               case 4:
                  obj4.area();
                  break;
```

```
                case 5:
                    break;
                default:
                    break;
            }
        }while(choice!=5);
    }
}
```

circle.java

```
package graphics;
import java.util.Scanner;
public class circle implements  area_cal
{
    int radius;
    @Override
    public void area()
    {
        Scanner sc = new Scanner(System.in);
        System.out.println("Input radius of circle : ");
        radius = sc.nextInt();
        String area = Double.toString(Math.PI*radius*radius);
        System.out.println("Area of the circle is : "+area);
    }
}
```

rectangle.java

```
package graphics;
import java.util.Scanner;
public class rectangle implements area_cal
{
    int l,b;
    @Override
    public void area()
    {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter the length of the rectangle :");
        l = sc.nextInt();
        System.out.println("Enter the breath of the rectangle");
        b = sc.nextInt();
        System.out.println("Area of the rectangle = "+l*b);
    }
}
```

square.java

```
package graphics;
import java.util.Scanner;
public class square implements area_cal
{
   int side;
   @Override
   public void area()
   {
      Scanner sc = new Scanner(System.in);
      System.out.println("Input side length of square : ");
      side = sc.nextInt();
      String area = Double.toString(side*side);
      System.out.println("Area of the square : "+area);
   }
}
```

triangle.java

```
package graphics;
import java.util.Scanner;
public class triangle implements  area_cal
{
   int height;
   int breadth;
   @Override
   public void area()
   {
      Scanner sc = new Scanner(System.in);
      System.out.println("Input height of the triangle : ");
      height = sc.nextInt();
      System.out.println("Input breadth of triangle : ");
      breadth = sc.nextInt();
      String area = Double.toString((height*breadth)/2f);
      System.out.println("Area of the triangle is : "+area);
   }
}
```

areacal.java

```
package graphics;
public interface area_cal
{
   void area();
}
```

Output:

```
C:\Users\ponnu\java\cycle4>javac graphics/Area.java

C:\Users\ponnu\java\cycle4>java graphics/Area
PONNU AUGUSTINE   23MCA044  15/04/24
Choose any    1)Circle   2)Rectangle   3)Square  4)Triangle 5)EXIT
1
Input radius of circle :
3
Area of the circle is : 28.274333882308138
Choose any    1)Circle   2)Rectangle   3)Square  4)Triangle 5)EXIT
2
Enter the length of the rectangle :
4
Enter the breath of the rectangle
3
Area of the rectangle = 12
Choose any    1)Circle   2)Rectangle   3)Square  4)Triangle 5)EXIT
3
Input side length of square :
3
Area of the square : 9.0
Choose any    1)Circle   2)Rectangle   3)Square  4)Triangle 5)EXIT
4
Input height of the triangle :
4
Input breadth of triangle :
3
Area of the triangle is : 6.0
Choose any    1)Circle   2)Rectangle   3)Square  4)Triangle 5)EXIT
5
```

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

Program:

ArithmeticMain.java

```
import arithmetic.ArithmeticOperations;
import java.util.Scanner;
public class ArithmeticMain
{
	public static void main(String[] args)
	{
		System.out.println("PONNU AUGUSTINE   23MCA044  15/04/24");
		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));
	}
}
```

Addition.java

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

Subtraction.java

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

Multiplication.java

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

Division.java

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

Output:

```
C:\Users\ponnu\java\cycle4>javac ArithmeticMain.java

C:\Users\ponnu\java\cycle4>java ArithmeticMain
PONNU AUGUSTINE   23MCA044  15/04/24
Enter the first number: 4
Enter the second number: 2
Addition: 6.0
Subtraction: 2.0
Multiplication: 8.0
Division: 2.0
```

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

Program:

```
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("PONNU AUGUSTINE   23MCA044  15/04/24");
		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:

```
C:\Users\ponnu\java\cycle4>javac Q3.java

C:\Users\ponnu\java\cycle4>java Q3
PONNU AUGUSTINE   23MCA044  15/04/24
Enter the username:
student
Enter the password:
student123
Authentication successful...
```

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

Program:

```
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("PONNU AUGUSTINE   23MCA044  15/04/24");
		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

```
C:\Users\ponnu\java\cycle4>javac Average.java

C:\Users\ponnu\java\cycle4>java Average
PONNU AUGUSTINE   23MCA044  15/04/24
Enter n numbers:
4
Enter number1
4
Enter number2
2
Enter number3
6
Enter number4
1
Average is 3.25
```

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

Program:

```
import java.util.*;
public class Linked
{
	public static void main(String[] args)
	{
		System.out.println("PONNU AUGUSTINE   23MCA044  15/04/24");
		System.out.println();
		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

```
C:\Users\ponnu\java\cycle4>javac Linked.java

C:\Users\ponnu\java\cycle4>java Linked
PONNU AUGUSTINE   23MCA044  15/04/24

[Olympics Medals, Gold, Silver, Bronze]
[Olympics Medals, Gold, Silver]
[Olympics Medals, Gold]
[Olympics Medals]
[]
```

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

Program:

```
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("PONNU AUGUSTINE  23MCA044  15/04/24");
		System.out.println();
		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

```
C:\Users\ponnu\java\cycle4>javac Q12.java

C:\Users\ponnu\java\cycle4>java Q12
PONNU AUGUSTINE   23MCA044  15/04/24

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]
```

23. Write a Java program to compare two hash set

Program:

```
import java.util.HashSet;
import java.util.Scanner;
import java.util.Set;
public class Q16
{
	public static void main(String[] args)
	{
		System.out.println("PONNU AUGUSTINE   23MCA044  15/04/24");
		System.out.println();
		Set<Integer> set1 = new HashSet<>();
		Set<Integer> set2 = new HashSet<>();
		Scanner scanner = new Scanner(System.in);
		// Input for Set 1
		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

```
C:\Users\ponnu\java\cycle4>javac Q16.java

C:\Users\ponnu\java\cycle4>java Q16
PONNU AUGUSTINE   23MCA044  15/04/24

Enter the number of elements in Set 1: 3
Enter the elements for Set 1:
1
2
3
Enter the number of elements in Set 2: 3
Enter the elements for Set 2:
1
2
3
Set 1: [1, 2, 3]
Set 2: [1, 2, 3]
Set 1 and Set 2 are equal.
```