

ASSIGNMENT 1

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Aim: Design a class 'Complex' with data members for real and imaginary part. Provide default and parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.

Theory:

1. Class

Class is a blueprint or a set of instructions to build a specific type of object. It is a basic concept of Object-Oriented Programming which revolve around the real-life entities. Class in Java determines how an object will behave and what the object will contain.

Syntax:

```
class <class_name>{  
    field;  
    method;  
}
```

2. Object

Object is an instance of a class. An object in OOPS is nothing but a self-contained component which consists of methods and properties to make a particular type of data useful. For example, color name, table, bag, barking. When you send a message to an object, you are asking the object to invoke or execute one of its methods as defined in the class.

From a programming point of view, an object in OOPS can include a data structure, a variable, or a function. It has a memory location allocated. Java Objects are designed as class hierarchies.

Syntax:

```
ClassName ReferenceVariable = new ClassName();
```

3. Constructor

In Java, a constructor is a block of codes similar to the method. It is called when an instance of the class is created. At the time of calling constructor, memory for the object is allocated in the memory. It is a special type of method which is used to initialize the object. Every time an object is created using the new() keyword, at least one constructor is called. It calls a default constructor if there is no constructor available in the class. In such case, Java compiler provides a default constructor by default.

There are two types of constructors in Java: default constructor, and parameterized constructor.

Code:

```
import java.util.Scanner;

public class Complex {

    public static void main(String[] args) {
        System.out.println("***** Complex Numbers Calculator *****\n");

        Menu: while (true) {
            float num1, num2;
            int opt;
            Complex_Operations cal = new Complex_Operations();
            Scanner input = new Scanner(System.in);

            System.out.println("Enter the real and imaginary part of first no.");
            num1 = input.nextInt();
            num2 = input.nextInt();
            Complex_Operations obj1 = new Complex_Operations(num1, num2);

            System.out.println("\nEnter the real and imaginary part of second no.");
            num1 = input.nextInt();
            num2 = input.nextInt();
            Complex_Operations obj2 = new Complex_Operations(num1, num2);

            System.out.println("\nSelect your operation\n");
            System.out.print("1.Add");
            System.out.print("\t2.Substract");
            System.out.print("\t3.Multiplication");
            System.out.print("\t4.Division");
            System.out.print("\t5.Exit");
            System.out.print("\n\nYour choice: ");
            opt = input.nextInt();
            System.out.println();

            switch (opt) {
                case 1:
                    cal.add(obj1, obj2);
                    break;
                case 2:
                    cal.sub(obj1, obj2);
                    break;
                case 3:
                    cal.mult(obj1, obj2);
                    break;
                case 4:
                    cal.div(obj1, obj2);
                    break;
                case 5:
                    System.out.println("x-x-x-x-x Thank you x-x-x-x-x");
                    input.close();
                    break Menu;
                default:
                    System.out.println("Invalid option");
            }
        }

        Decide: while (true) {
            System.out.println("\n1.Continue\t\t2.Exit");
```

```

        System.out.print("\nYour choice: ");
        opt = input.nextInt();
        System.out.println();
        switch (opt) {
            case 1:
                continue Menu;
            case 2:
                System.out.println("x-x-x-x-x Thank you x-x-x-x-x");
                input.close();
                break Menu;
            default:
                System.out.println("Invalid option");
                continue Decide;
        }
    }
}
}
}
}

```

```

public class Complex_Operations {
    float real, imag;

    Complex_Operations() {
        real = 0;
        imag = 0;
    }

    Complex_Operations(float x, float y) {
        real = x;
        imag = y;
    }

    void add(Complex_Operations c1, Complex_Operations c2) {
        float real, imag;
        real = (c1.real + c2.real);
        imag = (c1.imag + c2.imag);
        System.out.println("First complex number is : (" + c1.real + ")+(" + c1.imag + ")i");
        System.out.println("Second complex number is : (" + c2.real + ")+(" + c2.imag + ")i");
        System.out.println("*****");
        System.out.println("Addition is : (" + real + ")+(" + imag + ")i");
        System.out.println("*****");
    }

    void sub(Complex_Operations c1, Complex_Operations c2) {
        float real, imag;
        real = (c1.real - c2.real);
        imag = (c1.imag - c2.imag);
        System.out.println("First complex number is : (" + c1.real + ")+(" + c1.imag + ")i");
        System.out.println("Second complex number is : (" + c2.real + ")+(" + c2.imag + ")i");
        System.out.println("*****");
        System.out.println("Substraction is : (" + real + ")+(" + imag + ")i");
        System.out.println("*****");
    }

    void mult(Complex_Operations c1, Complex_Operations c2) {
        float real, imag, a1, b1, a2, b2;
        a1 = c1.real;
        b1 = c1.imag;
        a2 = c2.real;
    }
}

```

```

    b2 = c2.imag;
    real = ((a1 * a2) - (b1 * b2));
    imag = ((a1 * b2) + (a2 * b1));
    System.out.println("First complex number is : (" + c1.real + ") + (" + c1.imag + ")i");
    System.out.println("Second complex number is : (" + c2.real + ") + (" + c2.imag + ")i");
    System.out.println("*****");
    System.out.println("Multiplication is : (" + real + ") + (" + imag + ")i");
    System.out.println("*****");
}

void div(Complex_Operations c1, Complex_Operations c2) {
    float real, imag, a1, b1, a2, b2;
    a1 = c1.real;
    b1 = c1.imag;
    a2 = c2.real;
    b2 = c2.imag;
    real = (((a1 * a2) + (b1 * b2)) / ((a2 * a2) + (b2 * b2)));
    imag = (((a2 * b1) - (a1 * b2)) / ((a2 * a2) + (b2 * b2)));
    System.out.println("First complex number is : (" + c1.real + ") + (" + c1.imag + ")i");
    System.out.println("Second complex number is : (" + c2.real + ") + (" + c2.imag + ")i");
    System.out.println("*****");
    System.out.println("Division is : (" + real + ") + (" + imag + ")i");
    System.out.println("*****");
}

}

```

Output:

```
eclipse-workspace - OOP_Assig/src/Assig_1/Complex_Operations.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
[Icons] Problems @ Javadoc Declaration Console Debug
<terminated> Complex (1) [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Nov 26, 2021, 1:02:56 PM - 1:04:47 PM)
***** Complex Numbers Calculator *****

Enter the real and imaginary part of first no.
12 7

Enter the real and imaginary part of second no.
5 9

Select your operation

1.Add 2.Subtract 3.Multiplication 4.Division 5.Exit

Your choice: 1

First complex number is : (12.0)+(7.0)i
Second complex number is : (5.0)+(9.0)i
*****
Addition is : (17.0)+(16.0)i
*****

1.Continue 2.Exit

Your choice: 1

Enter the real and imaginary part of first no.
3 8

Enter the real and imaginary part of second no.
14 6

Select your operation

1.Add 2.Subtract 3.Multiplication 4.Division 5.Exit

Your choice: 2

First complex number is : (3.0)+(8.0)i
Second complex number is : (14.0)+(6.0)i
*****
Subtraction is : (-11.0)+(2.0)i
*****

1.Continue 2.Exit

Your choice: 1

Enter the real and imaginary part of first no.
6 15

Enter the real and imaginary part of second no.
14 3

Select your operation

1.Add 2.Subtract 3.Multiplication 4.Division 5.Exit

Your choice: 3

First complex number is : (6.0)+(15.0)i
Second complex number is : (14.0)+(3.0)i
*****
Multiplication is : (39.0)+(228.0)i
*****

1.Continue 2.Exit

Your choice: 1

Enter the real and imaginary part of first no.
8 9

Enter the real and imaginary part of second no.
11 4

Select your operation

1.Add 2.Subtract 3.Multiplication 4.Division 5.Exit

Your choice: 4

First complex number is : (8.0)+(9.0)i
Second complex number is : (11.0)+(4.0)i
*****
Division is : (0.90510947)+(0.4890511)i
*****

1.Continue 2.Exit

Your choice: 2
|
x-x-x-x-x Thank you x-x-x-x-x
```