

ASSIGNMENT NO. 1

Title - Classes and object

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.

Objective - To learn the concept of class, object and constructor.

Theory –

A] What is class in Java?

—→ A class is a user defined blueprint or prototype from which objects are created. It represents the set of properties or methods that are common to all objects of one type. It is a template or blueprint from which objects are created. It is a logical entity. It can't be physical. A class in Java can contain: a)Fields b)Methods

c)Constructors

d)Blocks

e)Nested class and interface Syntax

to declare a class:

```
class <class_name>
```

```
{
```

```
    field;
```

```
    method;
```

```
}
```

B]What is object in Java?

—> It is a basic unit of Object-Oriented Programming and represents the real life entities. An object is an instance of a class. A class is a template or blueprint from which objects are created. So, an object is the instance(result) of a class.

An object consists of :

- a)State: It is represented by attributes of an object. It also reflects the properties of an object.
- b)Behavior: It is represented by methods of an object. It also reflects the response of an object with other objects.
- c)Identity: It gives a unique name to an object and enables one object to interact with other objects.

C]Constructors in Java-

—> 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.

Rules for creating Java constructor-

- Constructor name must be the same as its class name
- A Constructor must have no explicit return type
- A Java constructor cannot be abstract, static, final, and synchronized

Types of Java constructors

*Default constructor (no-arg constructor):-

A constructor that has no parameter is known as the default constructor. If we don't define a constructor in a class, then the compiler creates default constructor(with no arguments) for the class. And if we write a constructor with arguments or no-arguments then the compiler does not create a default constructor. *Parameterized constructor:-

A constructor that has parameters is known as parameterized constructor. If we want to initialize fields of the class with your own values, then use a parameterized constructor.

Algorithm –

1. Start.
2. Create a complex class with member variables - real, imagi, r, i and d of float data type.
3. Define the default constructor and initialize member variables with 0.
4. Define the parameterized constructor with formal arguments and initialize them with actual arguments.
5. Define different method to perform Addition, Subtraction, Multiplication and Division for the complex numbers with parameters.
6. Create the main class, define the main function with input variables and create an object 'result' for the class complex.
7. Accept first real and imaginary number, second real and imaginary number and user choice by using do-while loop.
8. Using switch case-
 - If entered choice is 1 then call the Addition method and display the Result.
 - If entered choice is 2 then call the Subtraction method and display the result.
 - If entered choice is 3 then call the Multiplication method and display the result.
 - If entered choice is 4 then call the Division method and display the result.
 - Else display Invalid Choice!
9. Stop.

Program:-

```
import java.util.Scanner;
public class Complex {    float
real, imagi;    float
r,i,d;

    Complex() {        real
= 0;
        imagi = 0;
    }

    Complex(float no1, float no2) {
        real = no1;
        imagi = no2;
    }

    static void add(Complex C1, Complex C2)
    {
        //(a+bi)+(c+di)=(a+c)+(bi+di)
        float
r,i;
        r = C1.real + C2.real;
i = C1.imagi + C2.imagi;
        System.out.println("Addition of complex number is: " + r + "+" + i + "i");
    }

    static void sub(Complex C1, Complex C2)
    { // (a+bi)-(c+di)= (a-c) +(bi-di)
        float
r,i;
        r = C1.real - C2.real;
i = C1.imagi - C2.imagi;
        System.out.println("Subtraction of complex number is: " + r + "+" + i + "i");
    }

    static void multi(Complex C1, Complex C2)
    { //(a+bi) * (c+di) = (a*c - b*d) + (a*di + c*bi)
        float
r,i;
        r = (C1.real * C2.real) - (C1.imagi * C2.imagi);
```

```

i = (C1.real * C2.imagi) + (C1.imagi * C2.real);      System.out.println("Multiplication of complex
number is: " + r + "+" + i + "i");
}

```

```

static void div(Complex C1, Complex C2) {
    // (a+bi)/(c+di)= (a*c + b*d) + (c*di - a*bi) /(c^2 + d^2)
    float
r,i,d;
    d = (C2.real)*(C2.real) + (C2.imagi)*(C2.imagi);
r = ((C1.real * C2.real)+(C1.imagi * C2.imagi)) /d;      i
= ((C1.imagi * C2.real)-(C1.real * C2.imagi))/d;
    System.out.println ("Division of complex number is: " + r + "+" + i + "i");
}

```

```

public static void main(String[] args) {      float
no1, no2;
    Scanner sc = new Scanner(System.in);
    Complex result = new Complex();

    System.out.println("Enter first number ");
no1 = sc.nextFloat();      no2 = sc.nextFloat();
    Complex obj1 = new Complex(no1,no2);

    System.out.println("Enter second number ");
no1 = sc.nextFloat();
no2 = sc.nextFloat();
    Complex obj2 = new Complex(no1,no2);
    int
ch;
do {
    System.out.print("\nChoose choice of operation- \n");
    System.out.print("1)Addition\n");
    System.out.print("2)Subtraction\n");
    System.out.print("3)Multiplication\n");
    System.out.print("4)Division\n");
    System.out.print("5)Exit\n");

    System.out.println("\nEnter your choice");      ch
= sc.nextInt();
    switch (ch)

```

```

{
    case 1:
result.add(obj1, obj2);
        break;
    case 2:
result.sub(obj1, obj2);
        break;
    case
3:
        result.multi(obj1,
obj2);
        break;
    case 4:
        result.div(obj1,
obj2);
        break;
    default:
        System.out.println("INVALID CHOICE! CHOOSE AGAIN");
    }
}while(ch!=5);
}
}

```

```

Complex.java x
1  import java.util.Scanner;
2  public class Complex {
3      float real, imagi;
4      float r,i,d;
5
6      Complex() {
7          real = 0;
8          imagi = 0;
9      }
10
11     Complex(float no1, float no2) {
12         real = no1;
13         imagi = no2;
14     }
15
16     @
17     static void add(Complex C1, Complex C2)
18     { // (a+bi)+(c+di)=(a+c)+(bi+di)
19
20         float r,i;
21         r = C1.real + C2.real;
22         i = C1.imagi + C2.imagi;
23         System.out.println("Addition of complex number is: " + r + "+" + i + "i");
24     }
25
26     @
27     static void sub(Complex C1, Complex C2)
28     { // (a+bi)-(c+di)= (a-c) +(bi-di)
29
30         float r,i;
31         r = C1.real - C2.real;
32         i = C1.imagi - C2.imagi;
33
34         System.out.println("Subtraction of complex number is: " + r + "+" + i + "i");
35     }
36
37     @
38     static void multi(Complex C1, Complex C2)
39     { // (a+bi) * (c+di) = (a*c - b*d) + (a*di + c*bi)
40
41         float r,i;
42         r = (C1.real * C2.real) - (C1.imagi * C2.imagi);
43         i = (C1.real * C2.imagi) + (C1.imagi * C2.real);
44         System.out.println("Multiplication of complex number is: " + r + "+" + i + "i");
45     }
46
47     @
48     static void div(Complex C1, Complex C2)
49     { // (a+bi)/(c+di)= (a*c + b*d) + (c*di - a*bi) /(c^2 + d^2)
50
51         float r,i,d;
52         d = (C2.real)*(C2.real) + (C2.imagi)*(C2.imagi);
53         r = ((C1.real * C2.real)+(C1.imagi * C2.imagi)) /d;
54         i = ((C1.imagi * C2.real)-(C1.real * C2.imagi))/d;
55         System.out.println ("Division of complex number is: " + r + "+" + i + "i");
56     }
57
58     public static void main(String[] args) {
59         float no1, no2;
60         Scanner sc = new Scanner(System.in);
61         Complex result = new Complex();
62
63         System.out.println("Enter first number ");
64         no1 = sc.nextFloat();

```

```

61     no2 = sc.nextFloat();
62     Complex obj1 = new Complex(no1,no2);
63
64     System.out.println("Enter second number ");
65     no1 = sc.nextFloat();
66     no2 = sc.nextFloat();
67     Complex obj2 = new Complex(no1,no2);
68
69     int ch;
70     do {
71         System.out.print("\nChoose choice of operation- \n");
72         System.out.print("1)Addition\n");
73         System.out.print("2)Subtraction\n");
74         System.out.print("3)Multiplication\n");
75         System.out.print("4)Division\n");
76         System.out.print("5)Exit\n");
77
78         System.out.println("\nEnter your choice");
79         ch = sc.nextInt();
80
81         switch (ch) {
82             case 1:
83                 result.add(obj1, obj2);
84                 break;
85
86             case 2:
87                 result.sub(obj1, obj2);
88
89                 break;
90             case 3:
91                 result.multi(obj1, obj2);
92
93                 break;
94             case 4:
95                 result.div(obj1, obj2);
96
97                 break;
98             default:
99                 System.out.println("INVALID CHOICE! CHOOSE AGAIN");
100         }
101     }while(ch!=5);
102 }
103 }
104

```

OUTPUT-


```
Run: Complex x
"C:\Program Files\Java\jdk-16.0.2\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition
Enter first number
2 3
Enter second number
5 3

Choose choice of operation-
1)Addition
2)Subtraction
3)Multiplication
4)Division
5)Exit

Enter your choice
1
Addition of complex number is: 7.0+6.0i

Choose choice of operation-
1)Addition
2)Subtraction
3)Multiplication
4)Division
5)Exit

Enter your choice
3
Multiplication of complex number is: 1.0+21.0i

Choose choice of operation-
1)Addition
2)Subtraction
3)Multiplication
4)Division
5)Exit

Enter your choice
2
Subtraction of complex number is: -3.0+0.0i

Choose choice of operation-
1)Addition
2)Subtraction
3)Multiplication
4)Division
5)Exit

Enter your choice
4
Division of complex number is: 0.5588235+0.2647059i

Choose choice of operation-
1)Addition
2)Subtraction
3)Multiplication
4)Division
5)Exit
```

```
Enter your choice
7
INVALID CHOICE! CHOOSE AGAIN

Choose choice of operation-
1)Addition
2)Subtraction
3)Multiplication
4)Division
5)Exit

Enter your choice
5
INVALID CHOICE! CHOOSE AGAIN

Process finished with exit code 0
.
```

Conclusion- We have studied concept of class, object and constructor and hence, arithmetic operation of two complex numbers performed