Unit-3

Class and Object

Class: Class is a fundamental concept of object-oriented programming (OOP). A class is a group of objects which have common properties. It is a template or blueprint from which objects are created.

A class in Java can contain:

- **Declarations**
  - A class is declared using the class keyword followed by the class name. For example:

```
public class Student
  {
    //Data Member
    //Member Function
  }
```

- **Fields**
  - Fields can be of any data type, including primitive types, reference types, or other classes. Example. `int a,b;`
- **Methods**
  - Classes contain methods, which represent the behavior of the class.
  - Example:

```
public void Add(int x, int b)

 {

 }
```

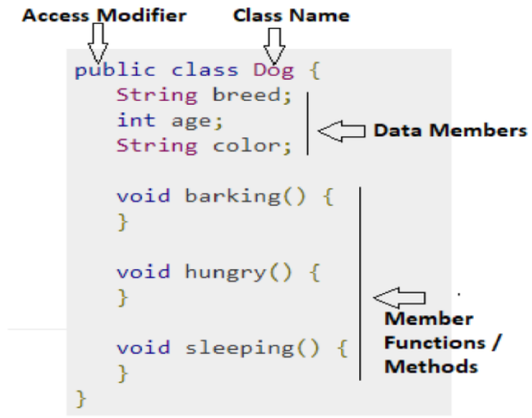
- **Constructors**
  - Constructors are special methods used for initializing objects.

```
public class Student
{
  public Student()
  {

  }
}
```

- **Access Modifier**
  - Classes, fields, and methods can have access modifiers such as **public**, **private**, **protected**, or **package-private (default).**
- **Class Body:** class body is surrounded by {}

General Form of Class:



```
public class Dog {
   String breed;
   int age;
   String color;

   void barking() {
   }

   void hungry() {
   }

   void sleeping() {
   }
}
```

Object: An entity that has **state** and **behavior** is known as an **object**.

An object has three characteristics:

- **State:** represents the data (value) of an object.
- **Behavior:** represents the behavior (functionality) of an object such as deposit, withdraw, etc.
- **Identity:** An object identity is typically implemented via a unique ID. The value of the ID is not visible to the external user. However, it is used internally by the JVM to identify each object uniquely.

For Example, Pen is an object. Its name is Reynolds; **color is white**, known as its **state**. It is **used to write**, so writing is its **behavior**.

There are three steps when creating an object from a class −

- **Declaration** − A variable declaration with a variable name with an object type.
- **Instantiation** − The 'new' keyword is used to create the object.

- **Initialization** − The 'new' keyword is followed by a call to a constructor. This call initializes the new object.

Syntax:

```
Student st=new Student();
```

Below Example shows implementation of Class and Object

```
public class App {
    public static void main(String[] args) throws Exception {
      Student st=new Student();
      st.DisplayName();
     }
  }
  class Student
  {
   public void DisplayName()
   {
    System.out.println("Sunil Chaudhary");
   }
  }
```

Abstraction	**Encapsulation**
Abstraction is a general concept formed by extracting common features from specific example or The act of withdrawing or removing something **unnecessary**	Encapsulation is the mechanism that binds together code and the data it manipulates, and keeps both **safe from outside interference** and **misuse**
You can use abstraction using **Interface** and **Abstract** class	You can implement encapsulation using **Access Modifiers**(public, protected and private)
Abstraction solves the problem in **Design** level	Encapsulation solves the problem in **Implementation** level
Hiding implementation using abstract class and interface	Encapsulation hiding data using getters and setters

Abstraction is a process of hiding the implementation details and showing only functionality to the user.

Abstraction means to show **What** part of functionality.

For example, if you have a class representing a car, the user of that class might only need to know how to **start** the car, **stop** the car, and perhaps how to **accelerate** and **brake**. They don't need to know the details of how the engine works or how the transmission shifts gears.

This is typically achieved using **abstract classes** and **interfaces**.

Using Abstract Class:

```java
public class App {
    public static void main(String[] args) throws Exception {
        Shape shape = new Circle();
        shape.draw(); // Output: Drawing Circle
     }
  }
abstract class Shape {
    abstract void draw(); // Abstract method
}
class Circle extends Shape {
    void draw() {
        System.out.println("Drawing Circle");
    }
}
class Rectangle extends Shape {
    void draw() {
        System.out.println("Drawing Rectangle");
    }
}
```

Using Interface

```java
public class App {
    public static void main(String[] args) throws Exception {
        Drawable circle = new Circle();
        circle.draw(); // Output: Drawing Circle
     }
  }
interface Drawable {
    void draw();
}
class Circle implements Drawable {
    public void draw() {
        System.out.println("Drawing Circle");
    }
}
class Rectangle implements Drawable {
    public void draw() {
        System.out.println("Drawing Rectangle");
    }
}
```

Encapsulation: **Encapsulation** is one of the fundamental concepts of Object Oriented Programming (OOP) paradigm. It is the process of *wrapping* the data stored in the member variables of a class with its member functions.
It is done in such a way that the data is hidden to everything outside the class scope, and can only be accessed and modified through its own member functions.

How to achieve Encapsulation:

- Declaring the class variables as **private** so that they are inaccessible from outside the scope of the class.
- Designing **getter** and **setter** methods for the class and using them accordingly.

Why do we need Encapsulation:

- It helps you in achieving loose coupling.
- Encapsulation makes the application simple and easy to debug.
- Allows the programmer to control the data accessibility of a class.

Advantages of Encapsulation:

- Cleaner, more organized and less complex code.
- More flexible code as can modify a unit independently without changing any other unit.
- Makes the code more secure.
- The code can be maintained at any point without breaking the classes that use the code.

LAB: Write a java program to achieve encapsulation using private access modifier.

Example: using private access modifier

```
public class App {
    private int length;
    private int breadth;
    public App(int l, int b)
    {
        this.length=l;
        this.breadth=b;
    }
    public void Area()
    {
        System.out.println(length*breadth);
    }
    public static void main(String[] args) throws Exception {

        App ap=new App(2,3);
        ap.Area();
    }
}
```

Output:6

LAB: Write a java program to achieve encapsulation using getter and setter.

Example: using **getter** and **setter**

```
public class App {
    private String author;
    private String title;
    public String getAuthor() {
        return author;
      }

      public void setAuthor(String a) {
        this.author = a;
      }

      public String getTitle() {
        return title;
      }

      public void setTitle(String t) {
        this.title = t;
      }
    public static void main(String[] args) throws Exception {

       App a=new App();
       a.setAuthor("Sunil Chaudhary");
       a.setTitle("MR.");
       System.out.println(a.getTitle()+" "+a.getAuthor());
    }
}
```

Output: MR. Sunil Chaudhary

Constructor:

A constructor is a block of codes similar to the method. It is called when an instance of the class is created.

Constructor name must be the same as its class name

A Constructor must have no explicit return type

There are three types of constructor in java.

- Default Constructor
- No-Args constructor
- Parameterized constructor

Default Constructor:

If we do not create any constructor, the Java compiler automatically creates a no-arg constructor during the execution of the program.

This constructor is called the default constructor.

```
public class App {
    int a;
    boolean b;
    public static void main(String[] args) throws Exception {
        App ap=new App();
        System.out.println(ap.a);
        System.out.println(ap.b);
     }
  }
```

No-Args Constructor:

constructor may or may not have any parameters (arguments).

If a constructor does not accept any parameters, it is known as a no-argument

```
public class App {

    public static void main(String[] args) throws Exception {
        Rectangle rect=new Rectangle();
        rect.Add();
     }
  }
  class Rectangle
  {
    int a=0;
    int b=0;
    public Rectangle()
    {
        a=5;
        b=6;
    }
    public void Add()
    {
        System.out.println(a+b);
    }
  }
```

Parameterized Constructor:

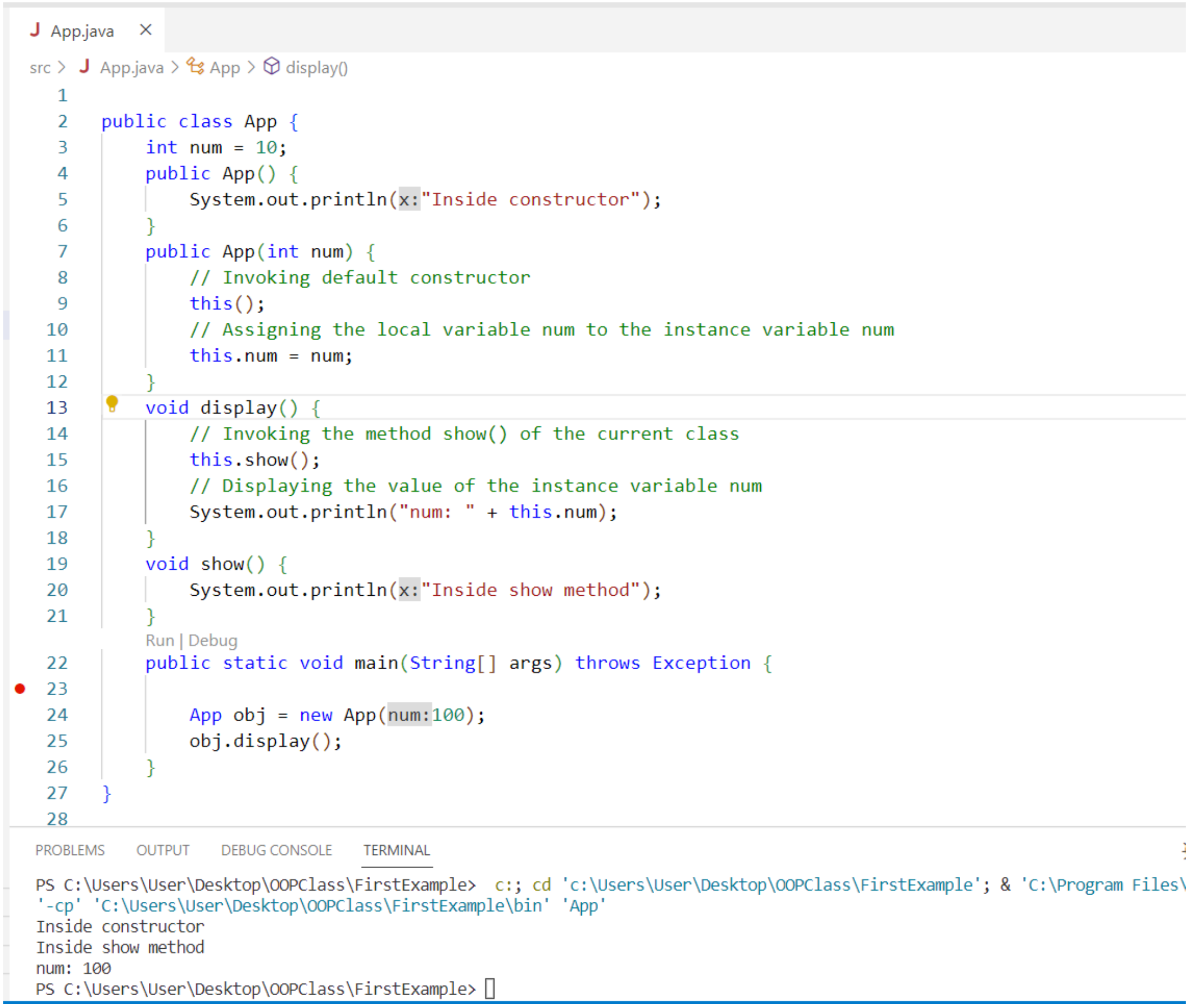
A Java constructor can also accept one or more parameters. Such constructors are known as parameterized constructors.

```
public class App {

    public static void main(String[] args) throws Exception {
        Rectangle rect=new Rectangle(5,6);
        rect.Add();
     }
  }
  class Rectangle
  {
    int first=0;
    int second=0;
    public Rectangle(int x, int y)
    {
        first=x;
        second=y;
    }
    public void Add()
    {
        System.out.println(first+second);
    }
  }
```

“this” keyword

- It can be used to call current class methods and fields, to pass an instance of the current class as a parameter,
- To differentiate between the local variable (variable that is declared inside the body of a method) and instance variables (variable is defined without the STATIC keyword, but as outside of a method declaration).
- To Invoke Default Constructor
- Using “this” reference can improve code readability and reduce naming conflicts.
- To Invoking **method** of **Current Class**



```java

public class App {
    int num = 10;
    public App() {
        System.out.println(x:"Inside constructor");
    }
    public App(int num) {
        // Invoking default constructor
        this();
        // Assigning the local variable num to the instance variable num
        this.num = num;
    }
    void display() {
        // Invoking the method show() of the current class
        this.show();
        // Displaying the value of the instance variable num
        System.out.println("num: " + this.num);
    }
    void show() {
        System.out.println(x:"Inside show method");
    }
    public static void main(String[] args) throws Exception {

        App obj = new App(num:100);
        obj.display();
    }
}

```

```
PS C:\Users\User\Desktop\OOPClass\FirstExample>  c:; cd 'c:\Users\User\Desktop\OOPClass\FirstExample'; & 'C:\Program Files\
'-cp' 'C:\Users\User\Desktop\OOPClass\FirstExample\bin' 'App'
Inside constructor
Inside show method
num: 100
PS C:\Users\User\Desktop\OOPClass\FirstExample> 
```