OBJECT-ORIENTED PROGRAMMING (OOPS) CONCEPTS IN JAVA

Object-Oriented Programming (OOP) is a programming paradigm that organizes software design around data, or objects, rather than functions and logic.

Java is an object-oriented language that follows key OOP principles such as **Encapsulation**, **Inheritence**, **Polymorphism**, and **Abstraction**.

1. Principles of OOP in Java:

a) Encapsulation :

Encapsulation is the concept of wrapping the data (variables) and methods (functions) that operate on the data into a single unit called a **class**.

The class's data is hidden from direct access by other classes and is only accessible through public getter / setter methods.

Example :

```
class Person {
    private String name;      // private variable
                                (encapsulation)
    // Public getter method for accessing private variable
public String getName () {
    return name;
}

// Public setter method for modifying private variable
public void setName (string name) {
    this.name = name;
}
}
```

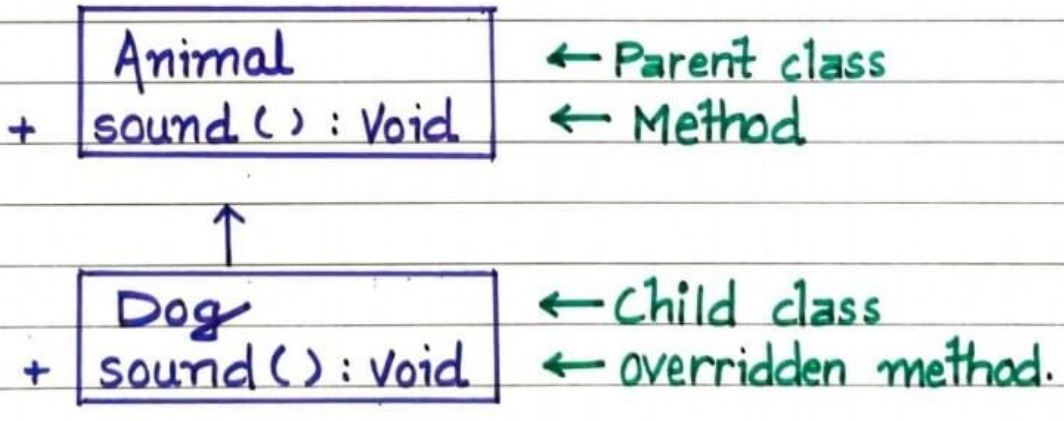
b) Inheritence :

Inheritence allows one class (child class) to inherit the properties and behaviors of another class (parent class). This promotes code reuse and the creation of a hierarchial class structure.

Example :

```
class Animal {
    void sound() {
        system.out.println ("Animal makes a sound");
    }
}

Class Dog extends Animal {
    void sound () {
        System.out.println ("Dog barks");
    }
}
```

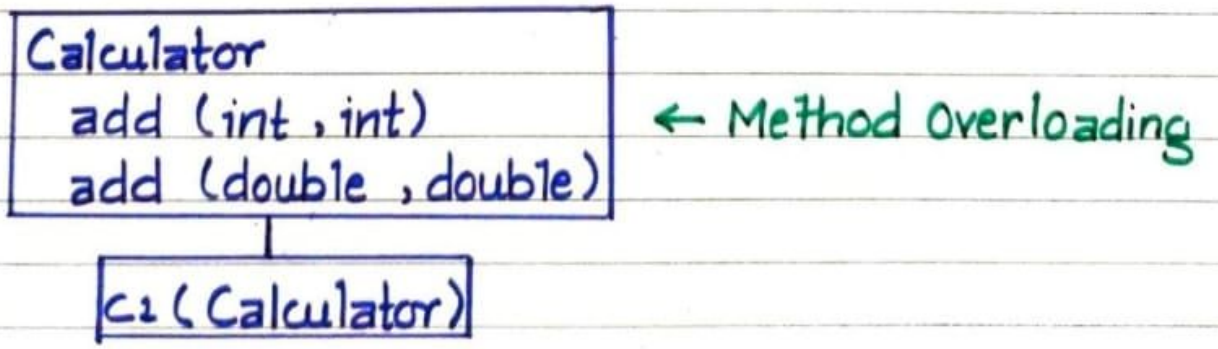


c) Polymorphism :

Polymorphism allows methods to behave differently depending on the object that invokes them.
This can be achieved through Method Overloading (compile-time) and Method Overriding. (runtime polymorphism).

Example : Method Overloading :

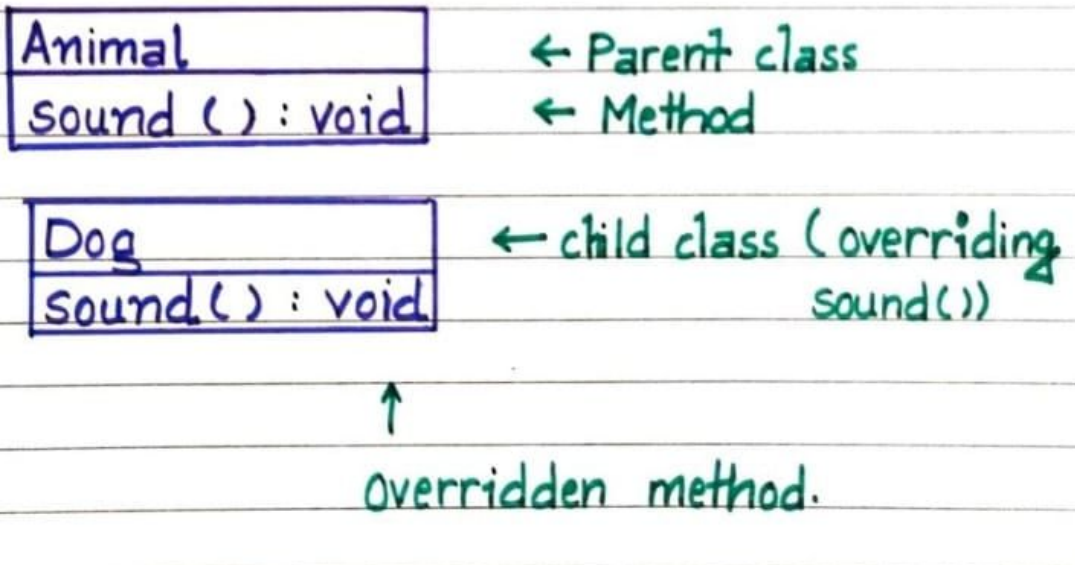
```
class Calculator {
    int add (int a , int b) {
        return a+b ;
    }
// Method overloading : same method name with
 different parameters.
double add (double a , double b) {
    return a + b ;
  }
}
```



Example : Method Overriding :

```
class Animal {
    void sound() {
        System.out.println("Animal makes a sound");
    }
}

Class Dog Extends Animal {
    @Override
    void sound() {
        System.out.println("Dog barks");
    }
}
```



d) Abstraction:

Abstraction is the concept of hiding the implementation details and exposing only the essential features of an object. This can be achieved using **abstract classes** or **interfaces**.

Example with Abstract class:

```
abstract class Shape {
    abstract void draw(); // Abstract method

  void color() {
    system.out.println("Coloring the shape");
  }
}

Class Circle extends Shape {
    @Override
    void draw() {
      System.out.println("Drawing circle");
  }
}
```

2. Classes and Objects:

- **Class:** A blueprint for creating objects, defining properties (attributes) and behaviours (methods).

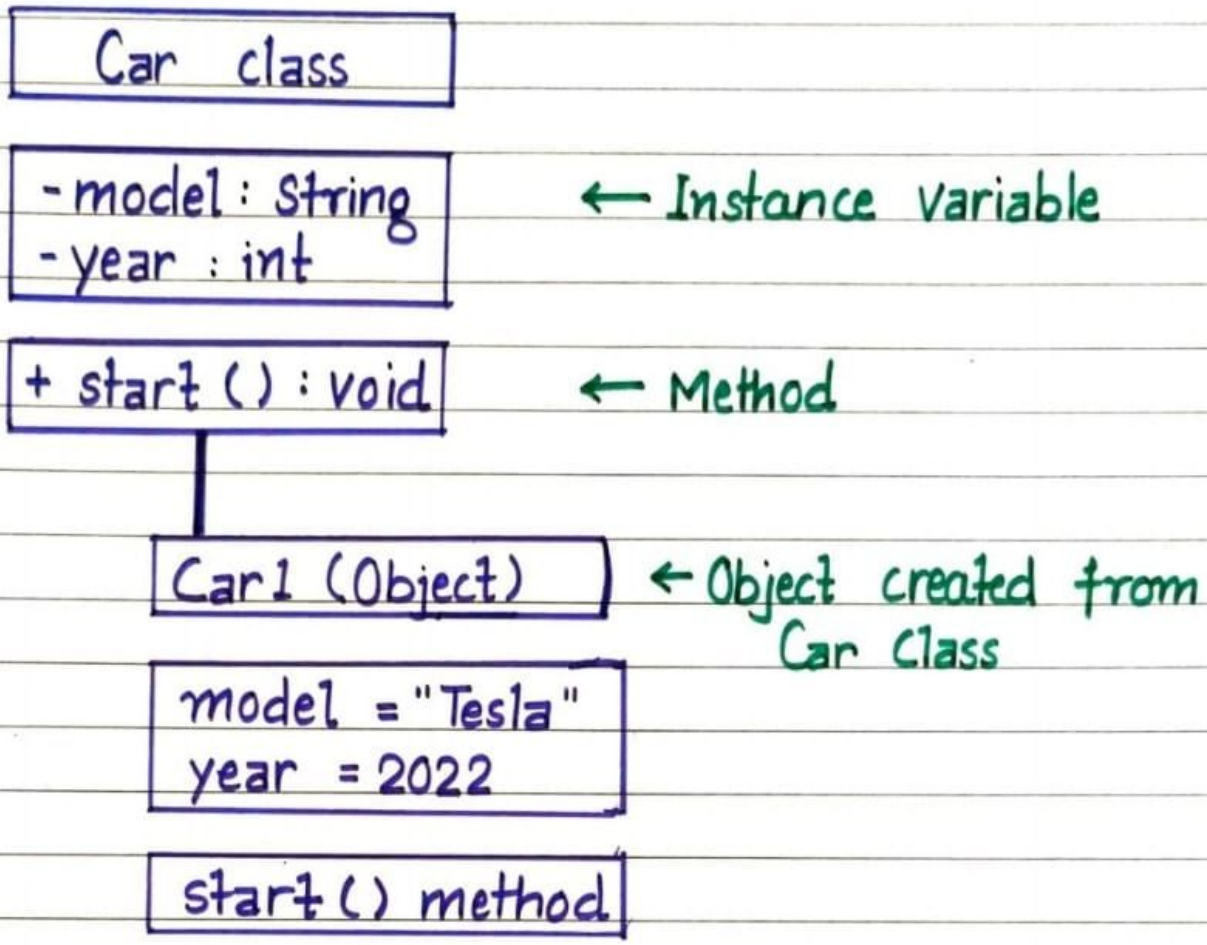
- **Object:** An instance of a class that holds data and can perform actions.

Example:

```
class Car {
    String model;
    int year;

  void start() {
     System.out.println("Car is starting");
   }
}

public class Main {
   public static void main(String[] args) {
      Car car1 = new Car(); //creating an object
      car1.model = "Tesla";
      car1.year = 2022;
      car1.start();    //calling the method
   }
}
```



3. Methods and Constructors:

- **Method:** A block of code that performs a specific task and can return a value.

- **Constructor:** A special method used to initialize objects. It is called when an object is created and does not have a return type.

Example of Constructor :

```
class Person {
    String name;
    int age;

  // constructor
  Person (String name, int age) {
    this.name = name;
    this.age = age;
  }
}

public class Main {
    public static void main (String[] args) {
      Person p1 = new Person ("John", 25);
    }                          //constructor called
}
```

4. this Keyword:

The this keyword refers to the current object instance. It is used to differentiate between instance variables and method parameters when they have the same name.

Example:

```
class Car {
    String model;
// constructor using 'this' to differentiate between
   instance variable and parameter

Car (String model) {
    this.model = model;
        //'this.model' refers to instance variable,
            'model' is the parameter.
  }
}
```

5. Static and Instance Members:

- **Instance Members:** Belong to an object and are created when the object is instantiated.
- **Static Members:** Belong to the class itself and are shared across all objects.

Example:

```
class Counter {
    int instanceCount = 0; // Instance variable
    static int staticCount = 0; // static variable

 // Method to increment counts
    void increment () {
        instantceCount ++ ;
        staticCount ++ ;
    }
}

public class Main {
  public static void main (String [] args) {
    Counter c1 = new Counter ();
    Counter c2 = new Counter ();

    c1.increment ();
    c2.increment ();
```

```
System.out.println ("Instance Count for c1 : " +
                    c1.instanceCount ); // 1
System.out.println ("Instance Count for c2 : "+
                    c2.instanceCount ); // 1
System.out.println ("Static Count (shared across
                    instances ): " + Counter.StaticCount); //2
  }
}
```