

# Object-Oriented Java

## Java objects' state and behavior

In Java, instances of a class are known as objects. Every object has state and behavior in the form of instance fields and methods respectively.

```
public class Person {  
    // state of an object  
    int age;  
    String name;  
  
    // behavior of an object  
    public void set_value() {  
        age = 20;  
        name = "Robin";  
    }  
    public void get_value() {  
        System.out.println("Age is " + age);  
        System.out.println("Name is " +  
name);  
    }  
  
    // main method  
    public static void main(String [] args)  
    {  
        // creates a new Person object  
        Person p = new Person();  
  
        // changes state through behavior  
        p.set_value();  
    }  
}
```

## Java instance

Java instances are objects that are based on classes.

For example, `Bob` may be an instance of the class

`Person`.

Every instance has access to its own set of variables which are known as *instance fields*, which are variables declared within the scope of the instance. Values for instance fields are assigned within the constructor method.

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

    // Constructor method
    public Person(int age, String name) {
        this.age = age;
        this.name = name;
    }

    public static void main(String[] args)
    {
        Person Bob = new Person(31, "Bob");
        Person Alice = new Person(27,
"Alice");
    }
}
```

## Java dot notation

In Java programming language, we use `.` to access the variables and methods of an object or a Class.

This is known as *dot notation* and the structure looks like this-

`instanceOrClassName.fieldOrMethodName`

```
public class Person {
    int age;

    public static void main(String [] args)
    {
        Person p = new Person();

        // here we use dot notation to set
age
        p.age = 20;

        // here we use dot notation to access
age and print
        System.out.println("Age is " +
p.age);
        // Output: Age is 20
    }
}
```

## Constructor Method in Java

Java classes contain a *constructor* method which is used to create instances of the class.

The constructor is named after the class. If no constructor is defined, a default empty constructor is used.

```
public class Maths {  
    public Maths() {  
        System.out.println("I am  
constructor");  
    }  
    public static void main(String [] args)  
{  
        System.out.println("I am main");  
        Maths obj1 = new Maths();  
    }  
}
```

## Creating a new Class instance in Java

In Java, we use the `new` keyword followed by a call to the class constructor in order to create a new *instance* of a class.

The constructor can be used to provide initial values to instance fields.

```
public class Person {  
    int age;  
    // Constructor:  
    public Person(int a) {  
        age = a;  
    }  
  
    public static void main(String [] args)  
{  
        // Here, we create a new instance of  
the Person class:  
        Person p = new Person(20);  
        System.out.println("Age is " +  
p.age); // Prints: Age is 20  
    }  
}
```

## Reference Data Types

A variable with a reference data type has a value that references the memory address of an instance. During variable declaration, the class name is used as the variable's type.

```
public class Cat {  
    public Cat() {  
        // instructions for creating a Cat  
        instance  
    }  
  
    public static void main(String[] args)  
    {  
        // garfield is declared with  
        reference data type `Cat`  
        Cat garfield = new Cat();  
        System.out.println(garfield); //  
Prints: Cat@76ed5528  
    }  
}
```

## Constructor Signatures

A class can contain multiple constructors as long as they have different parameter values. A signature helps the compiler differentiate between the different constructors.

A signature is made up of the constructor's name and a list of its parameters.

```
// The signature is `Cat(String  
furLength, boolean hasClaws)`.  
public class Cat {  
    String furType;  
    boolean containsClaws;  
  
    public Cat(String furLength, boolean  
hasClaws) {  
        furType = furLength;  
        containsClaws = hasClaws;  
    }  
    public static void main(String[] args)  
    {  
        Cat garfield = new Cat("Long-hair",  
true);  
    }  
}
```

## null Values

`null` is a special value that denotes that an object has a void reference.

```
public class Bear {
    String species;
    public Bear(String speciesOfBear;) {
        species = speciesOfBear;
    }

    public static void main(String[] args)
    {
        Bear baloo = new Bear("Sloth bear");
        System.out.println(baloo); // Prints:
        Bear@4517d9a3
        // set object to null
        baloo = null;
        System.out.println(baloo); // Prints:
        null
    }
}
```

## The body of a Java method

In Java, we use curly brackets `{ }` to enclose the body of a method.

The statements written inside the `{ }` are executed when a method is called.

```
public class Maths {
    public static void sum(int a, int b) {
        // Start of sum
        int result = a + b;
        System.out.println("Sum is " +
        result);
    } // End of sum

    public static void main(String [] args)
    {
        // Here, we call the sum method
        sum(10, 20);
        // Output: Sum is 30
    }
}
```

## Method parameters in Java

In java, parameters are declared in a method definition. The parameters act as variables inside the method and hold the value that was passed in. They can be used inside a method for printing or calculation purposes. In the example, a and b are two parameters which, when the method is called, hold the value 10 and 20 respectively.

```
public class Maths {  
    public int sum(int a, int b) {  
        int k = a + b;  
        return k;  
    }  
  
    public static void main(String [] args)  
{  
        Maths m = new Maths();  
        int result = m.sum(10, 20);  
        System.out.println("sum is " +  
result);  
        // prints - sum is 30  
    }  
}
```

## Java Variables Inside a Method

Java variables defined inside a method cannot be used outside the scope of that method.

//For example, `i` and `j` variables are available in the `main` method only:

```
public class Maths {  
    public static void main(String [] args)  
{  
        int i, j;  
        System.out.println("These two  
variables are available in main method  
only");  
    }  
}
```

## Returning info from a Java method

A Java method can return any value that can be saved in a variable. The value returned must match with the return type specified in the method signature.

The value is returned using the `return` keyword.

```
public class Maths {  
  
    // return type is int  
    public int sum(int a, int b) {  
        int k;  
        k = a + b;  
  
        // sum is returned using the return  
        keyword  
        return k;  
    }  
  
    public static void main(String [] args)  
    {  
        Maths m = new Maths();  
        int result;  
        result = m.sum(10, 20);  
        System.out.println("Sum is " +  
result);  
        // Output: Sum is 30  
    }  
}
```

## Declaring a Method

Method declarations should define the following method information: scope (private or public), return type, method name, and any parameters it receives.

```
// Here is a public method named sum  
whose return type is int and has two int  
parameters a and b  
public int sum(int a, int b) {  
    return(a + b);  
}
```

