

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.

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 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  
    }  
}
```

```
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);  
}
```

