9-Classes & Objects

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Learning Objectives

> Gain basic understanding of Object, Class, Inheritance, Interface, and Package

> Understand the benefits of using objects to build code

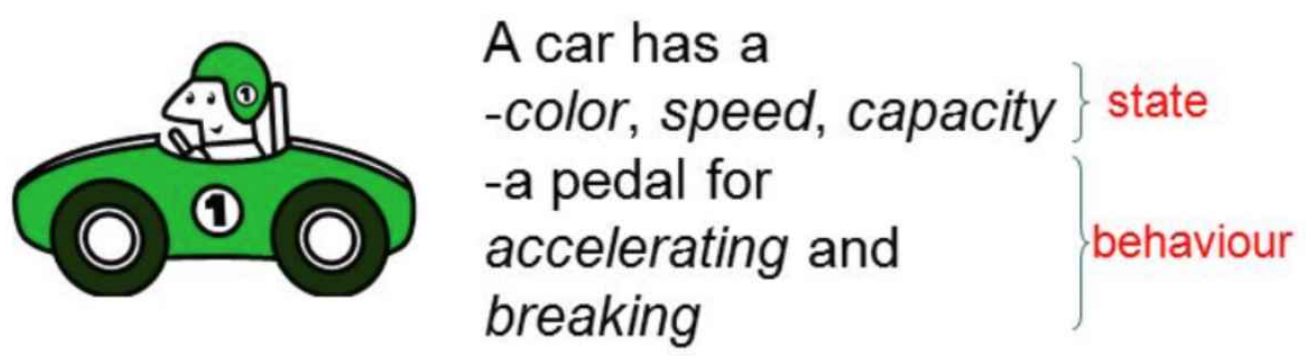
> Understand the benefits of data encapsulation

> Understand the benefits of inheritance and interface

What is an Object?

- An `object` is a software bundle of related **state and behavior**. Software objects are often used to **model real-world objects** in everyday life.

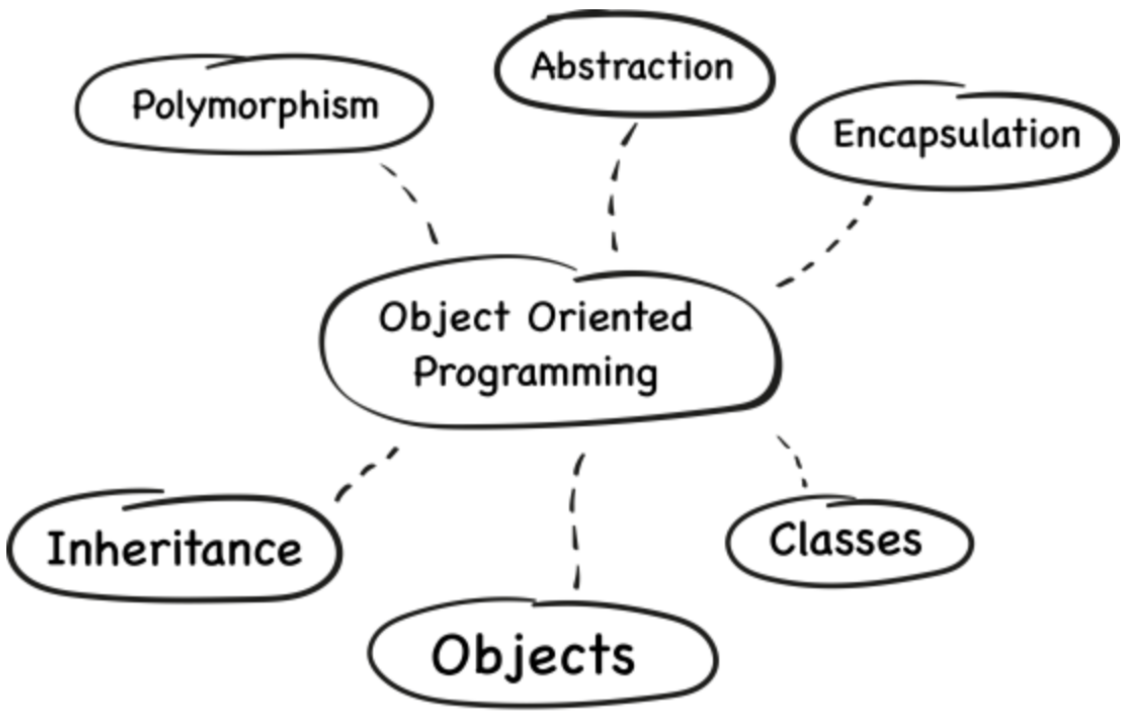
State and Behavior



- `Real-world objects` share two characteristics: They all have `state` and `behavior`.
  - For example, a dog has state (name, color, breed, hungry), and behavior (barking, fetching, wagging tail).
- Software objects are conceptually similar to real-world objects: they both consist of state and related behavior.
- An object stores its state in *fields* (variables in some programming languages) and exposes its behavior through *methods* (functions in some programming languages).
- Methods operate on an object's internal state and serve as the primary mechanism for object-to-object communication.

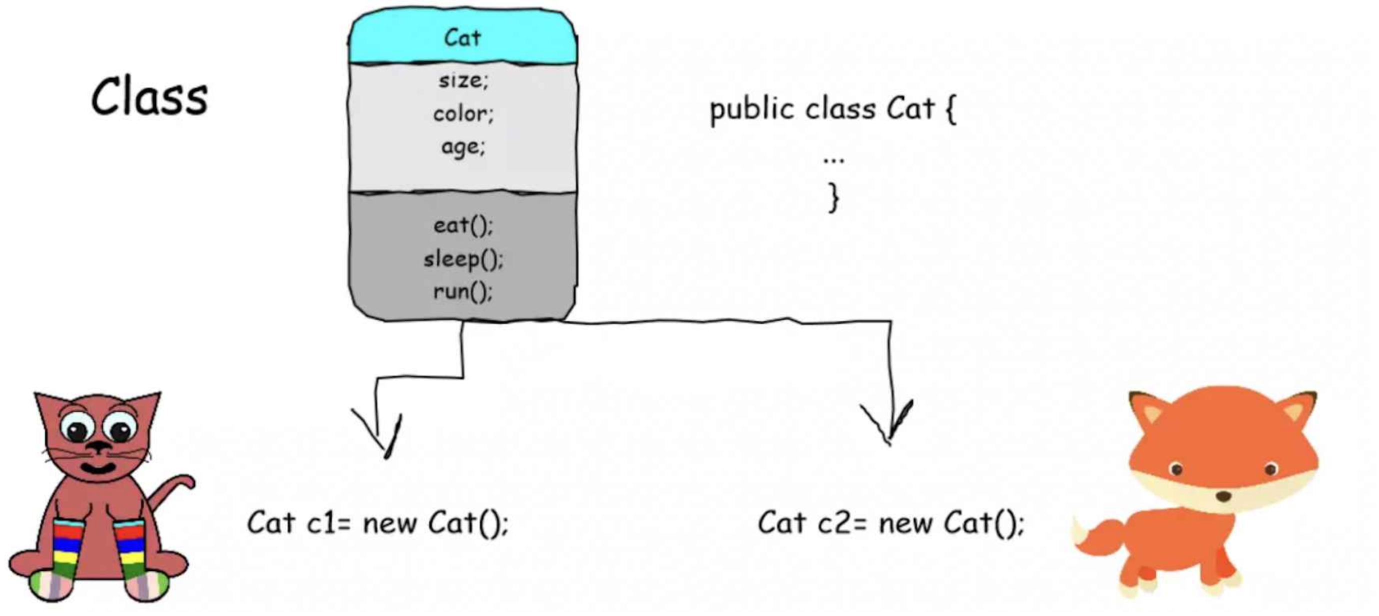
Object Oriented Programming - Java

- As one of the OOPs - Java, it complies with Encapsulation, Abstraction, Inheritance & Polymorphism fundamental programming concepts, called **`APIE`**. All these 4 concepts and programming mindset play a very important role throughout your developer life. In this course, we will go through it one by one seriously.



What is a Class?

- A class is a **blueprint** or **prototype** from which objects are created.
- It is **not a must to have the main method** in a class.
- The responsibility of creating and using new Cat objects may belong to some other class in your application.



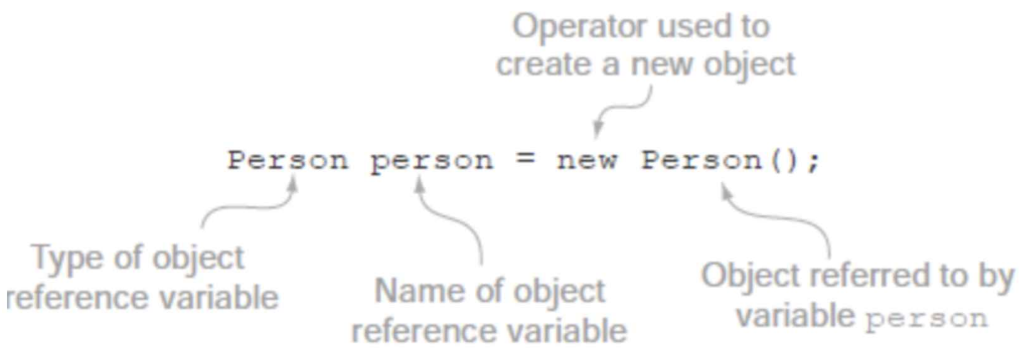
```java
public class Cat {
    private String name;
    private int weight;
    private String color;
    private int age;

    public void setName(String name) {
        this.name = name;
    }

    public void setWeight(int weight) {
        this.weight = weight;
    }

    public void setColor(String color) {
        this.color = color;
    }

    public void setAge(int age) {
        this.age = age;
    }

    public void toString() {
        System.out.println("name: " + name +
                " weight: " + weight +
                " color: " + color
                " age: " + age +);
    }
}
```

- Another class with the "main" method to create two "Cat" Objects, which is produced by the Class of Cat. That's why we can say the Class Cat is a prototype.

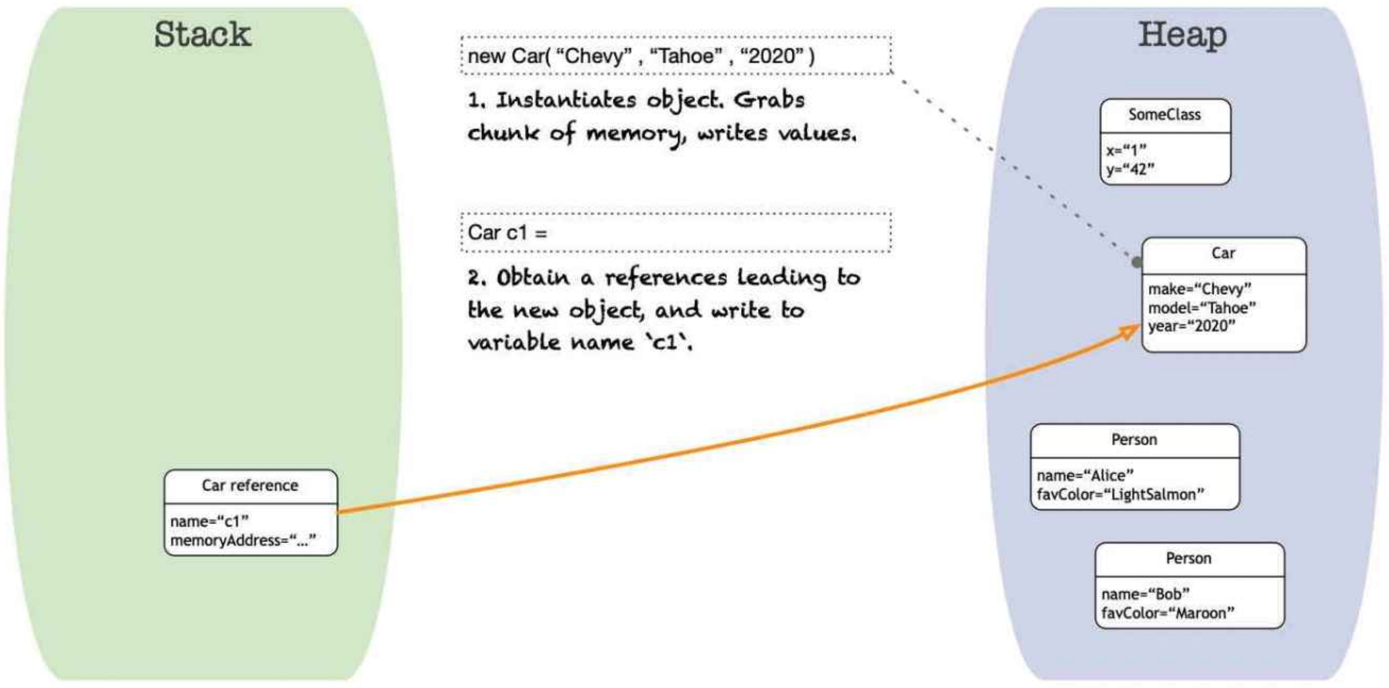
```java
public class CatDemo {

    public static void main(String[] args) {
        Cat cat1 = new Cat();
        Cat cat2 = new Cat();

        cat1.setName("Tommy");
        cat1.setWeight(4);
        cat1.setColor("Yellow");
        cat1.setAge(4);
        cat1.toString();

        cat2.setName("Ball");
        cat2.setWeight(6);
        cat2.setColor("Blue");
        cat2.setAge(7);
        cat2.toString();
    }

}

// Output:
// name: Tommy weight: 4 color: Yellow age: 4
// name: Ball weight: 6 color: Blue age: 7
```

Object References

- `Reference variables` are also known as *`object references`*. These terms can be used interchangeably.
- Objects are instances of classes, including both predefined and user-defined classes.


Operator used to create a new object
Person person = new Person();
Type of object reference variable
Name of object reference variable
Object referred to by variable person

- An object reference is, in fact, a **memory address** that points to a memory area where an object's data is located.
- When an object is instantiated with the **new** operator, a memory address value to that object is returned. That address is usually assigned to the reference variable.



Questions

- What are the two things that real-world and software objects both contain?
- Where is a software object's state is stored in?
- What is a software object's behavior exposed through?
- What is a class & object?
- What is the relationship between keyword "new", object reference, instance, memory address?