

# COMP 250

## INTRODUCTION TO COMPUTER SCIENCE

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Week 4-1: OOD4 JML Disinheritance

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Giulia Alberini, Fall 2020

# WHAT ARE WE GOING TO DO IN THIS VIDEO?



## OOD4

- UML diagrams
- Inheritance

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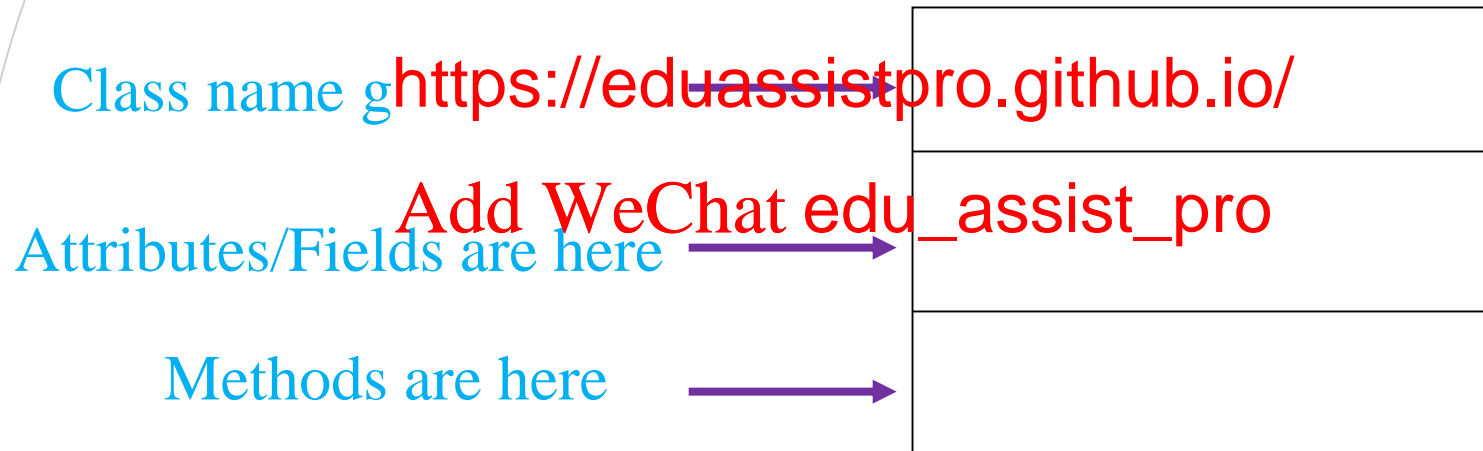
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# UML DIAGRAMS

Unified Modeling Language (UML) provides a set of standard diagrams for graphically depicting object-oriented systems.

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## EXAMPLE – DOG CLASS

- Fields/Attributes
  - String name
  - Person owner

- Constructors
  - Dog(String name)
  - Dog(String name, Person owner)

- Accessors and Mutators

■ getName()

■ setName()

■ getOwner()

■ setOwner(Person owner)

■ eat()

■ bark()

■ hunt()

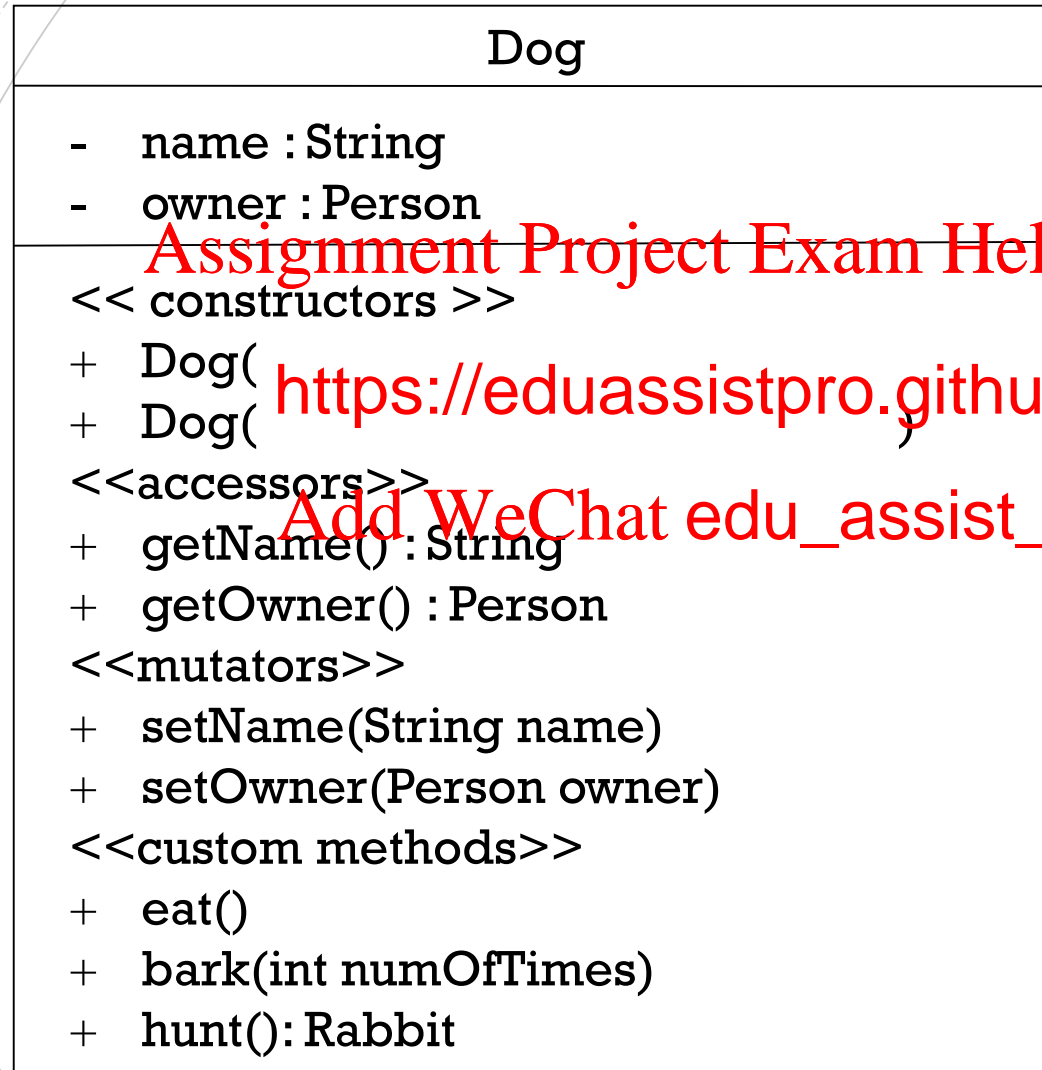
■

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## DOG CLASS: + MEANS PUBLIC, - MEANS PRIVATE



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## UNDERLINE IF FIELD/METHOD IS STATIC

Dog
<ul style="list-style-type: none"><li>- name : String</li><li>- owner : Person</li><li>- <u>numOfDogs: int</u></li></ul>
<< constructors >>
+ Dog()
+ Dog( )
<< acces
+ getName(): String
+ getOwner() : Person
+ <u>getNumOfDogs(): int</u>
<<mutators>>
+ setName(String name)
+ setOwner(Person owner)
<<custom methods>>
+ eat()
+ bark(int numOfTimes)
+ hunt(): Rabbit

# EASILY MAKE YOUR OWN DIAGRAMS

---

[github.com/prmr/JetUML](https://github.com/prmr/JetUML)

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# THE DOG CLASS

- Throughout the next few lectures I'll often refer to a `Dog` class.

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```
public class Dog {  
    private Person  
  
    public Dog(String name) {  
        this.name = name;  
    }  
}
```

## EXAMPLES USING DOG

```
public class Dog {  
    private String name;  
    private Person owner;
```

```
    public Dog(String aName) {  
        this.name = aName;  
    }  
}
```

```
    public static void main(String[] args) {  
        Dog myDog = new Dog("Snoopy");  
        System.out.println(myDog);  
    }  
}
```

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■ What prints?

## EXAMPLES USING DOG

```
public class Dog {  
    private String name;  
    private Person owner;
```

```
    public Dog(String aName) {  
        this.name = aName;  
    }  
  
    public static void main(String[] args) {  
        Dog myDog = new Dog("Snoopy");  
        String s = myDog.toString();  
        System.out.println(s);  
    }  
}
```

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■ What prints?

## EXAMPLES USING DOG

```
public class Dog {  
    private String name;  
    private Person owner;
```

```
    public Dog(String aName)  
    {  
        this.name = aName;  
    }  
}
```

```
    public static void main(String[] args) {  
        Dog myDog = new Dog("Snoopy");  
        Dog aDog = myDog;  
        System.out.println(myDog.equals(aDog));  
    }  
}
```

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■ What prints?

## EXAMPLES USING DOG

```
public class Dog {  
    private String name;  
    private Person owner;
```

```
    public Dog(String aName)  
    {  
        this.name = aName;  
    }  
}
```

```
    public static void main(String[] args) {  
        Dog myDog = new Dog("Snoopy");  
        Dog aDog = new Dog("Snoopy");  
        System.out.println(myDog.equals(aDog));  
    }  
}
```

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■ What prints?

toString() **AND** equals()

We have not defined these methods in the `Dog` class...

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- Where do they come from? <https://eduassistpro.github.io/>

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- Why can we use them?
- Can we change what they do?

# INHERITANCE

- In java, classes can be **derived** from other classes.

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- A class that is derived from another class is called a **subclass**.

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- The class from which the subclass is derived is called a **superclass**.

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- A subclass **inherits** all `public` (or `protected`) fields and methods from its superclass. Constructors are the only thing that a subclass does not inherit.



## BASIC IDEA

Suppose that you want to create a new class and that there is already a class that includes some code. Then instead of implementing this code from the existing one. By doing this, you can create a new class from the existing class without having to write it and debug it again.

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# THE Object CLASS

- Object is the only class in java without a superclass. All other classes have one and only one direct superclass.
- In the absence of any other superclass, every class is implicitly a subclass of Object.

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<https://docs.oracle.com/javase/7/docs/api/java/lang/Object.html>

# JAVA CLASS HIERARCHY

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Object defines and implement methods common to all classes, including the ones you have been writing.

## METHODS FROM `Object`

**This is where `equals` and `toString` come from!!**

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**<https://eduassistpro.github.io/>**

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**<https://docs.oracle.com/javase/7/docs/api/java/lang/Object.html>**

## AN EXAMPLE

Suppose we want to write a program with 3 classes: Animal, Dog, and Beagle.

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All dogs are ani

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relationships  
between  
classes

All beagles are dogs.

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Animals have a birthdate.

Dogs bark.

Beagles chase rabbits.

class  
definitions

## AN EXAMPLE

Suppose the class `Animal` is implemented as follows:

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```
public class Animal {
    private String name;

    public void eat() {
        System.out.println("Nom, nom, nom.");
    }

    // ...

}
```

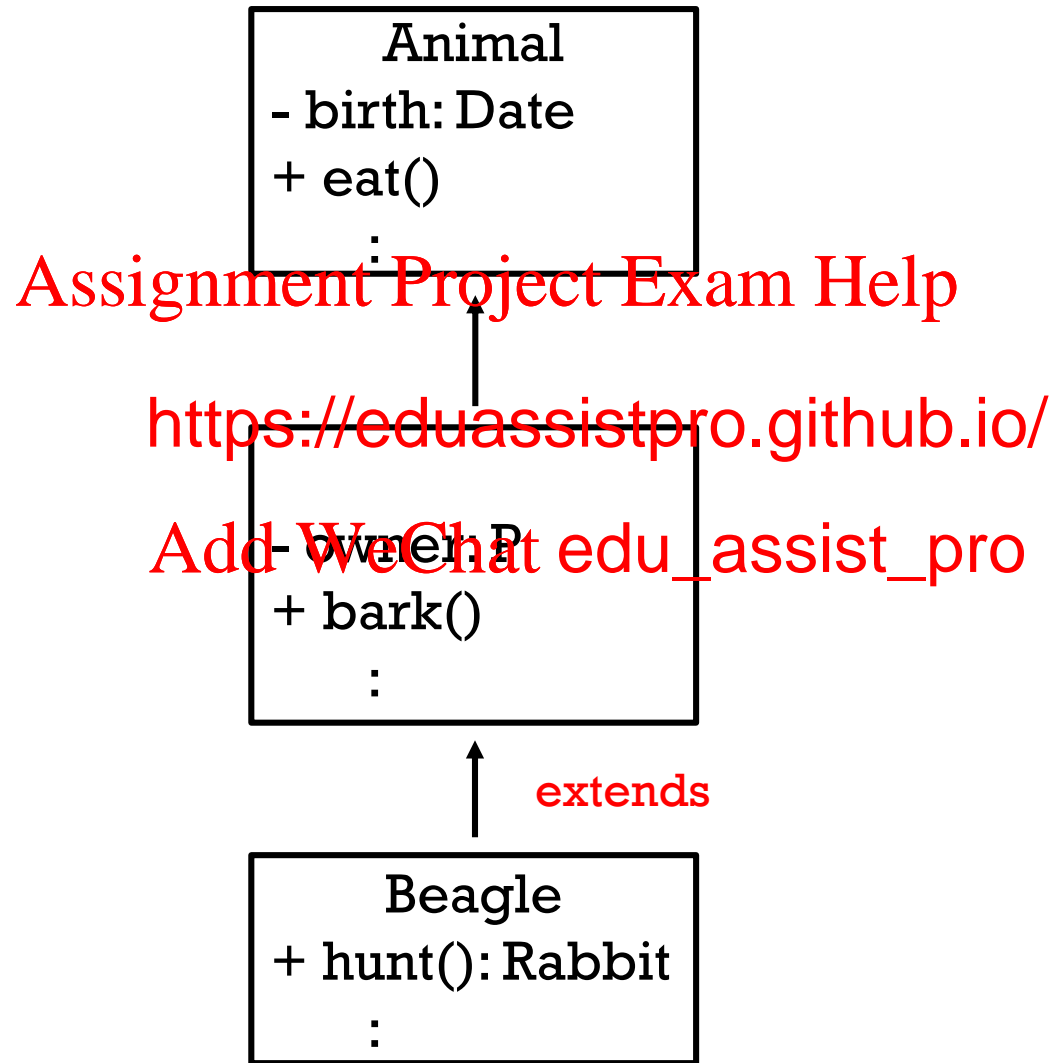
## AN EXAMPLE

Then, we can declare a class `Dog` that is a subclass of `Animal` as follow:

```
public class Dog extends Animal {  
    private  
    public void bark(  
        System.out.println("bark");  
    }  
}
```

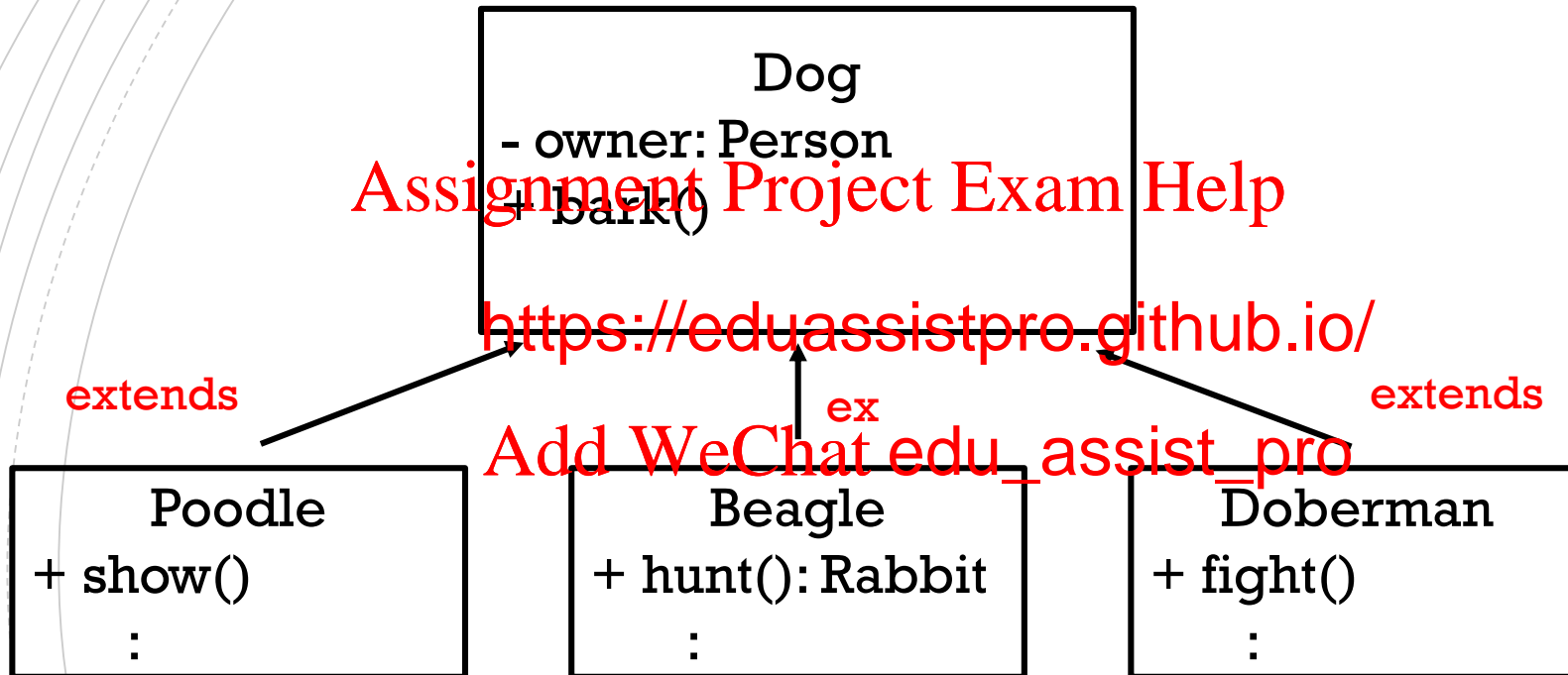
- `Dog` inherits the method `eat` from `Animal`. It does not inherit the field `birth` because it is `private`. `Dog` also adds the field `owner` and the method `bark`.

## A BIGGER PICTURE





## AS MANY SUBCLASSES AS WE NEED



Poodle, Beagle, and Doberman are all a *subclasses* of Dog. Dog is their *superclass*.

TRY IT!

Let's take a moment to create the `Shape` and `Circle` class and play around with methods and fields.

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`Shape`

- color: String
- + getColor(): String
- + setColor(c:String)

`Circle`

- radius: double
- + getRadius(): double
- + getArea(): double

## WHAT CAN YOU DO IN A SUBCLASS?

A subclass inherits all the non-private fields and methods of its superclass. In the subclass you can use the inherited members as is, replace them, or hide them. You can also add new members.

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- Fields:

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- The inherited fields can be used as **eld**.
- What if in the subclass you declare **the same name as the one** in the superclass? Then you **hide** the inherited field.  
(you should NOT do this)
- You can declare new field.

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# WHAT CAN YOU DO IN A SUBCLASS?

method signature =  
method name + list of  
parameters.

- Methods:

- The inherited methods can be used as they are.

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- If you write a non-static method with the same signature (and same return type) as the one from the superclass, you are **overriding** the method.

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- If you write a static method with the same signature (and same return type) as the one from the superclass, you are **hiding** the method.
  - You can declare new methods in the subclass.

# OVERLOADING VS OVERRIDING

## OVERLOADING

- Two or more methods in a class with *same name* but *different parameters*. (i.e. different signature)

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## OVERRIDING

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class.

## EXAMPLES – OVERLOADING

The method `abs` from `Math` is overloaded

The methods `add` and `remove` from `ArrayList<E>` are overloaded.

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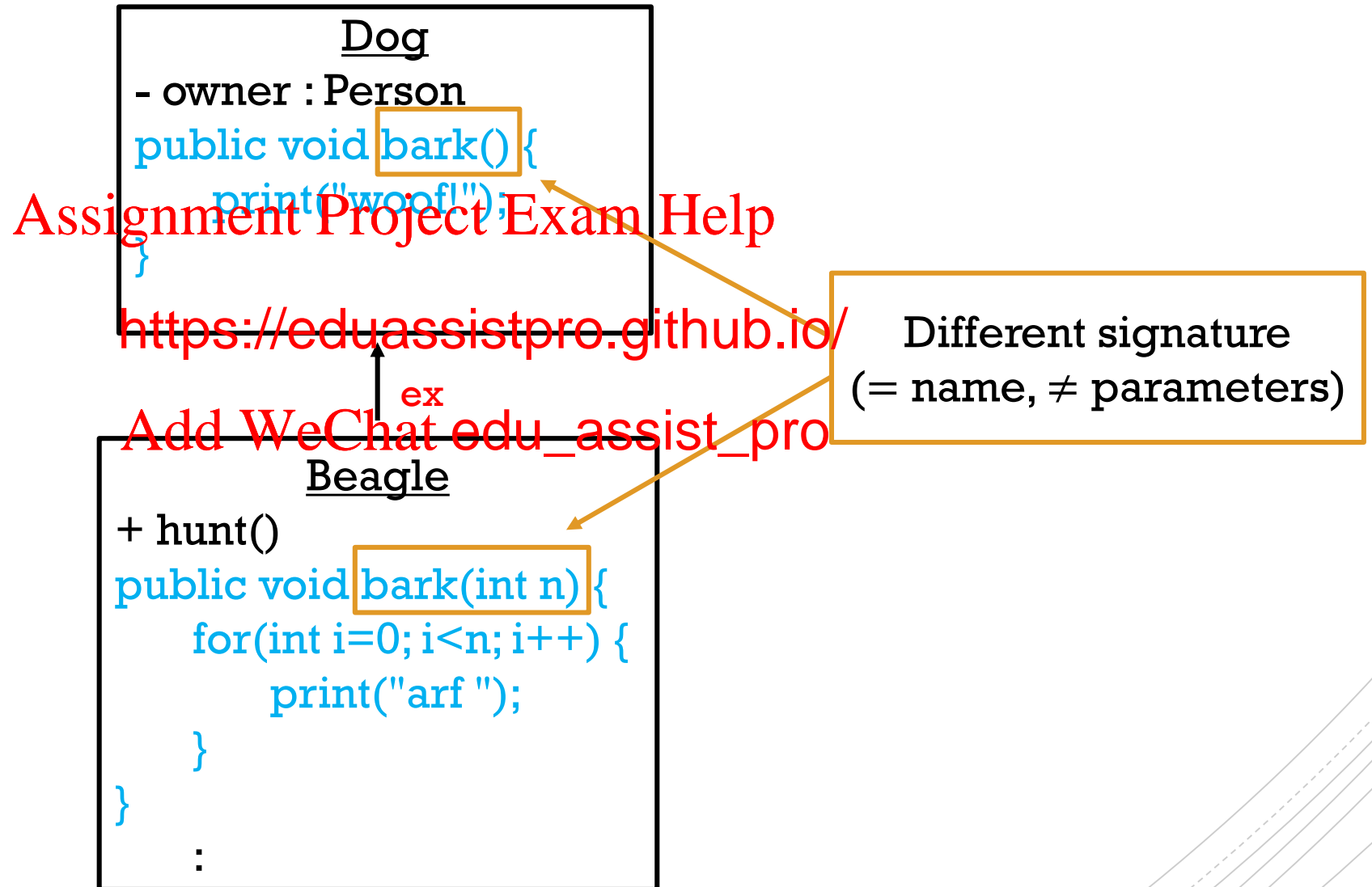
`remove(int index)`

Removes the element at the specified position in this list.

`remove(Object o)`

Removes the first occurrence of the specified element from this list, if it is present.

## EXAMPLES – OVERLOADING



## EXAMPLES – OVERLOADING

### Dog

```
- owner : Person  
public void bark() {  
    print("woof!");  
}
```

↑ extends

### Beagle

```
+ hunt()  
public void bark(int n) {  
    for(int i=0; i<n; i++) {  
        print("arf");  
    }  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Beagle snooty = new Beagle();  
    }  
}
```

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What prints?

➤ woof!

The method defined in the `Dog` class executes!



## EXAMPLES – OVERLOADING

### Dog

```
- owner : Person  
public void bark() {  
    print("woof!");  
}
```

↑ extends

### Beagle

```
+ hunt()  
public void bark(int n) {  
    for(int i=0; i<n; i++) {  
        print("arf");  
    }  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Beagle snooty = new Beagle();  
        snooty.bark(3);  
    }  
}
```

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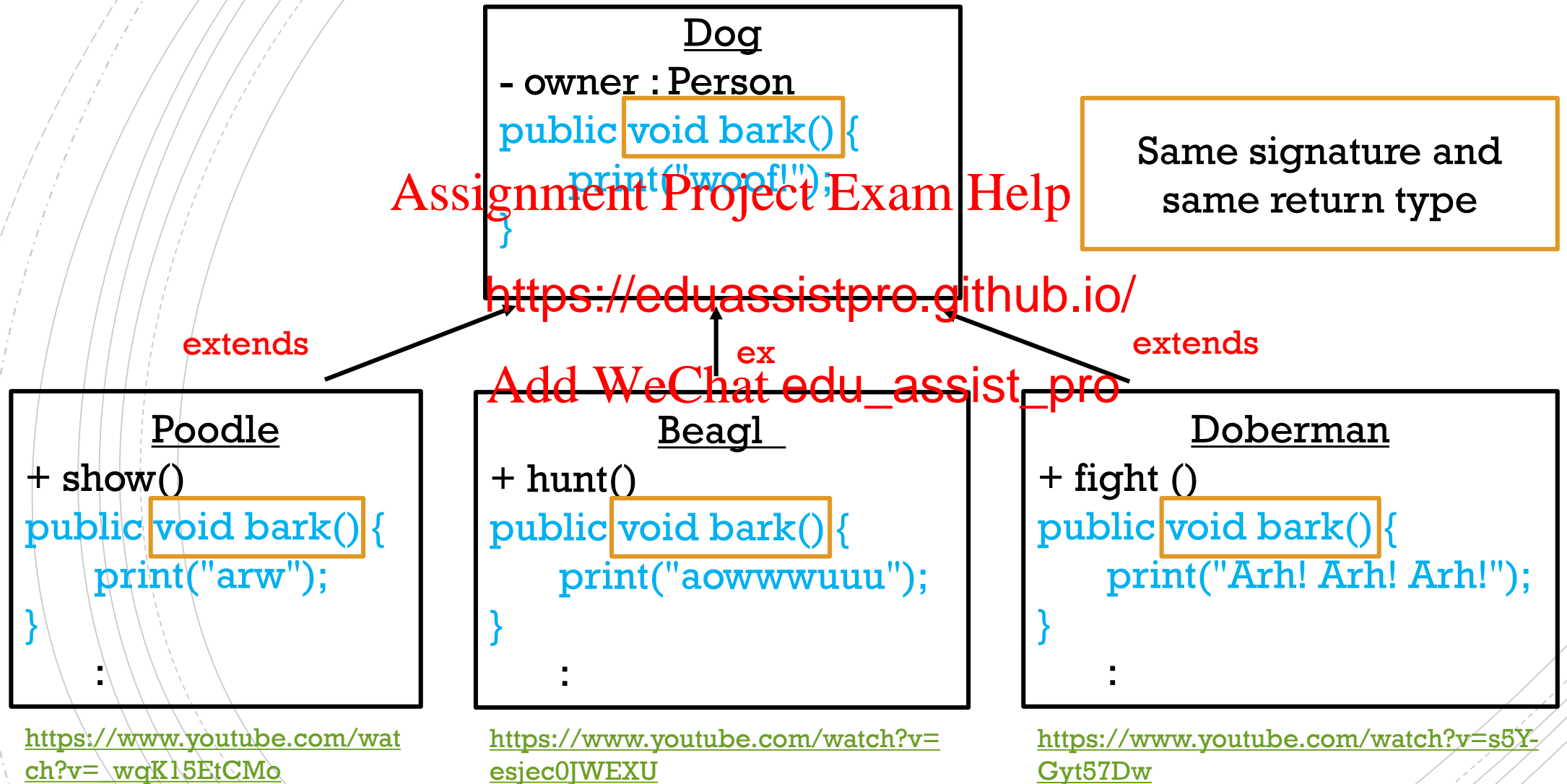
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What prints?

➤ arf arf arf

The method defined in the Beagle class executes!

## EXAMPLES – OVERRIDING



## EXAMPLES – OVERRIDING

### Dog

```
- owner : Person  
public void bark() {  
    print("woof!");  
}
```

:

↑ extends

### Beagle

```
+ hunt()  
public void bark() {  
    print("aowwwuuu");  
}
```

:

```
public class Test {  
    public static void main(String[] args) {  
        Beagle snooty = new Beagle();  
    }  
}
```

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What prints?

➤ aowwwuuu

The method defined in the Beagle class executes!

## EXAMPLES – OVERRIDING

### Dog

```
- owner : Person  
public void bark() {  
    print("woof!");  
}
```

↑ extends

### Beagle

```
+ hunt()  
public void bark() {  
    print("aowwwuuu");  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Dog shroopy = new Dog();  
    }  
}
```

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What prints?

➤ woof!

The method defined in the `Dog` class executes!



## NEXT FEW VIDEOS!

### Dog

- owner : Person

```
public void bark() {  
    print("woof!");  
}
```

:

↑ extends

### Beagle

+ hunt()

```
public void bark() {  
    print("aowwwuu");  
}
```

:

```
public class Test {  
    public static void main(String[] args) {  
        log.silly() = new Beagle();  
    }  
}
```

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Is this  
allowed??

If so, which  
bark() will  
execute???

## RECOMMENDED EXERCISE (SEE Q1)

To the two previous classes, let's add a class `Triangle` and a void method `displayInfo()` to all three classes.

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### Shape

- color: String
- + getColor(): String
- + setColor(c:String)
- + displayInfo()

### Circle

- radius: double
- + getRadius(): double
- + getArea(): double
- + displayInfo()

### Triangle

- base: double
- height: double
- + getArea(): double
- + displayInfo()

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## WHAT ABOUT CONSTRUCTORS?

Remember that if you don't write a constructor, the default constructor for a class looks as follows

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```
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}Add WeChat edu_assist_pro
```

It is a constructor with no-argument and with an empty body.

Important: as soon as you write your own constructor, you no longer have access to the default constructor.

## WHAT ABOUT CONSTRUCTORS?

- Constructors are not inherited! Each class has its own. You can write constructors for the subclass.

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- In the implementation of the `super` keyword, you must explicitly invoke one of the constructors from the superclass. <https://eduassistpro.github.io/>

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- If your constructor doesn't specifically invoke the superclass constructor, then java automatically inserts a call to the no-argument constructor of the superclass. NOTE: if the superclass does not have a no-argument constructor, we will get a compile-time error.
- `Object` has a no-argument constructor, this is why we never received a compile-time error when implementing the constructors for our classes.



## KEYWORD `super`

There are 2 uses for the keyword `super`:

1. To access members of the superclass. To do so, we can use `super` in a similar way to `this`.
  - As this, `super` refers to the superclass. This is why we can use `super` to access attributes and methods of the superclass.
  - Differently from this, `super` refers to the superclass. This is why we can use `super` to access attributes and methods of the superclass.
  - In general, it is not needed (since the subclass inherits all members of the superclass). It must be used if the method you want to access has been overridden or if the field has been hidden.

## EXAMPLES – super

### Dog

```
- owner: Person
public void bark() {
    print("woof!");
}
:
```

↑ extends

### Beagle

```
+ hunt()
public void bark() {
    print("aowwwuuu");
}
public void talk() {
    bark();
}
```

```
public class Test {
    public static void main(String[] args) {
        Beagle snooty = new Beagle();
    }
}
```

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What prints?

➤ aowwwuuu

## EXAMPLES – super

### Dog

```
- owner: Person  
public void bark() {  
    print("woof!");  
}  
:
```

↑ extends

### Beagle

```
+ hunt()  
public void bark() {  
    print("aowwwuuu");  
}  
public void talk() {  
    super.bark();  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Beagle snooty = new Beagle();  
    }  
}
```

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What prints?

➤ woof!

## EXAMPLES – super

### Dog

```
- owner: Person
public void bark() {
    print("woof!");
}
:
```

↑ extends

### Beagle

```
+ hunt()
public void bark() {
    print("aowwwuuu");
}
public void talk() {
    bark();
}
```

```
public class Test {
    public static void main(String[] args) {
        Dog copy = new Dog();
    }
}
```

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What prints?

➤ **compile-time error!**

There's no method called `talk` inside the `Dog` class.

## KEYWORD `super`

### 2. Inside the subclass constructors to invoke a constructor from the superclass.

- **Syntax:**

```
super ();
```

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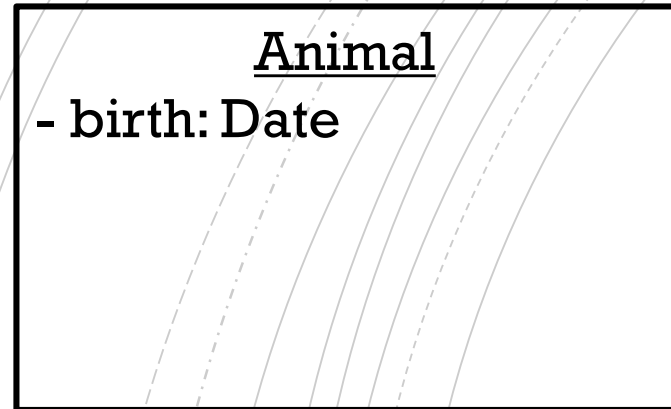
<https://eduassistpro.github.io/>  
(parameter list);

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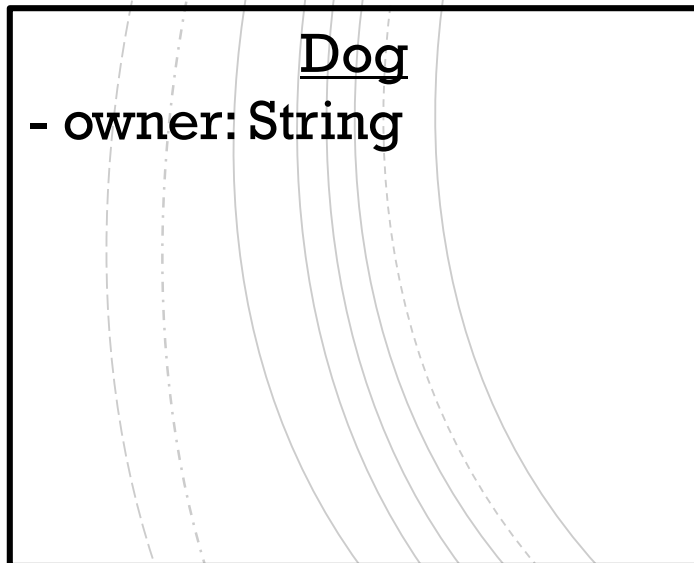
- **Example:**

```
public Dog(Person owner) {  
    super();  
    this.owner = owner;  
}
```

## EXAMPLES – super



↑ extends



```
public class Test {  
    public static void main(String[] args) {  
        Dog myDog = new Dog();  
    }  
}
```

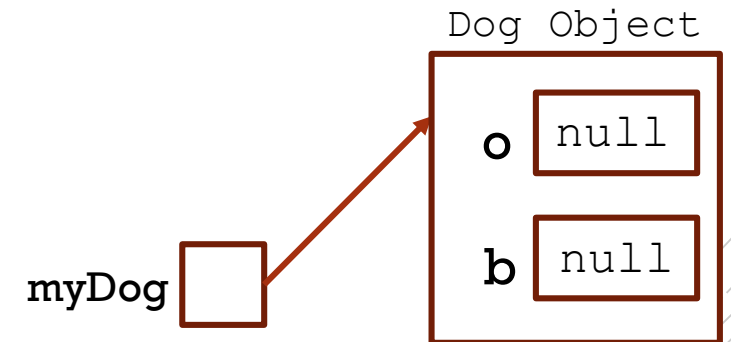
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Is this allowed? If so, what is created?

- Yes, the default constructor of Dog is used which implicitly calls on the default constructor from Animal.



## EXAMPLES – super

### Animal

- birth: Date

↑ extends

### Dog

- owner: String

```
public Dog(String p) {  
    this.owner = p;  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Dog myDog = new Dog("Giulia");  
    }  
}
```

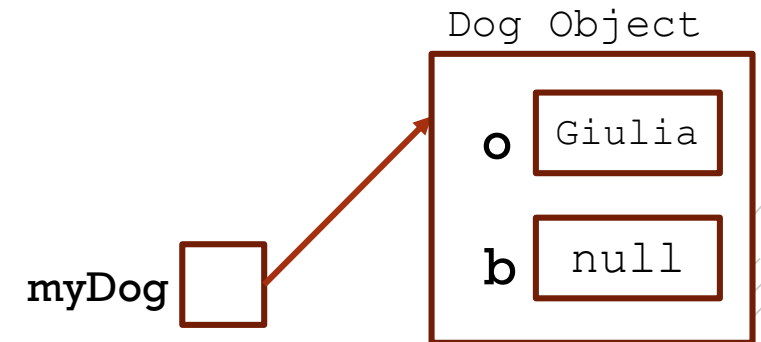
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Is this allowed? If so, what is created?

- Yes, the constructor of Dog implicitly calls on the default constructor from Animal.



## EXAMPLES – super

### Animal

- birth: Date

↑ extends

### Dog

```
- owner: String
public Dog(String p) {
    super();
    this.owner = p;
}
```

```
public class Test {
    public static void main(String[] args) {
        Dog myDog = new Dog("Giulia");
    }
}
```

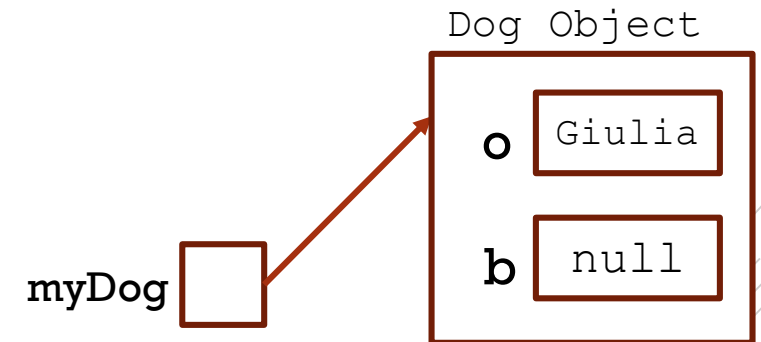
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Is this allowed? If so, what is created?

- Yes, the constructor of Dog explicitly calls on the default constructor from Animal.





## EXAMPLES – super

### Animal

- birth: Date

```
public Animal(Date b) {  
    this.birth = b;  
}
```

↑ extends

### Dog

- owner: String

```
public Dog(String p) {  
    super();  
    this.owner = p;  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Dog myDog = new Dog("Giulia");  
    }  
}
```

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Is this allowed? If so, what is created?

➤ *Compile-time error.*

There's no constructor with no arguments in the Animal class!

## EXAMPLES – super

### Animal

- birth: Date

```
public Animal(Date b) {  
    this.birth = b;  
}
```

↑ extends

### Dog

- owner: String

```
public Dog(String p) {  
    super(null);  
    this.owner = p;  
}
```

```
public class Test {  
    public static void main(String[] args) {  
Dog myDog = new Dog("Giulia");  
    }  
}
```

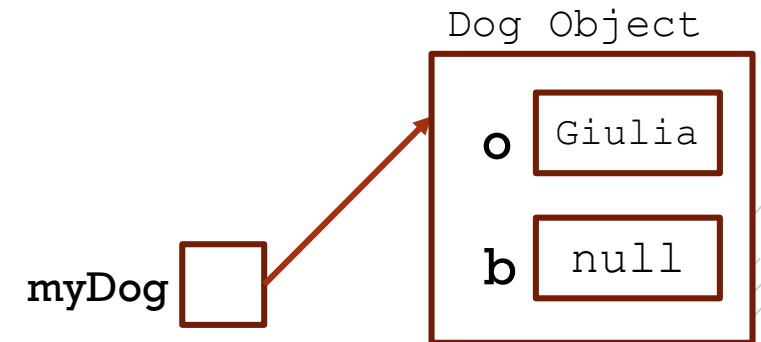
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Is this allowed? If so, what is created?

➤ Yes



## EXAMPLES – super

### Animal

- birth: Date

```
public Animal(Date b) {  
    this.birth = b;  
}
```

↑ extends

### Dog

- owner: String

```
public Dog(String p, Date d) {  
    super(d);  
    this.owner = p;  
}
```

```
public class Test {  
    public static void main(String[] args) {  
        Dog myDog = new Dog("Giulia", 6.1.2016);  
    }  
}
```

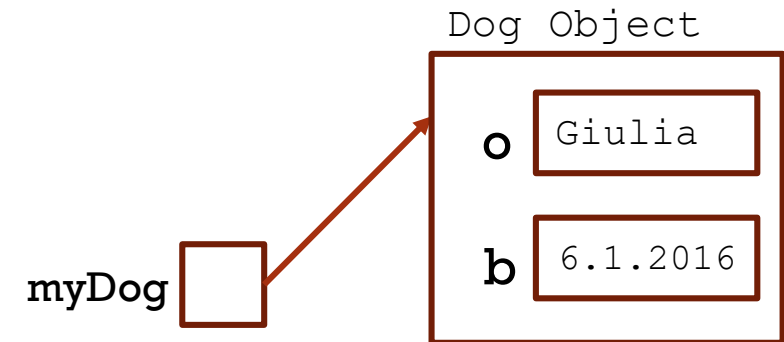
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Is this allowed? If so, what is created?

➤ Yes



## RECOMMENDED EXERCISE (SEE Q2)

**Assignment Project Exam Help**  
Go back to the three classes we have created and add appropriate constructors.

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An orange paint roller with a red handle, positioned horizontally. The roller is partially filled with orange paint, and there are orange paint splatters and drips around it. The text "Coming Soon" is written in white on the orange background of the roller.

# Coming Soon

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In the next

- The clas <https://eduassistpro.github.io/>
- Type conversion [Add WeChat edu\\_assist\\_pro](#)