COMP 250
INTRODUCTION TO COMPUTER SCIENCE

Week 4-3: OOL6 Type Conversion

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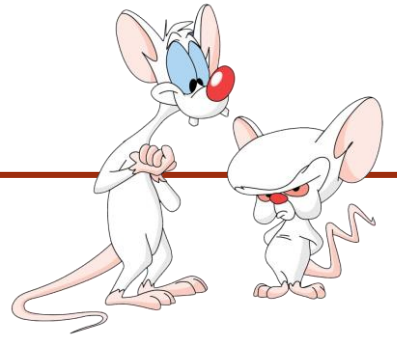
WHAT ARE WE GOING TO DO IN THIS VIDEO?



OOD6

- Modifiers and Inheritance
- Type Conversion

MODIFIERS and INHERITANCE

ACCESS CONTROL MODIFIERS

- Recall that a class can be declared to be either `public` or package-private (no keyword).
- A class can *extend* another class *if and only if* the latter is visible from where the former is located.

ACCESS CONTROL MODIFIERS

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- A class can *extend* another class *if and only if* the latter is visible from where the former is located.


```
package assignments.a1;

public class A {
    :
}
```

```
package lectures;
import assignments.a1.A;

public class B extends A{
    :
}
```

All public classes can be extended (even across packages)

ACCESS CONTROL MODIFIERS

- Recall that a class can be declared to be either `public` or package-private (no keyword).
- A class can *extend* another class *if and only if* the latter is visible from where the former is located.


```
package assignments.a1;

class A {
   :
}
```

```
package lectures;

public class B extends A{
   :
}
```

Not allowed, since A is not visible from B.

WHICH MEMBERS ARE INHERITED?

- Every superclass' member visible from where the subclass is located is inherited by the subclass (with the exception of constructors)

- Members include: fields, methods, inner/ static nested classes.

- Note that *a subclass cannot reduce the visibility of an inherited method*. The visibility can only be increased. (we'll understand better why in the next few classes)

ASIDE: NESTED CLASSES

- Note that a nested class is not a subclass.
- Outer and inner classes have access to all fields and methods of each other. Details are out of the scope of this course.

`final` KEYWORD

- **A class that has been declared `final` cannot be *extended*.**


```
public final class Dog {
    :
}
```

```
public class Beagle extends Dog {
    :
}
```

compile-time error!

final KEYWORD

- **A method that has been declared `final` cannot be *overridden*.**


```
public class Dog {
    public final void bark() {
        :
    }
}
```

```
public class Beagle extends Dog {
    public void bark() {
        :
    }
}
```

compile-time error!

TYPE CONVERSION

FROM LAST A COUPLE OF VIDEOS AGO

class Dog

Person owner

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

extends

class Beagle

void hunt ()

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

```
public class Test {

    public static void main(String[] args) {

        Dog snoopy = new Beagle();

        snoopy.bark();

    }
}
```


Is this allowed??

OBJECTS TYPE

- We have seen that an object is of the type of the class from which it was instantiated.

- For example, if we write


```
Dog myDog = new Dog();
```

then `myDog` points to an object of type `Dog`.

OBJECT TYPES

- **But `Dog` is a subclass of `Animal` which is a subclass of `Object`.**
- **Thus, a `Dog` is an `Animal` and is also an `Object`. We can use an object of type `Dog` wherever objects of type `Animal` or `Object` are called for.**
- **Note that the reverse is not necessarily true: an `Animal` could be a `Dog`, but not necessarily. Similarly, an `Object` could be an `Animal` or a `Dog`, but it isn't necessarily.**

TYPE CASTING – REFERENCE TYPES

- Casting allows us to use an object of one type in place of another type, if permitted.

- For example we can write

```
Animal myPet = new Dog();
```

This will not cause a compile-time error because there is an ***implicit upcasting*** since a `Dog` is for sure also an `Animal`.

TYPE CASTING – REFERENCE TYPES

On the other hand, consider the following

```
Animal myPet = new Dog();
Dog myDog = myPet;
```

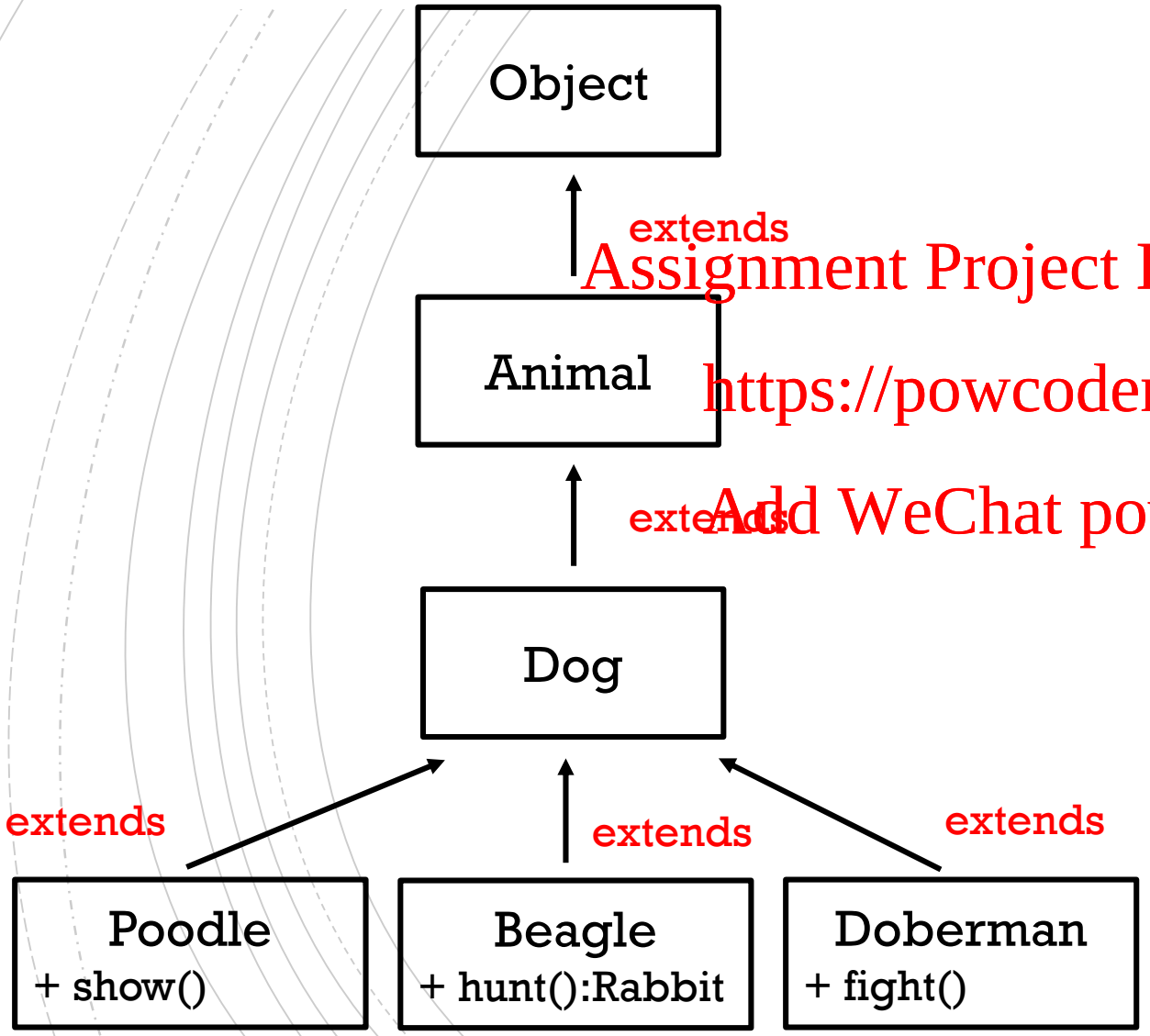

The second line will cause a compile-time error. From the compiler point of view, `myPet` is of type `Animal` and an `Animal` might not be a `Dog`.

However, we can tell the compiler that `myPet` is of the correct type, by ***explicitly downcasting***:

```
Dog myDog = (Dog) myPet;
```

If `myPet` turns out to be of the wrong type we'll get a run-time error.

HIERARCHY FROM LAST CLASS



Upcasting

Happens automatically

IMPORTANT!
Note that casting does NOT change the object itself, it just labels it differently!

Downcasting

The programmer has to manually do it.

EXAMPLES

```
Dog myDog = new Beagle();
```


Is this allowed?

- Yes, it is an example of upcasting which happens automatically.

EXAMPLES

```
Dog myDog = new Beagle();

Poodle myPoodle = myDog;
```


Is this allowed?

- **Compile-time error! The variable `myDog` is of type `Dog`, and it might not be pointing to a `Poodle`. It requires explicit downcasting to compile.**

EXAMPLES

```
Dog myDog = new Beagle();

Poodle myPoodle = (Poodle) myDog;
```


Is this allowed?

- **The code compiles, but there will be a run-time error because `myDog` is not pointing to a `Poodle` after all.**

EXAMPLES

```
Dog myDog = new Beagle();
myDog.hunt();
```


Is this allowed?

- **Compile-time error! The variable `myDog` is of type `Dog`, and there is no method called `hunt` inside the `Dog` class.**

EXAMPLES

```
Dog myDog = new Beagle();
((Beagle) myDog).hunt();
```


Is this allowed?

- Yes, this code will compile and run.

NEXT VIDEO!

class Dog

Person owner

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

extends

class Beagle

void hunt ()

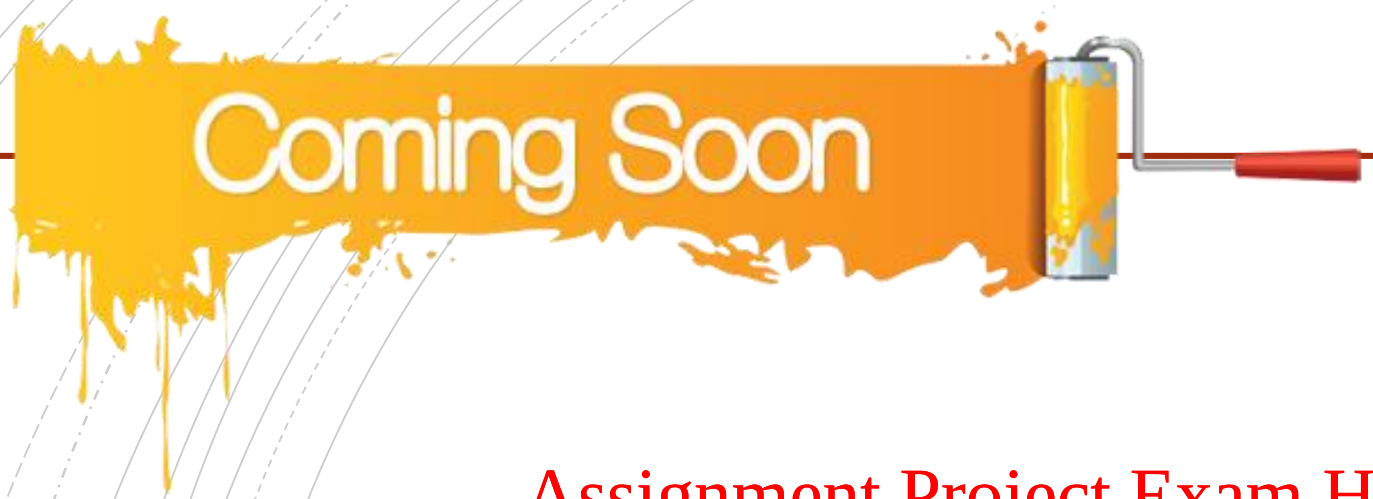
```
public void bark() {
    print("aowwwuuu");
}
    :
```

```
public class Test {

    public static void main(String[] args) {

        Dog snoopy = new Beagle();

        snoopy.bark();
    }
}
```


Which `bark()` will execute???

Is this allowed??

Yes, it's an example of upcasting!



In the next video:

- Polymorphism