CISC 3115 TY2

Interface

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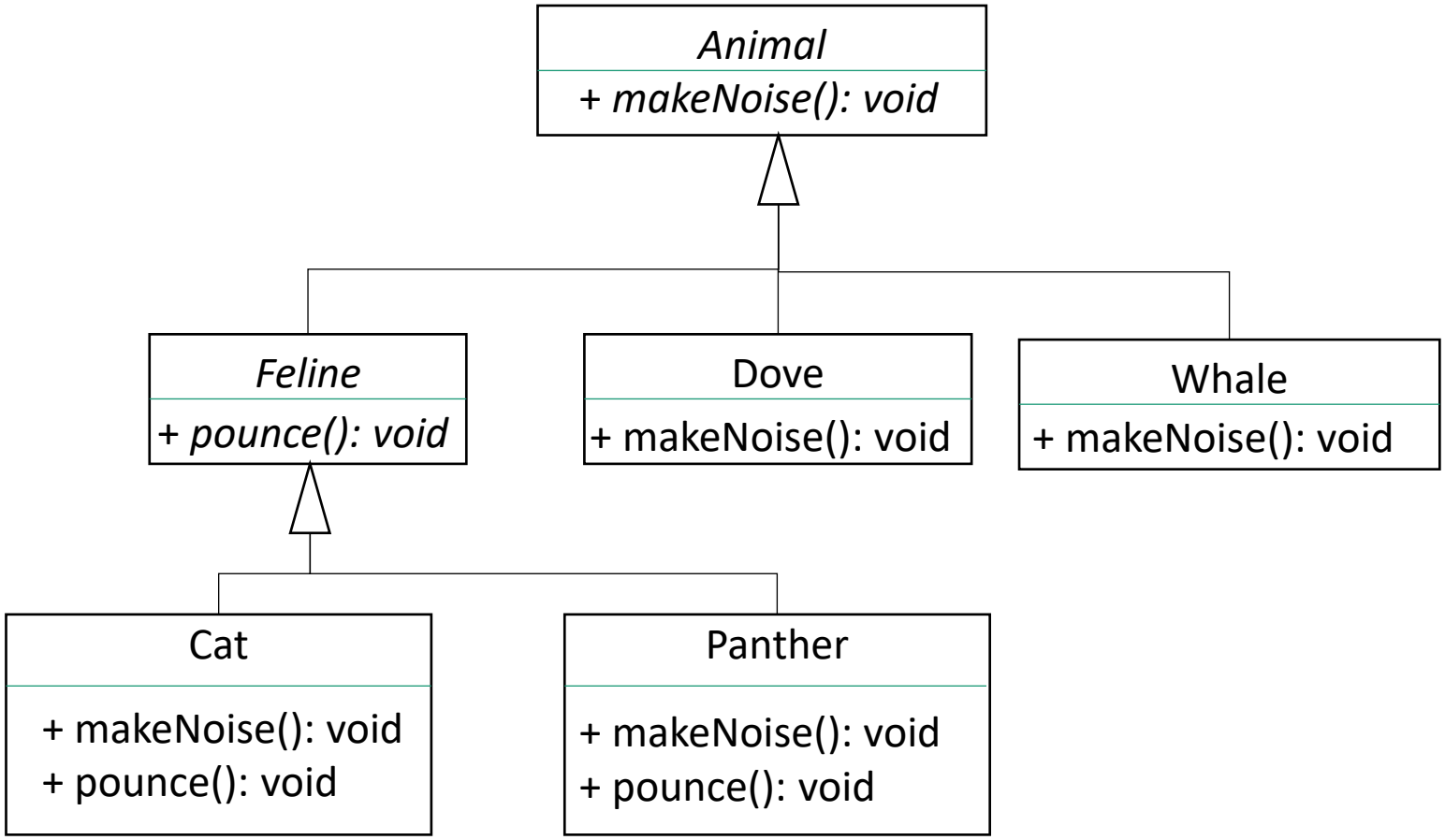
Outline

- Recap
  - Inheritance and polymorphism
  - Abstract method and class
- Interface
  - Motivation
  - Define interface
  - Extend interface
  - Implement interface
  - Use interface as data type
- Exercises

Different Classes, Same Behaviors

- Different classes, although vastly different, may exhibit similar behavior
  - Any communication devices can “transmit” and “receive”
  - Any vehicles can “move”
  - Any objects can be “compared” to each other
  - Any objects may be cloned
  - ……
- Using subclasses (inheritance via subclass) may be too rigid for this kind of flexibility in real life.

Let’s consider an Animal class hierarchy (for a computer game)



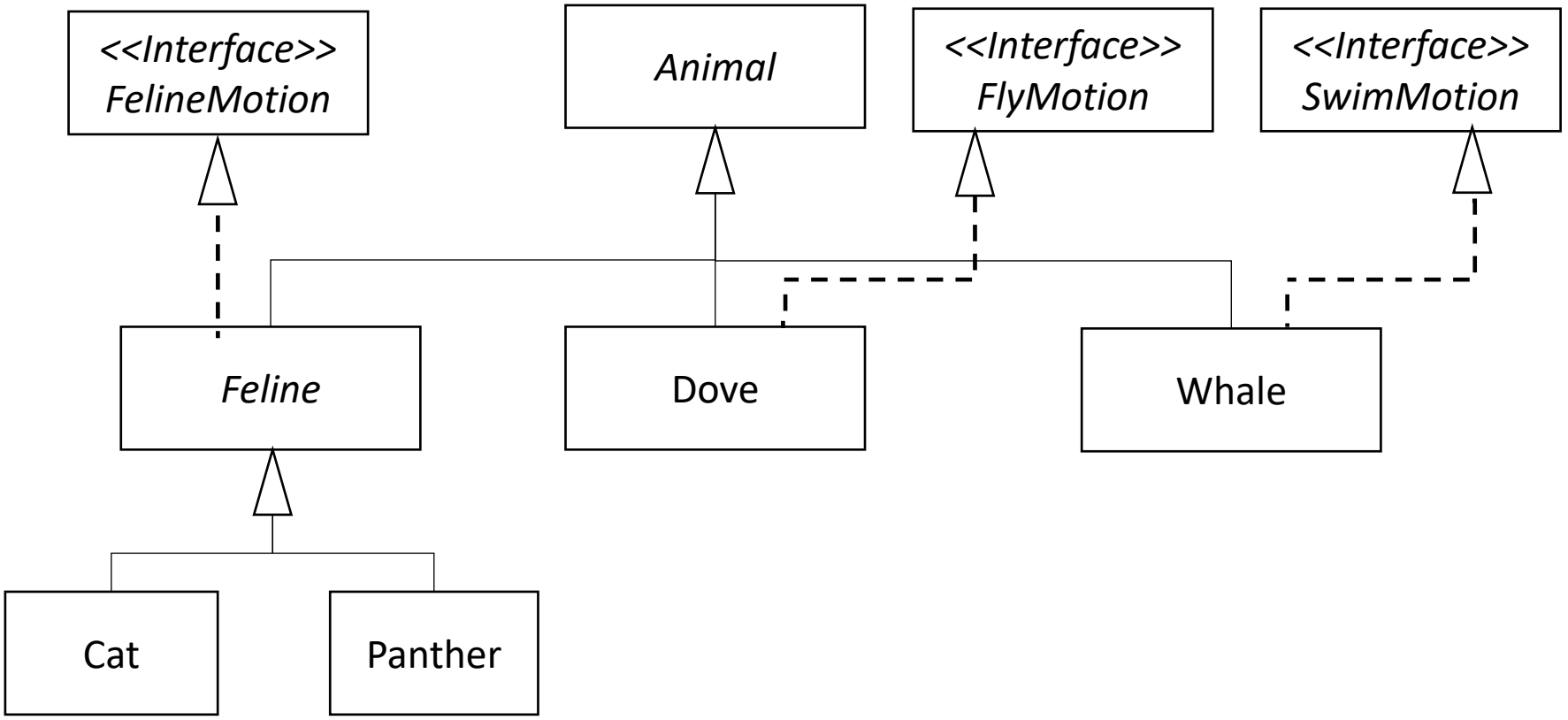
Improving the Animal Class Hierarchy?

- Different animals have different motions
  - Birds fly
  - Whales swim
  - Cats pounce
- But,
  - Can a bat fly? Can an insect fly?
  - Does every bird fly? Does every insect fly?
  - Can a dog swim? Can a bird also swim?
  - …

Introducing Java Interface

- Not the “interface” in “Graphical User Interface”
- Java has a reference type, called interface
  - Contain abstract methods only.
    - Java 8 introduces the concept of default methods and permits static methods (abstract methods with default implementation)
    - At this moment, pretend this does not exist (so that we aren’t distracted from the discussion that follows).
  - Define only one or more behaviors

The Improved Animal Class Hierarchy



How to Defining Interfaces: Birds Fly, Whales Swim, …

```
public interface FlyMotion {
        public void fly(Direction direction, double speed, double distance);
}

public interface SwimMotion {
        public void swim(Direction direction, double speed, double distance);
}

public interface FelineMotion {
        public void jump(Direction direction, double speed, double distance);
        public void pounce(Animal prey);
}
```

Implementing Interfaces

```
abstract class Feline implements FelineMotion {

…

        public void jump(Direction direction, double speed, double distance) { … }

         public void pounce(Animal prey) {  …   }

…

}


class Dove extends Animal implements FlyMotion { …

        public void fly(Direction direction, double speed, double distance) { … }

}
```

Questions?

- Interface
  - What is it?
  - Why?
  - How?
  - Implement interface
- Examples

Interface: Remark

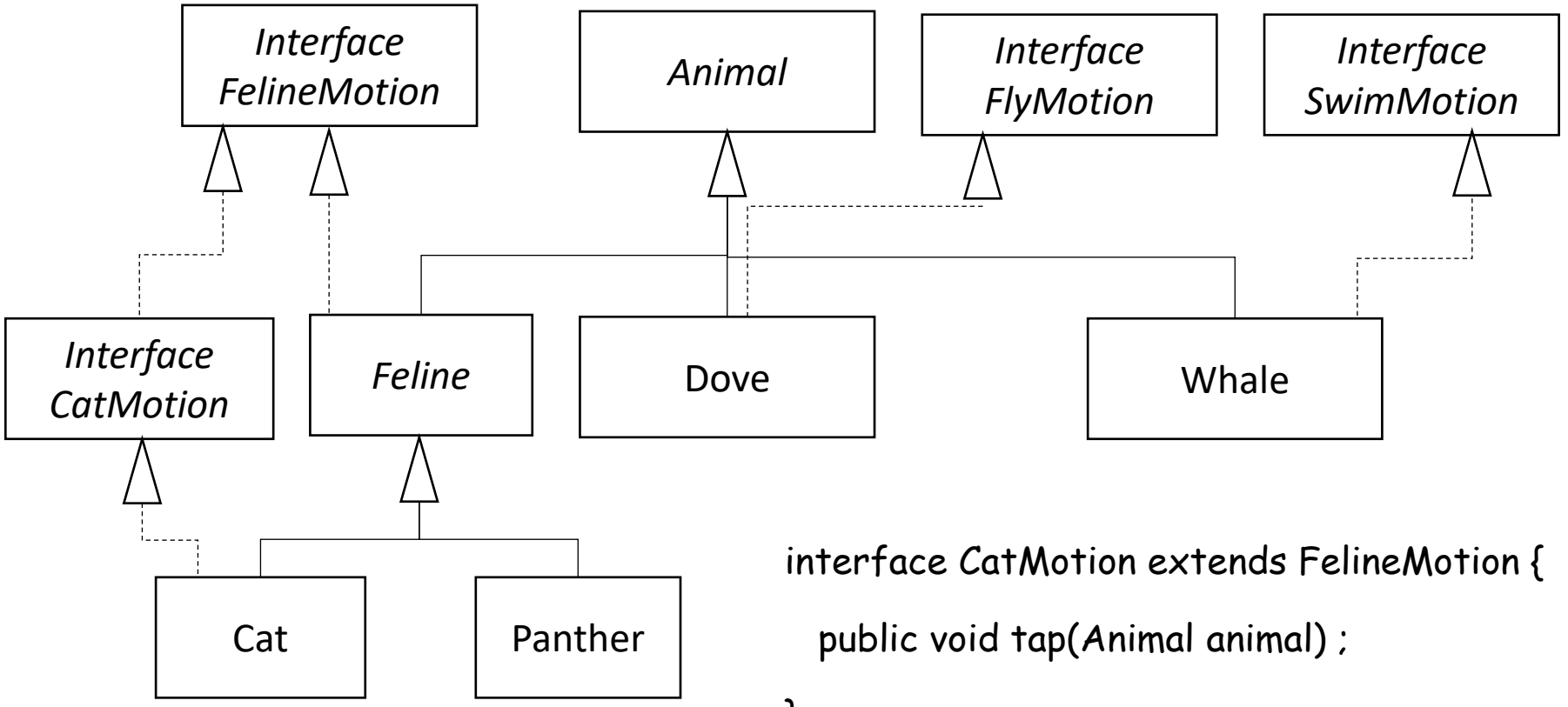
- Interfaces are like abstract classes, cannot be instantiated
  - can only be implemented by classes or extended by other interfaces
- “implement” and “extend” are two distinct Java terms, such as,
  - A class (the class) “implements” an interface (the class provides an implementation of the interface)
  - A class (the class) “extends” another class (the class becomes a subclass of the other)
  - An interface (the interface) “extends” another interface (define new behavior in the interface)

Evolving Interfaces

- Interfaces can be extended (like classes)

```
interface CatMotion extends FelineMotion {
   public void tap(Animal animal) ;
}
```

Extending FelineMotion

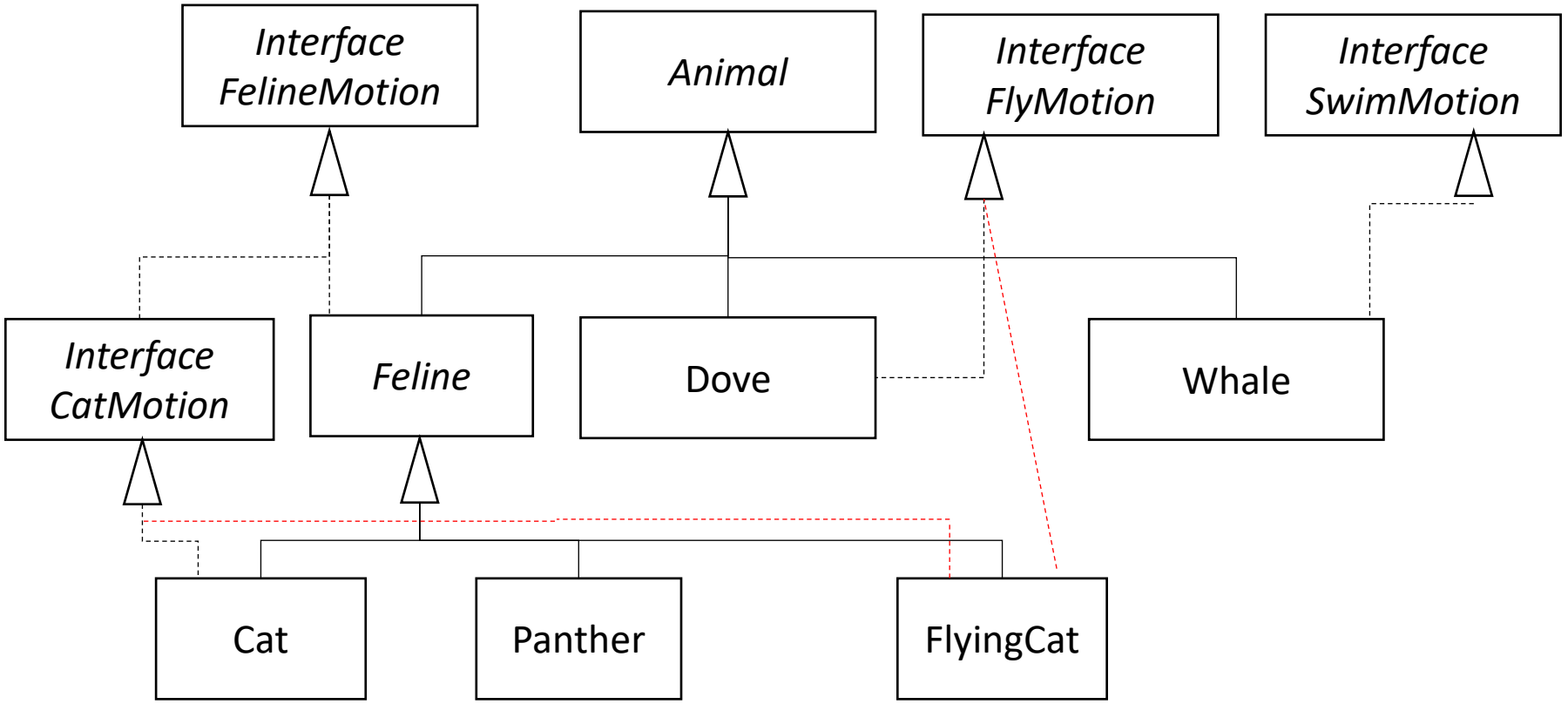



```
interface CatMotion extends FelineMotion {
   public void tap(Animal animal) ;
}
```

Questions?

- Extending interface
- Examples

Flying Cat


Interface FelineMotion
Animal
Interface FlyMotion
Interface SwimMotion
Interface CatMotion
Feline
Dove
Whale
Cat
Panther
FlyingCat

Implementing Multiple Interfaces

- A class **can** implement multiple interfaces
- But a class **cannot** extend multiple classes
- Which one of the following are is allowed in Java?

```
class FlyingCat extends
Cat, Dove {

…

}
```

```
class FlyingCat implements
FlyMotion, CatMotion {

    …

}
```

```
class FlyingCat extends
Feline implements
FlyMotion, CatMotion {

    …

}
```

Implementing Multiple Interfaces

- A class **can** implement multiple interfaces
- But a class **cannot** extend multiple classes

```
class FlyingCat extends
Cat, Dove {

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}
```

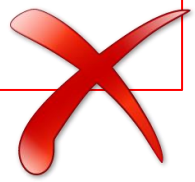

```
class FlyingCat implements
FlyMotion, CatMotion {

    …

}
```

```
class FlyingCat extends
Feline implements
FlyMotion, CatMotion {

    …

}
```

Questions

- Interfaces
  - Model common behaviors
  - Have only abstract methods
    - Since Java 8, can have default methods and static methods (virtual/abstract functions/methods with default implementations)
  - Can be extended
  - Must be implemented
- Assemble (or aggregate) behaviors
  - Examples

Using Interface as Type

- Interfaces are data types

```
void flyAll(ArrayList<BirdMotion> flyingAnimals) {
…
}

Void moveFlyable(FlyMotion flyable) {
…
}
```

Questions

- Interfaces are data types
- Write generic method with interface
- Examples