COMP 110/L Lecture 20

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Slides adapted from Dr. Kyle Dewey

Outline

- `super` in methods
- `abstract` Classes and Methods
- Polymorphism

`super` in Methods

Recap

You've seen `super` in constructors...

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```
public class Base {
  public Base(int x) { ... }
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public class Base {
   public Base(int x) { ... }
}
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```
public class Sub extends Base {
   public Sub(int x) {
      super(x);
   }
}
```

`super` in Methods

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Used to execute a superclass' implementation of a method.

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public class Base {
   public int returnNum() {
      return 17;
   }
}
```

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```
public class Base {
   public int returnNum() {
      return 17;
   }
}
```

```
public class Sub extends Base {
   public int returnNum() {
      return super.returnNum() + 3;
   }
}
```

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Used to execute a superclass' implementation of a method.

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public class Base {
   public int returnNum() {
      return 17;
   }
}
```

```
public class Sub extends Base {
   public int returnNum() {
      return super.returnNum() + 3;
   }
}
```

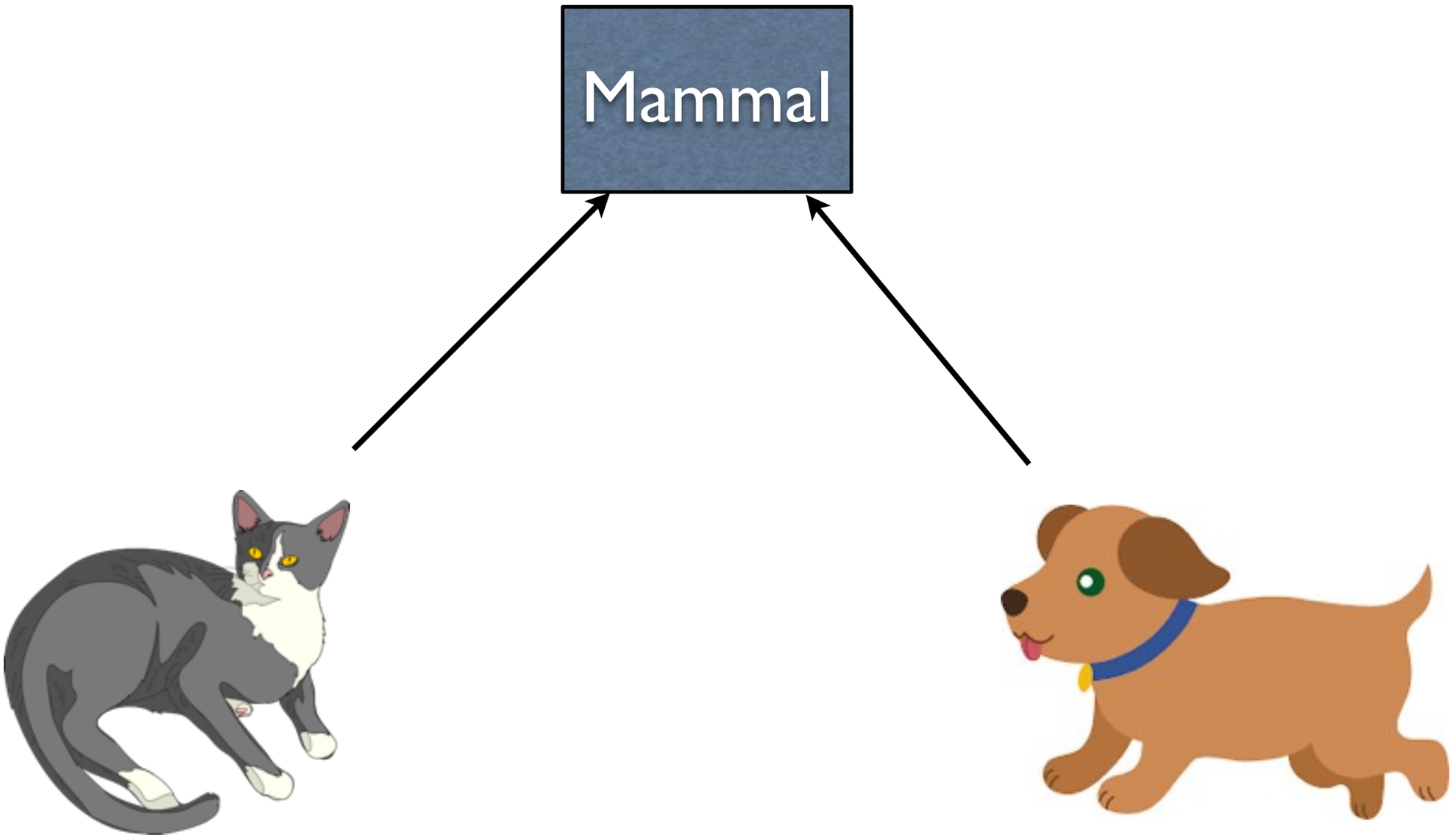
Returns 17

Example

- `Base.java`
- `Sub.java`
- `SuperMethodMain.java`

`abstract` Classes and Methods

Recap - A Problem



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public abstract class Mammal {
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```

~~`new Mammal("some string")`~~

Does not compile

Example

- `AbstractBase.java`
- `AbstractSub.java`
- `AbstractMain.java`

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public abstract class Abstract {
  public abstract int getValue();
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`abstract` Methods

- Methods of `abstract` classes can also be defined `abstract`
  - To be overridden later
- `abstract` methods have no bodies

```
public abstract class Abstract {
  public abstract int getValue();
}
```

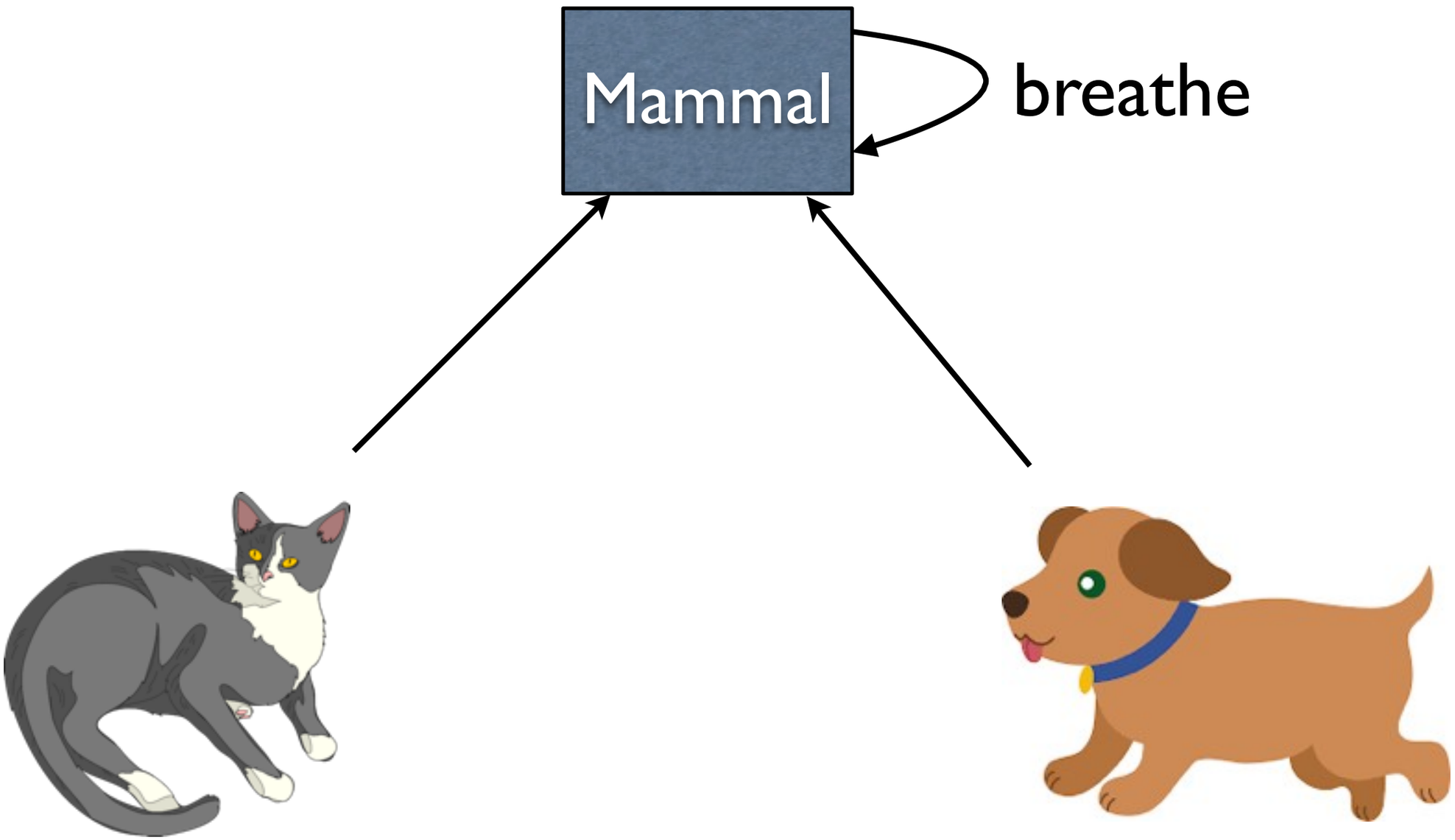
```
public class Sub extends Abstract {
  public int getValue() { return 5; }
}
```

Example

- `ArithmeticOperation.java`
- `Add.java`
- `Subtract.java`

Polymorphism

Revisit



```
Cat cat = new Cat(“Tom”);
Dog dog = new Dog(“Rover”);
 cat.breathe();
 dog.breathe();
```

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Cat cat = new Cat("Tom");
Dog dog = new Dog("Rover");
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Tom the mammal takes a breath
Rover the mammal takes a breath
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Mammal m1 = new Cat("Tom");
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Polymorphism

- "many-forms"
- A `Mammal` could be a `Cat` or a `Dog`
- Specific use in Java: a variable with a superclass type can hold an instance of any subclass, too

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Polymorphism Significance

Can write code without knowing exactly which implementation is used.

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```
public static void method(Mammal m) {
   m.breathe();
}
```

Example

- `Car.java`
- `SportsCar.java`
- `SemiTruck.java`
- `CarMain.java`

Example

- `MammalRevisited.java`
- `CatRevisited.java`
- `DogRevisited.java`
- `MammalMainRevisited.java`

Polymorphism

1. **Static** binding/Compile-Time binding/Early binding/Method **overloading**.(in same class)

2. **Dynamic** binding/Run-Time binding/Late binding/Method **overriding**.(in different classes)

Polymorphism

Static binding/Compile-Time binding/Early binding/Method overloading.(in same class)

Method overloading example:

```
class Calculation {
    public void sum(int a, int b) {
        System.out.println(a + b);
    }
    public void sum(int a, int b, int c) {
        System.out.println(a + b + c);
    }

    public static void main(String args[]) {
        Calculation obj = new Calculation();
        obj.sum(10, 10, 10);  // 30
        obj.sum(20, 20);     //40
     }
}
```

Polymorphism

Dynamic binding/Run-Time binding/Late binding/Method overriding.(in different classes)

Method overriding example:

```
class Animal {
   public void move() {
      System.out.println("Animals can move");
   }
}

class Dog extends Animal {
   public void move() {
      System.out.println("Dogs can walk and run");
   }
}

public class TestDog {
   public static void main(String args[]) {
      Animal a = new Animal();   // Animal reference and object
      Animal b = new Dog();         // Animal reference but Dog
object
      a.move();   //output: Animals can move
      b.move();  //output: Dogs can walk and run
   }
}
```