More Inheritance

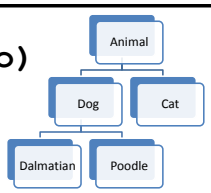
7/2/2009

Important Dates

- Project 1 - Check-off
  - Thursday 7/02/2009 ready BEFORE lab
- Review Session
  - Sunday 7/05/2009 – 306 Soda 1-4pm
- Midterm 1
  - Tuesday 7/07/2009 – 10 Evans 5-6pm
  - Covers everything through Monday's lab
- Project 2 released
  - Thursday 7/09/2009
- Project 1 due
  - Monday 7/13/2009 – 10pm

equals(Object o)

- Did you understand Wednesday's lab?




```
public class Animal {
    public void sniff(Animal a)
    {
        System.out.println("Animal sniff Animal");
    }
    public void sniff(Dog d)
    {
        System.out.println("Animal sniff Dog");
```

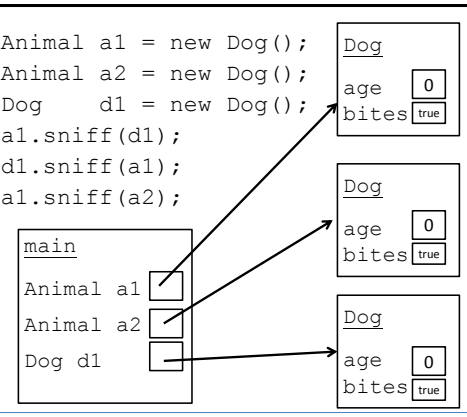
```
public class Dog extends Animal {
    public void sniff(Animal a)
    {
        System.out.println("Dog sniff Animal");
    }
    public void sniff(Dog d)
    {
        System.out.println("Dog sniff Dog");
    }
}
```

```
Animal a1 = new Dog();
Animal a2 = new Dog();
Dog    d1 = new Dog();
a1.sniff(d1);  ← Uses a1's dynamic type
d1.sniff(a1);  ← Uses a1's static type
a1.sniff(a2);  ← Uses a1's dynamic type
               Uses a2's static type
```

Inheritance

- Compilation:
  - CALLER: It makes sure that the static type of the object has the appropriate method
  - ARGS: It makes sure that the method takes in the static type of the arguments
- Run-time:
  - CALLER: When you call a method on an object it looks for the method starting at the object's dynamic type
  - ARGS: When you pass an object as an argument, it looks for a method with that static type

```
Animal a1 = new Dog();
Animal a2 = new Dog();
Dog    d1 = new Dog();
a1.sniff(d1);
d1.sniff(a1);
a1.sniff(a2);
```

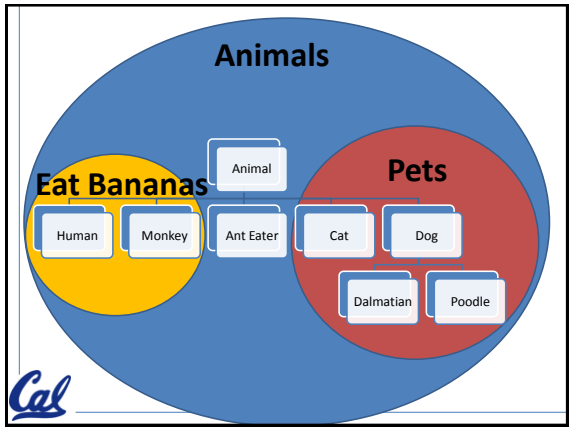


What about `equals(Object o)`

- ArrayList was using an Object reference

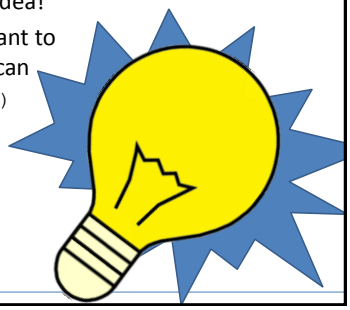
```
Object o1 = new Animal();
Object o2 = new Animal();
o1.equals(o2);
```

- If others will call your methods with more generic references, you want to provide a method that takes in an `Object`



Interfaces

- I have a GREAT idea!
- Everyone will want to make Pets that can
  - `eatKibble()`
  - `sitOnLap()`
- How?!?!
  - I don't care!!!!



The `Pet` interface

```
public interface Pet {
    public void eatKibble();
    public void sitOnLap();
}
```

`Dog` can implement the `Pet` interface

```
public class Dog extends Animal implements Pet{
    public void eatKibble()
    {
        System.out.println("yum! kibble!");
    }
    public void sitOnLap()
    {
        System.out.println("zzzzz");
    }
}
```

`Cat` can implement the `Pet` interface

```
public class Cat extends Animal implements Pet{
    public void eatKibble()
    {
        System.out.println("got milk?");
    }
    public void sitOnLap()
    {
        System.out.println("purrrrrrr");
    }
}
```

We can have a `Pet` remote control (`Pet` reference)

```
Pet p1 = new Dog();
Pet p2 = new Cat();
p1.eatKibble();
p2.sitOnLap();
```

Can we have a `Pet` object?

```
Pet p1 = new Pet();
```

Interfaces can be cool!!!

```
Pet[] myPets = new Pet[2];
myPets[0] = new Dog();
myPets[1] = new Cat();
for (Pet onePet : myPets)
{
    onePet.eatKibble();
}
```

Example

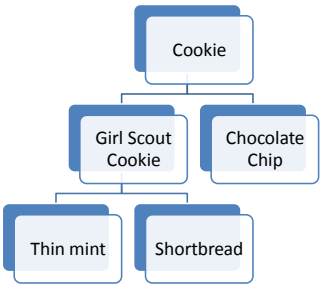
- The `sort` method of the `Array` class promises to sort an array of objects, but under one condition: the objects in the array must implement the `Comparable` interface:

```
public interface Comparable {
  int compareTo(Object other);
}
```

Summary of Interfaces

- Interfaces don't implement ANY methods
  - Just put a semicolon at the end of the method
- Classes can `implement` multiple `interfaces`
- To `implement` an interface you must write all of the methods that the `interface` defines

Cookies!



Abstract Classes (less lazy than Interfaces)

- I have a GREAT idea!
- Everyone will want to make `Cookie`s that can have these methods:
  - `ingredients()`
  - `isDelicious()`

- How?!?!
  - `isDelicious()` is pretty simple, I'll write that one
  - `ingredients()` ?!? Sounds too hard! I'll make that abstract

Abstract Class Cookie

```
public abstract class Cookie {
    public boolean delicious;
    public boolean isDelicious()
    {
        return delicious;
    }
    public abstract String[] ingredients();
}
```

`ChocolateChipCookie` can extend the `Abstract class Cookie`

```
public class ChocolateChipCookie extends Cookie{
    public ChocolateChipCookie()
    {
        this.delicious = true;
    }
    public String[] ingredients()
    {
        String [] ingredients = {"Sugar", "Chocolate"};
        return ingredients;
    }
}
```

We can have a `Cookie` remote control (`Cookie` reference)

```
Cookie c1 = new GirlScoutCookie();
Cookie c2 = new ChocolateChipCookie();
System.out.println("yum?:" + c1.isDelicious());
System.out.println("yum?:" + c2.isDelicious());
```

Can we have a `Cookie` object?

```
Cookie p1 = new Cookie();
```

Abstract Class Summary

- Label an Abstract class as `abstract`
- Label any methods that you don't want to implement as `abstract`
  - Your children MUST write all of the `abstract` methods
- Instance variables in the abstract class will be available in the child class
- You can only extend one Class (`abstract` or otherwise)