

09_1 Object Class

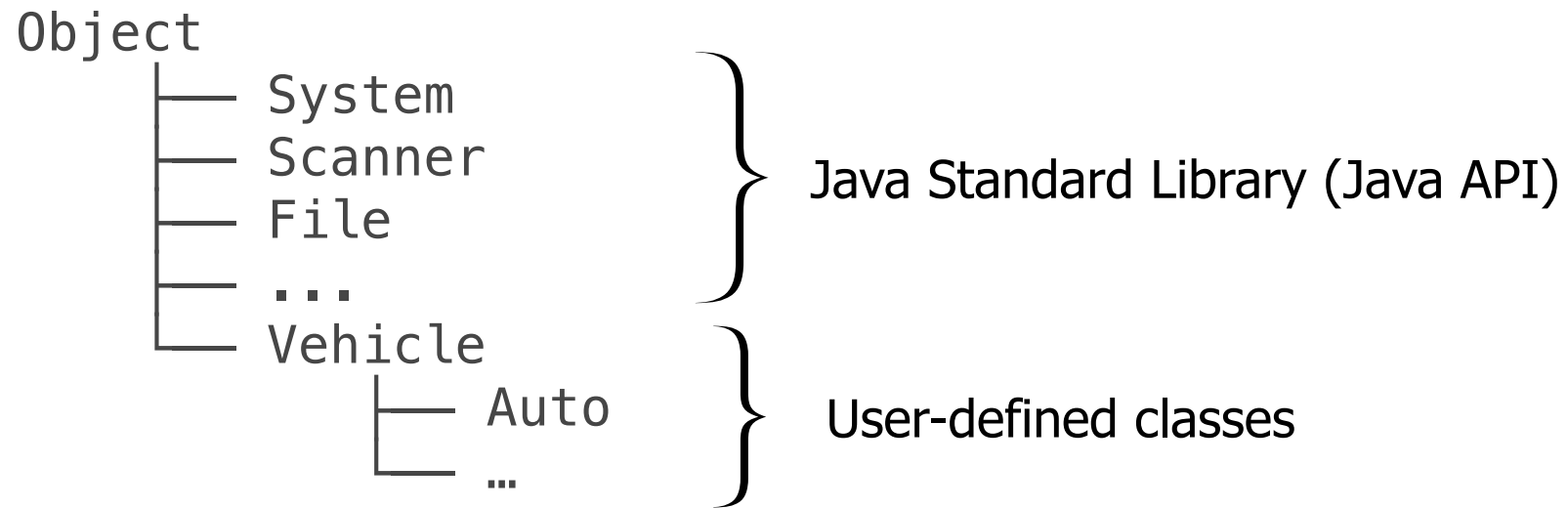
Object-Oriented Programming

java.lang package revisited

- **Object class**
- System class
- Class class
- String, StringBuilder, StringTokenizer
- Wrapper classes: Byte, Short, Character, Integer, Float, Double, Boolean
- Math class

Object class

- Inherited by default by all classes (in all packages) without 'extends' keyword
- Every class (including user-defined class) in java is a child or descendant of Object.



Methods in Object class (1/2)

- boolean equals(Object obj)
 - Testing whether two objects (caller and obj)'s references are the same or not
 - 'equals(obj)' is overridden and rewritten for almost all classes
- String toString()
 - Return the string representing the object's information
 - toString() is overridden and rewritten for almost all classes

Methods in Object class (2/2)

- `int hashCode()`
 - Return the hash code (an integer identifying the object) of the object
 - The same objects should return the same `hashCode()`
 - The `hashCode()` method of Object class usually returns the memory address of the object
 - Overridden `hashCode()` usually implemented with the value of other instance variables
 - `hashCode()` is mainly used with hash-based collection such as 'HashMap', 'HashSet', and 'HashTable' (see later chapter for collections)
 - Multiplying prime number is a technique to reduce the hash collision

Example) ObjectClassTest (1/4)

```
class Person {  
    private String name;  
    private int age;  
  
    public Person(String name, int age) {  
        this.name = name;  
        this.age = age;  
    }  
  
    public String getName() {  
        return name;  
    }  
  
    public int getAge() {  
        return age;  
    }  
}
```

Example) ObjectClassTest (2/4)

```
@Override
public boolean equals(Object other) {

    if (this == other) return true;
    if (other == null || getClass() != other.getClass()) return false;

    Person person = (Person) other; // downcasting

    return age == person.age &&
        (name == null ?
            person.name == null :
            name.equals(person.name));
}
```

Example) ObjectClassTest (3/4)

```
@Override
public int hashCode() {
    int result = (name != null) ? name.hashCode() : 0;
    result = 31 * result + age; // multiplying the prime number 31
    return result;
}

@Override
public String toString() {
    return "Person{" +
        "name='" + name + '\'' +
        ", age=" + age +
        '}';
}
}
```


Example) ObjectClassTest (4/4)

```
public class ObjectClassTest {  
    public static void main(String[] args) {  
        Person person1 = new Person("John", 25);  
        Person person2 = new Person("John", 25);  
        Person person3 = new Person("Jane", 30);  
  
        System.out.println("person1 equals person2: "+person1.equals(person2)); // true  
        System.out.println("person1 equals person3: "+person1.equals(person3)); // false  
  
        System.out.println("person1 hashCode: " + person1.hashCode()); // 71750734  
        System.out.println("person2 hashCode: " + person2.hashCode()); // 71850734  
        System.out.println("person3 hashCode: " + person3.hashCode()); // 71339152  
  
        System.out.println("person1 toString: " + person1.toString()); //...  
        System.out.println("person2 toString: " + person2.toString());  
        System.out.println("person3 toString: " + person3.toString());  
    }  
}
```

Example) EqualsWithPolymorphism (1/3)

```
class AClass {  
    private int x;  
  
    public AClass(int x) { this.x = x; }  
  
    @Override  
    public boolean equals(Object obj) {  
        if (obj == null) return false;  
        if (obj instanceof AClass) {  
            AClass other = (AClass) obj;  
            if (x == other.x) return true;  
            return false;  
        }  
        return false;  
    }  
}
```

Polymorphism:

Descendant object can be assigned to Ancestor type reference variable

Example) EqualsWithPolymorphism (2/3)

```
class BClass extends AClass {
    private int y;
    public BClass(int x, int y) { super(x); this.y = y; }

    public boolean equals(Object obj) {
        if (obj == null) return false;
        if (obj instanceof BClass) {
            BClass other = (BClass) obj; // downcasting
            if (super.equals(obj) && y == other.y)
                return true; // using super.equals
            return false;
        }
        return false;
    }
}

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

Example) EqualsWithPolymorphism (3/3)

```
public class EqualsWithPolymorphism {  
    public static void main(String[] args) {  
        AClass a1 = new AClass(3);  
        AClass a2 = new AClass(7);  
        BClass b1 = new BClass(3, 5);  
        BClass b2 = new BClass(7, 9);  
        CClass c = new CClass("Korea");  
        System.out.println(a1.equals(a1));    // true  
        System.out.println(a1.equals(b1));    // true  
        System.out.println(a1.equals(b2));    // false  
        System.out.println(a2.equals(c));    // false  
    }  
}
```