Class definition / declaration

A class (or class definition, or class declaration) is a blueprint that describes the contents of each object of the class. To the right is a definition of class *C*. Use it as a first model for any class that you write. We explain its pieces.

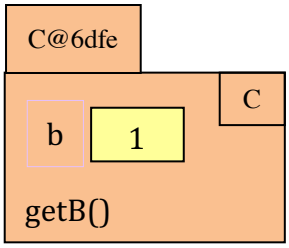
```
public class C {
    private int b;

    public int getB() {
        return b;
    }
}
```

Keyword **public** is an *access modifier*. It indicates that all parts of a program can access class *C*. The first brace { and last brace } delimit the *body* of the class. The body contains two declarations:

- A declaration of variable b. It is called a *field* of the class. Access modifier **private** indicates that this field can be accessed or referenced only from within objects of this class, not from outside the class.
- A declaration of function *getB*. It is **public**, so it can be referenced or called from outside the class. It returns an **int** value. Its body, delimited by { and }, contains the statement **return** *b*;.

There could be fewer or more variable declarations, and fewer or more method declarations. The order of the declarations in a class doesn't matter at all, but, the convention is to place the field declarations first.

Above, we said that the class is a blueprint that describes the contents of each object of the class. To the right we draw an object of the class, based on this blueprint.



It looks like a manila folder. The tab at the top contains the name of, or a pointer to, the object itself. The tab contains (1) the name of the class, (2) @, and (3) an integer written in hexadecimal. When *we* draw an object, we put any integer we want after @ to distinguish it from other objects. When a computer creates the object during program execution, it puts the address in memory of the object, written in hexadecimal.

We put a small box with the class name in the upper right.

The class definition contains a declaration of field *b*. Therefore, variable b is in the object; here, it happens to contain the value 1.

The class definition contains a declaration of method *getB*. Therefore, method *getB* is in the object. We write only the signature "*getB*()", but actually the whole method is there, and instead of *getB*() we might write:

getB() {…} or *getB*() { **return** b; }

Thus, every object of class *C* contains all the fields and methods that are declared in class *C*.

Subclasses and superclasses

To the right is a declaration of another class *S*. It is different from the declaration of *C* in that it has an *extends clause*,

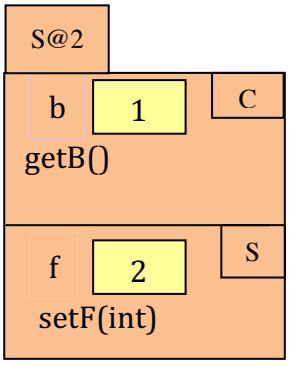
extends C

```
public class S extends C {
    private int f= 2;

    public void setF(int x) {
        f= x;
    }
}
```

This means that an object of class *S* contains not only the fields and methods declared in it but also *all the fields and methods of class C.* Here is some terminology:

- *S* is a *subclass* of *C.*
- *C* is a *superclass* of *S.*
- Subclass *S inherits* all fields and methods of superclass *C.*

We draw an object of class *S* to the right. Now there are two *partitions*, a partition for the components (fields and methods) declared in class *C* and a partition for the components declared in class *S*. The partition for *S* appears under the partition for *C* since *S* is the subclass and *C* is the superclass.



The declaration of a subclass is a great way to use previously written code. With just the introduction of "**extends** *C*", we get to use all that *C* has to offer. This is a major feature of object-oriented programming.

Class Object, the superest class of them all

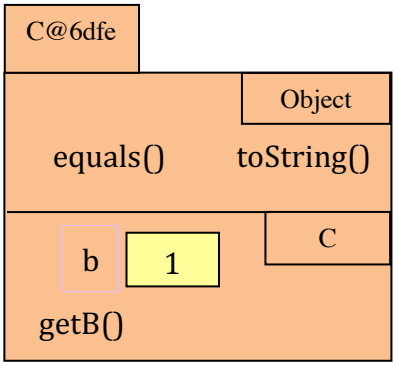
Java has a predeclared class *Object*, in package *java.lang*. Any class that does not explicitly extend another class automatically extends class *Object*. Since class *C* declared on the previous page does not explicitly extend another class, it automatically extends Object.

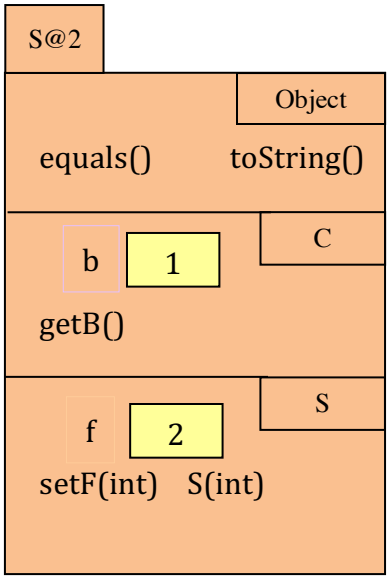
Therefore, the objects of class *C* and *S* on the previous page should be drawn as shown below. Note that object *S*@2 has *three* partitions: the top one for superclass *Object*, the middle one for its subclass *C*, and the lower one for *C*'s subclass *S*.

However, to reduce clutter, when there is no reason to draw attention to class *Object*, we may omit its partition.

Object has no superclass above it, so we call it the *superest* class of them all.

Class Object declares about 11 methods. The objects below show the two you will learn about first: *equals*() and *toString*(). They are discussed elsewhere.





and S. S is a subclass of C and C is a superclass of S.

To the right of the class definitions we draw an object of class S. It has three *partitions*: one for subclass S, one above it for class C, and one above that for class Object, the *superest* class of them all. Class Object is the superclass of any class that does not explicitly extend a class. At the top-right of a partition, we draw a box with the name of the class.

To avoid clutter, since we know partition Object is always at the top and we know something about what it contains, we often do not draw it.

In the partition for any class (like C), we draw the fields and write the signatures of the methods that are declared in that class. Thus, the partition for C contains field b, the constructor, and function getB. The signature for a method is just an abbreviation for the whole method, including its body. We work with the concept that the whole instance method (like getB) resides in the object.

The tab at the top of the object contains the name of the object. It consists of the class of the object (S), the @ sign, and a hexademical number giving the address in memory where the object resides. When *we* create or draw an object, we can put any number we want there, making sure that different ojects have different addresses.

When the following assignment is executed, first the new-expression is evaluated, creating the object shown and yielding as value of the new-expression the name S@6dfe, then that value is stored in s. Thus, s contains a pointer to the new object, not the new object itself.

```
S s= new S(1);
```