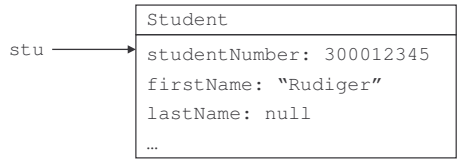
Working with References

References

- Every object variable in Java is really a **reference** to an object.
- Also true when an object is passed as an argument: a **reference** to the object is passed to the function.
- When the object is used, the reference is "followed" to find the actual object.

The Picture

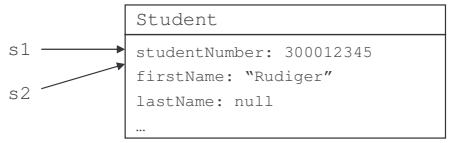
```
Student stu = new Student(300012345, "uid");
stu.setFirstName("Rudiger");
```



Aliases

- Assigning to an object copies the **reference**, not the whole object:

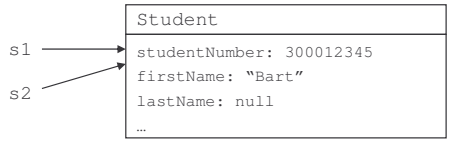
```
Student s1 = new Student(300012345, "uid");
s1.setFirstName("Rudiger");
Student s2 = s1;
```



Aliases

- Then, changes to one object will affect both references:

```
s2.setFirstName("Bart");
System.out.print( s1.getFirstName() );
  // prints "Bart"
```



Copying

- If we really do want to **copy** an object, it has to be done manually.
- Create a new instance and copy the relevant data over.
- Not an issue if there are no methods that modify the object: no unexpected results from changes.
  - eg. the `String` class
  - called "immutable objects" in Python

The `clone` Method

- Many classes contain a `.clone()` method.
  - This method returns a copy of the object.
  - i.e. a **new** object with the relevant data copied
- eg.

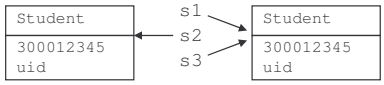
```
public Student clone() {
        Student s = new Student(
            studentNumber, userid);
        … // copy rest of the data to s
        return s;
    }
```

Equality and References

- When comparing two objects, the **references** are compared, not the object contents.

```
Student s1 = new Student(300012345, "uid");
Student s2 = new Student(300012345, "uid");
Student s3 = s1;
```

- Now: `s1==s3 && s1!=s2`



The `equals` Method

- Many classes contain a `.equals()` method.
  - Takes another object of the same type as its argument.
  - Return true if the two objects are "equal"
  - … whatever "equal" means for this type.
- eg.

```
public boolean equals(Student s) {
   return studentNumber==s.studentNumber;
}
```

this instance's data member — other instance's data member

The `compareTo` Method

- Used for more general comparison: <, ==, >
- `a.compareTo(b)` should return:
  - a negative `int` if `a < b`
  - 0 if `a==b`
  - a positive `int` if `a > b`
- Used by the built-in sorts for objects.
  - One call to `compareTo` gives all the info needed about relative order.

The "`this`" Reference

- It is often convenienct/necessary to explicitly refer to members of the current object.
  - eg. `return studentNumber==other.studentNumber;`
  - not totally clear where the first `studentNumber` comes from.
- There is a special variable `this` that always refers to the object that the code is defining.
  - previous example is now easier to read:

```
return this.studentNumber==other.studentNumber;
```

Specifying Scope with `this`

- In methods, we had to be careful to choose different names for arguments and data members.

```
public Student(long stunum) {
    studentNumber = stunum; }
```

- Using `this`, we can avoid the problem & keep names consistent:

```
public Student(long studentNumber) {
    this.studentNumber = studentNumber; }
```