CSSE 220

Objects

Import *SuperSimpleObjects* from repo

Import *TeamGradebook* from Moodle

Plan for today

- Talk about object references and box and pointer diagrams
- Talk about static methods
- Continue working on writing your own classes
- Get started on TeamGradebook, your new assignment

TeamGradebook

- Just a quick demo

Finishing up from last time...

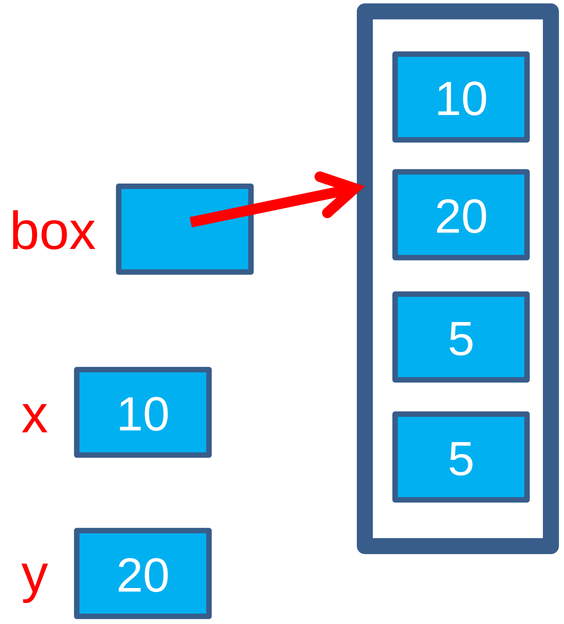
- Complete the StudentAssignments problem in the SuperSimpleObject project (or the one from last class)

Differences between primitive types and object types in Java

OBJECT REFERENCES

What Do Variables Really Store?

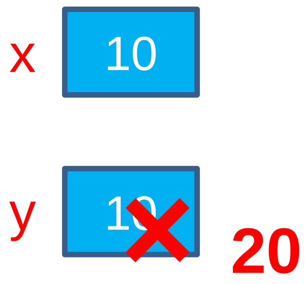
- Variables of primitive type store *values*
- Variables of class type store *references*

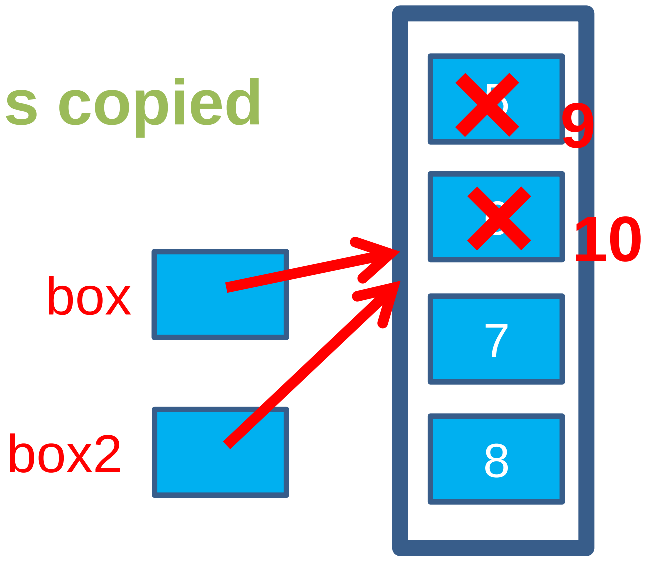


```
1. int x = 10;
2. int y = 20;
3. Rectangle box = new Rectangle(x, y, 5, 5);
```

Assignment Copies Values

- Actual value for number types
- **Reference** value for object types
  - The actual **object is not copied**
  - The **reference value** (“the pointer”) **is copied**
- Consider:





```
int x = 10;
int y = x;
y = 20;

Rectangle box = new Rectangle(5, 6, 7, 8);
Rectangle box2 = box;
box2.translate(4, 4);
```

Reference vs Value Equality

What gets printed?

```
String t1 = "hello";
String t2 = "hello";
System.out.println(t1 == t2);
System.out.println(t1.equals(t2));
```

May print **true** or **false**

Prints **true**

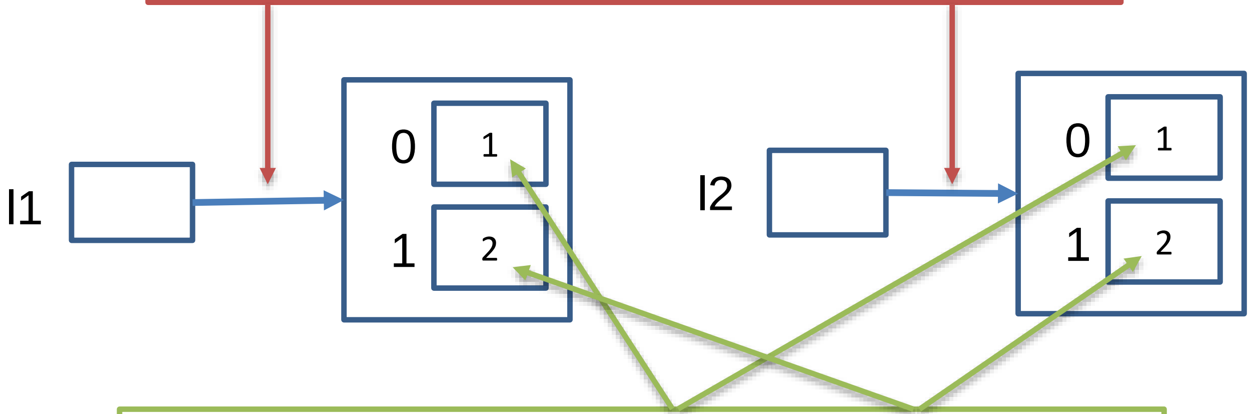
What gets printed here?

```
ArrayList<Integer> l1 = new ArrayList<Integer>();
l1.add(1);
l1.add(2);
ArrayList<Integer> l2 = new ArrayList<Integer>();
l2.add(1);
l2.add(2);
System.out.println(l1 == l2);
System.out.println(l1.equals(l2));
```

Prints **false**

Prints **true**

== operator compares references of two objects



equals(), in general, compares values of two objects

Q11

Box and pointer exercise

Q1 – Q10

Understanding static

STATIC

Why fields can’t always be static

```java
public class Student {
 private String name;
 private char grade;

 public Student(
     String name,
     char grade){
   this.name = name;
   this.grade = grade;
 }

 @Override
 public String toString(){
   return name +
     " has a grade of "
     + grade;
 }
}
```

Client program – of Student Class

```java
public static void main(String[] args) {
  Student a = new Student("Adam", 'A');
  Student b = new Student("Bryan", 'B');
  Student c = new Student("Chris", 'C');
  System.out.println(a);
  System.out.println(b);
  System.out.println(c);
}
```

OUTPUT – from Client program:

```
Adam has a grade of A
Bryan has a grade of B
Chris has a grade of C
```

Why fields can’t always be static

```
public class Student {
 private String name;
 private static char grade;

 public Student(
     String name,
     char grade){
   this.name = name;
   Student.grade = grade;
 }

 @Override
 public String toString(){
   return name +
     " has a grade of "
     + grade;
 }
}
```

Client program – of Student Class

```
public static void main(String[] args) {
  Student a = new Student("Adam", 'A');
  Student b = new Student("Bryan", 'B');
  Student c = new Student("Chris", 'C');
  System.out.println(a);
  System.out.println(b);
  System.out.println(c);
}
```

```
OUTPUT – from Client program:
Adam has a grade of C
Bryan has a grade of C
Chris has a grade of C
```

Static means there's only one instance of a field/method for all instances of a class that's created. So when you change a grade, it changes for all instances.

When do we make methods static?

- Utility Methods
  - Things like abs, sqrt, etc.
  - Don’t need an instance of a class to run them
- How do I know?
  - No references to non-static fields/methods
  - No “this” keyword used in method

When do we make fields static?

- Never
  - Seriously, this is disallowed for all the code you submit in CSSE220 (exception: CONSTANTS)
  - It makes your designs worse
- If it wasn’t disallowed, when would you use it?
  - Very rarely for memory efficiency, state that can’t be duplicated, or really meta code
  - BUT even professional programmers misuse static and cause themselves major problems
  - They’ll talk about some positive uses in CSSE374

```java
public class Car {

    private double mileage;

    //other stuff

    public double getMilesTravelled() {
        return this.mileage;
    }

    public static double convertMilesToKm(double numberOfMiles) {
        return numberOfMiles * 1.609344f;
    }

}
```

```java
//Elsewhere in a client program of Car class
```

```java
//requires you to have a car object
Car myCar = new Car();
// getMilesTravelled requires you to have a car object
System.out.println(myCar.getMilesTravelled());//output depends on code
//convertMilesToKm can be called on the class Car itself
System.out.println(Car.convertMilesToKm(77));//output is 123.919488
```

```java
public class Bicycle {

    private int speed;
    private static int numCreated = 0;

    public Bicycle(int speed) {
        this.speed = speed;
        Bicycle.numCreated++;
    }
    public int getSpeed() {
        return this.speed;
    }
    public static int getNumCreated() {
        return Bicycle.numCreated;
    }
}
```

```java
// Client does not need Bicycle object for calling getNumCreated
System.out.println(Bicycle.getNumCreated());
Bicycle myBike1 = new Bicycle(18);
Bicycle myBike2 = new Bicycle(1);
System.out.println(Bicycle.getNumCreated() + " " + myBike1.getSpeed());
```

```
0
2 18
```

Q12 - Q16

Exercise

- Start working on the TeamGradeBook homework. Try to finish the code for both add-student, add-absence and get-absences today
- If you are confused about what to do, get help!