DISC 08

OOP

OOP TERMINOLOGY

```
class Pet:
    happy = True
    def __init__(self, name):
        self.name = name

class Puppy(Pet):
    good_boy = True
    def bark(self):
        if Pet.happy:
            print(“woof”)
    def break_lamp(self):
        self.good_boy = False
        happy = False
```

class

class attributes

instance attributes

class attributes

methods

class

OOP TERMINOLOGY

```
brian = Puppy("brain")
marvin = Puppy("marv")
```

```
class Pet:
    happy = True
    def __init__(self, name):
        self.name = name

class Puppy(Pet):
    good_boy = True
    def bark(self):
        if Pet.happy:
            print("woof")
    def break_lamp(self):
        self.good_boy = False
        happy = False
```

no __init__ method defined here
check parent for __init__

objects

brian

name: "brain"

marvin

name: "marv"

HOW TO KEEP TRACK OF CLASSES AND OBJECTS

- Creating classes:
  - Go through the class definitions and write class names on the LHS
  - Write class attributes under the corresponding name
  - Write class methods under the corresponding name
- Creating objects:
  - Write name of object on the RHS
  - Go to the __init__ of the object's class and write the object's instance attributes under the object name on the RHS

1. Create classes

1.1

Writing the class attributes and methods under each class on the left will help remind you which method to execute when you call a method

Instructor
- degree: “PhD (Basketball)”
- __init__
- lecture

Student
- instructor:
- __init__
- attend_lecture
- visit_office_hours

TeachingAssistant
- __init__
- add_student
- assist

```
class Instructor:
    degree = "PhD (Basketball)" # this is a class attribute
    def __init__(self, name):
        self.name = name # this is an instance attribute

    def lecture(self, topic):
        print("Today we're learning about " + topic)

lebron = Instructor("Professor LeBron")
class Student:
    instructor = lebron

    def __init__(self, name, ta):
        self.name = name
        self.understanding = 0
        ta.add_student(self)

    def attend_lecture(self, topic):
        Student.instructor.lecture(topic)
        print(Student.instructor.name + " is awesome!")
        self.understanding += 1

    def visit_office_hours(self, staff):
        staff.assist(self)
        print("Thanks, " + staff.name)

class TeachingAssistant:
    def __init__(self, name):
        self.name = name
        self.students = {}

    def add_student(self, student):
        self.students[student.name] = student

    def assist(self, student):
        student.understanding += 1
```

1. Create classes

We missed something!

1.1

Instructor
- degree: “PhD (Basketball)”
- __init__
- lecture

Student
- instructor: lebron
- __init__
- attend_lecture
- visit_office_hours

TeachingAssistant
- __init__
- add_student
- assist

```
class Instructor:
    degree = "PhD (Basketball)" # this is a class attribute
    def __init__(self, name):
        self.name = name # this is an instance attribute

    def lecture(self, topic):
        print("Today we're learning about " + topic)

lebron = Instructor("Professor LeBron")
class Student:
    instructor = lebron

    def __init__(self, name, ta):
        self.name = name
        self.understanding = 0
        ta.add_student(self)

    def attend_lecture(self, topic):
        Student.instructor.lecture(topic)
        print(Student.instructor.name + " is awesome!")
        self.understanding += 1

    def visit_office_hours(self, staff):
        staff.assist(self)
        print("Thanks, " + staff.name)

class TeachingAssistant:
    def __init__(self, name):
        self.name = name
        self.students = {}

    def add_student(self, student):
        self.students[student.name] = student

    def assist(self, student):
        student.understanding += 1
```

1. Create classes

2. Create objects

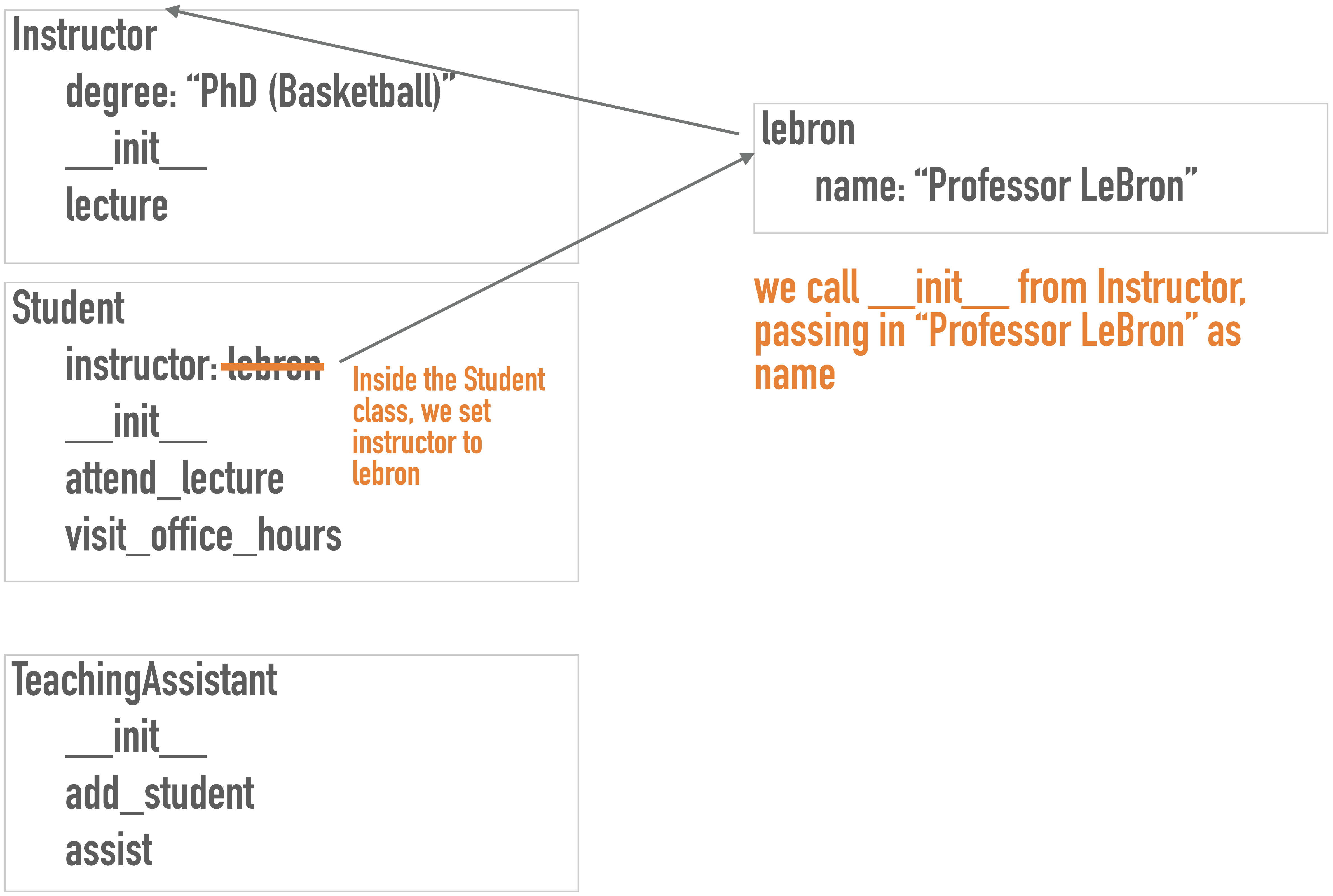
1.1

The current line will be displayed up here

```
>>> lebron = Instructor("Professor LeBron")
```

Classes

OBJECTS



Inside the Student class, we set instructor to lebron

we call __init__ from Instructor, passing in "Professor LeBron" as name

NOW THAT WE SET UP OUR CLASSES AND OBJECTS, WE CAN START EXECUTING THE CODE

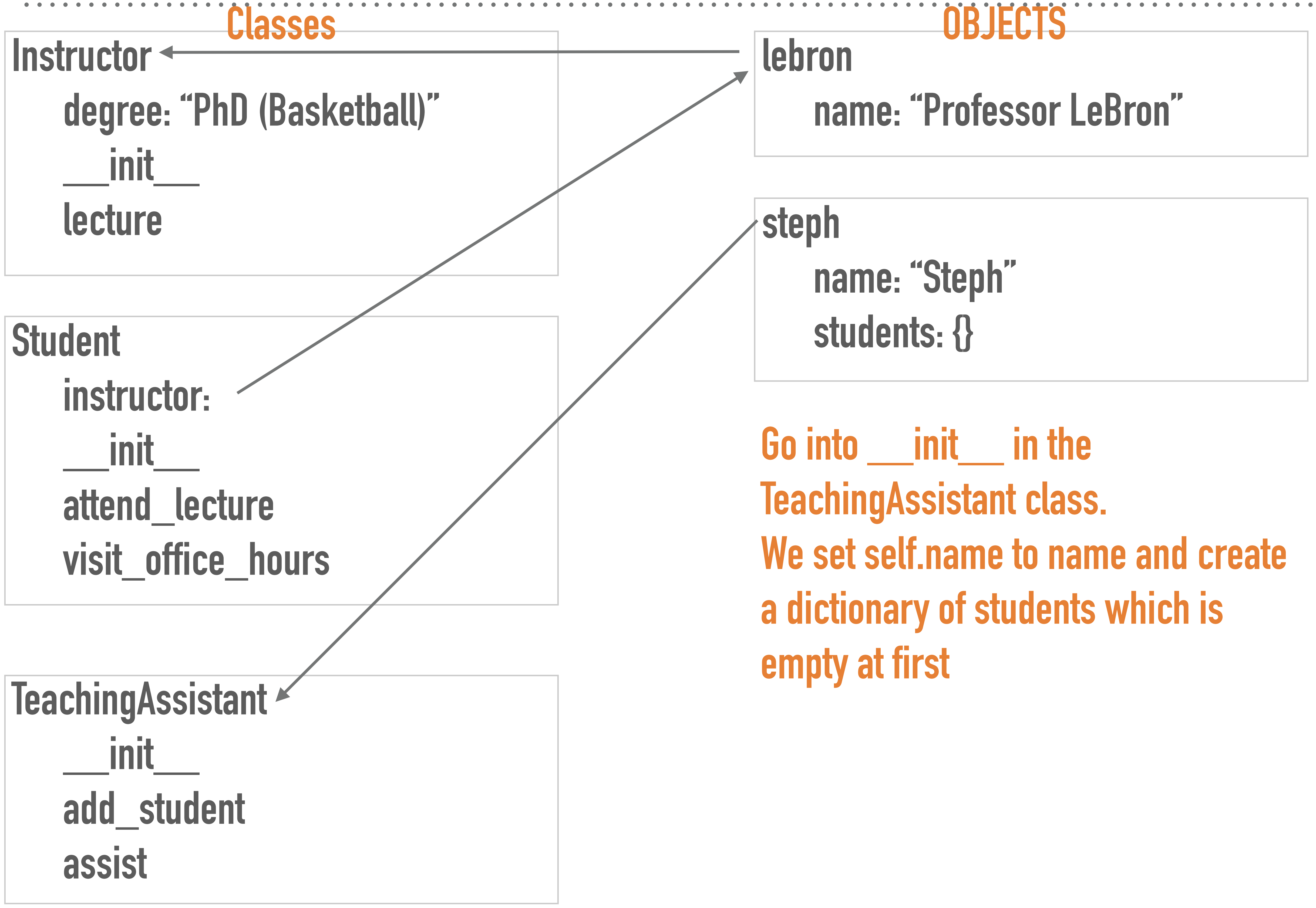
1.1

Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> steph = TeachingAssistant("Steph")
```

1. Create classes

2. Create objects



Go into __init__ in the TeachingAssistant class.
We set self.name to name and create a dictionary of students which is empty at first

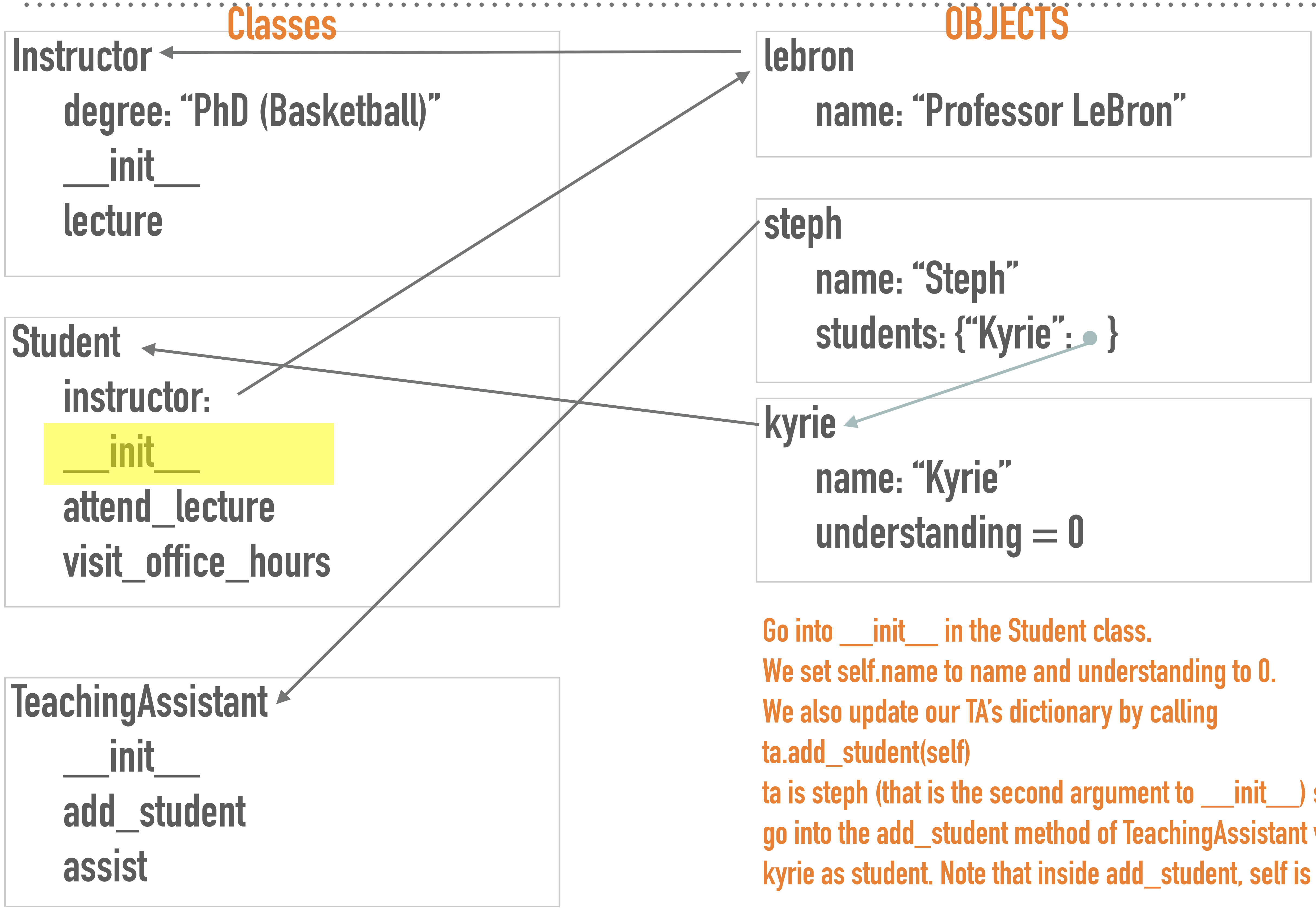
Now we are ready to walk through the lines on page 3
The current line will be displayed up here

1.1

```
>>> kyrie = Student("Kyrie", steph)
```

1. Create classes

2. Create objects



Go into __init__ in the Student class.
We set self.name to name and understanding to 0.
We also update our TA's dictionary by calling
ta.add_student(self)
ta is steph (that is the second argument to __init__) so we go into the add_student method of TeachingAssistant with kyrie as student. Note that inside add_student, self is steph

1.1

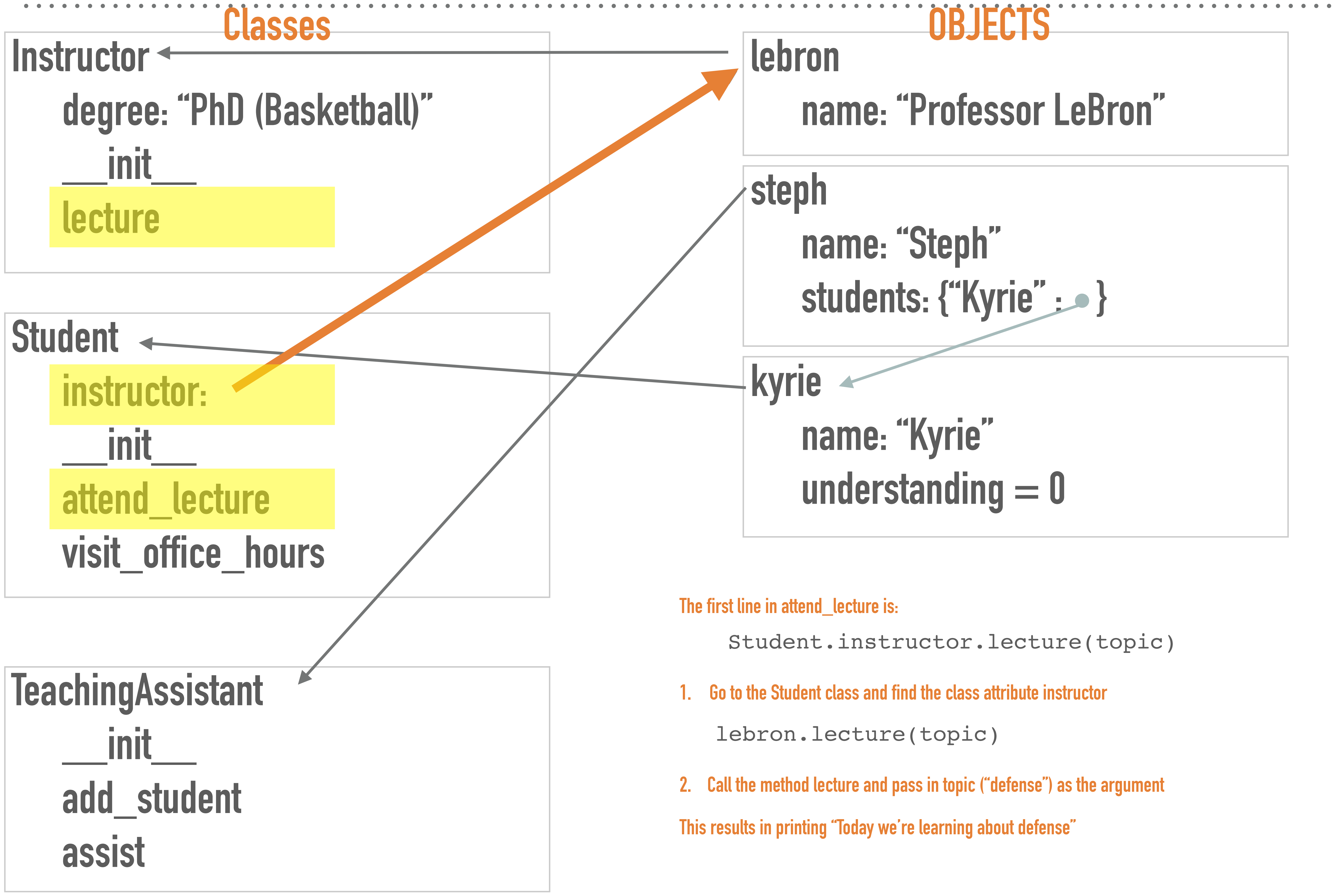
Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> kyrie.attend_lecture(“defense”)
```

“Today we’re learning about defense”

1. Create classes

2. Create objects



The first line in attend_lecture is:

```
Student.instructor.lecture(topic)
```

1. Go to the Student class and find the class attribute instructor

```
lebron.lecture(topic)
```

2. Call the method lecture and pass in topic (“defense”) as the argument

This results in printing “Today we’re learning about defense”

1.1

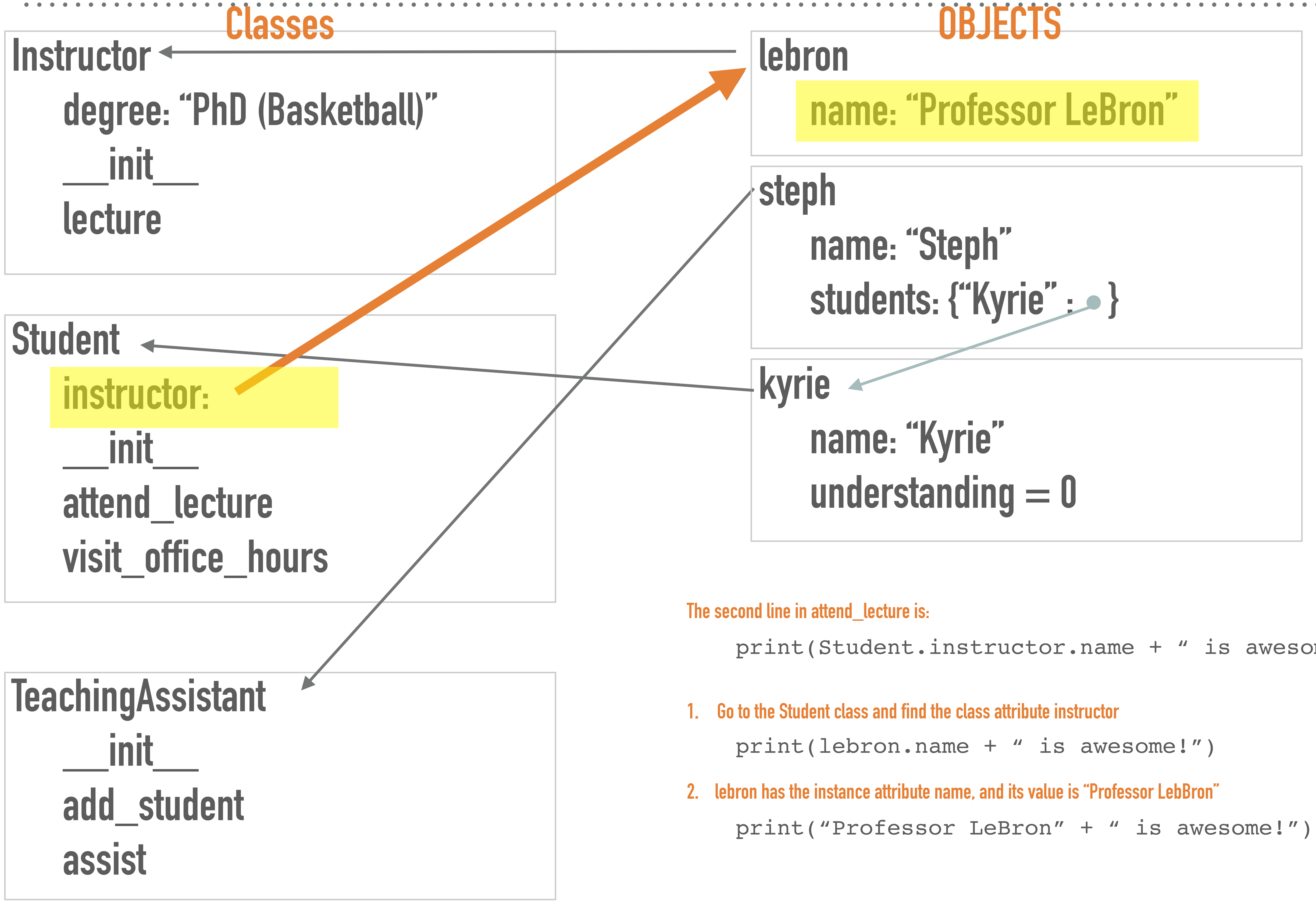
Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> kyrie.attend_lecture("defense")
```

Today we're learning about defense
Professor LeBron is awesome!

1. Create classes

2. Create objects



The second line in attend_lecture is:

```
print(Student.instructor.name + " is awesome!")
```

1. Go to the Student class and find the class attribute instructor

```
print(lebron.name + " is awesome!")
```

2. lebron has the instance attribute name, and its value is "Professor LebBron"

```
print("Professor LeBron" + " is awesome!")
```

Now we are ready to walk through the lines on page 3
The current line will be displayed up here

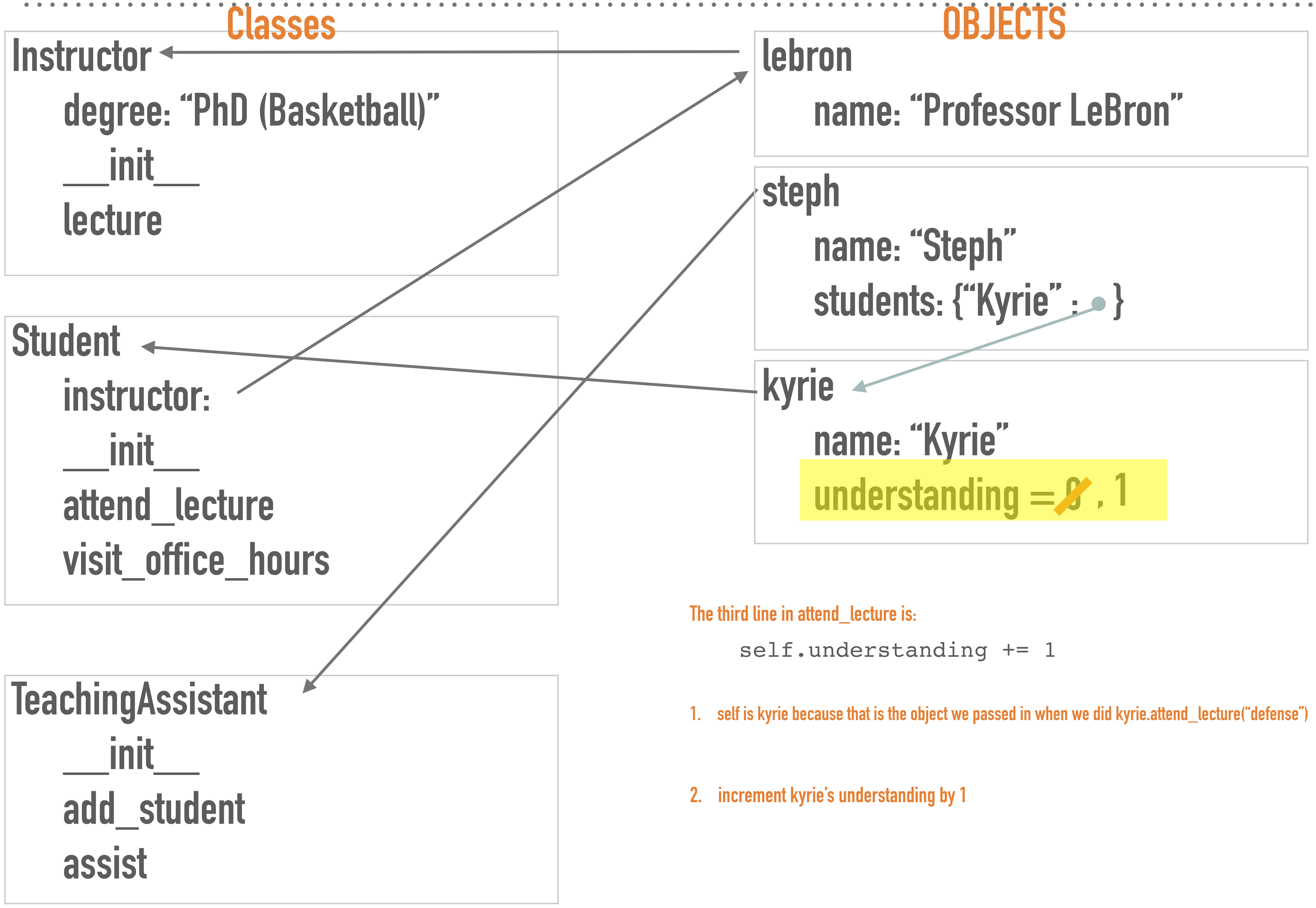
1.1

```
>>> kyrie.attend_lecture(“defense”)
```

Today we’re learning about defense
Professor LeBron is awesome!

1. Create classes

2. Create objects



The third line in attend_lecture is:

```
self.understanding += 1
```

1. self is kyrie because that is the object we passed in when we did kyrie.attend_lecture(“defense”)

2. increment kyrie’s understanding by 1

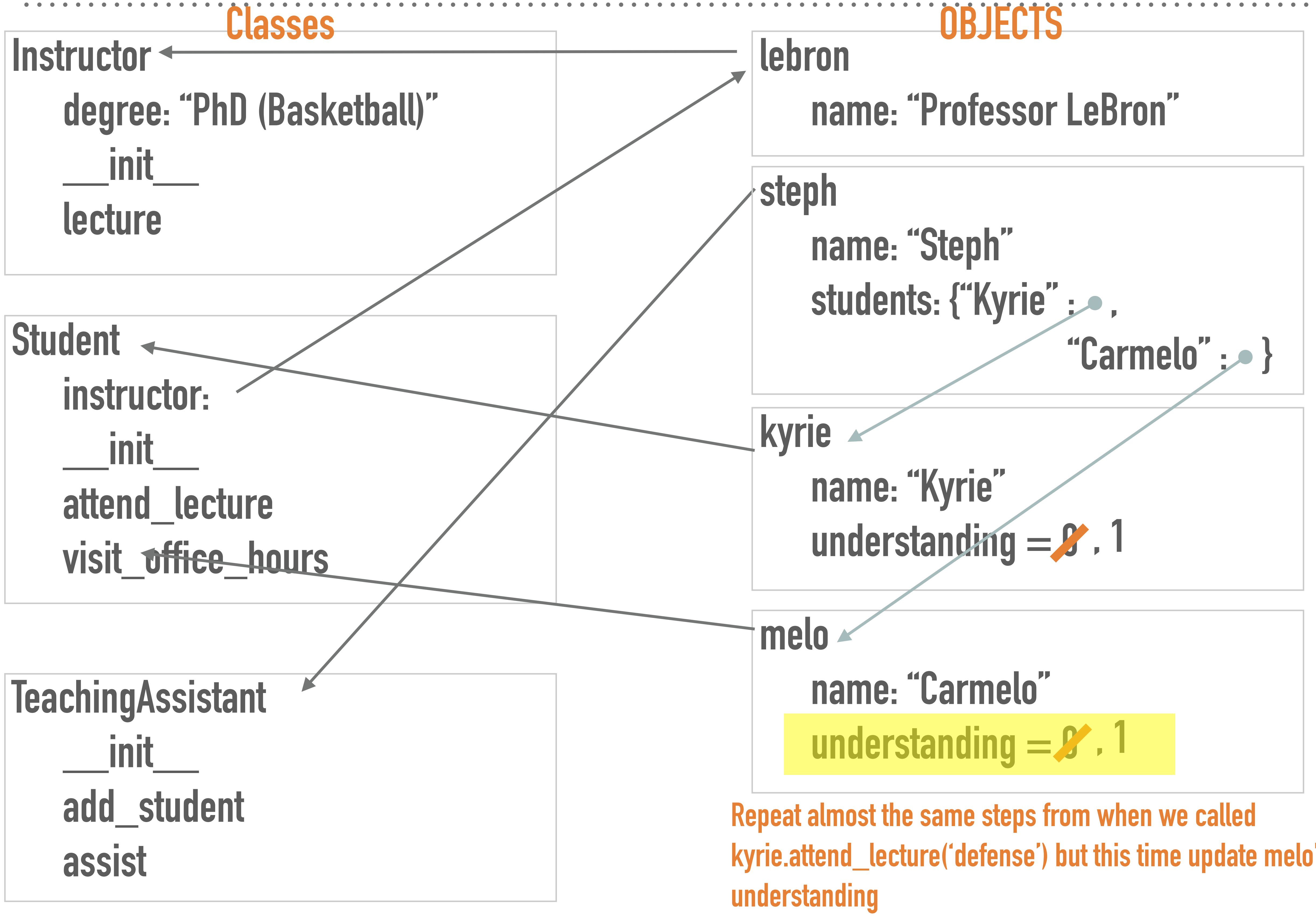
1.1

Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> melo.attend_lecture("championships!")
Today we're learning about championships
Professor LeBron is awesome!
```

1. Create classes

2. Create objects



Repeat almost the same steps from when we called kyrie.attend_lecture('defense') but this time update melo's understanding

Now we are ready to walk through the lines on page 3
The current line will be displayed up here

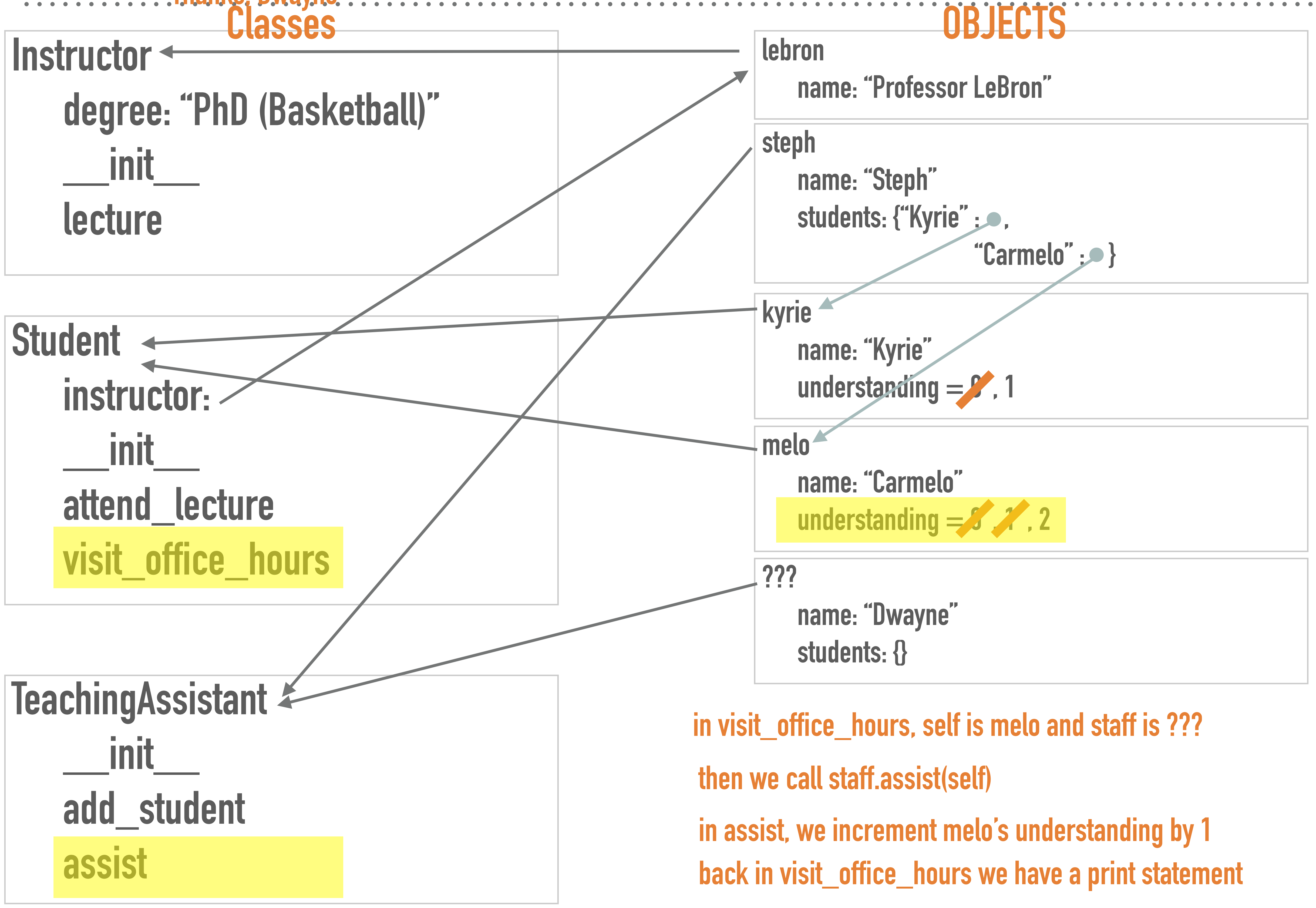
1.1

```
>>> melo.visit_office_hours
                 (TeachingAssistant("Dwayne"))
```

Thanks, Dwayne

1. Create classes

2. Create objects



in visit_office_hours, self is melo and staff is ???

then we call staff.assist(self)

in assist, we increment melo's understanding by 1

back in visit_office_hours we have a print statement

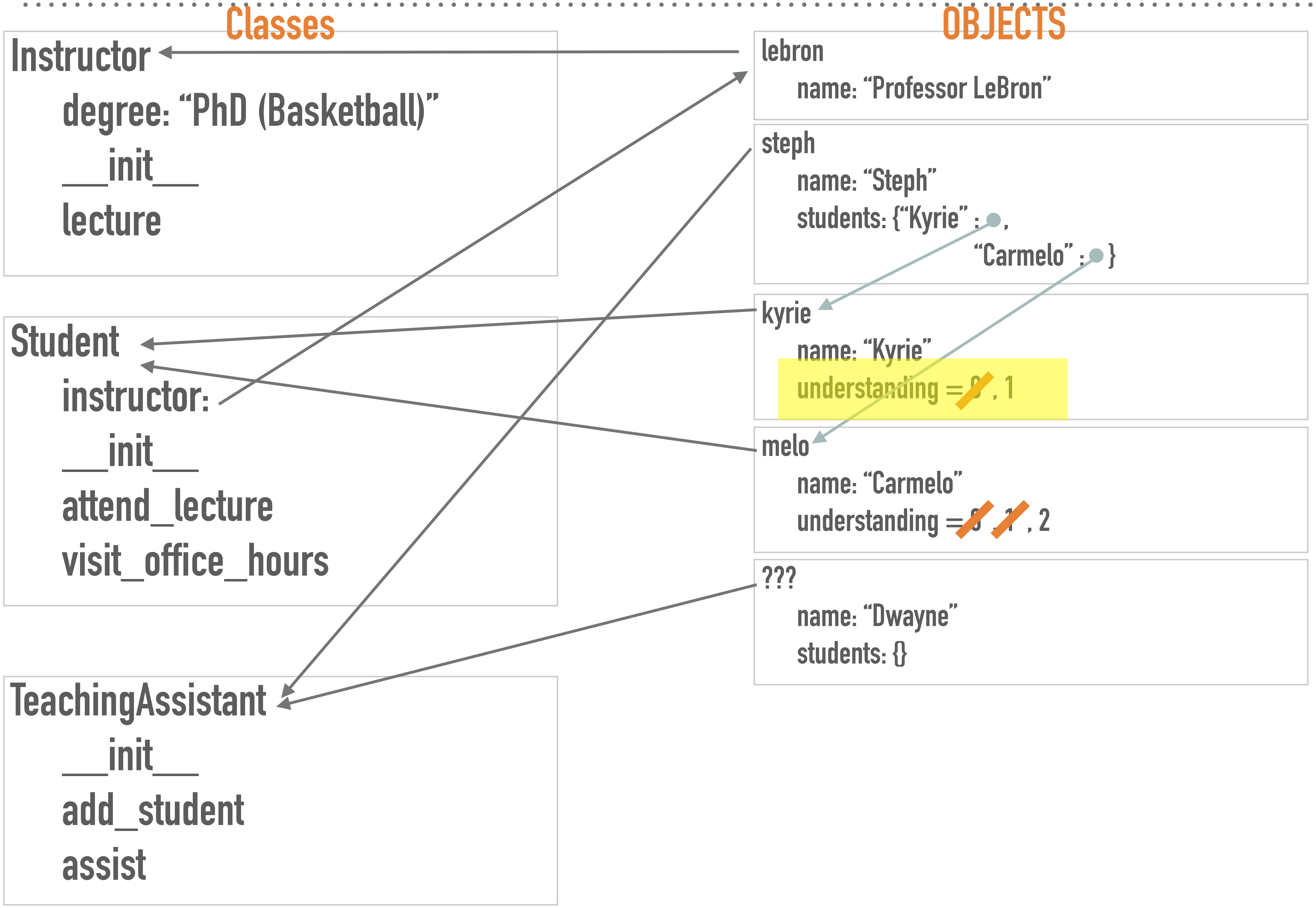
Now we are ready to walk through the lines on page 3
The current line will be displayed up here

1. Create classes

2. Create objects

1.1

```
>>> kyrie.understanding
1
```



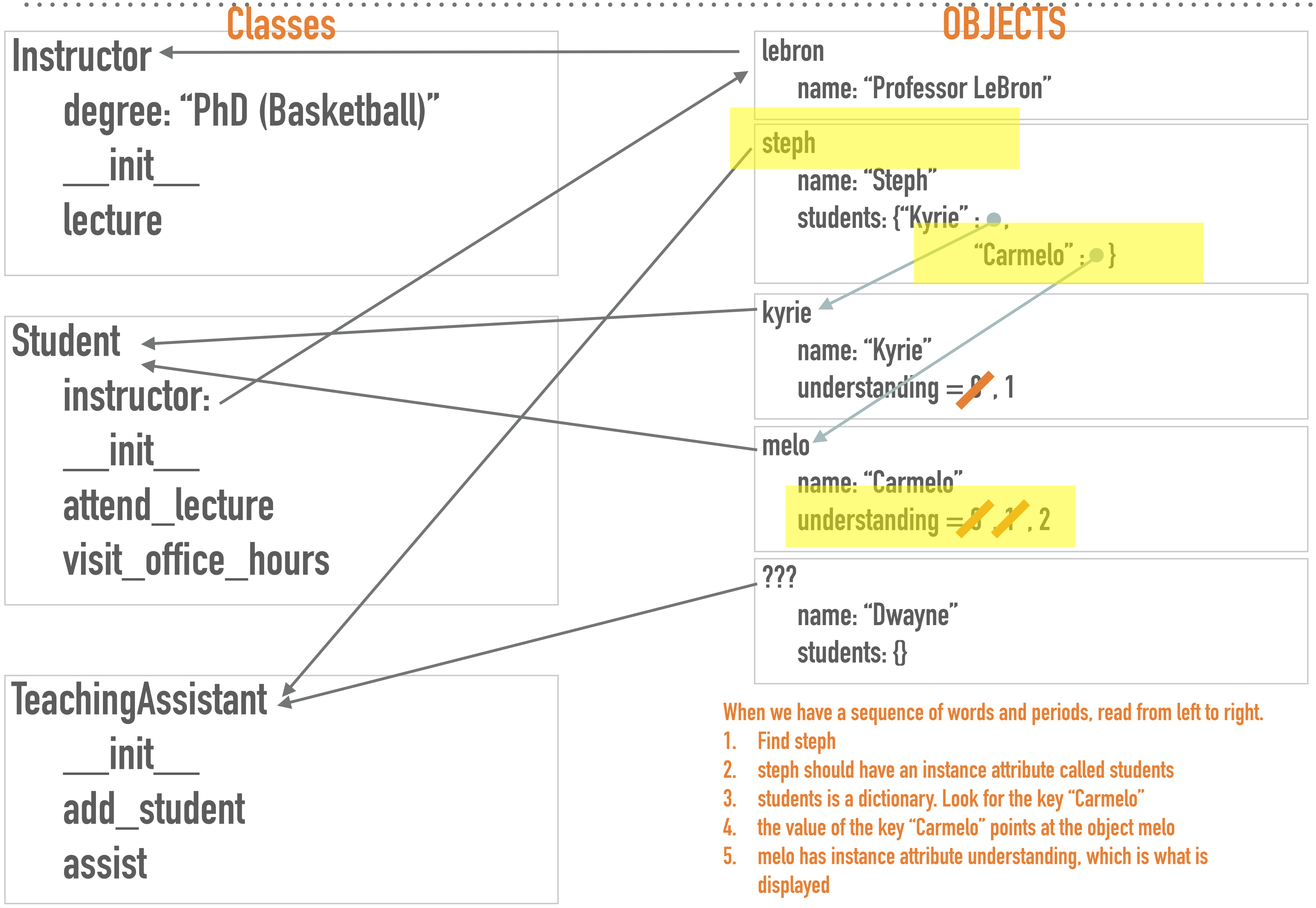
1.1

Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> steph.students["Carmelo"].understanding
2
```

1. Create classes

2. Create objects



When we have a sequence of words and periods, read from left to right.

1. Find steph
2. steph should have an instance attribute called students
3. students is a dictionary. Look for the key "Carmelo"
4. the value of the key "Carmelo" points at the object melo
5. melo has instance attribute understanding, which is what is displayed

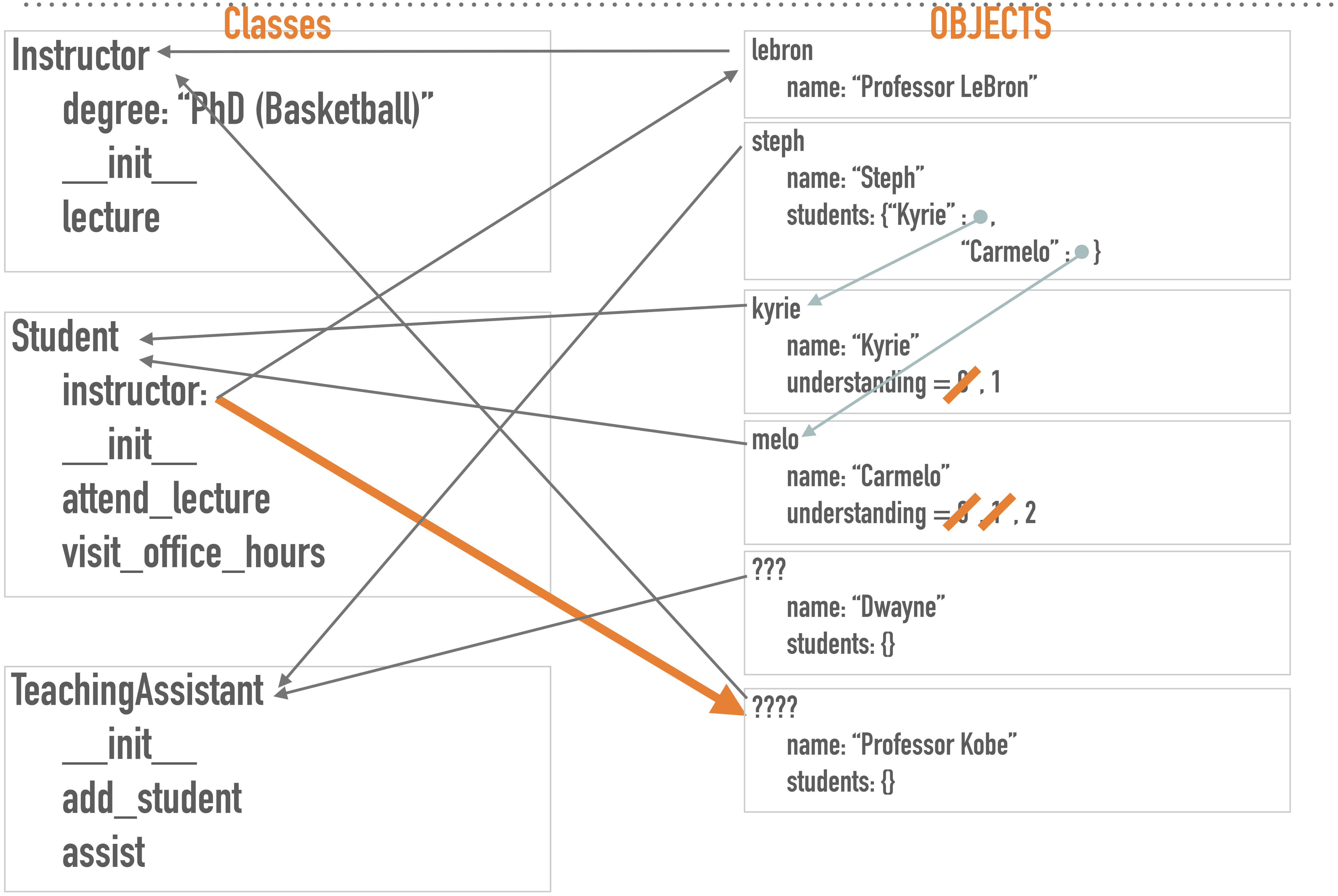
1.1

Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> Student.instructor =
              Instructor(“Professor Kobe”)
```

1. Create classes

2. Create objects



1.1

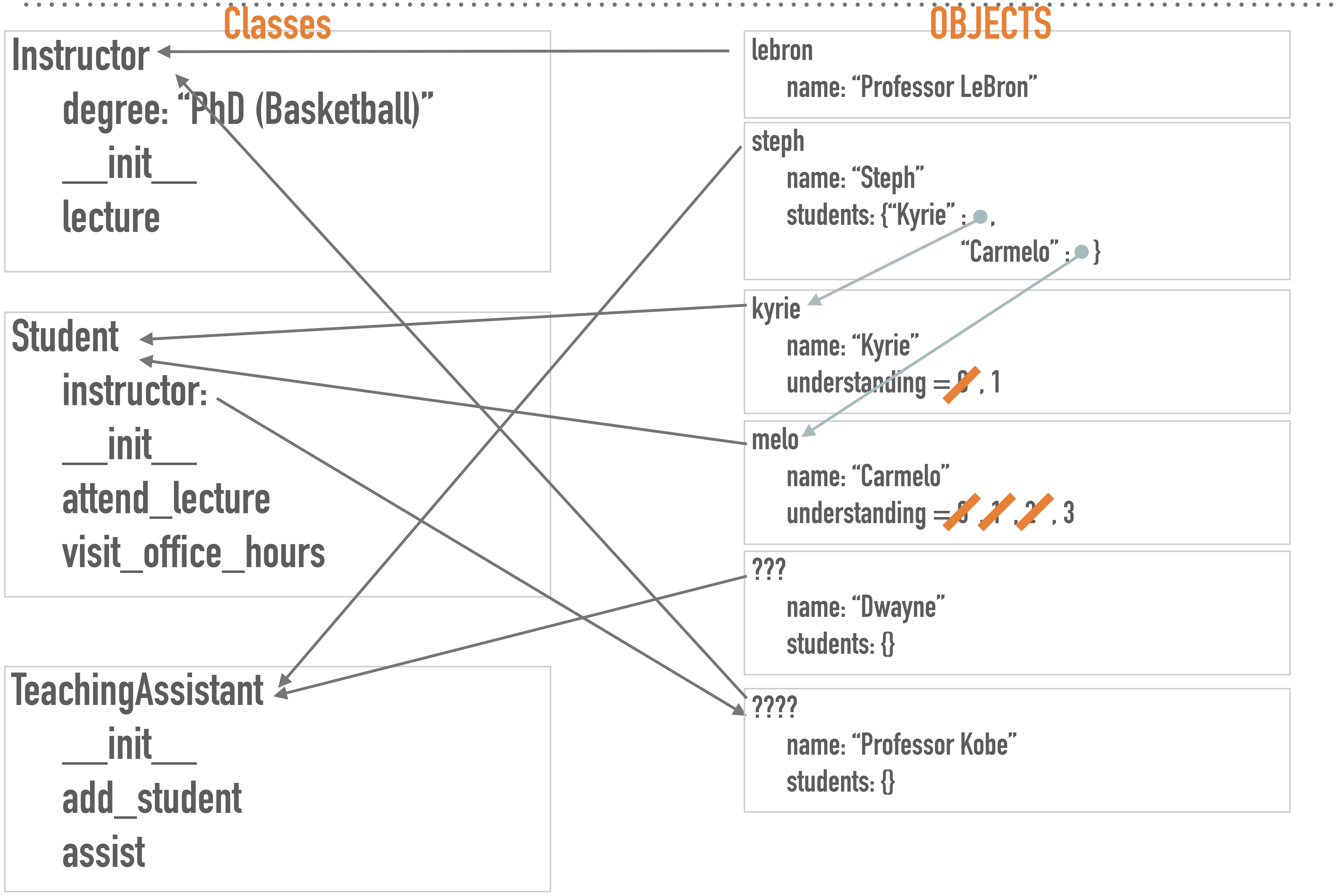
Now we are ready to walk through the lines on page 3
The current line will be displayed up here

```
>>> Student.attend_lecture(melo,
                           “game winners”)
```

Today we’re learning about game winners
Professor Kobe is awesome!

1. Create classes

2. Create objects



2.1 #3

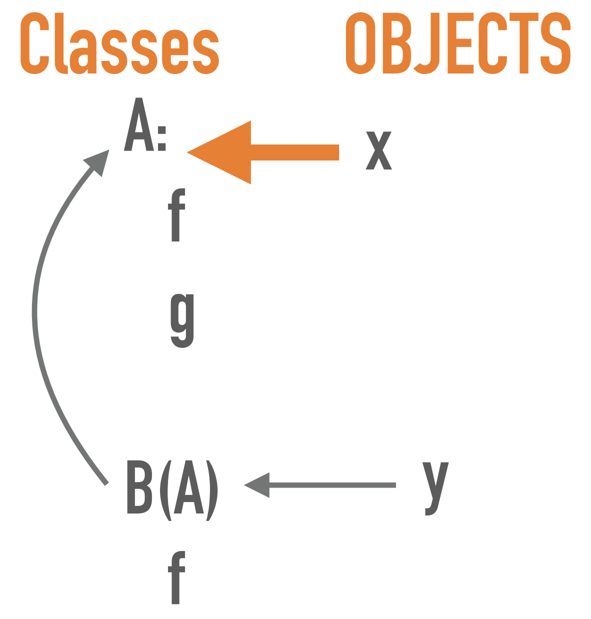
```
class A:
   def f(self):
      return 2
   def g(self, obj, x):
      if x == 0:
         return A.f(obj)
      return obj.f() + self.g(self, x = 1)
class B(A):
   def f(self):
      return 4
```

2.1 #3

1. Create classes

2. Create objects

```
class A:
   def f(self):
      return 2
   def g(self, obj, x):
      if x == 0:
         return A.f(obj)
      return obj.f() + self.g(self, x = 1)
class B(A):
   def f(self):
      return 4
```



```
>>> x.f()
```

1. check what type of object x is

   x points to A in our diagram

2. execute the method f in the class A, passing in x as self

   return 2

2.1 #3

1. Create classes

2. Create objects

```
class A:
   def f(self):
      return 2
   def g(self, obj, x):
      if x == 0:
         return A.f(obj)
      return obj.f() + self.g(self, x = 1)
class B(A):
   def f(self):
      return 4
```

Classes OBJECTS

$$\begin{tikzcd}
\text{A:} & x \arrow[l] \\
f & \\
g & \\
\text{B(A)} \arrow[uuu, bend left] & y \arrow[l] \\
f &
\end{tikzcd}$$

```
>>> x.f()
2
>>> B.f()
```

1. B is a class — we need an object to pass in as self

since we didn't pass anything in as self, this code will error

2.1 #3

1. Create classes

2. Create objects

```
class A:
    def f(self):
        return 2
    def g(self, obj, x):
        if x == 0:
            return A.f(obj)
        return obj.f() + self.g(self, x - 1)
class B(A):
    def f(self):
        return 4
```

$$\begin{tikzcd}
\text{Classes} & \text{OBJECTS} \\
A: & x \arrow[l] \\
f & \\
g & \\
B(A) \arrow[uuu, bend left] & y \arrow[l] \\
f &
\end{tikzcd}$$

```
>>> x.f()
2
>>> B.f()
Error
>>> x.g(x, 1)
4
```

1. what does this code mean in english? what is self? what method are we calling? what are we passing in as arguments?

   self is x because its in front of the dot
   we are calling the method g in the class A since x is an object whose type is A
   g takes in 2 arguments: obj is x and x is 1

2. now we are ready to execute code! is x == 0 true?

   x is 1, so we need to execute the second return statement.

3. what does obj.f() return?

   obj is x! we are calling the method f in class A where self is x. this just returns 2

4. what does self.g(self, x -1) return?

   self is x! we are calling the method g in class A where self is x and x is now 0.
   this will cause us to go into the first if statement.
   now we need to execute A.f(obj) where obj is x. we are calling method f in class A where self is x.
   this returns 2.

5. combine the results! what is the final return value? 4

2.1 #3

1. Create classes

2. Create objects

```
class A:
   def f(self):
      return 2
   def g(self, obj, x):
      if x == 0:
         return A.f(obj)
      return obj.f() + self.g(self, x - 1)
class B(A):
   def f(self):
      return 4
```

$$\begin{tikzcd}
\text{Classes} & \text{OBJECTS} \\
A: & x \arrow[l] \\
f & \\
g & \\
B(A) \arrow[uuu, bend left] & y \arrow[l] \\
f &
\end{tikzcd}$$

```
>>> x.f()

2

>>> B.f()

Error

>>> x.g(x, 1)

4

>>> y.g(x, 2)
```

1. what does this code mean in english? what is self? what method are we calling? what are we passing in as arguments?
   - self is y because its in front of the dot
   - we are calling the method g in the class A since y is an object whose type is B but there is no method g in class B and class A inherits from class A
   - g takes in 2 arguments: obj is x and x is 2
2. now we are ready to execute code! is x == 0 true?
   - x is 2, so we need to execute the second return statement.
3. what does obj.f() return?
   - obj is x! we are calling the method f in class A where self is x. this just returns 2
4. what method are we calling when we execute the line self.g(self, x - 1)? what arguments are we passing in?
   - self is y! we are calling the method g in class B. But since class B does not have method g, we look at its parent. So we call g in class A where self is y and x is 1
5. is x == 0 true?
   - We passed in 1 as x, so this statement is false.
6.