

Classes

David H Smith IV

University of Illinois Urbana-Champaign

Tues, Nov 30 2021

Reminders

Reminders

- Usual mix of homework (see the website)
- Quiz next Thursday, practice quiz will be up Saturday
- Practice final will be up next Tuesday.

Review + New Stuff: Class Constructors

Poll Question: Constructors

Which of the following are valid constructor function defs?

- ❶ `def __init__(self):`
- ❷ `def __init__(self, foo):`
- ❸ `def _init(self):`
- ❹ `def __init__(self, foo, *args, **kwargs):`
- ❺ `def __init__(self, foo, bar=0, *baz, **qux):`
- ❻ `def __init__(self, bar=0, foo, **qux, *baz):`

Consider each individually in groups and I will go through and ask which are valid.

Poll Question: Setting Things Up

What is printed in when the following code is run?

```
class Person:
    def __init__(self, name, age):
        myname = name
        myage = age
    def get_name(self):
        print(myname)

p1 = Person("Dave", 22)
print(p1.get_name())
```

- ☐ A NameError
- ☐ B 22
- ☐ C Dave
- ☐ D self

Poll Question: Setting Things Up

What is printed in when the following code is run?

```
class Person:
    def __init__(self, name, age):
        myname = name
        myage = age
    def get_date_of_birth(current_year):
        print(current_year - self.age)

p1 = Person("Dave", 22)
print(p1.get_date_of_birth(2021))
```

- ☐ A 1999
- ☐ B -1977
- ☐ C NameError
- ☐ D TypeError

Poll Question: Calling Class Functions in the Class

What code should replace the question marks?

```
class People:
    def __init__(self, *people):
        self.people_list = people

    def _get_age_difference(self, p2):
        return abs(self.age - p2.age)

    def get_age_differences(self, person, current_year):
        for p in self.people_list:
            if p is not self:
                n1 = self.name
                n2 = p.name
                diff = ??
                print("{} and {} are {} years apart".format(n2, n1, diff))
```

- ☐ A self._get__age_difference(p2)
- ☐ B _get__age_difference(p2)
- ☐ C _get__age_difference(self, p2)

Key Takeaways



Class Interfaces, Internal Methods, and Encapsulation

Encapsulation: Private vs Public

- Ⓐ Encapsulation is a fundamental concept in object oriented programming (OOP).
- Ⓑ Private vs Public Variables
 - Ⓐ **Public:** The values/methods can be used outside of the class.
 - Ⓑ **Private** The values/methods can't be used outside of the class.
- Ⓒ **Python doesn't have encapsulation!** (I have opinions on this...)

```
def Foo:
    _private_func(self):
        #...

    public_func(self):
        self._private_func() #Good practice
        #...

f = Foo()
f._private_func() #Not good practice
f.pubic_func() #Good practice
```

- Ⓐ Functions/variables *intended* to only be used in the classes start with an "_". Python's version of private.
- Ⓑ Functions/variables *intended* to be used anywhere don't start with an "_".
- Ⓒ **This is only by convention and has no impact on how the code runs or is interpreted.**

Overloading

Common Operators to Overload

Example

```
class Person:
    def __init__(self, name, age):
        self.name = name
        self.age = age
    def __sub__(self, other):
        return self.age - other.age
```

```
p1 = Person("Alice", 22)
p2 = Person("Bob", 27)
age_difference = p2 - p1
```

- > → `__gt__(self, other)`
- >= → `__ge__(self, other)`
- < → `__lt__(self, other)`
- <= → `__le__(self, other)`
- == → `__eq__(self, other)`

- - → `__sub__(self, other)`
- + → `__add__(self, other)`
- * → `__mul__(self, other)`
- / → `__truediv__(self, other)`
- % → `__mod__(self, other)`
- → `__str__(self)`

Iteration and Subscripting Overloads

To define the behaviour of the class when (1) a collection are being iterated over or a (2) single instance is being unpacked use the `__iter__(self)` function.

```
class Foo:
    def __init__(self, end):
        self.end = end

    def __iter__(self):
        """Commonly uses a generator"""
        c = 0
        while c < self.end:
            yield c
            c += 1

x = Foo(10)
for i in foo:
    print(i)
```



Subscripting Overloads

To define the behaviour of the `[]` operator when using variable unpacking or iteration use the `__getitem__(self)` function.

```
class Foo:
    def __init__(self, start, end):
        self.start = start
        self.end = end

    def __getitem__(self, item):
        """Commonly uses a generator"""
        value = self.start + item
        if item < value:
            return value

x = Foo(10)
print(x[3])
```