

Attributes

Announcements

Method Calls

Dot Expressions

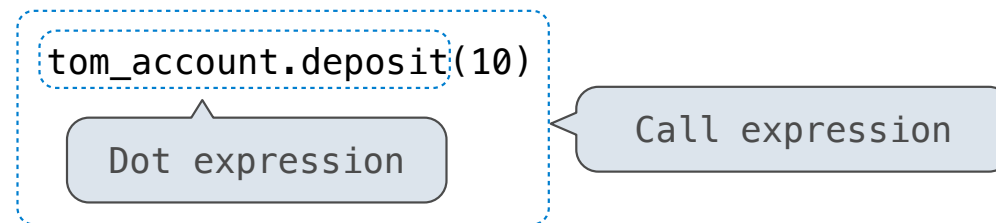
Methods are invoked using dot notation

`<expression> . <name>`

The `<expression>` can be any valid Python expression

The `<name>` must be a simple name

Evaluates to the value of the attribute looked up by `<name>` in the object that is the value of the `<expression>`



(Demo)

Attribute Lookup

Looking Up Attributes by Name

Both instances and classes have attributes that can be looked up by dot expressions

`<expression> . <name>`

To evaluate a dot expression:

1. Evaluate the `<expression>` to the left of the dot, which yields the object of the dot expression
2. `<name>` is matched against the instance attributes of that object; if an attribute with that name exists, its value is returned
3. If not, `<name>` is looked up in the class, which yields a class attribute value
4. That value is returned unless it is a function, in which case a bound method is returned instead

Accessing Attributes

Using `getattr`, we can look up an attribute using a string

```
>>> tom_account.balance  
10
```

```
>>> getattr(tom_account, 'balance')  
10
```

```
>>> hasattr(tom_account, 'deposit')  
True
```

`getattr` and dot expressions look up a name in the same way

Looking up an attribute name in an object may return:

- One of its instance attributes, or
- One of the attributes of its class

Class Attributes

The Class Statement

```
class <name>:  
    <suite>
```

The suite is executed when the class statement is executed.

A class statement creates a new class and binds that class to <name> in the first frame of the current environment

Assignment & def statements in <suite> create attributes of the class (not names in frames)

```
>>> class Clown:  
...     nose = 'big and red'  
...     def dance():  
...         return 'No thanks'  
...  
>>> Clown.nose  
'big and red'  
>>> Clown.dance()  
'No thanks'  
>>> Clown  
<class '__main__.Clown'>
```

Class Attributes

Class attributes are "shared" across all instances of a class because they are attributes of the class, not the instance

```
class Account:
    interest = 0.02 # A class attribute

    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder

# Additional methods would be defined here
```

```
>>> tom_account = Account('Tom')
>>> jim_account = Account('Jim')
>>> tom_account.interest
0.02
>>> jim_account.interest
0.02
```

The **interest** attribute is *not* part of the instance; it's part of the class!

Bound Methods

Terminology: Attributes, Functions, and Methods

All objects have attributes, which are name-value pairs

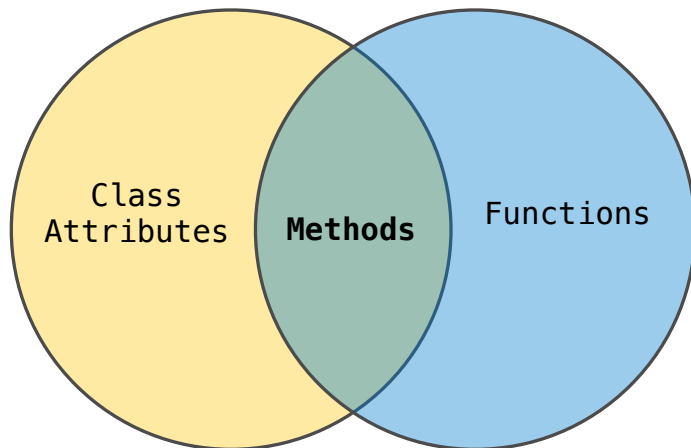
A class is a type (or category) of objects

Classes are objects too, so they have attributes

Instance attribute: attribute of an instance

Class attribute: attribute of the class of an instance

Terminology:



Python object system:

Functions are objects

Bound methods are also objects: a function that has its first parameter "self" already bound to an instance

Dot expressions evaluate to bound methods for class attributes that are functions

`<instance>.<method_name>`

Methods and Functions

Python distinguishes between:

- *Functions*, which we have been creating since the beginning of the course, and
- *Bound methods*, which couple together a function and the object on which that method will be invoked

Object + Function = Bound Method

```
>>> type(Account.deposit)
<class 'function'>
>>> type(tom_account.deposit)
<class 'method'>
```

```
>>> Account.deposit(tom_account, 1001)
1011
>>> tom_account.deposit(1007)
2018
```

Function: all arguments within parentheses

Method: One object before the dot and other arguments within parentheses