

# Python

## Object-Oriented Programming (OOP)

Thanks to all contributors:

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Let's see how OOP is useful in everyday Python:

```
>>> s = "some silly string"
>>> s.upper()
'SOME SILLY STRING'
>>> s.find("t")
12
>>> s.replace("silly", "sensible").title()
'Some Sensible String'
```

And you can actually interrogate this **object** s to find out their **methods**:

```
>>> dir(s)
['_add_', '__class__', '__contains__', '__delattr__', '__dir__',
 '__doc__', '__eq__', '__format__', '__ge__', '__getattribute__',
 '__getitem__', '__getnewargs__', '__gt__', '__hash__', '__init__',
 '__init_subclass__', '__iter__', '__le__', '__len__', '__lt__',
 '__mod__', '__mul__', '__ne__', '__new__', '__reduce__',
 '__reduce_ex__', '__repr__', '__rmod__', '__rmul__', '__setattr__',
 '__sizeof__', '__str__', '__subclasshook__', 'capitalize', 'casefold',
 'center', 'count', 'encode', 'endswith', 'expandtabs', 'find',
 'format', 'format_map', 'index', 'isalnum', 'isalpha', 'isascii',
 'isdecimal', 'isdigit', 'isidentifier', 'islower', 'isnumeric',
 'isprintable', 'isspace', 'istitle', 'isupper', 'join', 'ljust',
 'lower', 'lstrip', 'maketrans', 'partition', 'replace', 'rfind',
 'rindex', 'rjust', 'rpartition', 'rsplit', 'rstrip', 'split',
 'splitlines', 'startswith', 'strip', 'swapcase', 'title', 'translate',
 'upper', 'zfill']
```

And you can find out which **class** `s` is an **instance** of:

```
>>> type(s)  
<class 'str'>
```

You can build your own **class** for your own domain:

```
class FileAnalyser(object):  
    "A class above the rest"  
  
    def __init__(self, path):  
        items = open(path).read().split()  
        self.data = []  
        for item in items:  
            self.data.append(float(item))  
  
    def max(self):  
        return max(self.data)  
  
    def mean(self):  
        return sum(self.data) / len(self.data)
```

Then create an **instance** of your **class** and use it:

```
$ cat some_data.txt
```

**Inside the data file...**

```
1000 750 500 250 0
```

```
$ python
```

```
>>> from myclass import FileAnalyser
```

```
>>> da = FileAnalyser("some_data.txt")
```

```
>>> da.max()
```

```
1000.0
```

```
>>> da.mean()
```

```
500.0
```

You can make use of `help()` on your own class:

```
>>> help(FileAnalyser)
```

```
Help on class FileAnalyser in module myclass:
```

```
class FileAnalyser(builtins.object)
|   FileAnalyser(path)
|
|   A class above the rest
|
|   Methods defined here:
|
|   __init__(self, path)
|       Initialize self.  See help(type(self)) for accurate
signature.
|
|   max(self)
|
|   mean(self)
|
|   -----
|   Data descriptors defined here:
|
|   __dict__
|       dictionary for instance variables (if defined)
|
|   __weakref__
|       list of weak references to the object (if defined)
```

Let's look in detail at our class...:

```
class FileAnalyser(object):  
    "A class above the rest"
```

Class Definition:  
Defines the class name.  
  
Optionally include a doc  
string below.



Let's look in detail at our class...:

```
class FileAnalyser(object):  
    "A class above the rest"  
  
    def __init__(self, path):  
        items = open(path).read().split()  
        self.data = []  
        for item in items:  
            self.data.append(float(item))
```

`__init__` is the  
"constructor" method:

- Not necessary
- Very useful
- Always called when class is first created.

"self" means "belonging to  
this instance/object":

- Needed for all attributes that you want to be visible to every part of the object.

Let's look in detail at our class...:

```
class FileAnalyser(object):  
    "A class above the rest"  
  
    def __init__(self, path):  
        items = open(path).read().split()  
        self.data = []  
        for item in items:  
            self.data.append(float(item))  
  
    def max(self):  
        return max(self.data)
```

Now we add more methods:

- "self" is always required as first argument.

Let's look in detail at our class...:

```
class FileAnalyser(object):  
    "A class above the rest"  
  
    def __init__(self, path):  
        items = open(path).read().split()  
        self.data = []  
        for item in items:  
            self.data.append(float(item))  
  
    def max(self):  
        return max(self.data)  
  
    def mean(self):  
        return sum(self.data) / len(self.data)
```

# More about OOP

Most python packages use OOP extensively.

We'll come across many examples in the next sessions.

E.g.:

```
from netCDF4 import Dataset
# Create HDF5 *format*, classic *model*
dataset = Dataset('data/test.nc', 'w', format='NETCDF4_CLASSIC')
print(dataset.file_format)
```

# OOP Terminology (1)

## **class**

Tell Python to make a new type of thing.

## **object**

Two meanings: the most basic type of thing, and any instance of some thing.

## **instance**

What you get when you tell Python to create a variable of given class.

## **def**

How you define a method of a class.

## **self**

Inside the methods in a class, self is a variable for the instance/object being accessed.

# OOP Terminology (2)

## **inheritance**

The concept that one class can inherit traits from another class, much like you and your parents.

## **attribute**

A property that classes have that are from composition and are usually variables.

## **is-a**

A phrase to say that something inherits from another, as in a "salmon" is-a "fish."