Python

Object-Oriented Programming (OOP)

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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:





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:

\$ python

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

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...:

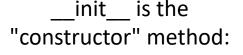
```
class FileAnalyser(object):
    "A class above the rest"
```

self.data = []

for item in items:
 self.data.append(float(item))

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

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



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

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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."



