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__', ..., '__str__', '__subclasshook__',
'_formatter_field_name_split', '_formatter_parser',
'capitalize', 'center', 'count', 'decode', 'encode',
'endswith', 'expandtabs', 'find', 'format', 'index',
'isalnum', 'isalpha', 'isdigit', 'islower', 'isspace',
'istitle', 'isupper', 'join', 'ljust', 'lower',
'lstrip', '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)
<type '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
>>> 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 __main__:

class FileAnalyser(__builtin__.object)
 |  A class above the rest
 |
 |  Methods defined here:
 |
 |  __init__(self, path)
 |
 |  max(self)
 |
 |  mean(self)
 |
 |  -------------------------------------------------------------
 |  Data descriptors defined here:
 |
```

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.

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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))
```

__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.

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        return max(self.data)
```

Now we add more methods:

- "self" is always required as first argument.

Let’s look in detail at our class…:

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    def mean(self):
        return sum(self.data) / len(self.data)
```
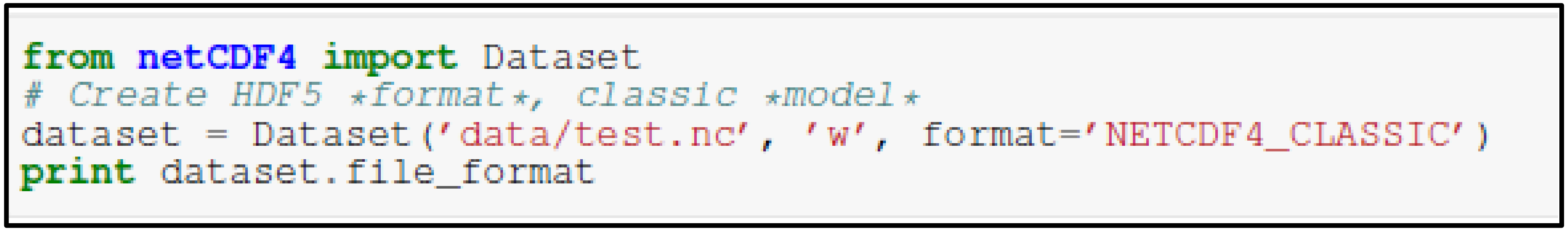

More about OOP

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."