Programming in Python

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COURSE 5

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x ***File: MyModule.py***	**Python 2.x / 3.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
	`import MyModule`
	
	`print (MyModule.Sum(10,20))`

Output
30

Both files test.py and MyModule.py are located in the same folder.

After the execution of test.py the following things will happen:

- *MyModule.pyc* file will appear in the same folder (Python 2.x)
- A folder with the name *__pycache__* that contains a file called *MyModule.cpython-35.pyc* will appear in the same folder (Python 3.5) → the version will be different for different versions of Python 3

Modules

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Python 2.x / 3.x ***File: MyModule.py***	**Python 2.x / 3.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
`print ("MyModule loaded")`
	`import MyModule`
	
	`print (MyModule.Sum(10,20))`
	`import MyModule`

Output

```
MyModule loaded
30
```

Loading a module will automatically execute any code (main code) that resides in that module.

The main code of a module (code that is written directly and not within a function or a class) will only me executed once (the first time a module is loaded).

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x *File: MyModule.py*	**Python 2.x / 3.x** *File: test.py*

```
def Sum(x,y):
    return x+y
print ("MyModule loaded")
```
	```
	import MyModule

	print (MyModule.Sum(10,20))
	import MyModule
	```

What if MyModule iis not located in the same folder as test.py file ?

Output

```
Traceback (most recent call last):
  File “test.py", line 1, in <module>
    import sys,MyModule
ImportError: No module named 'MyModule'
```

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x ***File: MyModule.py***	**Python 2.x / 3.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
`print ("MyModule loaded")`
	`import sys`
	
	`sys.path += ["<folder>"]`
	
	`import MyModule`
	
	`print (MyModule.Sum(10,20))`
	`import MyModule`

In the above piece of code "<folder>" represents a path to the folder where the file MyModule.py resides.

Output

```
MyModule loaded
30
```

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x ***File: MyModule.py***	**Python 2.x / 3.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
`print ("MyModule loaded")`
	`import MyModule`
	
	`print (dir (MyModule))`

Output

```
Python 2.x ➔ ['Sum', '__builtins__', '__doc__', '__file__', '__name__', '__package__']
```

```
Python 3.x ➔ ['Sum', '__builtins__', '__cached__', '__doc__', '__file__', '__loader__', '__name__',
              '__package__', '__spec__']
```

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x ***File: MyModule.py***	**Python 2.x / 3.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
`print ("MyModule loaded")`
	`import MyModule`
	
	`print (MyModule.__file__)`
	`print (MyModule.__name__)`
	`print (MyModule.__package__)`

Attributes:

- __file__ ➔ full path of the file that corresponds to the module (it could be a pyc file as well)
- __name__ ➔ name of the module (in this example : MyModule)
- __package__ ➔ name of the package (in this example empty string in Python 3.x and None in Python 2.x)

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x ***File: MyModule.py***	**Python 2.x / 3.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
`print (__name__)`
	`import MyModule`

Output

```
__main__
```

Output

```
MyModule
```

If a python script is executed directly, the value of *__name__* parameter will be __main__. If it is executed using import, the value of *__name__* parameter will be the name of the module.

Modules

Any Python code (python script) can be used as a module.

Python 2.x / 3.x
File: MyModule.py

```
def Sum(x,y):
      return x+y
if __name__ == "__main__":
      print("Main code")
      print("Testing sum(10,20) = ",Sum(10,20))
else:
      print("Module loaded")
```

Python 2.x / 3.x
File: test.py

```
import MyModule
```

Output

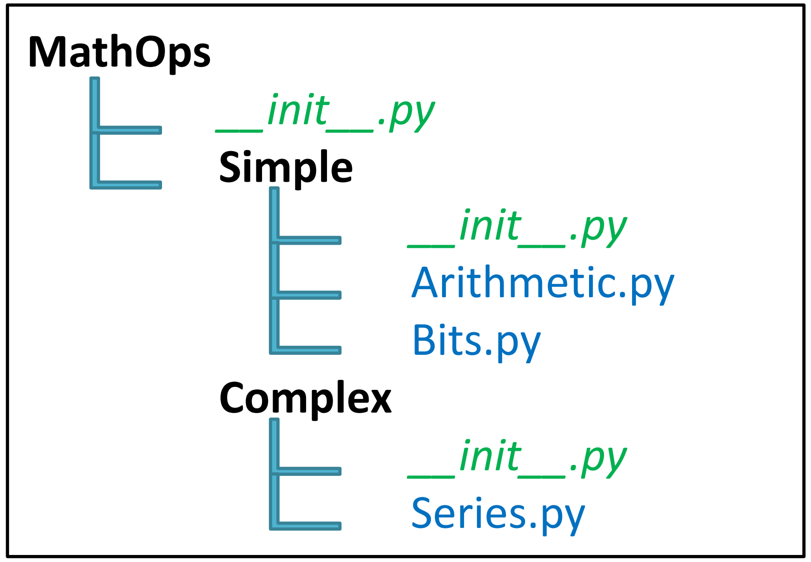
```
Main code
Testing sum(10,20) = 30
```

Output

```
Module loaded
```

Packages

Python scripts can also be grouped in packages. Packages must be grouped in folder, and in each folder a __init__.py must exist. That file is considered to be an entry point for that package/subpackage.



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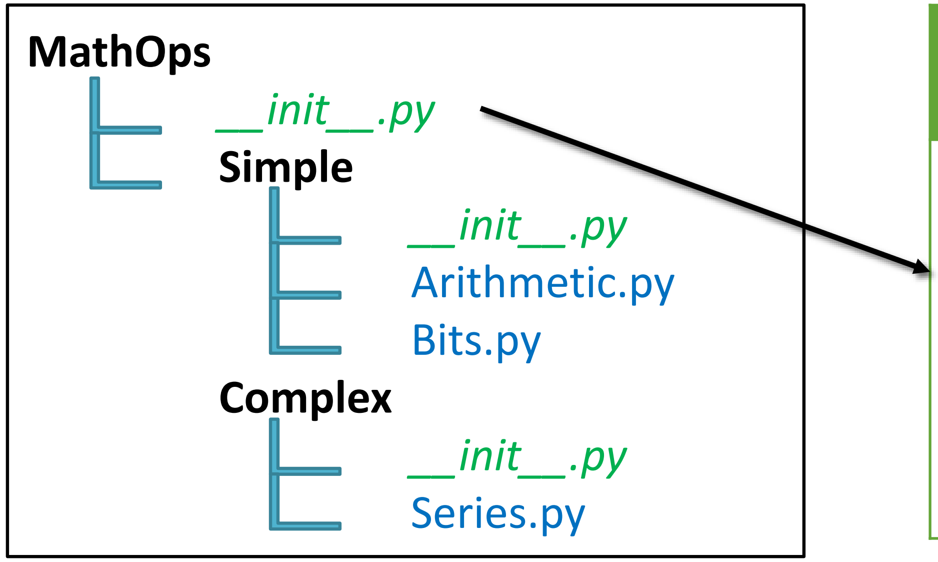

Python 2.x / 3.x
File: __init__.py

```
print ("Package MathOps init")
```

Packages

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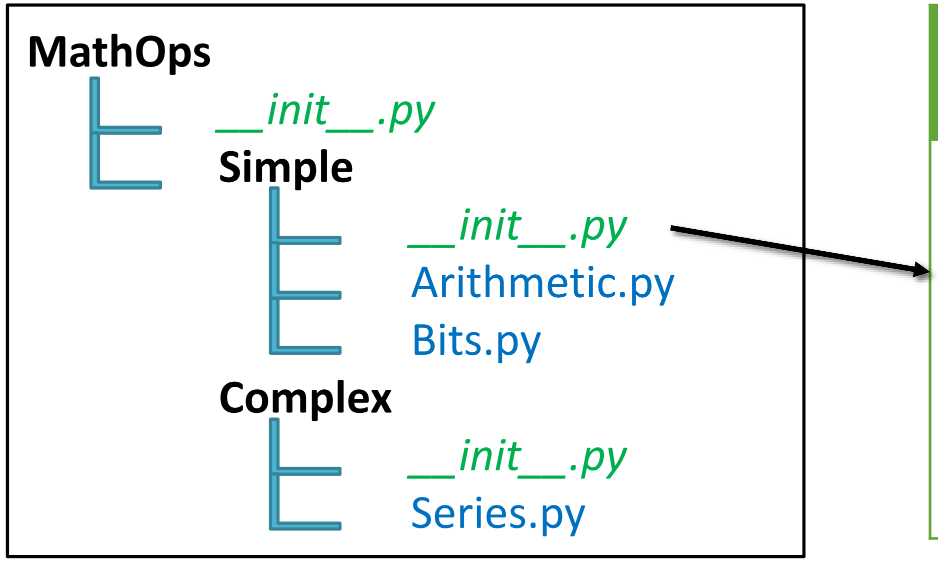

Python 2.x / 3.x
File: __init__.py

```
print ("Package MathOps.Simple init")
```

Packages

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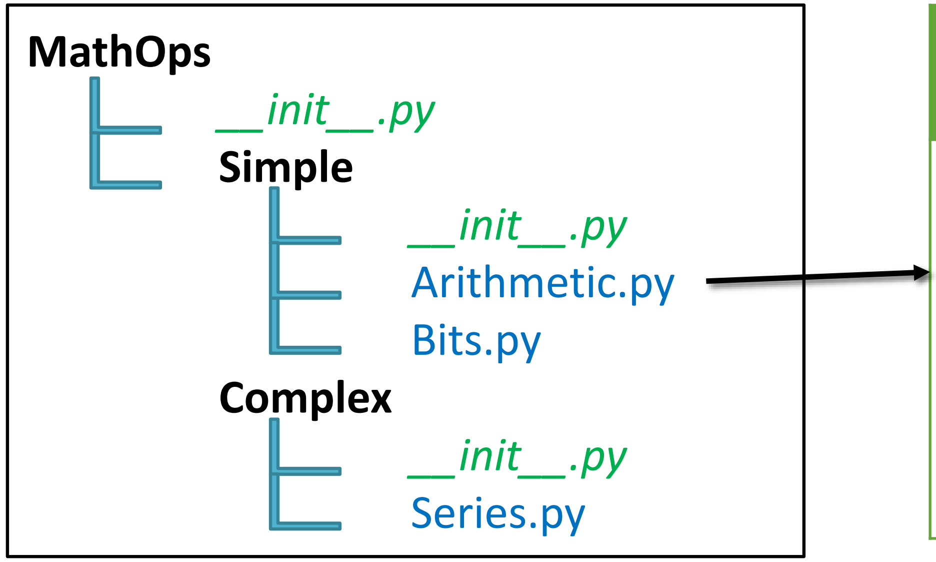

Python 2.x / 3.x
File: Arithmetic.py

```
def Add(x,y):
        return x+y
def Sub(x,y):
        return x-y
```

Packages

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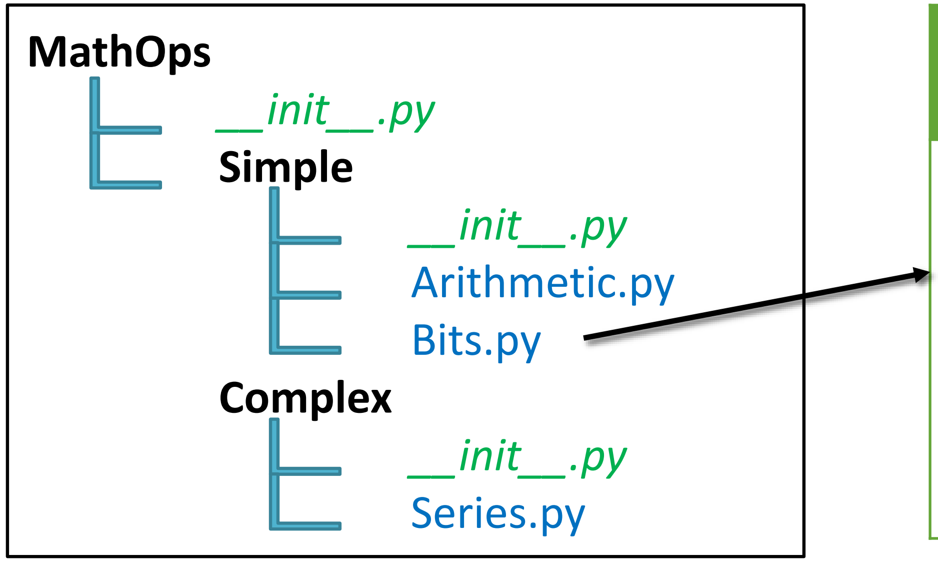
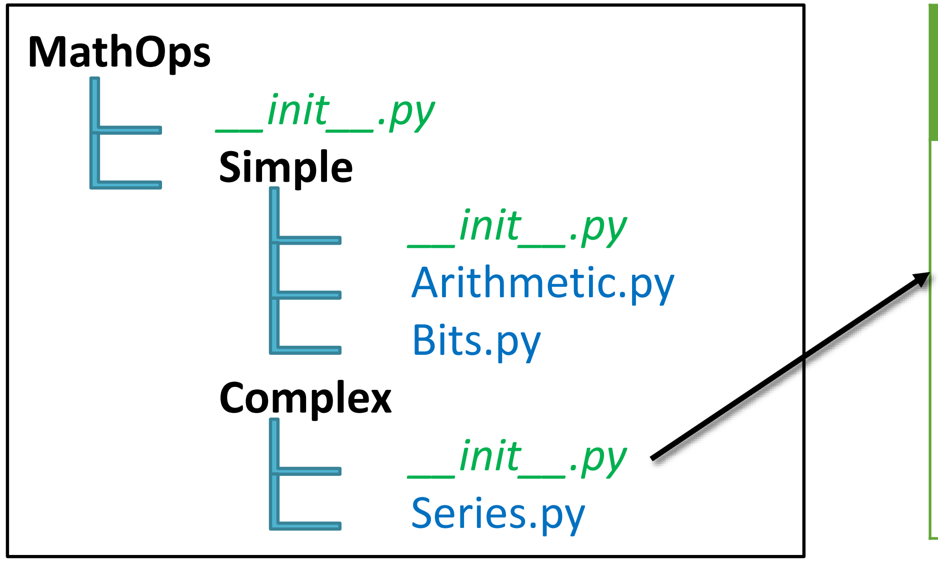


Python 2.x / 3.x
File: Bits.py

```
def SHL(x,y):
        return x << y
def SHR(x,y):
        return x >> y
```

Packages

Python scripts can also be grouped in packages. Packages must be grouped in folder, and in each folder a __init__.py must exist. That file is considered to be an entry point for that package/subpackage.

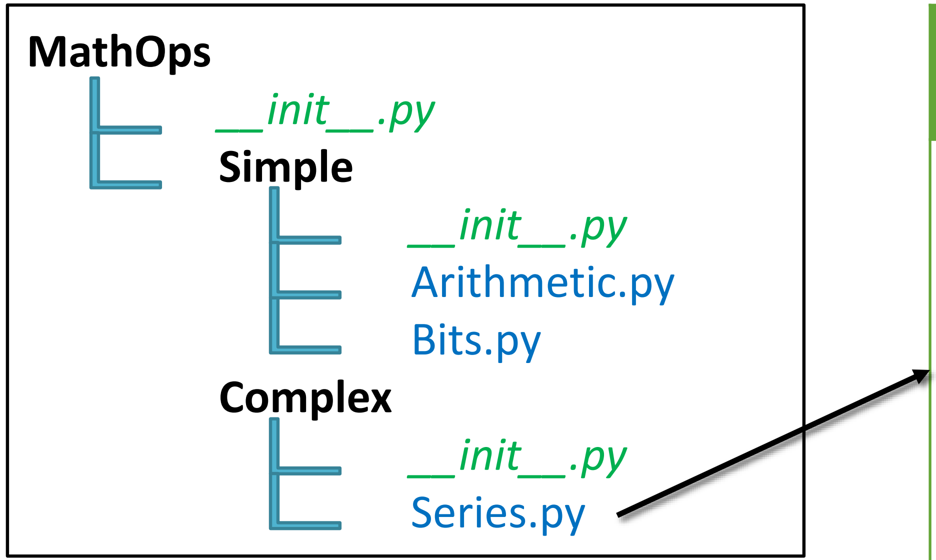


Python 2.x / 3.x
File: __init__.py

```
print ("Package MathOps.Complex init")
```

Packages

Python scripts can also be grouped in packages. Packages must be grouped in folder, and in each folder a __init__.py must exist. That file is considered to be an entry point for that package/subpackage.



Python 2.x / 3.x
File: Series.py

```
def Sum(*p):
        c = 0
        for i in p:
                c+= i
        return c
def Product(*p):
        c = 1
        for i in p:
                c *= i
        return c
```

Packages

Usage:

Python 2.x / 3.x

```
import MathOps.Simple.Arithmetic

print (MathOps.Simple.Arithmetic.Add(2,3))
```

```
from MathOps.Simple import Arithmetic as a

print (a.Add(2,3))
```

Output

```
Package MathOps init
Package MathOps.Simple init
5
```

Packages

Usage:

Python 2.x / 3.x

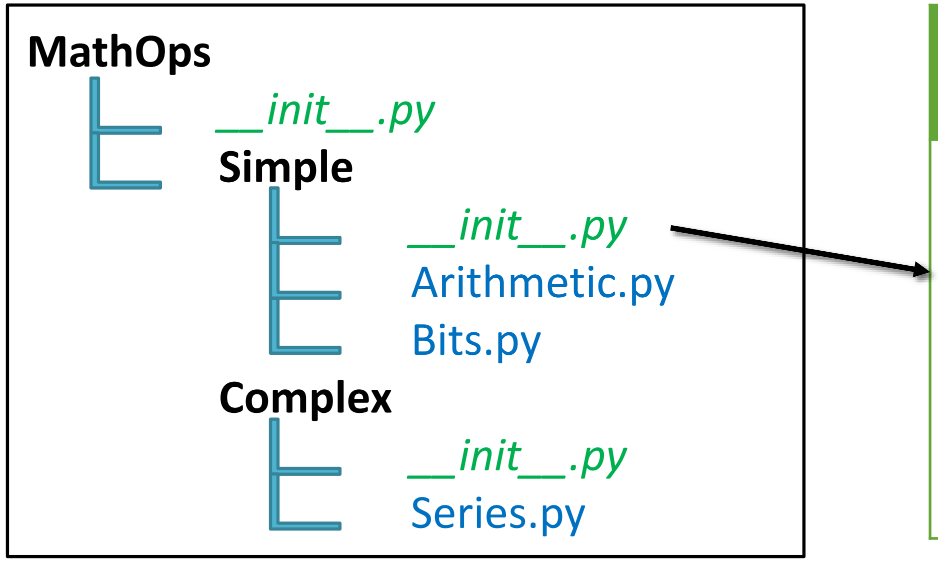
```
from MathOps.Simple import *

print (Arithmetic.Add(2,3))
print (Bits.SHL(2,3))
```

Output

```
Package MathOps init
Package MathOps.Simple init
Traceback (most recent call last):
  File “test.py", line 3, in <module>
    print (Arithmetic.Add(2,3))
NameError: name 'Arithmetic' is not defined
```

Packages

To be able to use a syntax similar to "from <module> import *" a module variable "__all__" must be defined. That variable will hold a list of all modules that belongs to that package.



Python 2.x / 3.x
File: __init__.py

```
print ("Package MathOps.Simple init
        with __all__ set")
__all__ = ["Arithmetic","Bits"]
```

Packages

Usage:

Python 2.x / 3.x

```
from MathOps.Simple import *

print (Arithmetic.Add(2,3))
print (Bits.SHL(2,3))
```

Output

```
Package MathOps init
Package MathOps.Simple init with __all__ set
5
16
```

Modules/Packages

If you want a module and/or package to be available to all the scripts that are executed on that system just copy the module or the entire package folder on the Python search path and you will be able to access it directly. These paths are:

- **Windows:** <PythonFolder>\Lib (Exemple: C:\Python27\Lib or C:\Python35\Lib)
- **Linux:** /usr/lib/<PythonVersion> (Example: /usr/lib/python2.7 or /usr/lib/python3.5)

Python 2.x
File: C:\Python27\Lib\MyModule.py

```
def Sum(x,y):
        return x+y
print ("MyModule loaded")
```

Python 2.x
File: test.py

```
import MyModule
print (MyModule.Sum(10,20))
import MyModule
```

Output

```
MyModule loaded
30
```

Modules/Packages

Python also has a special library (importlib) that can be use to dynamically import a module.

- ***importlib.****import_module* (moduleName,package=None) ➔ to import a module
- ***importlib.****reload* (module) ➔ to reload a module that was already loaded

Python 2.x ***File: C:\Python27\Lib\MyModule.py***	**Python 2.x** ***File: test.py***

`def Sum(x,y):`
`        return x+y`
`print ("MyModule loaded")`
	`import importlib`
	
	`m = importlib.import_module("MyModule")`
	`print (m.Sum(10,20))`

Output

```
MyModule loaded
30
```

Dynamic code

Python has a keyword (exec) that can be used to dynamically compile and execute python code.

The format is exec (code, [global],[local]) where [global] and [local] represents a list of global and local definition that should be used when executing the code.

Python 2.x / 3.x

```
exec("x=100")
print(x)
```

Output

```
100
```

```
exec("def num_sum(x,y): return x+y")
print(num_sum(10,20))
```

Output

```
30
```

```
s = "abcdefg"
exec("s2=s.upper()")
print(s2)
```

Output

```
ABCDEFG
```

Dynamic code

Because of this keyword, python can obfuscate or modify itself during runtime.

Python 2.x / 3.x

```
data = [0x65, 0x66, 0x67, 0x21, 0x54, 0x76, 0x6E, 0x62, 0x29, 0x79,
        0x2D, 0x7A, 0x2D, 0x7B, 0x2A, 0x3B, 0x0E, 0x0B, 0x0A, 0x73,
        0x66, 0x75, 0x76, 0x73, 0x6F, 0x21, 0x79, 0x2C, 0x7A, 0x2C,
        0x7B]
s = ""
for i in data:
       s += chr(i-1)
exec(s)
print(Suma(1,2,3))
```

Output

```
6
```

Dynamic code

Because of this keyword, python can obfuscate or modify itself during runtime.

Python 2.x / 3.x

```
data = [0x65, 0x66, 0x67, 0x21, 0x54, 0x76, 0x6E, 0x62, 0x29, 0x79,
        0x2D, 0x7A, 0x2D, 0x7B, 0x2A, 0x3B, 0x0E, 0x0B, 0x0A, 0x73,
        0x66, 0x75, 0x76, 0x73, 0x6F, 0x21, 0x79, 0x2C, 0x7A, 0x2C,
        0x7B]
s = ""
for i in data:
      s += chr(i-1)
exec(s)
print(Suma(1,2,3))
```

```
def Suma(x,y,z):
    return x+y+z
```

Output

```
6
```