The Python Language

Global Knowledge®

Objectives

- Learn the basics of the Python language
- Define code blocks
- Work with variables
- Test for true / false using various conditionals
- Write loops to work with sets of data
- Consume external code via packages and modules
- Create isolated development environments
- Use deterministic clean up for recovering resources

The ‘shape’ of a Python program

- Python defines code blocks (known as **suites** in Python) using whitespace and colons.

```
def somemethod(name):

    if name == "Michael":
        print("Hi old friend")
    else:
        print("Nice to meet you")
        print("My name is … ")

def main():
    somemethod()
```

Things to note:

- No semicolons
- Code blocks start with ‘:’
- Whitespace really really matters
- There are no braces
- There are no parentheses
- Tabs are not your friend

Code suites

Variables

- Declaring variables is no-nonsense

```
name = "Jeff"
print( "Hi there " + name )
name = 42
print( name )
```

Note:

- You do not declare the type
- Variables are not strongly-typed (but types are)
- Discover current type via **`type(var)`**
- Compare references with **`id(var)`** and **`var1 is var2`**
- Compare values with **`var1 == var2`**

Variables [scope]

- Variable scope
  - Python does not have strict block scope like many C-based languages
  - Not restricted to the declaring scope
  - Scope is global or function level
    - Initialize first => function scope
    - Use first => global scope (must be explicit)

```
num1 = 40

if num1 > 10:
    num2 = 2
    print("Num from if: " + str(num2))

print("Looks like the number is " + str(num1 + num2))

# prints 'Looks like the number is 42'
```

Variables [global scope]

- Variable scope
  - **global** keyword can promote scope
  - **nonlocal** keyword can allows us to share scopes (for closures)

```
sharedVal = 3

def method1():
    global sharedVal
    if sharedVal == 3:
        sharedVal = 7

    sharedVal += 1

method1()
print( sharedVal ) # prints 8
```

Comments

- Comments are indicated with the **# character**
- They last for rest of a single line
- Class / function documentation comments use an alternate syntax (details later)

```
name = "Jeff"
print( "Hi there " + name ) # use string concat
num = 42
# I wouldn't try this one!
print( "Hi there " + num) # this is an error!
```

Conditionals: Truthiness

- The following are considered **`False`**
  - **`None`**
  - **`False`**
  - zero of any numeric type, for example**`, 0, 0L, 0.0, 0j`**.
  - any empty sequence, for example, **`'', (), []`**.
  - any empty mapping, for example, **`{}`**.
  - instances of user-defined classes, if the class defines a **`__nonzero__()`** or **`__len__()`** method, which returns **`False`**
- Everything else is **`True`**

Conditionals: if statements

- **if** statements are simple suites
- Additional tests are done using **elif** (not **else if**)
- **and** and **or** are words (not symbols, e.g. **&&** and **||**)
- **else** statements can appear at the end

```
if len(name) > 5:
   print('Oh you have a long name!')
elif len(name) == 5:
   print('Let me guess, your name is Sarah?')
elif len(name) == 4 and name[0] == 'T':
   print('Let me guess, your name is Todd?')
else:
   print('Filling out forms must be quick for you!')
```

Conditionals: Ternary statements

- Ternary statements are compressed **if** / **else** suites
- They are meant to be readable rather than concise

```
name = "Jeff"
val = "short name" if len(name) < 5 else "long name"
print(val) # prints 'short name'
```

Empty code suites (blocks): Pass statement

- Sometimes you want an empty block
  - maybe you commented out some code
  - maybe you're sketching out the structure
- The **pass** keyword keeps things running

```
if len(name) > 5:
    pass
```

While loops

- While loops run until a condition becomes false

```
num1 = 1
num2 = 2

while num1 < 100:
   num1 = num1 * num2
   print( num1 )

# prints 2,4,8,16,32,64,128
```

For in loops

- For loops in Python fundamentally work on iterable sets
  - There is no index-based looping construct!
  - Many types are iterable
    - lists, sets, dictionaries, strings, files, classes, …

```
name = "Jeff"

for ch in name:
    print( ch, end=', ' )

# prints 'J', 'e', 'f', 'f',
```

For in loops [with indexes]

- For loops *can* use an index
  - Uses **range** function
  - But it's less Pythonic
  - range was considered harmful in Python 2.7 (it's not in 3)

```
name = "Jeff"

for i in range( len(name) ):
    print( name[i] )

# prints 'J', 'e', 'f', 'f',
```

For in loops [with indexes (better)]

- Index + element for loops can be combined
  - uses **enumerate** function
  - returns tuples of (index, element)
  - more Pythonic

```
name = "Jeff"

for t in enumerate(name):
    print( t )

# prints (0, 'J'), (1, 'e'), (2, 'f'), (3, 'f')
```

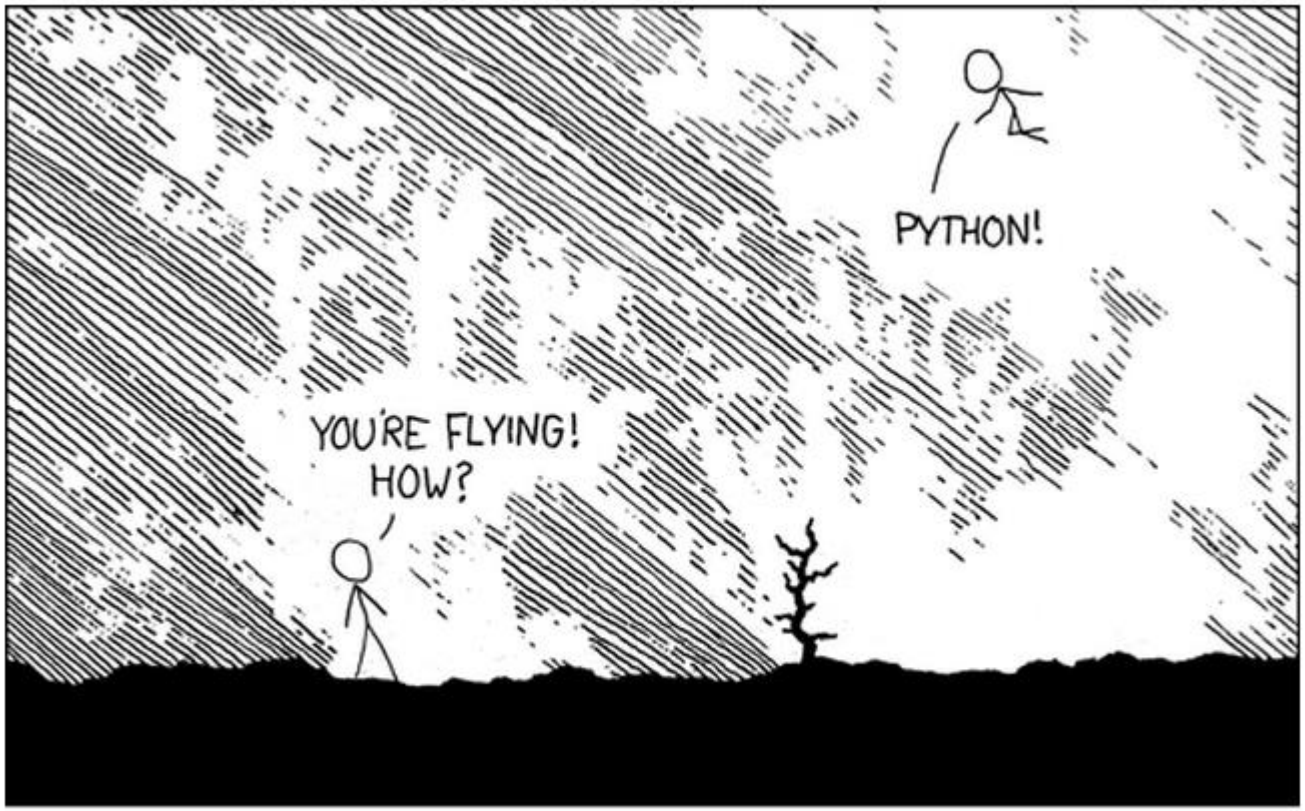
Loops and else statements

- All looping constructs support a final clause using **else**
- Only runs if
  - the loop completes **without** early breaks
  - the loop completes but never runs
- Don't forget the key line in the Zen of Python
  - "... that way may not be obvious at first unless you're Dutch."

```
print("Else loop test")
v = 7
while v < 10:
    v += 1
    print(v)
    if v == 9:
        break;
else:
    print("else v is now " + str(v))
```

Consuming libraries

- Python can access functionality from other modules, packages, and libraries using the **import** statement.



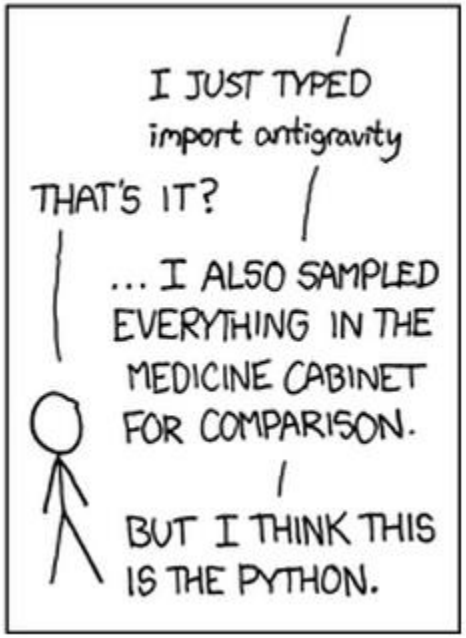


Image credit: XKCD: http://xkcd.com/353/

Consuming libraries [import keyword]

- Python can access functionality from other modules, packages, and libraries using the **import** statement.
- Import gives you access to
  - other scripts you have written
  - modules and packages from third parties
  - components of the standard library

Consuming libraries [standard library]

- Accessing the standard library

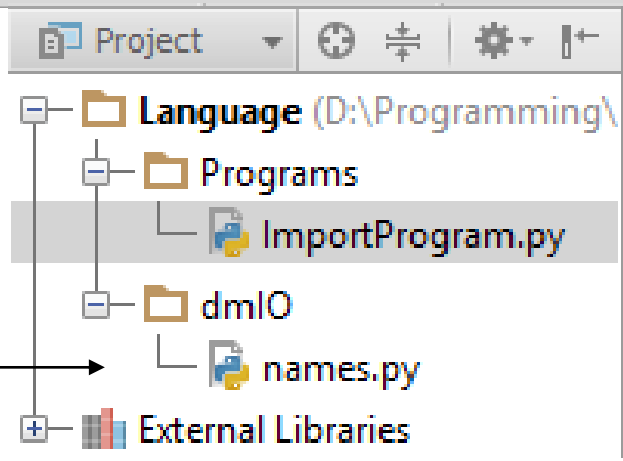
```
import sys

print("Please enter your name: ", end='')
sys.stdout.flush()
name = sys.stdin.readline()

print("Nice to meet you " + name)
```

Consuming libraries [other scripts]

- Accessing other scripts



Include relative paths for working folder

```
import dmIO.names

userName = dmIO.names.queryUserForName()
print("Nice to meet you " + userName)

# Sample execution:
# Please enter your name: Jeff
# Nice to meet you Jeff
```

Consuming libraries [importing your script]

- When your scripts are imported, they may run code you did not intend to run
  - Use the **__name__** convention to test if your script is the main script.

```
if __name__ == "__main__":
    # your code here
```

Consuming libraries [import details]

- Import has several forms

```
import dmIO.names # default: keep namespace

userName = dmIO.names.queryUserForName()
print("Nice to meet you " + userName)
```

```
from dmIO.names import queryUserForName # single method / class
import

userName = queryUserForName()
print("Nice to meet you " + userName)
```

```
from dmIO.names import * # import everything, no namespaces

userName = queryUserForName()
print("Nice to meet you " + userName)
```

Consuming libraries [third-party packages]

- Python has several package managers which install and upgrade third-party packages
  - **setuptools** (download and run ez_setup.py)
  - **pip** (default since 3.4, else download and run get-pip.py, requires setuptools)
- These are similar to
  - NPM from node.js [1]
  - NuGet from .NET [2]
  - Gems from Ruby [3]

Consuming libraries [third-party packages]

- Installing packages
  - **`pip install <packagename>`**

Install requests package

Developer Command Prompt for VS2012

```
(env) C:\>pip install requests
Downloading/unpacking requests
  Downloading requests-2.0.1.tar.gz (412kB): 412kB downloaded
  Running setup.py egg_info for package requests

Installing collected packages: requests
  Running setup.py install for requests

Successfully installed requests
Cleaning up...
```

Use package

Developer Command Prompt for VS2012 - python

```
(env) C:\Users\Michael Kennedy\Documents\Python\SecondProj>python
>>> import requests
>>> r = requests.get("http://www.develop.com")
>>> len(r.text)
31635
>>>
```

Consuming libraries [virtual environments]

- Virtual environments allow multiple Python projects that have different (and potentially conflicting) requirements, to coexist on the same computer.
- With virtual environments you can
  - Store multiple versions of a package
  - Store packages in non-admin users folders (sudo install not required)
  - Clearly express dependencies for a deployment

Consuming libraries [using virtualenv]

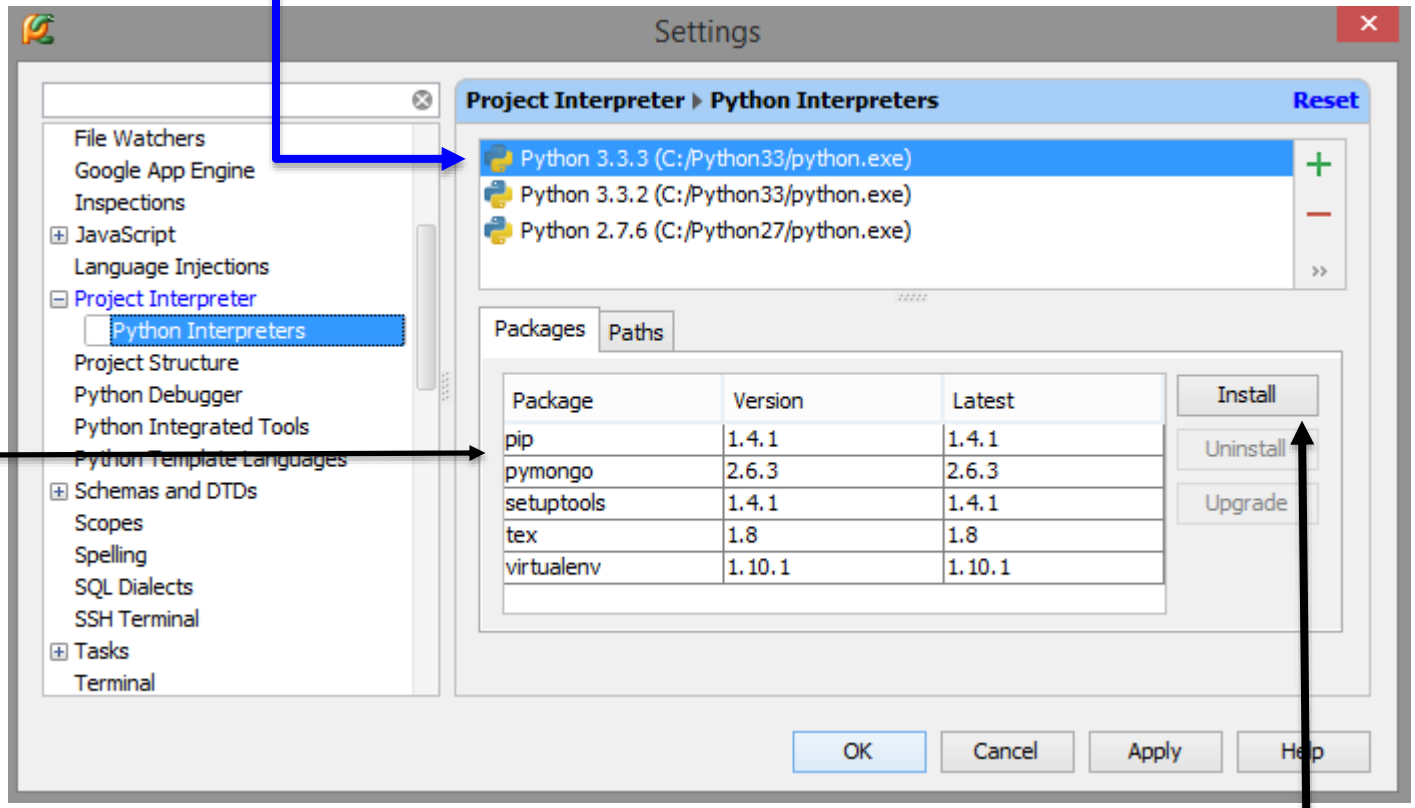
- Install virtual environments
  - **`sudo pip install virtualenv`**
- Create a virtual environment in working folder
  - **`virtualenv .\env`**
- Install your packages (e.g. requests)
  - **`.\env\scripts\pip install requests`**
- Activate your terminal / cmd session
  - **`.\env\scripts\activate.bat or source` (on OS X)**
- Run python scripts and commands as usual
  - but will target the virtual environment
- Run 'deactivate' to turn off the virtual environment

Note: Python 3.3+ includes a built-in way to do this:
http://docs.python.org/dev/library/venv.html

Consuming libraries [PyCharm]

- PyCharm has support for package management

For a selected interpreter or virtual environment

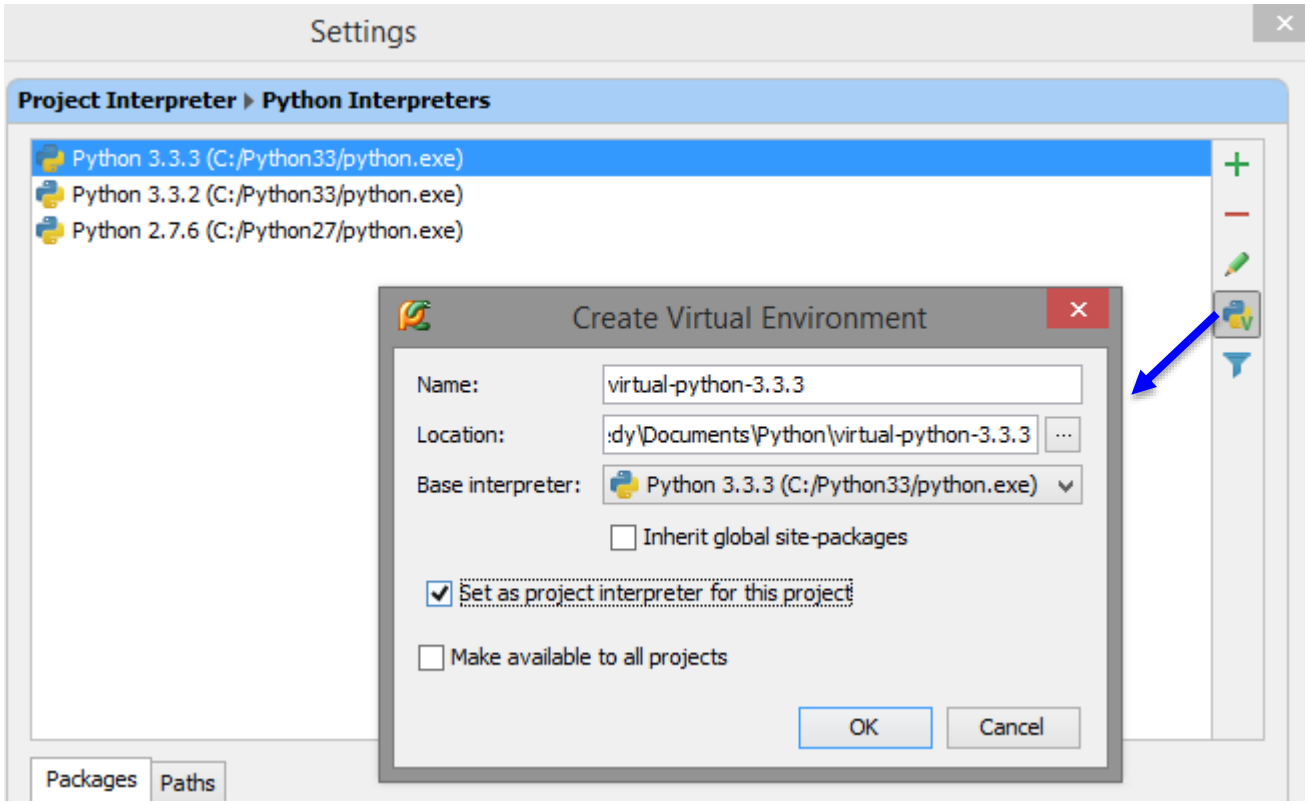


Manage / update installed packages

Install new packages

Consuming libraries [PyCharm]

- PyCharm has support for virtual environments
  - Can isolate environment
  - Can inherit global package settings



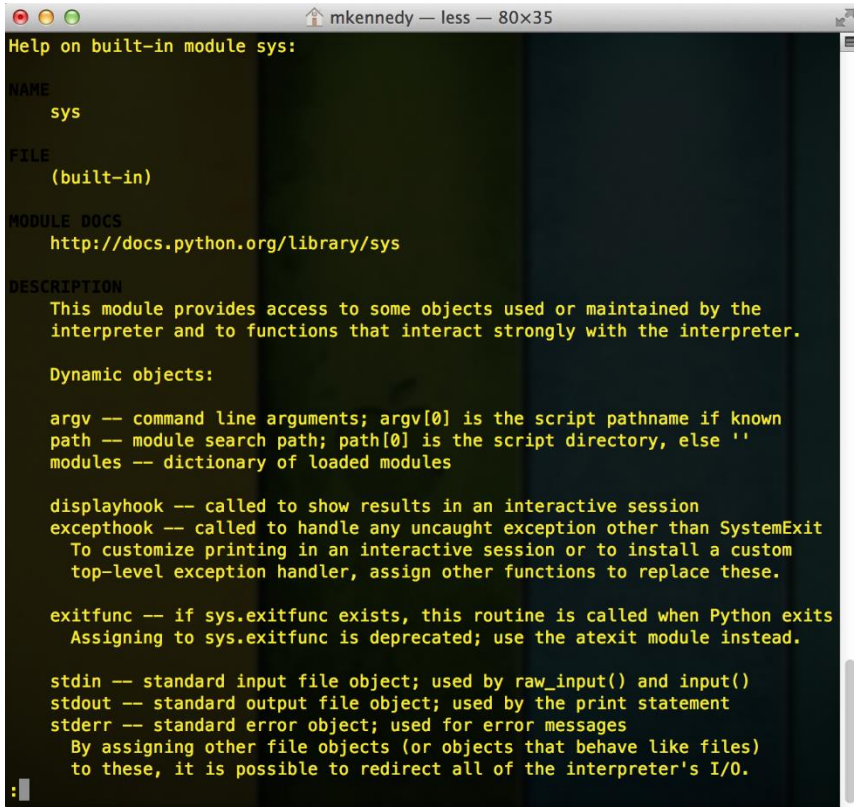
Deterministic clean up

- Python memory management uses
  - Eager reference counting
  - Secondary generational garbage collector (for cycles)
- To ensure timely clean up use the **`with`** statement

```
with open('foo.txt') as fin:
    # perform some action with fin
    pass # <-- work with fin
    # cleanup happens on exit code suite
```

Getting help

- Python has good documentation with examples
  - Visit http://docs.python.org/3.3/contents.html
  - Just Google it (typically fastest access to docs.python.org)
  - Type **help(class)** or **help(namespace)** (hint: q to quit)



Getting help

- Not everything is documented, but you can still browse it with the **`dir(namespace)`** command.

mkennedy — Python — 80×35

```
Last login: Mon Nov 25 09:32:45 on ttys000
Michaels-MacBook-Pro-2:~ mkennedy$ python
Python 2.7.5 (default, Aug 25 2013, 00:04:04)
[GCC 4.2.1 Compatible Apple LLVM 5.0 (clang-500.0.68)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import sys
>>> dir ( sys)
['__displayhook__', '__doc__', '__excepthook__', '__name__', '__package__', '__s
tderr__', '__stdin__', '__stdout__', '_clear_type_cache', '_current_frames', '_g
etframe', '_mercurial', 'api_version', 'argv', 'builtin_module_names', 'byteorde
r', 'call_tracing', 'callstats', 'copyright', 'displayhook', 'dont_write_bytecod
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e', 'exit', 'flags', 'float_info', 'float_repr_style', 'getcheckinterval', 'getd
efaultencoding', 'getdlopenflags', 'getfilesystemencoding', 'getprofile', 'getre
cursionlimit', 'getrefcount', 'getsizeof', 'gettrace', 'hexversion', 'long_info'
, 'maxint', 'maxsize', 'maxunicode', 'meta_path', 'modules', 'path', 'path_hooks
', 'path_importer_cache', 'platform', 'prefix', 'ps1', 'ps2', 'py3kwarning', 'se
tcheckinterval', 'setdlopenflags', 'setprofile', 'setrecursionlimit', 'settrace'
, 'stderr', 'stdin', 'stdout', 'subversion', 'version', 'version_info', 'warnopt
ions']
>>> >
```

Summary

- Python uses whitespace and colons to define blocks
- Variables do not require type definitions
- There are two types of conditionals
- Python does not have an index for loop
- Packages are imported using the import keyword
- Virtual environments allow us to work in clean envs
- With statement allows for safe use of recourse-based data