A Crash Course in Python

Adapted from Stephen Saville and Andrew Lusk

SIGUnix Meeting
Mon 28 Oct 2002
8:00 pm
1310 DCL

Based on the excellent tutorial by Guido Van Rossum:
http://www.python.org/doc/current/tut/tut.html

How to Start Python

Interactive:

```
python
>>> print "Hello World"
Hello World
>>>
```

From File:

```
myfile.py:
print "Hello World\n"

python myfile.py
Hello World
```

Python Data Types

Numbers:	`float_num = 10.0`	`int_num = 25`
Strings:	`my_str = "Hello world"`	
Lists:	`my_list =  [1, 2, 3, 4]`	
Tuples:	`my_tuple = (1, 4, 32, "hello")`	
Dictionaries:	`my_dict = {'a': 24.5, 'b': ' hello', 42: 'answer'}`	
Objects:	`my_inst = MyClass('hello')`	
Modules:	`import my_module`	

Numbers

Integers:

```
>>> my_int = 4
>>> my_int/3
1
```

Floating Point:

```
>>> my_float = 5.5
>>> 20/my_float
3.6363636363636362
```

Complex Numbers:

```
>>> 4+3j
(4+3j)
>>> _ - 3j
(4+0j)
>>> my_complex = complex(10,3)
```

Strings

```
>>> str = "Hello, my friends, welcome to Python."
>>> str.upper()
'HELLO, MY FRIENDS, WELCOME TO PYTHON.'
>>> str.index('my')
7
>>> str[0:5]
'Hello'
>>> str + " I hope you enjoy your stay."
'Hello, my friends, welcome to Python. I hope you
enjoy your stay'
>>> print str(5) + " + " + str(3) + " = " + str(3+5)
5 + 3 = 8
>>> str.count('e')
4
>>> len(str)
37
```

Lists

```
>>> lst = ['3', 45, 'hello', 2]
>>> lst[2]
'hello'
>>> del lst[2]
>>> lst
['3', 45, 2]
>>> lst.append('world')
>>> lst
['3', 45, 2, 'world']
```

List Methods:

```
  append(x) - add x to the end of the list
  extend(L) - add all items in sequence L to end of list
insert(i,x) - insert x at a position i
  remove(x) - remove first item equal to x
   pop([i]) - remove item at position i or end of list
   index(x) - return index of first item equal to x
   count(x) - count occurances of x
     sort() - sort the list
  reverse() - reverse the list
```

Tuples

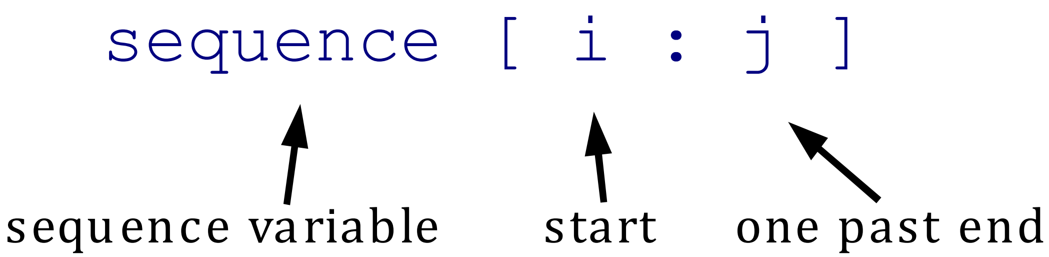
```
>>> tup = (6, 7, 'forty-two', 'question?')
>>> tup[0]  6
>>> del tup[3]
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: 'tuple' object doesn't support item deletion
>>> tup2 = ((1,2,3),[4,5,6]); tup2
((1, 2, 3), [4, 5, 6])
```

Sequence Operations (*s*, *t* sequences):

```
      x in s - test if s contains x
  x not in s - test if s does not contain x
       s + t - sequence concatenation
s * n, n * s - n shallow copies of s
        s[i] - ith element of s
      s[i:j] - slice of s
      len(s) - length of s (number of elements)
      min(s) - minimal element of s
      max(s) - maximal element of s
```

Slicing up Sequences

Slice Operator:



```
sequence [ i : j ]
```

sequence variable

start

one past end

```
>>> seq = (0, 1, 2, 3, 4, 5, 6, 7, 8)
>>> seq[0]
0
>>> seq[-1]
8
>>> seq[1:4]
(1, 2, 3)
>>> seq[:3]
(0, 1, 2)
>>> seq[3:]
(3, 4, 5, 6, 7, 8)
>>> seq[-3:]
(6, 7, 8)
```

Dictionaries (mapping types)

```
>>> dict = {42: 'forty-two', 'naomi': 'person'}, 3: [1,2]}
>>> dict[42]
'forty-two'
>>> dict['naomi']
'person'
>>> del dict[42]; dict
{3: [1, 2], 'naomi': 'person'}
>>> dict.keys()
[3, 'naomi']
```

Mapping Operations Abridged (*d* mapping object):

len(*d*) – number of items in *d*

d[*k*] – item of *d* with key *k*

d[*k*] **=** *x* – associate key *k* with value *x*

del *d*[*k*] – delete item with key *k*

k **in** *d* – test if *d* has an item with key *k*

d.**items()** – a copy of the (*key*, *value*) pairs in *d*

d.**keys()** – a copy of the list of keys in *d*

d.**values()** – a copy of the list of values in *d*

Control Flow Statements

If Conditionals:

```
>>> x = 2
>>> if x < 4:
...     print "x is so small\n"
... else:
...     print "x is big!\n"
...
x is so small
```

For Loops:

```
>>> for x in [1,2]:
...     print x
...
1
2
```

While Loops:

```
>>> x = 0
>>> while x < 4:
...     x += 1
...
>>> x
4
```

If Conditionals

```
if conditional1:
    statement1
    ...
    statementn
elif conditional2:
    statements
else:
    statements
```

For Statements

```
for name in list:
    statement1
    statement2
    ...
    statementn
```

The Range Function:

```
range([start,]stop[,step])
    make a list of integers in the range [start, stop),
    progressing by step each time.

>>> range(2,8)
[2, 3, 4, 5, 6, 7]
>>> range(10,2,-2)
[10, 8, 6, 4]
```

While Loops

```
while conditional:
    statement1
    statement2
    ...
    statementn
```

Breaking out of Loops

```
from random import randrange

for n in range(10):
    r = randrange(0,10)  # get random int in [0,10)
    if n == r: continue  # skip iteration if n=r
    if n > r: break      # exit the loop if n>r
    print n
else:
    print "wow, you are lucky!\n"

if n < 9:
    print "better luck next time\n"
```

Break, Continue and Else:

```
   break - exit the loop immediately
continue - skip to next loop iteration
    else - executed when a loop falls off the end
```

Functions

```
>>> def f1():
...    print "Hello"
...
>>> def f2():
...    print "World"
...
>>> def f3(f):
...    f()
...
>>> f3(f1)
Hello
>>> f3(f2)
World
>>>
```

Basic Def

```
def name([arg1, arg2, ...]):
    statement1
    ...
    statementn
    [return [expression]]
```

Returning Values:

```
return [expression]
    exit the function, optionally returning the result
    of expression to the one who invoketh the function
```

The Argument List

```
def name(arg[=defval], ..., [*arglist], [**kwdict]):
    function-body
```

Default Arguments

```
def charIndex(string, char, start=0, len=-1):
    if len<0: len=len(string)
    ...
```

Keyword Arguments

```
charAt("MakeMyDay", "M", len=4)
```

Extended Argument Lists

```
def arbitraryfun(*arglist):
    ...
def keywordfun(**kwdict):
    ...
```

Lamba Forms

Function Objects

```
>>>  def subtractor(x, y): return x - y
...
>>>  sub = subtractor
>>>  add = lambda(x, y): return x + y
>>> sub(5, 7)
-2
>>> add(5, 7)
12
```

```
lambda arglist: expression
```

Pass

```
def void():
    pass

class Nada:
    pass
```

The Pass Statement:

pass – do nothing but fill a syntactic hole

Classes

```
class Area:
    def __init__(self, x=0.0, y=0.0, w=0.0, h=0.0):
        self.x = x
        self.y = y
        self.w = w
        self.h = h

    def pointIn(self, x, y):
        return self.x <= x <= self.x + self.w and \
               self.y <= y <= self.y + self.h

    def move(self, dx, dy):
        self.x += dx
        self.y += dy
```

Initializer Method

__init__(*self*[, args]**)**

method called to initialize a new instance of the class.

Basic Syntax

```
class name(bases):
    statements
```

Class Inheritance

```
class Rect(Area):
    pass

class Circle(Area):
    def __init__(self, x=0.0, y=0.0, r=0.0):
        self.x = x
        self.y = y
        self.r = r
    def pointIn(self, x, y):
        return (x-self.x)**2 + (y-self.y)**2 < self.r**2
```

Class Instances

```
area = Area(1.0, 1.0, 4.0, 4.0)
point_in = area.pointIn(1.5, 2.0)
```

Functional Programming

Filter

```
def positives(list):
    return filter(lambda x: return x > 0, list)
```

filter(*function*, *sequence***)**

return all items in sequence for which function is true

Map

```
def lookup(dict, klist):
    return map(lambda k: return dict[k], klist)
```

map(*function*, *sequence*)

return the result of function applied to
all items in sequence

Functional Programming Cont.

List Comprehensions

```
>>> [x**2 for x in range(10)]
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

```
>>> [x**2 for x in range(10) if x < 4]
[0, 1, 4, 9]
```

[*expression* **for** *name* **in** *sequence* [**if** *conditional*] **...**]

Modules

Importing Modules

```
>>> import sys
>>> print sys.version
2.2.1 (#1, Oct  4 2002, 15:26:55)
>>> from math import *
>>> sin(pi/2)
1.0
```

The Import Statement

```
import module
from module import name[, ...]
from module import *
from package import module
```

Standard Modules

sys - python system variables, including **argv**

os - generic system interface (cross-platform)

os.path - generic filesystem interface (cross-platform)

re - regular expressions

time - time query and conversion

math - basic floating-point math functions (C libm)

Online Module Index

http://www.python.org/doc/current/lib/modindex.html