CS 683 Emerging Technologies
Fall Semester, 2005
Doc 1 Python Basics
Contents

References

Python Tutorial, Guido van Rossum,
http://www.python.org/doc/current/tut/tut.html

Python Reference Manual, Guido van Rossum,
http://docs.python.org/ref/ref.html

Python Library Reference, Guido van Rossum,
http://docs.python.org/lib/lib.html

Learning Python, Lutz & Ascher, O'Reilly, 1999

Reading Assignment

Sept 6. Chapters 1-4 of the Python Tutorial

Sept 8. Chapters 5-8 of the Python Tutorial

Sept 13. Chapters 9-11 of the Python Tutorial

Some Useful Python Web Sites

Main Python Site

http://www.python.org/

Beginner's Guide to Python

http://wiki.python.org/moin/BeginnersGuide

Beginner's Download Guide

http://wiki.python.org/moin/BeginnersGuide/Download

General Download Guide

http://www.python.org/download/

How to run a Python program under Windows

http://www.python.org/doc/faq/windows.html#how-do-i-run-a-python-program-under-windows

List of Python Introductions

http://www.python.org/doc/Intros.html

Python Tutorial, Guido van Rossum,

http://www.python.org/doc/current/tut/tut.html

Dive Into Python, Mark Pilgrim, online Book

http://diveintopython.org/

comp.lang.python, python news group

http://groups.google.com/group/comp.lang.python

Running Python

- Interpreter
- Script file
- Compiled code
- Application

Interpreter

```
Al 11->python
Python 2.3.5 (#1, Mar 20 2005, 20:38:20)
[GCC 3.3 20030304 (Apple Computer, Inc. build 1809)] on
darwin
Type "help", "copyright", "credits" or "license" for more in-
formation.
>>> 1 + 2
3
>>>
```

Instructions for Windows machines

Script File

Unix Example

File name: helloWorld.py

```
#! /usr/bin/env python

print 'Hello World'
```

Make the file executable:

```
Al 45->chmod u+x helloWorld.py
```

Run the file

```
Al 46->helloWorld.py
```

Note details may differ between Unix machines

Instructions for Windows machines

Python Built-in Types
Python Numbers

Literals	Description
123, -34, 0	Integer (C long)
2323232323232L	Long Integer (unlimited size)
1.23, 3.14e-10, 4E21, 5.3e+43	Floating-point (C double)
052, 0x4da	Octal & Hex
2+5j, 7.2-8j, 2J	Complex number

```
>>> a = 5
>>> b =2
>>> a * b
10
>>> a / 3
1
>>> a / 3.0
1.6666666666666667
>>> c = 3 + 2j
>>> a + c
(8+2j)
>>> abs(-5)
5
```

Numeric Operations

For more information see:

- Operations on all numeric types
- Math module

Variable Names

- Case sensitive
- Must start with underscore or letter
- May contain letters, digits or underscores cat_3
- Can not use reserved words

Reserved Words

and	del	for	is	raise
assert	elif	from	lambda	return
break	else	global	not	try
class	except	if	or	while
continue	exec	import	pass	yield
def	finally	in	print	

Operator Precedence

Operators	Description
x or y	Lazy logical or
x and y	Lazy logical and
not x	logical negation
<, <=, >, >=, ==, <>, !>, is, is not, in, not in	Comparison, identity tests, sequence membership
X | y	Bitwise or
x ^ y	Bitwise exclusive or
x & y	Bitwise and
x<<y, x>>y	Shift x left(right) by y bits
x+y, x-y	Addition/Concatenation, subtraction
x*y, x/y, x%y	Mult/repetition, division, remander/format
-x, +x, ~x	Negation, identity, bitwise complement
x[k], x[i:j], x.y, x(...)	Indexing, slicing, qualification, functions call
(...), [...], {...}, `...`	Tuple, list, dictionary, conversion to string

Strings

Immutable - once create can not change

```
aString = 'Cat in the hat' #a Comment
bString = "Cat in the hat"
multiLineString = """Cat in
   the
   hat"""

>>> a = 'cat'
>>> b = 'dog'
>>> a + b
'catdog'
>>> a * 3
'catcatcat'
>>> a[0]
'c'
>>> a[1]
'a'
>>> len(a)
3
>>> a[-1]          #a[len(a) - 1] that is index from end
't'
>>> 'a' in a
True
>>> 'a' not in b
True
>>> min(a)         #min element in a
'a'
>>> max(b)
'o'
```

Slicing

```
>>> six = '012345'
>>> len(six)
6
>>> six[2:4]          #from index 2 up to index 4
'23'
>>> six[:4]           #from start up to index 4
'0123'
>>> six[3:]           #from index 3 to end
'345'
>>> six[:]            #Make a copy - from start to end
'012345'

>>> six[1:5:2]        #from index 1 up to 5 step 2
'13'
```

More on slicing

Formatting

like springf in C

```
>>> template = 'We have %d too many %s'

>>> template % (10, 'crashers')
'We have 10 too many crashers'

>>> template % (5, 'hurricanes')
'We have 5 too many hurricanes'
```

String formatting details

String methods

```
>>> string.capitalize()
'This is an example'
>>> string.split()
['this', 'is', 'an', 'example']
>>> string.split('i')
['th', 's ', 's an example']
>>> string.split('ia')
['this is an example']
>>> string.split('an')
['this is ', ' example']
```

List of String methods

Iterating Strings

for variableName in aString:

```
>>> a = 'c1t2'
>>> for c in a:
...     if c.isdigit(): print c
...
1
2
```

Lists

Mutable ordered collection

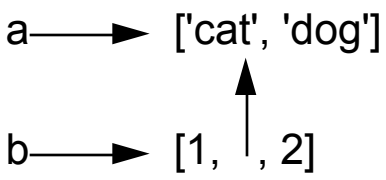
```
>>> aList = ['cat', 'dog', 3, 'mouse']
>>> aList[2]
3
>>> aList[1:3]
['dog', 3]

>>> aList.sort()
>>> aList
[3, 'cat', 'dog', 'mouse']

>>> aList[0] = 'tea'
>>> aList
['tea', 'cat', 'dog', 'mouse']

>>> aList.append('trap')
>>> aList
['tea', 'cat', 'dog', 'mouse', 'trap']

>>> del aList[1]
>>> aList
['tea', 'dog', 'mouse', 'trap']

>>> del aList[1:3]
>>> aList
['tea', 'trap']
```

Nesting Lists

```
>>> a = ['cat', 'dog']
>>> b = [1, a, 2]
>>> b
[1, ['cat', 'dog'], 2]

>>> len(b)
3
>>> b[1]
['cat', 'dog']

>>> b[1][0]
'cat'

>>> b[1][0] = 'new'
>>> b
[1, ['new', 'dog'], 2]
>>> a
['new', 'dog']
```

Assignments Create References

```
>>> a = ['cat', 'dog']
>>> b = [1, a, 2]
```



Tuples

Immutable ordered collection

Immutable list

```
>>> aTuple = ('cat', 'dog', 'mouse')
>>> aTuple[2]
'mouse'
>>> for item in aTuple:
...     print item
...
cat
dog
mouse

>>> aTuple[1:2]
('dog',)

>>> tupleAlso = 1, 2, 3
>>> tupleAlso
(1, 2, 3)
>>> emptyTuple = ()

>>> aTuple[1] = 5
Traceback (most recent call last):
  File "<stdin>", line 1, in ?
TypeError: object doesn't support item assignment
```

del and append are also illegal

Sequences

- String
- Unicode String
- List
- Tuple
- Buffer
- Xrange objects

Sequence operations

Dictionaries

Mutable map (or hashtable)

Keys must be immutable

```
>>> offices = { 'whitney': 'GMCS 561', 'beck':'GMCS-407B'
}
>>> offices['whitney']
'GMCS 561'

>>> offices.keys()
['beck', 'whitney']
>>> offices.values()
['GMCS-407B', 'GMCS 561']

>>> offices.has_key('lewis')
False

>>> offices['lewis'] = 'GMCS-544'

>>> offices.has_key('lewis')
True
>>> offices.has_key('Lewis')
False

>>> del offices['whitney']
>>> offices.keys()
['beck', 'lewis']
```

More about Dictionaries

Long Lines

Use a "\" to continue code on the next line

```
if 1900 < year < 2100 and 1 <= month <= 12 \
   and 1 <= day <= 31 and 0 <= hour < 24 \
   and 0 <= minute < 60 and 0 <= second < 60:  #Valid date
       return 1
```

Inside [], () and {} don't need the backslashes

```
month_names = ['Januari', 'Februari', 'Maart',
               'April',   'Mei',      'Juni',                #Dutch names
               'Juli',    'Augustus', 'September',
               'Oktober', 'November', 'December']
```

Files

```
>>> sampleFile = open('test', 'w')
>>> sampleFile.write('This is a test\n')
>>> shopingList = 'bread' , 'cheese', 'lentils'
>>> shopingList
('bread', 'cheese', 'lentils')
>>> sampleFile.writelines(shopingList)
>>> sampleFile.writelines(shopingList)
>>> sampleFile.close()

>>> sampleFile = open('test', 'r')
>>> sampleFile.readline()
'This is a test\n'
>>> sampleFile.readline()
'breadcheeselentilsbreadcheeselentils'

>>> sampleFile = open('test', 'r')
>>> sampleFile.readline()
'This is a test\n'
>>> sampleFile.readlines()
['breadcheeselentilsbreadcheeselentils']
```

File modes: 'r', 'w', 'a' (append)

More file operations

Equality

a is b

Do a & b point to same object

a == b

Do a & b have point to objects that have same structure and value

```
>>> a = [1, ('cat', 3)]
>>> b = [1, ('cat', 3)]
>>> c = a
>>> a == b, a is b, a == c, a is c
(True, False, True, True)
```

Comparing

```
>>> a = [1, ('cat', 3)]
>>> d = [1, ('cat', 4)]
>>> a < d, a == d, a > d
(True, False, False)

>>> {1:1, 2:2} < {1:2, 2:1}, {1:1, 2:2} > {1:2, 2:1}
(True, False)

 23 < 'cat' , 23 == 'cat', 23 > 'cat'
(True, False, False)

>>> 23 < [1, 'cat']
True

>>> ['cat'] < ('cat'), ['cat'] == ('cat'), ['cat'] > ('cat')
(True, False, False)
```

Numbers are compared as number

String are compared lexicographically

Lists & tuples are compared by comparing each component, from left to right

Dictionaries are compared as sorted (key, value) lists

Can comparing different types, but results can be meaningless

Boolean Values

Language defines boolean types

- True
- False

However other values can be evaluated as boolean

```
>>> if 'cat': print 'hi'
...
hi
```

Values equivalent to False

- None
- Numeric zero of all types
- Empty sequences: '' [] ()
- Empty mappings: {}

All other values are interpreted as True