Tutorial III: Introduction to Python

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Sage-Days 55

Arithmetic

```
2+2
```

4

```
(50-5*6)/4
```

5

```
7/3  #integer division returns the floor
```

2

Assigning values

```
width = 5*9
print width
```

```
45
```

```
x=y=z=0  #you can assign values simultaneously
print (x,y,z)
```

```
(0,0,0)
```

Basic Data Types

```
1.5 #float
```

1.5

```
3 #int
```

3

```
2^40 #long
```

1099511627776

```
'hello world' #string
```

hello world

List Data Type

```
l=[]            #empty list
l.append(1)     #add en element to the end of the list
l.append(3)
l
[1,3]
l.insert(0,5)#add 5 in entry 0
l
[0,1,3]
l.pop()         #get and remove the last entry
3
l.delete(0)     #delete the 0th entry
l
[1]
```

List Data Type

```
l=[1,2,3,4]  #create and assign a list
l
```

[1,2,3,4]

```
l[0]  #access the 1st element of the list
```

1

```
l+[5,6,7] #append [5,6,7] to the list 'l'
```

[1,2,3,4,5,6,7]

```
l[1:3]  #access a sublist of a list
```

[2,3,4]

More Lists

```
l=[n for n in range(10)]  #contruct a list
l
```

[0,1,2,3,4,5,6,7,8,9]

```
len(l)   #number of elements in the list
```

10

```
l[1] = 10  #assign a value to a place in the list
l
```

[0,10,2,3,4,5,6,7,8,9]

For loops

```python
for n in range(3): #same as range(0,3)
    print n
```

```
0
1
2
```

```python
for n in range(2,5,2):  #increment by 2
    print n
```

```
2
4
```

For loops

```python
l=[2,3,5,7,11,13]
for p in l:  #loop through the elements of a list
    print p,
```

```
2, 3, 5, 7, 11, 13
```

```python
l=['cat', 'dog', 'mouse']
for w in l:
    print (w,len(w))
```

```
cat 3
dog 3
mouse 5
```

while loops

```
n=0
while n < 3:
    print n
    n=n+1
```

```
0
1
2
```

```
a,b=0,1
while b < 100:
    print b,  # ',' suppresses the newline
    a,b = b, a+b
```

while loops

```python
n=0
while n < 3:
    print n
    n=n+1
```

```
0
1
2
```

```python
a,b=0,1
while b < 100:
    print b,  # ',' suppresses the newline
    a,b = b, a+b
```

```
1 1 2 3 5 8 13 21 34 55 89
```

if statements

```python
x = int(input('Please enter an integer: ')) #42
if x < 0:
    x = 0
    print('Negative changed to zero')
elif x == 0:
    print('Zero')
elif x == 1:
    print('Single')
else:
    print('More')
```

functions

```python
def mysign(n):
    """
    returns the sign of the input n
    """
    if n ==0:
        return('zero')
    if n > 0:
        return('positive')
    return('negative')

mysign(10)
```

positive

Functions

```python
def primelist(N=20):
    """
    returns a list of primes less than or equal to
        N
    """
    P=[]
    for n in range(N+1):
        if n.is_prime(): #this is a sage function
            P.append(n)
    return(P)

primelist(17)
```

```
2, 3, 5, 7, 11, 13, 17
```

```python
primelist()  #uses the default N=20
```

```
2, 3, 5, 7, 11, 13, 17, 19
```

Default value warning

```python
def f(a, L=[]):
    L.append(a)
    return L

print(f(1))
print(f(2))
print(f(3))
```

```
[1]
[1, 2]
[1, 2, 3]
```

Default value warning

```python
def f(a, L=None):
    if L is None:
        L=[]
    L.append(a)
    return L

print(f(1))
print(f(2))
print(f(3))
```

```
[1]
[2]
[3]
```

key word arguemnts

```
def store(kind, *args, **kwds):
    print "This is a", kind, "store."
    for a in args:
        print a,
    print \n #new line
    keys = sorted(kwds.keys())
    for kw in keys:
        print(kw, ":", kwds[kw])

store('cheese',10,12,'goat', shopkeeper="Jane Doe",
           client="John Doe")
```

```
This is a cheese store
10 12 goat
shopkeeper : Jane Doe
client : John Doe
```

Dictionaries

Dictionaries are key:value pairs

```
tel = {'jack': 4098, 'sape': 4139}
tel['guido'] = 4127
tel
```

’sape’: 4139, ’guido’: 4127, ’jack’: 4098

```
tel['jack']
```

4098

```
list(tel.keys())
```

[’sape’, ’guido’, ’jack’]

```
'guido' in tel
```

True

Other data types

1. Tuple: (1,2,3) - immutable
2. Set: $\{1,2,3,3\}$ - unordered, no duplicate elements

Classes and member functions

```python
class myclass:
    i=10

    def mymember(name):
        print "hello", name,"."

X=myclass()
X.i
```

10

```python
X.mymember('Bob')
```

hello Bob.

A couple things to be aware of for Sage

1. In python ˆ is ’XOR’ you need to use $**$ for exponentiation.
2. 1 is an ’int’, Integer(1) is a Sage/GMP integer.
3. ’set’ is a python set, ’Set’ is a Sage set.

Exercises

1. `http://projecteuler.net/problems`
2. `http://www.ling.gu.se/~lager/python_exercises.html`
3. Tutorial: `http://docs.python.org/3/tutorial/`