

Show a max
loop with a list

Python Lists

Chapter 8



Python for Informatics: Exploring Information
www.py4inf.com



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A List is a kind of Collection



- A collection allows us to put many values in a single “variable”
- A collection is nice because we can carry all many values around in one convenient package.

```
friends = [ 'Joseph', 'Glenn', 'Sally' ]
```

```
carryon = [ 'socks', 'shirt', 'perfume' ]
```

What is not a “Collection”

- Most of our variables have one value in them - when we put a new value in the variable - the old value is over written

```
$ python  
Python 2.5.2 (r252:60911, Feb 22 2008, 07:57:53)  
[GCC 4.0.1 (Apple Computer, Inc. build 5363)] on darwin  
>>> x = 2  
>>> x = 4  
>>> print x  
4
```

List Constants

- List constants are surrounded by square brackets and the elements in the list are separated by commas.
- A list element can be any Python object - even another list
- A list can be empty

```
>>> print [1, 24, 76]
[1, 24, 76]
>>> print ['red', 'yellow', 'blue']
['red', 'yellow', 'blue']
>>> print ['red', 24, 98.6]
['red', 24, 98.599999999999994]
>>> print [ 1, [5, 6], 7]
[1, [5, 6], 7]
>>> print []
[]
```

We already use lists!

```
for i in [5, 4, 3, 2, 1]:
    print i

print 'Blastoff!'

5
4
3
2
1
Blastoff!
```

Lists and definite loops - best pals

```
friends = ['Joseph', 'Glenn', 'Sally']
```

```
for friend in friends:
    print 'Happy New Year:', friend
print 'Done!'

Happy New Year: Joseph
Happy New Year: Glenn
Happy New Year: Sally
Done!
```



Looking Inside Lists

- Just like strings, we can get at any single element in a list using an index specified in square brackets

Joseph	Glenn	Sally
0	1	2

```
>>> friends = ['Joseph', 'Glenn', 'Sally']
>>> print friends[1]
Glenn
>>>
```

Lists are Mutable

- Strings are "immutable" - we *cannot* change the contents of a string - we must make a new string to make any change
- Lists are "mutable" - we *can* change an element of a list using the index operator

```
>>> fruit = 'Banna'
>>> fruit[0] = 'b'
Traceback
TypeError: 'str' object does not
support item assignment
>>> x = fruit.lower()
>>> print x
banna
>>> lotto = [2, 14, 26, 41, 63]
>>> print lotto
[2, 14, 26, 41, 63]
>>> lotto[2] = 28
>>> print lotto
[2, 14, 28, 41, 63]
```

How Long is a List?

- The len() function takes a list as a parameter and returns the number of *elements* in the list
- Actually len() tells us the number of elements of *any* set or sequence (i.e. such as a string...)

```
>>> greet = 'Hello Bob'
>>> print len(greet)
9
>>> x = [ 1, 2, 'joe', 99]
>>> print len(x)
4
>>>
```

Using the range function

- The range function returns a list of numbers that range from zero to one less than the parameter
- We can construct an index loop using for and an integer iterator

```
>>> print range(4)
[0, 1, 2, 3]
>>> friends = ['Joseph', 'Glenn', 'Sally']
>>> print len(friends)
3
>>> print range(len(friends))
[0, 1, 2]
>>>
```

A tale of two loops...

```
>>> friends = ['Joseph', 'Glenn', 'Sally']
>>> print len(friends)
3
>>> print range(len(friends))
[0, 1, 2]
>>>

friends = ['Joseph', 'Glenn', 'Sally']
for friend in friends :
    print 'Happy New Year:', friend

for i in range(len(friends)) :
    print 'Happy New Year:', friends[i]

Happy New Year: Joseph
Happy New Year: Glenn
Happy New Year: Sally
```

Concatenating lists using +

- We can create a new list by adding two existing lists together

```
>>> a = [1, 2, 3]
>>> b = [4, 5, 6]
>>> c = a + b
>>> print c
[1, 2, 3, 4, 5, 6]
>>> print a
[1, 2, 3]
```

Lists can be sliced using :

```
>>> t = ['a', 'b', 'c', 'd', 'e', 'f']
>>> t[1:3]
['b', 'c']
>>> t[:4]
['a', 'b', 'c', 'd']
>>> t[3:]
['d', 'e', 'f']
>>> t[:]
['a', 'b', 'c', 'd', 'e', 'f']
```

Remember: *Just like in strings*, the second number is "up to but not including"

List Methods

```
>>> x = list()
>>> type(x)
<type 'list'>
>>> dir(x)
['append', 'count', 'extend', 'index', 'insert', 'pop', 'remove', 'reverse', 'sort']
>>>
```

<http://docs.python.org/tutorial/datastructures.html>

Building a list from scratch

- We can create an empty list and then add elements using the append method
- The list stays in order and new elements are added at the end of the list

```
>>> stuff = list()
>>> stuff.append('book')
>>> stuff.append('ipod')
>>> print stuff
['book', 'ipod']
>>> stuff.append('cookie')
>>> print stuff
['book', 'ipod', 'cookie']
```

Is Something in a List?

- Python provides two operators that let you check if an item is in a list
- These are logical operators that return True or False
- They do not modify the list

```
>>> some = [1, 9, 21, 10, 16]
>>> 9 in some
True
>>> 15 in some
False
>>> 20 not in some
True
>>>
```

A List is an Ordered Sequence

- A list can hold many items and keeps those items in the order until we do something to change the order
- A list can be sorted (i.e. change its order)
- The sort method (unlike in strings) means "sort yourself"

```
>>> friends = ['Joseph', 'Glenn', 'Sally']
>>> friends.sort()
>>> print friends
['Glenn', 'Joseph', 'Sally']
>>> print friends[2]
Sally
>>>
```

Built in Functions and Lists

- There are a number of functions built into Python that take lists as parameters
- Remember the loops we built? These are much simpler

```
>>> nums = [3, 41, 12, 9, 74, 15]
>>> print len(nums)
6
>>> print max(nums)
74
>>> print min(nums)
3
>>> print sum(nums)
154
>>> print sum(nums)/len(nums)
25
```

<http://docs.python.org/lib/built-in-funcs.html>

```
total = 0
count = 0
while ( True ) :
    inp = raw_input('Enter a number:')
    if inp == 'done': break
    value = float(inp)
    total = total + value
    count = count + 1

average = total / count
print 'Average:', average
```

Averaging with a list

```
Enter a number: 3
Enter a number: 9
Enter a number: 5
Enter a number: done
Average: 5.66666666667
```

```
numlist = list()
while ( True ) :
    inp = raw_input('Enter a number:')
    if inp == 'done' : break
    value = float(inp)
    numlist.append(value)

average = sum(numlist) / len(numlist)
print 'Average:', average
```

Best Friends: Strings and Lists

```
>>> abc = 'With three words'
>>> stuff = abc.split()
>>> print stuff
['With', 'three', 'words']
>>> print len(stuff)
3
>>> print stuff[0]
With
>>> print stuff
['With', 'three', 'words']
>>> for w in stuff:
...     print w
...
With
three
words
>>>
```

Split breaks a string into parts produces a list of strings. We think of these as words. We can access a particular word or loop through all the words.

```
>>> line = 'A lot of spaces'
>>> etc = line.split()
>>> print etc
['A', 'lot', 'of', 'spaces']
>>>
>>> line = 'first#second#third'
>>> thing = line.split()
>>> print thing
['first#second#third']
>>> print len(thing)
1
>>> thing = line.split('#')
>>> print thing
['first', 'second', 'third']
>>> print len(thing)
3
>>>
```

When you do not specify a delimiter, multiple spaces are treated like “one” delimiter.

You can specify what delimiter character to use in the splitting.

From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008

```
fhand = open('mbox-short.txt')
for line in fhand:
    line = line.rstrip()
    if not line.startswith('From '): continue
    words = line.split()
    print words[2]
Sat
Fri
Fri
Fri
...
```

```
>>> line = 'From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008'
>>> words = line.split()
>>> print words
['From', 'stephen.marquard@uct.ac.za', 'Sat', 'Jan', '5', '09:14:16', '2008']
>>>
```

The Double Split

- Sometimes we split a line one way and then grab one of the pieces of the line and split that piece again

From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008

```
words = line.split()
email = words[1]
pieces = email.split('@')
['stephen.marquard', 'uct.ac.za']
'uct.ac.za'
```

The Double Split

- Sometimes we split a line one way and then grab one of the pieces of the line and split that piece again

```
From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008
```

```
words = line.split()          stephen.marquard@uct.ac.za
email = words[1]
pieces = email.split('@')     ['stephen.marquard', 'uct.ac.za']
print pieces[1]

                                'uct.ac.za'
```

The Double Split

- Sometimes we split a line one way and then grab one of the pieces of the line and split that piece again

```
From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008
```

```
words = line.split()          stephen.marquard@uct.ac.za
email = words[1]
pieces = email.split('@')     ['stephen.marquard', 'uct.ac.za']
print pieces[1]
```

The Double Split

- Sometimes we split a line one way and then grab one of the pieces of the line and split that piece again

```
From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008
```

```
words = line.split()          stephen.marquard@uct.ac.za
email = words[1]
pieces = email.split('@')     ['stephen.marquard', 'uct.ac.za']
print pieces[1]

                                'uct.ac.za'
```

Mystery Problem...

```
From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008
```

```
fhand = open('mbox-short.txt')
for line in fhand:
    line = line.rstrip()
    words = line.split()
    if words[0] != 'From' : continue
    print words[2]
```

```
Sat
Traceback (most recent call last):
  File "search8.py", line 5, in <module>
    if words[0] != 'From' : continue
IndexError: list index out of range
```

List Summary

- Concept of a collection
- Lists and definite loops
- Indexing and lookup
- List mutability
- Functions: len, min, max, sum
- Slicing lists
- List methods: append, remove
- Sorting lists
- Splitting strings into lists of words
- Using split to parse strings