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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 overwritten.

```bash
$ 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!

```python
for i in [5, 4, 3, 2, 1] :
    print i
print 'Blastoff!'`
Lists and definite loops - best pals

friends = ['Joseph', 'Glenn', 'Sally']
for friend in friends:
    print 'Happy New Year:', friend
print 'Done!'
Looking Inside Lists

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

```
>>> 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

```python
>>> fruit = 'Banana'
>>> fruit[0] = 'b'
Traceback
TypeError: 'str' object does not support item assignment

>>> x = fruit.lower()
>>> print(x)
banana

>>> 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...)

```python
>>> 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**.

```python
>>> 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']

for friend in friends:
    print 'Happy New Year:', friend

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

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

Happy New Year: Joseph
Happy New Year: Glenn
Happy New Year: Sally
• We can create a new list by adding two existing lists together

```python
>>> 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:

```python
>>> t = [9, 41, 12, 3, 74, 15]
>>> t[1:3]
[41, 12]
>>> t[:4]
[9, 41, 12, 3]
>>> t[3:]
[3, 74, 15]
>>> t[:]
[9, 41, 12, 3, 74, 15]
```

**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**.

```python
>>> stuff = list()
>>> stuff.append('book')
>>> stuff.append(99)
>>> print stuff
['book', 99]
>>> stuff.append('cookie')
>>> print stuff
['book', 99, '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

```python
>>> 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."

```python
>>> friends = [ 'Joseph', 'Glenn', 'Sally' ]
>>> friends.sort()
>>> print friends
['Glenn', 'Joseph', 'Sally']
>>> print friends[1]
Joseph
```
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.

```python
>>> 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
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

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

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

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

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

>>> 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 Pattern

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

```python
words = line.split()
email = words[1]
```
The Double Split Pattern

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

```python
words = line.split()
email = words[1]
pieces = email.split('@')

stephen.marquard@uct.ac.za
['stephen.marquard', 'uct.ac.za']
```
The Double Split Pattern

• 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

```python
words = line.split()
email = words[1]
pieces = email.split('@')
print pieces[1]
```

```python
stephen.marquard@uct.ac.za
['stephen.marquard', 'uct.ac.za']
```
The Double Split Pattern

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

```
words = line.split()
email = words[1]
pieces = email.split('@')
print pieces[1]
```

```
stephen.marquard@uct.ac.za
['stephen.marquard', 'uct.ac.za']

'uct.ac.za'
```
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