Python Dictionaries

Chapter 9

Python for Informatics: Exploring Information
www.pythonlearn.com

UNIVERSITY OF MICHIGAN

school of information

What is a Collection?

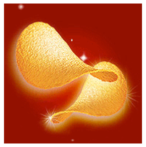
- A collection is nice because we can put more than one value in them and carry them all around in one convenient package.
- We have a bunch of values in a single "variable"
- We do this by having more than one place "in" the variable.
- We have ways of finding the different places in the variable

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
```

A Story of Two Collections..



- List
  - A linear collection of values that stay in order

- Dictionary
  - A “bag” of values, each with its own label

Dictionaries

http://en.wikipedia.org/wiki/Associative_array

Dictionaries

- Dictionaries are Python’s most powerful data collection
- Dictionaries allow us to do fast database-like operations in Python
- Dictionaries have different names in different languages
  - Associative Arrays - Perl / Php
  - Properties or Map or HashMap - Java
  - Property Bag - C# / .Net

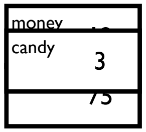
http://en.wikipedia.org/wiki/Associative_array

Dictionaries

- Lists index their entries based on the position in the list
- Dictionaries are like bags - no order
- So we index the things we put in the dictionary with a “lookup tag”

```
>>> purse = dict()
>>> purse['money'] = 12
>>> purse['candy'] = 3
>>> purse['tissues'] = 75
>>> print purse
{'money': 12, 'tissues': 75, 'candy': 3}
>>> print purse['candy']
3
>>> purse['candy'] = purse['candy'] + 2
>>> print purse
{'money': 12, 'tissues': 75, 'candy': 5}
```

```
>>> purse = dict()

>>> purse['money'] = 12
>>> purse['candy'] = 3
>>> purse['tissues'] = 75

>>> print purse
{'money': 12, 'tissues': 75, 'candy': 3}

>>> print purse['candy']
3

>>> purse['candy'] = purse['candy'] + 2

>>> print purse
{'money': 12, 'tissues': 75, 'candy': 5}
```



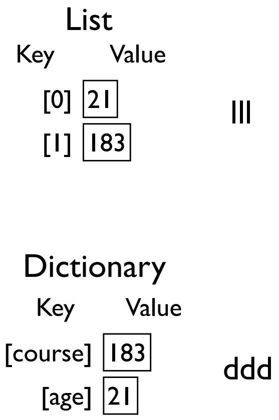
Comparing Lists and Dictionaries

- Dictionaries are like Lists except that they use keys instead of numbers to look up values

```
>>> lst = list()
>>> lst.append(21)
>>> lst.append(183)
>>> print lst
[21, 183]
>>> lst[0] = 23
>>> print lst
[23, 183]
```

```
>>> ddd = dict()
>>> ddd['age'] = 21
>>> ddd['course'] = 182
>>> print ddd
{'course': 182, 'age': 21}
>>> ddd['age'] = 23
>>> print ddd
{'course': 182, 'age': 23}
```

```
>>> lst = list()
>>> lst.append(21)
>>> lst.append(183)
>>> print lst
[21, 183]
>>> lst[0] =23
>>> print lst
[23, 183]
>>> ddd = dict()
>>> ddd['age'] = 21
>>> ddd['course'] = 182
>>> print ddd
{'course': 182, 'age': 21}
>>> ddd['age'] = 23
>>> print ddd
{'course': 182, 'age': 23}
```



Dictionary Literals (Constants)

- Dictionary literals use curly braces and have a list of key : value pairs
- You can make an empty dictionary using empty curly braces

```
>>> jjj = { 'chuck' : 1 , 'fred' : 42, 'jan': 100}
>>> print jjj
{'jan': 100, 'chuck': 1, 'fred': 42}
>>> ooo = { }
>>> print ooo
{}
>>>
```

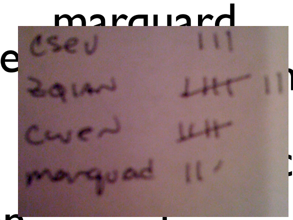
Most Common Name?

zhen zhen marquard cwen
csev zhen csev
marquard marquard csev cwen
zhen
zhen

Most Common Name?

Most Common Name?

zhen zhe marquard cwen
csev hen csev
marquard sev cwen
zhen zhen



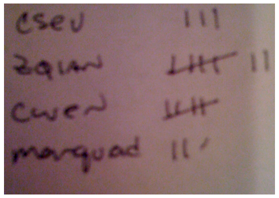
csev	III
zqian	𝍸 II
cwen	𝍸
marquad	II'

Many Counters with a Dictionary

- One common use of dictionary is counting how often we "see" something

```
>>> ccc = dict()
>>> ccc['csev'] = 1
>>> ccc['cwen'] = 1
>>> print ccc
{'csev': 1, 'cwen': 1}
>>> ccc['cwen'] = ccc['cwen'] + 1
>>> print ccc
{'csev': 1, 'cwen': 2}
```

Key	Value



csev	III
zqian	𝍸 II
cwen	𝍸
marquad	II'

Dictionary Tracebacks

- It is an error to reference a key which is not in the dictionary
- We can use the in operator to see if a key is in the dictionary

```
>>> ccc = dict()
>>> print ccc['csev']
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
KeyError: 'csev'
>>> print 'csev' in ccc
False
```

When we see a new name

- When we encounter a new name, we need to add a new entry in the dictionary and if this the second or later time we have seen the name, we simply add one to the count in the dictionary under that name

```
counts = dict()
names = ['csev', 'cwen', 'csev', 'zqian', 'cwen']
for name in names :
    if name not in counts:
        counts[name] = 1
    else :
        counts[name] = counts[name] + 1
print counts
```

```
{'csev': 2, 'zqian': 1, 'cwen': 2}
```

The get method for dictionary

- This pattern of checking to see if a key is already in a dictionary and assuming a default value if the key is not there is so common, that there is a method called get() that does this for us

```
if name in counts:
    print counts[name]
else :
    print 0
```

```
print counts.get(name, 0)
```

Default value if key does not exist (and no Traceback).

```
{'csev': 2, 'zqian': 1, 'cwen': 2}
```

Simplified counting with get()

- We can use get() and provide a default value of zero when the key is not yet in the dictionary - and then just add one

```
counts = dict()
names = ['csev', 'cwen', 'csev', 'zqian', 'cwen']
for name in names :
    counts[name] = counts.get(name, 0) + 1
print counts
```

Default

```
{'csev': 2, 'zqian': 1, 'cwen': 2}
```

Writing programs (or programming) is a very creative and rewarding activity. You can write programs for many reasons ranging from making your living to solving a difficult data analysis problem to having fun to helping someone else solve a problem. This book assumes that everyone needs to know how to program and that once you know how to program, you will figure out what you want to do with your newfound skills.

We are surrounded in our daily lives with computers ranging from laptops to cell phones. We can think of these computers as our ``personal assistants'' who can take care of many things on our behalf. The hardware in our current-day computers is essentially built to continuously ask us the question, ``What would you like me to do next?''.

Our computers are fast and have vasts amounts of memory and could be very helpful to us if we only knew the language to speak to explain to the computer what we would like it to ``do next''. If we knew this language we could tell the computer to do tasks on our behalf that were reptitive. Interestingly, the kinds of things computers can do best are often the kinds of things that we humans find boring and mind-numbing.

the clown ran after the car and the car ran into the tent and the tent fell down on the clown and the car

Counting Pattern

```
counts = dict()
print 'Enter a line of text:'
line = raw_input('')

words = line.split()
print 'Words:', words

print 'Counting...'
for word in words:
    counts[word] = counts.get(word,0) + 1

print 'Counts', counts
```

The general pattern to count the words in a line of text is to split the line into words, then loop thrugh the words and use a dictionary to track the count of each word independently.

Counting Words

```
python wordcount.py
Enter a line of text:
the clown ran after the car and the car ran into the tent
and the tent fell down on the clown and the car

Words: ['the', 'clown', 'ran', 'after', 'the', 'car', 'and', 'the',
'car', 'ran', 'into', 'the', 'tent', 'and', 'the', 'tent', 'fell', 'down',
'on', 'the', 'clown', 'and', 'the', 'car']
Counting...

Counts {'and': 3, 'on': 1, 'ran': 2, 'car': 3, 'into': 1, 'after': 1,
'clown': 2, 'down': 1, 'fell': 1, 'the': 7, 'tent': 2}
```

http://www.flickr.com/photos/71502646@N00/2526007974/

```
counts = dict()
print 'Enter a line of text:'
line = raw_input('')

words = line.split()
print 'Words:', words

print 'Counting...'
for word in words:
    counts[word] = counts.get(word,0) + 1

print 'Counts', counts
```

```
python wordcount.py
Enter a line of text:
the clown ran after the car and the car
ran into the tent and the tent fell down
on the clown and the car

Words: ['the', 'clown', 'ran', 'after', 'the',
'car', 'and', 'the', 'car', 'ran', 'into', 'the',
'tent', 'and', 'the', 'tent', 'fell', 'down', 'on',
'the', 'clown', 'and', 'the', 'car']
Counting...

Counts {'and': 3, 'on': 1, 'ran': 2, 'car': 3,
'into': 1, 'after': 1, 'clown': 2, 'down': 1,
'fell': 1, 'the': 7, 'tent': 2}
```

Definite Loops and Dictionaries

- Even though dictionaries are not stored in order, we can write a for loop that goes through all the entries in a dictionary - actually it goes through all of the keys in the dictionary and looks up the values

```
>>> counts = { 'chuck' : 1 , 'fred' : 42, 'jan': 100}
>>> for key in counts:
...     print key, counts[key]
...
jan 100
chuck 1
fred 42
>>>
```

Retrieving lists of Keys and Values

- You can get a list of keys, values or items (both) from a dictionary

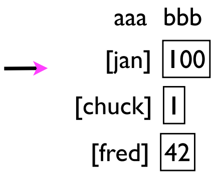
```
>>> jjj = { 'chuck' : 1 , 'fred' : 42, 'jan': 100}
>>> print list(jjj)
['jan', 'chuck', 'fred']
>>> print jjj.keys()
['jan', 'chuck', 'fred']
>>> print jjj.values()
[100, 1, 42]
>>> print jjj.items()
[('jan', 100), ('chuck', 1), ('fred', 42)]
>>>
```

What is a 'tuple'? - coming soon...

Bonus: Two Iteration Variables!

- We loop through the key-value pairs in a dictionary using *two* iteration variables
- Each iteration, the first variable is the key and the the second variable is the *corresponding* value for the key

```
>>> jjj = { 'chuck' : 1 , 'fred' : 42, 'jan': 100}
>>> for aaa,bbb in jjj.items() :
...         print aaa, bbb
...
jan 100
chuck 1
fred 42
>>>
```



aaa bbb

[jan] 100

[chuck] 1

[fred] 42

```
name = raw_input("Enter file:")
handle = open(name, 'r')
text = handle.read()
words = text.split()

counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1

bigcount = None
bigword = None
for word,count in counts.items():
    if bigcount is None or count > bigcount:
        bigword = word
        bigcount = count

print bigword, bigcount
```

```
python words.py
Enter file: words.txt
to 16
```

```
python words.py
Enter file: clown.txt
the 7
```

Summary

- What is a collection?
- Lists versus Dictionaries
- Dictionary constants
- The most common word
- Using the get() method
- Hashing, and lack of order
- Writing dictionary loops
- Sneak peek: tuples
- Sorting dictionaries