CMSC 723
Computational Linguistics I

Introduction to Python and NLTK

Session 2
Wednesday, September 9, 2009

Outline

- Spend 30-40 minutes on Python
  - Not an intro!
  - *Very quick* run-through of how Python does stuff you already know (being CS majors /programmers)
- Spend 30-40 minutes on NLTK
- Break (5 mins)
- Second half: Hands-on session (2 fun problems!)

Python

Running Python

- Download & install python
  - http://wiki.python.org/moin/BeginnersGuide/Download
- Run interactive interpreter
  - Type `python` at command prompt
- Run scripts
  - Type `python script.py arg1 arg2 ...`
- Run scripts in interactive mode:
  - Type `python -i script.py arg1 arg2 ...`

Why Python?

- High-level Data Types
- Automatic memory management
- Intuitively Object Oriented
- Powerful & versatile standard library
- Native unicode support
- Readable (even other people's code!)
- Easily extensible using C/C++

http://www.python.org/about/

The Zen of Python

- No statement delimiters, e.g., semicolon
- Code blocks are *required* to be indented
  - loops, conditional statements & functions
  - No curly braces or explicit *begin*/*end*
- Everything is an object!
  - Can assign everything to a variable
  - Can pass everything to a function (even functions!)

http://www.python.org/doc/current/ref/indentation.html
http://www.python.org/doc/current/ref/objects.html

Python Datatypes

- No explicit datatype declaration
- An object has a fixed type, once assigned
- Explicit conversion required
- None (NULL object)

```
>>> s1 = 'a string' # a string object
>>> s2 = 123 # an integer object
>>> s1 + s2
TypeError: cannot concatenate ’str’ and ’int’ objects
>>> s1 +str(s2) # convert integer to string
'a string123'
```

🟩 string literals 🟪 built-in functions

🟥 comments 🟧 keywords

Datatypes: Lists

- One of the most useful Python types
- Analogous to Perl array and Java ArrayList

```
>>> a = [1, 2, 3, 1, 5] # a list of 5 integers; can be anything
>>> a[0] # lists are zero−indexed
1
>>> a[1:3] # the slice [a[1], a[2]]
[2,3]
>>> a[−1] # negative slicing − the last element of a
5
>>> 5 in a # membership test; returns built−in boolean True/False
True
>>> a.append(6) # list objects have methods; here’s one to append stuff
>>> a
[1, 2, 3, 1, 5, 6]
```

Datatypes: Lists

- One of the most useful Python types
- Analogous to Perl array and Java ArrayList

```
>>> a.insert(2, 7) # insert 7 at position 3 (2+1)
>>> a
[1, 2, 7, 3, 1, 5, 6]
>>> len(a) # how many elements in a ?
7
>>> a.extend([8, 9]) # concatenate with another list
>>> a += [10] # same as a.extend([10])
>>> a
[1, 2, 7, 3, 1, 5, 6, 8, 9, 10]
>>> a.remove(1) # remove first occurrence of 1; raise exception if none
>>> a
[2, 7, 3, 1, 5, 6, 8, 9, 10]
```

Datatypes: Lists

- One of the most useful Python types
- Analogous to Perl array and Java ArrayList

```
>>> a
[2, 7, 3, 1, 5, 6, 8, 9, 10]
>>> a.sort() # sort ascending in place
>>> a
[1, 2, 3, 5, 6, 7, 8, 9, 10]
>>> a.pop(0) # pop and return the 1st element
1
>>> a.sort(reverse=True) # sort descending
>>> a
[10, 9, 8, 7, 6, 5, 3, 2]
>>> a[1:3] * 3 # concatenate three copies of this slice
[9, 8, 9, 8, 9, 8]
```

Datatypes: Tuples

- Cannot be changed once created (immutable)
- Method-less objects

```
>>> t = (1, 2, 3) # parens instead of square brackets
>>> t[1] # indexing works just likes lists
2
>>> t.append(4) # can't do this !
AttributeError: 'tuple' object has no attribute 'append'
>>> t.remove(1) # ... or this !
AttributeError: 'tuple' object has no attribute 'remove'
>>> 3 in t # membership test still works
True
>>> t[:2] # so does slicing
(1, 2)
>>> t == tuple(list(t)) # tuples can be made into lists and vice versa
True
```

Datatypes: Dictionaries

- Used in Assignment 1 to encode graph
- Analogous to Perl hash and Java HashTable

```
>>> d1 = {'a':1, 'b':2, 'c':3} # comma-separated key:value pairs
>>> d1['b'] # look up the value for a given key
2
>>> 'f' in d1 # check key membership
False
>>> d2 = dict([('a', 1), ('b', 2), ('c', 3)]) # create using a list of tuples
>>> d1 == d2
True
>>> d1.keys() # list of all the keys
['a', 'b', 'c']
>>> d1.values() # list of all the values
[1, 2, 3]
```

Datatypes: Dictionaries

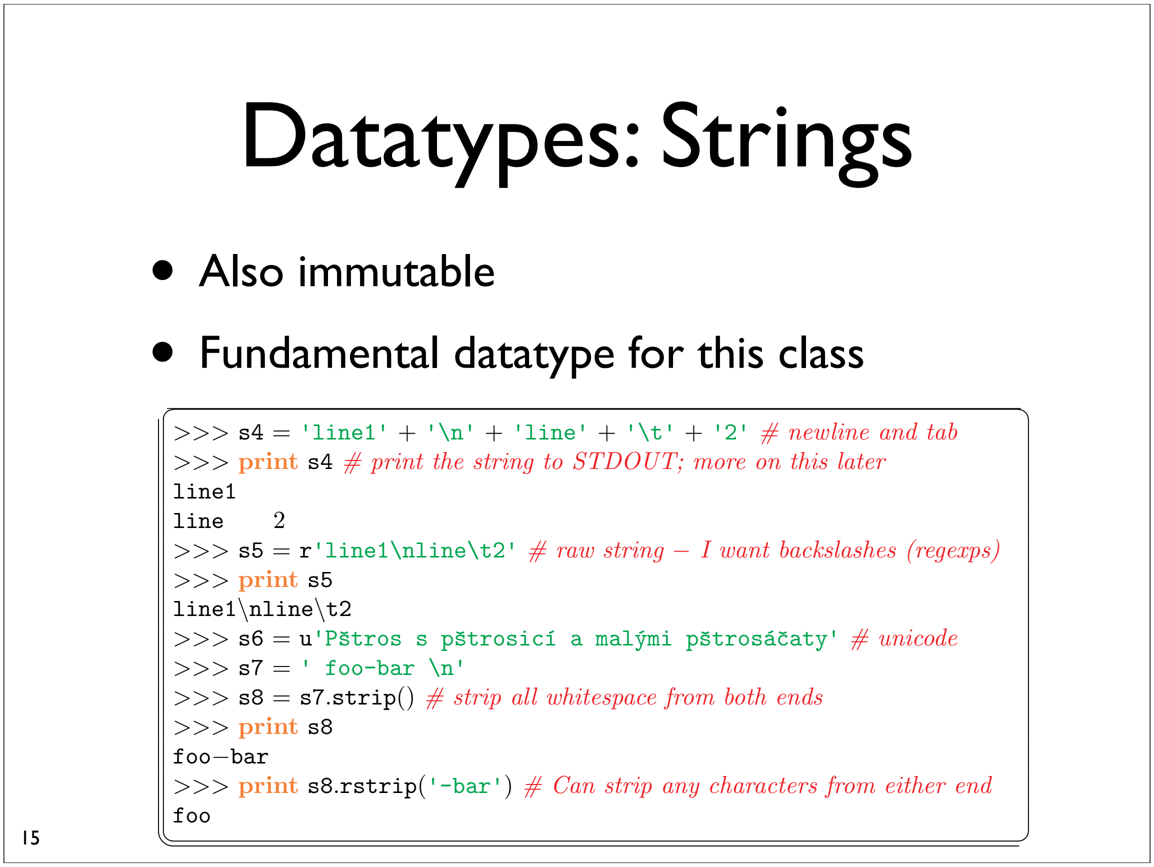
- Used in Assignment 1 to encode graph
- Analogous to Perl hash and Java HashTable

```
>>> d1.items() # get list of (key, value) tuples
[('a',1), ('b',2), ('c',3)]
>>> del d1['b'] # delete item by key
>>> d1
{'a': 1, 'c': 3}
>>> d1.clear() # clear everything
>>> d1
{}
>>> d1[[1,2,3]] = 1 # keys must be immutable; lists are out
TypeError: list objects are unhashable
```

Datatypes: Strings

- Also immutable
- Fundamental datatype for this class

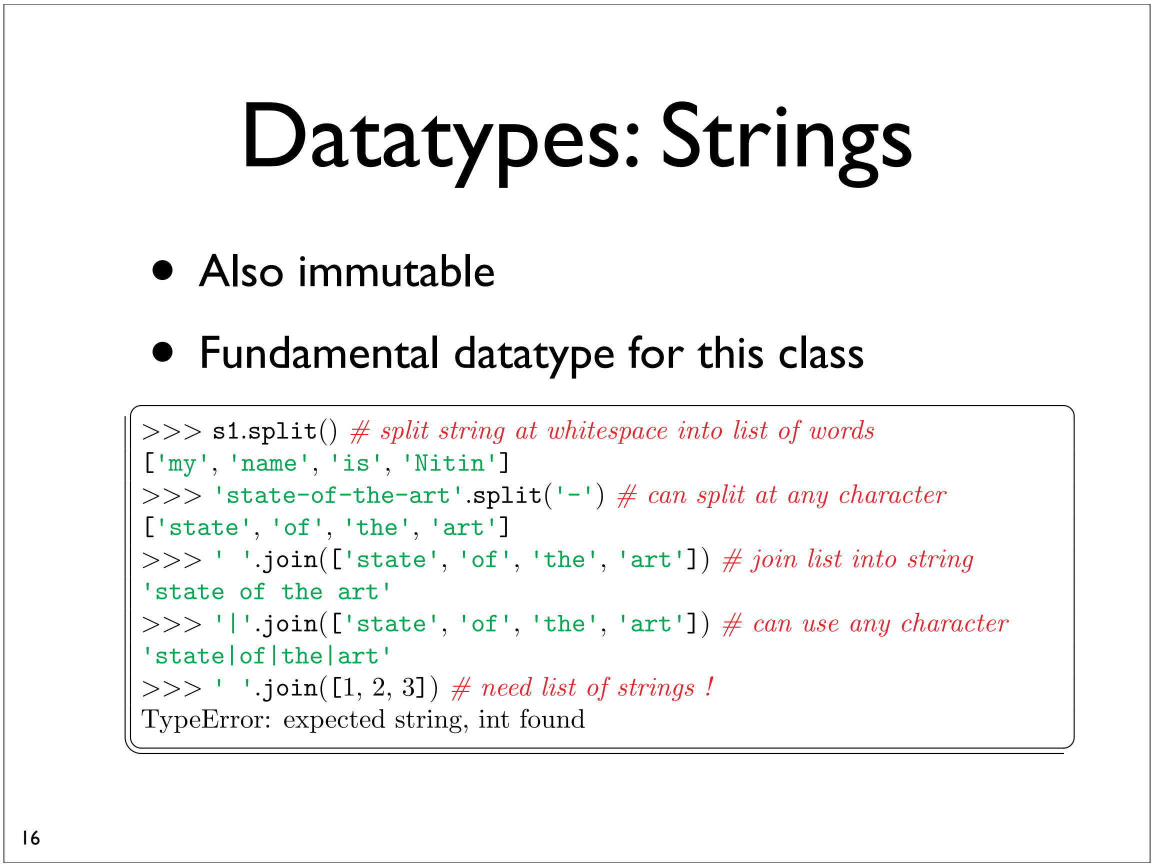
```
>>> s1 = 'my name is Nitin' # can use single quotes ...
>>> s2 = "my name is Nitin" # ... or double quotes
>>> s3 = "what's your name" # use double to quote single (& vice versa)
>>> s3 += '?' # create new string, perform concatenation, overwrite s3
>>> s1*2 # replicate and concatenate
'my name is Nitinmy Name is Nitin'
>>> s1[5:10] # slicing works
'me is'
>>> len(s1) # how many characters in string s1 ?
16
>>> str(45) # convert to string
'45'
```



Datatypes: Strings

- Also immutable
- Fundamental datatype for this class

```
>>> s4 = 'line1' + '\n' + 'line' + '\t' + '2' # newline and tab
>>> print s4 # print the string to STDOUT; more on this later
line1
line    2
>>> s5 = r'line1\nline\t2' # raw string − I want backslashes (regexps)
>>> print s5
line1\nline\t2
>>> s6 = u'Pštros s pštrosicí a malými pštrosáčaty' # unicode
>>> s7 = ' foo-bar \n'
>>> s8 = s7.strip() # strip all whitespace from both ends
>>> print s8
foo−bar
>>> print s8.rstrip('-bar') # Can strip any characters from either end
foo
```



Datatypes: Strings

- Also immutable
- Fundamental datatype for this class

```
>>> s1.split() # split string at whitespace into list of words
['my', 'name', 'is', 'Nitin']
>>> 'state-of-the-art'.split('-') # can split at any character
['state', 'of', 'the', 'art']
>>> ' '.join(['state', 'of', 'the', 'art']) # join list into string
'state of the art'
>>> '|'.join(['state', 'of', 'the', 'art']) # can use any character
'state|of|the|art'
>>> ' '.join([1, 2, 3]) # need list of strings !
TypeError: expected string, int found
```

Datatypes: Sets

- Python provides a native *set* datatype

```
>>> a = set([1, 2, 3, 4, 4, 3, 2]) # build a set from a list
>>> print a # no duplicates
set([1, 2, 3, 4])
>>> b = set([]) # create empty set
>>> b.add(1) # add element
>>> b.add(5)
>>> print a.union(b) # supports all set operations as methods
set([1, 2, 3, 4, 5])
>>> print a.intersection(b)
set([1])
>>> print a.difference(b)
set([2, 3, 4]])
```

Loops and conditionals

```
out = []
>>> for i in [1, 2, 3, 4, 5]: # note the colon ...
        out.append(i+i) # ... & the indentation (usually 4 spaces)
```

for loop

```
odd, even = [], [] # init two empty lists
>>> for i in [1, 2, 3, 4, 5]:
       if i % 2:
           odd.append(i)
       else:
           even.append(i)
```

if-then statement

```
i = 0
out = []
>>> while i <= 10:
       out.append(i)
       i += 1
```

while loop

Functions

- Arguments and return values not typed
- Default return value: None

```
>>> def fib(n): # generate the nth fibonacci number
        if n == 1 or n == 2: # note indentation again
            return 1
        else:
            return fib(n-1) + fib(n-2)
>>> fib(4)
3
>>> fib(5)
5
```

Classes

- Define your own or inherit
- No need for interfaces or headers

```
>>> class complex: # define a complex number class; note indentation
        # the constructor method
        def __init__(self, a, b): #1st argument is always instance pointer
            self.a = a
            self.b = b
        def __str__(self): # how to print a complex number
            return '%d + %di' % (self.a, self.b)
        def add(self, other): # add another complex number
            return complex(self.a + other.a, self.b + other.b)
```

Classes

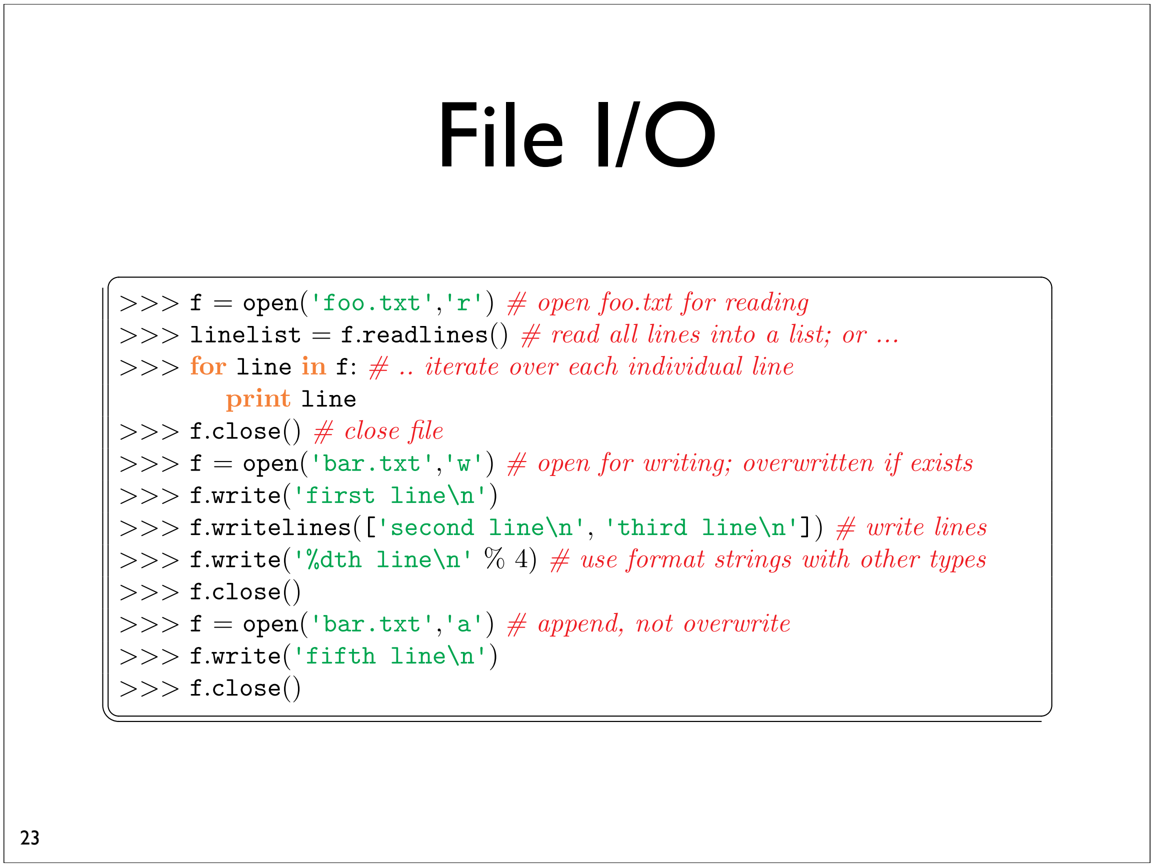
- Define your own or inherit
- No need for interfaces or headers

```
>>> c = complex(3,5) # create a complex number instance
>>> print c
3 + 5i
>>> d = complex(4,3)
>>> print c.add(d)
7 + 8i
```

Printing Stuff

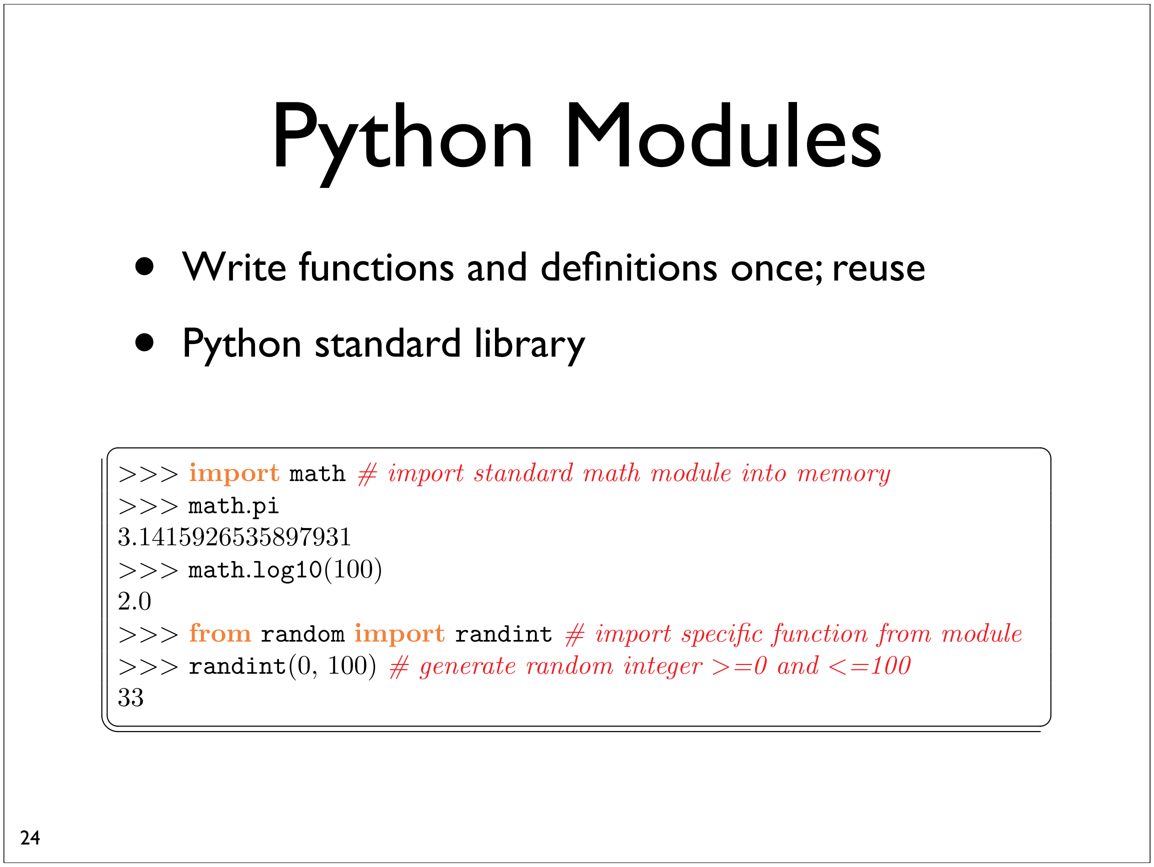
- Invaluable for debugging
- Use format strings for more control

```
>>> i = 10
>>> s = 'string'
>>> f = 35123.4
>>> print i, f, s # print variables with a space between them
10 35123.4 string
>>> print "i = %d, f = %f, s = %s" % (i, f, s) # format strings
i = 10, f = 35123.400000, s = string
```



File I/O

```
>>> f = open('foo.txt','r') # open foo.txt for reading
>>> linelist = f.readlines() # read all lines into a list; or ...
>>> for line in f: # .. iterate over each individual line
        print line
>>> f.close() # close file
>>> f = open('bar.txt','w') # open for writing; overwritten if exists
>>> f.write('first line\n')
>>> f.writelines(['second line\n', 'third line\n']) # write lines
>>> f.write('%dth line\n' % 4) # use format strings with other types
>>> f.close()
>>> f = open('bar.txt','a') # append, not overwrite
>>> f.write('fifth line\n')
>>> f.close()
```



Python Modules

- Write functions and definitions once; reuse
- Python standard library

```
>>> import math # import standard math module into memory
>>> math.pi
3.141592653589793l
>>> math.log10(100)
2.0
>>> from random import randint # import specific function from module
>>> randint(0, 100) # generate random integer >=0 and <=100
33
```

Python Modules

- Write functions and definitions once; reuse
- Python standard library

```
>>> import sys
>>> type(sys.argv) # list of arguments passed; argv[0] = script name
<type 'list'>
>>> for line in sys.stdin: # sys.stdin is a stream just like a file
        print line
>>> sys.stdout.write('The %s is %d\n' % ('answer',42)) # so is stdout
The answer is 42
```

http://docs.python.org/modindex.html

Python Modules

- Write functions and definitions once; reuse
- Python standard library

```
>>> import re # module handing regular expressions
>>> sent = 'The Olympics or the olympics ?'
>>> pat = r'[oO]lympics' # better to use raw strings
>>> m = re.search(pat, sent) # a ”match object”
>>> print m.span(), m.group()
(4,12) Olympics
>>> m = re.match(pat, sent) # match vs search.
>>> m == None # Why doesn't this work ?
True
>>> print re.findall(pat, sent) # find ALL matches
['Olympics','olympics']
>>> pat = r'([Oo])lympics') # find sub−matches as well
>>> m = re.search(pat,sent); print m.group(), m.group(1)
Olympics O
```

Python Modules

- Write functions and definitions once; reuse
- Python standard library

```
# Build a regexp to extract all occurrences of 'the' below; use re.findall
>>> sent = 'Another man said;the woman was Gaia_The_Oracle'
>>> pat = r'[tT]he'  # Wrong! Also matches 'Another'
>>> pat = r'\b[tT]he\b'  # Still wrong! Doesn't match second 'The'
>>> pat = r'[^a-zA-Z][tT]he[^a-zA-Z]'
>>> print re.findall(pat, sent)
[';the ', '_The_'] # Whoops ! Don't need the context!
>>> pat = r'[^a-zA-Z]([tT]he)[^a-zA-Z]'
>>> print re.findall(pat, sent)
['the', 'The'] # Voila !
```

http://docs.python.org/lib/module-re.html

Python "Lifesavers"

Generate a list of numbers from m to n

```
>>> out = []
>>> i = 0
>>> while i < 10:
        out.append(i)
        i += 1
>>> print out
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

Before

Python “Lifesavers”

Generate a list of numbers from m to n

```
>>> l = range(10)
>>> print l
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

After

Python “Lifesavers”

Create new lists from a given list

```
>>> nums = range(1, 11) # 1..10
>>> odd, even = [], []
>>> for n in nums:
        if n % 2:
            odd.append(n)
        else:
            even.append(n)
>>> print odd
[1, 3, 5, 7, 9]
>>> print even
[2, 4, 6, 8, 10]
```

Before

Python “Lifesavers”

Create new lists from a given list

```
>>> nums = range(1, 11)
>>> odd = [n for n in nums if n % 2]  # a ”list comprehension”
>>> even = [n for n in nums if n not in odd]
>>> print odd
[1, 3, 5, 7, 9]
>>> print even
[2, 4, 6, 8, 10]
```

After

Python “Lifesavers”

Read all lines from a file that start with an ‘a’
& strip newlines

```
>>> lines = []
>>> f = open('file.txt','r')
>>> for line in f:
        line = line.strip()
        if line[0] == 'a':
            lines.append(line)
```

Before

Python “Lifesavers”

Read all lines from a file that start with an ‘a’
& strip newlines

```
>>> f = open('file.txt','r')
# list comprehensions and string methods to the rescue !
>>> lines = [line.strip() for line in f if line.startswith('a')]
```

After

Python “Lifesavers”

‘Find full paths for all files in a directory that
match the pattern ‘A[0-9].txt’

```
>>> import os, re
>>> files = []
>>> for f in os.listdir('/courses/cmsc723'):
        if re.match(r'A[0-9].txt$',f):
            files.append(os.path.abspath(f))
```

Before

Python “Lifesavers”

‘Find full paths for all files in a directory that match the pattern ‘A[0-9].txt’

```
>>> import glob
>>> files = glob.glob('/courses/cmsc723/A[0-9].txt')
```

After

Python “Lifesavers”

‘Get a list of bigrams, i.e., overlapping two-word sequences, given a sentence’

```
>>> s = 'This is a sentence'
>>> words = s.split()
>>> bigrams = []
>>> for i in range(len(words)-1):
        bigrams.append(' '.join(words[i:i+2]))
>>> bigrams
['This is', 'is a', 'a sentence']
```

Before

Python “Lifesavers”

‘Get a list of bigrams, i.e., overlapping two-word sequences, given a sentence’

```
>>> s = 'This is a sentence'
>>> words = s.split()
>>> bigrams = zip(words,words[1:]] # Think of a regular zipper!
>>> bigrams
[('This', 'is'), ('is', 'a'), ('a', 'sentence')]
>>> bigrams = [' '.join(t) for t in bigrams]
```

After

NLTK

The Natural Language ToolKit

[http://www.nltk.org/download]

Why NLTK ?

- Fully self-contained natural language toolkit
- About 50 corpora with real-world data
  - Some POS-tagged as well as parsed
- Tools & Visualizers
  - Tokenizers, taggers, parsers, stemmers, classifiers
- Semantic & lexical resources (WordNet)

Using NLTK

- Single top-level module
- Everything accessible after single import

```
>>> import nltk # import top-level namespace and you are done !
```

NLTK Corpora

- ~50 corpora bundled with NLTK
- Most contain multiple files (some have sections)

```
>>> import nltk
>>> from nltk.corpus import gutenberg # The Gutenberg corpus
>>> gutenberg.fileids() # the texts included in this corpus
('austen-emma.txt', 'austen-persuasion.txt' ...)
>>> gutenberg.words('austen-emma.txt') # list of words in ”Emma”
['[', 'Emma', 'by', 'Jane', 'Austen', '1816', ']', ...]
>>> gutenberg.sents('austen-emma.txt') # list of word lists
[['[', 'Emma', 'by', 'Jane', 'Austen', '1816', ']'], ['VOLUME', 'I'], ...]
```

NLTK Corpora

- ~50 corpora bundled with NLTK
- Most contain multiple files (some have sections)

```
>>> import nltk
>>> from nltk.corpus import brown # The Brown corpus
>>> brown.categories() # the brown corpus is divided into ...
['adventure', 'belles_lettres', 'editorial', ..., 'science_fiction']
>>> brown.fileids() # multiple files make up each section ...
('ca01', 'ca02', 'ca03', 'ca04', 'ca05', ... , 'cr09')
>>> brown.words(categories='news') # list of words in section 'news'
['The', 'Fulton', 'County', 'Grand', 'Jury', 'said', ...]
>>> brown.tagged_words(categories='news') # list of word/tag tuples
[('The', 'AT'), ('Fulton', 'NP-TL'), ...]
>>> brown.sents(categories='news') # list of word lists
>>> brown.tagged_sents(categories='news') # list of word/tag tuple lists
```

Counting in NLTK

- Frequency and Conditional Frequency
- First class objects

```
>>> import nltk
>>> from nltk.corpus import brown
>>> fd = nltk.FreqDist() # Instantiate a FreqDist object
>>> for sent in brown.sents(categories='news'): # frequency of lengths
        fd.inc(len(sent)) # increment count for this length
>>> print len(fd) # how many different lengths are there ?
73
>>> print fd.max() # the most frequent length
20
>>> for length, count in fd.items()[1:3]: # iteration is ordered
        print length, count # next 2 most common lengths
17 164
23 158
>>> print fd.hapaxes() # hapax legomena: things only said once
[66, 72, 83, 84, 96, 102]
```

Counting in NLTK

- Frequency and Conditional Frequency
- First class objects

```
>>> import nltk
>>> from nltk.corpus import brown
>>> cfd = nltk.ConditionalFreqDist()
>>> ambiguous_words = ['bank', 'duck', 'hand']
>>> for (word, tag) in brown.tagged_words(): # use all sections
        if word.lower() in ambigious_words: # lowercase word
            cfd[word].inc(tag) # count tag given word
>>> for aw in ambiguous_words:
        print aw, cfd[aw]
bank <FreqDist: 'NN': 54>
duck <FreqDist: 'VB': 7, 'NN': 2>
hand <FreqDist: 'NN': 410, 'VB': 7, 'NN-HL': 1>
```

Remember Zipfians?

- Introduced in first session
- Also in ACM Crossroads article (assigned reading)

$$f.r = c \quad \Rightarrow \quad f = \frac{c}{r}$$

```
f = frequency
r = rank
c = constant
```

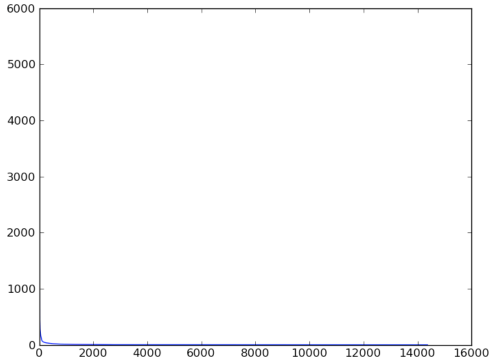
“Few things are very frequent, Most are infrequent”
“Long Tail”
“Power Law Distribution”

Plotting in NLTK

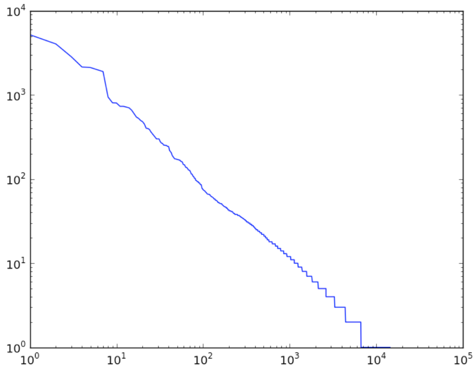
- Use Matplotlib
- Let’s verify Zipf’s law for various sections

```
>>> import nltk
>>> from nltk.corpus import brown
>>> import matplotlib
>>> matplotlib.use('TkAgg') # use a cross−platform backend
>>> from matplotlib.pyplot import plot, loglog, show
>>> fd = nltk.FreqDist() # Instantiate a FreqDist object
>>> for word in brown.words(categories='news'): # iterate over words
        fd.inc(word) # increment count for this word
>>> freqs = [t[1] for t in fd.items()]
>>> ranks = range(len(freqs))
>>> plot(ranks, freqs) # regular plot
>>> show()
>>> loglog(ranks, freqs) # log−log plot
>>> show()
```

Plotting in NLTK



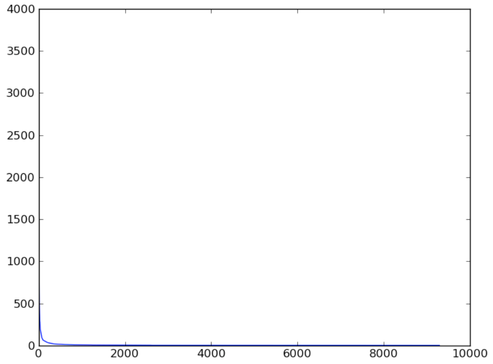
Regular



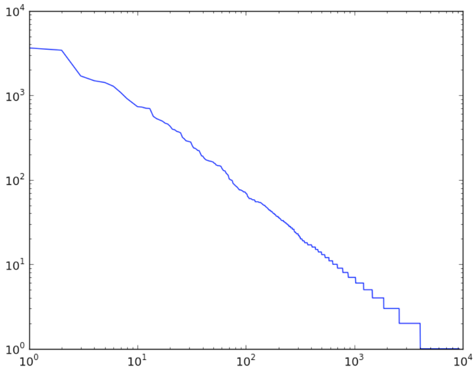
Log-Log

NEWS

Plotting in NLTK



Regular



Log-Log

FICTION

Hands-on Session

Problem 1

"Spin Alley"

Given a corpus of presidential state of the union addresses, find out how many times each president used the words below *and* draw histograms (*without* using matplotlib):

(a) war
(b) economy
(c) change
(d) bipartisan

Note: You may restrict yourself to the last 6 U.S. Presidents

To start you off ...

```
>>> import nltk

# a list of the words that interest us
>>> query_words = ['war', 'economy', 'change', 'bipartisan']

# State of the Union corpus and all its speeches; note naming convention
>>> from nltk.corpus import state_union as su # shorter name for convenience
>>> print su.fileids() # EXAMINE THE FILENAMES CLOSELY!
('1945-Truman.txt', '1946-Truman.txt', ..., '2006-GWBush.txt')

# define president names (preferably like the way are used in the filenames)
>>> presidents = ['Ford', 'Carter', 'Reagan', 'Bush', 'Clinton', 'GWBush']
```

Solution[†] Stub

1. Locate and store the speeches for each president

2. Conditional-count by iterating over all the words

   HINT: Make sure you are counting the "right form" of words

3. Plot the histograms using the counts

   HINT: How does a histogram relate to a native Python datatype?

[†] A solution, not necessarily the most efficient one.

Time to code!

I'll reveal a part of the solution every 5 minutes!

Final solution at the end!

Solution

1

```
# Locate the speeches for each president
speechdict = {}
for p in presidents:
    speechdict[p] = [ x for x in su.fileids() if p in x.rstrip('.txt').split('-') ]
```

2

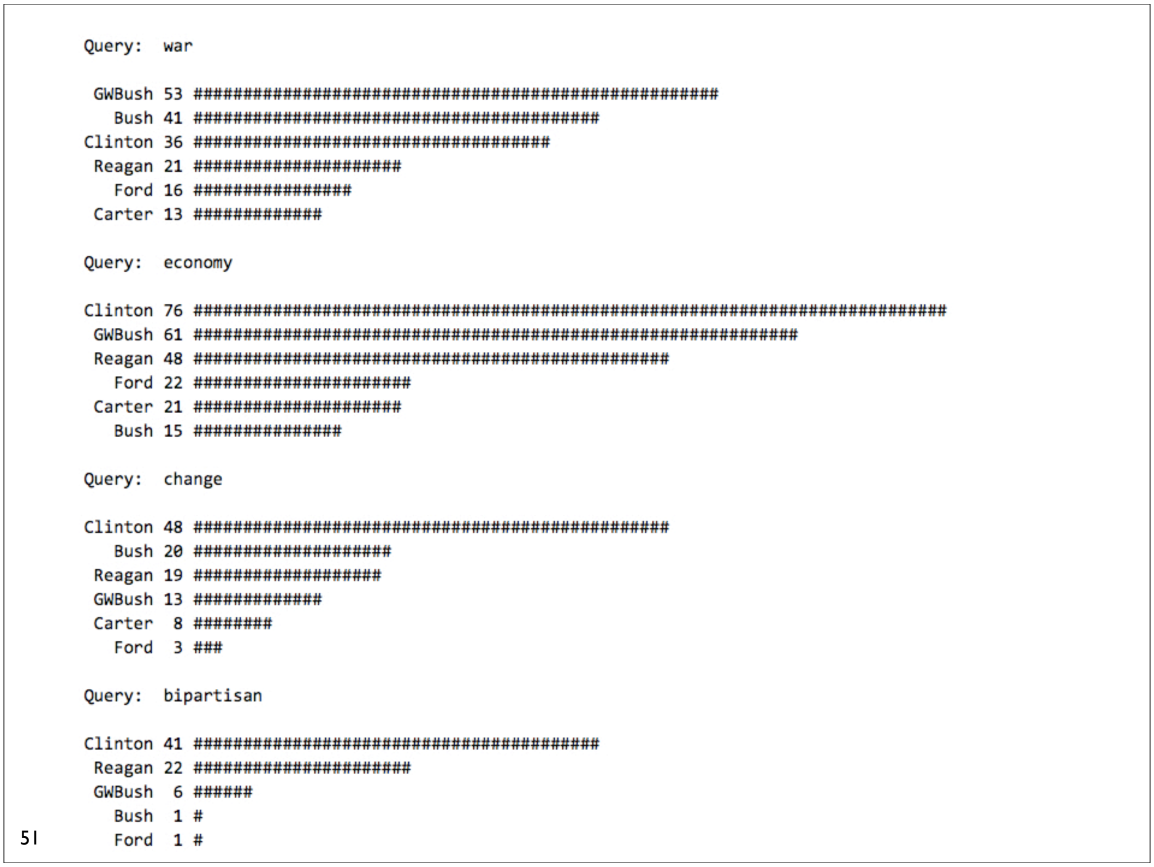
```
# Do the counting
cfd = nltk.ConditionalFreqDist()
for prez, speechlist in speechdict.items():
    for speech in speechlist:
        for word in su.words(speech):
            word = word.lower()
            if word in query_words:
                cfd[word].inc(prez)
```

Solution

3

```
# we now have a cfd and all we need to do is to print out
# the statistics for each query word
>>> for word in query_words:
        print 'Query:', word, '\n'
        for president, count in cfd[word].items():
            print '%7s %2d %s' % (president, count, '#'*count)
```

Voila! We're Done!
Let's run it and see what happens!



```
Query:  war

 GWBush 53 #####################################################
   Bush 41 #########################################
Clinton 36 ####################################
 Reagan 21 #####################
   Ford 16 ################
 Carter 13 #############

Query:  economy

Clinton 76 ############################################################################
 GWBush 61 #############################################################
 Reagan 48 ################################################
   Ford 22 ######################
 Carter 21 #####################
   Bush 15 ###############

Query:  change

Clinton 48 ################################################
   Bush 20 ####################
 Reagan 19 ###################
 GWBush 13 #############
 Carter  8 ########
   Ford  3 ###

Query:  bipartisan

Clinton 41 #########################################
 Reagan 22 ######################
 GWBush  6 ######
   Bush  1 #
   Ford  1 #
```

Problem 2

“Name That Bill”

Download the two data files from the course webpage.

Each file contain congressional speeches on a specific bill from 2005-2006 (109th Congress).

Provide your best estimate as to what each bill is about.

Solution[†] Stub

1. Unzip each file and examine the resulting directories

2. Note that each file in the directory is *a* speech about the bill.

   HINT 1: What’s the *simplest* feature we could use to get an idea of the bill topic?

   HINT 2: Do all of the words in the speeches carry semantic content? What about non-words? And even some *content* words may just get in the way.

   HINT 3: You might need to use *twice as big* a feature from Hint 1 for the second bill.

[†] A solution, not necessarily the best one.

To start you off ...

```
>>> import nltk

# List of function/non−content words in NLTK
>>> from nltk.corpus import stopwords
>>> stopwords = stopwords.words('english')
```

The rest of what you need has *already* been covered in this lecture

Time to code!

I'll reveal a part of the solution every 5 minutes!

Final solution at the end!

Solution

1

```
# Figure out what words to filter
stopwords = stopwords.words('english')
# incl. useless content words
stopwords += ['mr.', 'chairman', 'madam', 'yield', 'speaker', 'gentleman']
```

2

```
# Iterate over the files in each dir and count bigrams
fd = FreqDist()
path = '/Users/nmadnani/Desktop/1' # or whatever path you have
for f in glob.glob('%s/*.txt' % path):
    line = open(f).read().strip()
    words = line.split()
    # Figure out the useful words in the sentence
    content_words = [x for x in words if x not in stopwords and \
                        not re.search('[^a-zA-Z]', x)]
    # Count the bigrams
    content_bigrams = zip(content_words, content_words[1:])
    for cb in content_bigrams:
        fd.inc(cb)
```

Solution

3

```
# Print out the top 10 bigrams which should tell us about the bill
for w in fd.keys()[:10]:
    print ’ ’.join(w)
```

Voila! We’re Done!
Let’s run it and see what happens!

Bill 1

```
health care, health insurance, small businesses, small
business, health plans, association health, balance time,
million people, number uninsured, underlying bill
```

Output

Small Business Health Fairness Act of 2005 (HR 525)

To amend title I of the Employee Retirement Income Security Act of 1974 to improve access and choice for entrepreneurs with small businesses with respect to medical care for their employees.
http://www.govtrack.us/congress/bill.xpd?bill=h109-525

Answer

Bill 2

```
real id, united states, id act, driver licenses, driver
license, border security, homeland security, conference
report, american people, national security
```

Output

Bill 2
REAL ID Act of 2005 (HR 418)

To establish and rapidly implement regulations for State driver's license and identification document security standards, to prevent terrorists from abusing the asylum laws of the United States, to unify terrorism-related grounds for inadmissibility and removal, and to ensure expeditious construction of the San Diego border fence
http://www.govtrack.us/congress/bill.xpd?bill=h109-418.

Answer

Questions?

```
>>> import this
>>> from __future__ import braces
```

Python Easter Eggs!
Try them out!

Useful Readings

- Python style guide

  http://www.python.org/doc/essays/styleguide.html

- Python performance tips

  http://wiki.python.org/moin/PythonSpeed/PerformanceTips

- Mark Pilgrim's *Dive Into Python*

  http://diveintopython.org/toc/index.html

- NLTK Book

  http://www.nltk.org/book