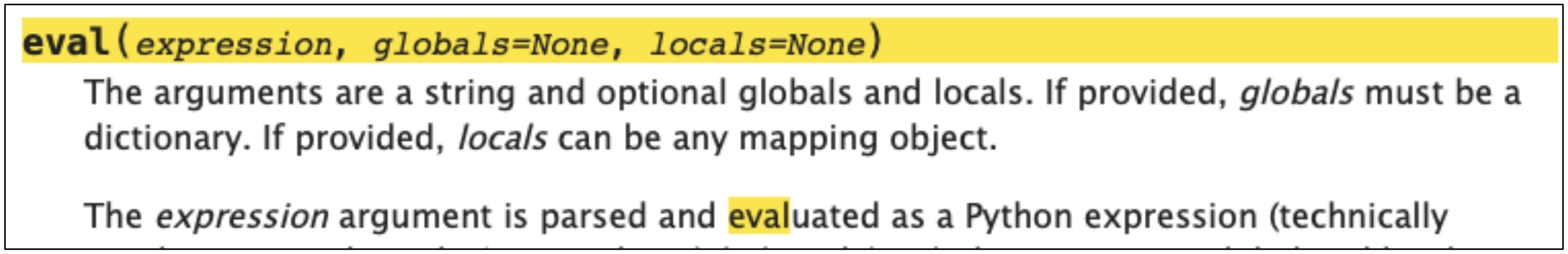
LING 388: Computers and Language

Lecture 9

Today's Topics

- Python:
  - eval()
  - sorting: sorted() and list.sort()
  - key= sort parameter
  - more on lists: stacks, queues and reversed() and .reverse()
- Homework 5

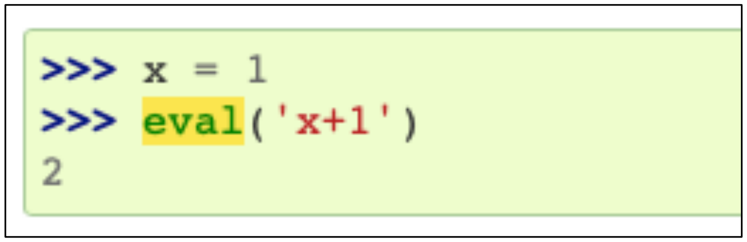
`eval()`



eval(*expression, globals=None, locals=None*)

The arguments are a string and optional globals and locals. If provided, *globals* must be a dictionary. If provided, *locals* can be any mapping object.

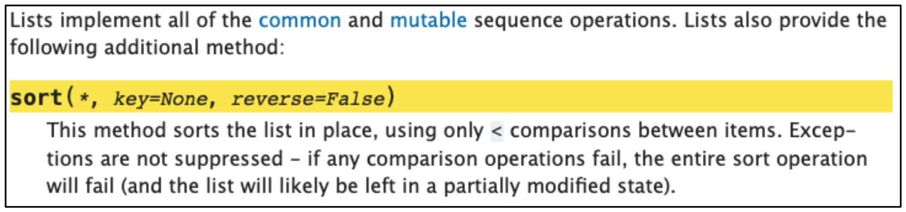
The *expression* argument is parsed and evaluated as a Python expression (technically



```
>>> x = 1
>>> eval('x+1')
2
```

`sorted(list) vs. list.sort()`

Mutable

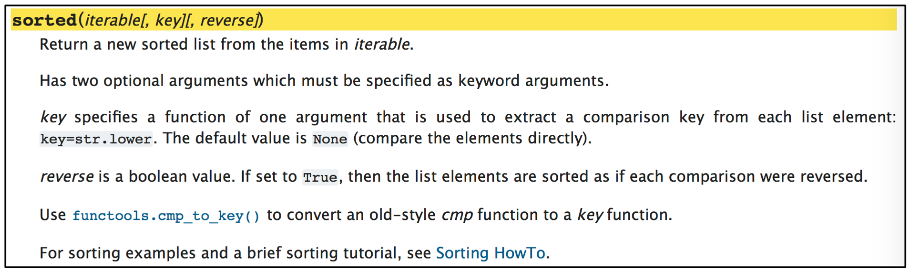


Lists implement all of the common and mutable sequence operations. Lists also provide the following additional method:

`sort(*, key=None, reverse=False)`

This method sorts the list in place, using only `<` comparisons between items. Exceptions are not suppressed – if any comparison operations fail, the entire sort operation will fail (and the list will likely be left in a partially modified state).

Fresh copy (non-mutable)



`sorted(iterable[, key][, reverse])`

Return a new sorted list from the items in *iterable*.

Has two optional arguments which must be specified as keyword arguments.

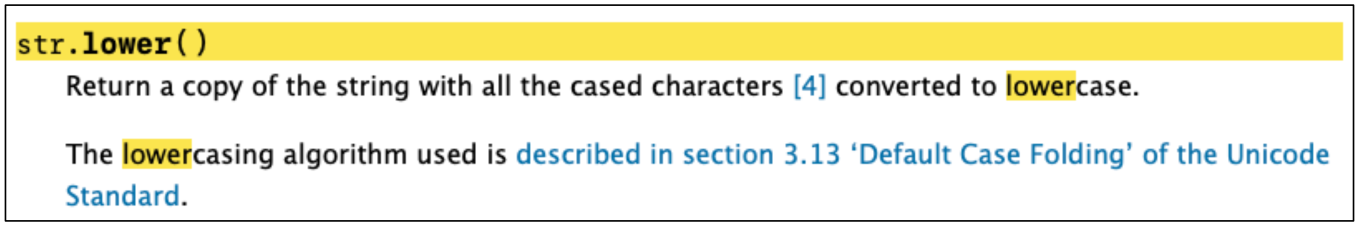
key specifies a function of one argument that is used to extract a comparison key from each list element: `key=str.lower`. The default value is `None` (compare the elements directly).

reverse is a boolean value. If set to `True`, then the list elements are sorted as if each comparison were reversed.

Use `functools.cmp_to_key()` to convert an old-style *cmp* function to a *key* function.

For sorting examples and a brief sorting tutorial, see Sorting HowTo.

- Let's talk about the key parameter!



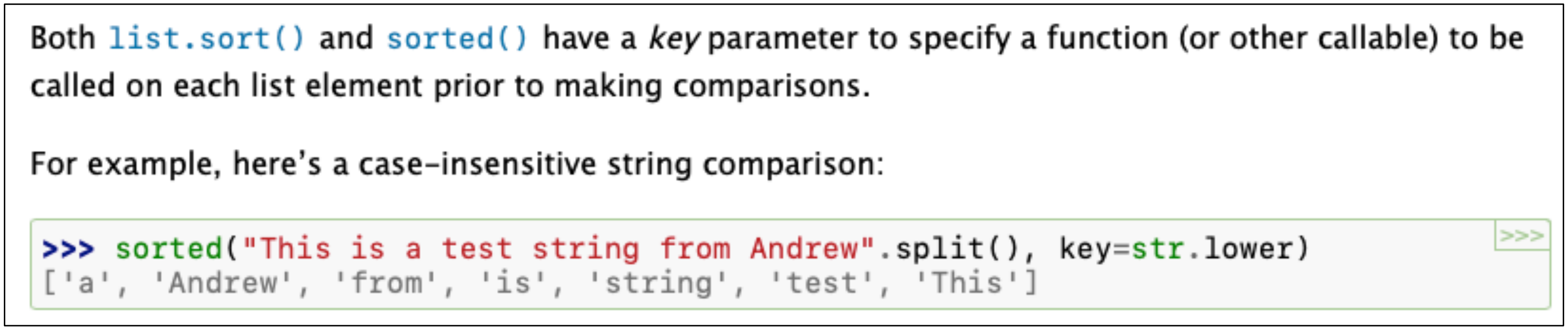
`str.lower()`

Return a copy of the string with all the cased characters [4] converted to lowercase.

The lowercasing algorithm used is described in section 3.13 ‘Default Case Folding’ of the Unicode Standard.

key= sort parameter

https://docs.python.org/3/howto/sorting.html



Both `list.sort()` and `sorted()` have a *key* parameter to specify a function (or other callable) to be called on each list element prior to making comparisons.

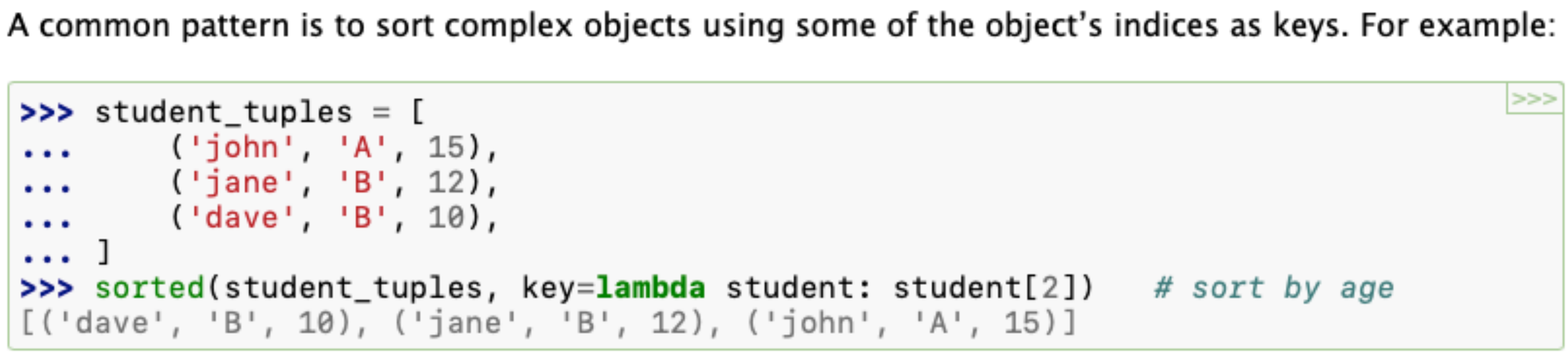
For example, here's a case-insensitive string comparison:

```
>>> sorted("This is a test string from Andrew".split(), key=str.lower)
['a', 'Andrew', 'from', 'is', 'string', 'test', 'This']
```

The value of the *key* parameter should be a function (or other callable) that takes a single argument and returns a key to use for sorting purposes. This technique is fast because the key function is called exactly once for each input record.

key= sort parameter

- Useful for sorting records



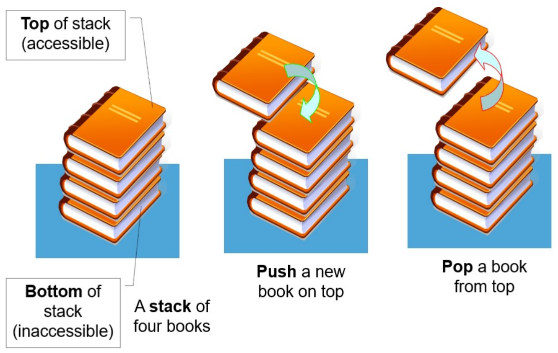
A common pattern is to sort complex objects using some of the object's indices as keys. For example:

```
>>> student_tuples = [
...     ('john', 'A', 15),
...     ('jane', 'B', 12),
...     ('dave', 'B', 10),
... ]
>>> sorted(student_tuples, key=lambda student: student[2])   # sort by age
[('dave', 'B', 10), ('jane', 'B', 12), ('john', 'A', 15)]
```

Python Lists

- Lists as stacks

https://visualgo.net/en/list?slide=4



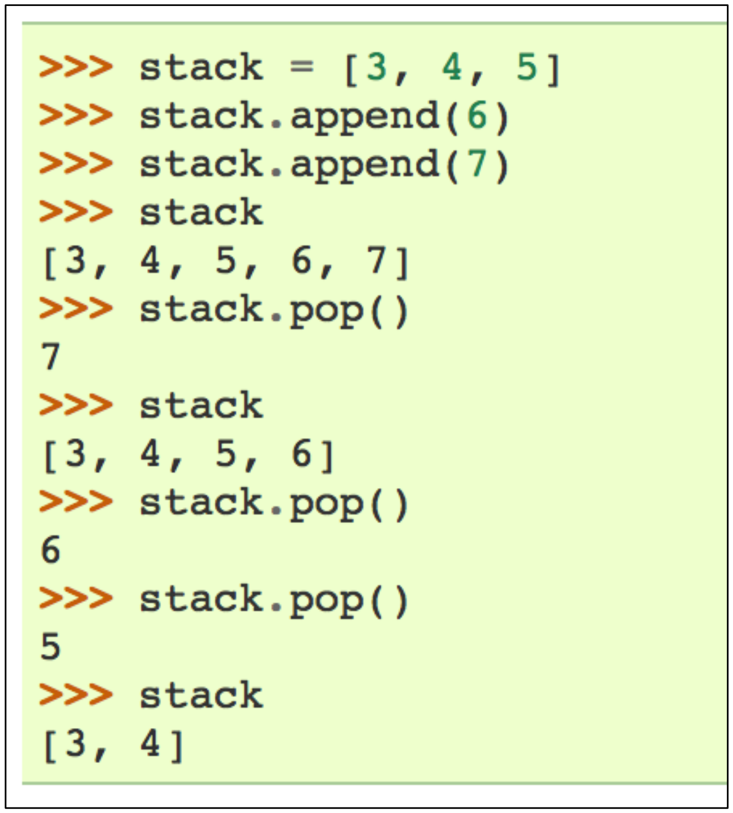
Only the top of the stack is immediately accessible

- Lists as queues

https://www.appcoda.com/ios-concurrency/

Front and rear are accessible

Python List as a Stack


```
>>> stack = [3, 4, 5]
>>> stack.append(6)
>>> stack.append(7)
>>> stack
[3, 4, 5, 6, 7]
>>> stack.pop()
7
>>> stack
[3, 4, 5, 6]
>>> stack.pop()
6
>>> stack.pop()
5
>>> stack
[3, 4]
```

- Note that .pop() removes from the right end and .append() adds to the right end.
- How to save the element of a list popped off the stack? Use a variable, e.g. x:
  - `x = list.pop()`
- Stacking operations are:
  - `list.append()`
  - `list.pop()`

Python List as a Stack

- Suppose we have

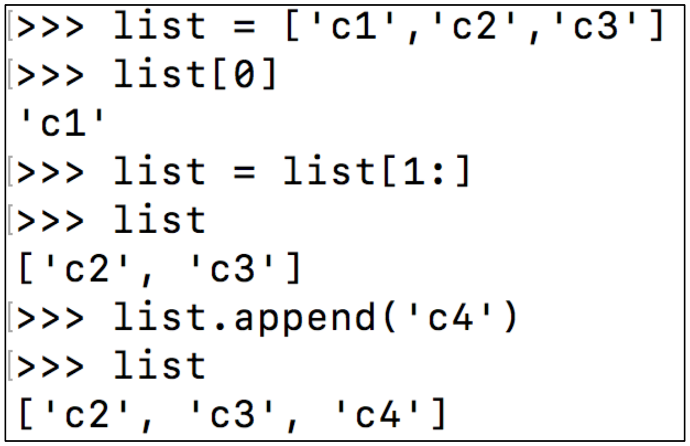
```
list = ['a', 'c', 'b']
```

- How do we flip the order of b and c using stack operations?
- **Answer**:

```
>>> x1 = list.pop()
>>> x2 = list.pop()
>>> list.append(x1)
>>> list.append(x2)
```

Python List as a Queue

EXAMPLE:



```
>>> list = ['c1','c2','c3']
>>> list[0]
'c1'
>>> list = list[1:]
>>> list
['c2', 'c3']
>>> list.append('c4')
>>> list
['c2', 'c3', 'c4']
```

- Method append() to add to right end of the queue
- `list[0]` gives us the head, i.e. left end, of the queue
- Note: `x = list[0]` saves the head of the queue into variable x
- `list = list[1:]` deletes the head of the queue from the queue
- Also can use `del list[0]`

Python List as a Queue

- Queuing operations are:
  - `list.append(newitem)`
  - `del list[0]`
  - `first = list[0]`

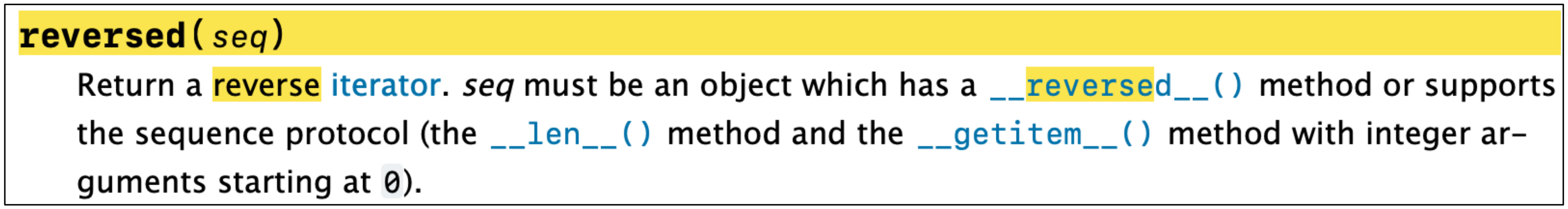
  - `first` = first in queue
- Note:

  `list`, `first` and newitem are variable names; *you can use any name you like*

- Recall stacking operations are:
  - `list.append(newitem)`
  - `top = list.pop()`

  - `top` = top of stack

reversed()



reversed(*seq*)

Return a reverse iterator. *seq* must be an object which has a `__reversed__()` method or supports the sequence protocol (the `__len__()` method and the `__getitem__()` method with integer arguments starting at `0`).

```
>>> reversed(['a','b','c'])
<list_reverseiterator object at 0x10f0fa850>
>>> list(reversed(['a','b','c']))
['c', 'b', 'a']
>>> for x in reversed(['a','b','c']):
...     print(x)
...
c
b
a
```

.reverse()

Similar to `.sort()` vs. `sorted()`:

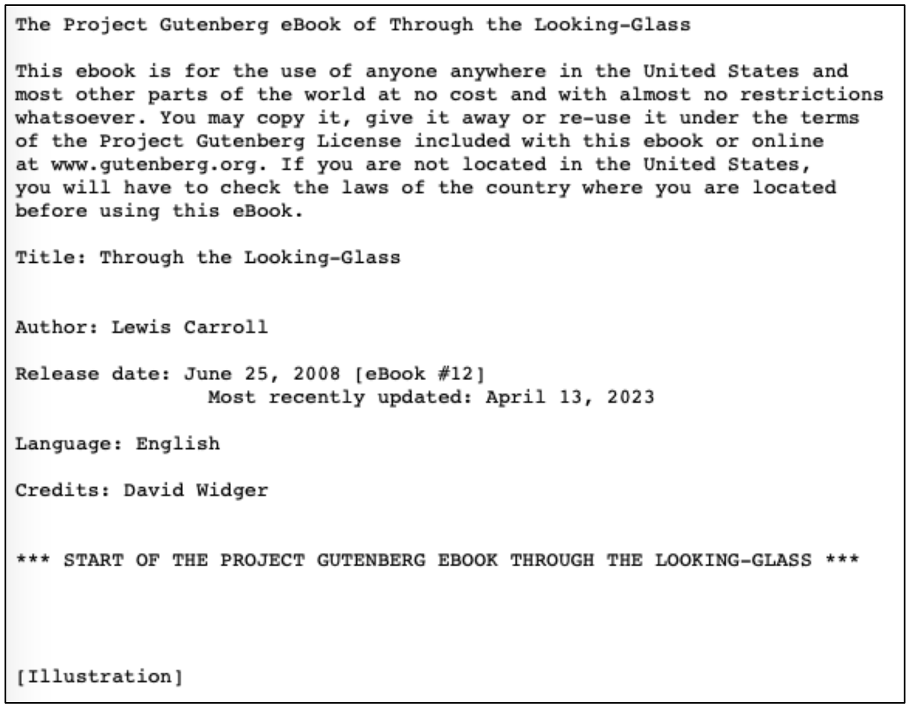
```
>>> ['a','b','c'].reverse()
>>> x = ['a','b','c']
>>> x.reverse()
>>> x
['c', 'b', 'a']
>>>
```

Homework 5

- *Through the Looking-Glass* (1872), by Charles Dodgson, AKA Lewis Carroll is a sequel to *Alice's Adventures in Wonderland* (1865).
- Step1:
  - Go to Project Gutenberg (www.gutenberg.org)
  - Find it and download the Plain Text (UTF-8 format) file
  - You might want to rename it to something memorable, e.g. `looking–glass.txt`
  - Put it in the same directory as where you run your Python

Homework 5

- Step 2:
  - Open the file in a text editor, e.g. NotePad (Windows) or TextEdit (macOS) etc.
  - Delete the lines that are NOT part of the book
  - Save the file as Plain Text



```
The Project Gutenberg eBook of Through the Looking-Glass

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Title: Through the Looking-Glass


Author: Lewis Carroll

Release date: June 25, 2008 [eBook #12]
                Most recently updated: April 13, 2023

Language: English

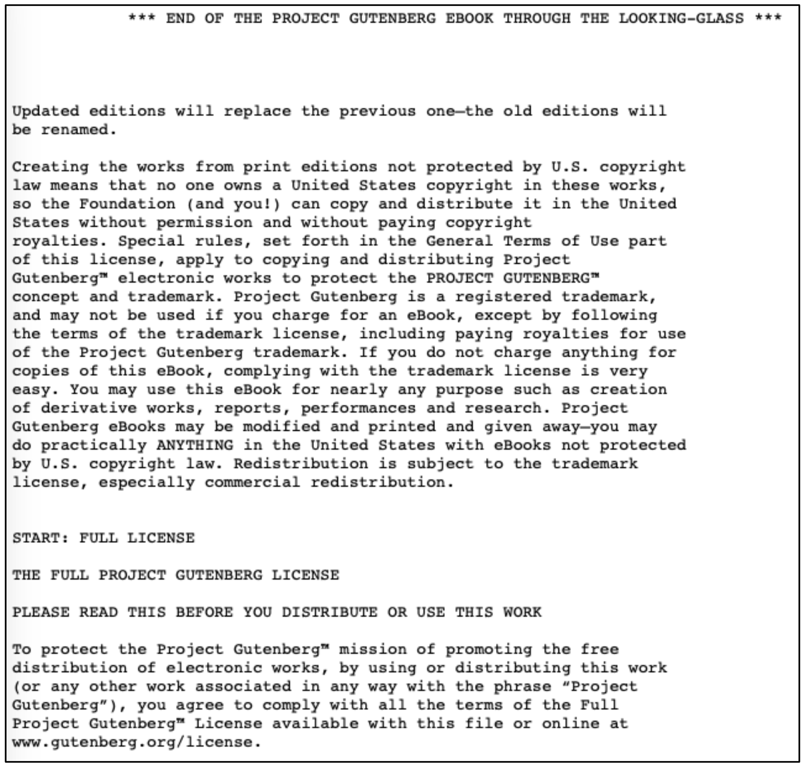
Credits: David Widger


*** START OF THE PROJECT GUTENBERG EBOOK THROUGH THE LOOKING-GLASS ***



[Illustration]
```

Homework 5



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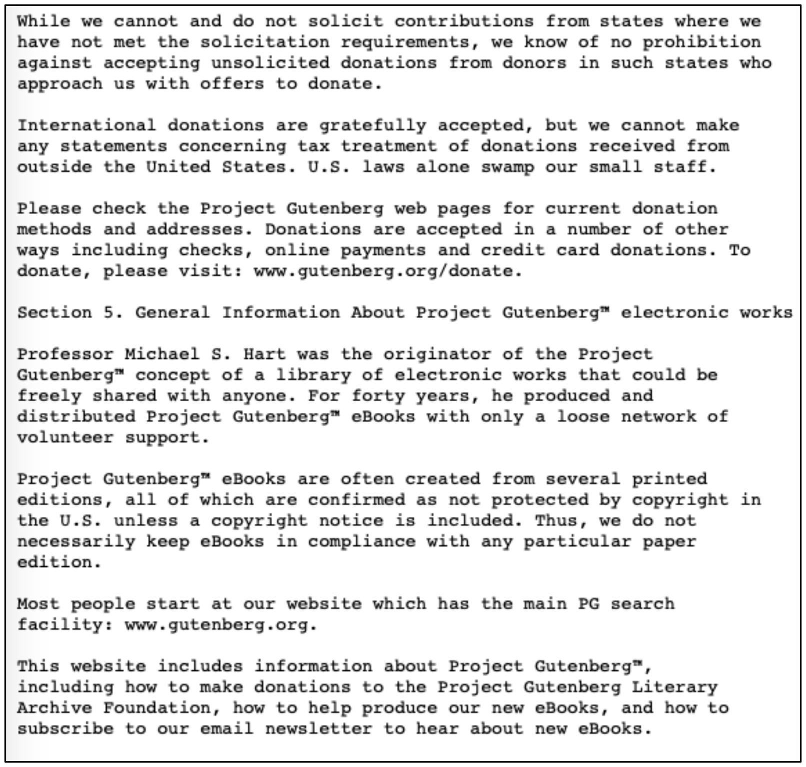
```



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Homework 5

- Step 3: load the file as a String into Python
  - *String stored as a variable* raw *below.*
  - `fh = open(`*`filename`*`)`
  - `raw = fh.read()`
  - what does `len(raw)` report?

Homework 5

- Step 4:
  - nltk has a `nltk.word_tokenize(string)` function to convert an English language String into a list of words.
  - `import nltk`
  - `words = nltk.word_tokenize(raw)`
  - what does `len(words)` report?

Homework 5

- Step 5:
  - Calculate the average number of characters per word of the entire book.
  - compare your answer to that for `carroll-alice.txt`
  - (See Exercise 2 from previous lecture.)

Homework 5

- Step 6:
  - Compute the word length distribution for `looking_glass.txt`.
  - do it both for the book AND the vocabulary of the book
  - see Exercises last lecture and nltk.FreqDist()
  - Compare the graphs with `carroll-alice.txt` (*same author*)
  - Are they similar or different?

Homework 5

- Submit to sandiway@arizona.edu
- SUBJECT: 388 Homework 5 *YOUR NAME*
- One PDF file only
    - include Python terminal and graph screenshots in your answer
- Deadline:
    - midnight Monday
    - we will review the homework on Tuesday