LING 300 - Topics in Linguistics:
Introduction to Programming and Text Processing for Linguists

Week 3

Basic Python 1

Notes from Assignment 2

- Whitespace is invisible and therefore tricky
  e.g. top word = 46401 instances of ‘ ’
  Can run another sed to remove this, or a one-command fix:

  ```
  sed 's/ +/\n/g'
  ```

- Similar, `sed '/^$/d'` works but misses lines with spaces

- `[0-9]` is all digits (doesn’t work to do e.g. `[0-100]`)

Notes from Assignment 2

Quoting!

- Be very careful with quoting! And (), [], etc.
  Each ' requires another ' to close it,
  each " requires another " to close it.

- Syntax highlighting helps a lot.

Notes from Assignment 2

Quoting!

- Double quotes interpret arguments (e.g. `"$1"`) and escapes, Single quotes leave them be.
  https://stackoverflow.com/questions/6697753/difference-between-single-and-double-quotes-in-bash

- Whitespace (spaces, tabs, newlines) is interpreted as a delimiter between arguments!
  (See TLCL Ch. 7)

Notes from Assignment 2

Stream Management!

- Be aware that almost all text filter commands can accept the input file as an argument (e.g. `sed 's/sad/happy/g' input.txt`)

- Careful with > (write) vs. >> (append)

- > and >> end the stream (alternatively can use `tee`)

Notes from Assignment 2

- Better to not generate auxiliary files, e.g.:

```
grep love shakes.txt > lovelines.txt
wc -l lovelines.txt
```

- This works, but adds cruft and obscures things later - if we come back in a day, how exactly did we get `lovelines.txt`? Once it's created we lose the "story," if you will.
  Thus piping!

```
grep love shakes.txt | wc -l
```

Notes from Assignment 2

- Don’t call programs like nano / less from a script:
  it’ll stop execution of the script until you close that instance.
  nano/less are not text filters like grep/sed/tr/sort/etc.
  - They can *receive* input from stdin,
    they just don’t pass it through to stdout

- This and all further assignments should be runnable!
  (don’t write the answer, write the code that generates it)

Notes from Assignment 2

"Solutions" are posted on the course website

No claim to perfection, there is no perfect "right answer"!

Variable Types define different sorts of data

Numeric	*Sequence*	*Text*	*Truthy*
integer	**list**	**str**ing	**bool**ean
`42`	`['y', 2, False]`	`'hello!'`	`True, False`
float	**tuple**	*None*	(next week)
`42.0`	`(6, 'b', 19.7)`	`None`	*Set* set
			Mapping dict{}

Statements are units of code that do something

Assignment (=)

```
year = 2020 # integer


mssg = 'hooray!' # string


e = 2.71828 # float
```

Statements are units of code that do something

Equality Testing (==, !=, >, <, >=, <=)

```
>>> year != 2016
True

>>> mssg == 'howdy!'
False

>>> e <= 3
True
```

Statements are units of code that do something

Arithmetic (`+`, `-`, `*`, `/`, `**`)

```
>>> year * 3
6060

>>> 'hip hip ' + mssg
'hip hip hooray!'

>>> e / 2
1.35914
```

Statements are units of code that do something

Incrementing (arithmetic plus assignment)

```
>>> year += 18
>>> year
2038

>>> mssg *= 5
>>> mssg
'hooray!hooray!hooray!hooray!hooray!'
```

Functions take input, do some computation, produce output

Important Built-ins 1

```
print(x) # print representation of x

help(x) # detailed help on x

type(x) # return type of x

dir(x) # list methods and attributes of x
(methods are functions bound to objects)
(attributes are variables bound to objects)
```

Functions take input, do some computation, produce output

Important Built-ins 2

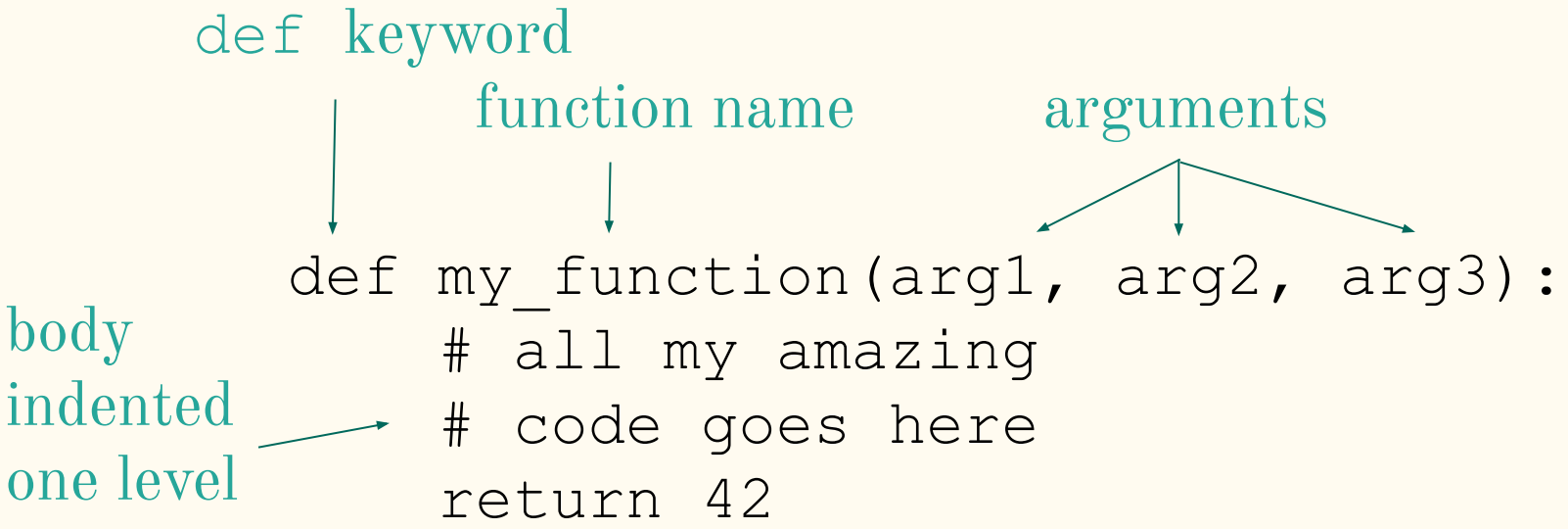
```
sorted(x) # return sorted version of x

min(x), max(x) # mathematical operations
sum(x)         # on sequences

int(x), float(x), bool(x) # 'casting', a.k.a.
list(x), tuple(x), str(x) # type conversion
```

Functions take input, do some computation, produce output

Defining New Functions



Control Flow organizes the order code executes

Conditionals - **if**, **elif**, **else** - enter section if condition is met

```
>>> x = int(input("Please enter an integer: "))
Please enter an integer: 42
>>> if x < 0:
...     print('Negative!')
... elif x == 0:
...     print('Zero!')
... else:
...     print('Positive!')
Positive!
```

Control Flow organizes the order code executes

Loops - **for ... in** - loop over items of a sequence

```
>>> # Measure some strings:
... words = ['cat', 'window', 'defenestrate']
>>> for w in words:
...     print(w, len(w))
...
cat 3
window 6
defenestrate 12
```

Control Flow organizes the order code executes

Loops - **for ... in** - loop over numbers by using **range**

```
>>> for i in range(5):
...     print(i)
…
0
1
2
3
4
```

Control Flow organizes the order code executes

Loops - **for ... in** - for reading lines in a file with **open**

```
>>> for line in open('shakes.txt'):
...     print(line)
1609

THE SONNETS

by William Shakespeare
```

Control Flow organizes the order code executes

Loops - **while** - loop until condition is met

```
>>> # Fibonacci: sum of two elements defines the next
... a, b = 0, 1
>>> while a < 10:
...     print(a, end=' ')
...     a, b = b, a+b
... print('')
...
0 1 1 2 3 5 8
```

Whitespace is obligatory for demarcating code blocks

The body of

function definitions

and

control flow elements

must be indented

by one level

Recommended to be

--\t-- one tab

. . . . or four spaces

```
def run_tests(func, tests):¤¬
····print('\tRunning {} tests on the `{}` function...'.
····errors = 0¤¬
····for val, ret in tests:¤¬
····|···try:¤¬
····|···|···if type(val) == tuple:¤¬
····|···|···|···assert func(*val) == ret¤¬
····|···|···else:¤¬
····|···|···|···assert func(val) == ret¤¬
····|···except AssertionError:¤¬
····|···|···print('\t\terror for input {}'.format(val))
····|···|···errors += 1¤¬
····if errors == 0:¤¬
····|···print('\tAll tests passed!')¤¬
```

Whitespace is obligatory for demarcating code blocks

- Most text editors deal with whitespace semi-intelligently

- E.g., emacs sees that a file ends in .py,
  and interprets the text as python code (syntax highlighting)
  and tries to make the whitespace consistent

- Pressing the [Tab] key will jump to the logical indent.
  But be careful e.g. closing control flow statements,
  try pressing [Tab] multiple times.

String and List Indexing

```
>>> job_title = 'LINGUIST'
```

Char (or List Item)	L	I	N	G	U	I	S	T
Index	0	1	2	3	4	5	6	7
Reverse Index	-8	-7	-6	-5	-4	-3	-2	-1

Syntax:
sequence[start:end]

```
>>> job_title[3:-1]
'GUIS'   # inclusive of start, not inclusive of end

>>> job_title[:5]
'LINGU'    # can leave off start or end
```

String Methods are functions associated with string objects

strip, rstrip, lstrip

```
>>> s = '  my sTrInGggg!\n'
>>> s = s.strip()
>>> s
'my sTrInGggg!'
>>> s = s.strip('!').strip('g')
>>> s
'my sTrInG'
```

upper, lower

```
>>> s = s.lower()
>>> s
'my string'
```

find

```
>>> s.find('str')
3
```

replace

```
>>> s.replace('my','your')
'your string'
```

startswith, endswith

```
>>> s.startswith('balloon')
False
```

List Methods are functions associated with list objects

append

```
>>> x = [1, 4, 9, 16]
>>> x.append(9)
>>> x
[1, 4, 9, 16, 9]
```

index

```
>>> x.index(4)
1
```

remove deletes the first occurrence

```
>>> x.remove(9)
>>> x
[1, 4, 16, 9]
```

pop removes and returns the last element

```
>>> x.pop()
9
>>> x
[1, 4, 16]
```

Strings and Lists

Strings are like sequences of characters

Key difference: lists are mutable — can be changed

```
my_list[3] = 'yes'
```

strings are immutable — cannot be changed

```
my_str[3] = 'n'
```

String methods to convert to/from lists

split

```
>>> s = 'my string'
>>> s.split()
['my', 'string']
```

join

```
>>> ' '.join(['your','string'])
'your string'
```

Assignment Walkthrough

Answers are short but can be tricky!

Think *Decomposition*

how can I break this into smaller, doable sub-problems?

Tests provided after each function! (non-exhaustive)

Assignment Walkthrough

You **must** do

```
module load python/anaconda3.6
```

every time you login to Quest

Run the assignment with:

```
python assignment.py
```

The assignment **must** run when you are done!