Welcome to Python for Data Analysis at SEI

- Instructor: John Strickler (jstrickler@gmail.com)
- Class time: 9:00 AM - 4:00 PM
- Lunch 12 Noon – 1 PM
- IDE: **PyCharm Community Edition** *Or your favorite*

  Grab a course manual (if wanted) and a make name tent

  Course manual soft copy hosted online (see whiteboard)
- *WiFi code: HF8J7THB*
- *Materials: http://certcc.org hhsuser healthy1s*
  - *WINDOWS: Unzip py3data.zip with Desktop as target*
  - *MAC/LINUX: Extract py3data.tgz to home folder (or Desktop)*

What Can Python Do?

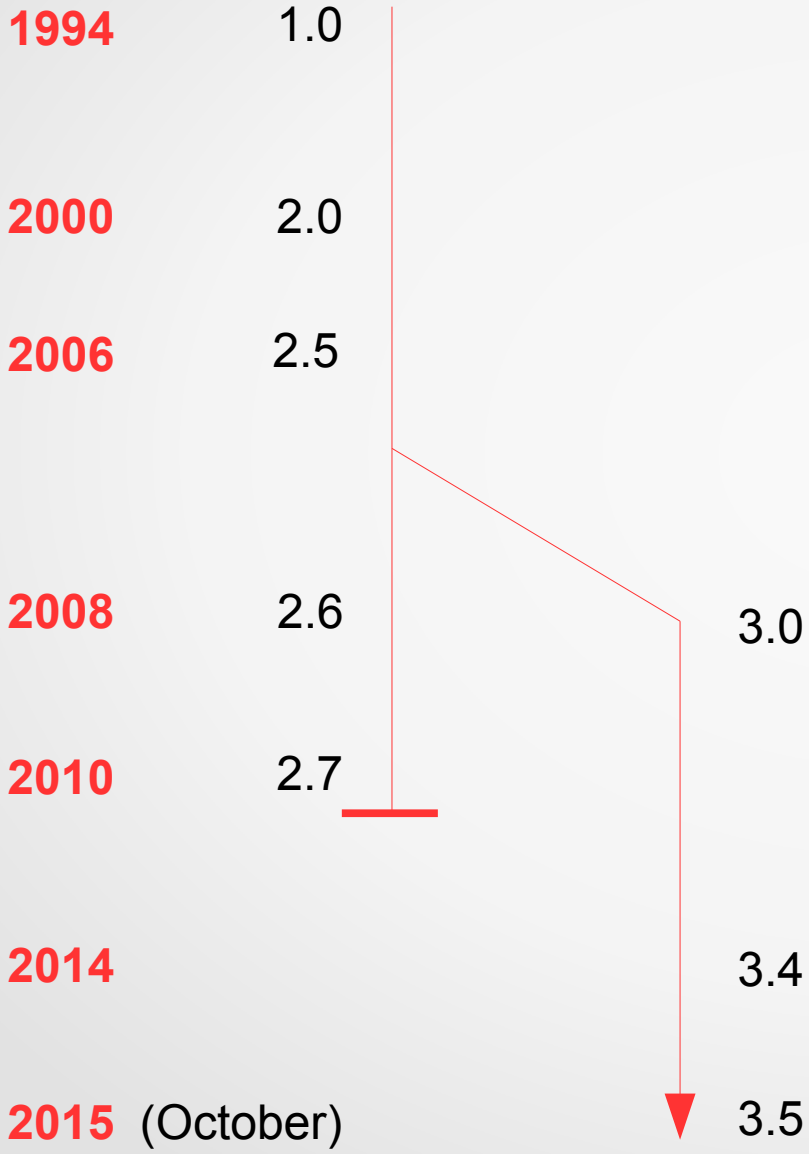
- Web apps
- Web services (REST, SOAP)
- Data mining/web scraping
- Data science
- End-user GUI apps
- System Administration (Windows, Mac, Linux)
- Scientific/Engineering analysis
- Data visualization
- Cloud apps

Advantages of Python

- Readable
- Multi-paradigm
- Modular
- Exceptions
- Standard library
- Extensible and embeddable

Disadvantages of Python

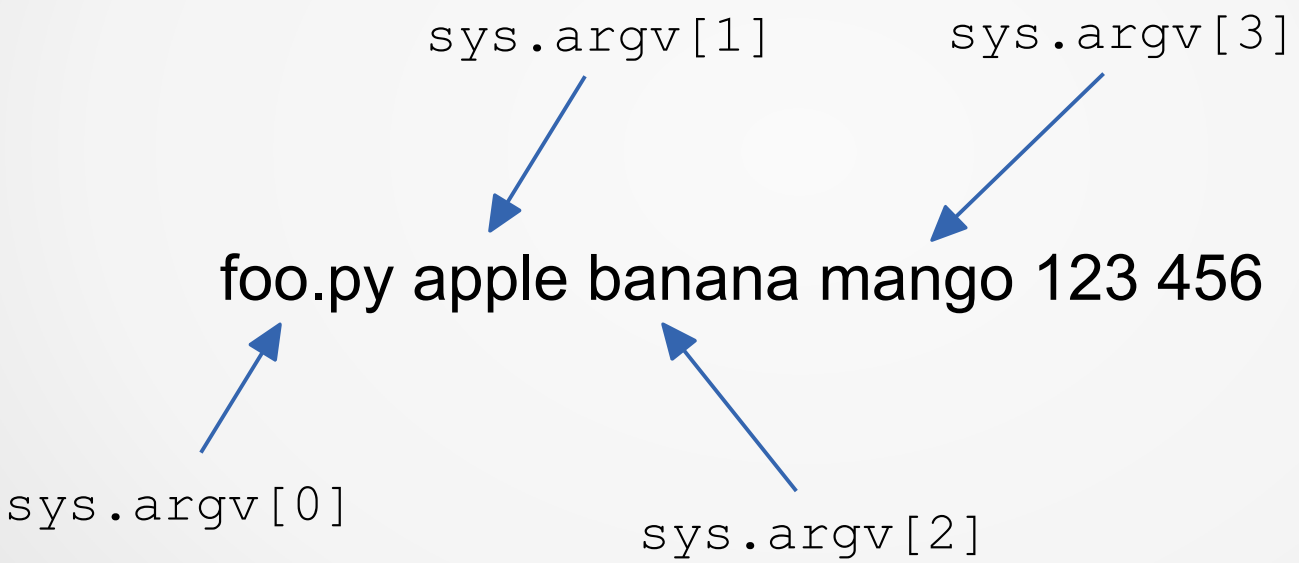
Python Evolution



String literals

- Single-delimited
  - 'spam\n' "spam\n"
- Triple-delimited
  - '''spam\n''' """spam\n"""
- Raw
  - r'spam\n'

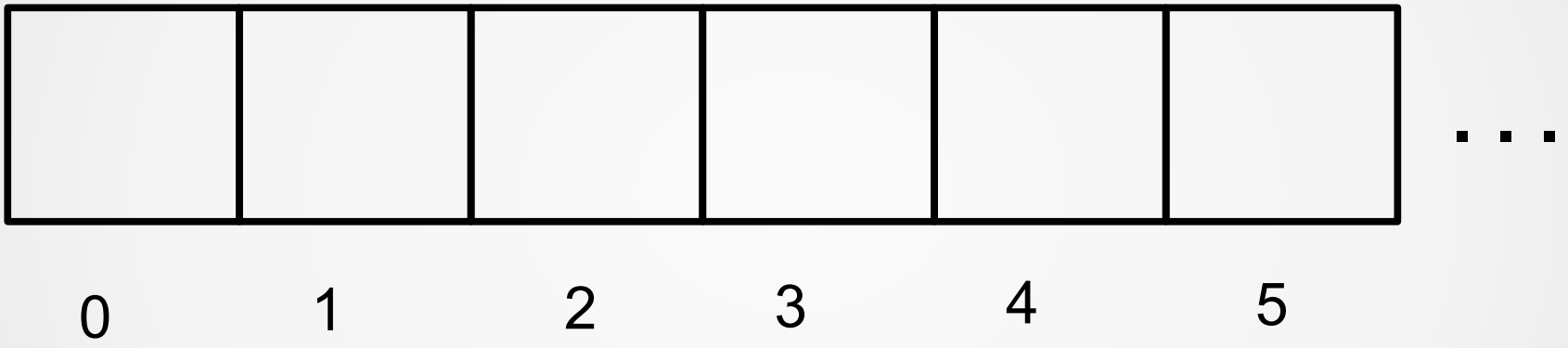
Command Line Parameters



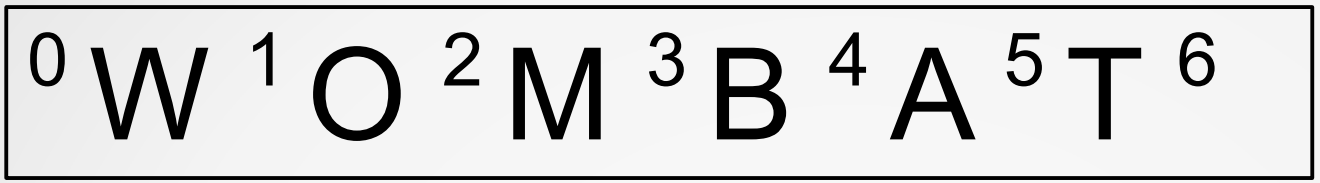
Indenting blocks

```
Block statement:
    Statement
    Statement
    Nested Block Statement:
        Statement
        Statement
    Statement
    Statement

Statement
```

Sequences



Slices




```
s = "WOMBAT"

s[0:3]        first 3 characters  "WOM"
s[:3]         same, using default start of 0 "WOM"
s[1:4]        s[1] through s[3] "OMB"
s[3:6]        s[3] through end  "BAT"
s[3:len(s)]   s[3] through end  "BAT"
s[3:]         s[3] through end, using default end "BAT"
```

Lists vs Tuples

Lists

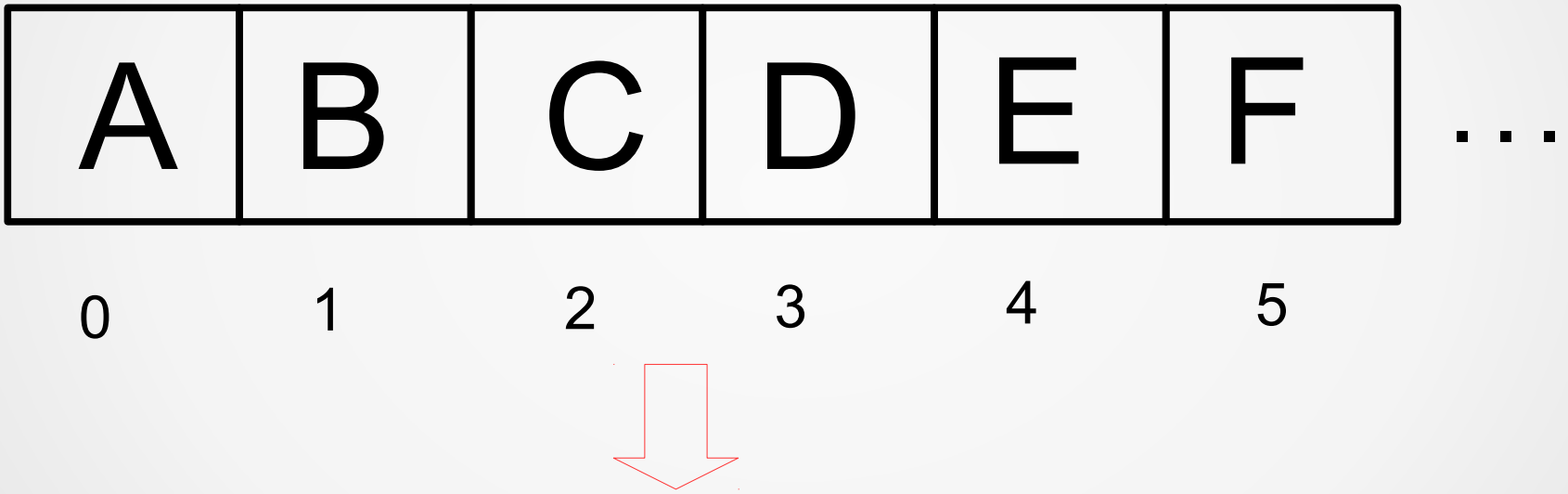
- Dynamic Sequence
- Mutable/unhashable
- Order doesn't matter
- Designed for looping
- Think "ARRAY"

Tuples

- Collection of related fields
- Immutable/hashable
- Order matters
- Designed for unpacking
- Think "STRUCT" or "RECORD"

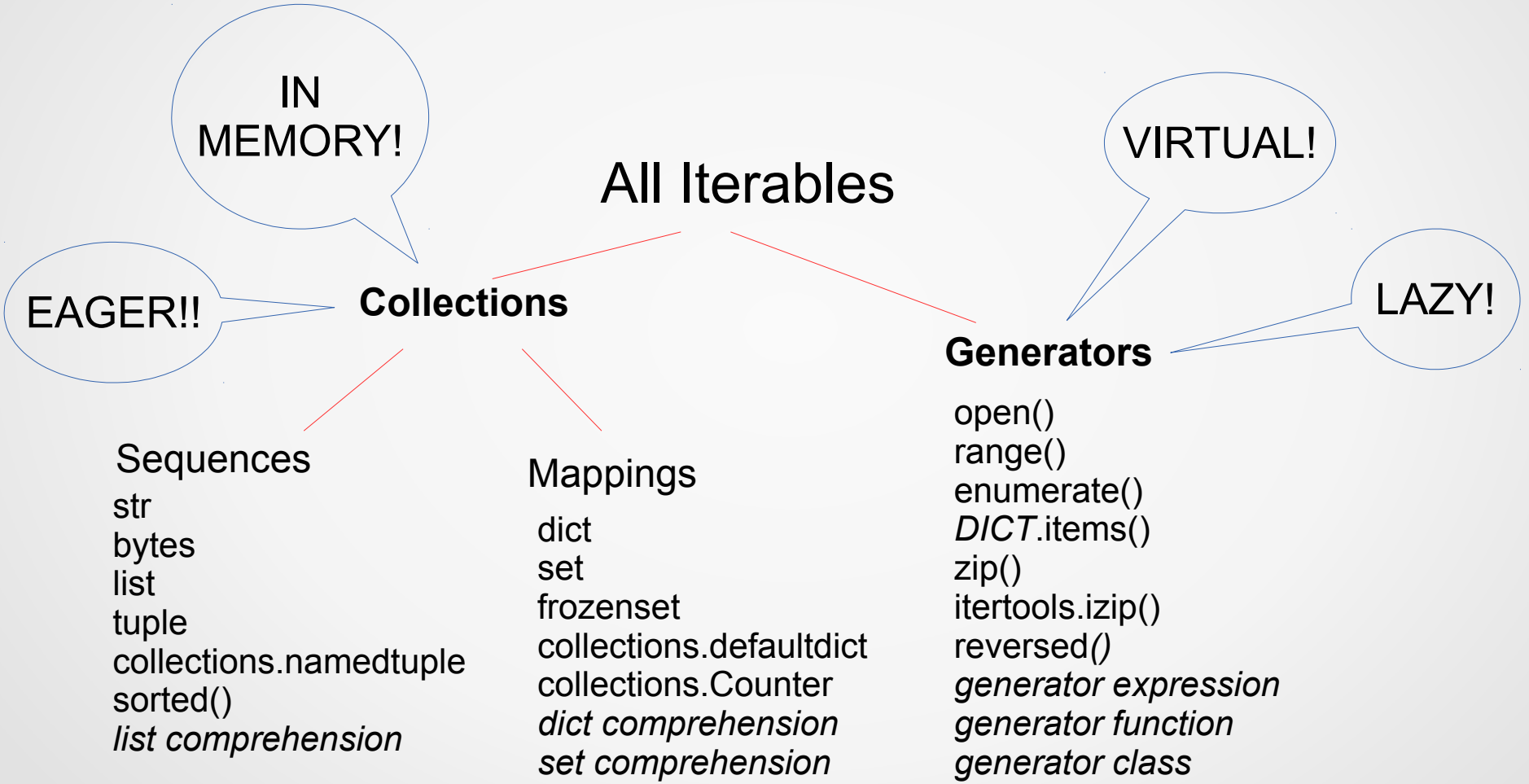
Myth #1: tuples are just read-only lists
Myth #2: tuples are faster than lists
Myth #3: tuples use less memory than lists (*slightly* true)

enumerate()

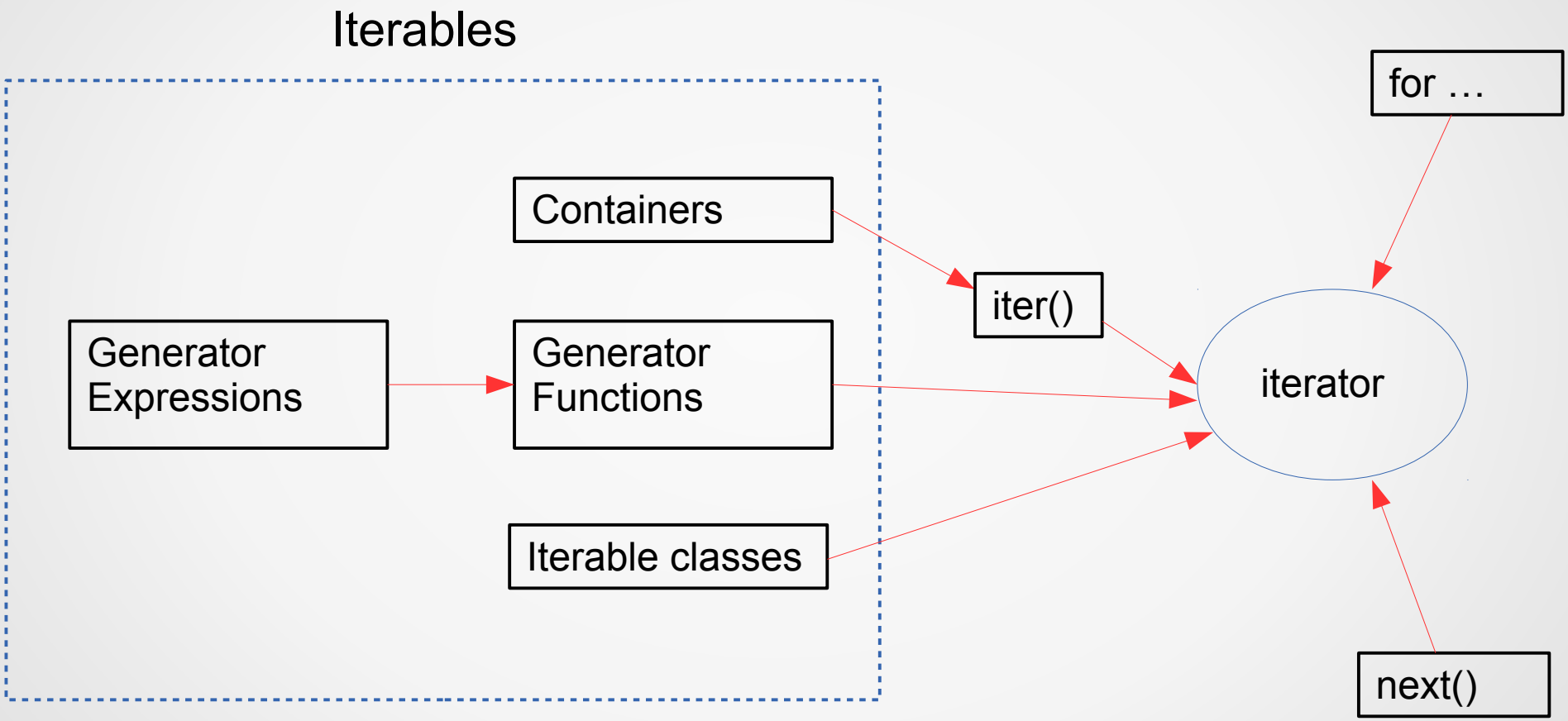


(0, A), (1, B), (2, C), (3, D), (4, E), (5, F)...

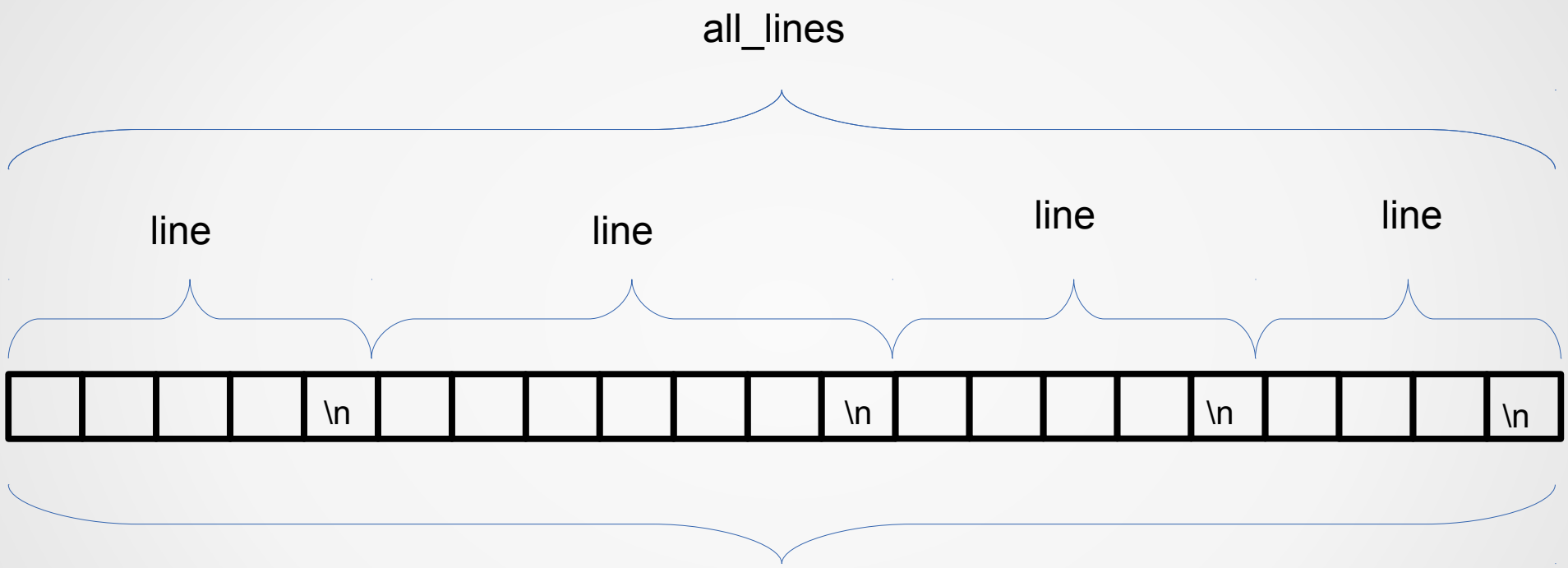
Iterables


All Iterables
IN MEMORY!
EAGER!!
Collections
VIRTUAL!
LAZY!
Generators
Sequences
str
bytes
list
tuple
collections.namedtuple
sorted()
list comprehension
Mappings
dict
set
frozenset
collections.defaultdict
collections.Counter
dict comprehension
set comprehension
open()
range()
enumerate()
DICT.items()
zip()
itertools.izip()
reversed()
generator expression
generator function
generator class

Iterables and iterators



Reading text files



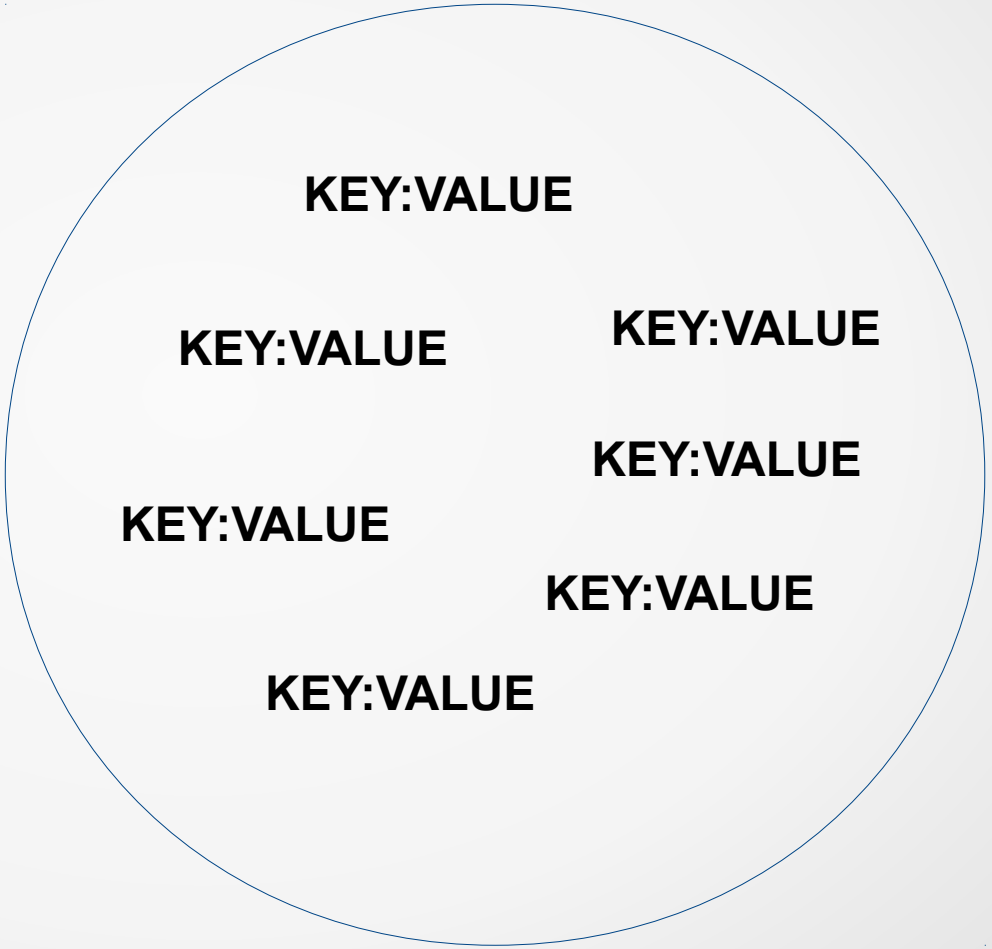

```
for line in FILE:
    pass

contents = FILE.read()

all_lines = FILE.readlines()
```

What do these words mean?

- formication
- ramiferous

Dictionary

- Key/value pairs
- Not ordered
- Keys are unique
- Use .items() to loop through k/v pairs



dict.items()

A	B	C	D	E	F
100	200	300	400	500	600

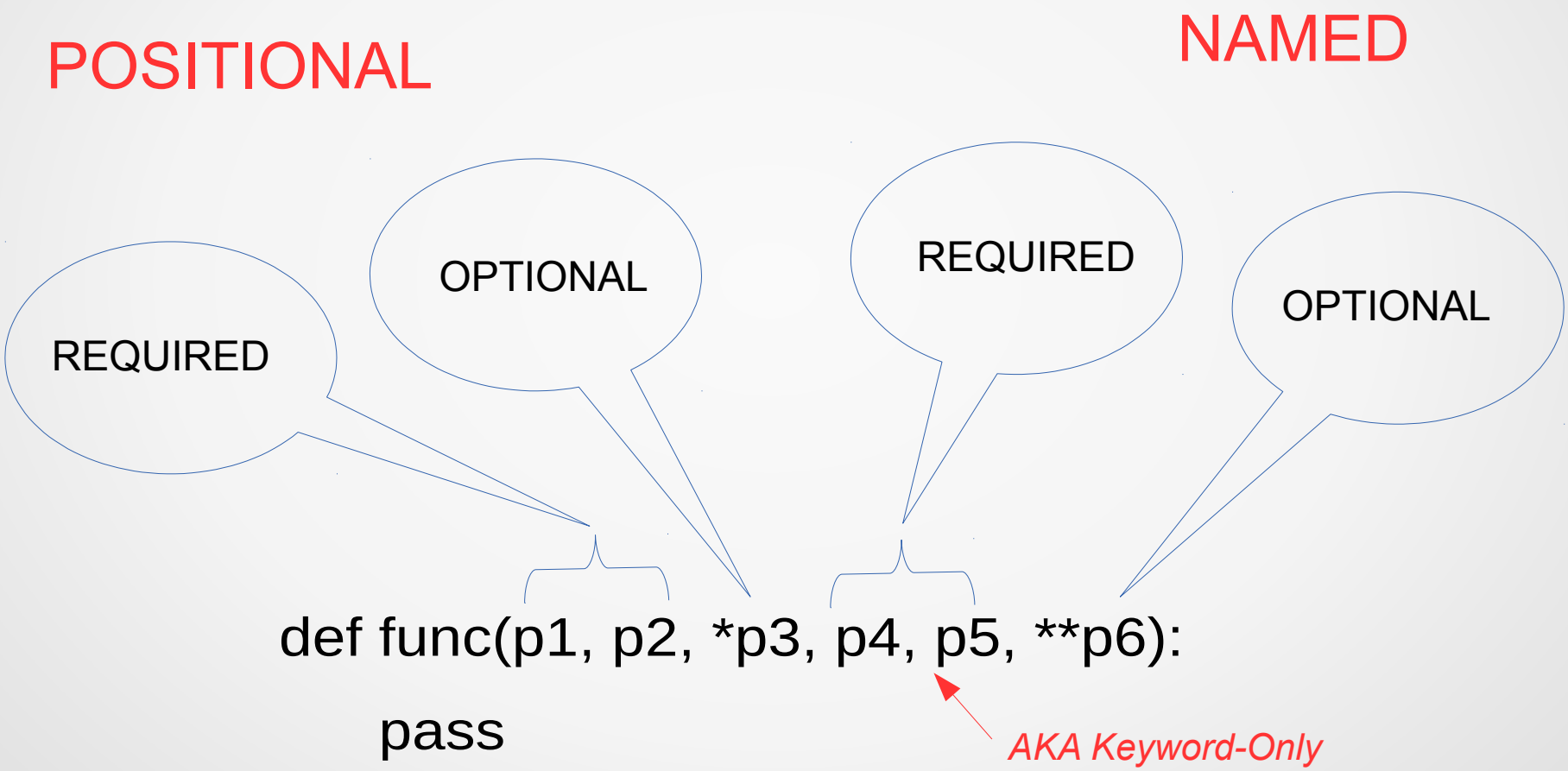
keys

. . .

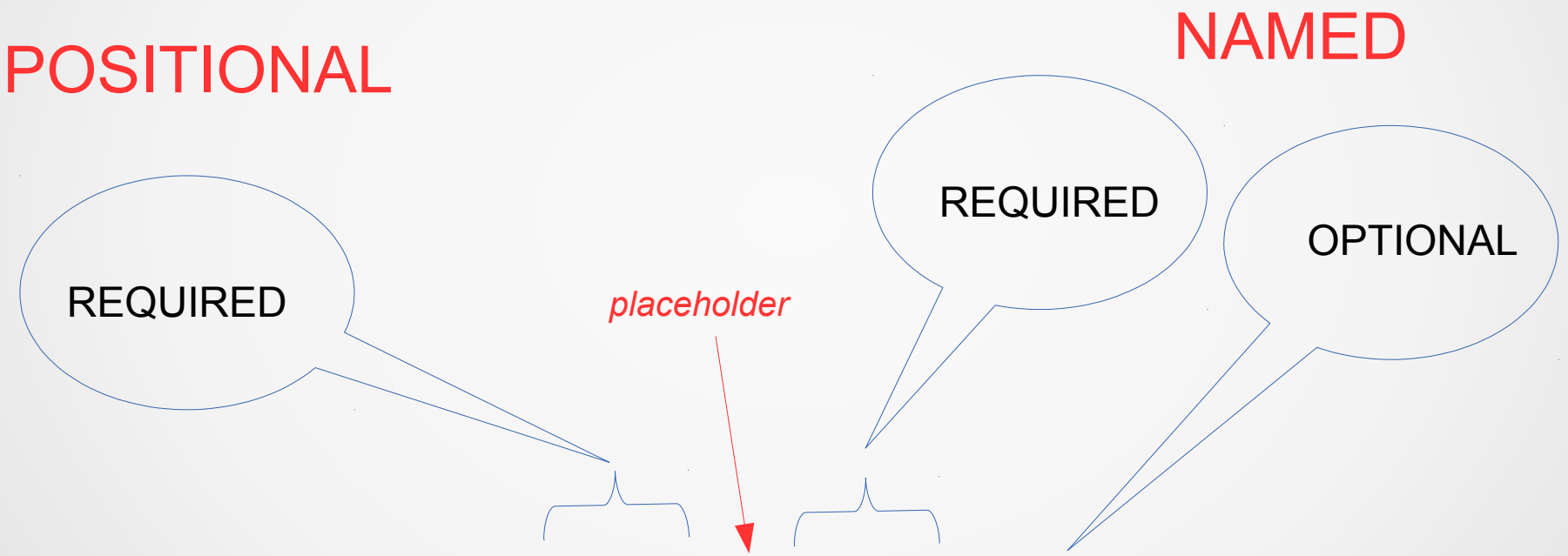
values

(A, 100), (B, 200), (C, 300), (D, 400), (E, 500), (F, 600) ...

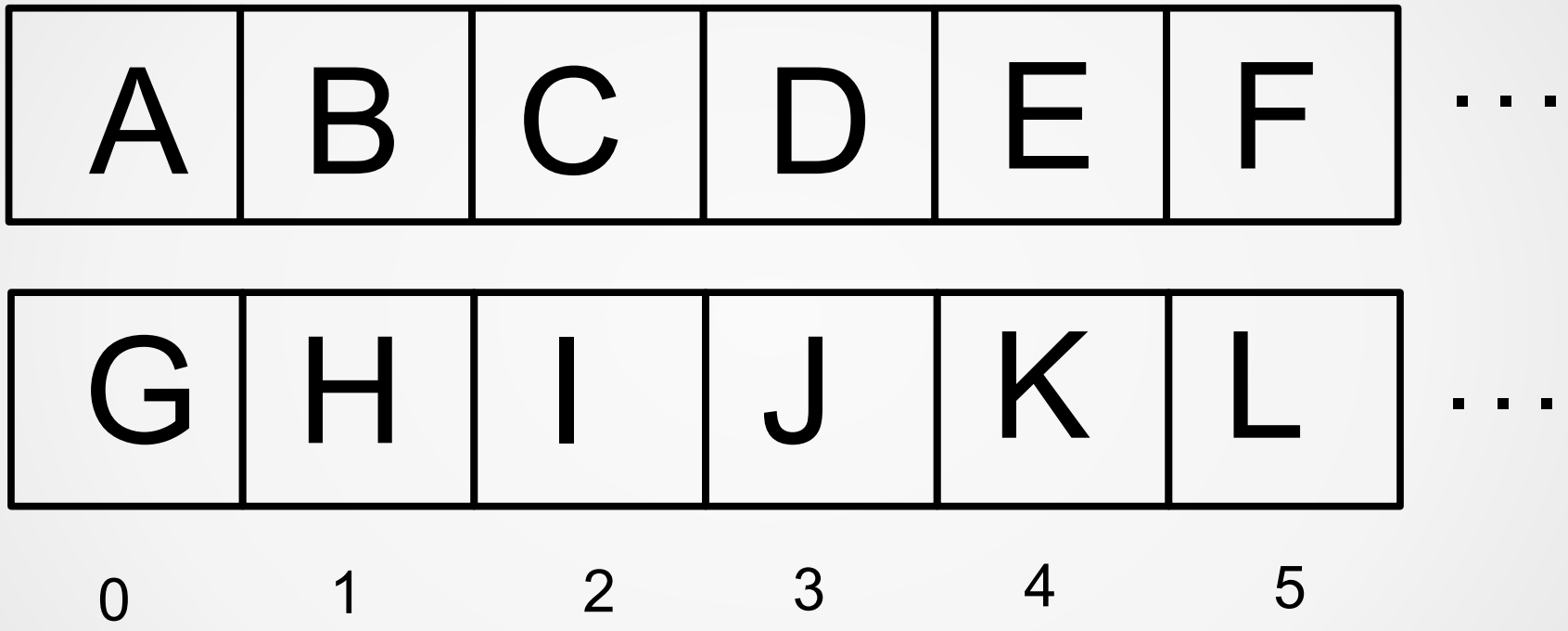
Function parameters



Function parameters, cont'd

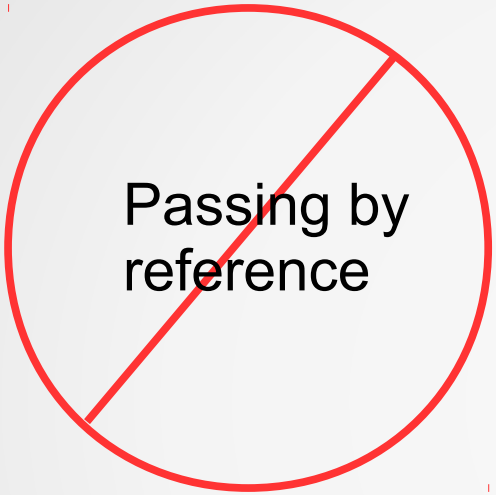


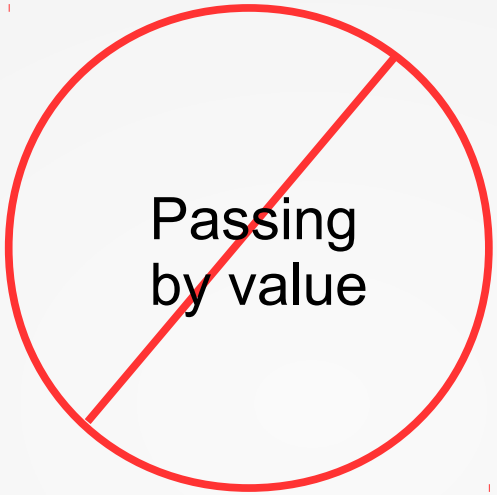
zip()



(A, G), (B,H), (C, I), (D, J), (E, K), (F, L)...

Parameter passing





Passing by
sharing

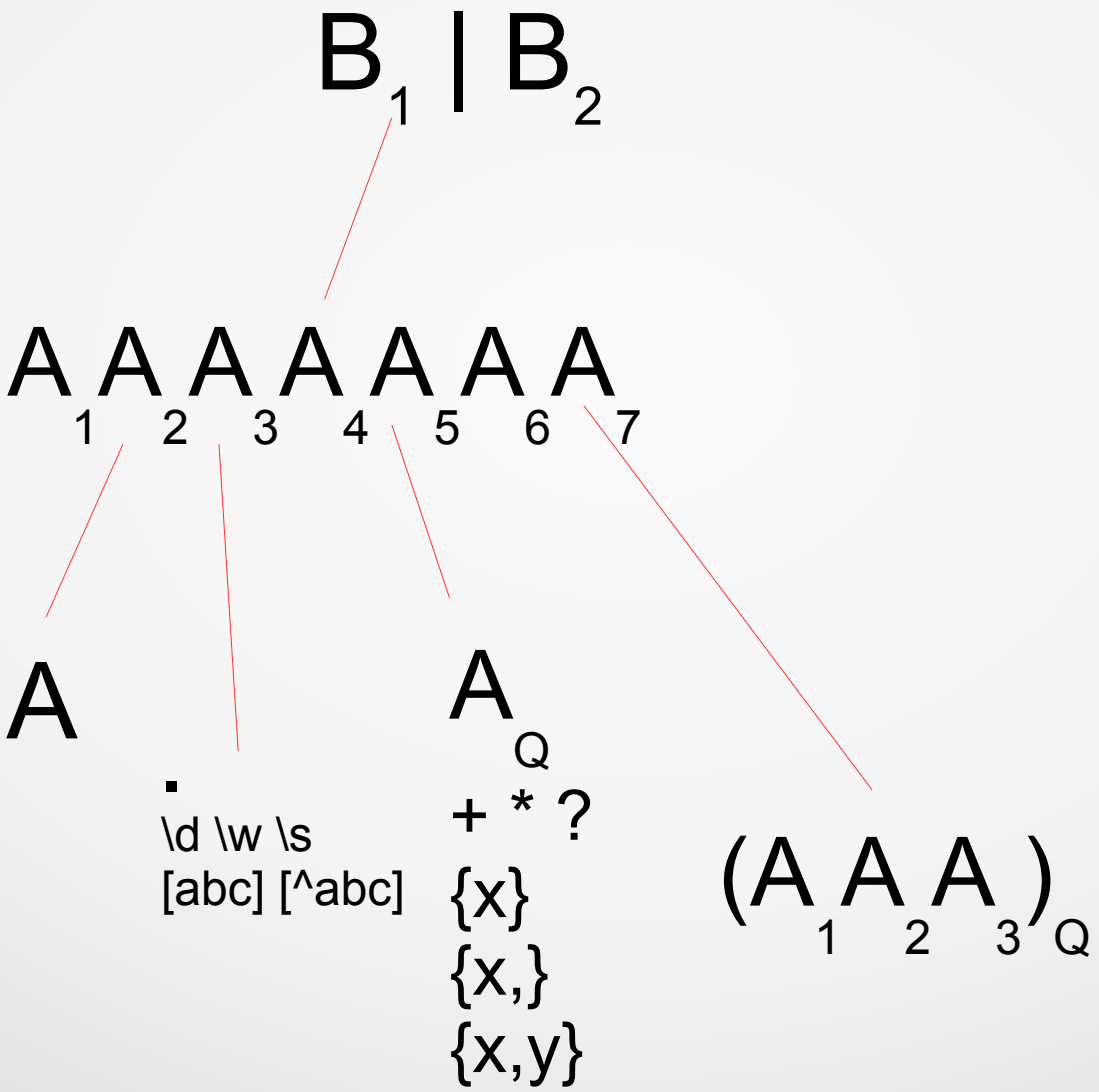
- Read-only reference is passed
- Mutables may be changed via reference
- Immutables may not be changed

```
def spam(x, y):
    x = 5
    y.append('ham')

foo = 17
bar = ['toast', 'jam']

spam(foo, bar)
```

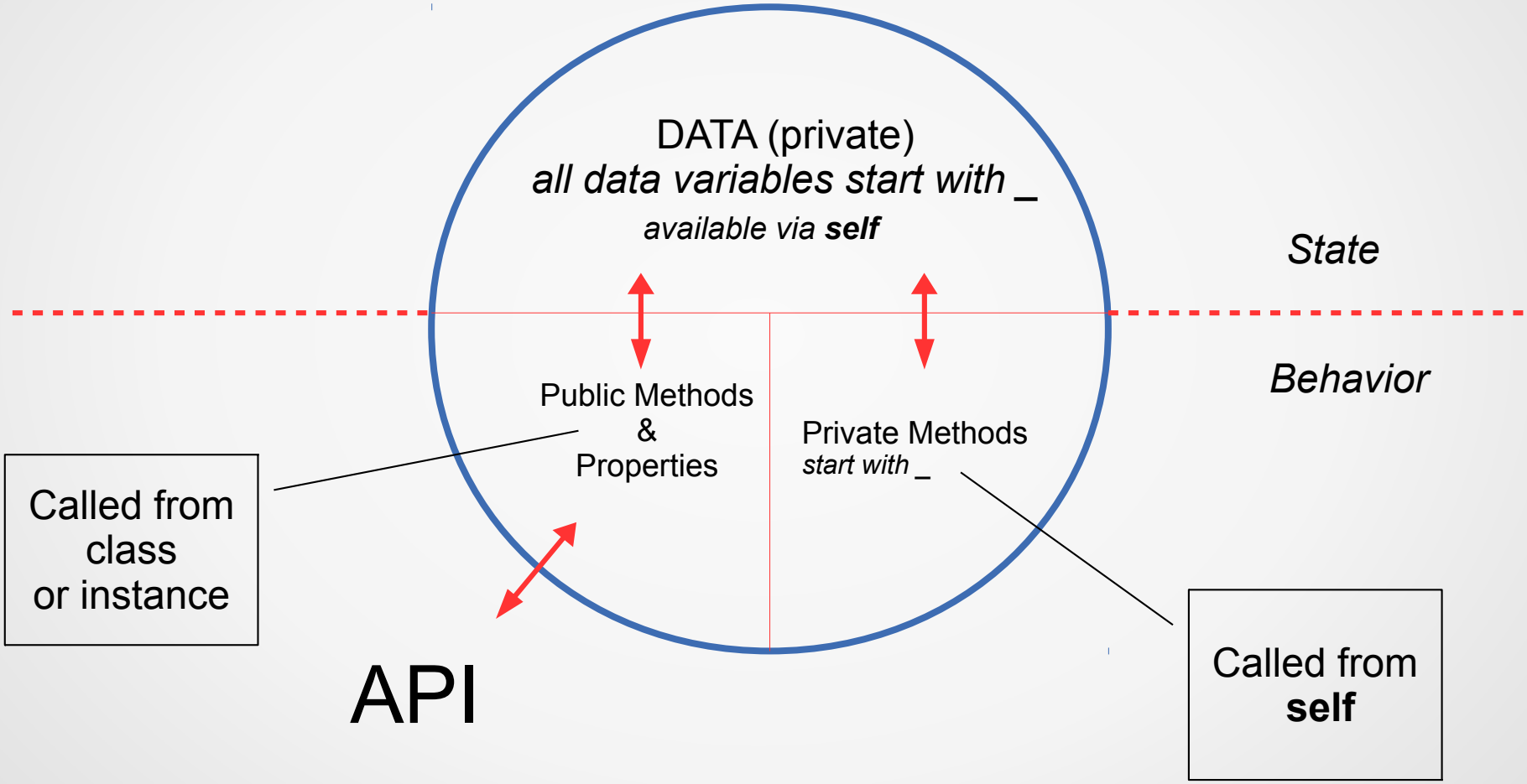
Regular expression tasks

- Search (is the match in the text?)
- Retrieve (get the matching text)
- Replace (substitute new text for match)
- Split (get what *didn't* match)

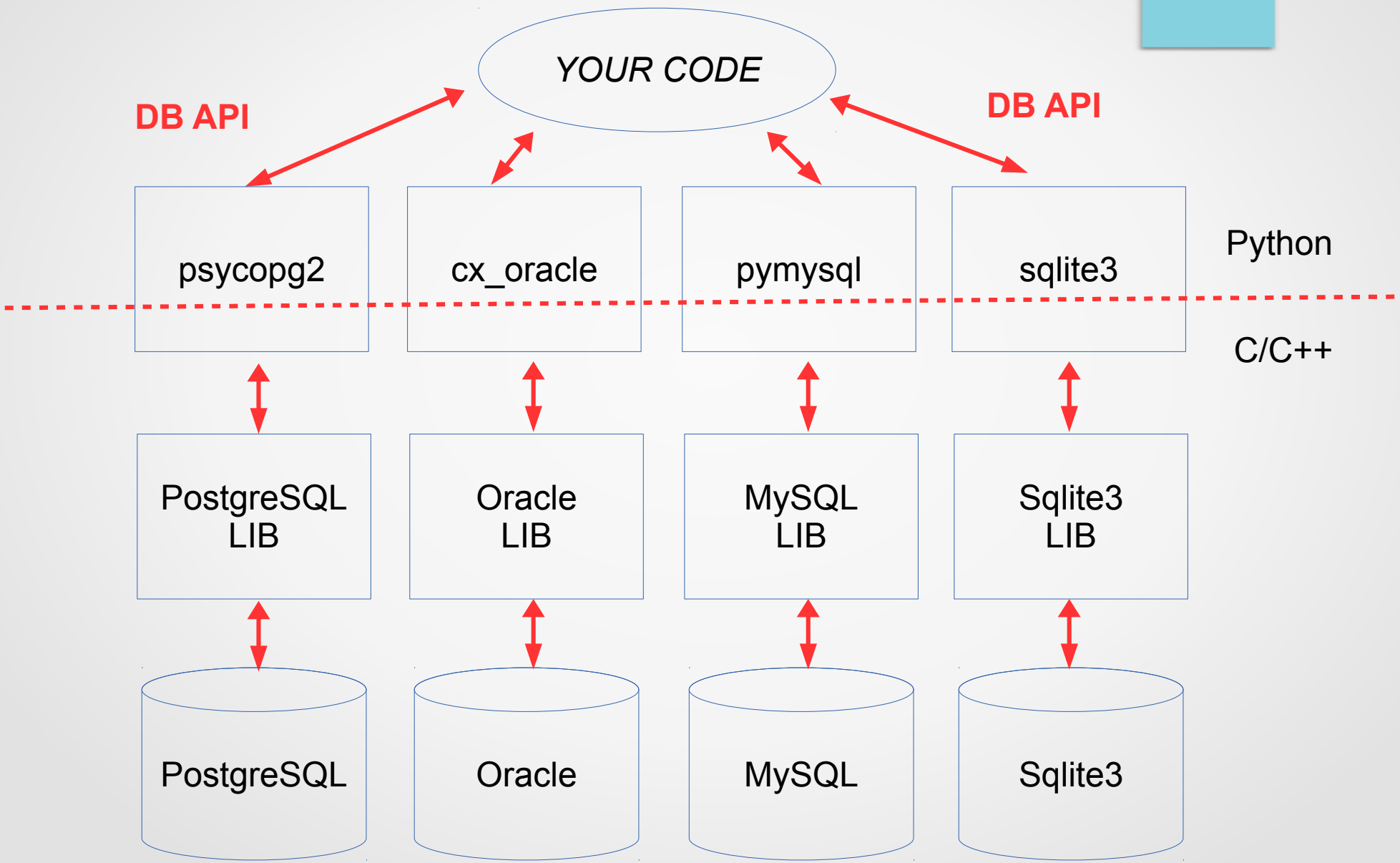
Regular Expressions



A Python Class



Python DB architecture



DB API

- conn = *package*.connect(*server, db, user, password, etc.*)
- cursor = conn.cursor()
- num_lines = cursor.execute(*query*)
- num_lines = cursor.execute(*query-with-placeholders, param-iterable)*)
- all_rows = cursor.fetchall()
- some_rows = cursor.fetchmany(n)
- one_row = cursor.fetchone()
- conn.commit()
- conn.rollback()

ElementTree

presidents.xml

```
<presidents>
    <president term=1>
        <lastname>Washington</lastname>
        <firstname>George</firstname>
    </president>
    <president term=2>
        <lastname>John</lastname>
        <firstname>Adams</firstname>
    </president>
</presidents>
```

ElementTree

```
Element
      tag='presidents'
  Element {'term':1 }
    tag='president'
      Element
        tag='lastname'
        text='Washington'
      Element
        tag='firstname'
        text='George'
  Element {'term':2 }
    tag='president'
      Element
        tag='lastname'
        text='Adams'
      Element
        tag='firstname'
        text='John'
```

Why ranges are inclusive/exclusive (Edsger W. Djikstra)

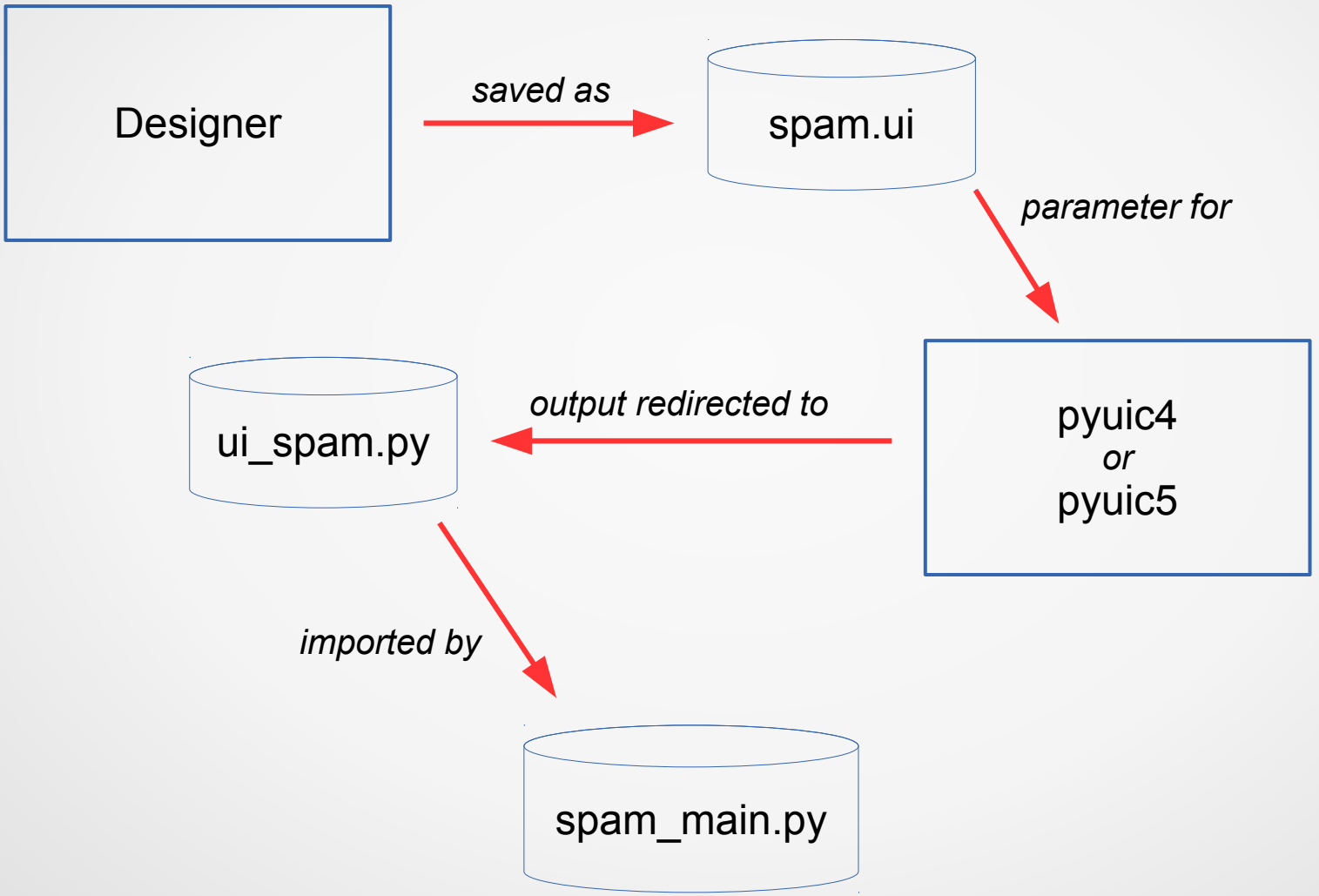
- 2, 3, 4, 5
  - 2:6 inc/exc
  - 1:5 exc/inc
  - 2:5 inc/inc
  - 1:6 exc/exc
- 0, 1, 2, 3
  - 0:4 inc/exc
  - -1:3 exc/inc
  - 0:3 inc/inc
  - -1:4 exc/exc
- -2, -1, 0, 1
  - -2:2 inc/exc
  - -3:1 exc/inc
  - -2:1 inc/inc
  - -3:2 exc/exc

- No Negative numbers
- Stop – start is # values
- Upper bound is lower bound of adjacent range

Good sources of Python books

- http://www.packtpub.com
- http://www.oreilly.com

PyQt Designer Workflow



Context managers

```
with EXPR as VAR:
        BLOCK


mgr = (EXPR)
exit = type(mgr).__exit__  # Not calling it yet
value = type(mgr).__enter__(mgr)
exc = True
try:
    try:
        VAR = value  # Only if "as VAR" is present
        BLOCK
    except:
        # The exceptional case is handled here
        exc = False
        if not exit(mgr, *sys.exc_info()):
            raise
        # The exception is swallowed if exit() returns true
finally:
    # The normal and non-local-goto cases are handled here
    if exc:
        exit(mgr, None, None, None)
```

Pandas Dataframe Indexing

- DF.*indextype*[row_indexer, column_indexer]
  - Default indexer is **:** (all values)
  - Indexer can be
    - Label (examples: 'a', 5, 'result')
    - List of labels (examples: ['a', 'b', 'e'], [5, 4, 1])
    - Slice (example: 'a':'f', 2:3, 3:, 20150123: :
- Index types
  - .loc (label or Boolean array, NOT positional)
  - .iloc (integer or Boolean array, positional)
  - .ix (hybrid – primarily label, falls back to integer)

Decorator Syntax

```
@mydecorator
def myfunction():
    pass
```

same as

```
myfunction = mydecorator(myfunction)
```

```
@mydecorator(myparam)
def myfunction():
    pass
```

same as

```
myfunction = mydecorator(myparam)(myfunction)
```

Wheels

- Universal Wheel (all platforms)
  - Written for both Python 2 and Python 3
  - No extensions
- Pure Python Wheel (all platforms)
  - Written for Python 2 or Python 3
  - No extensions
- Platform Wheel (platform-specific)
  - Written for Python 2 or Python 3
  - Has extensions
  - Automatically created if non-Python code present

URL Mapping

Show how the URL maps to the actual Django files, including the url conf and the views, and maybe the templates

•Two hard problems in computer science

- cache invalidation
- naming things
- off-by-one errors

A Joke

- How do you tell the difference between a plumber and a chemist? Ask them to pronounce unionized.

If programming languages were religions

- Perl would be Voodoo - An incomprehensible series of arcane incantations that involve the blood of goats and permanently corrupt your soul. Often used when your boss requires you to do an urgent task at 21:00 on friday night.