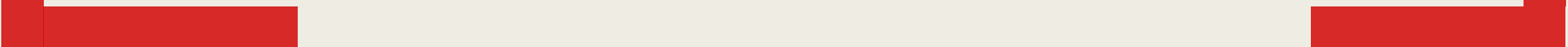




# Introduction to Python

EECS 4415  
Big Data Systems

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# Background

# Why Python?

- "Scripting language"
- Very easy to learn
- Interactive front-end for C/C++ code
- Object-oriented
- Lots of libraries
  - *including tools for **data analysis***
- Powerful, scalable
  - *supporting tools that handle **very large datasets***

# Pseudocode

```
if grade equals 60 and assignment in assignments list
    print "passed"
else
    print "failed"
```

# Python code

```
if grade == 60 and assignment in assignments_list:  
    print("passed")  
else:  
    print("failed")
```

# Python syntax

- Much of it is similar to C syntax
- Exceptions:
  - *missing operators: ++, --*
  - *no { } for blocks*
    - only whitespace and indentation
  - *different keywords*
  - *no type declarations!*
  - *lots of extra features*

# Starting and exiting Python

```
% python
Python 3.5.2 ...
>>> print("hello")
hello
>>> ^D
%
```

# Running a Python file

Contents of file.py:

```
print ("hello world")
```

Executing it in terminal:

```
% python file.py  
hello world  
%
```



# Simple data types

- Numbers
  - *integer*
  - *floating-point*
  - *complex!*
- Strings
  - *characters are strings of length 1*
- Booleans are `0/1` (or `False/True`)
- Comments with `#`

# Simple data types: operators

- `+` `-` `*` `/` `%` (like C)
- `+=` `-=` *etc.* (no `++` or `--`)
- Assignment using `=`
  - *but semantics are different!*
    - `a = 1`
    - `a = "foo" # OK`
- Can also use `+` to concatenate strings

# Python Script

Contents of file.py:

```
print ("hello world")
```

Executing it in terminal:

```
% python file.py  
hello world  
%
```

# Compound data types (1)

- Lists:

```
a = [1, 2, 3, 4, 5]
print (a[1]) # 2
some_list = []
some_list.append("foo")
some_list.append(12)
print (len(some_list)) # 2
```

## Compound data types (2)

### ■ Tuples:

```
a = (1, 2, 3, 4, 5)
print (a[1]) # 2
empty_tuple = ()
```

### ■ Difference between lists and tuples:

- *lists are mutable; tuples are immutable*
- *lists can expand, tuples can't*
- *tuples are slightly faster*

# Compound data types (3)

## ■ Dictionaries:

```
a = {"age": 18, "b": "123a", 3: True}
print (a[3]) # True
print (a["age"]) # 18
```

## ■ Key-Value pairs

- *key can be number or string*
- *value can be anything, including another sub-dictionary*

# Compound data types (4)

- Objects:

```
class Thingy:  
    # methods and properties  
t = Thingy()  
t.method()  
print (t.field)
```

- Built-in data structures (lists, dictionaries) also objects
  - *though internal representation is different*

# Control flow (1)

- `if, if/else, if/elif/else`

```
if a == 0:
    print ("zero!")
elif a < 0:
    print ("negative!")
else:
    print ("positive!")
```

- Notes:

- *blocks delimited by indentation!*
- *colon (:) used at end of control flow keywords*



## Control flow (2)

- `while` loops

```
a = 10
while a > 0:
    print (a)
    a -= 1
```

# Control flow (3)

- `for` loops

```
for a in range(10):  
    print (a)
```

- Really a "foreach" loop
- Common `for` idiom:

```
a = [3, 1, 4, 1, 5, 9]  
for i in range(len(a)):  
    print (a[i])
```

# Control flow (4)

- `pass` keyword

```
if a == 0:  
    pass # do nothing  
else:  
    # whatever
```

- `continue` statement similar to C

# File access

- `for..in` loops

```
f = open("some_file", "r")
for line in f:
    # do something with line...
```

- Files normally end in `.py`

# Functions

- Definition

```
def foo(x):  
    y = 10 * x + 2  
    return y
```

- Execution

```
print (foo(10)) # 102
```

- All variables are local unless specified as `global`
- Arguments passed by value

# Modules (1)

- Access other code by importing modules:

```
import math  
print (math.sqrt(2.0))
```

- or

```
from math import sqrt  
print (sqrt(2.0))
```

- or

```
from math import *  
import sys, string, math
```

## Modules (2)

- Try to avoid `from some_module import *`
  - *dumps all names from some\_module into local namespace*
  - *easy to get name conflicts this way*
- Code you write in file `foo.py` is part of module "`foo`"

```
from foo import my_function
import bar
```

# Strings and formatting

```
i = 10
d = 3.1415926
s = "I am a string!"
print ( "%d\t%f\t%s" % (i, d, s) )
```



# Links and other material

- Python tutorials:
  - <https://www.w3schools.com/python/>
  - <https://www.learnpython.org/>
- Python documentation:
  - <https://docs.python.org/3/>