# More on Functions; Some File I/O

UW CSE 190p

Summer 2012

# Review

```
def myfunc(n):
    total = 0
    for i in range(n):
        total = total + i
    return total

print myfunc(4)
```

What is the result?

# Exercise: Control Flow

```
def c_to_f(c):
    print "c_to_f"
    return c / 5.0 * 9 + 32

def make_message(temp):
    print "make_message"
    return "The temperature is "+str(temp)

for tempc in [19,22,21]:
    tempf = c_to_f(tempc)
    message = make_message(tempf)
    print message
```

```
c_to_f
make_message
The temperature is 66.2
c_to_f
make_message
The temperature is 71.6
c_to_f
make_message
The temperature is 69.8
```

# Loop Gotcha: Indentation

```
def c_to_f(c):
    print "c_to_f"
    return c / 5.0 * 9 + 32

def make_message(temp):
    print "make_message"
    return "The temperature is "+str(temp)

for tempc in [19,22,21]:
    tempf = c_to_f(tempc)
    message = make_message(tempf)
print message
```

```
c_to_f
make_message
c_to_f
make_message
c_to_f
make_message
The temperature is 69.8
```

# Function Gotcha: Local Variables

```
def c_to_f(c):
    result = c / 5.0 * 9 + 32
    return result

tempf = c_to_f(19)
print result
```

A mistake! What happens here?

See examples in the book:
http://thinkcspy.appspot.com/build/functions.html#variables-and-parameters-are-local

# Local variables

```
def c_to_f(c):
    result = c / 5.0 * 9 + 32
    return result

tempf = c_to_f(19)
print result
```

Local *scope*

Global *scope*

*English definition:*
*scope (n): extent or range of view, outlook, application, operation, effectiveness, etc.:*

# Local Scope and Global Scope

```
def normal_pressure(pressure):
    result = pressure - pressure_at_sea_level
    return result

pressure_at_sea_level = 7
print normal_pressure(16)
```

Does this work?
How?

# Local Scope and Global Scope

- When Python encounters a variable, it
  - first checks to see if the variable is defined in the local scope
  - then checks to see if the variable is defined in the global scope

*But: try to avoid this feature.*

*Keep global variables global, and local variables local*

# Local Scope and Global Scope

```
def normal_pressure(pressure):
    pressure_at_sea_level = 7
    result = pressure - pressure_at_sea_level
    return result

print normal_pressure(16)
```

*Better*

# Confusing Variables

```
def atm_to_mbar(pressure):
    return pressure * 1013.25

def mbar_to_mmHg(pressure):
    return pressure * 0.75006

pressure = 1.2 # in atmospheres
pressure = atm_to_mbar(pressure)
pressure = mbar_to_mmHg(pressure)
print pressure
```

# A Better Way

```
def atm_to_mbar(pressure):
    return pressure * 1013.25

def mbar_to_mmHg(pressure):
    return pressure * 0.75006

in_atm = 1.2
in_mbar = atm_to_mbar(in_atm)
in_mmHg = mbar_to_mmHg(in_mbar)
print in_mmHg
```

Much more clear!!

# Function Gotcha: Return Value

```
def c_to_f(c):
    print c / 5.0 * 9 + 32
```

*No return value!?!*

```
print c_to_f(19)
```

*Anything wrong here?*

*Good practice: Always include a return statement!*

# Q: Can functions call other functions?

```
def atm_to_mbar(pressure):
    return pressure * 1013.25

def mbar_to_mmHg(pressure):
    return pressure * 0.75006

def atm_to_mmHg(pressure):
    in_mbar = atm_to_mbar(pressure)
    in_mmHg = mbar_to_mmHg(in_mbar)
    return in_mmHg

print atm_to_mmHg(5)
```

# Local Scope and Global Scope revisited

- When Python encounters a variable, it
  - first checks to see if the variable is defined in the local scope
  - then checks to see if the variable is defined in the next most outer scope
  - then checks to see if the variable is defined in the next most outer scope
  - …
  - then checks to see if the variable is defined in the global scope

# Function Engineering

- Breaking down a program into functions is *the fundamental activity* of programming!
- How do you decide when to use a function?
  - One rule from the last lecture: DRY
  - Whenever you are tempted to copy and past code, don't!
- Now how do you design a function?

# Function Engineering

- How do you design a function?
- Step 1: Write the program as if the function you want already existed

```
print "This is the temperature in Farenheit: ", tempf
tempc = f_to_c(tempf)
print "This is the temperature in Celsius: ", tempc
```

*Always start this way!*

# Function Engineering

- How do you design a function?
- Step 2: Describe the inputs and output. Refer to their type.

```
# Inputs: a number representing degrees farenheit
# Return value: a number representing degrees celsius
```

# Function Engineering

- How do you design a function?
- Step 3: Implement the function

```
def f_to_c(num):
    result = (f - 32) / 9.0 * 5
    return result
```

# File Input and Output

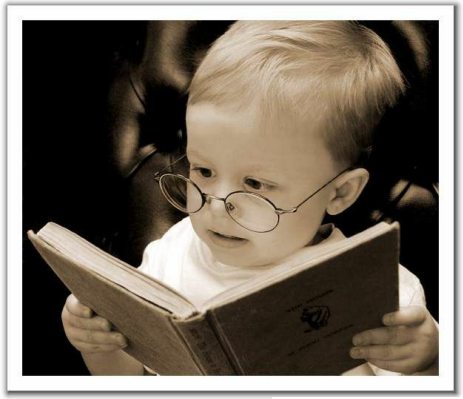
- As a programmer, when would one use a file?
- As a programmer, what does one do with a file?

# Important operations

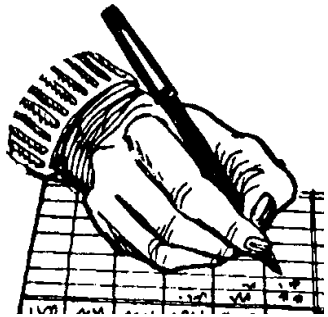
- open a file

- close a file

- read data



- write data



# Read a file in python

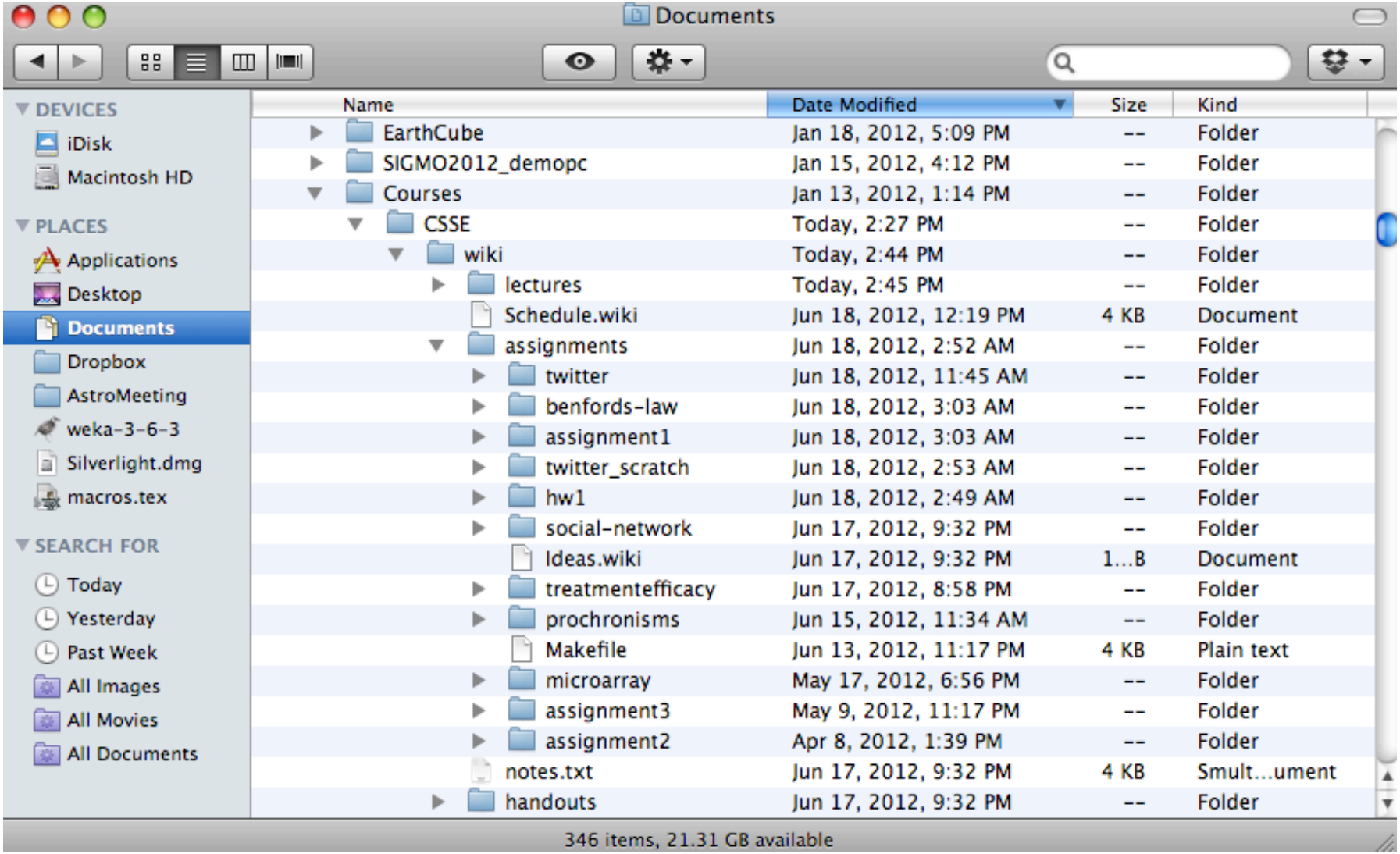
```
myfile = open("datafile.dat", "r")

for line_of_text in myfile:
  print line_of_text
```

historical convention

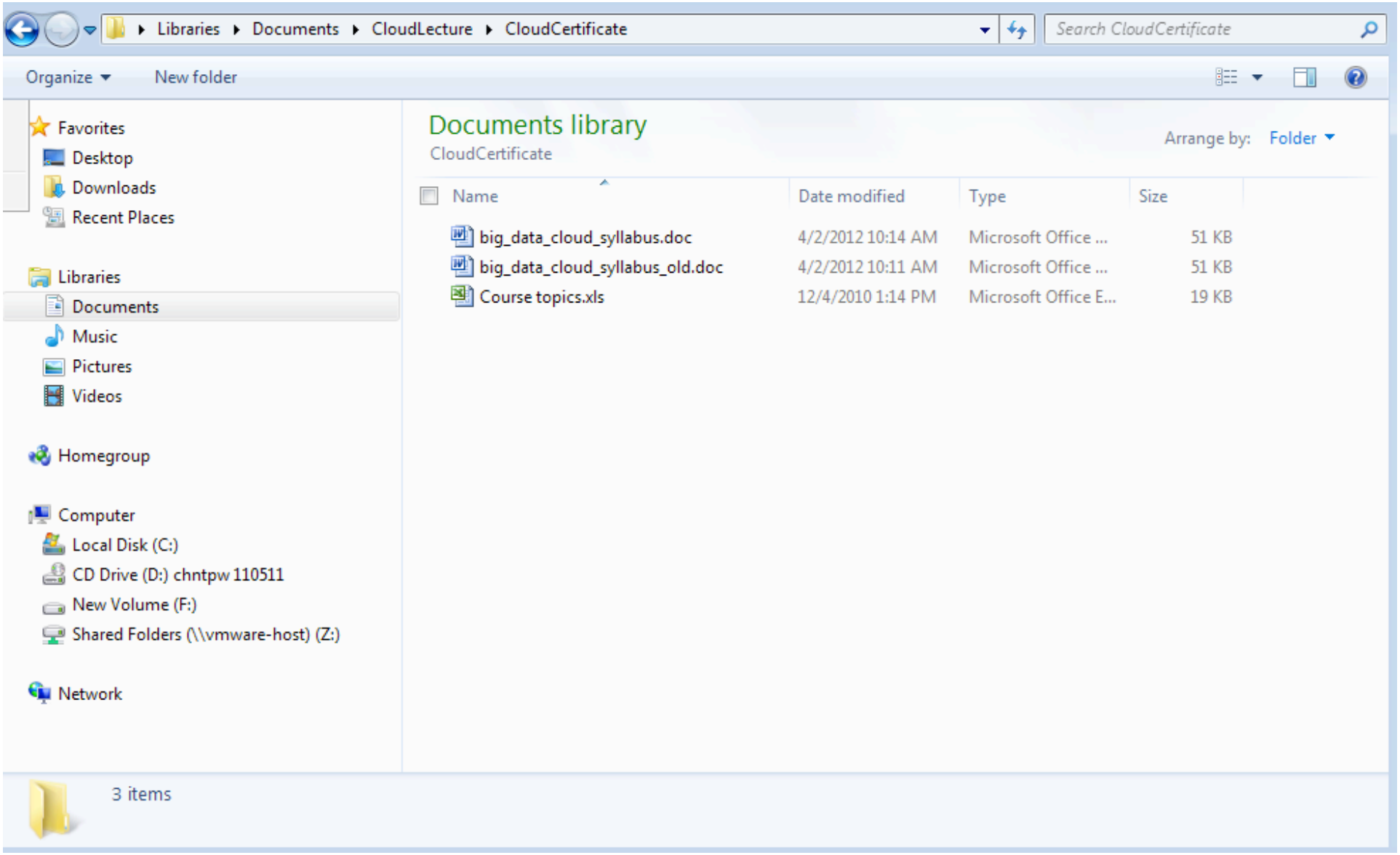
*Assumption: file is a sequence of lines*

*File Gotcha: where does Python expect to find this file?*

# “Current Working Directory”



# “Current Working Directory”



# “Current Working Directory” in Python

```
>>> import os   # “os” stands for “operating system”
>>> os.getcwd()
'/Users/billhowe/Documents'
```

*This point is minor, but can be the source of confusion and bugs.*

*A reasonable practice is just to work from the default location.*

*On my systems:*

*Windows: 'C:\\Python27'*

*Mac: ‘/Users/billhowe/Documents’*

# Read a file in python

```
myfile = open("datafile.dat", "r")

all_data_as_a_big_string = myfile.read()
```

*Another way to read data*

# Write to a file in python

```
myfile = open("output.dat", "w")

myfile.write("a bunch of data")
```

historical convention

# Write to a file in python

```
myfile = open("output.dat", "w")

myfile.write(4)
```

historical convention

```
Traceback (most recent call last):
  File "writefile.py", line 3, in <module>
    myfile.write(4)
TypeError: expected a character buffer object
```

```
myfile.write(str(4))
```

# Write to a file in python

```
myfile = open("output.dat", "w")

myfile.write("a line of text\n")
```

Use "\n" to indicate the end of a line