

CompSci 101

Introduction to Computer Science



Nov. 29, 2016

Prof. Rodger

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Lab this week - Madlibs

Rudolph the <adjective>-nosed <noun>
had a very <adjective> nose. And if you ever
<verb> it, you would really say it glowed.

Rudolph the **large**-nosed **pig** had a very
crooked nose. And if you ever **swim** it, you
would really say it glowed.

Noun: pig, cow, book, car, hand, lamp, bed, ...



Announcements

- Reading and RQ 17 due next time
- Assignment 7 due today
 - Assign 8 due Dec 6
 - APT 9 due Thursday
 - Exam 2 back tomorrow
 - Coming... Points dropped on RQ, Lecture and Lab
- Today:
 - How do you access directories
 - Recursion – Solving problems by solving smaller and smaller similar problems

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Prof Rodger Office Hours today shifted...

- Today Only: 3:30-4:45pm

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Math, Engineering, Sociology

- Netflix prize in 2009
 - Beat the system, win
 - <http://nyti.ms/sPvR>



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Assignment 8: Collaborative Filtering

- How does Amazon know what I want?
 - Lots of customers, lots of purchases
- How does Pandora know music like Kanye's?
 - This isn't really collaborative filtering, more content-based
- How does Netflix recommend movies?
 - Why did they offer one million \$\$ to better their method?
- Students at Duke who like CompSci also like ...
 - Could this system be built?

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From User Rating to Recommendations



| Spectre | Martian | Southpaw | Everest | PitchPerfect 2 |
|---------|---------|----------|---------|----------------|
| 3 | -3 | 5 | -2 | -3 |
| 2 | 2 | 3 | 2 | 3 |
| 4 | 4 | -2 | 1 | -1 |

- | **What should I choose to see?**
 - What does this depend on?
- | **Who is most like me?**
 - How do we figure this out

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Plan for Today

- Recursion
 - Solving problems by solving similar but smaller problems
- Programming and understanding ...
 - Hierarchical structures and concepts
 - What is a file system on a computer?
 - What is the Internet?
 - How does the Domain Name System Work?
- How do you access directories?
 - And all the files in a directory, and the ...

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Recursion

Solving a problem by solving similar but smaller problems

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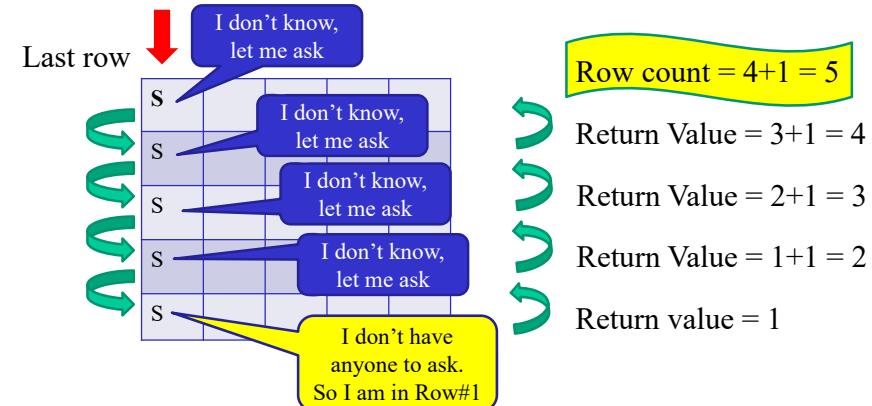
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Recursion

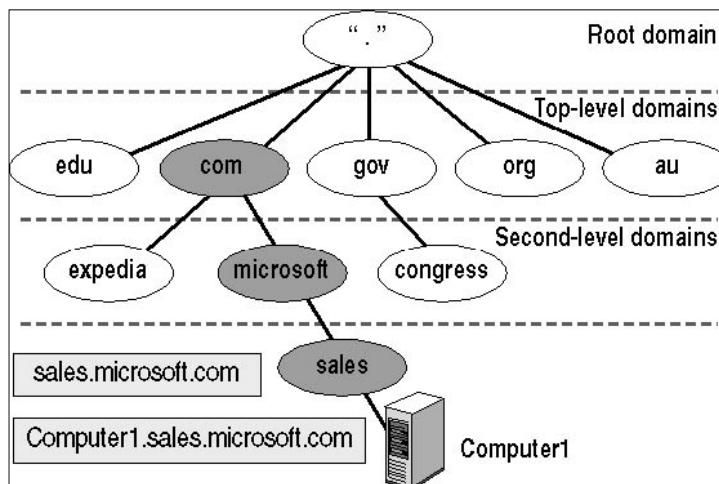
Solving a problem by solving similar but smaller problems

Question - How many **rows** are there in this classroom?

Similar but smaller question - How many **rows** are there until your row?

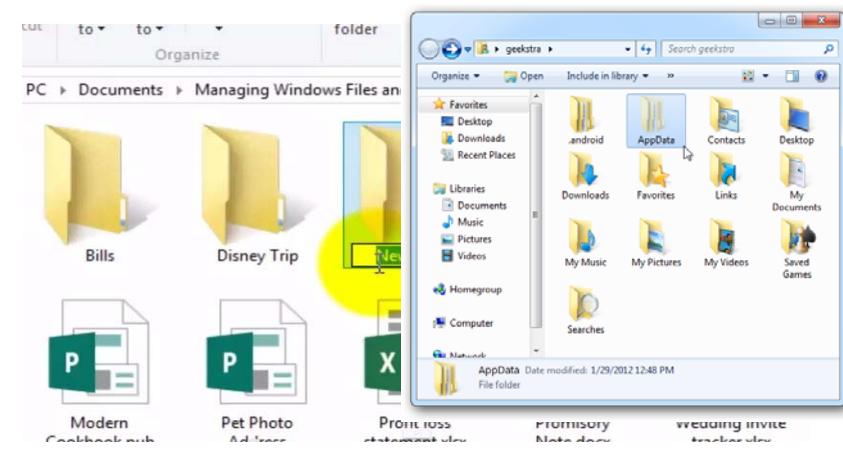


Domain Name System (DNS)

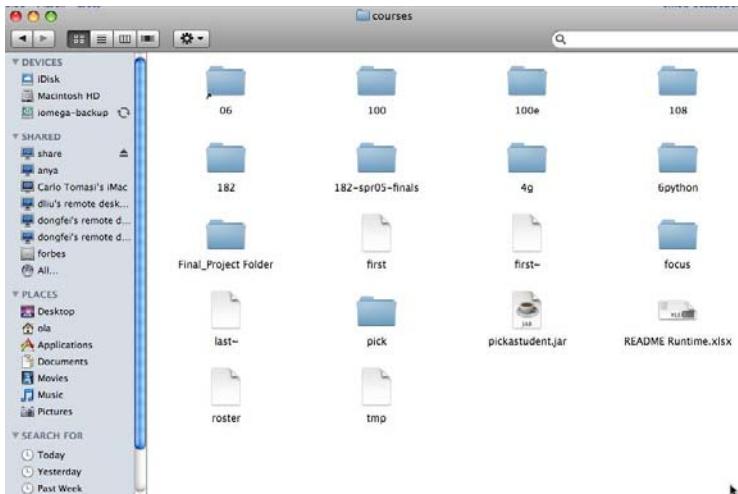


Link: <http://computer1.sales.microsoft.com>

What's in a file-system Folder?



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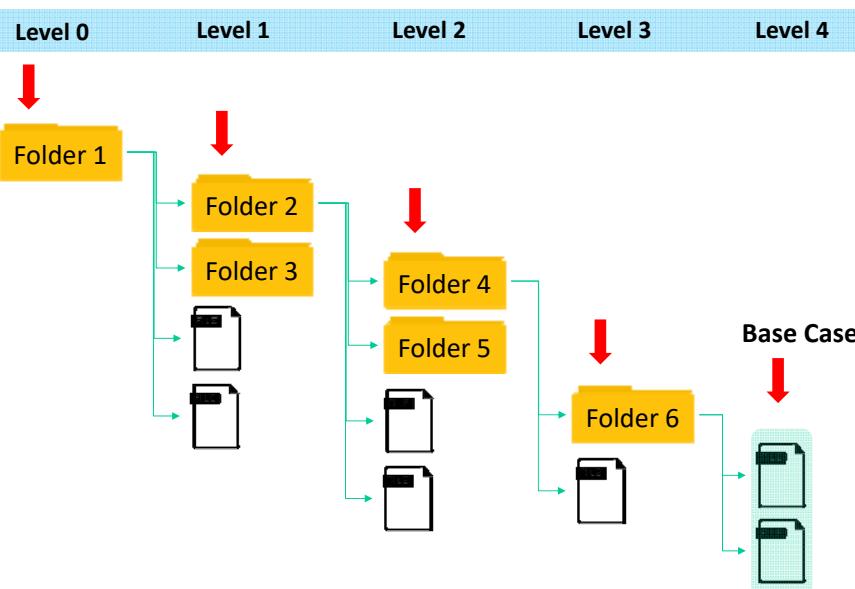


What's in a folder on your computer?

- Where are the **large** files?
- How do you **find them**?
- They take up space!
 - What's the plan –

1. Erase?
2. Backup?

Hierarchy in Folder Structure



Recursion to find ALL files in a folder

- A folder can have sub folders and files
- A file cannot have sub files

```
def visit(dirname):
    for inner in dirname:
        if isdir(inner): _____ Is that a directory?
            visit(inner)
        else: _____ If not a directory, it will be a file
            print name(inner), size(inner)
```

Finding large files: FileVisit.py

```
def bigfiles(dirname,min_size):  
    large = []  
    for sub in os.listdir(dirname):  
        path = os.path.join(dirname,sub)  
        if os.path.isdir(path):  
            subs = bigfiles(path,min_size)  
            large.extend(subs)  
        else:  
            size = os.path.getsize(path)  
            if size > min_size:  
                large.append((path,size))  
    return large  
  
# on Mac like this:  
#bigs = bigfiles("/Users/Susan/Documents",10000)  
# on Windows like this:  
bigs = bigfiles("C:\\\\Users\\\\Susan\\\\Documents",10000)
```

Example Run

- ('C:\\\\Users\\\\Susan\\\\files\\\\courses\\\\cps101\\\\w
orkspace\\\\spring2015\\\\assign4_transform\\\\d
ata\\\\romeo.txt', 153088L)
- ('C:\\\\Users\\\\Susan\\\\files\\\\courses\\\\cps101\\\\w
orkspace\\\\spring2015\\\\assign4_transform\\\\d
ata\\\\twain.txt', 13421L)
- ('C:\\\\Users\\\\Susan\\\\files\\\\courses\\\\cps101\\\\w
orkspace\\\\spring2015\\\\assign5_hangman\\\\sr
c\\\\lowerwords.txt', 408679L)
- ...

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Finding Large Files questions
bit.ly/101f16-1129-1

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The os and os.path libraries

- Libraries use an API to isolate system dependencies
 - C:\\\\x\\\\y # windows
 - /Users/Susan/Desktop # mac
- FAT-32, ReFS, WinFS, HFS, HSF+, fs
 - Underneath, these systems are different
 - Python API insulates and protects programmer
- Why do we have `os.path.join(x,y)`?
 - x = /Users/Susan/Documents
 - y = file1.txt
 - Output = /Users/Susan/Documents/file1.txt

Dissecting FileVisit.py

- How do we find the contents of a folder?
 - Another name for folder: directory
- How do we identify folder? (by name)
 - `os.listdir(dirname)` returns a list of files and folder
- Path is `c:\user\ola\foo` or `/Users/ola/bar`
 - `os.path.join(dir,sub)` returns full path
 - Platform independent paths
- What's the difference between file and folder?
 - `os.path.isdir()` and `os.path.getsize()`

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Does the function call itself? No!

```
def visit(dirname):  
    for inner in dirname:  
        if isdir(inner):  
            visit(inner)  
        else:  
            print name(inner), size(inner)
```

- Is a file inside itself? No!
- Does pseudo code make sense?
 - Details make this a little harder in Python, but close!

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Structure matches Code

Find large files

If you see a folder,

1. Find the large files and subfolders
2. For the subfolders, repeat the process of finding large files and any other folders within that subfolder
3. Repeat the process until you reach the last folder

Compress or Zip a folder

If you see a folder,

1. Find the files and subfolders
2. For the subfolders, repeat the process of finding files and any other folders within that subfolder
3. At the last stage, start compressing files and move up the folder hierarchy

Structure matches Code

- Structure of list of lists

– Can also lead to processing a list which requires processing a list which ...

```
[ [ [a,b], [c,d], [a, [b,c],d] ]  
(a *(b + c (d + e*f)) + (a* (b+d)))
```

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Recursion

- Simpler or smaller calls
- Must have a base case when no recursive call can be made
 - Example - The last folder in the folder hierarchy will not have any subfolders. It can only have files. That forms the base case

Sir Anthony (Tony) Hoare



There are two ways of constructing a software design. One way is to make it so simple that there are obviously no deficiencies. And the other way is to make it so complicated that there are no obvious deficiencies.

Turing Award, didn't get recursion.....

Inventor of quicksort

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Mystery Recursion

bit.ly/101f16-1129-2

```
def Mystery(num):  
    if num > 0:  
        return 1 + Mystery(num/2)  
    else:  
        return 2 + num
```

Something Recursion

bitly/101f16-1129-3

```
def Something(data):  
    # data is a list of integers  
    if len(data) == 0:  
        return 0  
    if data[0] % 2 == 0: # it is even  
        return data[0] + Something(data[1:])  
    else:  
        return Something(data[1:])


```