

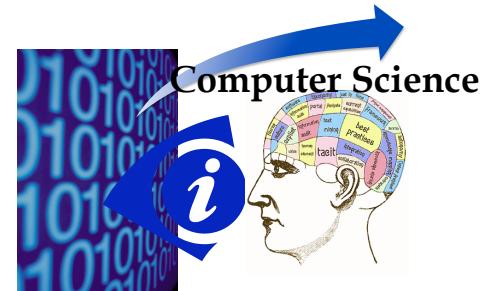
COMPSCI 101, Spring 2012
Introduction to Computer Science
Owen Astrachan

<http://www.cs.duke.edu/courses/spring12/compsci101>
<http://www.cs.duke.edu/~ola>

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1.1

Data into Information and Knowledge



men and women: this is compsci 101

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1.2

Prerequisites for CompSci 101

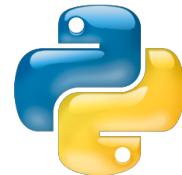


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1.3

Is a picture worth a thousand words?

- <http://www.google.com/images?q=world%20wide%20web&biw=1238&bih=969>
- <http://www.google.com/images?q=computer%20science&biw=1370&bih=1081>
- <http://www.google.com/images?q=internet&biw=1370&bih=1081>
- <http://www.google.com/images?q=programming&biw=1370&bih=1081>



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1.4

Anatomy of a search [query]

- [http://www.google.com/images?
q=programming&biw=1370&bih=1081](http://www.google.com/images?q=programming&biw=1370&bih=1081)
- What comes after the question-mark in the URL?
 - What is the query string?
 - What are the browser dimensions?
 - What is constant in the search query, what changes?
 - How is the query *parameterized*?
 - How are multiple-word queries handled?
- What does this have to do with Computer Science and programming?

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1.5

Questions about Computer Science

What is it that distinguishes it from the separate subjects with which it is related?
What is *the linking thread* which gathers these disparate branches into a single discipline?
My answer to these questions is simple --- it *is the art of programming a computer*. It is the art of designing efficient and elegant methods of getting a computer to solve problems, theoretical or practical, small or large, simple or complex.

C.A.R. (Tony) Hoare

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1.6

Milking Stool v Neural Queue

- Engineering, Mathematics, Science
 - Pillars of computer science?
 - Braid of computer science?
- Other aspects of CS?
 - Technology and policy
 - Art and visualization
 - Collaborative Filtering



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1.7

It's not all programming at all, but ...

- What is the nature of intelligence? How can one predict the performance of a complex system? What is the nature of human cognition? Does the natural world 'compute'?
- *It is the interplay between such fundamental challenges and the human condition that makes computer science so interesting.* The results from even the most esoteric computer science research programs often have widespread practical impact. Computer security depends upon the innovations in mathematics. Your Google search for a friend depends on state-of-the-art distributed computing systems, algorithms, and artificial intelligence.

<http://www.post-gazette.com/pg/04186/341012.stm>

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1.8

Understanding Information/Data

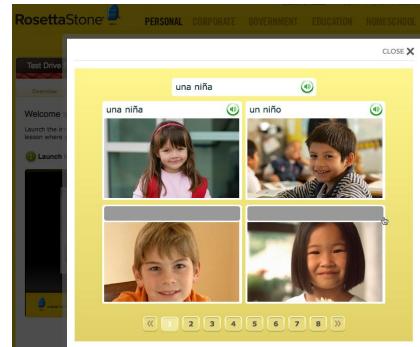
- Does understanding computer science help you when you want a new smart phone?
- Does knowledge of programming help you get your laptop connected to a wireless access point?
- Does experience with algorithms and algorithmic approaches help physicians and attorneys?
- Are these important to society, to you?

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1.9

How will you learn to 'speak'?

- <http://www.rosettastone.com/personal/demo>



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1.10

What language will we learn?

- <http://www.python.org/>
- Python is a *multi-paradigm* language
 - Procedural
 - Functional
 - Object-Oriented
- Simple, huge libraries, widely used
- Guido is BDFL



1.11

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Why is it called Python?

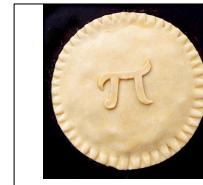
- <http://www.youtube.com/watch?v=anwy2MPT5RE>



A



B



+



— 9.8 m/sec²

C

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1.12

Course Overview: Is this the right one?

- There are details, see the [course web page](#)
 - Midterms and final are open book, what does that mean?
 - APTs: Algorithmic Problem-solving and Testing
 - Weekly small programming assignments, tested online
 - Programming assignments: solo, group, ...
 - Lab/recitation: group and individual work
- Why should you come to class?
 - Meet people, learn things, participate in a community
 - Provide help, get help, wonder, dance, think
- Why is this course so great?
 - Because you're in it

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1.13

What's in CompSci 101?

- Learning about computing, computer science, and programming
 - Vocabulary of Python and programming languages
 - Crafting programs from the vocabulary
 - *Power of automation, repetition, scale*
 - Understanding and changing the world
- Programming using Python
 - Tools: Eclipse, EPD, Libraries, ...
 - Engineering and analyzing designs and programs
 - Using mathematical and scientific techniques
 - Appreciating and learning art and science of programming
 - Moving toward scaling solutions (continued later courses)

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1.14

Questions

If you gotta ask, you'll never know
Louis Armstrong: "What's Jazz?"



If you gotta ask, you ain't got it
Fats Waller: "What's rhythm?"



What questions did you ask today?
Arno Penzias



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1.15

From Blog to Scientific Visualization

- Text Cloud aka Tag Cloud
 - Number of occurrences/emphasis indicated by size of word
 - Great visual/statistic: <http://chir.ag/phernalia/preztags/>
 - <http://www.nytimes.com/gst/mostsearched.html?period=30&format=tagcloud>
 - What information is stored in the URL of the NYTimes site above?



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1.16

Problem Solving and Programming

- How many words are in a file? A webpage?
 - What's a word?
 - What's a file?
 - How do we solve this: simply, quickly, ...?
 - What's the best we can do? Constraints?
- How many different/unique words are in a file?
 - How is this related to previous task?
- How many words do two files have in common?
 - Spell-checking, Google did you mean ..?
- How many codons common to DNA strands?

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1.17

Toward a Pythonic Tagcloud generator

- This is valid and correct Python code, questions?

```
def countWords(filename):  
    file = open(filename)  
    str = file.read()  
    words = str.split()  
    unique = set(words)  
    print "filename: ", filename  
    print "total # words = ", len(words)  
    print "unique # words = ", len(unique)  
if __name__ == "__main__":  
    countWords('/data/kjv10.txt')  
  
filename: /data/kjv10.txt  
total # words = 823135  
unique # words = 34027
```

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1.18

Python vocabulary

- Python has a large standard library
 - Organized in *modules*: sys, io, math, os, ...
 - <http://docs.python.org/library/index.html>
 - API browseable online, but Eclipse IDE helps a lot
- Python users often use third-party libraries too
 - Scientific, visual, plotting, ...
 - We will use EPD: Enthought Python Distribution
- Python is a multi-paradigm language, though this won't matter so much in the beginning
 - Very useful later!

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1.19

Python and Programming Concepts

- Names are important, abstractions
 - What is <http://152.3.140.1>
 - What is <http://www.amazon.com>
- Types are important, facilitate operations
 - What is foo.pdf, foo.mp4, foo.jpg, foo.wav
 - Do the file extensions guarantee file type?
- Thinking in terms of names and types can help
 - Python has types, inferred dynamically
 - Python uses types differently from Java and C++
 - Static v Dynamic

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1.20

Duke Contributions



Google

Everything
More

Any time
Past 2 days
More search tools



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Type the two words:

CAPTCHA™
stop spams.
read books.

About 143,000,000 results (0.46 seconds)

Did you mean: [computer science](#)

Computer science - Wikipedia, the free encyclopedia
Computer science or computing science (sometimes abbreviated CS) is the study of the theoretical foundations of information and computation, ...
History - Major achievements - Areas of computer science
en.wikipedia.org/wiki/Computer_science - Cached - Similar #17 in Learn Programming

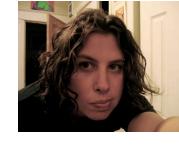


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1.21

Semi-random former students

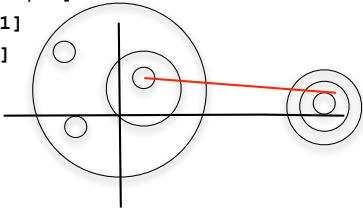


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1.22

From Idea to Algorithm to Program

- **Finding minimal crossing count**
 - Applications? Puzzle-solving?
 - Given (x_i, y_i, r_i) and P_1, P_2 -- determine minimal number of circles to cross to get from P_1 to P_2
- **Input:**
 - $[-3, 2, 2, 0, -4, 12, 12, 12]$
 - $[-1, 2, 3, 1, 5, 1, 1, 1]$
 - $[1, 3, 1, 7, 1, 1, 2, 3]$
 - $(2, 3) (13, 2)$
- **Output:**
 - 5



1.23

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Why is programming fun?

Fred Brooks

- First is the sheer joy of making things
- Second is the pleasure of making things that are useful
- Third is the fascination of fashioning complex puzzle-like objects of interlocking moving parts
- Fourth is the joy of always learning
- Finally, there is the delight of working in such a tractable medium. The programmer, like the poet, works only slightly removed from pure thought-stuff.



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1.24