

COMPSCI 101, Fall 2013

Introduction to Computer Science

Robert Duvall

Welcome!

<http://www.cs.duke.edu/courses/fall13/compsci101>

What is Oceanography?

- **How to understand the ocean?**

- how to conduct a study or map?
- know more about Mars than our own oceans!

- **What is Google Earth without the ocean?**

- **Census of Marine Life**

- researchers in more than 80 nations
- represented by Duke Professor Patrick N. Halpin



Human or Computer?

- How to distinguish a human user from a computer?



- How to help humanity too?

- used by over 100,000 web sites
- transcribes over 40 million words per day
- all done for free!

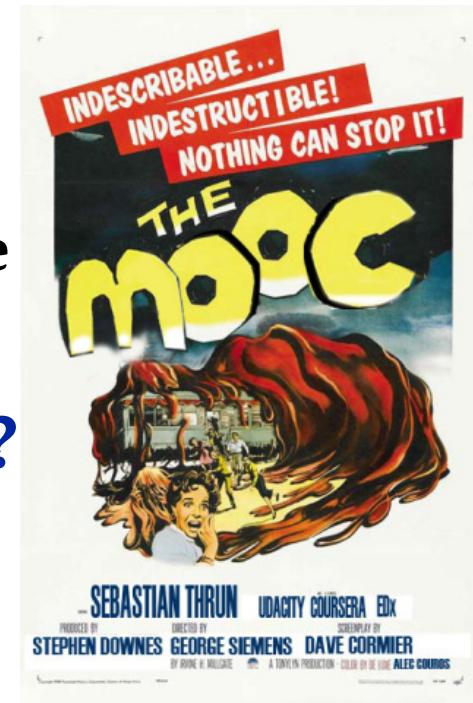
- Luis von Ahn calls it
Massive Scale Human Collaboration



Personalize and Expand Education?



- Improve individual education?
 - money is not the answer
 - just computers are not the answer
- How to improve access?
 - tuition is too high
 - requirements are too restrictive
- Online courses + tablets = ???



Computer Science with Other Disciplines



The story of the internet continues to be the story of our time ... if you truly want to follow -- or, better still, bend -- that story's arc, you should know how to write code.

Christina Cacioppo on leaving Union Square Ventures to learn to program

Given the current state of technology, what can I do radically differently to make a discontinuity — not an incremental change, but put us in a different place?

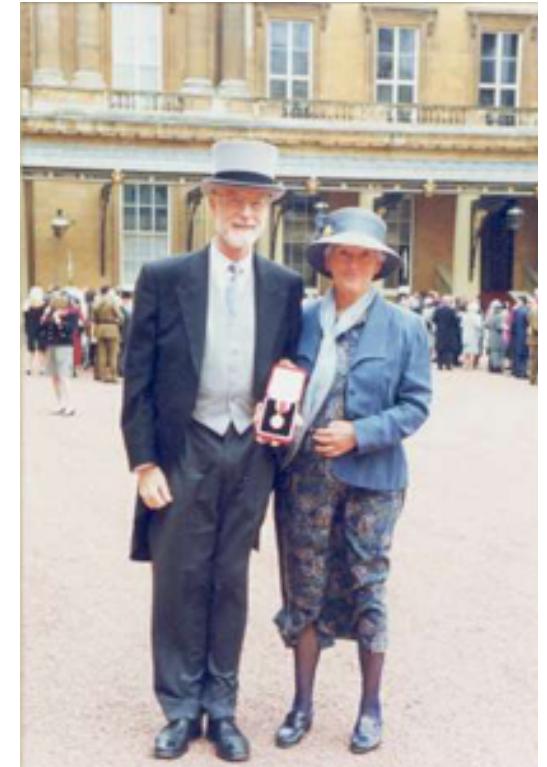
Sebastian Thrun, cofounder of Udacity



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.

Sir Charles Antony Richard (Tony) Hoare



Prerequisites for CompSci 101



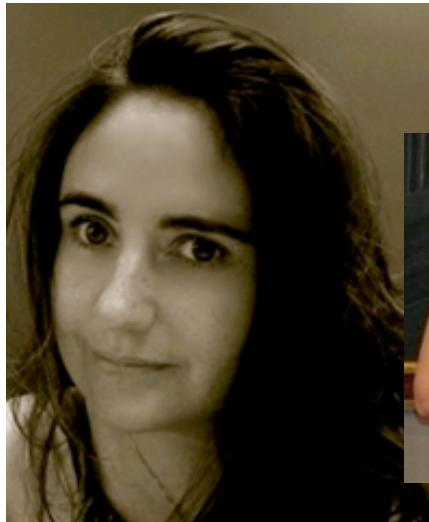
Course Overview: Is this the right one?

- **No Experience Needed!**
 - Other options: CompSci 92, CompSci 94, ISIS courses
 - Difference? Focused on programming
 - Experience? CompSci 201
- **Collaboration encouraged!**
 - Be active, not just a sponge
 - You are an excellent resource
 - Use the discussion board
- **No curve ☺**
- **No cramming ☹**

Course Overview: Policies

- **There are details, see the course web page**
 - Midterms: closed book, final is open book
 - Practice, Practice, Practice: weekly programs, tested online
 - Lab: small sections with group and individual work
 - Projects: combination of practice problems, open ended
- **Expectations of Excellence**
 - do optional work AND do very well on the Final
 - exceed basic expectations
- **Why should you come to class?!?**
 - Meet people, learn things, participate in a community

Who's taken CompSci 101?



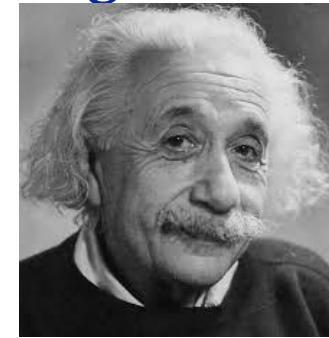
Questions

He who asks is a fool for five minutes, but he who does not ask remains a fool forever.

Chinese Proverb

**The important thing is not to stop questioning.
Curiosity has its own reason for existing.**

Albert Einstein



What questions did you ask today?

Arno Penzias

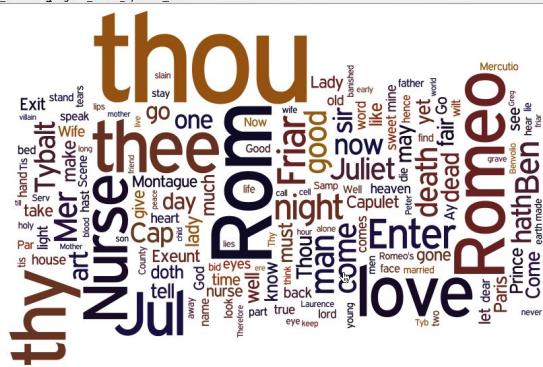
Anatomy of a search [query]

- <http://www.google.com/images?q=programming>
- **What comes after the question-mark in the URL?**
 - What is the query string?
 - 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?**

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?
- Our Survey?

What information is stored in the URL of the NYTimes site above?



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?

Towards a Program

- What steps are needed?
- What order should they be in?
- What kinds of things to test?

Why is programming fun?

Fred Brooks

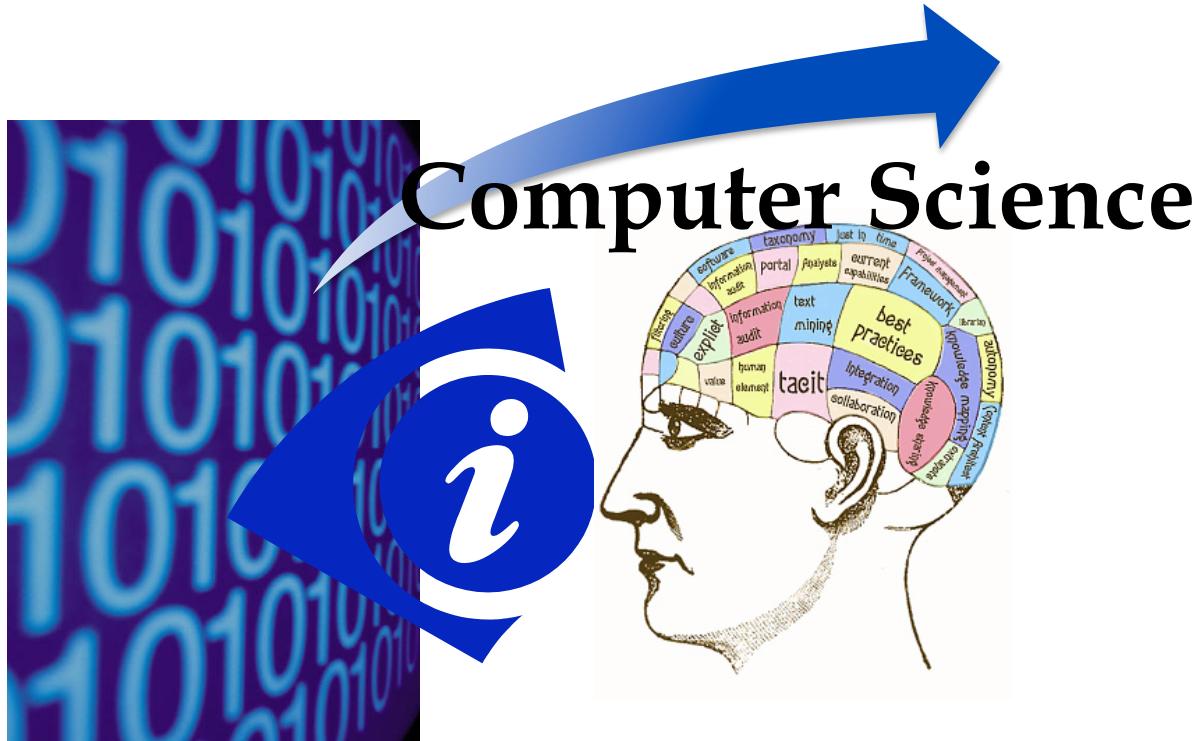
- First is the sheer joy of making things
- Second is the pleasure of making things that are useful
- Third is the fascination of fashioning complex puzzle-like objects of interlocking moving parts
- Fourth is the joy of always learning
- Finally, there is the delight of working in such a tractable medium.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



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)

Data into Information and Knowledge



Now - See What's Happening App
by Rahul Chaturvedi took CompSci 101 Fall 2012

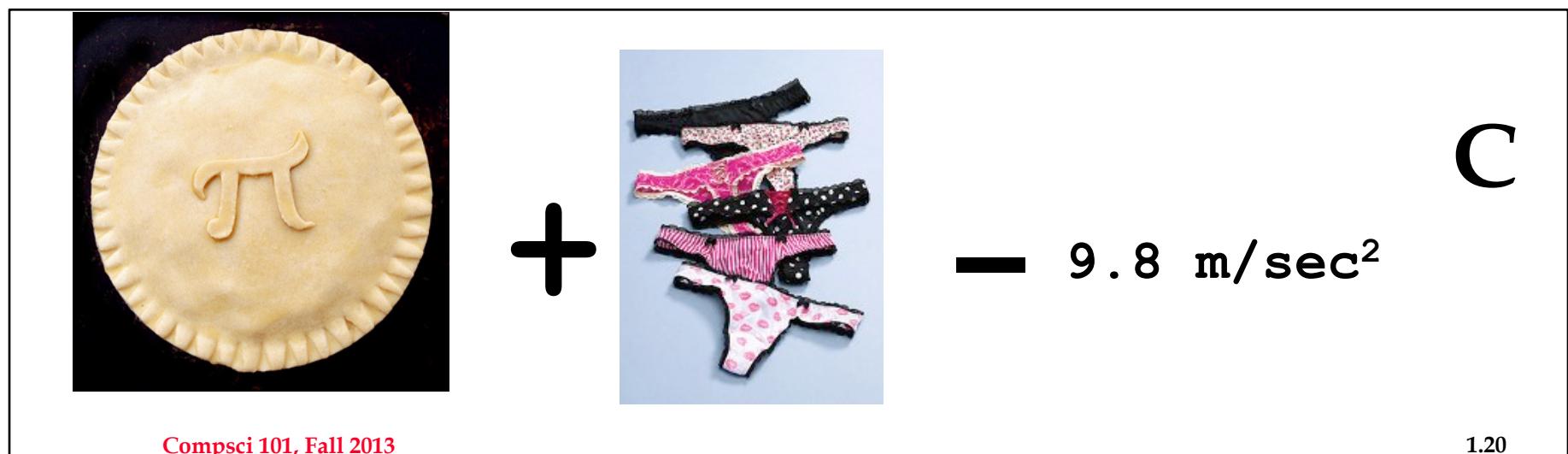
What language will we learn?

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



Why is it called Python?

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



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!

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