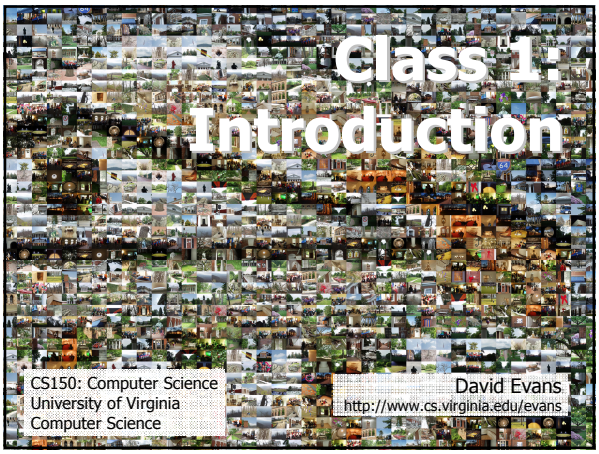


What is Computer Science?

Let *AB* and *CD* be the two given numbers not relatively prime. It is required to find the greatest common measure of *AB* and *CD*.

If now *CD* measures *AB*, since it also measures itself, then *CD* is a common measure of *CD* and *AB*. And it is manifest that it is also the greatest, for no greater number than *CD* measures *CD*.

Euclid's Elements, Book VII, Proposition 2 (300BC)

The note on the *inflected* line is only difficult to you, *because it is so easy.* There is in fact nothing in it, but you think there must be some grand mystery hidden under that word *inflected*!

Whenever from any point *without* a given line, you draw a long to any point *in* the given line, you have *inflected* a line *upon a given line.*

Ada Byron (age 19), letter to Annabella Acheson (explaining Euclid), 1834

What is the difference between Euclid and Ada?

"It depends on what your definition of 'is' is."

Bill Gates (at Microsoft's anti-trust trial)

Geometry vs. Computer Science

- Geometry (mathematics) is about *declarative* knowledge: "what is"
  - If now *CD* measures *AB*, since it also measures itself, then *CD* ***is*** a common measure of *CD* and *AB*
- Computer Science is about *imperative* knowledge: "how to"

Computer Science has little to do with beige (or translucent blue) boxes called "computers" and is not a real science.

Computer Science

"How to" knowledge:

- Ways of describing information processes (computations) — Language
- Ways of predicting properties of information processes — Logic

What kinds of things do we want to predict?

Science, Engineering, Other?

Science?

- Understanding Nature through Observation
  - About *real* things like bowling balls, black holes, antimatter, electrons, comets, etc.
- Math and Computer Science are about *fake* things like numbers, graphs, functions, lists, etc.
  - Computer Science is a useful tool for *doing* real science, but not a real science

Engineering?

"Engineering is **design under constraint**… Engineering is synthetic - it strives to create what can be, but it is constrained by nature, by cost, by concerns of safety, reliability, environmental impact, manufacturability, maintainability and many other such 'ilities.' ..."

William Wulf

Apollo Guidance Computer, 1969

1 Cubic Foot

Why did they need to fit the guidance computer in the rocket?

Measuring Computers

- 1 bit = smallest unit of information
  - True or False
  - 0 or 1
  - If we start with 2 possible choices, and get 1 bit, we can eliminate one of the choices

How much power?

- Apollo Computer: 30720 bits of changeable memory
- Lab machines have 512 MB (RAM)
  - 1 Megabyte = 1024 Kilobytes, 1 Kilobyte = 1024 Bytes, 1 Byte = 8 bits
  - 512 MB

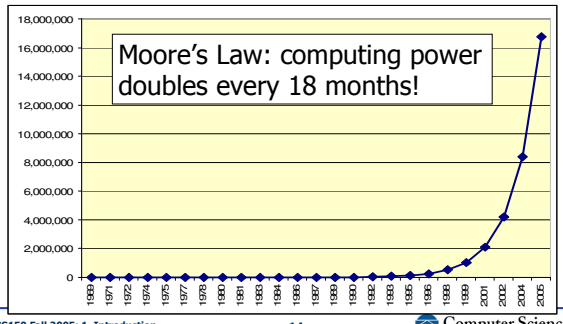
You will understand this notation soon…but don't worry if you don't now

```
> (* 512 1024 1024 8)
4294967296          ~ 4.3 Billion bits
> (round (/ (* 386 1024 1024 8) 30720))
139810
```

You have 105 404 times more power than AGC

If Apollo Guidance Computer power is 1 inch, you have 2.2 miles!

Computing Power 1969-2005 (in Apollo Control Computer Units)



Constraints Computer Scientists Face

- Not like those for engineers:
  - Cost, weight, physics, etc.
  - If ~8 Million times what people had in 1969 isn't enough for you, wait until 2007 and you will have 20 Million times…
- More like those for Musicians and Poets:
  - Imagination and Creativity
  - Complexity of what we can understand

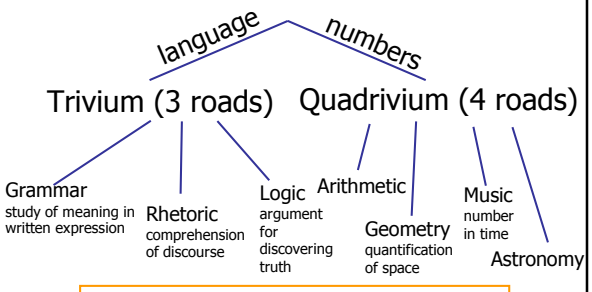
So, what is computer science?

- ~~Science~~
  - No: its about fake things like numbers, not about observing and understanding nature
- ~~Engineering~~
  - No: we don't have to deal with engineering-type constraints
- Liberal Art

Liberal Arts: ~1100

- Illiberal Arts
  - arts for the non-free: pursued for economic reasons
- Liberal Arts
  - arts for the *free*: pursued for intrinsic reasons

The Liberal Arts



We will see all of these in this class!

Course Expectations

Course Roadmap

Computer Science from Euclid and Ada } 1st Class
to } PS 1-5
Quantum Computing } Lecture
and } PS 6-7
the World Wide Web

Liberal Arts Illiberal Arts (Intellectual) ($$$$)

What You Should Expect

- The fourth (?) coolest class at UVa
  - Less cool than PHYE162, PHYE163, PHYE164
- This course will be consistent with the original notion of a Liberal Arts education
- This course will be as consistent as possible with Mr. Jefferson's vision for the University

You should expect these of **all** your classes!

Like Drinking from a Firehose

It may hurt a little bit, and a lot of water will go by you, but you won't go away thirsty!

Help Available

- Me: David Evans (Call me "Dave" or "Coach")
  - Office Hours will be posted (after your surveys)
  - Always available by email, if I don't reply in 24 hours, send again and complain
- Assistant Coaches: David Faulkner and Dan Upton
- Web site: http://www.cs.virginia.edu/cs150
  - ***Everything*** goes on the web, you should visit it often
- **Your classmates** (read the course pledge carefully!)

What I Expect of You

1. Everything on the Course Pledge
   - You should actually **read it** not just sign it (you will lose points on PS1 if your submission reveals that you didn't read it!)
2. You are a "Jeffersonian Student"
   1. Believe knowledge is powerful
   2. Interested in lots of things, ahead of your time
   3. Want to use what you learn to do good things
   4. Care more about what you learn than grades and degree requirements

Background Expected

- Language:
  - Reasonable reading and writing in English
  - Understanding of subject, verb and object
- Math:
  - Whole numbers, add, subtract, multiply, divide
  - Exponentiation, logarithms (we will review)
- Logic: *and*, *or*, *not*
- Computer Literacy: read email, browse web

If I ever appear to expect anything else, stop me!

A Course for Everyone!

- CLAS, SEAS, Commerce, Arch, etc.
- 1st, 2nd, 3rd, 4th, 5th Years, Community Scholars, Faculty
- No background expected…but challenging even for students with lots of previous CS courses (if you've already taken CS415 talk to me first)
- Computer Science (future-) majors…but worthwhile even if you don't take another CS course

Shameless Pitch

- We need more students in this class!
- Recruit your friends
- Recruit your enemies
- Recruit random CLAS students

I will course action anyone who comes Friday into the class.

First Main Theme: Recursive Definitions

What is the longest word in the English language?

According to Guinness

floccipoccinihilipilification

the act of rendering useless

Making Longer Words

antifloccipoccinihilipilification

the act of rendering not useless

antiantifloccipoccinihilipilification

the act of rendering useless

Language is *Recursive*

No matter what word you think is the longest word, I can always make up a longer one!

word ::= **anti-***word*

If you have a word, you can always make up a new word by adding **anti** in front. Since the result is a word, you can make a longer new word by adding **anti-** in front again.

Recursive Definitions

- We can define things in terms of themselves
- Recursive definitions are different from circular definitions: they eventually end with something real

word ::= **anti-***word*

word ::= **floccipoccinihilipilification**

Recursive Definitions

Allow us to express infinitely many things starting with a few.

This is powerful!

We will see **lots** of examples in this course.

Charge

- Before 5pm Thursday:
  - Registration survey (see course web site)
- Before Friday:
  - Read GEB p. 3-41
    - Anyone who can produce "MU", gets an automatic A+ in the course
  - Read SICP p. 1-21
- Don't floccipoccinihilipilificate

Thanks!

- 2003 CS 200 students, 2002 CS200 students, 2001 CS655 students
- 2002 Assistant Coaches: Jon Erdman, Dante Guanlao, Stephen Liang, Portman Wills
- 2003 Assistant Coaches: Rachel Dada, Jacques Fournier, Spencer Stockdale, Katie Winstanley
- 2004 Assistant Coaches: Sarah Bergkuist, Andrew Connors, Patrick Rooney, Katie Winstanley
- Guest Speakers: Radhika Nagpal (2002), Tim Koogle (2003)
- 6.001 teachers: Gerry Sussman, Bob Berwick
- CS Department: Jim Cohoon, Ginny Hilton, Anita Jones, John Knight, Worthy Martin, Chris Milner, Brenda Perkins, Gabe Robins, Mary Lou Soffa, Jack Stankovic
- Teaching Resource Center: Marva Barnett, Freda Fretwell
- 2001-2 UTF Fellows: Phoebe Crisman, John Lach, Debra Lyon, Emily Scida, Brian Smith, David Waldner; UTF Mentor: Judith Shatin
- Anna Chefter, Chris Frost, Thad Hughes, Jerry McGann, Shawn O'Hargan, Mike Peck