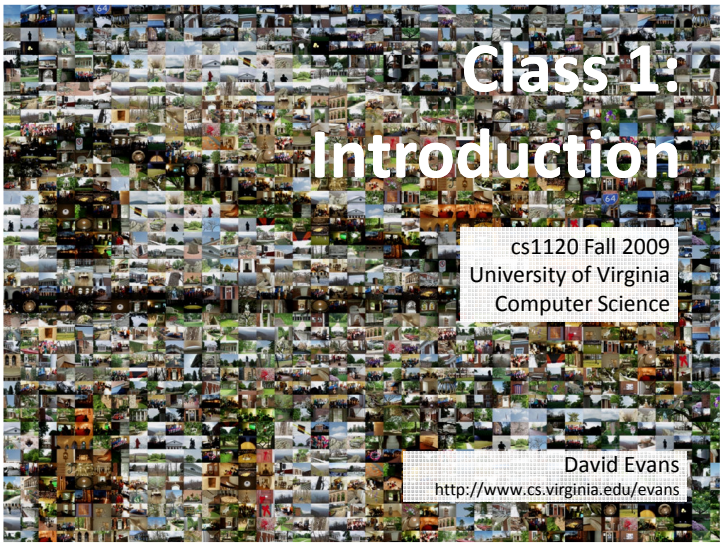
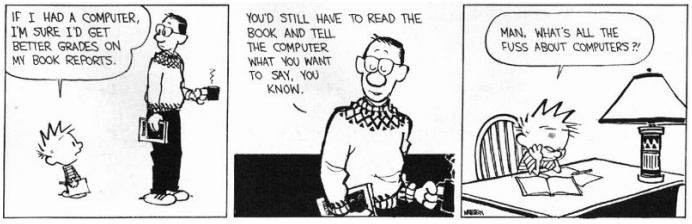


What is **Computer Science**?



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 Clinton)

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

"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?
- Ways of executing information processes — Machines

Outline

- What is Computer Science
- **Science, Engineering, Other?**
  - **Introduction to Information**
- Expectations for the Course

Science?

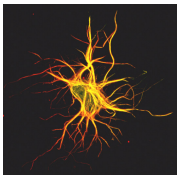
- Science is about **understanding nature through observation**
  - About *real* things like bowling balls, black holes, antimatter, electrons, comets, etc.
- Math and Computer Science are about *fake* things like numbers, graphs, functions, lists, etc.
  - Computer Science is a useful tool for *doing*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

Science

Alternate view: there is lots of interesting computation in nature

Plant Growth (ps3)

Evolution is (mostly) an information process



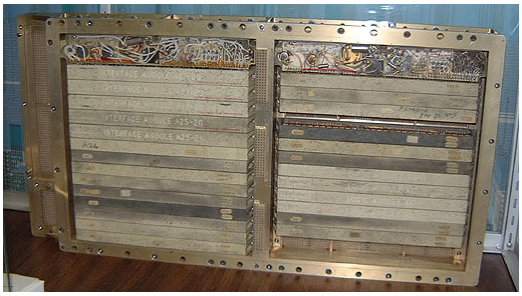
How do brains compute?

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 and George Fisher

Apollo Guidance Computer, 1969



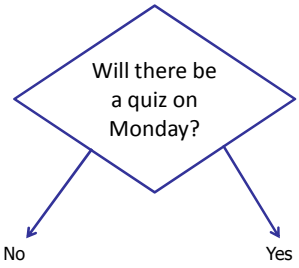
1 Cubic Foot

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

Measuring Computers

bit = smallest unit of information

If we start with 2 possible choices, and get one bit of information, we can eliminate one of the choices.



How much power?

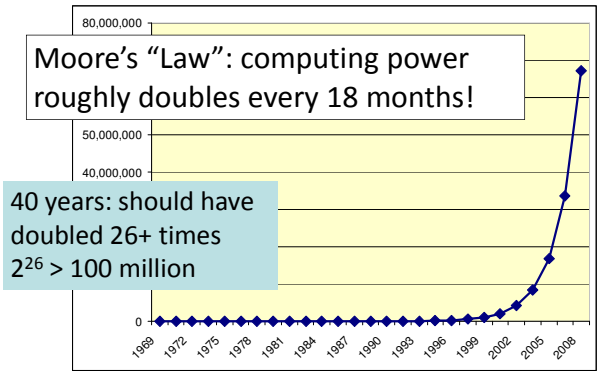
- Apollo Computer: 61440 bits of changeable memory
- Lab machines have (at least) 1 GB (RAM)
  - 1 Gigabyte = 1024 Megabytes,
    1 Megabyte = 1024 Kilobytes,
    1 Kilobyte = 1024 Bytes,
    1 Byte = 8 bits

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

```
> (* 1024 1024 1024 8)
8589934592                ~ 8.6 Billion bits
> (round (/ (* 1024 1024 1024 8) 61440))
139810                    You have 139 810 times more power than AGC
```

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

Computing Power 1969-2008 (in Apollo Control Computer Units)



Moore's "Law": computing power roughly doubles every 18 months!

40 years: should have doubled 26+ times
$2^{26} > 100$ million

Constraints Computer Scientists Face

- Not like those for engineers:
  - Cost, weight, physics, etc.
  - If ~20 Million times what people had in 1969 isn't enough for you, wait until 2011 and you will have 80 Million times…
- More like those for Musicians and Poets:
  - Imagination and Creativity
  - Complexity of what we can understand

Is there anything else that has improved like computing power in your lifetime?

So, what is computer science?

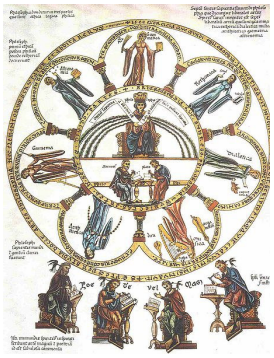
- ~~Science~~
  - No: its about fake things like numbers, not about observing and understanding nature
- ~~Engineering~~
  - No: we don't have to deal with engineering-type constraints
- Liberal Art

Liberal Arts: ~1100

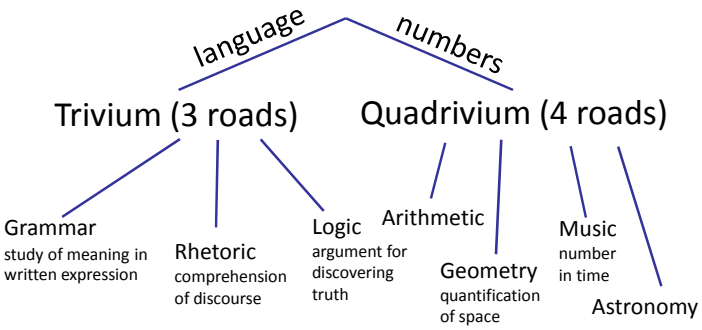
- **Illiberal** Arts

  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!

Outline

- What is Computer Science
- Science, Engineering, Other?
  - Introduction to Information
- **Expectations for the Course**

Course Roadmap

Computer Science from Euclid and Ada — Today

to — PS 1-6

Quantum Computing — Lecture

and — PS 8-9

the World Wide Web

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

Like Drinking from a Firehose

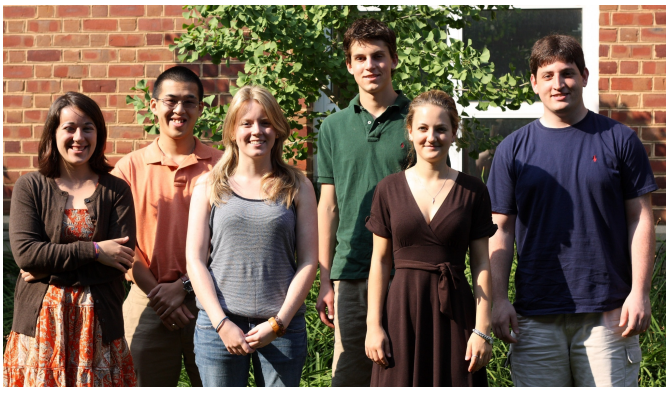
It may hurt a little bit, and a lot of water will go by you, but you won't go away thirsty!

Don't be overwhelmed! You will do fine.

Help Available

- Me: David Evans (Call me "Dave" or "Coach")
  - Office Hours
    - Tomorrow (Thursday): 9:30-10:30am and 1:30-2:30pm
    - Regular office hours will be scheduled after your surveys
  - By email, if I don't reply in 24 hours send again and complain
- Grad TA: Bill Stitson
- Assistant coaches: (next slide)
  - Help hours in Olsson 001, Small Hall, Thorton Stacks
  - Posted on website: first are tonight, 6-9pm in Olsson 001
- **Your classmates** (read the course pledge carefully!)

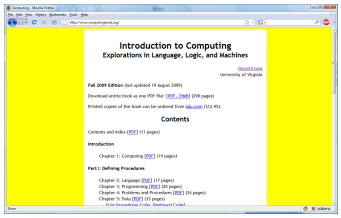
Assistant Coaches



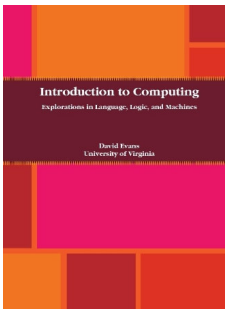
Michael Lew Ethan Fast Paul DiOrio

Rachel Lathbury Rachel Rater Rebecca Zapfel

Course Book



www.computingbook.org



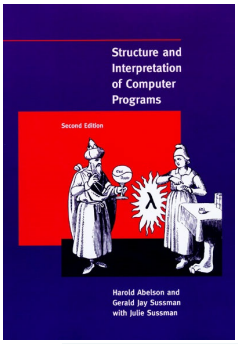
Printed by lulu.com

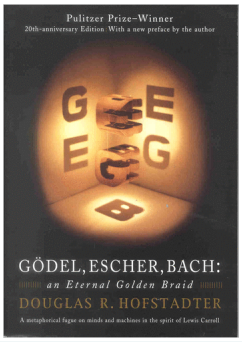
Available free on-line, but print for reading!

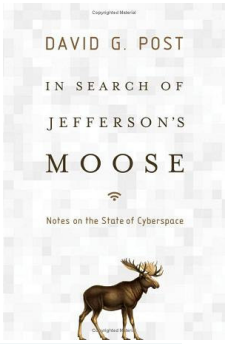
Help improve the book!

- Feedback
  - Things that are hard to understand
  - Parts that are boring to read
  - Any mistakes (including simple writing errors, but especially any technical errors)
- Solutions to exercises
- Design a real cover!

Other Books







Not required, but highly recommended!

Course Website/Blog

http://www.cs.virginia.edu/cs1120

Everything goes on the web, visit it often

Subscribe to RSS feeds

Register to submit comments

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:
  - 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.
- Pre-College, 1st, 2nd, 3rd, 4th, 5th Years, Community Scholars, University Professors
- No computing background expected…but challenging even for students with lots of previous CS courses
- Computer Science (future-) majors…but worthwhile even if you don't take another CS course

Charge

- **Before 11:59pm tomorrow (Thursday): Registration survey** (see course web site)
- **Before Friday's class:**
  - Read Course Book Chapters 1 and 2
  - Read and sign course pledge
- **Due next Wednesday:** Problem Set 1