

COS 109: Computers in our World

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- **TAs:**
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- see **Web page** for our office hours, or make an appointment
 - **LaPaugh today 3-4:30**
- *** fill out the survey, including your lab preferences!**
 - For our planning: you come to **any, all, or no sessions** any time
 - labs start next week
- **notes will be posted online before class (not everything)**

Today:

- **Administrivia**
- **Course overview**
 - what's in the news?
 - numeracy
 - topics
 - important basic ideas

Administration

- **Read [General Information Web page](#)!** Highlights:
 - Readings: ~1 hour each week, before class
(skim slashdot.org ~2 min/day)
 - 8 labs: 2-3 hours/week plus reading to prepare
 - 8 problem sets: 1-2 hours/week
read the collaboration policy on the web page
 - open-book take-home midterm during midterm week
 - open-book final exam in January
 - grading (approximately):
 - 20% labs + 20% problem sets + 20% midterm + 40% final
 - class participation helps; **frequent absences will definitely hurt**
- **Check [Announcements](#) and [Schedule and Assignments](#) Web pages daily!**

House rules

- *** please ask questions about anything at any time**
- please turn cell phones off
- you may take notes on your laptop, but please do it silently
- please stay away if you're sick !!!

A bit of numeracy

"Motorists who send or receive a text message have a tendency to take their eyes off the road for five seconds to do so. That is enough time for their car to travel more than the length of a football field at highway speeds."
(*New York Times*, 8/31/09)

Is this distance ...

- (1) much too high? (couldn't possibly travel that far)
- (2) much too low? (will travel much further)
- (3) about right? (say within a factor of two)

Course Topics

Course Topics: Technical

- **hardware**
 - how computers represent and process information
 - what's inside a computer, how does it work, how is it built?
- **software**
 - how we tell computers how to do things
 - a gentle introduction to programming in Javascript
- **communications**
 - how the Internet and Web work
 - threats and countermeasures: cryptography
- **systems / case studies**
 - putting things together:
search engines, peer to peer, ...

Course Topics: Social

Address while we consider technical topics

Concerns

- Privacy
- Intellectual property
- Security
- Access
- ...?????

Considerations

- Legal rights
- Social norms
- Economic impacts

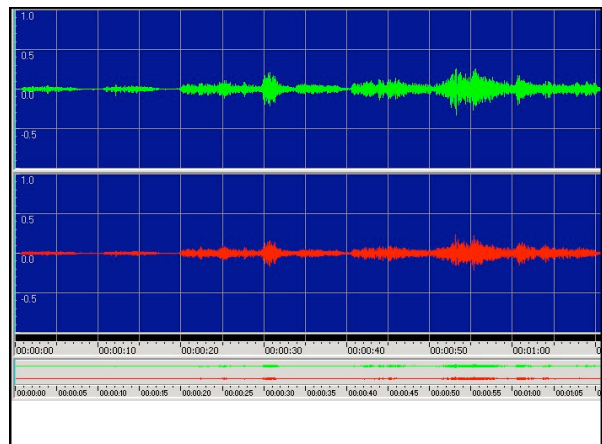
Important basic ideas

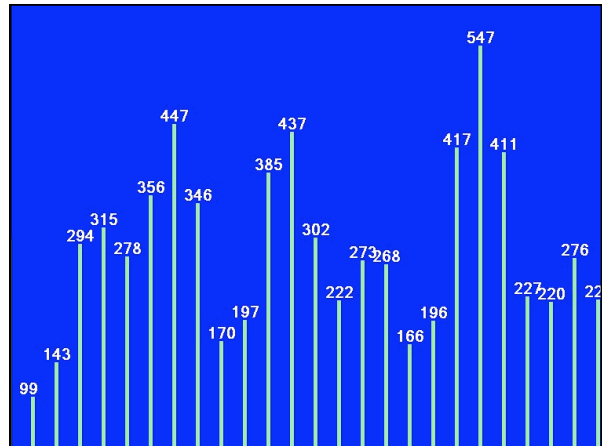
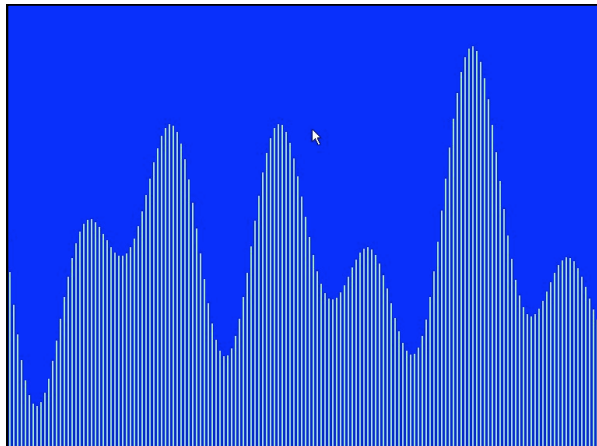
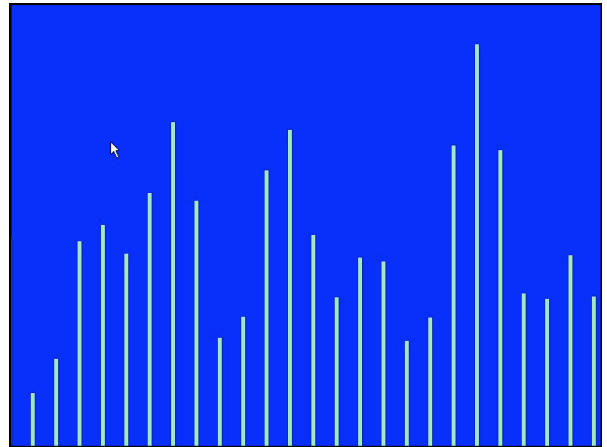
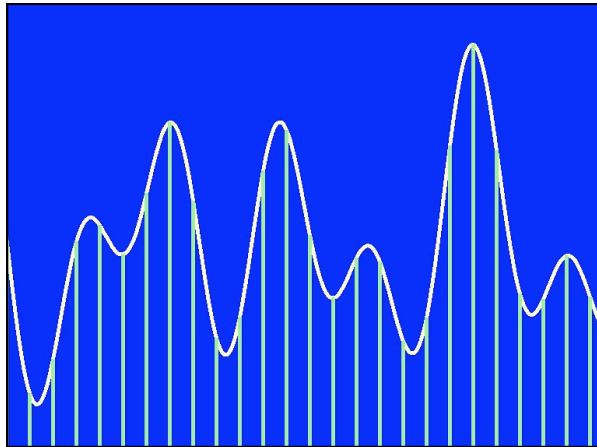
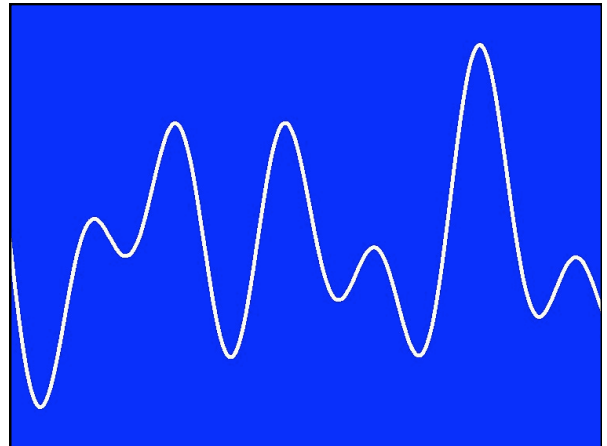
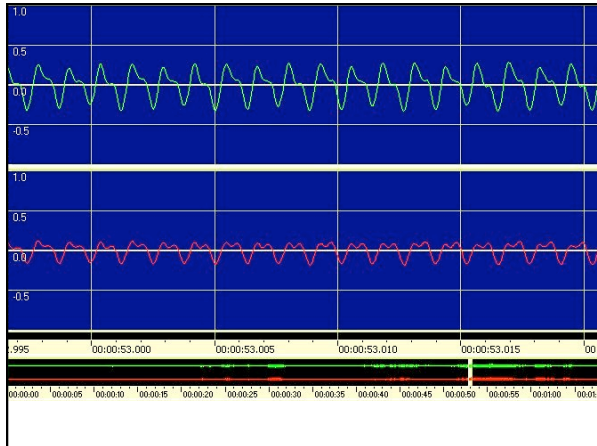
Four fundamental ideas

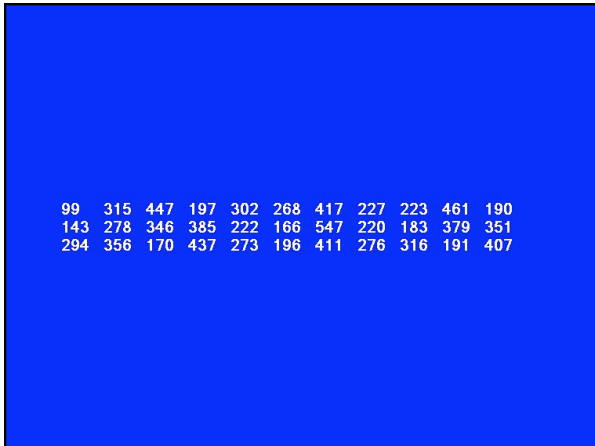
- **universal digital representation of information**
 - it's all just numbers
- **universal digital computer that processes information**
 - its instructions and its data are just numbers
- **universal digital network that carries information**
 - instructions, data and everything else are just numbers
- **universal availability of digital systems**
 - digital technology gets smaller, faster, cheaper all the time
- **and it's all changing very fast**

Its all just numbers ...

Music

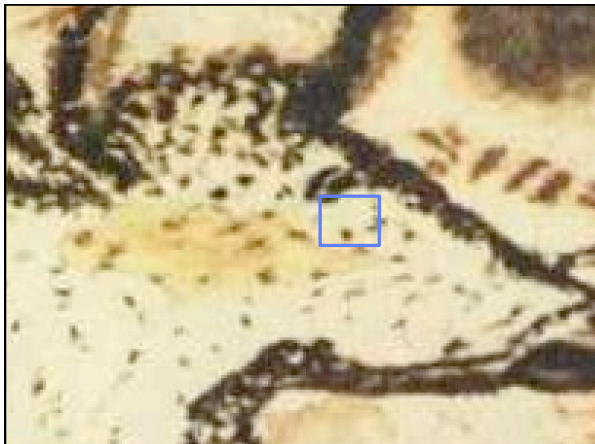


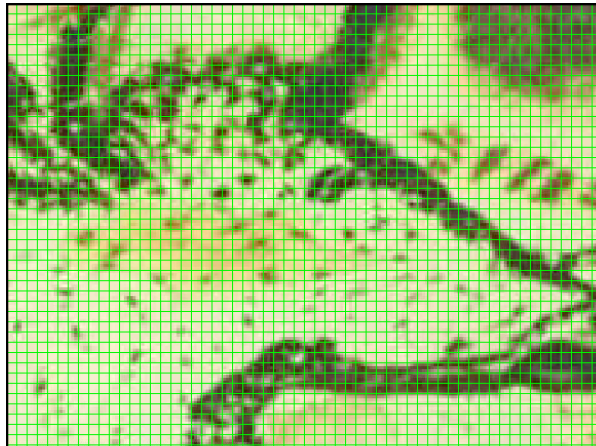




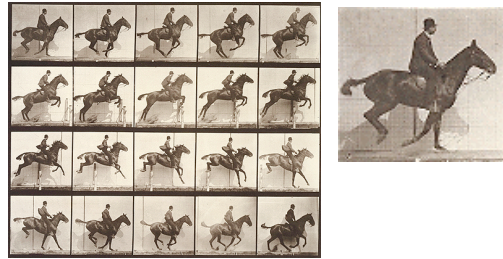
Its all just numbers ...

Pictures



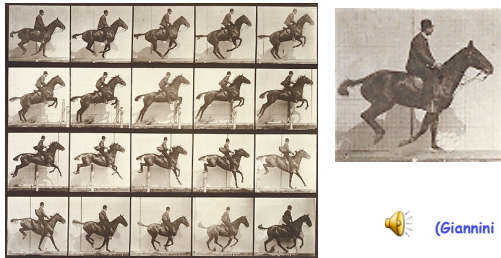


Movies = pictures



Eadweard Muybridge, ~1878

Movies = pictures + sound



 (Giannini Brass)

Eadweard Muybridge, ~1878

Universal digital representation

- Music is just numbers
- Pictures are just numbers
- Movies are just numbers
- TV and radio are just numbers
- Books and newspapers are just numbers
- Telephone calls are just numbers

They're all just numbers

Universal digital processor

- computers just process numbers
- computer memory stores the data to work on and the instructions that say what to do with the data
- computer programs are just numbers
- computers are general-purpose:
 - we can change what the computer does by storing different numbers in its memory

Universal digital network

- the Internet just carries numbers
- to and from universal digital processors
- it doesn't know or care what the numbers mean
- it's easy to build services on top of it
 - web, mail, chat, peer to peer, phone, movies
- it's hard to control what flows through it
 - it's just numbers

Universal availability of digital systems

- digital computers are everywhere
- connected to a digital network that's everywhere
- moving digital data everywhere
- available to everyone cheaply
- universal digital devices ("convergence")



social, legal, economic consequences

Some examples

Intellectual property

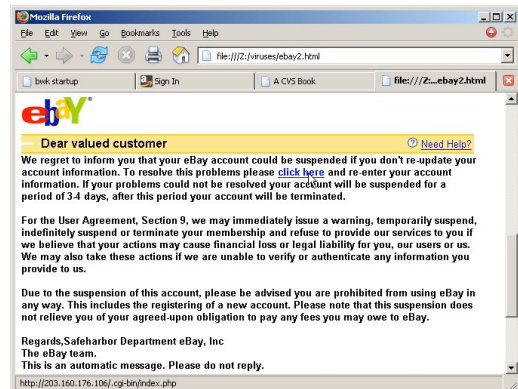
- music, movies, TV, etc., are all digital
 - copies are free, copies are perfect, distribution is free
- technically, it's impossible to prevent copying
 - cryptography, watermarking, etc., don't work
 - there is always the "analog hole"
- legally, it's difficult to prevent copying
 - sensible laws are hard to write
 - laws are different in different countries
 - many countries don't protect intellectual property

Privacy and Surveillance

- data for shopping, banking, taxes, ..., is all digital
 - public records are increasingly digital too
 - e.g., election contributions often include home addresses
- data about where you are and what you're doing is all digital
 - e.g., web use,
- all of this data is easy to collect, store, copy, analyze, sell, use for good or ill
- technically, it's impossible to control access
 - we're vulnerable to bugs, incompetence, stupidity, theft
- legally, in USA, we don't control data about ourselves
 - anyone can collect and sell anything about all of us
 - laws are different in different countries
 - some (but not all) countries are more restrictive

Security

- the universal network makes us vulnerable to strangers
 - the Internet has no geography
 - it's easy to lie about who you are and where you are
 - the bad guys are usually far away
- general-purpose computers are everywhere
 - "active content": web pages, email can contain programs
- leads to spam, phishing, viruses, spyware, botnets, ...
- it's impossible to control such programs



It's not just computers any more

- computers and networking are spreading into devices
- devices are increasingly powerful
- devices and systems are increasingly connected to the Internet

cell phones
cable TV
consumer electronics
cars
planes
medical systems
telephone, power and other infrastructure systems
weapons
...

So we should give up on the digital age?

- True
- False

- Lots of desirable functions from digital technology
- Couldn't go back even if we wanted to
- Understanding something about the technology helps us deal with issues

Course Goals

- **Understanding of how digital systems work**
 - principles, not just today's details
- **Some sense of the past and possible futures**
 - history, trends, potential, intrinsic limitations, tradeoffs
- **Some appreciation of computer science as a discipline**
 - great ideas, algorithms, limits of computers
- **Some understanding of consequences of the technology for societal issues**
 - legal, economic, personal
- **Useful quantitative reasoning**
 - numeracy: reasoning, estimation, plausibility, ...
 - judgment: do the numbers make sense?
- **Intelligent skepticism about technology**