COS 109 basic info

MASKS REQUIRED for now

- Brian Kernighan

  bwk@cs.princeton.edu www.cs.princeton.edu/~bwk

  office hours: right after class or make an appointment

– Archie McKenzie, archiem@princeton.edu, Wed & Sun 6-9

- web site: www.cs.princeton.edu/courses/archive/fall22/cos109

  (we won't use Canvas very much)

- please fill out the survey (link is also on web site)

  `https://forms.gle/cZYdW7xSdPMi3RfP6`

- first problem set is due midnight Wednesday Sep 14
- first lab is due midnight Sunday Sep 18

  (both are posted on course web page)

House rules

- turn off your phone and laptop
  - it helps to keep you and me engaged
- let me know if there's anything I can do to make this work better
- COVID precautions
  - for now, please be vaccinated, boosted, masked, socially distanced
- ask questions / make comments / ... about anything any time
- questions so far?

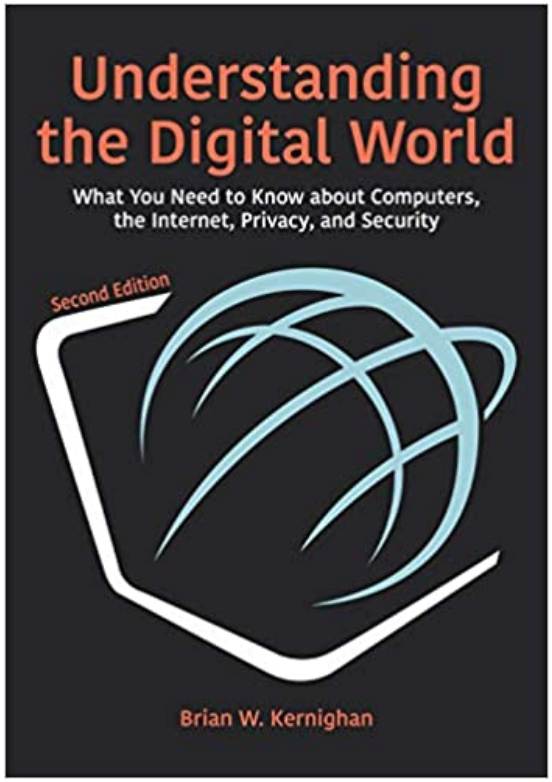
Administrivia (check the web page for updates!)

- notes will be posted online
  - but not everything will be in them or in the textbook
- readings: ~ 1 hour/week, before class
  - textbook readings are important; most others are cultural enrichment
- 8 problem sets: ~ 1-2 hours each
  - posted by Wednesday, due following Wednesday by midnight
- 8 labs: ~ 2-3 hours each, plus reading to prepare
  - posted by Sunday, due following Sunday by midnight
  - do the labs on your own, any time
- open-book take-home midterm during midterm week
- open-book take-home final exam during December exam period
- grading (*approximately*):

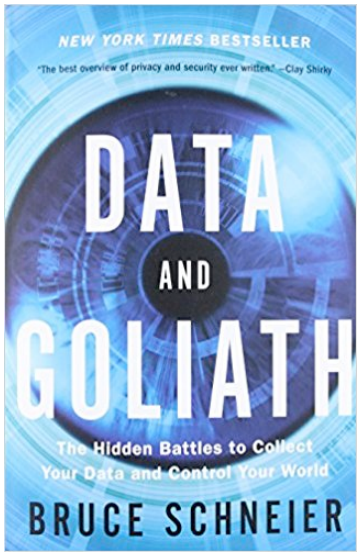
  20% problem sets + 20% labs + 20% midterm + 35% final + 5% participation
- regular attendance at lectures is required; participation helps

Textbook

- 2nd edition is definitely preferable
  - get the paperback version!
- 1st edition is ok



- good supplementary reading if you're interested in privacy and security =>



Course outline

- hardware (3-4 weeks)
  - how computers represent and process information
  - what's inside a computer, how it works, how it's built
- software (3-4 weeks)
  - how we tell computers how to do things
  - a very gentle introduction to programming in Python
- communications + data (3-4 weeks)
  - how the Internet and the Web work
  - machine learning, artificial intelligence
  - threats and defenses: privacy, security, cryptography
- along the way
  - current events, history, QR / QCR, ...

Hardware: tangible devices and gadgets

- how computers represent and process information
  - universal digital representation of information:
    everything is represented as numbers
  - bits, bytes, binary

- a computer is a universal digital processor
  - it stores data and instructions in the same memory
  - the instructions are numbers
  - it's a general purpose machine:
    change the numbers and it does something different
  - your phone is a computer

- hardware has been getting exponentially smaller, cheaper, faster for ~60 years

Software: telling computers what to do

- algorithms
  - precise sequences of steps to perform various tasks
  - what's possible, what's feasible, what's efficient
    some problems are intrinsically very hard (we think)

- programs and programming
  - implementation of algorithms to be run on a computer
  - programming languages: how to express the steps
  - real programs: operating systems and applications

- software intellectual property issues
  - patents, copyrights, standards, ...

Communications: computers talking to each other

- the Internet is a universal digital network
  - depends on protocols, standards, agreements, cooperation
- we can easily communicate with people anywhere
  - we are visible to and accessible by strangers everywhere
- information passes through many sites
  - where it can be inspected, modified, blocked, slowed down, …
- personal privacy and security are at risk
  - tracking, data aggregation, surveillance (government and commercial)
  - phishing, identity theft, ...
  - viruses, worms, bots, hijacking, trolls, disinformation, ...
- everything on the Internet is vulnerable
  - cyber attacks
  - Internet of Things

It's not just computers

- computers and networking are spreading into devices
- devices are increasingly powerful
- devices and systems are increasingly connected to the Internet: "Internet of Things"

phones
games, toys
consumer electronics: Alexa et al, smart TVs, Fitbit, Ring, Nest, ...
cars (self-driving or not)
planes
medical systems and devices
infrastructure: phones, power, transportation, manufacturing, ...
weapons
...

Privacy

- data about shopping, banking, location, taxes, ..., is all digital
  - public records are increasingly digital too
    e.g., election contributions often include home addresses

- data is easy to collect, store, copy, analyze, sell

- 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 (and they do)
  - laws are different in different countries (e.g., European Union GDPR)

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
  - web pages and email can contain programs
  - phone apps often contain spyware and malware

- leads to spam, phishing, viruses, spyware, ransomware, ...
  - tracking and surveillance by governments and businesses
  - theft by criminals everywhere

- it's impossible to control such programs
  - and to eliminate tracking and surveillance,
    trolling, fake news, influencing

Goals of the course

- understanding how digital systems work
  - hardware, software, communications
  - representation, processing, storage, transmission of information
  - principles, not just today's details and buzzwords
  - a handful of useful skills

- 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, capabilities and limits of computers
  - and its usefulness in other academic fields

- useful QCR
  - numeracy: reasoning, estimation, assessing numbers, ...
  - judgment: do the numbers make sense? are they plausible?
  - enough programming that it's not a mystery

- intelligent skepticism about technology