# COS 109
# Computers in our World

Lecture 1

# Outline for today

- boring administrative stuff
  - schedule, psets, labs, grading, textbook, mechanics, ...
- course overview
- (maybe a bit of quantitative reasoning)
- A reminder:

  Parts of this course are being recorded for people who can't attend in real time.

  Recordings will be deleted after a couple of weeks. Don't plan on binge-watching at the end of the semester.

  (It would probably be bad for your mental health anyway.)

# Basic info

- Brian Kernighan
  bwk@cs.princeton.edu  www.cs.princeton.edu/~bwk
  office hours: temorarily, right after class
  or make an appointment with wase.princeton.edu or by email
  TGIF Friday 5pm?

- course assistants:
  Francisca Weirich-Freiberg '21 (fsw2@), Abby Gupta '22 (amgupta@)

- web site:  www.cs.princeton.edu/courses/archive/fall20/cos109
  (Canvas is mostly for recordings and links to other places)

- please fill out the survey (on Canvas and web site, or forms.gle/cZYdW7xSdPMi3RfP6)
- first problem set is due midnight Thursday Sep 10
- first lab is due midnight Sunday Sep 13

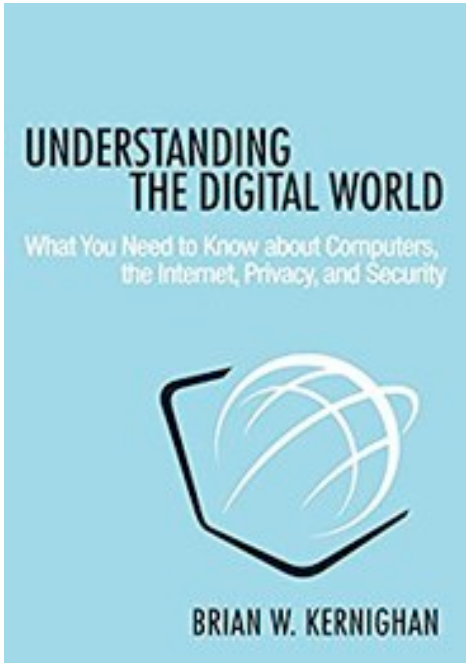
# Administrivia (check the web page for updates!)

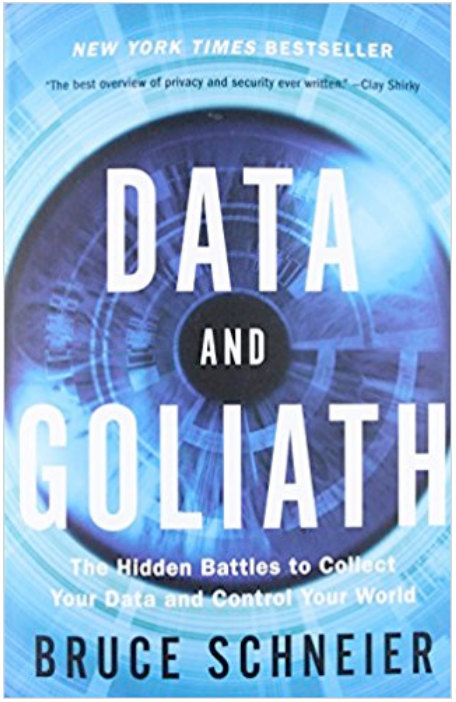
- notes will be posted online ahead of time
  - but not everything will be in them or in the textbook
- readings: ~ 1 hour/week, before class
- 7 problem sets: ~ 1-2 hours each
  - posted Wednesday, due following Thursday midnight
- 7 labs: ~ 2-3 hours each, plus reading to prepare
  - posted by Saturday, due following Sunday midnight
  - do the labs on your own, any time
- open-book midterm during midterm week
- open-book 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

- I will distribute a PDF draft of the new edition soon.
- It's not yet frozen: comments are welcome.
- good supplementary reading if you're interested in privacy and security =>

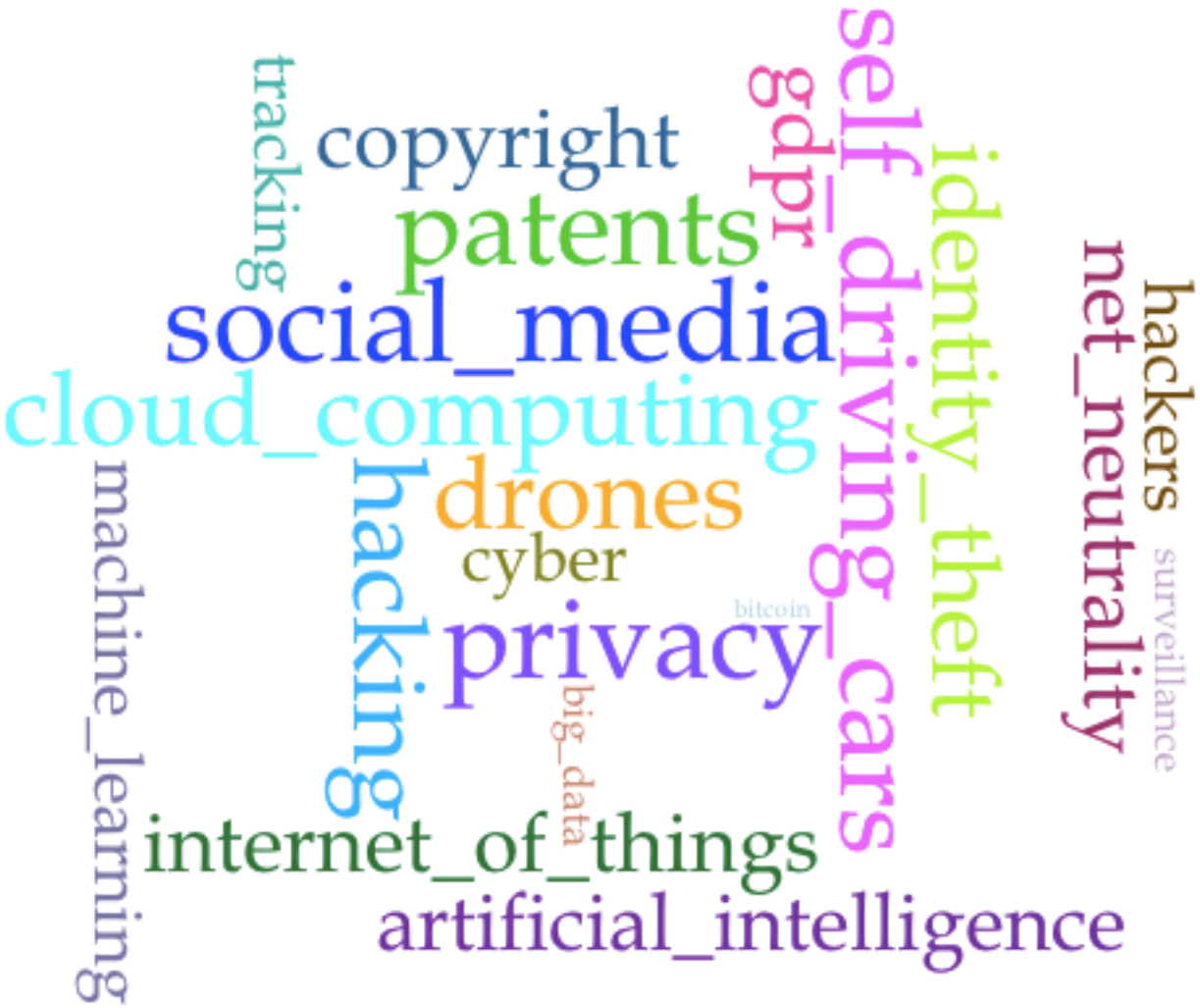


# House rules

- turn on your video if at all possible (backgrounds are fine)
  - it helps to keeps you and me engaged
- ask questions about anything any time
  - raise your real or virtual hand, speak up, or use chat
- let me know if there's anything I can do to make this work better
  - directly, or via Abby and Francisca

# Buzzwords!


tracking
copyright
patents
gdpr
self_driving_cars
identity_theft
hackers
net_neutrality
surveillance
social_media
cloud_computing
drones
machine_learning
hacking
cyber
bitcoin
privacy
big_data
internet_of_things
artificial_intelligence

# Some of this year's buzzwords

- social media
- fake news, disinformation
- facial recognition
- privacy, surveillance, tracking
- cloud computing, big data
- artificial intelligence, machine learning
- hackers, hacking
- ransomware
- GDPR, CCPA
- big tech, antitrust
- cyber-[everything]
- self-driving cars
- Internet of Things
- robocalls
- drones

# Things to notice

- pervasive computer systems; we depend on them completely
- complicated mixture of legal, political, economic, social issues

- running themes:
  privacy & security
  money & property
  rights: individual, government, corporations
  jurisdiction: who gets to decide

- things are changing at a rapid rate
  - Google is 22: founded in Sept 1998
  - Facebook is 16: founded in 2004
  - Twitter is 14: founded in 2006
  - iPhone is 13: appeared in 2007
  - Instagram is 10: Oct 2010
  - Zoom is 9: April 2011

# 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 Javascript and Python

- communications + data (3-4 weeks)
  - how the Internet and the Web work
  - big data, 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 smaller, cheaper, faster exponentially for 50+ 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, ...
cars (self-driving or not)
planes
medical systems
infrastructure:  telephone, power, transportation, ...
weapons
...

# 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 quantitative reasoning
  - numeracy:  reasoning, estimation, assessing numbers, ...
  - judgment:  do the numbers make sense?  are they plausible?

- intelligent skepticism about technology