CS 208e
Computers and Ethics
Tuesday, December 4th, 2018
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What are ethics?

What do we mean when we say “ethics”?
What are some of the issues that computer scientists / engineers / scientists need to think about with regard to ethics in the field?

Alt text: I mean, it’s not like we could just demand to see the code that’s governing our lives. What right do we have to poke around in Facebook’s private affairs like that?
Who owns your data?

https://www.youtube.com/watch?v=y1txYjoSQQc
Big Companies

Where does responsibility lie with big companies?
“As soon as we started programming, we found to our surprise that it wasn’t as easy to get programs right as we had thought. Debugging had to be discovered. I can remember the exact instant when I realized that a large part of my life from then on was going to be spent in finding mistakes in my own programs.”

Maurice Wilkes, 1913-

Maurice Wilkes, lecture on “The Design and Use of the EDSAC,” September 23, 1979
The Inevitability of Bugs

Simply because of its inevitable large size, the software capable of performing the battle management task for strategic defense will contain errors. All systems of useful complexity contain software errors.


Although programming techniques have improved immensely since the early days, the process of finding and correcting errors in programming known graphically—if inelegantly—as debugging still remains a most difficult, confused and unsatisfactory operation. . . . Although we are happy to pay lip-service to the adage that to err is human, most of us like to make a small private reservation about our own performance on special occasions when we really try. It is somewhat deflating to be shown publicly and incontrovertibly by a machine that even when we do try, we in fact make just as many mistakes as other people. If your pride cannot recover from this blow, you will never make a programmer.

— Christopher Strachey, Scientific American, 1966
What Makes Computing Different?

- Computers are used to solve hard problems, which means that the difficulty is typically intrinsic to the application.
- Software has high “system complexity” and is therefore difficult to distribute among members of a large team.
- Bugs are omnipresent and inevitable.
- Software systems are discrete rather than continuous: there is no way to “overengineer” such systems to ensure correctness.
- Software systems are inherently chaotic: small changes in initial conditions generate massive changes in the results.
- The economics of software systems means that even flawed products can have tremendous economic value.
The Importance of Economics

- Economics has more impact on directions in modern computing than technology does. The most significant factors are:

  - Low distribution costs. Software is expensive to produce, but essentially free to duplicate and distribute. Because development costs can be distributed across a larger base, big players have a distinct advantage.
  
  - Network externalities. The value of software increases with the number of people using that software.
  
  - High cost-effectiveness. Software tends to be remarkably useful, even when bugs exist.
  
  - Shortage of highly skilled labor. Individual Productivity varies widely among software developers. Demand is high for the most productive programmers, but the supply is extremely limited.
Variations in Programmer Productivity

• In 1968, a study by Sackman, Erikson, and Grant\(^1\) revealed that programmers with the same level of experience exhibit variations of more than 20 to 1 in the time required to solve particular programming problems.

• More recent studies\(^2, 3, 4\) confirm this high variability.

• Most industry insiders believe that the productivity variance is even higher today. In 2005, Google’s VP for Engineering, Alan Eustace, told The Wall Street Journal that one top-notch engineer is worth 300 times or more than the average.\(^5\)


Therac-25: The Killer Machine

https://blog.bugsnag.com/bug-day-race-condition-therac-25/

Race Condition example:

```
if (x == 5) // the “check”
{
    y = x * 2; // the “act”

    // if another thread changed x in between “if (x==5)”
    // and “y = x * 2” above, y will not be equal to 10.
}
```
Patriot Missile
Patriot Missle: Binary Calculation Error

- Floating point numbers
- The binary expansion of $1/10$ is $0.00011001100110011001100110011001100110011001100...$
- 24 bit register in the Patriot stored instead $0.00011001100110011001100110011001100$
- An error $0.0000000000000000000000011001100...$ binary, or about $0.000000095$ decimal

Cost: 28 soldiers died, 100 injured
Patriot Missile: The Range Gate

Figure 2-12  Effect of conversion error on range gate calculation.
What can / should we do about malicious programmers?
What should we expect / demand from our government?
The Government: Whistleblowers

Is whistleblowing the answer?

Edward Snowden
American computer professional

Edward Joseph Snowden is an American computer professional, former Central Intelligence Agency employee, and former contractor for the United States government who copied and leaked classified information from the National Security Agency in 2013. Wikipedia
The Government: Police and Tech

Apple vows to resist FBI demand to crack iPhone linked to San Bernardino attacks

What are the ethical issues around tech and privacy?
Germany surveillance: Security trumps privacy as video bill passed

What are the ethical issues around tech and privacy?

Public video surveillance appears set to become more commonplace in Germany after the lower house of parliament approved a package of new measures.
Stanford to step-up teaching of ethics in technology

University that helped spawn Silicon Valley responds to criticism of tech industry

Marc Tessier-Lavigne: ‘We are thinking through the ethics and impact of technological advances.’

Andrew Jack and Hannah Kuchler June 3, 2018

The university at the heart of Silicon Valley is to inject ethics into its technology teaching and research amid growing criticism of the excesses of the industry it helped spawn.

The board of Stanford University, one of the world’s richest higher education institutions with an endowment of $27bn, will meet this month to agree funding and a plan to implement the findings of an internal review that recommends a new initiative focused on “ethics, society and technology” and improved access to those on lower incomes.

https://www.ft.com/content/a374fdac-6589-11e8-90c2-9563a0613e56
Tech’s Ethical ‘Dark Side’: Harvard, Stanford and Others Want to Address It


Laura Norén, who teaches a data science ethics course at New York University, said, “You can patch the software, but you can’t patch a person if you, you know, damage someone’s reputation.”

Sam Hodgson for The New York Times