

Computing and Society I



Admin



- Questions?
- Quizzes return XXX

Course outcomes



- Let's look at the syllabus for the course outcomes

Course outcomes



- Let's look at the syllabus for the course outcomes
 - We've covered most of them.
 - But some completely untouched
 - Recursion
 - Simple algos incomplete
 - Functions from fundamental syntax
 - Computers and Society
 - So let's fix that – at least for one of them
- Oh and yes – it is on the outcomes, so it will be on the quizzes/exams

Ethics and Responsibility



- In Math/Science discipline like computer science
 - easy to focus on getting the program right
 - but also need to consider the program itself.
 - In age of computerized everything
 - do we really want all functions computerized.
 - for those that are, what are the risks
 - What are the (unintended) consequences?

The rent Algorithm



- A company created an algorithm to help landlords set rents to the maximum amount the market would bear.
- <https://www.propublica.org/article/yieldstar-rent-increase-realpage-rent>
- In the old days
 - Want to see if you should raise rent? Call around pretending to be a potential renter.
 - Now plug your apartments into the rent algorithm like so many others and it will tell you.
 - The money quote: “One of the algorithm’s developers told ProPublica that leasing agents had “too much empathy” compared to computer generated pricing.”

Ethics and legality



- This is not always easy – because unethical and illegal are not always the same
 - <https://medium.com/free-code-camp/the-code-im-still-ashamed-of-e4c021dff55e>
 - Summary: young man gets good job building software quiz for drug company that pushed company's drug
 - Quiz site is aimed at teen-aged girls
 - Company's drugs most common side effects were guess what?

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 - Summary: young man gets good job building software quiz for drug company that pushed company's drug
 - Quiz site is aimed at teenaged girls
 - Company's drugs most common side effects were guess what?
 - "It turned out that among the main side effects of that drug were severe depression and suicidal thoughts."
- Tell Story of a middle aged students blackballed from industry and he had to move here

Bugs



- computer complexity
 - bugs a fact of life
 - MS windows
 - Monthly updates - > irregular updates.
 - Linux& unix (including Mac)
 - irregular updates.
 - Steam
 - Games and apps, update required?
 - live with bugs in some things
 - but not others.
 - like what?

Therac-25: The first software assisted Deaths



- Therac-25 total computer problem.
 - radiation treatment machine
 - successor to previous machines developed as joint venture.
 - completely software controlled.
 - previous versions of software designed for previous machines
 - prev machines had hardware safeties.
 - operator types x (x-ray), then e (low powered electron beam), system reports ready, operator says go
 - system says error (usually means dose not administered)
 - operator tells it to try again.

Therac-25 Interface



- https://upload.wikimedia.org/wikipedia/commons/9/90/The_rac25_Interface.png
-

PATIENT NAME: John		BEAM TYPE: E		ENERGY (KeV):		10
TREATMENT MODE: FIX						
		ACTUAL		PRESCRIBED		
UNIT RATE/MINUTE		0.000000		0.000000		
MONITOR UNITS		200.000000		200.000000		
TIME (MIN)		0.270000		0.270000		
GANTRY ROTATION (DEG)		0.000000		0.000000		VERIFIED
COLLIMATOR ROTATION (DEG)		359.200000		359.200000		VERIFIED
COLLIMATOR X (CM)		14.200000		14.200000		VERIFIED
COLLIMATOR Y (CM)		27.200000		27.200000		VERIFIED
WEDGE NUMBER		1.000000		1.000000		VERIFIED
ACCESSORY NUMBER		0.000000		0.000000		VERIFIED
DATE: 2012-04-16		SYSTEM: BEAM READY		OP.MODE: TREAT		AUTO
TIME: 11:48:58		TREAT: TREAT PAUSE		X-RAY		173777
OPR ID: 033-tfs3p		REASON: OPERATOR		COMMAND: █		

But the Therac-25 was a long time ago



- Therac-25 was a story about
 - how a company fundamentally changed a hardware product which looked to its users like the same product
 - The company used (buggy) software to try to bridge the gap.
 - And that was a long time ago – every (ABET accredited or ACM compliant) CS program covers this, so we learned our lesson right?

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 - And that was a long time ago – every (ABET accredited or ACM compliant) CS program covers this, so we learned our lesson right?
 - Then why does that story sound familiar to us today?
 - Think of a problem from about 6-7 years ago?
 - Different hardware – ‘papered over’ with software leading to death and disaster?
 - In aviation this time

But the Therac-25 was a long time ago



- Therac-25 was a story about
 - how a company fundamentally changed a hardware product which looked to its users like the same product
 - The company used (buggy) software to try to bridge the gap.
 - Why should that sound familiar to us today?
 - Boeing 737 Max

Boeing 737 Max



- Boeing 737
 - Entered airline service 50+ years ago in 1968
 - Has been a workhorse ever since
 - Boeing 737 Max
 - Entered airline service in 2017
 - Looks like a 737 in many ways (body is the same)
 - Much bigger engines - Flies completely differently
 - Has computer assist flying
 - Really doesn't like to give pilots control when a sensor fails.
 - Fatal software assisted crashes in 2018 and 2019
 - Same fundamental problem 35 years later
-

British Postal Scandal



- British postal software led to wrongful prosecution of at least 1000 people over at least 13 years
 - And likely more than 10,000 were improperly fined.
 - <https://archive.md/20250711010254/https://www.nytimes.com/2025/07/10/world/europe/uk-post-office-scandal-report.html>
 - Described as one of the worst miscarriages of justice in British history
 - Software rolled out in 1999 (alleged that software devs knew of problems then)
 - By 2000 first “problems balancing the books” reported.
 - Postal service tells each postmaster/assistant complaining that “they are the only one”
 - By 2013 Members of Parliament start investigating
 - In 2020 a formal investigation starts
 - In 2025, 166 page report of damning evidence implicates developers at the software shop and Postal management for destroying lives (including at least 13 suicides)

Software Disasters with CS1 Understandable Causes



- 1991: Early Patriot Missile Failure
- 1996: ESA loses rocket
 - <http://www.ima.umn.edu/~arnold/disasters/ariane.html>
- 1998: NASA Mars orbiter fails – crashes into mars
<http://www.jpl.nasa.gov/news/releases/99/mcoloss1.html>
- 2016 internet outage in much of east coast US
- Some of these are pretty old, but not as old as the Therac-25 when Boeing managed to repeat history

Patriot Missal Failure



- 1991 Gulf war I
 - summary: Patriot Missile battery in Dharan, Saudi Arabia, failed to track and intercept incoming Iraqi Scud missile. Scud struck an Army barracks, killing 28 soldiers and injuring around 100 other people
 - cause: small rounding error caused by representing fraction $1/10$ in binary (repeating number in binary)
 - hardware had counter that counted number of tenths of a second since bootup. Get current time by counter * $1/10$
 - time needed to predict where scud should be at current time.
 - battery had been on alert for 100 hours, error was .34 seconds
 - in that time the scud traveled close to half a mile.

ESA Loses Rocket



- On June 4, 1996:
 - unmanned Ariane 5 rocket launched by the European Space Agency exploded just forty seconds after its lift-off
 - rocket on its first voyage,
 - cost:
 - a decade of development costing \$7 billion.
 - rocket and its cargo valued at \$500 million.
- cause of the failure
 - software failure
 - 64 bit floating point number relating to the horizontal velocity of the rocket was converted to a 16 bit signed integer
 - value was greater than 32,767
 - Python just makes a bigger type of number, but that is why it is too slow for rocket science

Mars Orbiter Crashes



- Units Units Units
 - Mars Orbiter crashes
 - Cause: two teams, two states, two sets of units
 - California team: This is NASA, we are in the United States, of course we are using feet and pounds
 - Colorado team: This is science, of course we are using newtons and meters
 - As you know, when passing an argument to a function, no units attached – just a number
 - So splat.

2016 Internet outage in Eastern US



- 2016 internet in much of eastern US down for afternoon
 - Cause, thousands of compromised IoT devices used to DDOS the name servers
 - DDOS?

2016 Internet outage in Eastern US



- 2016 internet in much of eastern US down for afternoon
 - Cause, thousands of compromised IoT devices used to DDOS the name servers
 - DDOS? Distributed Denial of Service attack
 - Basically they were asking “what is the number for this server?” so much that the name servers couldn’t keep up.
 - Root cause: tens of thousands of small devices like ring doorbells and internet enabled fridges that had never changed the default password and got ‘hacked’
- Fix since then: don’t let customers use all the features of their devices till they change the passwords.

Preventative Hacking



- Sometimes we cause the crash to keep it from happening in the wild
- <https://www.wired.com/story/how-30-lines-of-code-blew-up-27-ton-generator/>
- 30 lines of python blows up a generator

Small selection



- Small selection of major software and human interaction glitches
 - some worse than others
 - Some cherry-picked to be understandable by CS1 students
 - some situations need to be more careful than others.
 - Many are from a while ago.
 - software better?
 - maybe just more declassified from a while ago.
 - Look at the generator blow up – the demo happened in 2007 but it wasn't made public till 2020
- And of course next

Log4j (log4shell)



- Log4j
 - Small open source logging library for java
 - Maintained by 3 unpaid volunteers in their spare time
- Dec 2021, vulnerability discovered as Minecraft server hack
 - Discuss logging
 - Deeper look for those interested:
<https://news.sophos.com/en-us/2021/12/17/inside-the-code-how-the-log4shell-exploit-works/>
 - What could go wrong?

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 - What could go wrong?
 - <https://www.express.co.uk/life-style/science-technology/1539451/log4j-vulnerability-empty-victims-bank-accounts>
 - <https://www.politico.eu/article/belgium-defense-ministry-hit-with-cyberattack/>
 - Belgium in Dec 2021 – what happened 2-3 months later?

Chase Bank 'infinite money glitch'



- Aug-Sept 2024 chase bank ATMs are vulnerable to check fraud
 - Failure of Software Engineers (CS) and Software Security Professionals (Cyber)
 - ATMs accepts fraudulent checks, don't contact the issuing bank to make sure the funds exist, and then immediately make cash available to dispense
 - <https://www.yahoo.com/news/chase-says-viral-bank-glitch-trend-is-actually-fraud-a-cybersecurity-expert-explains-why-financial-hacks-that-seem-to-o-good-to-be-true-usually-are-213629242.html>

Shai-Hulud Malware on ctrl/TinyColor



- In Sept 2025 we had the Shai-Hald (sha1-hulud) Malware attack
 - Lets get one of the cyber security folks to tell us what happened
 - Since it was a few weeks ago.

Shai-Halud Malware on ctrl/TinyColor



- In Sept 2025 we had the Shai-Halud Malware attack
 - A contributor to a npm (the main javascript/web programming package manager) package had access to a github repository with a *secret* token to publish several packages to NPM.
 - The contributor used this to publish a corrupted version of TinyColor (2million downloads a week) and about 40 lesser used npm packages.
 - When installed as part of a web developer's toolchain, these infected packages would scan the local machine for more secrets and push them to a remote website.
 - The whole thing was an issue for a bout 12-24 hours. The extent of the lost secrets/tokens is unclear as of Sept 17 2025

Cyber Security and SBOMS



- What are SBOMs
 - Especially you cybersec folks
 - Though you haven't met them formally in courses yet

Cyber Security and SBOMS



- What are SBOMs
 - Software Bill Of Materials
 - Most Cyber Security (And many of the Software Engineers who work with them and have them embedded in their software dev teams) will work with them
 - Basically a list of all of the 'dependencies' (external libraries like DearPyGui and friends) and dependencies of those dependencies in the software being developed.
- Most cyber sec folks will likely need to know multiple programming languages including scripting and 'infrastructure as code' languages. (this compromise was github actions – infra as code)
 - Software devs might just know 2-4 languages really deeply.

But AI will save us right?



- AI will save us
- <https://www.technologyreview.com/2023/02/20/1068824/ai-actually-helpful-disaster-response-turkey-syria-earthquake/>
- Really bright people say so
- <https://a16z.com/ai-will-save-the-world/>
-

But AI will save us right?



- What happens when AI starts reporting something that isn't true
- <https://www.firstpost.com/world/chatgpt-makes-up-a-sexual-harassment-scandal-names-real-professor-as-accused-12418552.html>
- Or they start trying to learn from each others output
- <https://www.businessinsider.com/ais-trained-on-each-other-start-produce-junk-content-study-2023-6>
- These AIs are amazing tools - as long as you use them as tools, if you let them drive, they are not
 - <https://www.pcmag.com/news/vibe-coding-fiasco-replite-ai-agent-goes-rogue-deletes-company-database>
- Which is why you need to know this (comp151) material deep in your bones, so you can **use** it well, rather than letting it run the show.

The Tea App



- The Tea App (July 2025):
 - **Supposedly** an app where women can share stories about abusive partners so other women will know
 - **Actually**: A massively insecure app coded by someone with six months of experience heavily leaning on AI tools.
 - Leaks the data (including scans of drivers licenses) of 72 thousand users.
 - Turns out the credentials needed to get that data were embedded in plain text in the application
 - Any (even junior) app developer or fourth year cyber-security student will have everything they need to do that data breach.
- More evidence: **You have to use the tools – don't let them drive**, **even 95% right in medicine or engineering leads to death or loss**
- <https://www.ainvest.com/news/tea-app-data-breach-exposes-72-000-users-ai-generated-code-security-lapse-2507/>

Good for now



- We might revisit similar issues later, but now lets get back to programming fundamentals.