

# Computer Reliability

## Lecture 8-1

**Computers & Society (CPSC 430)**

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# Computer Reliability

- Data-Entry and Retrieval errors
  - Voter logs
  - Long gun registry
  - False arrests
  - Credit records
- *What responsibility does the maintainer of a database have for the integrity of the data in it? What rights should the people about whom data is stored have to access it, and to have the data corrected?*
- *There is a trade-off between making a crime database more extensive and more accurate. How should this trade-off be managed?*

# Dataset errors – protected words and invalid characters

- In 2016, a security researcher from California named Joseph Tartaro decided to get a vanity license plate. His choice: NULL
- He hoped that would get him out of tickets, since NULL means "undefined" in many databases
- He ended up collecting fines for all people with missing license plates (\$12,049 total)
- Christopher Null, a journalist for WIRED, commented: "He had it coming"
- Sources:
  - <https://radiolab.org/episodes/null>
  - <https://www.wired.com/story/null-license-plate-landed-one-hacker-ticket-hell/>

# Software and Billing Errors

- **System Malfunctions**

- Huge bills in the mail
- Errors in government statistics
- Mail undelivered
- Rent system charged people too much

- **System Failures**

- 911 system had huge delays
- Errors in stock exchange platforms
- Air traffic control systems
- Emergency room scheduling systems
- Airline scheduling software crash leads to 1100 canceled flights
- Boeing 777 autopilot malfunction led to erratic flying
  - More recently, Boeing had issues with their MAX model and MCAS software
  - [https://en.wikipedia.org/wiki/Maneuvering\\_Characteristics\\_Augmentation\\_System](https://en.wikipedia.org/wiki/Maneuvering_Characteristics_Augmentation_System)

- *Examples from your own experience?*

# Embedded Systems

- **Patriot missiles**
  - Accumulating floating point truncation errors led them not to fire at incoming missiles
- **Ariane 5**
  - Floating point to integer conversion error led rocket to explode
- **Mars climate orbiter**
  - Imperial/metric unit conversion led to crash
- **Denver International Airport**
  - \$311 million automated baggage system never worked, eventually replaced with a \$71 million traditional system
- **Tokyo stock exchange**
  - Accepted an order for selling 610,000 shares at 1 yen, instead of 1 share at 610,000 yen. Then wouldn't cancel the order.

# More Embedded Systems

- **Electronic Voting Machines**
  - Fails to record various ballots
  - Records way too many votes
  - Records way too few votes
  - Votes recorded correctly but counted wrong (integer overflow)
  - Votes were changed at the confirmation screen
- **Therac-25**
  - A linear accelerator used to for cancer radiation therapy
  - Occasionally gave patients way too much radiation
  - Traced to various software errors, including two race conditions
- *How much should be done to prevent such problems?*
- *How should we decide that a system is safe?*

# Computer Reliability

“Self-driving cars should be allowed to operate on public roads once they have been shown to be at least slightly safer than the average human driver.”

