CPSC 430
Computers & Society

Class 5B: Computer Reliability (Chp 8) and Professional Ethics (Chp 9)

Dr. Firas Moosvi | 2024_S2

Slides courtesy of Dr. Kevin Leyton-Brown

Class Outline

1. Announcements (5 mins)
2. Computer Reliability (80 mins)
3. Break (10 mins)
4. Professional Ethics (20 mins)
5. Break (10 mins)
6. Reminders before next class (5 mins)

Announcements

Computer Reliability

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 low-key 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

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
  - In 2006, TSE 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. The lawsuit was finally settled in 2015.

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 Simulations

- Simulations are used to answer questions about scenarios that can’t be easily observed in the real world
  - Hurricanes
  - Nuclear explosions
  - Climate change
  - Car crashes
- Models are only useful if they accurately describe reality

- *What would you need to see to trust a simulation?*
- *How accurate does a simulation have to be to be useful?*

Software Warranties

- Software companies tend to write license agreements saying that the software may not perform as promised
  - "we expressly disclaim … the implied warranties of merchantability and fitness for a particular purpose"
- Why is this reasonable?
  - Software is expensive
  - Other expensive goods are backed up by warranties

- *Should software come with warranties? If so, what should these warranties cover?*
- *Do software makers have a moral obligation to produce software that does what it promises?*

Break

Case Study: Self-driving vehicles

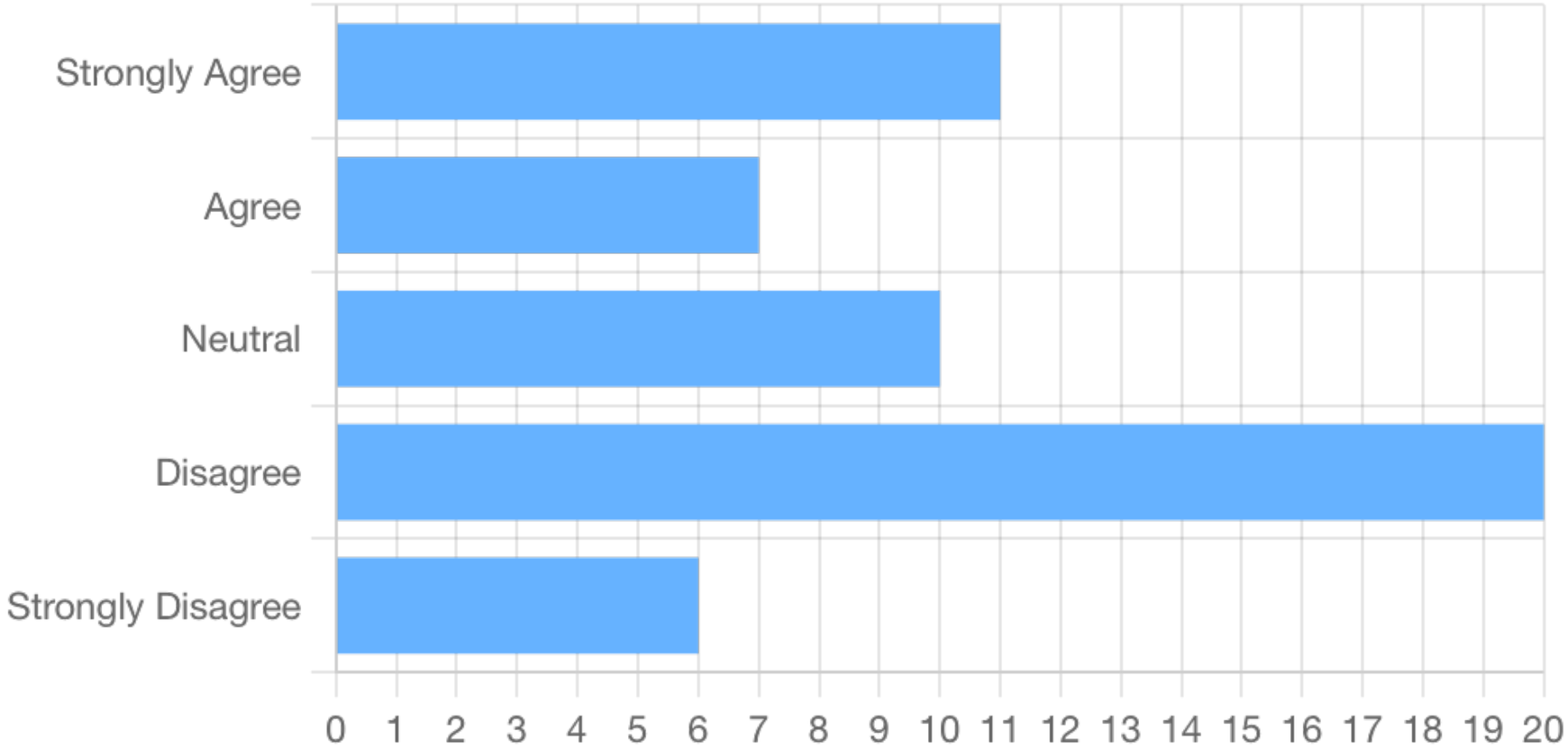
Self driving vehicles

- SAE International:
  - SAE Level 0 – No Automation
  - SAE Level 1 – Driver Assistance (adjustments to steering or acceleration/deceleration)
  - SAE Level 2 – Partial Automation: (adjustments to both steering and acceleration/deceleration)
  - **SAE Level 3 – Conditional Automation: "the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene"**
  - SAE Level 4 – High Automation: automated driving system with occasional requests for intervention from the human driver (not crucial)
  - SAE Level 5 – Full Automation

- SAE level 3 creates the "hands off problem"; Ford, Volvo and Google decided to skip this step. Do you agree?
- Do you agree with Quinn's assessment that Tesla Motor is partially responsible for Joshua Brown's death?

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."



Activity

Professional Ethics

Is Software Engineering a Profession?

- In many ways software engineering is similar to other professions such as law or accounting
  - Dependence on professional education and practical training
  - Professional associations (IEEE, ACM)
  - Potential for bad decisions to cause significant public harm
- It's not a "full-fledged" profession:
  - No formal accreditation/licensing system
- All the same, sensible to ask software engineers to follow a code of ethics.
  - One with significant support is described in the book.
  - Nothing it says ought to come as a big surprise at this point in the course ☺.

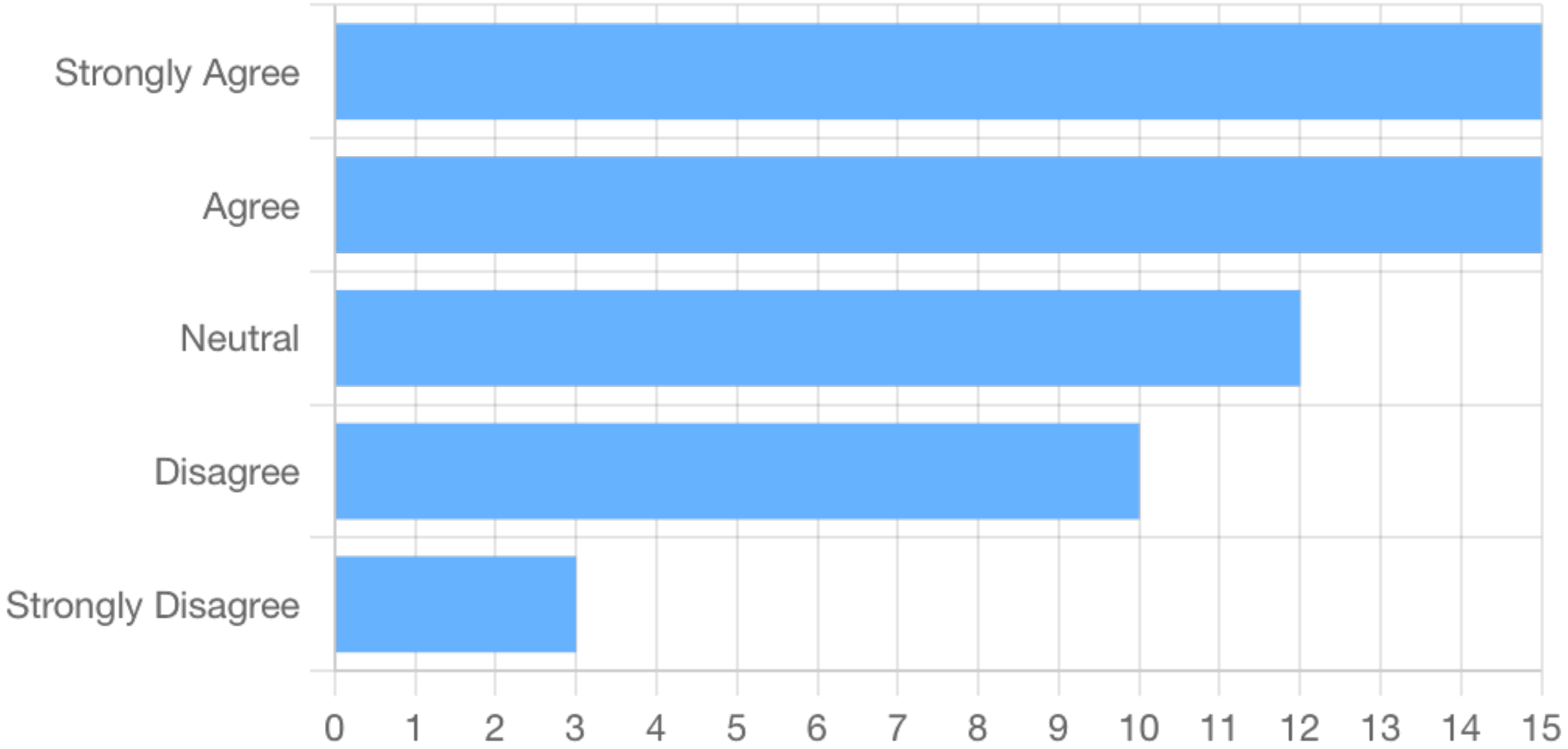
Whistle-Blowing

- Revealing a real or potential harm to the public being caused by your employer.
  - Not an attempt to take revenge on the employer, e.g., for turning down a promotion
  - Not an attempt to avoid personal responsibility for a problem that is about to come to light anyway.

- *Under what circumstances is whistle-blowing morally **justified**? When is it morally **necessary**?*

Professional Ethics

"Computer scientists and data scientists should not aid in the development of autonomous weapon systems."



Case Study

- Software Recommendation
  - Sam Shaw sought advice on how to improve security of his business's local area network
  - Professor Jane Smith answered Sam's questions
  - She also recommends, NetCheks, a software package to him to identify security problems
  - She does not mention the "best buy" option
  - She does not mention that she is shareholder of NetCheks
- Did Professor Jane Smith behave ethically?

Case Study

- Antiworm
  - The internet is plagued by a new worm that infected PCs by exploiting a security hole
  - Tim Smart created an antiworm that exploited the same security hole, but fixed it
  - Tim released the antiworm, taking precautions to ensure that it cannot be traced back to him
  - The antiworm was effective, but looked just like another worm and the system administrators battled its spread.
- Did Tim behave ethically?

Reminders before next class