



Lecture 19

Computer Reliability

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Participation Quiz

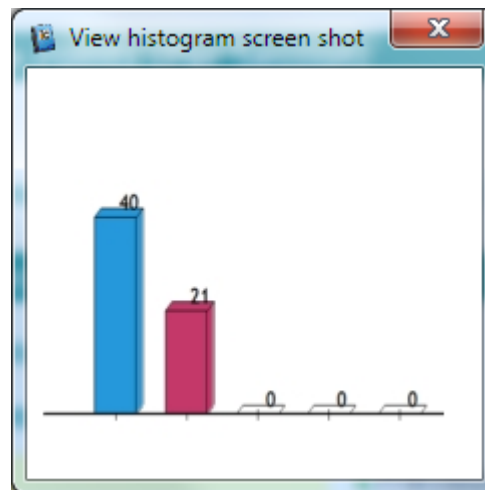
1. What is the French word for “eggplant?”

- A. のみもの
- B. すきやき
- C. Aubergine
- D. デザート
- E. \$&%()@@@

doesn't it

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.”



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 tradeoff between making a crime database more extensive and more accurate. How should this tradeoff be managed?*

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

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 Simulations

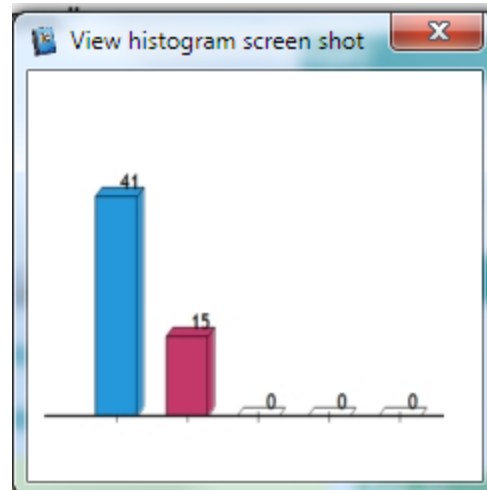
- Simulations are used to answer questions about scenarios that can't be easily observed in the real world
 - Hurricanes
 - Nuclear explosions
 - Climate change
 - Car crashes
- Models are only useful if they accurately describe reality
- *What would you need to see to trust a simulation?*
- *How accurate 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?*

Computer and Network Security

“Canadians should have the right to vote online in federal, provincial and municipal elections.”



Online Voting

- Motivation:
 - More people would vote
 - Votes would be counted more quickly
 - Cost less money
 - Avoid disputed elections like Florida 2000
 - Eliminate ballot box tampering
 - Software can prevent accidental over-, under-voting
- Risks:
 - Gives unfair advantage to those with home computers
 - More difficult to preserve voter privacy
 - More opportunities for vote selling
 - Obvious target for a DDoS attack
 - Security of election depends on security of home computers
 - Susceptible to phony vote servers
 - No paper copies of ballots for auditing or recounts