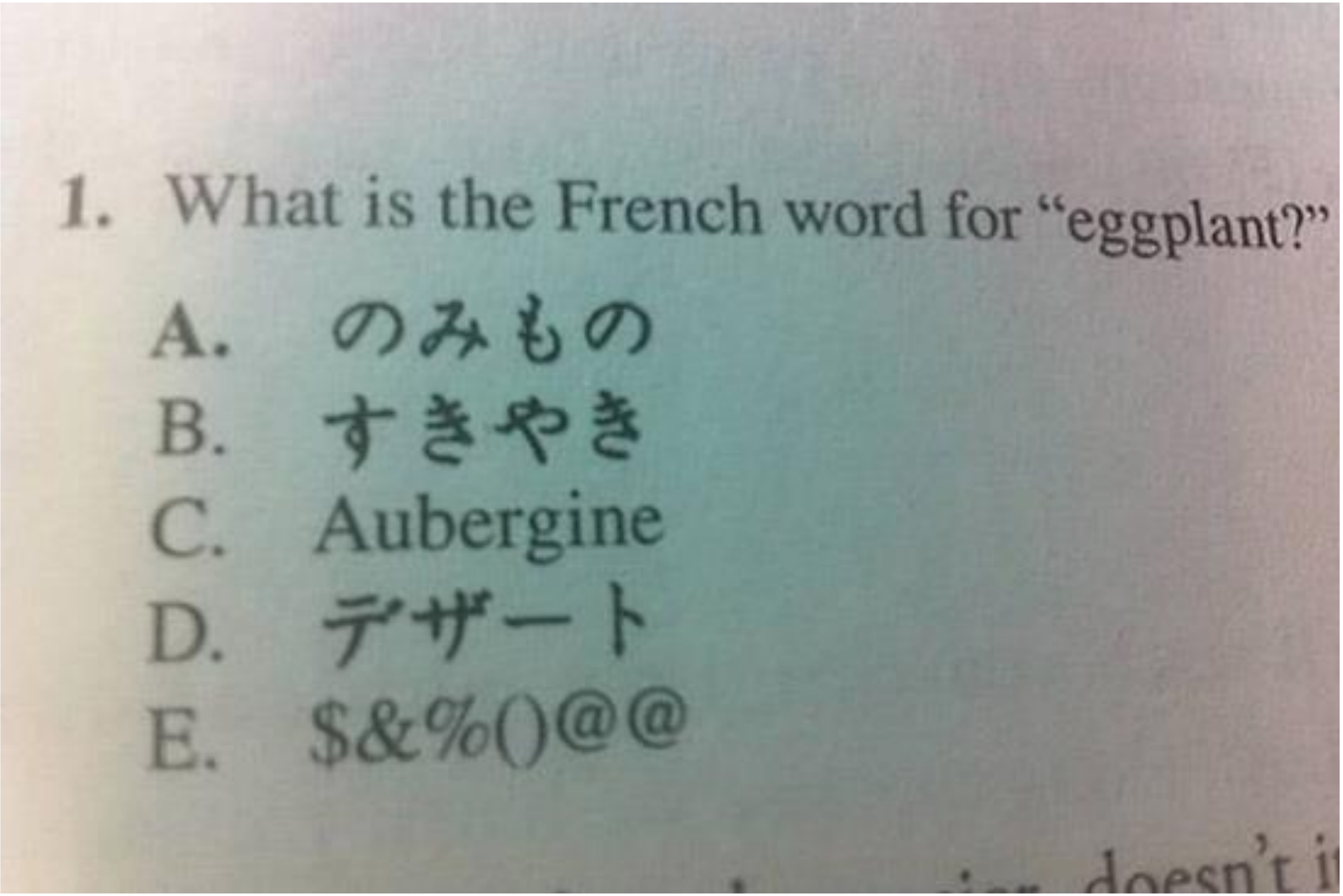
# Lecture 8-1
# Computer Reliability

Addison-Wesley
is an imprint of

PEARSON

# 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. $&%()@@

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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 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.

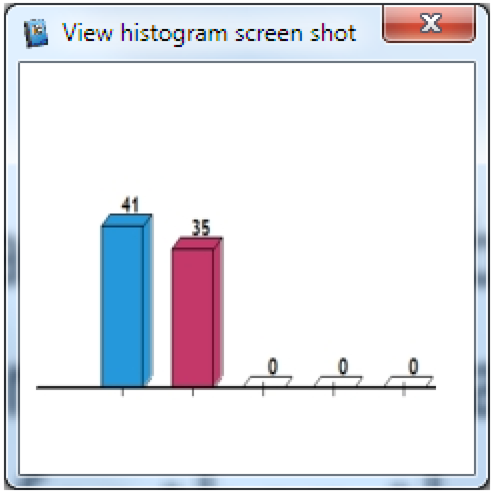
# More Embedded Systems

- 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 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 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?*