

# CS 4001: Computing, Society & Professionalism

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Week 12: Computer and Network  
Security, Computer Reliability

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# 8.1 Introduction

- Computer systems are sometimes unreliable
  - Erroneous information in databases
  - Misinterpretation of database information
  - Malfunction of embedded systems
- Effects of computer errors
  - Inconvenience
  - Bad business decisions
  - Fatalities

## **8.2 Data-Entry or Data-Retrieval Errors**

# Two Kinds of Data-related Failure

- A computerized system may fail because wrong data entered into it
- A computerized system may fail because people incorrectly interpret data they retrieve

# Disfranchised Voters

- November 2000 general election
- Florida disqualified thousands of voters
- Reason: People identified as felons
- Cause: Incorrect records in voter database
- Consequence: May have affected election's outcome

# False Arrests

- Sheila Jackson Stossier mistaken for Shirley Jackson
  - Arrested and spent five days in detention
- Roberto Hernandez mistaken for another Roberto Hernandez
  - Arrested twice and spent 12 days in jail
- Terry Dean Rogan arrested after someone stole his identity
  - Arrested five times, three times at gun point

# Accuracy of NCIC Records

- March 2003: Justice Dept. announces FBI not responsible for accuracy of NCIC information
- Exempts NCIC from some provisions of Privacy Act of 1974
- Should government take responsibility for data correctness?

**Class Activity 1:** Should NCIC continue to maintain a centralized database of stolen vehicles? Discuss from an act utilitarian perspective.



# Dept. of Justice Position

- Impractical for FBI to be responsible for data's accuracy
- Much information provided by other law enforcement and intelligence agencies
- Agents should be able to use discretion
- If provisions of Privacy Act strictly followed, much less information would be in NCIC
- Result: fewer arrests

# Position of Privacy Advocates

- Number of records is increasing
- More erroneous records → more false arrests
- Accuracy of NCIC records more important than ever

## **8.3 Software and Billing Errors**

# Errors When Data Are Correct

- Assume data correctly fed into computerized system
- System may still fail if there is an error in its programming

# Comair Cancelled All Flights on Christmas Day, 2004



AP Photo/Al Behrman, File

# Other System Malfunctions

- Hackers taking control of systems:
  - At Black hat Conference in Las Vegas, computer security researcher Jay Radcliffe show how he could wirelessly hack into and control the insulin pump he was wearing
  - In July 2015, two researchers demonstrated that they could hack into a Jeep Cherokee with a touch screen to gain control of the vehicle's vital functions

# Analysis: E-Retailer Posts Wrong Price, Refuses to Deliver

- Amazon.com in Britain offered iPaq for £7 instead of £275
- Orders flooded in
- Amazon.com shut down site, refused to deliver unless customers paid true price

**Class Activity 2:** Was Amazon.com wrong in refusing to fill the orders on the wrong price of the iPAQs? Discuss from a rule utilitarian and Kantian perspective.



## **8.4 Notable Software System Failures**

# Patriot Missile

- Designed as anti-aircraft missile
- Used in 1991 Gulf War to intercept Scud missiles
- One battery failed to shoot at Scud that killed 28 soldiers
- Designed to operate only a few hours at a time
- Kept in operation  $> 100$  hours
- Tiny truncation errors added up
- Clock error of 0.3433 seconds  $\rightarrow$  tracking error of 687 meters

# Patriot Missile Failure

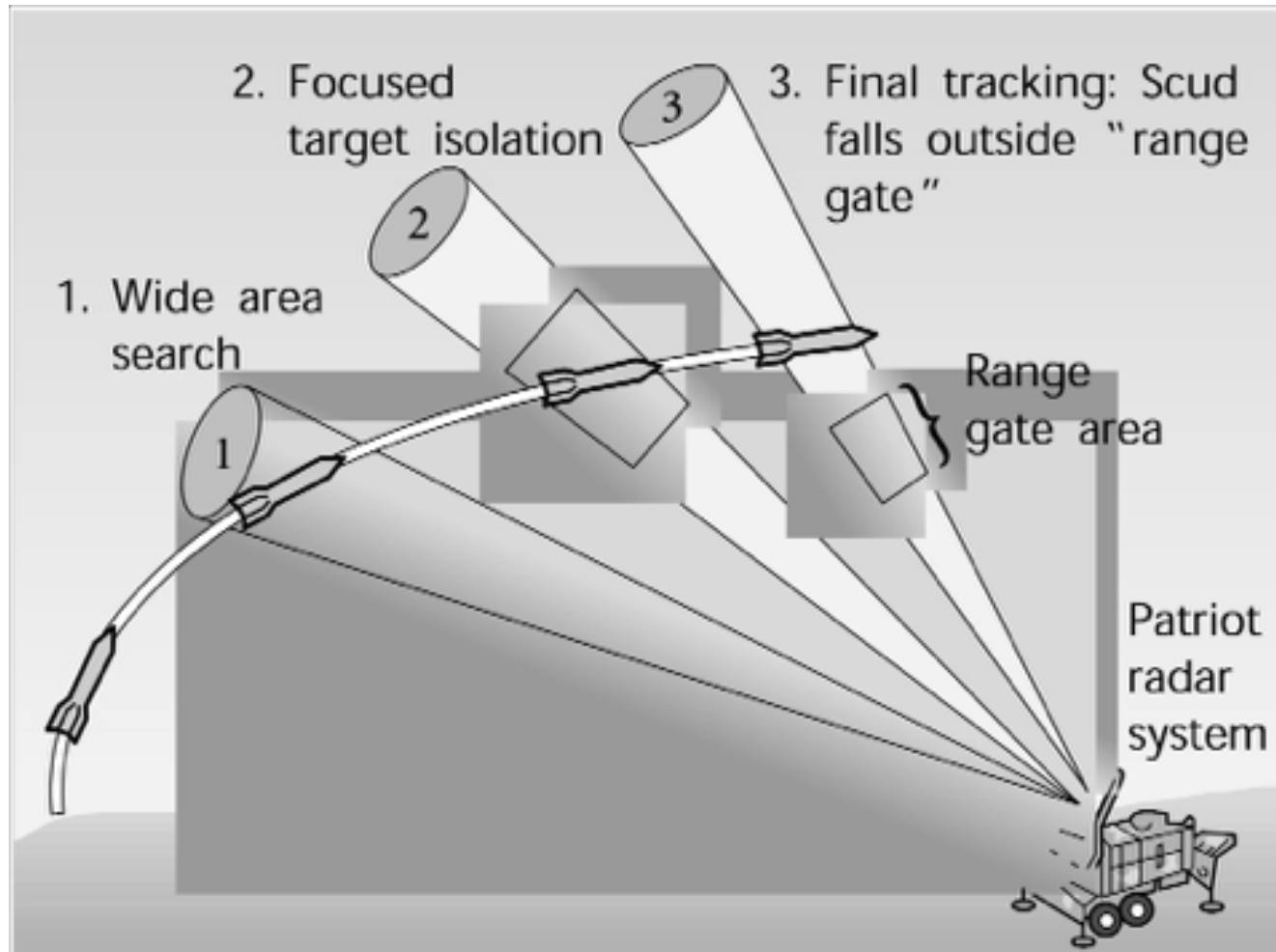


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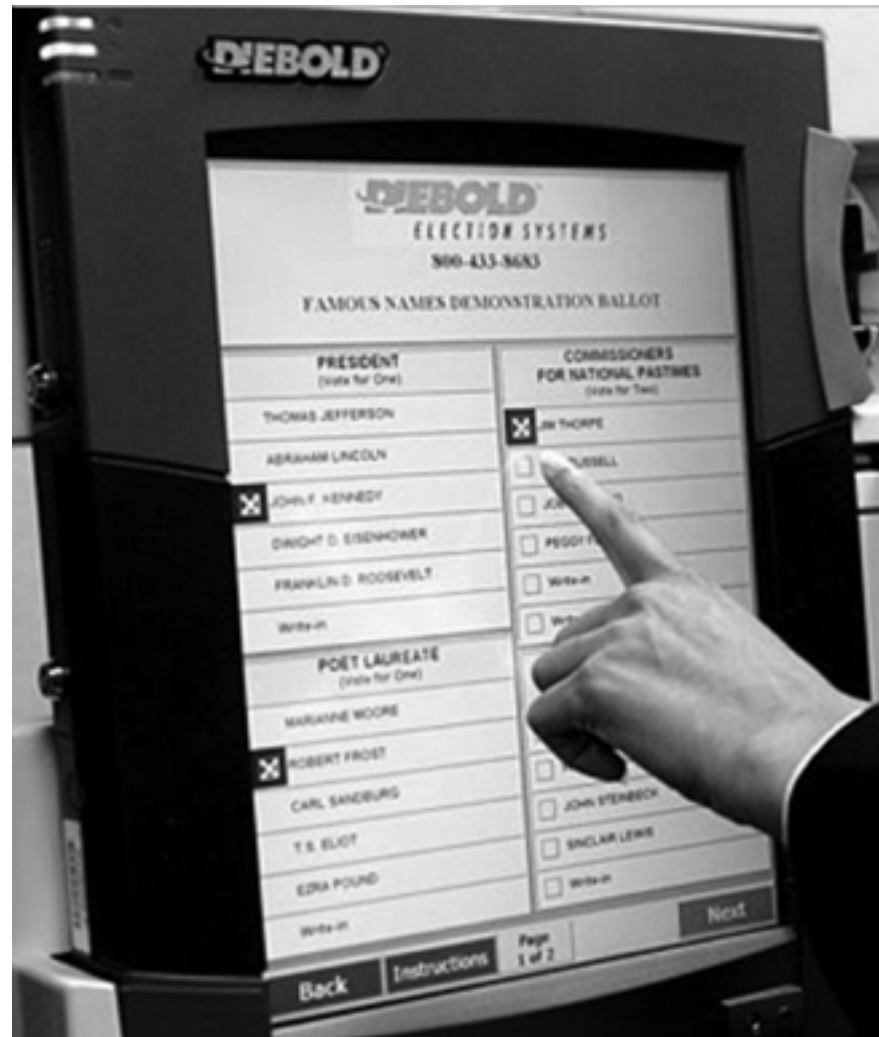
# Tokyo Stock Exchange

- First day of trading for J-Com
- Mizuho Securities employee mistakenly enters order to sell 610,00 shares at 1 yen, instead of 1 share at 610,000 yen
- Employee overrides computer warning
- After sell order posted on exchange's display board, Mizuho tries to cancel order several times; software bug causes attempts to fail
- Mizuho loses \$225 million buying back shares

# Direct Recording Electronic Voting Machines

- After problems with 2000 election, Congress passed Help America Vote Act of 2002
- HAVA provided money to states to replace punch card voting systems
- Many states used HAVA funds to purchase direct recording electronic (DRE) voting machines
- Brazil and India have run national elections using DRE voting machines exclusively
- In November 2006 1/3 of U.S. voters used DRE voting machines

# Diebold Electronic Voting Machine



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**Class Activity 3:** What could be potential problems with EVMs?

## **8.8 Software Warranties and Vendor Liability**



# Shrinkwrap Warranties

- Some say you accept software “as is”
- Some offer 90-day replacement or money-back guarantee
- None accept liability for harm caused by use of software

**Class Activity 4a:** Should companies and programmers take responsibility of software malfunctions or errors?

# Shrinkwrap Warranties

- Some say you accept software “as is”
- Some offer 90-day replacement or money-back guarantee
- None accept liability for harm caused by use of software

**Class Activity 4b:** When someone is bullied on Facebook (by a person they don't know in the offline world) and this person then dies by suicide, is Facebook responsible for having somehow "caused harm"?

Extras

# Act Utilitarian Analysis: Database of Stolen Vehicles

- Over 1 million cars stolen every year
- Just over half are recovered, say 500,000
- Assume NCIC is responsible for at least 20%
- 100,000 cars recovered because of NCIC
- Benefit of \$5,000 per car (owner gets car back; effects on national insurance rates; criminal doesn't profit)
- Total value of NCIC stolen vehicle database: \$500,000/year
- Only a few stories of false arrests
- Assume 1 false arrest per year (probably high)
- Assume harm caused by false arrest \$55,000 (size of award to Rogan)
- Benefit surpasses harm by \$445,000/year
- Conclusion: Good to have NCIC stolen vehicles database

# Rule Utilitarian Analysis

- Imagine rule: A company must always honor the advertised price
- Consequences
  - More time spent proofreading advertisements
  - Companies would take out insurance policies
  - Higher costs → higher prices
  - All consumers would pay higher prices
  - Few customers would benefit from errors
- Conclusion
  - Rule has more harms than benefits
  - Amazon.com did the right thing

# Kantian Analysis

- Buyers knew 97.5% markdown was an error
- They attempted to take advantage of Amazon.com's stockholders
- They were not acting in "good faith"
- Buyers were in the wrong, not Amazon.com



# Issues with DRE Voting Machines

- Voting irregularities
  - Failure to record votes
  - Overcounting votes
  - Misrecording votes
- Lack of a paper audit trail
- Vulnerability to tampering
- Source code a trade secret, can't be examined
- Possibility of widespread fraud through malicious programming

# Moral Responsibility of Software Manufacturers

- If vendors were responsible for harmful consequences of defects
  - Companies would test software more
  - They would have to purchase liability insurance
  - Software would cost more
  - Start-ups would be affected more than big companies
  - Less innovation in software industry?
  - Software would be more reliable?
- Making vendors responsible for harmful consequences of defects may be a bad idea, but...
- Consumers should not have to pay for bug fixes