Lecture 1

• What Does Ethics Have to do with Computing?

(Some slides are from M. Quinn, Ethics for the Information Age, Pearson © 2013.)

Organization of Lecture

• Introduction to Course: Why ethics?

• Brief history: From Computing to the Information Age

• Information technology and ethics

1.1 Introduction to Course:

Why teach a Computer Ethics course?
Why teach a Computer Ethics course?

- Required course for all BS/BA CIS students at UO
- Required course for national accreditation for a CS degree
- Professional Responsibility
  - Legal and ethical standards for professionals
    - Code of Ethics for ACM and IEEE members
    - Compare to doctors, lawyers, civil engineers
    - Liability

BUT….. Why teach a Computer Ethics course?

- Technologies may solve problems, but also create new problems to solve
  - Almost impossible to predict social change from new technology
    - Example: Automobile
- Using technology can change human behavior
  - Physical changes (e.g., laptops)
  - Psychological changes (e.g., cell phones and multi-tasking)
  - Social changes (e.g., campaigning for US President)
  - Ethical & Legal issues (e.g., pornography and the internet)
- As computer professionals, we have a responsibility
  - To be aware of ethical and legal issues
  - To integrate these issues into our design decisions
  - To notify our employer about these issues

Example: Pornography

- Law
  - Legal in US to obtain pornography, except where the subjects are children
- Norms
  - Soft-core vs. Hard-core Porn
  - Adults vs. Children as consumers
- The Market
  - $10 billion in US
- Architecture vs Code
  - Brick & Mortar Stores vs. Internet
The Information Age creates many new ethical issues

- New Functionality: Era characterized by unprecedented access to information by governments and other organizations, business, and individuals
  - Catalysts
    - Low-cost computers
    - High-speed communication networks
    - Access by individuals
- New Functionality = Many Social and Ethical Changes
  - Old laws do not apply to computer information and communication
  - Norms and markets changing rapidly

How can we understand social and ethical issues?

- Study the past technological change for understanding social change
- Study how to think about social change and ethics
  - Learn how to think about ethical questions
    - Logical thinking based on argument & evidence
    - Create generalizations from specific examples
  - Learn how to talk & listen
    - See many sides of an issue
    - Paraphrase & respect opinions not shared

1.2 Brief history: From Computing to the Information Age
Summary

• Technological Changes in computing
  – From hardware changes: slow to fast, large to small scale chips, small to large scale storage
  – From software changes: programming to GUIs
  – From integrating computing with communications
  – From group use (government, business, organizations) to individual
• What social changes have these brought?

Punched Card Tabulation

• Punched cards (late 19th century)
  – One record per card
  – Cards could be sorted into groups, allowing computation of subtotals by categories
• Early adopters
  – U.S. Bureau of the Census
  – Railroads
  – Retail organizations
  – Heavy industries

Punched Card used for US Census 1890
Electric Tabulator at U.S. Census Bureau

Tabulators → Punched Card Data Processing Systems early 1900’s to late 1980’s

- Electro-Mechanical systems 1900’s to 1970’s
  - Receives input data as punched cards
  - Transformations of input done by programmed plug-boards
    - Sorting, Tabulating
  - Produced output as a punched card or print-out
- Punched cards used in computer based systems until late 1980’s
  - Stored input and output data, including programs

FORTRAN programming
The First Computers - late 1940’s

• Developed in response to WWII
  – Computing ballistics trajectories
    • Von Neumann
    • Atanasoff-Berry Computer: vacuum tubes
  – ENIAC: externally programmed with wires
  – EDVAC: program stored in memory
  – Cryptography
    • Turing
    • Decoding the German Enigma machine
First Commercial Computers – 1950’s

• Remington-Rand
  – Completed UNIVAC in 1951
  – Delivered to U.S. Bureau of the Census
  – Predicted winner of 1952 Pres. election
• IBM
  – Larger base of customers from punched card legacy
  – Far superior sales and marketing organization
  – Greater investment in research and development
  – Dominated mainframe market by mid-1960s


CBS News Coverage of 1952 Presidential Election Featured UNIVAC Computer

Programming Languages - late 1950’s

• Assembly language
  – Symbolic representations of machine instructions
  – Programs just as long as machine language programs
• FORTRAN
  – First higher-level language (shorter programs)
  – Designed for scientific applications
• COBOL
  – U.S. Department of Defense standard
  – Designed for business applications
IBM System/360 - 1970’s to 1980’s

• Before System/360
  – IBM dominated mainframe marked in 1960s
  – IBM computers were incompatible
  – Switch computers → rewrite programs

• System/360
  – Series of 19 computers with varying levels of power
  – All computers could run same programs
  – Upgrade without rewriting programs

Engineers Test IBM System/360 CPUs

Liberating us from the Punched Card: Time-Sharing Systems and BASIC – early 1970’s

• Time-Sharing Systems
  – Divide computer time among multiple users
  – Users connect to computer via terminals
  – Cost of ownership spread among more people
  – Gave many more people access to computers

• BASIC programming language
  – Developed at Dartmouth College
  – Simple, easy-to-learn, popular language for teaching programming
Hardware Technology Changes allow Personal Computers

- Vacuum tubes (early 1900’s – 1950’s)
- Semiconductors
- Transistors (1947 Bell Labs)
- Integrated Circuit (1958 Texas Instruments)
- Microprocessor chip (Intel 1971)
- Trend: faster, cheaper, more reliable, smaller and more energy-efficient

Personal Computer – late 1970’s to 1990’s

- Altair 8800 (late 1970’s)
  - Gates and Allen create BASIC interpreter
  - Interpreter pirated at Homebrew Computer Club meeting
- Personal computers become popular – 1980’s
  - Apple Computer: Apple II
  - Tandy Corporation: TRS 80
- Developments draw businesses to personal computers – late 1980’s
  - Computer spreadsheet program: VisiCalc
  - IBM launches IBM PC

Steve Wozniak and Steve Jobs with Apple I Personal Computer
Graphical User Interface

- Xerox PARC (Palo Alto Research Center)
  - Alan Kay sees Doug Engelbart demo in 1968
  - Alto personal computer (early 1970s)
  - Bit-mapped display, keyboard, and mouse
- Apple Computer
  - Steve Jobs visits Xerox PARC in 1979
  - Macintosh (1984)
  - Bit-mapped display, keyboard, and mouse
- Microsoft Windows (1990)
  - Released in May 1990
  - Quickly became dominant graphical user interface

Single-Computer Hypertext Systems

- Peter Brown at University of Kent
  - Released versions for Macintosh and IBM PC
- Apple Computer
  - HyperCard (1987)
  - Hypertext system based on "stacks" of "cards"
  - Links represented by buttons
  - Basis for best-selling games Myst and Riven

Early Remote Computing – 1960’s

- Stibitz and Williams build Complex Number Calculator at Bell Labs
- Bell Labs part of AT&T (phone company)
- Teletype chosen for input/output
- Allows operator to be distant from machine
- Long-distance demonstration between New Hampshire and New York City
- Initially circuit-switching, later dial-up modem
ARPANET – early 1970’s

- DoD creates ARPANET in early 1970s
- Licklider conceives of “Galactic Network” 1962
- Decentralized design to improve survivability
- Packet-switching replaces circuit switching

Circuit-switched v. Packet-switched Networks

Email

- Creation
  - Tomlinson at BBN writes software to send, receive email messages on ARPANET, 1971
  - Roberts creates email utility
- Current status
  - One of world’s most important communication technologies
  - Billions of messages sent in U.S. every day
**Internet - 1983**

- Kahn conceives of open architecture networking, 1972 while at ARPANET
- Cerf and Kahn design TCP/IP protocol
- Internet: network of networks communicating using TCP/IP
- Initially implemented in 1983

**NSFNET – late 1980’s**

- Created by National Science Foundation
- Built on concepts of ARPANET and Internet
- Provided access grants to universities
- Encouraged commercial subscribers for regional networks
- Banned commercial traffic on NSFNET Backbone
- Private companies developed long-distance Internet connections
- After private networks established, NSF shut down NSFNET Backbone

**World Wide Web**

- First browser built at CERN in Switzerland
  - Berners-Lee created Web protocols
  - Protocols based on TCP/IP → general
  - Hypertext + Graphical User Interface (HTML)
- Later browsers
  - Mosaic
  - Netscape Navigator
  - Netscape Mozilla
  - Microsoft Internet Explorer (most popular)
Search Engines

- Crawler-based engines (Google, AltaVista)
  - Programs called spiders follow hyperlinks and visit millions of Web pages
  - System automatically constructs Web page database
- Human-assisted engines (Open Directory)
  - Humans build Web page database
  - Web page summaries more accurate
  - Far fewer Web pages in database
- Hybrid systems (MSN Search)

Broadband - 2000’s

- Broadband
  - High-speed Internet connection
  - At least 10x faster than dial-up connection
  - Enhanced by fiber optic networks
- Typical broadband speeds
  - Japan (#1 in world): 63 megabits/second
  - South Korea (#2): 40 megabits/second
  - United States (#15): 2 megabits/second

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We end up in 2013!

- Individual general purpose computer with an integrated communications system for phone and internet
- Portable (hand-sized), relatively inexpensive
- Touch-sensitive GUI, video input/output,
- Real-time data collection of location, picture, sound
- Storage of data in remote server for integrating multiple devices

Apple iPhone
Product of the Information Age

Traffic Information on the Web
1.3 Information Technology and Ethics

IT & Ethics Issues (1/3)

- **Privacy: Email**
  - Easy way to keep in touch
  - Spam has become a real problem
- **Freedom of Expression: Web**
  - Free access to huge amounts of information
  - Harmful consequences of some sites
- **Intellectual Property: CDs, MP3s**
  - Free or cheap copies readily available
  - May be unfair to musicians

IT & Ethics Issues (2/3)

- **Ownership of Information: Credit cards**
  - Convenience over cash and checks
  - Increases possibility of identity theft
  - Who owns information about transactions?
- **Security:**
  - Open architecture of Internet leads to theft
  - How do we protect our systems from hacking?
IT & Ethics Issues (3/3)

- **Software Reliability:**
  - Who is responsible if software harms someone?
- **Who controls the World Wide Web:**
  - A conduit for democratic ideas?
  - Another tool for totalitarian governments?

Summary

- Rate of technological change accelerating
- Wrong question: “What will the computer do to us?”
- Right question: “What will we make of the computer?”
  (quoting Seymour Papert)