

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

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1.1 Introduction to Course:

Why teach a Computer Ethics course?

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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

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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

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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

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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

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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

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1.2 Brief history: From Computing to the Information Age

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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?

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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

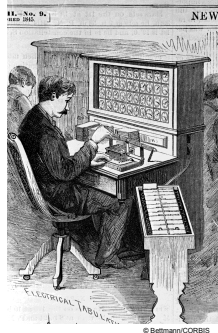
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Punched Card used for US Census 1890

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Electric Tabulator at U.S. Census Bureau



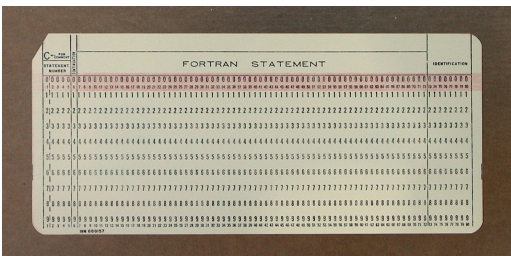
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Tabulators → Punched Card Data Processing Systems early 1900's to late 1980's

- 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

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FORTRAN programming



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IBM 082 Sorter



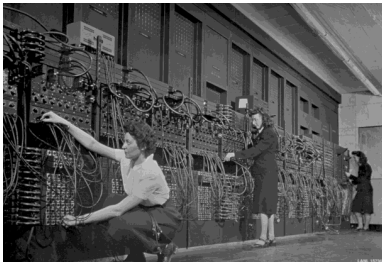
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The First Computers - late 1940's

- 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

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Programming the ENIAC



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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

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CBS News Coverage of 1952 Presidential Election Featured UNIVAC Computer



Hagley Museum and Library. Accession number 1984.240

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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

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IBM System/360 - 1970's to 1980's

- Before System/360
 - IBM dominated mainframe market 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

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Engineers Test IBM System/360 CPUs



Courtesy of International Business Machines Corporation

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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

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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

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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

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Steve Wozniak and Steve Jobs with Apple I Personal Computer



© Kimberly White/Corbis

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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

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Single-Computer Hypertext Systems

- Peter Brown at University of Kent
 - Guide (1982)
 - 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

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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

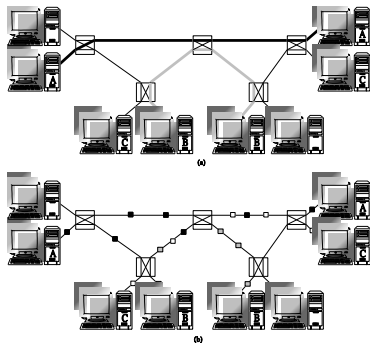
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ARPANET – early 1970's

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

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Circuit-switched v. Packet-switched Networks



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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

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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

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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

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World Wide Web

- First browser built at CERN in Switzerland
 - Tim Berners-Lee: WorldWideWeb (1990)
 - 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)

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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)

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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

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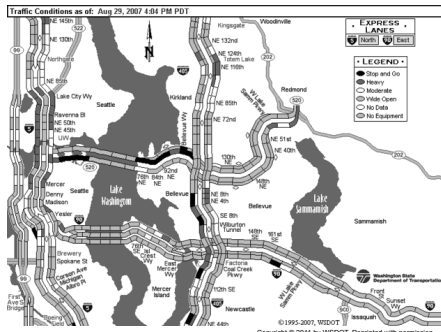
Apple iPhone Product of the Information Age



Courtesy Apple Inc. All rights reserved.

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Traffic Information on the Web



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1.3 Information Technology and Ethics

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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

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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?

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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?

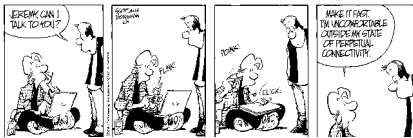
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Summary

- 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)

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