COS 126 Lecture 26: History

Mechanical Calculators

Abacus (~1000 BC)

Slide rule (Napier, 1617)

Adding machine (Pascal, 1642)

Jacquard loom
- punched card control

Difference engine (Babbage, 1820)

Tabulating machines (Hollerith, 1890)
- punched card readers
- application: census

Telephone circuits
- relay-based
- counting
- memory
- switching

Desk calculators

Cryptanalyis/ballistics

Charles Babbage

Conceived the first
- automatic digital computer

Built "difference engine" (1820)
- mechanical calculator
- special-purpose (evaluate polynomials)

Designed "analytical engine" (1833)
- involved features of modern machines
  - "store" (memory unit)
  - "mill" (arithmetic unit)
  - "control" (instructions on punch cards)

Sponsored by Lady Ada Lovelace
- daughter of Lord Byron
- first computer programmer?

Idea from Jacquard loom?

"Father of modern computing?"
- machine was impossible to build
- work forgotten for a century

Other "notable contributions"
- helped develop British postal system
- invented the cowcatcher

Evolution of modern machine

Turing Bombe (WW-II)

Mark 1 (Aiken, 1944)
"relay" computer/calculator

ENIAC (Mauchly/Eckert, 1945)
"electronic" computer
18,000 electron tubes
100 multiplies/second
plugboard "programming"

von Neumann
stored program computer design

UNIVAC (1950)
electronic, stored-program

transistor (1947)
core memory (1950s)
integrated circuit (1960s)

microprocessor
VLSI microcomputer

Top ten programming languages

COBOL

FORTRAN

Algol

LISP

PL/I

Ada

Pascal

C

C++

Java

Applications

Military
- cryptography
- ballisitics

Science/mathematics/engineering
- large-scale numerical calculations
- measurement/analysis
- simulation
- control

Commercial computing
- information processing
- word processing

"Personal" computing
- computer in every home?

Entertainment

Sample future applications

Put knowledge online

Human genome project

Medical technology
- "X-ray" vision

Simulation
- materials/cars/planes
- earth/biosphere
- space/matter
- economic systems
- brain

"paintbrush", musical instrument

Communications
- teleconferencing
- video on demand

Commercial/business systems

Artificial Intelligence
- vision/language understanding
- robotic control systems
- learning/problem-solving

Present and future computer systems

Only the numbers change!

SUPERCOMPUTER
- "roomful of computer"
- thousands of processors
- 10^12 instructions/second
- 10^12 bytes RAM
- 10 machines / $50 million each

FILE SERVER
- 1000 users
- 10^12 bytes online storage
- 10,000 machines / $50 thousand each

PERSONAL COMPUTER
- "personal productivity tool"
- word processor, database, graphics
- C, Java, Maple, etc., etc.
- 10^8 instructions/second
- 10^8 bytes RAM
- 10 million machines / $3000 each

NETWORK COMPUTER
- "X-term for the millenium"
- runs Java
- 10^9 instructions/second
- 10^7 bytes RAM
- 100 million (?) / $200 each

Persistent Ideas

on-off switch

layers of abstraction

von Neumann machine

procedural languages

algorithms/complexity

keyboard/display

recursive programs and structures

formal languages/automata

memory hierarchy

printed page

symbolic mathematics

modelling physical objects

networks

timesharing/parallelism

computability/NP-completeness