History of Computer Science

Blaise Pascal (approx. 1650)
- built a machine with 8 gears called the Pascaline to assist French government in compiling tax reports

Pascaline

J.M. Jacquard (early 1800’s)
- developed loom that used punched cards (the equivalent of stored programs)

Jacquard's Loom

Punched cards
- information coded on cards (forerunner of modern storage devices)
- cards could be linked in a series (forerunner of programs)
- Such programs can automate human tasks
Charles Babbage

- British scientist and inventor, 1860's
- Known as 'the Father of the Computer'

Babbage’s computer

- Difference Engine
- Could compute and print tables, but never got out of the 'working prototype' stage because of technological limits

Babbage’s dream machine

- The Analytical Engine
- Steam powered calculating machine using programs on punched cards.
- The analytical engine was never completed in his lifetime.

Analytical Engine plans

Analytical Engine, con't

- Contained all the elements of modern computers including
  - 'mill' (for calculating)
  - 'store' (for holding instructions)
  - 'operator' (for carrying out instructions)
  - Reading and writing device

Countess Ada Augusta Lovelace

- Lord Byron's daughter
- Mathematician
- Devised way to use punched cards to give instructions to Babbage's machines
- The 'first computer programmer'
**Countess Ada Augusta Lovelace**

Invented a tabulating machine using punched cards (same size as ours today).

Founded forerunner of IBM

**Herman Hollerith (1890 census)**

Invented a tabulating machine using punched cards (same size as ours today).

Founded forerunner of IBM

**Hollerith’s machine**

**Thomas Watson, Sr. (head of IBM in 1924)**

Made his fortune in punched card tabulating equipment and office equipment

Never convinced that computing machines were worth the risk.

Turned over the company to his son in mid 1950’s

**Early Electronic Computers**

- Konrad Zuse
  - German engineering student, 1930’s
  - Never allowed to complete his computer

- ABC Computer
  - Atanasof and Berry
  - 1937

- Mark I, Harvard, 1944
  - Automatic calculator used paper tapes

**The ABC machine**

1937
The first electronic computer

Dr. John V. Atanasof
Clifford Berry
John von Neumann

- invented the stored program concept (data and instructions stored in memory in binary form).
- 1940's

Computer Science History

- Alan Turing
  - WW II
  - Enigma
  - "Computers"
- John von Neumann
  - Programs as data
- ENIAC

ENIAC

Genesis of modern computing

Hardware “Generations”

- Hardware
  - vacuum tubes
  - transistors
  - printed circuits
  - integrated circuits
- Moore’s law
  - Circuit capacity doubles every 18 months
  - True from 1972 to the present day
The First Generation of Computers

- 1951-1958
- Vacuum tubes for internal operations
- Magnetic drums for memory
- Limited memory
- Heat and maintenance problems

ENIAC (19,000 vacuum tubes)

ENIAC Modular programming?

Age of the dinosaurs

1st Generation (con’t)

- Punched cards for input and output
- Slow input, processing and output
- Low-level symbolic languages for programming

UNIVAC

- UNIVAC I (1951)
- developed by Mauchley and Eckert for Remington Rand
- replaced IBM tabulating machines at the Census Bureau
**UNIVAC**

J. Presper Eckert and Walter Cronkite and the UNIVAC I on election night 1952

**Machine language**

- Machine language: 0’s and 1’s, the only language a computer can directly execute.

**Assembly language**

- Made programming easier.
- Uses abbreviations instead of binary code i.e., LD for load.
- Machine-dependent (not portable)

**The Second Generation of Computers**

- 1959-1964
- Transistors for internal operations
- Magnetic cores for memory
- Increased memory capacity

**IBM 360**

- Magnetic tapes and disks for storage
- Reductions in size and heat generation
- Increase in processing speed and reliability
- Increased use of high-level languages

**Second Generation (con’t)**
High-level languages

- The first high-level programming languages were
  - FORTRAN (1954)
  - COBOL (1956)
  - LISP (1961)
  - BASIC (1964)

Admiral Grace Hopper

- 1952: She introduces the new concept that computers could be programmed using symbols on paper (languages).
- Later writes the COBOL language.

The Third Generation of Computers

- 1965-1970
- Integrated circuits on silicon chips for internal operations (IC’s)
- Increased memory capacity
- Common use of minicomputers

Third generation (con’t)

- Emergence of the software industry
- Reduction in size and cost
- Increase in speed and reliability
- Introduction of families of computers

Key term: LSI

- LSI (Large Scale Integration) - method by which circuits containing
  - thousands of components are packed on a single chip

Third generation (con’t)

- Compatibility problems (languages, I/O devices, etc. were informally standardized)
- Minicomputers popular in offices.
The Fourth Generation of Computers

- 1971-today
- VLSI (100,000's of components/chip)
- Development of the microprocessor
- Microcomputers and supercomputers

Ted Hoff, Intel
Designer of first microprocessor

4th generation design

VLSI (each wafer has 100-400 IC's with millions of transistors on each one)

Fourth Generation (con’t)

- Greater software versatility
- Increase in speed, power and storage capacity
- Parallel processing
- Artificial intelligence and expert systems
- Robotics

Graphic User Interfaces (GUI)

Macintosh, 1984
Lisa, 1983
Sun, 1988

Key term: Microprocessor

Microprocessor: programmable unit on a single silicon chip, containing all essential CPU components (ALU, controller)
**Key term: Microcomputer**

*Microcomputer: small, low-priced, personal computer.*

**Early microcomputers**

- Apple I, 1976
- Apple II, 1977

**Apple computer company**

Steve Wozniak and Steve Jobs

**Early IBM microcomputers**

- IBM PC, 1981
- IBM XT, 1983 w/10M Hard drive

**Software giants**
Programming language giants

Niklaus Wirth
Pascal, 1972

BASIC, 1964
David Kennedy,
Dartmouth U

Key term: Supercomputer

Supercomputer: perform millions of operations per second and process enormous amounts of data
Costs in tens of millions of dollars

Supercomputers

(l to r) Cray xmp, ymp and Cray 2

Cray T90, 40gigaflops

Processor speed growth

Environment “Generations”

Environments
- single process
- batch process
- time-shared
  - one powerful computer serving multiple users
- personal computer
  - multiple individual computers
- client/server
  - individual computers (clients) interacting with powerful computer providing services to multiple users (server)