

## History of Computer Science



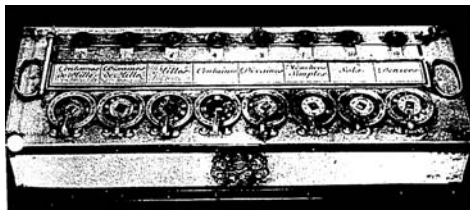
1870 MEMBERS OF THE BIRMINGHAM ACADEMY COMPANY  
PHOTOGRAPH BY W. H. WOODS

## 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)



Ketabton.com

## 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'



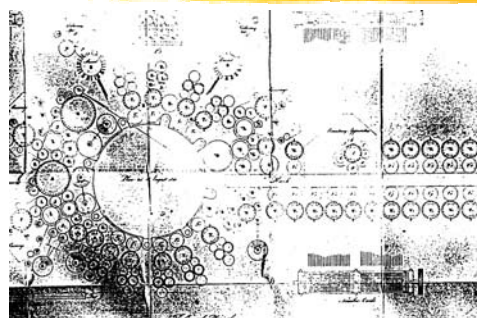
## Babbage's computer

- ⌘ 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



## 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

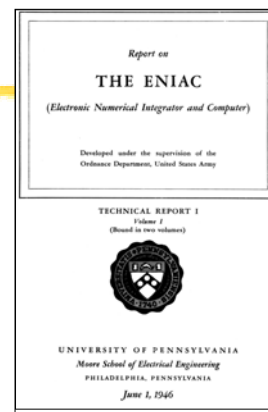
☒ "Computers"

⌘ John von Neumann

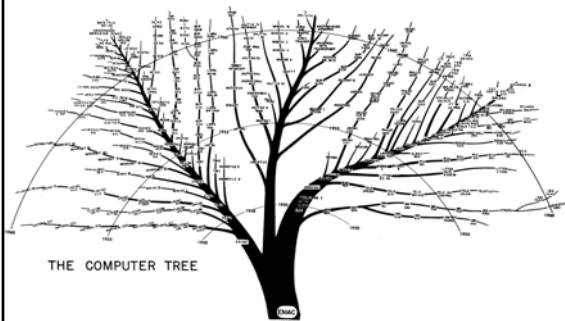
☒ Programs as data

⌘ 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)



Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

## 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

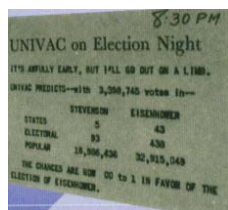
## UNIVAC

- ⌘ 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

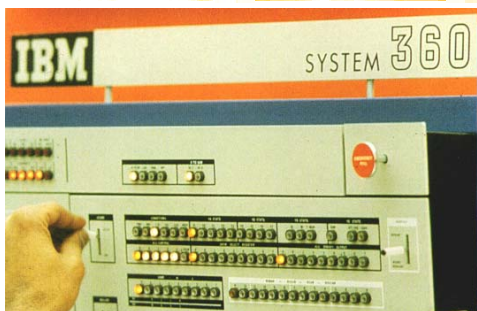
- ⌘ Made programming easier.
- ⌘ Uses abbreviations instead of binary code i.e., LD for load.
- ⌘ Machine-dependent (not portable)

## The Second Generation of Computers

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



## IBM 360



## Second Generation (con't)

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

## 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

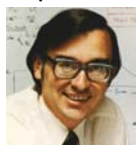
## Third generation (con't)

- ⌘ Compatibility problems (languages, I/O devices, etc. were informally standardized)
- ⌘ Minicomputers popular in offices.



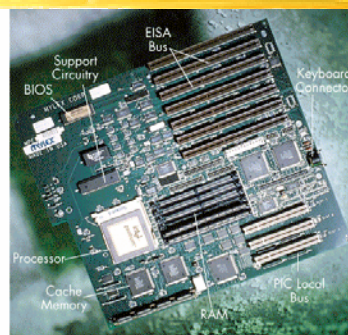
## The Fourth Generation of Computers

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

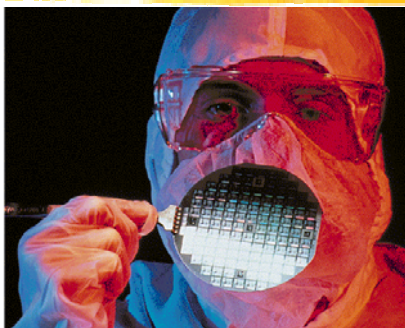


Ted Hoff, Intel  
Designer of first microprocessor

## 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)



Lisa, 1983



Macintosh, 1984



Sun, 1988

## Key term: Microprocessor

- ⌘ Microprocessor: programmable unit on a single silicon chip, containing all essential CPU components (ALU, controller)



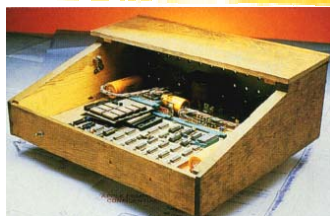
## Modern microprocessor



## Key term: Microcomputer

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

## Early microcomputers

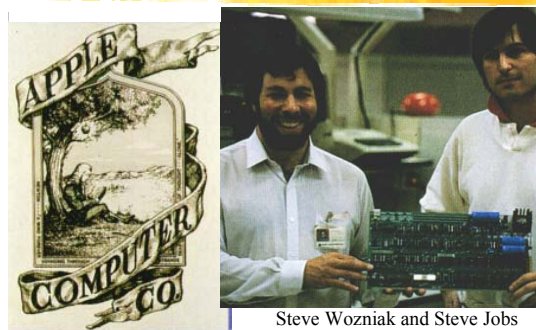


Apple I, 1976



Apple II, 1977

## Apple computer company



Steve Wozniak and Steve Jobs

## Early IBM microcomputers

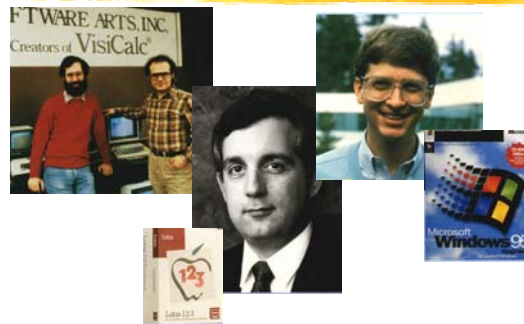


IBM PC, 1981



IBM XT, 1983  
w/10M Hard drive

## Software giants



## Programming language giants



BASIC, 1964  
David Kennedy,  
Dartmouth U



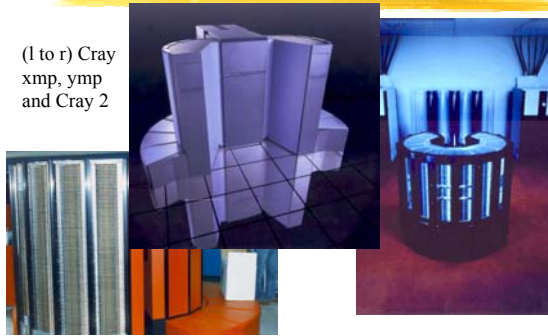
Niklaus Wirth  
Pascal, 1972

## Key term: Supercomputer

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

## Supercomputers

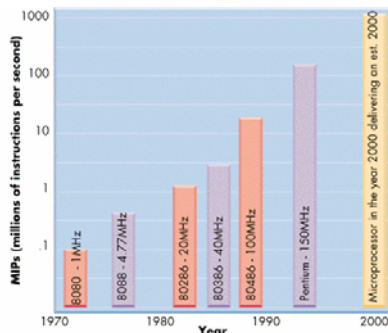
(l to r) Cray xmp, ymp and Cray 2



## 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)

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