computer science
illuminated

History of Computing

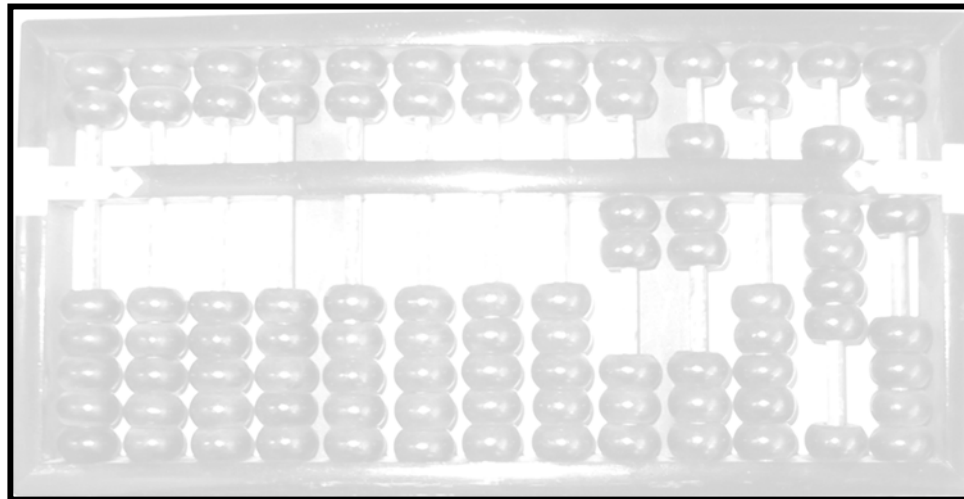## Nell Dale & John Lewis
(adaptation by Michael Goldwasser)

Early History of Computing

Abacus (origin? 2000BC)

An early device to represent numeric values with beads.

Note that the "computing" is still done by the human.
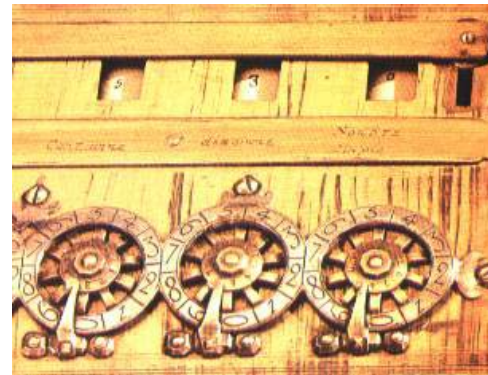

More Info

The Pascaline

Blaise Pascal (1623-1662)

Mechanical device to do addition.

Used gear positions to represent information and a turn of a crank to manipulate the gears.

More info

Wilhelm Leibniz

Wilhelm Leibniz (1646-1716)

gear-based mechanism (Stepped Reckoner) similar to Pascal's, but "hardwired" for some multiplications.
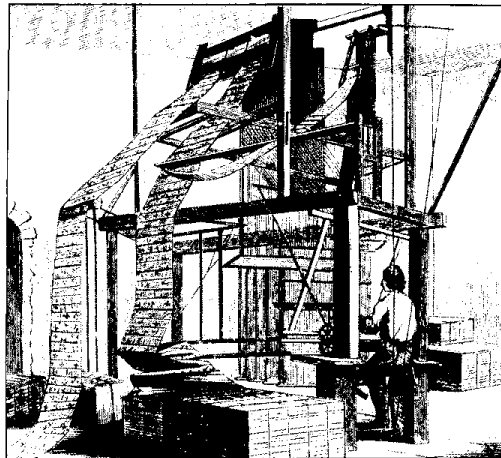

[More info](#)

Jacquard's Loom

Joseph Jacquard (c. 1801)

Mechanical loom with weaving pattern based on holes in paper which had the effect of raising and lowering particular hooks (i.e., programmable)

More info

Other "punched card" systems

Music Boxes and Player Pianos (1800's, 1900's)
→ links to history, pictures, music

Herman Hollerith (1860-1929):
census tabulation using punched cards - led to founding of IBM (originally Tabulating Machine Company)

The Analytical Engine

Charles Babage (1792-1871)

Difference Engine: a gear-based computer he built

Analytical Engine: a design for a gear-based computer which would be *programmable* using punched cards. Machine was never fully realized as he ran out of money. Technical problem was that gear-based machine had some inherent inaccuracy that might go unnoticed in watch or loom, but not in complex arithmetic calculations.

Modern Computers - Electricity

Breakthrough: Can control flow of electrons. Electrons travel faster, more accurately, and with less power/cost than gears.

Earliest Models:

Non-military (thus funding/support limited)
John Atansoff & Clifford Berry (Iowa State, 1937-1941)
Konrad Zuse and Helmut Schreyer (Germany, c. WWII)

Military (thus funding/support plentiful)
Mark 1 (Howard Aiken et al, Harvard/IBM, 1941-1944)
Colossus (Alan Turing et al, England, 1943)
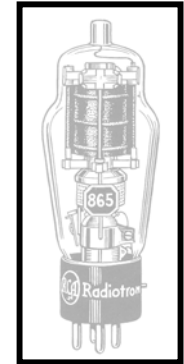ENIAC (John von Neumann et al, Penn, 1940s)

First Generation Hardware (1951-1959)

Vacuum Tubes

Large, not very reliable, generated a lot of heat

Magnetic Drum

Memory device that rotated under a read/write head

Card Readers → Magnetic Tape Drives

Development of these sequential auxiliary storage devices

Second Generation Hardware (1959-1965)

Transistor (Bell Telephone, 1947)
Replaced vacuum tube, fast, small, durable, cheap

Magnetic Cores
Replaced magnetic drums, information available instantly

Magnetic Disks
Replaced magnetic tape, data can be accessed directly

Third Generation Hardware (1965-1971)

Integrated Circuits

Replaced circuit boards, smaller, cheaper, faster, more reliable.

Transistors

Now used for memory construction

Terminal

An input/output device with a keyboard and screen

Fourth Generation Hardware (1971-?)

Large-scale Integration
Great advances in chip technology

PCs, the Commercial Market, Workstations
Personal Computers were developed as new companies like Apple and Atari came into being. Workstations emerged.

Parallel Computing and Networking

Parallel Computing

Computers rely on interconnected central processing units that increase processing speed.

Networking

With the Ethernet small computers could be connected and share resources. A file server connected PCs in the late 1980s.

ARPANET and LANs → Internet

Next Generation Hardware (?)

- **Quantum Computing**
  data based on spin of electrons

- **DNA Computing**
  info stored as sequences which can be merged/duplicated

- **???**