Lesson 1:
Introduction to Computer Science

History

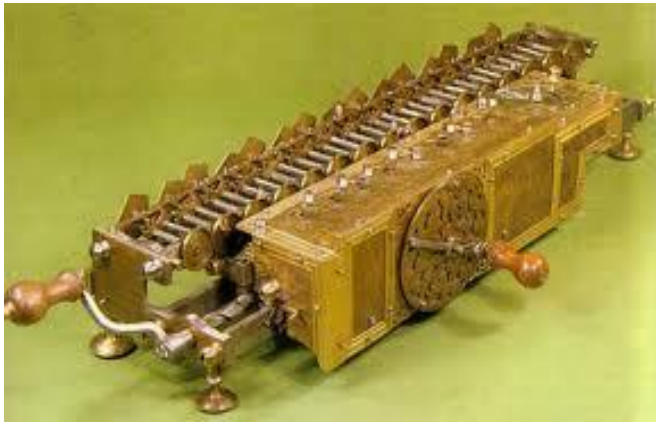
History: First calculators

- Abacus (3,000A.C): to perform fast and complex calculations (multiplication, division, square root). Still used in China, at schools
- Napier's bones (17th century): John Napier was a Scottish mathematician, famous for inventing logarithms. He invented a device of a pallet with printed numbers that, thanks to an ingenious and complicated mechanism, allowed him to carry out operations of multiplication and division.
- Calculus rules (1610): William Oughtred invented slide rules that, through addition and subtraction, allowed direct arithmetic calculations (multiplication, division)

History: Mechanical calculators

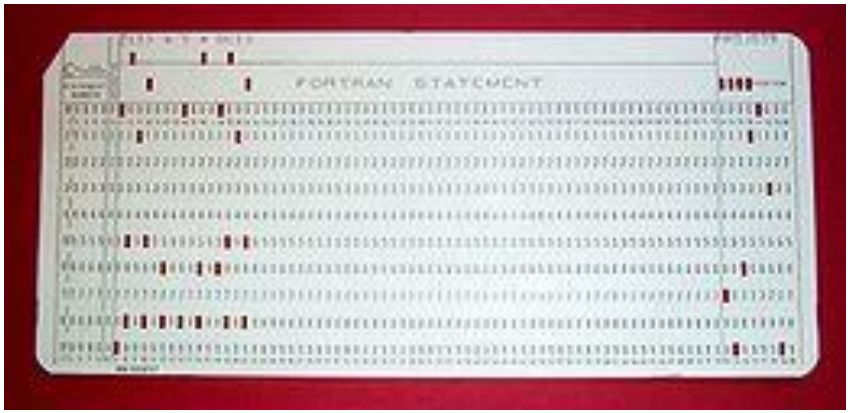
- In 1617, Wilhelm Schickard designed a first calculator capable of adding, subtracting, multiplying and dividing, but it was not built.
- In 1642, the French physicist and mathematician Blaise Pascal invented the first mechanical calculator, the Pascaline.
- In 1672 the German philosopher and mathematician Gottfried Wilhelm Leibniz invented a calculating machine (Stepped Reckoner) that could do the 4 basic arithmetic operations and obtain square roots in binary system. He also made a study of Binary mathematics which allowed Boole to develop a system of logic, Boolean algebra in 1854, an important step for early computers.





History: Perforated cards

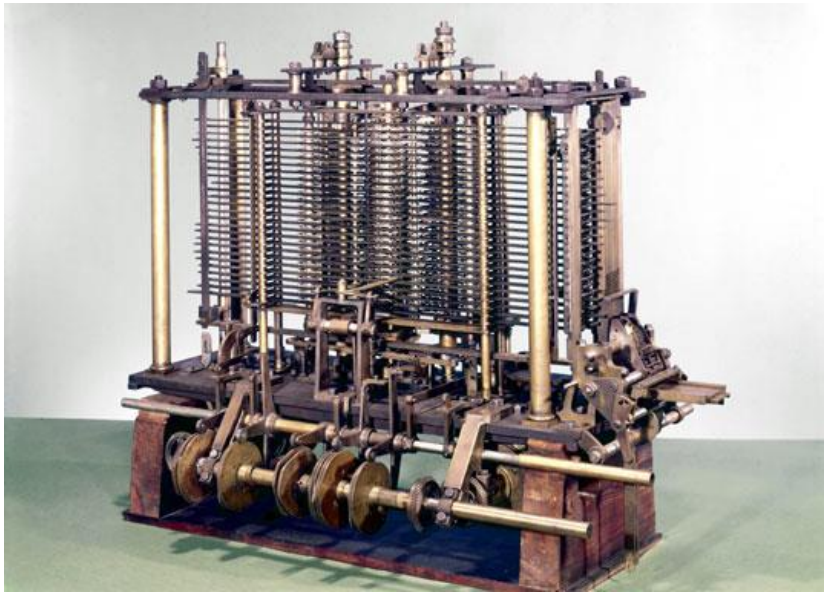
- In 1801 the Frenchman Joseph Marie Jacquard used a perforated card mechanism to control the pattern formed by the threads of the fabrics made by a knitting machine.



IMPORTANT !! Algorithms were integrated in the physical structure

History: Perforated cards

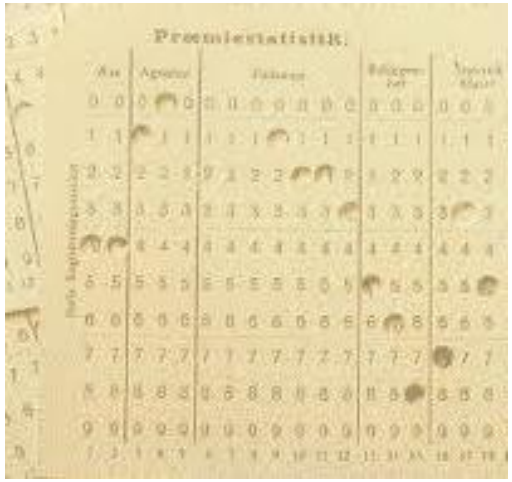
- Charles Babbage (1793-1871) created an analytical engine that allowed adding, subtracting, multiplying and dividing, with a speed of 60 sums per minute.
- In 1843 Ada Byron / **Ada Lovelace** (1815-1851) suggested the idea that punched cards should be adapted so that Babbage's engine would repeat certain operations.



IMPORTANT !! Ada Lovelace is considered the first programmer, and Charles Babbage the inventor of the modern digital computer

History: Perforated cards

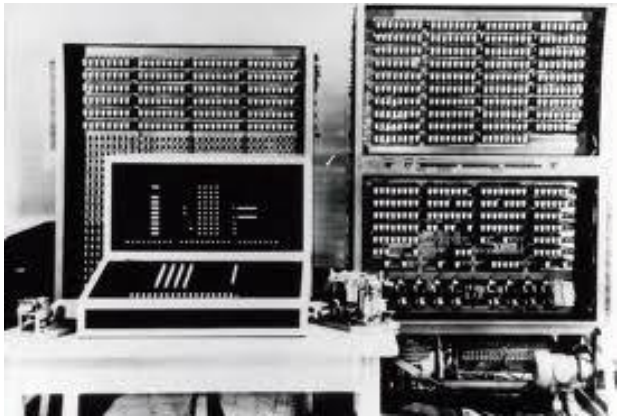
- In 1879, Herman Hollerith developed a computer system using punched cards to read American census records in which the holes represented persons' sex, age, race, and so on. Thanks to Hollerith's tabulating machine the 1890, the census was conducted in 2'5 years, five years less than the 1880 census.

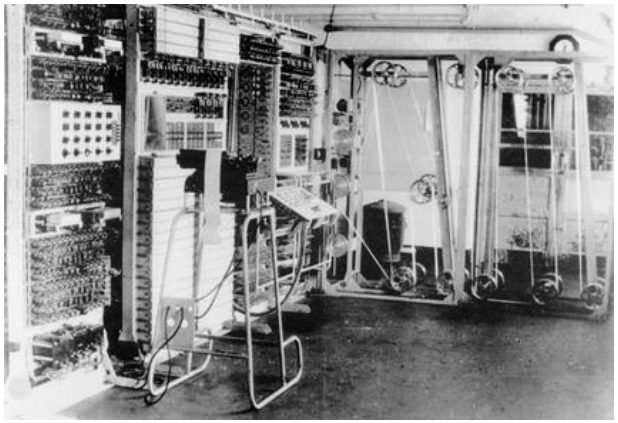


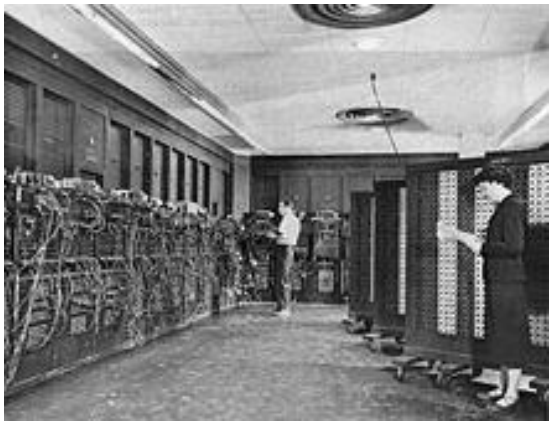
✋ IMPORTANT !! Hollerith founded: the Tabulating Machine Company. In 1924 Hollerith merged his company with two more to form the International Business Machines (IBM).

History: First digital computers

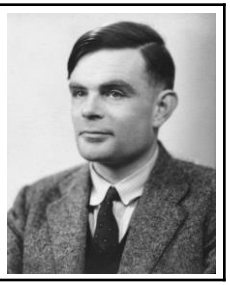
- Z3 (1941 K. Zuse) first programmable and automatic machine with features used to define a computer.
- COLOSSUS (1943) used by Alan Turing to decode German encrypted messages
- L'ENIAC - *Electronic Numerical Integrator And Computer* (1947 Mauchly i Eckert) allowed to perform tasks that were previously impossible







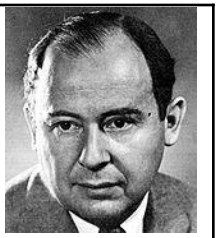
✋IMPORTANT !!
Electronic elements (vacuum valves) replace mechanic ones.
Digital calculations replace analog calculations
A. Turing is considered the father of modern computing



History: First Generation

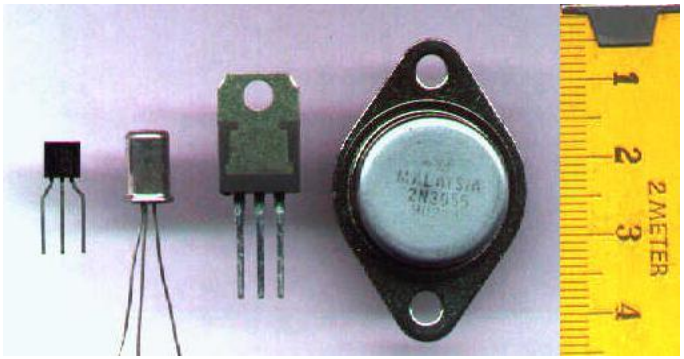
- EDVAC (1952) John Von Neumann proposes a modified version of the ENIAC. This machine presented two important differences with respect to the ENIAC:
  - It uses binary arithmetic, which simplifies electronic computing circuits.
  - It works with a stored program. ENIAC was programmed by plugging in hundreds of plugs and activating a small number of switches.
- UNIVAC I: Designed for general purposes. First machine to process alphanumeric and data problems. Commercial computers are born

✋ IMPORTANT!!! Von Neumann is considered the father of today's computer architecture



History: Second generation (1958-1964): Transistors

- A transistor and a valve perform equivalent functions, so that each valve can be replaced by a transistor. A transistor can be the size of a lentil while a vacuum tube is the size of a hunting shotgun cartridge. While the supply voltages of the tubes were around 300 volts, those of the transistors are 10 volts.
- New professions were created; programmer, analyst, expert in information systems, and the software industry started.
- The evolution of computers led to the emergence of high-level, more understandable languages such as COBOL, FORTRAN or BASIC..



History: Third generation (1964-1971): Integrated Circuits

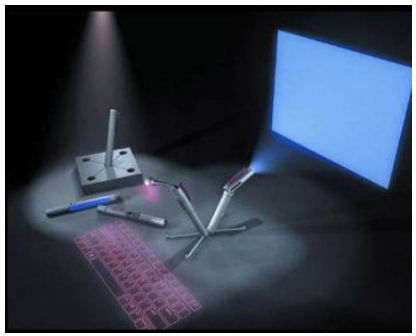
- An integrated circuit encapsulates transistors on the same chip. When transistors become smaller and closer, an electrical impulse travels faster, as less space has to pass. Up to millions of transistors have been integrated into a single chip.
- Integrated Electronics (Intel) is founded, which is dedicated to the construction of integrated circuits
- IBM 360 appears

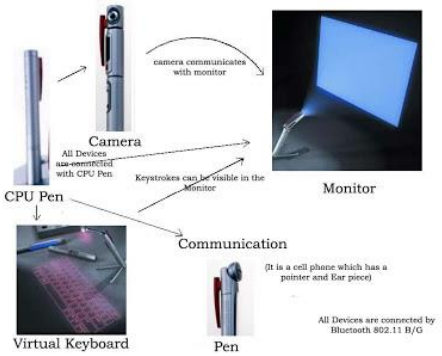
History: Fourth generation (1971 onwards): PC's

- The basis of the fourth generation was the invention of the microprocessor by Marcian Hoff
- Microprocessor-based computers were originally very limited (in computing and speed), and there was no attempt to make a small-sized version of a minicomputer. They were for different market.
- 1976. Steve Wozniak and Steve Jobs founded Apple Computer.
- 1978. Intel manufactures the CPU, Intel 8086 (16-bit). IBM launched its first PC, with an Intel 8088 (with 8-bit external data bus). The PCs we have on the market today are an evolution of the 8086.

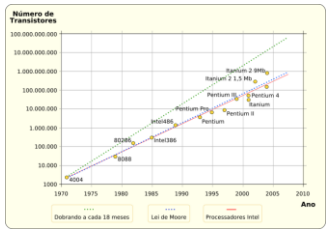
The Future

- No commercial substitute for silicon chips has yet been found. Among others, we talk about **DNA-based computers** (where DNA molecules would interact by performing calculations in parallel), **quantum computers** (which would be based not only on 0 or 1, but also on a set of intermediate states typical of quantum physics).
- A constant trend in the development of computers is microminiaturization, an initiative that tends to compress more circuit elements into an ever smaller chip space.





IMPORTANT!!! Moore's Law: In 1965 he said that the capacity of microprocessors would double every 2 years



Type of computer

- Supercomputer.
- Central computer, also called mainframe.
- Workstation
- Servers
- Personal Computer
- Microcontroller.
- Mobile phone, tablet, PDA