1. The History of Computers

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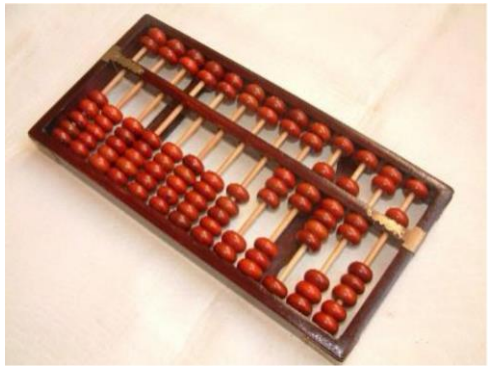
Computer

- "Computer" first use recorded in 1613:
  - Job title: a human who performed calculations
  - The Harvard Observatory Computers
  - NACA/NASA

- Into 20th century the "computer" was re-defined:
  - Any device that aids humans in performing various calculations or computation tasks

Abacus

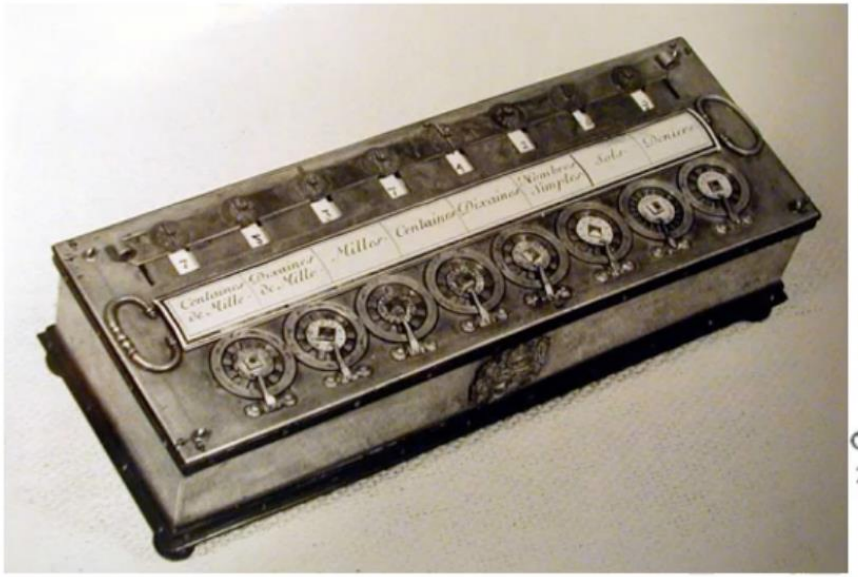
- Abacus: the first device for calculations, ancestor of modern computers
- 2700 – 2300 BC
- Different types
- Rods → unit (unit, tens, hundreds, thousands)
- Beads → digit
- Addition, subtraction, multiplication, division

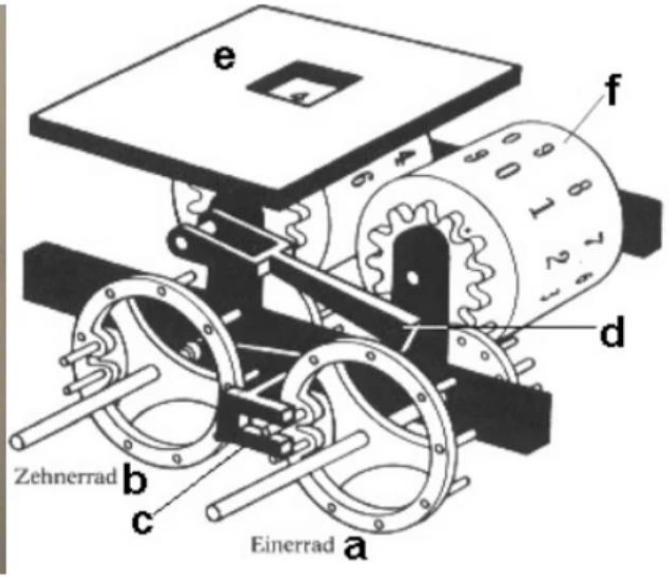


The “Pascaline”

Mechanical Era

- Also known as the arithmetic machine
- Invented by Blaise Pascal in 1642
- First mechanical calculator
- Use gears and levers to increase the automation of calculation





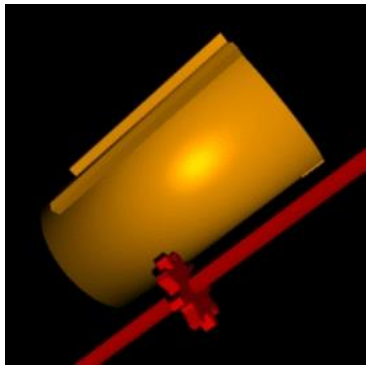
The “Pascaline”

- Higher wheel rotates by 1 when a lower dial produces a carry
  - Can do **addition** directly on machine
  - Can do **subtraction** by method of complements
  - Short **multiplication/division** by repeated **addition/subtraction**
  - Example: 28 + 35 = 63

https://www.youtube.com/watch?v=3h71HAJWnVU

The "Stepped Reckoner"

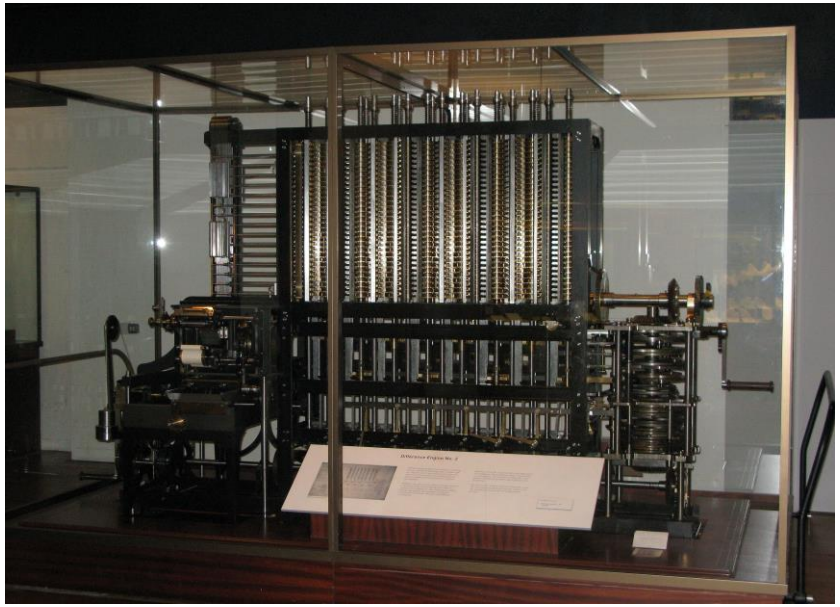
- Invented by Gottfried Wilhem von Leibniz in 1671
- Also known as the Leibniz calculator
- *...it is beneath the dignity of excellent men to waste their time in calculation when any peasant could do the work just as accurately with the aid of a machine.*-- Gottfried Leibniz
- Can do **addition** and **subtraction** as on the Pascaline
- "Leibniz wheel" allows for long **multiplication** and **division**



https://www.youtube.com/watch?v=OacMkA38QiQ

The Difference Engine

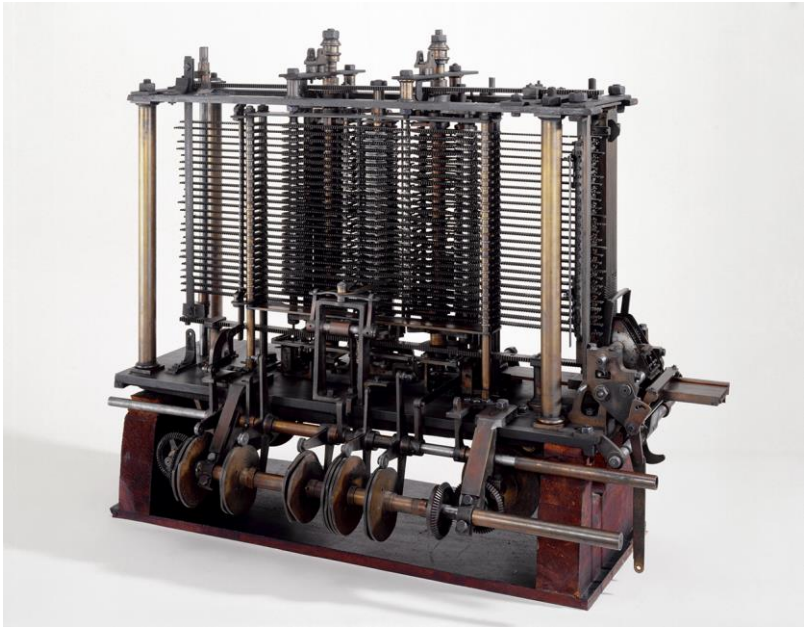
- Considered the first computer
- Invented by Charles Babbage in 1822
- Evaluates polynomials. Therefore, it can approximate trigonometric functions, logarithms, etc. (apart from addition, subtraction, multiplication and division)



The London Science Museum's difference engine, the first one actually built from Babbage's design. Source: https://en.wikipedia.org/wiki/Difference_engine

The Analytical Engine

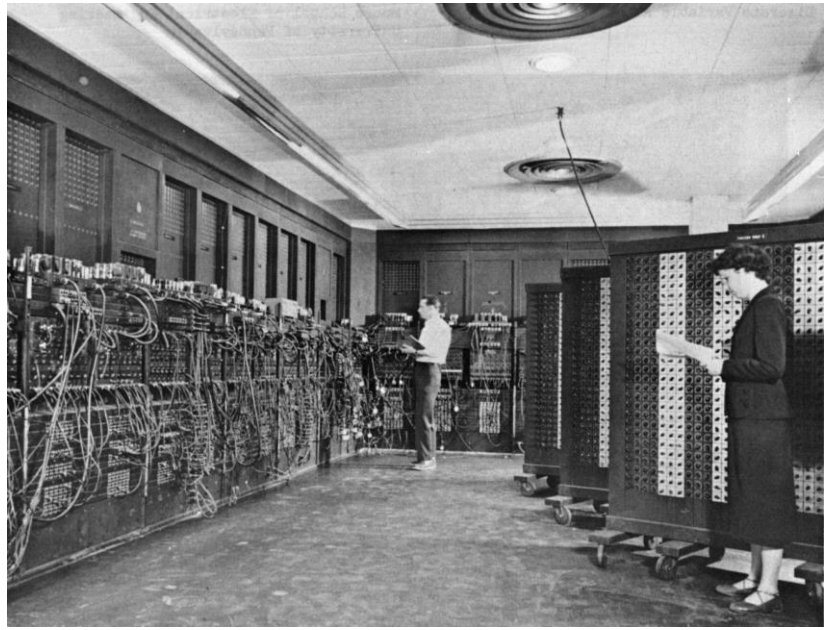
- Invented by Charles Babbage in 1837
- Described by Ada Lovelace
- Considered the first programmable computer
- Basic components found in all modern computers:
  - **Mill** performs arithmetic operations
  - **Operator** processes operations specified by punch cards
  - **Store** holds data on punch cards
  - **Output** prints results



Portion of the calculating machine with a printing mechanism of the Analytical Engine, built by Charles Babbage, as displayed at the Science Museum (London). Source: https://en.wikipedia.org/wiki/Analytical_Engine

ENIAC

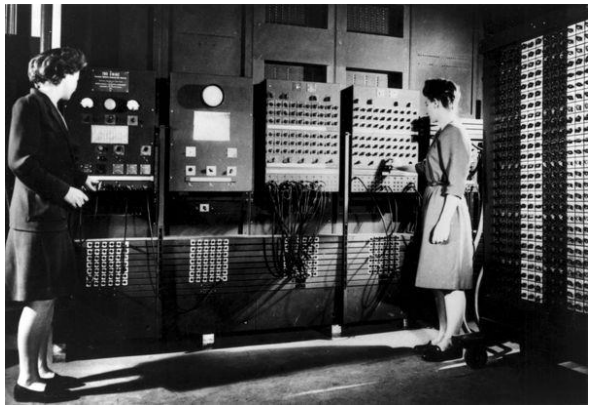
- 1943-1946, **E**lectronic **N**umerical **I**ntegrator **A**nd **C**alculator
- Developed at the University of Pennsylvania for the United States Army
- Arguably the first large-scale, general purpose, electronic digital computer
- Breath-taking speed: 300 multiplications or 5000 additions per second
- Enormous size: 17,500 vacuum tubes, 500,000 soldered connections, filled a 50-foot long basement room, weighed 30 tons



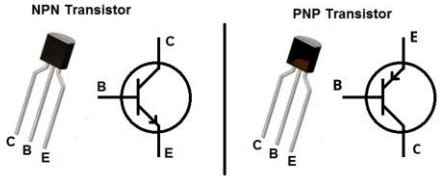
Electronic Era

Generations of Electronic Computer

- 1st Generation (1940 – 1956) -- Vacuum Tubes:
  - Very large
  - Expensive
  - Huge amount of electricity
  - E.g., ENIAC



- 2nd Generation (1956 – 1963) -- Transistors:
  - Smaller
  - Faster
  - Cheaper



- Both 1st and 2nd generations:
  - Punched cards for input
  - Print-outs for output

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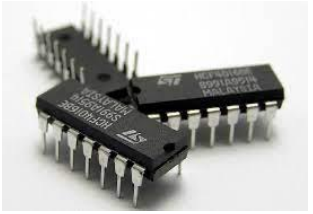
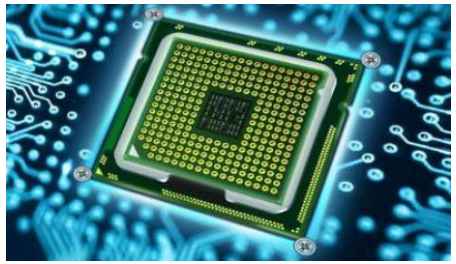
Generations of Electronic Computer



- 3rd Generation (1964 – 1971) -- Integrated Circuits (IC):
  - Faster, cheaper, smaller
  - Less electricity, fewer mistakes
  - Keyboards, monitors (replacing punched cards and print-outs)



- 4th Generation (1967 – present) -- Microprocessor:
  - Small, portable, cheaper
  - Less electricity, less heat
  - More ways to interact (e.g., touch screen, stylus pen, etc.)

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Generations of Electronic Computer

- 5th Generation (present/future) – Artificial Intelligence (AI):
  - Bridge the gap between computing and thinking

AlphaGo

ChatGPT