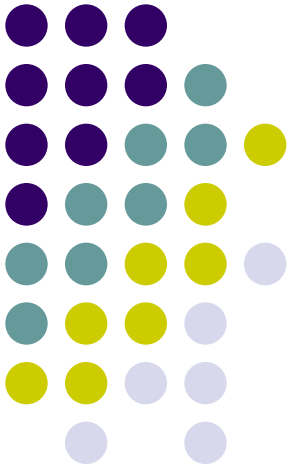
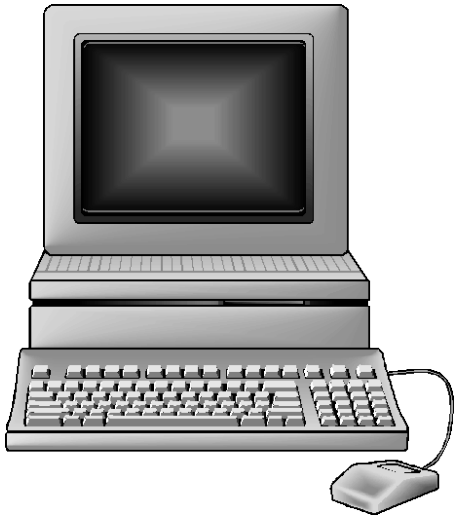
CSE 301
History of Computing

The Origins of Computing

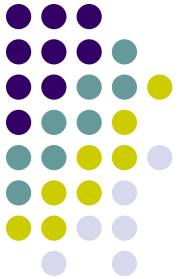


What is a Computer?



- one who computes
- a person employed to make calculations in an observatory, in surveying, etc.
- “a programmable machine that can execute a list of instructions in a well-defined manner”
  - Webopedia

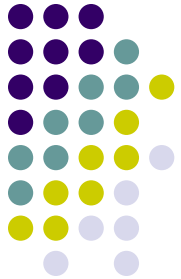
Requirements



- Your computer must be able to:
  - perform arithmetic operations
  - make logical decisions (if X is true, do Y)
  - be programmed
  - process data into information
  - display results
  - store results/data
  - store programs for reuse

- We are describing a stored-program computer
  - a.k.a. Von Neumann machine

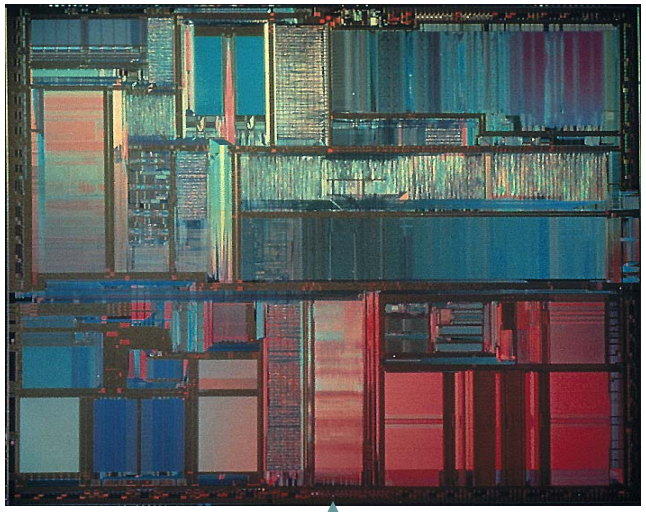
Modern Computers are assemblies of components



- Keyboard
- Monitor
- Central Processing Unit (CPU)
- Random Access Memory (RAM)
- Hard Drive
- Motherboard

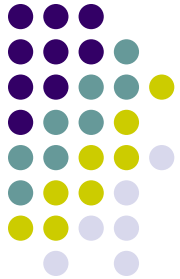
CPU (Microprocessor Chip)

- Brain of the computer
- Made of Integrated Circuits (ICs), which have millions of tiny transistors and other components
- Performs all calculations & executes all instructions
- Example chips for PC:
  - Intel (Celeron, Pentium)
  - AMD (K-6 and Athlon)



Inside the Chip

What's a Giga Hertz (GHz) ?

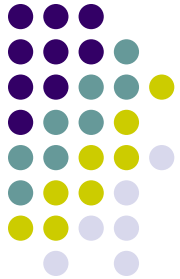


- A unit of measurement for CPU speed (clock speed)
  - G (giga) means 1 billion, M (mega) would be 1 million
  - Hz is for frequency per second
  - GHz means 1 billion clock cycles per second
- CPUs may execute multiple operations each clock cycle
- So what does a 2.8 GHz CPU mean?
  - 2,800,000,000 clock cycles per second
  - Performs at least 2,800,000,000 operations per second

Main Memory (RAM)

- Stores data for programs currently running
- Temporary
  - empty when power is turned off
- Fast access to CPU

What's a Giga Byte (GB)?



- GB measures the amount of data the it can store
  - G (giga) for 1 billion
  - M (mega) for 1 million

- Data quantities are measured in bytes
  - 1 ***Bit*** = stores a single on/off piece of information
  - 1 ***Byte*** = 8 bits
  - 1 ***Kilobyte*** = 2^{10} (~1,000 bytes)
  - 1 ***Megabyte*** = 2^{20} (~1,000,000 bytes)
  - 1 ***Gigabyte*** = 2^{30} (~1,000,000,000 bytes)

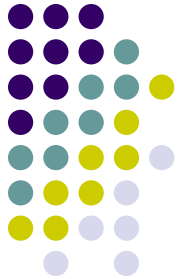
Hard Drive

- Stores data and programs
- Permanent storage (theoretically)
  - when you turn off the computer, it is not emptied

Motherboard

- Connects all the components together

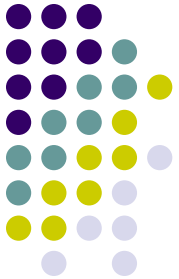
In studying the history of computers, where do we start?



- We could go back thousands of years
  - Mathematical developments
  - Manufacturing developments
  - Engineering innovations
  - The wheel?

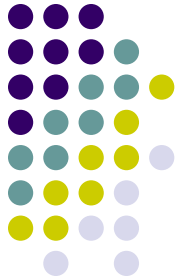
- The basis of all modern computers is the binary number system

Count to 8 in binary



- 0001
- 0010
- 0011
- 0100
- 0101
- 0110
- 0111
- 1000

What number system do you use?

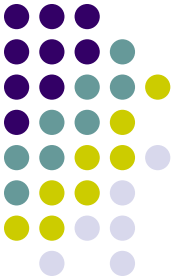


- Decimal (base-10)
  - Has been in use for thousands of years
  - Guesses:
    - first China
    - then India
    - then Middle East
    - then Europe (introduced as late as 1200)
- It is not particularly efficient
- Not a good system for computers
- Why use decimal?

Greek Number System

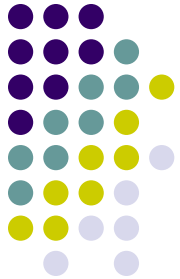
Letter	Value	Letter	Value	Letter	Value
α΄	1	ι΄	10	ρ΄	100
β΄	2	κ΄	20	σ΄	200
γ΄	3	λ΄	30	τ΄	300
δ΄	4	μ΄	40	υ΄	400
ε΄	5	ν΄	50	φ΄	500
ϝ΄ or ς΄ or στ΄	6	ξ΄	60	χ΄	600
ζ΄	7	ο΄	70	ψ΄	700
η΄	8	π΄	80	ω΄	800
θ΄	9	ϟ΄	90	ϡ΄	900

Computers use Binary



- Why?
  - Much simpler circuits needed for performing arithmetic

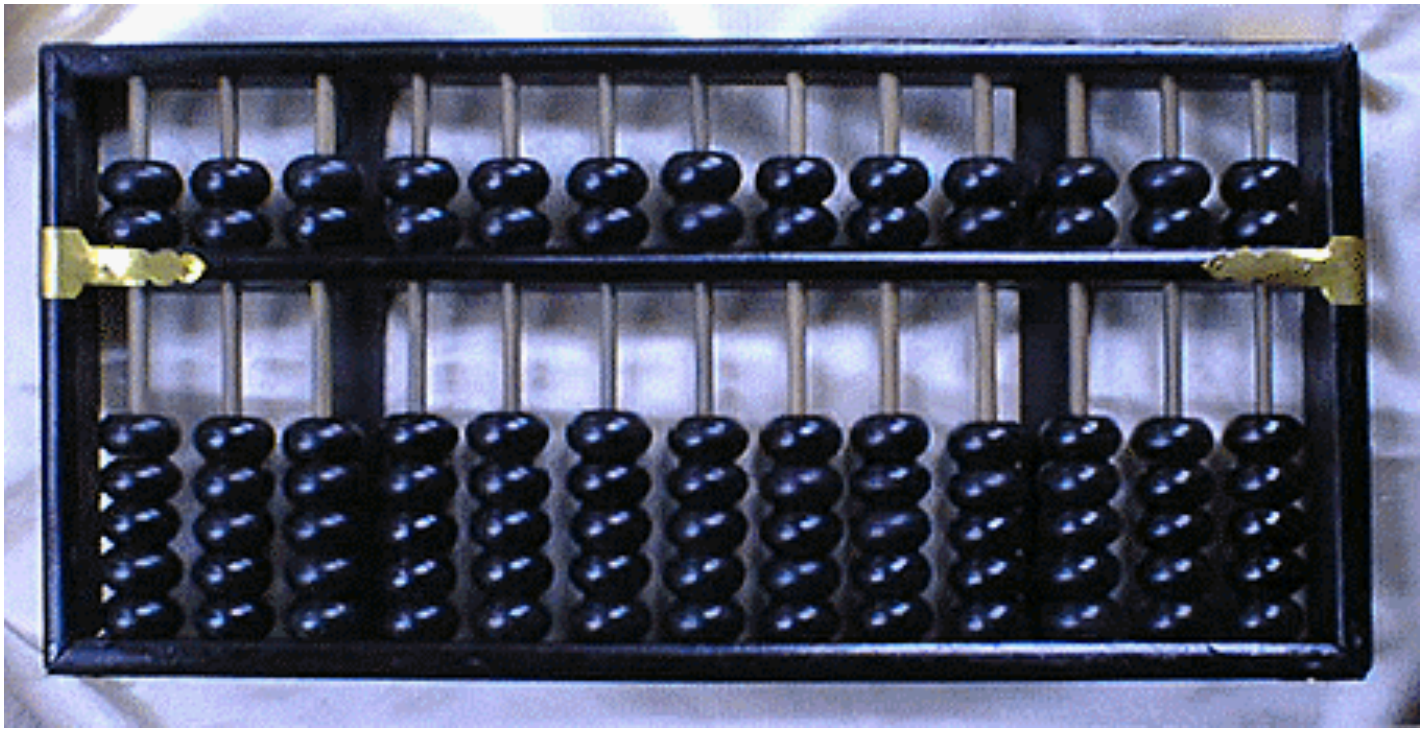
Some factoids



- 4th Century AD
  - Mayan astronomer-priests begin using a positional number system based on base 20
- 1708
  - Swedenborg proposes decimal notation should be replaced for general use by octal.
- 1732
  - Leonhard Euler, Swiss mathematician
  - used binary notation in correspondence
- 1887
  - Alfred B. Taylor publishes “Which base is best?” and concludes it is base 8.

Early Computational Devices

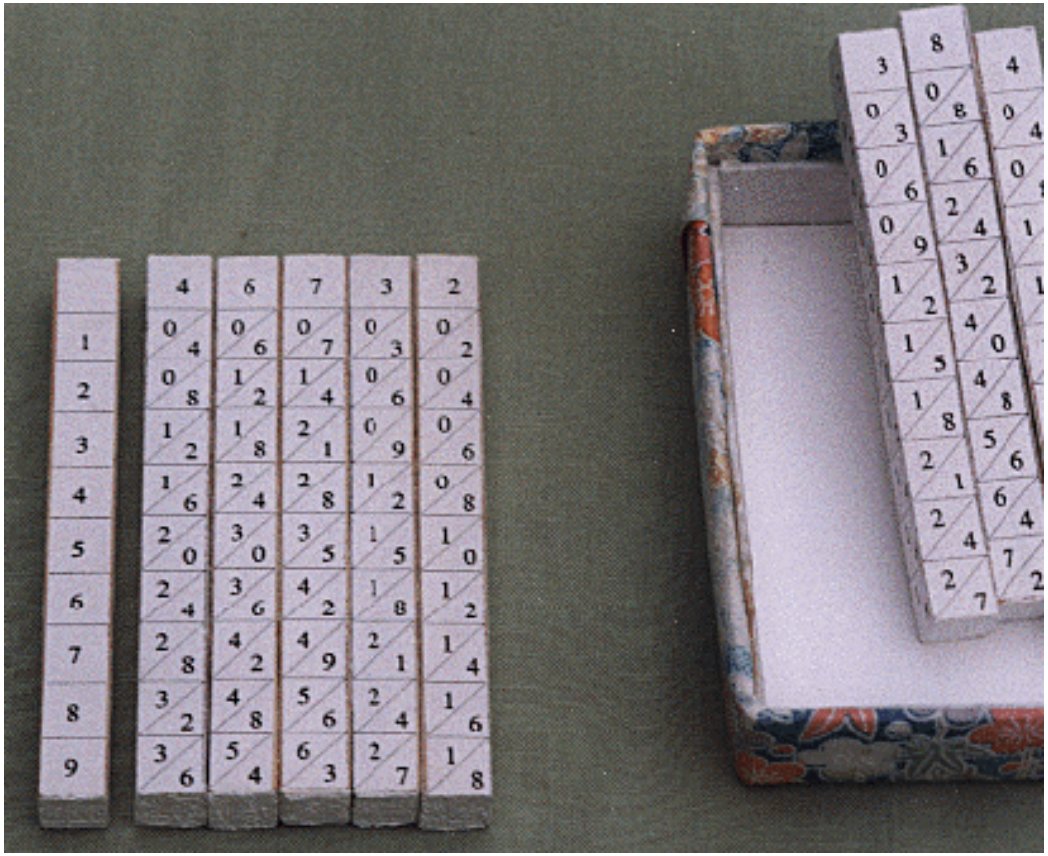
- (Chinese) Abacus
  - Used for performing arithmetic operations



Early Computational Devices

- Napier's Bones, 1617
  - For performing multiplication & division

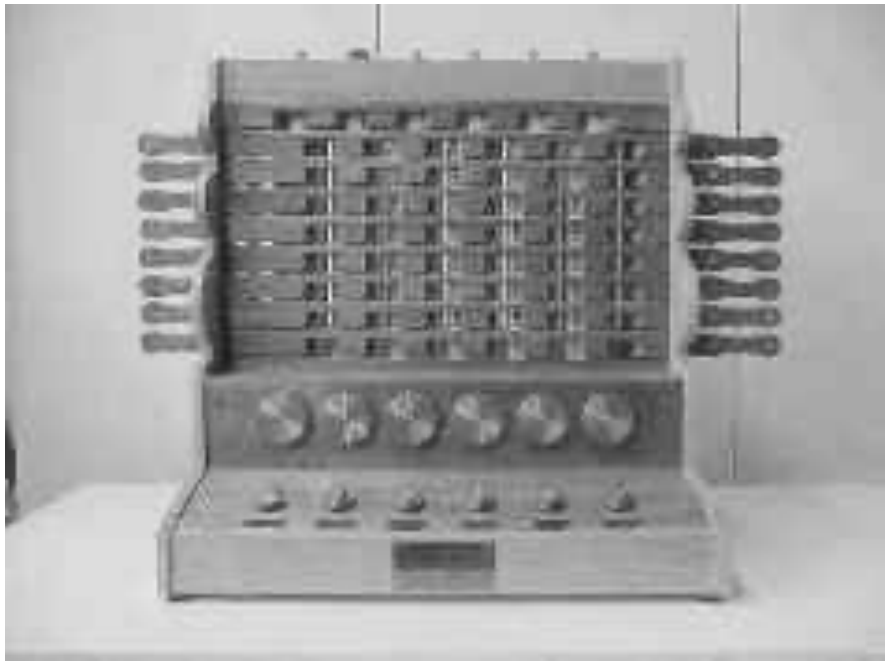
John Napier
1550-1617



Early Computational Devices

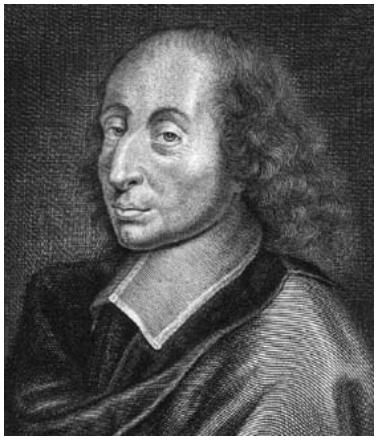
- Schickard's Calculating Clock
  - first mechanical calculator, 1623

Wilhelm Schickard
1592-1635



Early Computational Devices

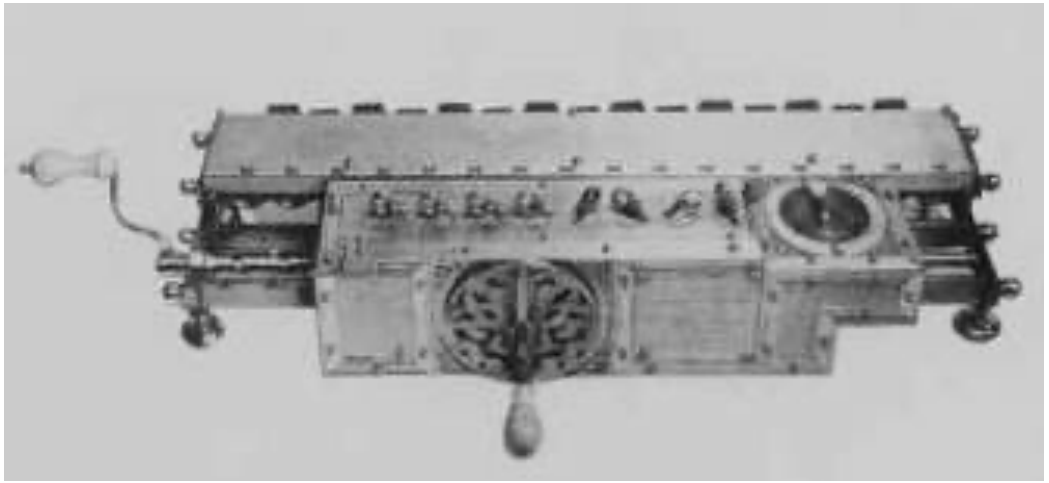
- Pascaline mechanical calculator



Blaise Pascal
1623-1662

Early Computational Devices

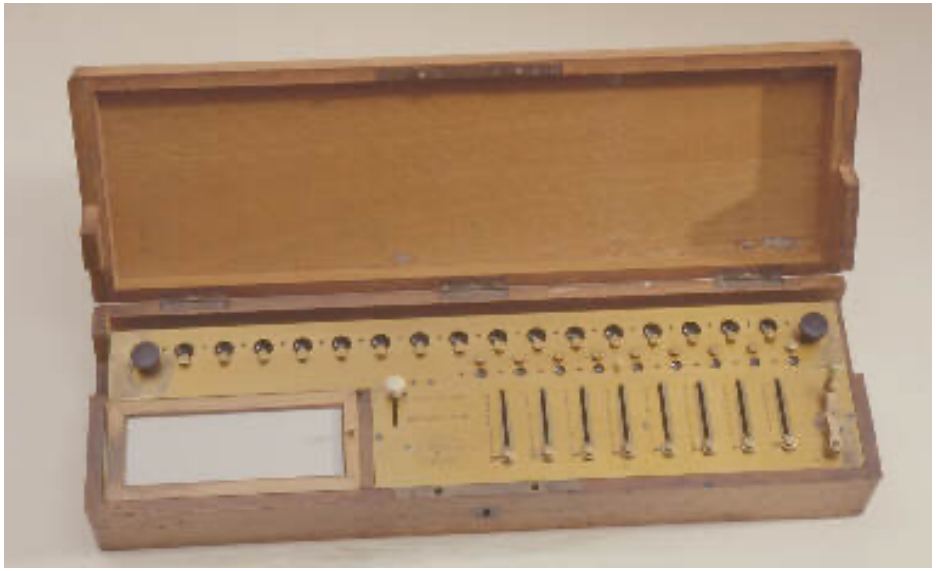
- Leibniz's calculating machine, 1674



Gottfried Wilhelm von Leibniz
1646-1716

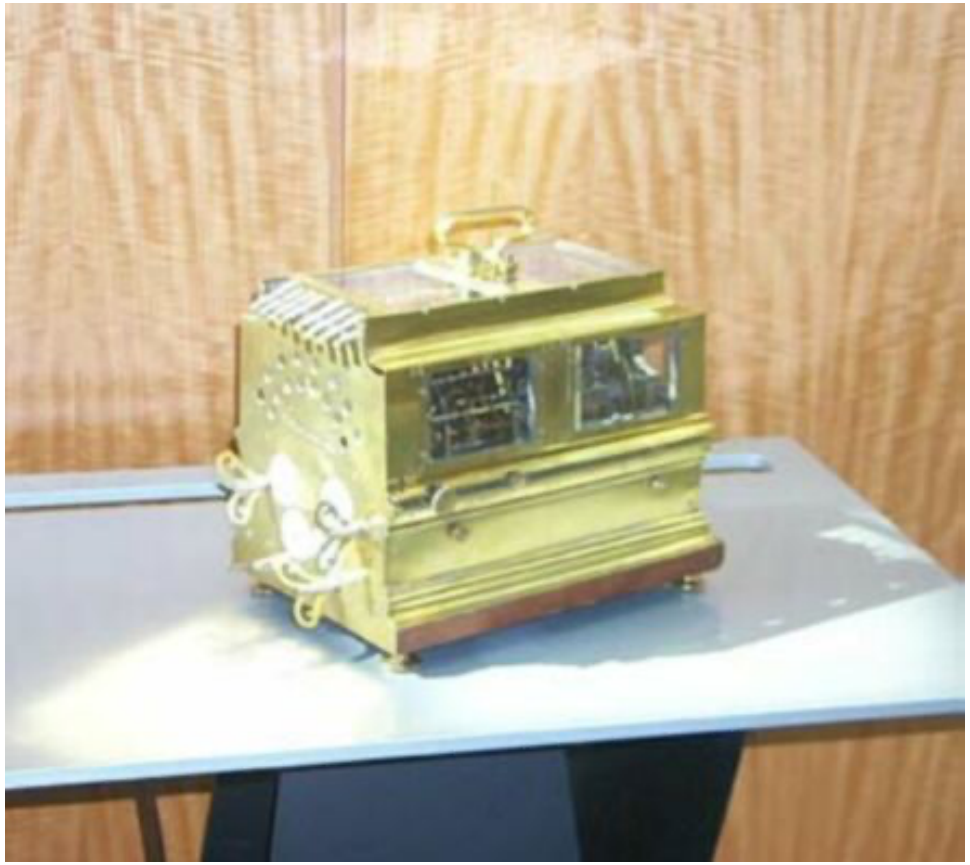
Early Computational Devices

- Thomas Arithmometer, 1820



Early Computational Devices

- Arithmaurel, 1849



Early Computational Devices

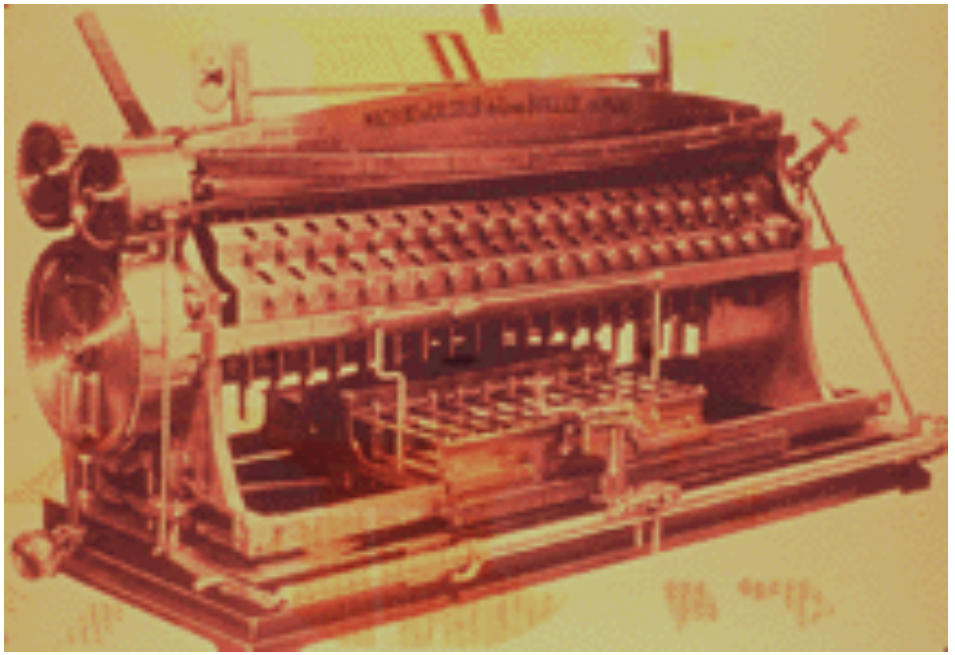
- Comptometer

Dorr Eugene Felt
1862-1930

Early Computational Devices

- Bollée's Machine

Léon Bollée
1870-1933

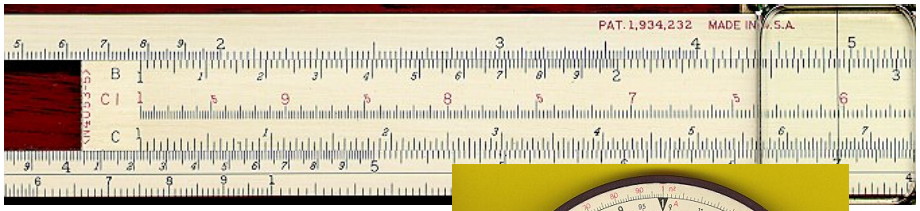


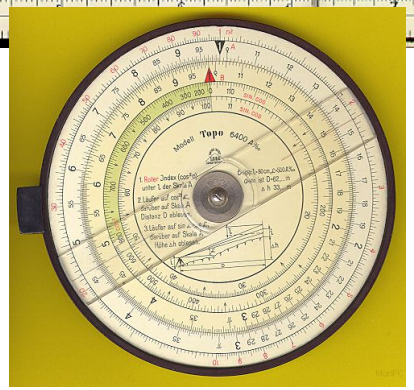
Early Computational Devices

- Madas and Curta

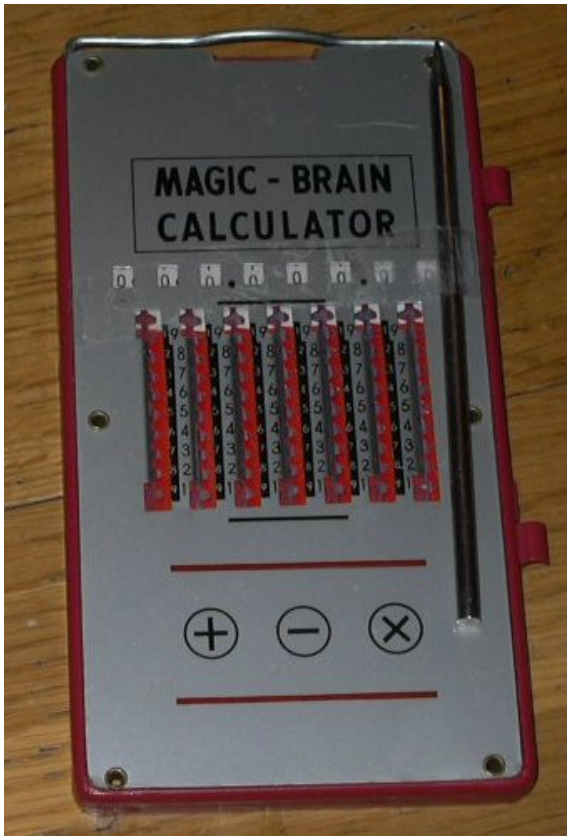
Early Computational Devices

- Slide Calculators





William Oughtred
1574-1660



Early Computational Devices

- Atari 2600 (1977)