

E2011: Theoretical fundamentals of computer science

Topic 1: Computing platforms - a historical perspective

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Outline

A historical perspective

- Earliest devices

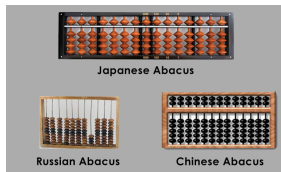
- Rise of digital computing

First computers

Earliest devices

Abacus

- ▶ starting around 3000 BC
- ▶ widely spread across ancient civilizations (Babylonians, Chinese, Greeks,...)
- ▶ basic arithmetic operations



from: <https://alohagujarat.com/blog/the-origin-and-evolution-of-abacus>



from: <https://www.ecb.torontomu.ca/~elf/abacus/history.html>

Quipu

- ▶ cultures in Andean region
- ▶ knots on strings for keeping records



Public Domain, <https://commons.wikimedia.org/w/index.php?curid=123557>

Antikythera mechanism

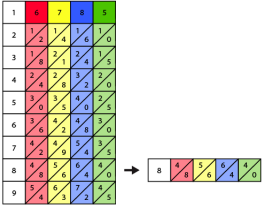
- ▶ cca 100 BC
- ▶ analog device for astronomical calculations
- ▶ one of the earliest mechanical "computers"
- ▶ uses dials for input/output and gears to perform operations



from: <https://www.livescience.com/antikythera-mechanism-photos>

Napier's Bones (1617)

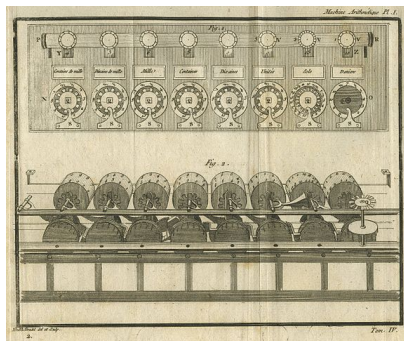
- ▶ rods with engraved numbers
- ▶ enabled multiplication and division through a series of mechanical calculations



from:
https://en.wikipedia.org/wiki/Napier's_bones

Pascal's calculator (1642)

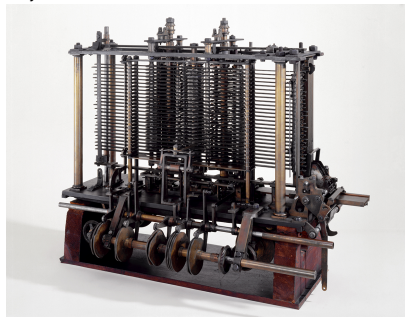
- ▶ "Pascaline"
- ▶ rotating wheels for performing additions and subtractions
- ▶ intended for computing taxes
- ▶ could use different bases (6, 10, 12, 20) in various configurations



from: https://en.wikipedia.org/wiki/Pascal's_calculator

Babbage's analytical engine (1837)

- ▶ first design of a general-purpose computer
- ▶ arithmetic logic unit, control flow, loops and memory
- ▶ use of punched cards for programming



from:

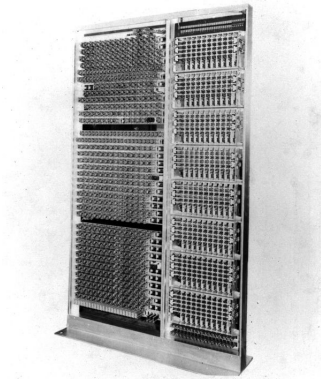
https://en.wikipedia.org/wiki/Analytical_engine

Electronic relays, vacuum tubes, transistors



- ▶ electronic relays:
electro-mechanical devices

from: <https://computerhistory.org/>



PHOTOGRAPH NO. 86182 - Laboratory Equipment - Computing System for Complex Numbers - Front View - Relay and Switch Frame per EG-554023 - Case 20678 - 9/2/39

Electronic relays, vacuum tubes, transistors

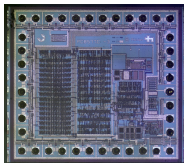
- ▶ vacuum tubes/valves:
thermionic effect

from: <https://computerhistory.org/>

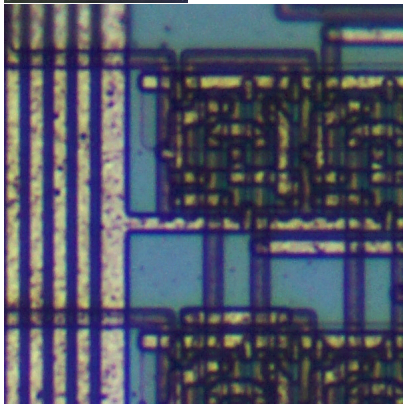


recreation
of Colossus computer - from
https://en.wikipedia.org/wiki/Colossus_computer

Electronic relays, vacuum tubes, transistors

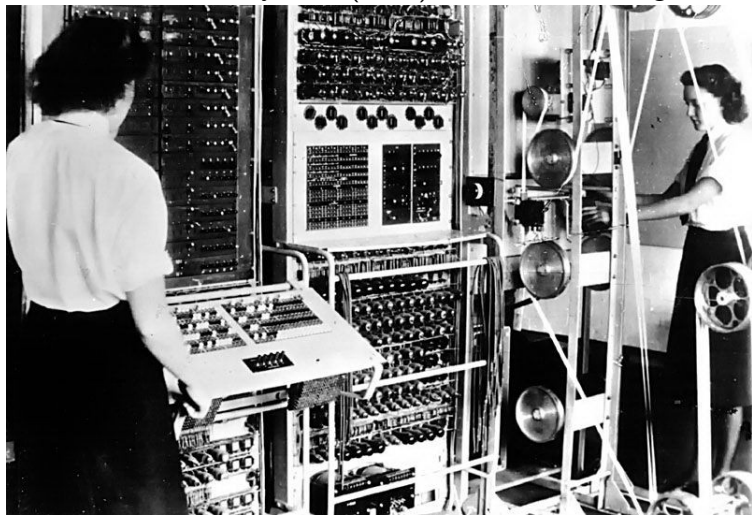


- ▶ transistors: semiconductor device, can amplify or switch electrical signals
- ▶ 1833: Faraday: first semiconductor effect
- ▶ 1948: Shockley transistor

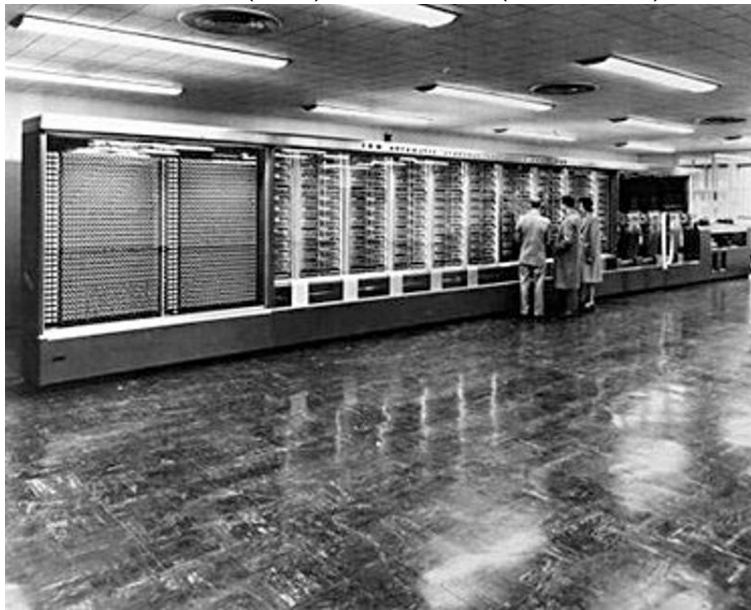


Visit the "Computing History Museum":
[https://www.computerhistory.org/!](https://www.computerhistory.org/)

Colossus at Bletchley Park (1944) - built for breaking codes



Mark I at Harvard (1944) - relay-based (3,500 relays)



ENIAC (1946) - vacuum tube-based, 1000x faster



IBM 650 (1954) - first mass-produced computer



CDC 6600 (1964) - fastest of its time, introduces "peripherals"



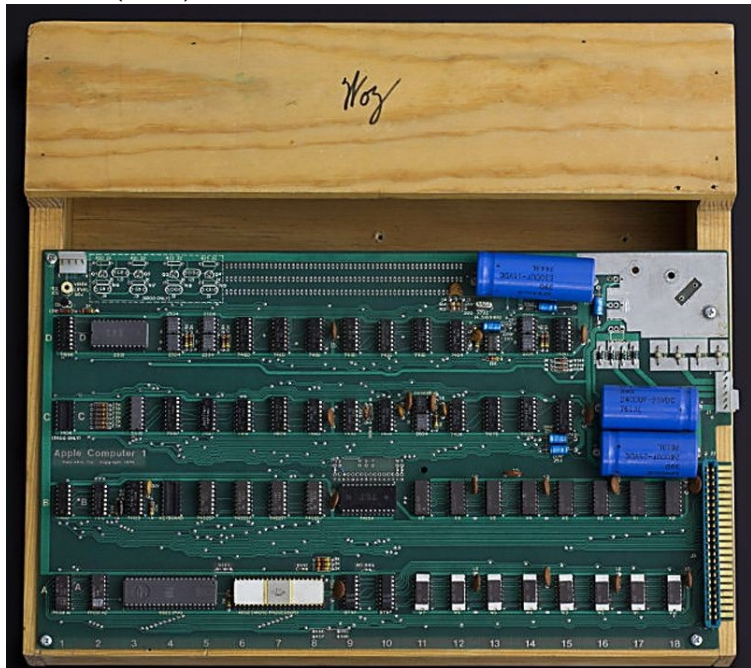
IBM System/360 (1964) - IBM's first integrated circuit computer



Xerox PARC Alto (1974) - windows, icons, mouse, LAN...



Apple I (1976) - for hobbyists



Cray I (1976) - one of the most successful supercomputers (8 units sold; approx. 38M USD/pc. in today's money)



Frontier (HPE) (2021) - first exascale computer

