**COMPUTING HISTORY**

A computer might be described with deceptive simplicity as “an apparatus that performs routine calculations automatically.” Such a definition would owe its deceptiveness to a naive and narrow view of calculation as a strictly mathematical process. In fact, calculation underlies many activities that are not normally thought of as mathematical. Walking across a room, for instance, requires many complex, [albeit](https://www.merriam-webster.com/dictionary/albeit) subconscious, calculations. Computers, too, have proved capable of solving a vast array of problems, from balancing a checkbook to even—in the form of guidance systems for robots—walking across a room.

Before the true [power](https://www.britannica.com/science/power-physics) of computing could be realized, therefore, the naive view of calculation had to be overcome. The inventors who laboured to bring the computer into the world had to learn that the thing they were inventing was not just a number cruncher, not merely a calculator. For example, they had to learn that it was not necessary to invent a new computer for every new calculation and that a computer could be designed to solve numerous problems, even problems not yet imagined when the computer was built. They also had to learn how to tell such a general problem-solving computer what problem to solve. In other words, they had to invent programming.

They had to solve all the heady problems of developing such a device, of [implementing](https://www.merriam-webster.com/dictionary/implementing) the design, of actually [building](https://www.britannica.com/technology/building) the thing. The history of the solving of these problems is the history of the computer. That history is covered in this section, and links are provided to entries on many of the individuals and companies mentioned. In addition, see the articles [computer science](https://www.britannica.com/science/computer-science) and [supercomputer](https://www.britannica.com/technology/supercomputer).

**Early Computation:-**

to Mathematical statements need not be abstract only; when a statement can be illustrated with actual numbers, the numbers can be communicated and a community can arise. This allows the repeatable, verifiable statements which are the hallmark of mathematics and science. These kinds of statements have existed for thousands of years, and across multiple civilizations, as shown below:

The earliest known tool for use in computation is the [Sumerian](https://en.wikipedia.org/wiki/Sumer) [abacus](https://en.wikipedia.org/wiki/Abacus), and it was thought to have been invented in [Babylon](https://en.wikipedia.org/wiki/Babylon) c. 2700–2300 BC. Its original style of usage was by lines drawn in sand with pebbles. Abaci, of a more modern design, are still used as calculation tools today. This was the first known calculator and most advanced system of calculation known to date - preceding [Archimedes](https://en.wikipedia.org/wiki/Archimedes) by 2,000 years.

In c. 1050–771 BC, the [south-pointing chariot](https://en.wikipedia.org/wiki/South-pointing_chariot) was invented in [ancient China](https://en.wikipedia.org/wiki/History_of_China#Ancient_China). It was the first known [geared](https://en.wikipedia.org/wiki/Gear) mechanism to use a [differential gear](https://en.wikipedia.org/wiki/Differential_gear), which was later used in [analog computers](https://en.wikipedia.org/wiki/Analog_computer). The [Chinese](https://en.wikipedia.org/wiki/China) also invented a more sophisticated abacus from around the 2nd century BC known as the [Chinese abacus](https://en.wikipedia.org/wiki/Chinese_abacus).[[8]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-8)

In the 5th century BC in [ancient India](https://en.wikipedia.org/wiki/History_of_India), the [grammarian](https://en.wikipedia.org/wiki/Philologist) [Pāṇini](https://en.wikipedia.org/wiki/P%C4%81%E1%B9%87ini" \o "Pāṇini) formulated the [grammar](https://en.wikipedia.org/wiki/Grammar) of [Sanskrit](https://en.wikipedia.org/wiki/Sanskrit) in 3959 rules known as the [Ashtadhyayi](https://en.wikipedia.org/wiki/Ashtadhyayi" \o "Ashtadhyayi) which was highly systematized and technical. Panini used metarules, [transformations](https://en.wikipedia.org/wiki/Transformational_grammar) and [recursions](https://en.wikipedia.org/wiki/Recursion).[[9]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-9)

In the 3rd century BC, [Archimedes](https://en.wikipedia.org/wiki/Archimedes) used the mechanical principle of balance (see [Archimedes Palimpsest#Mathematical content](https://en.wikipedia.org/wiki/Archimedes_Palimpsest#Mathematical_content)) to calculate mathematical problems, such as the number of grains of sand in the universe ([*The sand reckoner*](https://en.wikipedia.org/wiki/The_sand_reckoner)), which also required a recursive notation for numbers (e.g., the [myriad](https://en.wikipedia.org/wiki/Myriad) [myriad](https://en.wikipedia.org/wiki/Myriad)).

The [Antikythera mechanism](https://en.wikipedia.org/wiki/Antikythera_mechanism" \o "Antikythera mechanism) is believed to be the earliest known mechanical analog computer.[[10]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-10) It was designed to calculate astronomical positions. It was discovered in 1901 in the [Antikythera](https://en.wikipedia.org/wiki/Antikythera" \o "Antikythera) wreck off the Greek island of Antikythera, between Kythera and [Crete](https://en.wikipedia.org/wiki/Crete), and has been dated to *circa* 100 BC.

Mechanical analog computer devices appeared again a thousand years later in the [medieval Islamic world](https://en.wikipedia.org/wiki/Islamic_Golden_Age) and were developed by [Muslim astronomers](https://en.wikipedia.org/wiki/Islamic_astronomy), such as the mechanical geared [astrolabe](https://en.wikipedia.org/wiki/Astrolabe) by [Abū Rayhān al-Bīrūnī](https://en.wikipedia.org/wiki/Ab%C5%AB_Rayh%C4%81n_al-B%C4%ABr%C5%ABn%C4%AB" \o "Abū Rayhān al-Bīrūnī),[[11]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-usc-11) and the [torquetum](https://en.wikipedia.org/wiki/Torquetum) by [Jabir ibn Aflah](https://en.wikipedia.org/wiki/Jabir_ibn_Aflah).[[12]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-12) According to [Simon Singh](https://en.wikipedia.org/wiki/Simon_Singh), [Muslim mathematicians](https://en.wikipedia.org/wiki/Islamic_mathematics) also made important advances in [cryptography](https://en.wikipedia.org/wiki/Cryptography), such as the development of [cryptanalysis](https://en.wikipedia.org/wiki/Cryptanalysis) and [frequency analysis](https://en.wikipedia.org/wiki/Frequency_analysis) by [Alkindus](https://en.wikipedia.org/wiki/Al-Kindi" \o "Al-Kindi).[[13]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-13)[[14]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-14) [Programmable](https://en.wikipedia.org/wiki/Program_(machine)) machines were also invented by [Muslim engineers](https://en.wikipedia.org/wiki/Inventions_in_medieval_Islam), such as the automatic [flute](https://en.wikipedia.org/wiki/Flute) player by the [Banū Mūsā](https://en.wikipedia.org/wiki/Ban%C5%AB_M%C5%ABs%C4%81" \o "Banū Mūsā) brothers,[[15]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-Koetsier-15) and [Al-Jazari](https://en.wikipedia.org/wiki/Al-Jazari)'s [humanoid robots](https://en.wikipedia.org/wiki/Humanoid_robot)[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] and [*castle clock*](https://en.wikipedia.org/wiki/Castle_clock), which is considered be the first [programmable](https://en.wikipedia.org/wiki/Computer_program) analog computer.[[16]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-Ancient_Discoveries-16)

During the Middle Ages, several European philosophers made attempts to produce analog computer devices. Influenced by the Arabs and [Scholasticism](https://en.wikipedia.org/wiki/Scholasticism), Majorcan philosopher [Ramon Llull](https://en.wikipedia.org/wiki/Ramon_Llull) (1232–1315) devoted a great part of his life to defining and designing several *logical machines* that, by combining simple and undeniable philosophical truths, could produce all possible knowledge. These machines were never actually built, as they were more of a [thought experiment](https://en.wikipedia.org/wiki/Thought_experiment) to produce new knowledge in systematic ways; although they could make simple logical operations, they still needed a human being for the interpretation of results. Moreover, they lacked a versatile architecture, each machine serving only very concrete purposes. In spite of this, Llull's work had a strong influence on [Gottfried Leibniz](https://en.wikipedia.org/wiki/Gottfried_Leibniz) (early 18th century), who developed his ideas further, and built several calculating tools using them.

Indeed, when [John Napier](https://en.wikipedia.org/wiki/John_Napier) discovered logarithms for computational purposes in the early 17th century, there followed a period of considerable progress by inventors and scientists in making calculating tools. The apex of this early era of formal computing can be seen in the [difference engine](https://en.wikipedia.org/wiki/Difference_engine) and its successor the [analytical engine](https://en.wikipedia.org/wiki/Analytical_engine) (which was never completely constructed but was designed in detail), both by [Charles Babbage](https://en.wikipedia.org/wiki/Charles_Babbage). The analytical engine combined concepts from his work and that of others to create a device that if constructed as designed would have possessed many properties of a modern electronic computer. These properties include features such as an internal "scratch memory" equivalent to [RAM](https://en.wikipedia.org/wiki/Random-access_memory), multiple forms of output including a bell, a graph-plotter, and simple printer, and a programmable input-output "hard" memory of [punch cards](https://en.wikipedia.org/wiki/Punch_cards) which it could modify as well as read. The key advancement which Babbage's devices possessed beyond those created before his was that each component of the device was independent of the rest of the machine, much like the components of a modern electronic computer. This was a fundamental shift in thought; previous computational devices served only a single purpose, but had to be at best disassembled and reconfigured to solve a new problem. Babbage's devices could be reprogramed to solve new problems by the entry of new data, and act upon previous calculations within the same series of instructions. [Ada Lovelace](https://en.wikipedia.org/wiki/Ada_Lovelace" \o "Ada Lovelace) took this concept one step further, by creating a program for the analytical engine to calculate [Bernoulli numbers](https://en.wikipedia.org/wiki/Bernoulli_numbers), a complex calculation requiring a recursive algorithm. This is considered to be the first example of a true computer program, a series of instructions that act upon data not known in full until the program is run. Following Babbage, although unaware of his earlier work, [Percy Ludgate](https://en.wikipedia.org/wiki/Percy_Ludgate) in 1909 published the 2nd of the only two designs for mechanical analytical engines in history.[[17]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-17)

Several examples of analog computation survived into recent times. A [planimeter](https://en.wikipedia.org/wiki/Planimeter" \o "Planimeter) is a device which does integrals, using [distance](https://en.wikipedia.org/wiki/Distance) as the analog quantity. Until the 1980s, [HVAC](https://en.wikipedia.org/wiki/HVAC) systems used [air](https://en.wikipedia.org/wiki/Air) both as the analog quantity and the controlling element. Unlike modern digital computers, analog computers are not very flexible, and need to be reconfigured (i.e., reprogrammed) manually to switch them from working on one problem to another. Analog computers had an advantage over early digital computers in that they could be used to solve complex problems using behavioral analogues while the earliest attempts at digital computers were quite limited.

**SUPER COMPUTERS**

**In** terms of supercomputing, the first widely acknowledged supercomputer was the [Control Data Corporation](https://en.wikipedia.org/wiki/Control_Data_Corporation) (CDC) [6600](https://en.wikipedia.org/wiki/CDC_6600)[[66]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-66) built in 1964 by [Seymour Cray](https://en.wikipedia.org/wiki/Seymour_Cray). Its maximum speed was 40MHz or 3 million floating point operations per second ([FLOPS](https://en.wikipedia.org/wiki/FLOPS)). The CDC 6600 was replaced by the [CDC 7600](https://en.wikipedia.org/wiki/CDC_7600) in 1969;[[67]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-67) although its normal clock speed was not faster than the 6600, the 7600 was still faster due to its peak clock speed, which was approximately 30 times faster than that of the 6600. Although CDC was a leader in supercomputers, their relationship with Seymour Cray (which had already been deteriorating) completely collapsed. in 1972, Cray left CDC and began his own company, [Cray Research Inc](https://en.wikipedia.org/wiki/Cray_Research).[[68]](https://en.wikipedia.org/wiki/History_of_computing#cite_note-68) With support from investors in Wall Street, an industry fueled by the Cold War, and without the restrictions he had within CDC, he created the [Cray-1](https://en.wikipedia.org/wiki/Cray-1) supercomputer. With a clock speed of 80 MHz or 136 megaFLOPS, Cray developed a name for himself in the computing world. By 1982, Cray Research produced the [Cray X-MP](https://en.wikipedia.org/wiki/Cray_X-MP) equipped with multiprocessing and in 1985 released the [Cray-2](https://en.wikipedia.org/wiki/Cray-2), which continued with the trend of multiprocessing and clocked at 1.9 gigaFLOPS. Cray Research developed within a population relating to disease, and more.

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