



# Modern computing

# Computing and civilisation

Methods of computation have been part of human civilisation since its earliest times. One of the earliest computational needs was to work out time, the seasons and the solstices. Trade also required calculation and computation. Accounts had to be

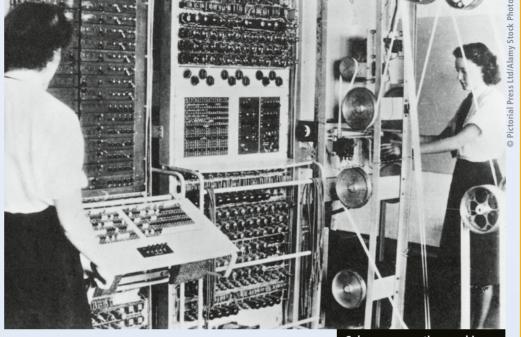
One of the longest lived 'computers' is the abacus, invented over 4,000 years ago in Babylon. It is a frame with rows of beads or wooden discs that slide on wooden or wire crosspieces and can still be found in use from eastern Europe to the Pacific.

The earliest modern computing machines were entirely mechanical, using wheels, gears, handles and so on, to perform computational tasks. The first such machine was designed by Charles Babbage in the 1830s but never constructed. Development of such machines was relatively slow, but pioneers began to create a variety of mechanical computational devices such as cash registers.

### Bletchley Park

The modern computer had to wait until the Second World War to begin development, by which time the advantages of electronic machines were becoming evident. The focus of innovation was Bletchley in Buckinghamshire, which became the centre of Britain's 'cyberwarfare' institution devoted to cracking secret German codes, an endeavour requiring massive mathematical calculation.

The first giant electronic computers, appropriately named Colossus I and Colossus II, came into use in December 1943 and June 1944, based on 1,500 and 2,400 fragile vacuum valves respectively, which could be damaged by – among other things – insects, hence the term 'computer bug.' Programmers had to physically rewire them by plugging and unplugging electric wires. Data was fed in by means of holes punched in paper strips. The US equivalent, ENIAC weighed 30 tonnes, contained 18,000 vacuum tubes, and was capable of 5,000 basic calculations a second. It was used in atomic weapon and rocket research.



Colossus computing machine, Bletchley Park, England (1940s)

# Alan Turing: towards the universal machine

One of the first people to recognise the limitless potential of electronic computers at this time was Alan Turing (1912–54) who theorised the possibility of a 'universal machine' based, as the name of his paper mentioned, 'on computable numbers'. Though, at its heart, the computer was, and still is, based on no more than calculating binary numbers (a number system based on two symbols, 0 and 1) Turing believed its scope was vast even to the point of creating so-called artificial intelligence.

Since then, computing has developed rapidly in terms of hardware, software and communication. The scale and pace have been exponential. The number of computations per second has gone from 300 in 1945 to billions today. Computers can guide spacecraft, store immense amounts of information, perform splitsecond searches of mountains of data, record music and film.

Futurologists claim computers will be able to think and even that evolution will leap from the human body to the intelligent computer processor, putting an end to the Anthropocene period of human pre-eminence on the planet.

1943

Colossus I begins to break German wartime codes

1947

**Bell Laboratories** produce solidstate transistors to replace valves

The first computer network, ARPANET, is set up to link some US military computers and is used until 1990

1960

1974

The MITS Altair, using the Intel 8080 chip, is the first microcomputer to be marketed

IBM PC becomes the first mass market personal computer

1989

Tim Berners-Lee proposes a World Wide Web, the internet

1996

Sergev Brin and Larry Page develop the Google search engine 2016

First reprogrammable quantum computer produced based on sub-atomic particles

2023

Chatbots emerge capable of 'learning' independently and sharing their knowledge on a vast scale

#### 1945

**Electronic Numerical** Integrator and Calculator (ENIAC) activated in the USA

1958

First semiconductors (silicon chips) devised

First email sent. A simple table tennis simulator, Pong, becomes the first commercially successful computer game

MicroPro Wordstar released and becomes the first commercially successful word processing programme 1984

Apple pioneers multiple windows, drop-down menus and the mouse in its first Macintosh computers

Pentium processor expands use of graphics and music on PCs

1999

First wireless (Wi-Fi) network introduced, which has a range of about 100 metres

First steps in producing a viable molecular-based computing system announced by US Defence Advanced Research Projects Agency (DARPA)

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