

In 1801, the Jacquard loom could produce entirely different weaves by changing the "program" – a series of pasteboard cards with holes punched in them. This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. Auxiliary tasks accompanying and related to programming include analyzing requirements, testing, debugging (investigating and fixing problems), implementation of build systems, and management of derived artifacts, such as programs' machine code. Scripting and breakpointing is also part of this process. The first step in most formal software development processes is requirements analysis, followed by testing to determine value modeling, implementation, and failure elimination (debugging). High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. After the bug is reproduced, the input of the program may need to be simplified to make it easier to debug. Later a control panel (plug board) added to his 1906 Type I Tabulator allowed it to be programmed for different jobs, and by the late 1940s, unit record equipment such as the IBM 602 and IBM 604, were programmed by control panels in a similar way, as were the first electronic computers. They are the building blocks for all software, from the simplest applications to the most sophisticated ones. The choice of language used is subject to many considerations, such as company policy, suitability to task, availability of third-party packages, or individual preference. Text editors were also developed that allowed changes and corrections to be made much more easily than with punched cards. Programs were mostly entered using punched cards or paper tape. For example, when a bug in a compiler can make it crash when parsing some large source file, a simplification of the test case that results in only few lines from the original source file can be sufficient to reproduce the same crash. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. Whatever the approach to development may be, the final program must satisfy some fundamental properties. The first compiler related tool, the A-0 System, was developed in 1952 by Grace Hopper, who also coined the term 'compiler'. Techniques like Code refactoring can enhance readability. Programmers typically use high-level programming languages that are more easily intelligible to humans than machine code, which is directly executed by the central processing unit. Many programmers use forms of Agile software development where the various stages of formal software development are more integrated together into short cycles that take a few weeks rather than years. As early as the 9th century, a programmable music sequencer was invented by the Persian Banu Musa brothers, who described an automated mechanical flute player in the Book of Ingenious Devices. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. Debugging is often done with IDEs. Standalone debuggers like GDB are also used, and these often provide less of a visual environment, usually using a command line. Many applications use a mix of several languages in their construction and use. Following a consistent programming style often helps readability. Programs were mostly entered using punched cards or paper tape.