

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. New languages are generally designed around the syntax of a prior language with new functionality added, (for example C++ adds object-orientation to C, and Java adds memory management and bytecode to C++, but as a result, loses efficiency and the ability for low-level manipulation). 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. The first step in most formal software development processes is requirements analysis, followed by testing to determine value modeling, implementation, and failure elimination (debugging). Provided the functions in a library follow the appropriate run-time conventions (e.g., method of passing arguments), then these functions may be written in any other language. Compilers harnessed the power of computers to make programming easier by allowing programmers to specify calculations by entering a formula using infix notation. Programmable devices have existed for centuries. Scripting and breakpointing is also part of this process. Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. In 1206, the Arab engineer Al-Jazari invented a programmable drum machine where a musical mechanical automaton could be made to play different rhythms and drum patterns, via pegs and cams. By the late 1960s, data storage devices and computer terminals became inexpensive enough that programs could be created by typing directly into the computers. It is usually easier to code in "high-level" languages than in "low-level" ones. In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. Various visual programming languages have also been developed with the intent to resolve readability concerns by adopting non-traditional approaches to code structure and display. Many applications use a mix of several languages in their construction and use. Use of a static code analysis tool can help detect some possible problems. Some of these factors include: The presentation aspects of this (such as indents, line breaks, color highlighting, and so on) are often handled by the source code editor, but the content aspects reflect the programmer's talent and skills. In 1801, the Jacquard loom could produce entirely different weaves by changing the "program" – a series of pasteboard cards with holes punched in them. A similar technique used for database design is Entity-Relationship Modeling (ER Modeling). Ideally, the programming language best suited for the task at hand will be selected. The following properties are among the most important: In computer programming, readability refers to the ease with which a human reader can comprehend the purpose, control flow, and operation of source code. Assembly languages were soon developed that let the programmer specify instruction in a text format (e.g., ADD X, TOTAL), with abbreviations for each operation code and meaningful names for specifying addresses. 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.