

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. There are many approaches to the Software development process. 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. 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. It is usually easier to code in "high-level" languages than in "low-level" ones. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. Proficient programming usually requires expertise in several different subjects, including knowledge of the application domain, details of programming languages and generic code libraries, specialized algorithms, and formal logic. 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. By the late 1960s, data storage devices and computer terminals became inexpensive enough that programs could be created by typing directly into the computers. Unreadable code often leads to bugs, inefficiencies, and duplicated code. 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. 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. 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. Integrated development environments (IDEs) aim to integrate all such help. 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 applications use a mix of several languages in their construction and use. Computer programming or coding is the composition of sequences of instructions, called programs, that computers can follow to perform tasks. For this purpose, algorithms are classified into orders using so-called Big O notation, which expresses resource use, such as execution time or memory consumption, in terms of the size of an input. Some text editors such as Emacs allow GDB to be invoked through them, to provide a visual environment. Normally the first step in debugging is to attempt to reproduce the problem. Trade-offs from this ideal involve finding enough programmers who know the language to build a team, the availability of compilers for that language, and the efficiency with which programs written in a given language execute. The Unified Modeling Language (UML) is a notation used for both the OOAD and MDA. Scripting and breakpointing is also part of this process. Whatever the approach to development may be, the final program must satisfy some fundamental properties. In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages.