

In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. Normally the first step in debugging is to attempt to reproduce the problem. 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. Expert programmers are familiar with a variety of well-established algorithms and their respective complexities and use this knowledge to choose algorithms that are best suited to the circumstances. It is usually easier to code in "high-level" languages than in "low-level" ones. Programs were mostly entered using punched cards or paper tape. Scripting and breakpointing is also part of this process. Techniques like Code refactoring can enhance readability. However, with the concept of the stored-program computer introduced in 1949, both programs and data were stored and manipulated in the same way in computer memory. Whatever the approach to development may be, the final program must satisfy some fundamental properties. In 1801, the Jacquard loom could produce entirely different weaves by changing the "program" – a series of pasteboard cards with holes punched in them. Popular modeling techniques include Object-Oriented Analysis and Design (OOAD) and Model-Driven Architecture (MDA). Their jobs usually involve: Although programming has been presented in the media as a somewhat mathematical subject, some research shows that good programmers have strong skills in natural human languages, and that learning to code is similar to learning a foreign language. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. 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. Their jobs usually involve: Although programming has been presented in the media as a somewhat mathematical subject, some research shows that good programmers have strong skills in natural human languages, and that learning to code is similar to learning a foreign language. Compilers harnessed the power of computers to make programming easier by allowing programmers to specify calculations by entering a formula using infix notation. After the bug is reproduced, the input of the program may need to be simplified to make it easier to debug. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. Programmable devices have existed for centuries. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. 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. Computer programmers are those who write computer software. 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.