

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. Methods of measuring programming language popularity include: counting the number of job advertisements that mention the language, the number of books sold and courses teaching the language (this overestimates the importance of newer languages), and estimates of the number of existing lines of code written in the language (this underestimates the number of users of business languages such as COBOL). 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. Sometimes software development is known as software engineering, especially when it employs formal methods or follows an engineering design process. Compilers harnessed the power of computers to make programming easier by allowing programmers to specify calculations by entering a formula using infix notation. 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. However, readability is more than just programming style. Some text editors such as Emacs allow GDB to be invoked through them, to provide a visual environment. The academic field and the engineering practice of computer programming are both largely concerned with discovering and implementing the most efficient algorithms for a given class of problems. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. 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. Allen Downey, in his book *How To Think Like A Computer Scientist*, writes: Many computer languages provide a mechanism to call functions provided by shared libraries. Programming languages are essential for software development. FORTRAN, the first widely used high-level language to have a functional implementation, came out in 1957, and many other languages were soon developed—in particular, COBOL aimed at commercial data processing, and Lisp for computer research. 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. 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. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. One approach popular for requirements analysis is Use Case analysis. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. 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. The academic field and the engineering practice of computer programming are both largely concerned with discovering and implementing the most efficient algorithms for a given class of problems. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages.