

This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. Many applications use a mix of several languages in their construction and use. Integrated development environments (IDEs) aim to integrate all such help. Trial-and-error/divide-and-conquer is needed: the programmer will try to remove some parts of the original test case and check if the problem still exists. In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. Readability is important because programmers spend the majority of their time reading, trying to understand, reusing and modifying existing source code, rather than writing new source code. Also, specific user environment and usage history can make it difficult to reproduce the problem. 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. Techniques like Code refactoring can enhance readability. Normally the first step in debugging is to attempt to reproduce the problem. There exist a lot of different approaches for each of those tasks. Some languages are very popular for particular kinds of applications, while some languages are regularly used to write many different kinds of applications. Following a consistent programming style often helps readability. 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). 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. Ideally, the programming language best suited for the task at hand will be selected. 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 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. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. The first compiler related tool, the A-0 System, was developed in 1952 by Grace Hopper, who also coined the term 'compiler'. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. When debugging the problem in a GUI, the programmer can try to skip some user interaction from the original problem description and check if remaining actions are sufficient for bugs to appear. 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. Computer programming or coding is the composition of sequences of instructions, called programs, that computers can follow to perform tasks. Some languages are very popular for particular kinds of applications, while some languages are regularly used to write many different kinds of applications.