

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. Computer programmers are those who write computer software. There exist a lot of different approaches for each of those tasks. 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. 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. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. 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. For example, COBOL is still strong in corporate data centers often on large mainframe computers, Fortran in engineering applications, scripting languages in Web development, and C in embedded software. 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. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. Ideally, the programming language best suited for the task at hand will be selected. This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. By the late 1960s, data storage devices and computer terminals became inexpensive enough that programs could be created by typing directly into the computers. 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). 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. Programmable devices have existed for centuries. 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. It is very difficult to determine what are the most popular modern programming languages. Techniques like Code refactoring can enhance readability. There exist a lot of different approaches for each of those tasks. 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. 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. 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.