

This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. Normally the first step in debugging is to attempt to reproduce the problem. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. 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). Computer programmers are those who write computer software. After the bug is reproduced, the input of the program may need to be simplified to make it easier to debug. 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. 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. 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). It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. Normally the first step in debugging is to attempt to reproduce the problem. Techniques like Code refactoring can enhance readability. There are many approaches to the Software development process. While these are sometimes considered programming, often the term software development is used for this larger overall process – with the terms programming, implementation, and coding reserved for the writing and editing of code per se. Many applications use a mix of several languages in their construction and use. Code-breaking algorithms have also existed for centuries. 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 Unified Modeling Language (UML) is a notation used for both the OOAD and MDA. 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. However, readability is more than just programming style. These compiled languages allow the programmer to write programs in terms that are syntactically richer, and more capable of abstracting the code, making it easy to target varying machine instruction sets via compilation declarations and heuristics. There exist a lot of different approaches for each of those tasks. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. Unreadable code often leads to bugs, inefficiencies, and duplicated code.