

Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. Scripting and breakpointing is also part of this process. 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. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. 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). Use of a static code analysis tool can help detect some possible problems. 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). Some text editors such as Emacs allow GDB to be invoked through them, to provide a visual environment. A study found that a few simple readability transformations made code shorter and drastically reduced the time to understand it. There exist a lot of different approaches for each of those tasks. 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. 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. 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. Debugging is a very important task in the software development process since having defects in a program can have significant consequences for its users. Also, specific user environment and usage history can make it difficult to reproduce the problem. The Unified Modeling Language (UML) is a notation used for both the OOAD and MDA. Provided the functions in a library follow the appropriate run-time conventions (e.g., method of passing arguments), then these functions may be written in any other language. Computer programmers are those who write computer 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. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. Languages form an approximate spectrum from "low-level" to "high-level"; "low-level" languages are typically more machine-oriented and faster to execute, whereas "high-level" languages are more abstract and easier to use but execute less quickly. 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. Ideally, the programming language best suited for the task at hand will be selected. In 1801, the Jacquard loom could produce entirely different weaves by changing the "program" – a series of pasteboard cards with holes punched in them. 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.