

Also, specific user environment and usage history can make it difficult to reproduce the problem. It affects the aspects of quality above, including portability, usability and most importantly maintainability. A study found that a few simple readability transformations made code shorter and drastically reduced the time to understand it. They are the building blocks for all software, from the simplest applications to the most sophisticated ones. 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. 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. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. 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. Some languages are very popular for particular kinds of applications, while some languages are regularly used to write many different kinds of applications. In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. 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. There exist a lot of different approaches for each of those tasks. It is usually easier to code in "high-level" languages than in "low-level" ones. 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. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. The Unified Modeling Language (UML) is a notation used for both the OOAD and MDA. It is usually easier to code in "high-level" languages than in "low-level" ones. They are the building blocks for all software, from the simplest applications to the most sophisticated ones. A similar technique used for database design is Entity-Relationship Modeling (ER Modeling). Some of these factors include: The presentation aspects of this (such as indents, line breaks, color highlighting, and so on) are often handled by the source code editor, but the content aspects reflect the programmer's talent and skills. 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. 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). 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. Auxiliary tasks accompanying and related to programming include analyzing requirements, testing, debugging (investigating and fixing problems), implementation of build systems, and management of derived artifacts, such as programs' machine code.