

A similar technique used for database design is Entity-Relationship Modeling (ER Modeling). Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. 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). 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. 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. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. Also, specific user environment and usage history can make it difficult to reproduce the problem. 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. Unreadable code often leads to bugs, inefficiencies, and duplicated code. 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). 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. Allen Downey, in his book *How To Think Like A Computer Scientist*, writes: Many computer languages provide a mechanism to call functions provided by shared libraries. It is usually easier to code in "high-level" languages than in "low-level" ones. Integrated development environments (IDEs) aim to integrate all such help. Popular modeling techniques include Object-Oriented Analysis and Design (OOAD) and Model-Driven Architecture (MDA). FORTRAN, the first widely used high-level language to have a functional implementation, came out in 1957, and many other languages were soon developed—in particular, COBOL aimed at commercial data processing, and Lisp for computer research. 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. Also, specific user environment and usage history can make it difficult to reproduce the problem. Whatever the approach to development may be, the final program must satisfy some fundamental properties. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. 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. 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. Sometimes software development is known as software engineering, especially when it employs formal methods or follows an engineering design process.