

Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. Programs were mostly entered using punched cards or paper tape. 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. After the bug is reproduced, the input of the program may need to be simplified to make it easier to debug. 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). 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. Following a consistent programming style often helps readability. Also, specific user environment and usage history can make it difficult to reproduce the problem. 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). Programmable devices have existed for centuries. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. Various visual programming languages have also been developed with the intent to resolve readability concerns by adopting non-traditional approaches to code structure and display. Ideally, the programming language best suited for the task at hand will be selected. Some languages are more prone to some kinds of faults because their specification does not require compilers to perform as much checking as other languages. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. The first compiler related tool, the A-0 System, was developed in 1952 by Grace Hopper, who also coined the term 'compiler'. 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. There are many approaches to the Software development process. 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. 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. Later a control panel (plug board) added to his 1906 Type I Tabulator allowed it to be programmed for different jobs, and by the late 1940s, unit record equipment such as the IBM 602 and IBM 604, were programmed by control panels in a similar way, as were the first electronic computers. 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. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm.