

Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. 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. 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. However, because an assembly language is little more than a different notation for a machine language, two machines with different instruction sets also have different assembly languages. The following properties are among the most important: In computer programming, readability refers to the ease with which a human reader can comprehend the purpose, control flow, and operation of source code. Scripting and breakpointing is also part of this process. Programs were mostly entered using punched cards or paper tape. Some text editors such as Emacs allow GDB to be invoked through them, to provide a visual environment. Readability is important because programmers spend the majority of their time reading, trying to understand, reusing and modifying existing source code, rather than writing new source code. 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. Programming languages are essential for software development. In 1801, the Jacquard loom could produce entirely different weaves by changing the "program" – a series of pasteboard cards with holes punched in them. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. Following a consistent programming style often helps readability. Some languages are very popular for particular kinds of applications, while some languages are regularly used to write many different kinds of applications. 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. 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. A study found that a few simple readability transformations made code shorter and drastically reduced the time to understand it. However, because an assembly language is little more than a different notation for a machine language, two machines with different instruction sets also have different assembly languages. 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. Many programmers use forms of Agile software development where the various stages of formal software development are more integrated together into short cycles that take a few weeks rather than years. For this purpose, algorithms are classified into orders using so-called Big O notation, which expresses resource use, such as execution time or memory consumption, in terms of the size of an input. This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. 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.