

Programs were mostly entered using punched cards or paper tape. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. Different programming languages support different styles of programming (called programming paradigms). A similar technique used for database design is Entity-Relationship Modeling (ER Modeling). 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. 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. 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 first compiler related tool, the A-0 System, was developed in 1952 by Grace Hopper, who also coined the term 'compiler'. 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. The first step in most formal software development processes is requirements analysis, followed by testing to determine value modeling, implementation, and failure elimination (debugging). This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. Trade-offs from this ideal involve finding enough programmers who know the language to build a team, the availability of compilers for that language, and the efficiency with which programs written in a given language execute. 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. Some text editors such as Emacs allow GDB to be invoked through them, to provide a visual environment. A similar technique used for database design is Entity-Relationship Modeling (ER Modeling). In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. 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. 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. Normally the first step in debugging is to attempt to reproduce the problem. 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. 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. For example, when a bug in a compiler can make it crash when parsing some large source file, a simplification of the test case that results in only few lines from the original source file can be sufficient to reproduce the same crash.