

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. In 1801, the Jacquard loom could produce entirely different weaves by changing the "program" – a series of pasteboard cards with holes punched in them. Use of a static code analysis tool can help detect some possible problems. 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. Computer programmers are those who write computer software. It affects the aspects of quality above, including portability, usability and most importantly maintainability. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. There exist a lot of different approaches for each of those tasks. Unreadable code often leads to bugs, inefficiencies, and duplicated code. 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. 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. In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. 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. However, Charles Babbage had already written his first program for the Analytical Engine in 1837. Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. Compilers harnessed the power of computers to make programming easier by allowing programmers to specify calculations by entering a formula using infix notation. Popular modeling techniques include Object-Oriented Analysis and Design (OOAD) and Model-Driven Architecture (MDA). 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. Implementation techniques include imperative languages (object-oriented or procedural), functional languages, and logic languages. 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. 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. The choice of language used is subject to many considerations, such as company policy, suitability to task, availability of third-party packages, or individual preference. This can be a non-trivial task, for example as with parallel processes or some unusual software bugs. Debugging is a very important task in the software development process since having defects in a program can have significant consequences for its users.