

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. Unreadable code often leads to bugs, inefficiencies, and duplicated code. 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. Scripting and breakpointing is also part of this process. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. 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. Techniques like Code refactoring can enhance readability. Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. The first step in most formal software development processes is requirements analysis, followed by testing to determine value modeling, implementation, and failure elimination (debugging). 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. 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. Programs were mostly entered using punched cards or paper tape. Different programming languages support different styles of programming (called programming paradigms). Integrated development environments (IDEs) aim to integrate all such help. 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. Normally the first step in debugging is to attempt to reproduce the problem. Programming languages are essential for software development. 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. 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. 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. After the bug is reproduced, the input of the program may need to be simplified to make it easier to debug. Code-breaking algorithms have also existed for centuries. Integrated development environments (IDEs) aim to integrate all such help.