

Normally the first step in debugging is to attempt to reproduce the problem. Unreadable code often leads to bugs, inefficiencies, and duplicated code. He gave the first description of cryptanalysis by frequency analysis, the earliest code-breaking algorithm. By the late 1960s, data storage devices and computer terminals became inexpensive enough that programs could be created by typing directly into the computers. 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'. There exist a lot of different approaches for each of those tasks. 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. Following a consistent programming style often helps readability. Whatever the approach to development may be, the final program must satisfy some fundamental properties. Some languages are very popular for particular kinds of applications, while some languages are regularly used to write many different kinds of applications. Expert programmers are familiar with a variety of well-established algorithms and their respective complexities and use this knowledge to choose algorithms that are best suited to the circumstances. In 1206, the Arab engineer Al-Jazari invented a programmable drum machine where a musical mechanical automaton could be made to play different rhythms and drum patterns, via pegs and cams. The Unified Modeling Language (UML) is a notation used for both the OOAD and MDA. 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. The academic field and the engineering practice of computer programming are both largely concerned with discovering and implementing the most efficient algorithms for a given class of problems. 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. Integrated development environments (IDEs) aim to integrate all such help. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. Following a consistent programming style often helps readability. 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. 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. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware.