

After the bug is reproduced, the input of the program may need to be simplified to make it easier to debug. Computer programmers are those who write computer software. Debugging is a very important task in the software development process since having defects in a program can have significant consequences for its users. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. 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. 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. In the 1880s, Herman Hollerith invented the concept of storing data in machine-readable form. Debugging is a very important task in the software development process since having defects in a program can have significant consequences for its users. 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. Auxiliary tasks accompanying and related to programming include analyzing requirements, testing, debugging (investigating and fixing problems), implementation of build systems, and management of derived artifacts, such as programs' machine code. There exist a lot of different approaches for each of those tasks. 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. The first step in most formal software development processes is requirements analysis, followed by testing to determine value modeling, implementation, and failure elimination (debugging). 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. Programming languages are essential for software development. Programming languages are essential for software development. Ideally, the programming language best suited for the task at hand will be selected. Normally the first step in debugging is to attempt to reproduce the problem. 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. In the 9th century, the Arab mathematician Al-Kindi described a cryptographic algorithm for deciphering encrypted code, in A Manuscript on Deciphering Cryptographic Messages. There are many approaches to the Software development process. Text editors were also developed that allowed changes and corrections to be made much more easily than with punched cards. 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. Techniques like Code refactoring can enhance readability. A study found that a few simple readability transformations made code shorter and drastically reduced the time to understand it.