

Program, Programming History and Program Design

What is a Program?

A program is a set of instructions that a computer follows to perform a specific task. These instructions are written in a programming language, which allows humans to communicate with computers. Programs can range from simple scripts that automate repetitive tasks to complex systems like operating systems, video games, and enterprise software.

What is Programming?

Programming is the process of designing and building an executable computer program to accomplish a specific computing task. It involves tasks such as analysis, developing algorithms, profiling algorithms' accuracy and resource consumption, and implementing algorithms in a programming language.

Historical Overview of Programming

Early Developments (Pre-1950s)

- Ada Lovelace (1843): Often considered the first computer programmer, Ada Lovelace wrote an algorithm for Charles Babbage's early mechanical general-purpose computer, the Analytical Engine.
- Alan Turing (1936): Introduced the concept of a theoretical computing machine, now known as the Turing Machine, which is the basis for modern computer science.

First Generation: Machine Code (1940s-1950s)

- ENIAC (1945): The first electronic general-purpose computer. Programs were written in machine code, consisting of binary digits (0s and 1s).
- Assembly Language: Introduced to simplify programming by using mnemonic codes instead of binary.

Second Generation: Assembly Language (1950s-1960s)

- Assembly Language: Provided a more human-readable form of machine code. However, it was still tedious and error-prone.
- Autocode: Early high-level languages that simplified some aspects of programming.

Third Generation: High-Level Languages (1950s-1960s)

- FORTRAN (1957): The first high-level programming language designed for scientific and engineering calculations.
- COBOL (1959): Designed for business data processing.

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- LISP (1958): Created for artificial intelligence research.
- ALGOL (1960): Introduced many concepts that influenced later languages.

Fourth Generation: Structured Programming (1970s-1980s)

- C (1972): A powerful systems programming language that has influenced many later languages.
- Pascal (1970): Promoted structured programming and data structuring.

Fifth Generation: Object-Oriented and Visual Programming (1980s-1990s)

- C++ (1983): Added object-oriented features to C.
- Java (1995): Designed for portability and ease of use on the internet.
- Visual Basic (1991): Simplified development with a graphical interface for Windows applications.

Program Design and Its Objectives

Program design is a critical phase in the software development process that involves creating a blueprint for a software application. The primary objective of program design is to ensure that the software meets specified requirements and is efficient, maintainable, scalable, and user-friendly.

The **objective of program design** is to create a blueprint for a software application that ensures it meets the specified requirements, is efficient, maintainable, and scalable. Effective program design focuses on various aspects such as functionality, usability, performance, security, and reliability.

The primary objectives of program design:

1. Meeting Requirements: Ensure the program fulfills all specified tasks and functionalities as per the user or business needs.
2. Efficiency: Optimize the use of system resources (CPU, memory, disk space) to ensure the program runs smoothly.
3. Maintainability: Write clear and understandable code to facilitate easy updates and bug fixes.
4. Modularity: Divide the program into discrete modules or components that can be developed, tested, and maintained independently.
5. Documentation: Provide comprehensive documentation for the code, including comments and external documents explaining the design and usage.
6. Scalability
 - Vertical Scalability: Design the program to efficiently use increasing amounts of resources on a single server.
 - Horizontal Scalability: Ensure the program can run on multiple servers or distributed systems, handling increased load by adding more machines.

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- 7. Security
 - Data Protection: Ensure the program protects sensitive data from unauthorized access and breaches.
 - Authentication and Authorization: Implement mechanisms to verify the identity of users and control their access to resources.

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