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Programming Languages

Machine Code

Machine Code is a binary representation of instructions in a format that the CPU can decode and execute. It has an operation code (opcode) instruction and an address or data to use (operand).

Low-level Languages

Low-level languages are written in assembly code and are translated to machine code by an assembler when they are run. Each low-level instruction is translated into one machine code instruction. The most common use for low-level code is on embedded systems, where instructing the hardware directly is important.

However, this code only works on one type of processor, as each processor has it’s own instruction set. Also, this type of code is harder for developers to understand but is quick and memory efficient.

Higher-level Languages

High-level languages are written in languages such as python, java, or C. It is translated by a compiler or interpreter into machine code when it is run. Unlike low-level code, one line of code can translate to many lines of machine code. It is easier to write and understand higher-level languages.

However, higher-level code is less memory efficient and may be slower to execute if not optimised properly.

Compilers

Compilers are used to translate code from higher-level languages into object code and then into machine code and will then be run. The whole program is translated before the program runs.

Advantages:

* Code is optimised
* No need to be translated at runtime
* Faster execution
* Original source code can be kept secret

Disadvantages:

* The program will not run if there is a syntax error
* Code must be recompiled every time it is changed
* Designed for a specific type of processor

Interpreters

Interpreters translate source code from higher-level languages directly into machine code, ready for the CPU to execute. This is done line by line, as the program is run.

Advantages:

* Easier to write code, as the program will always run, and stop when it finds an error.
* Code does not need to be recompiled when it is changed
* Makes interpreted languages easy for beginners to learn

Disadvantages:

* Translation software is needed at run time
* Speed of execution is slower
* Code is not optimised
* Source code is needed