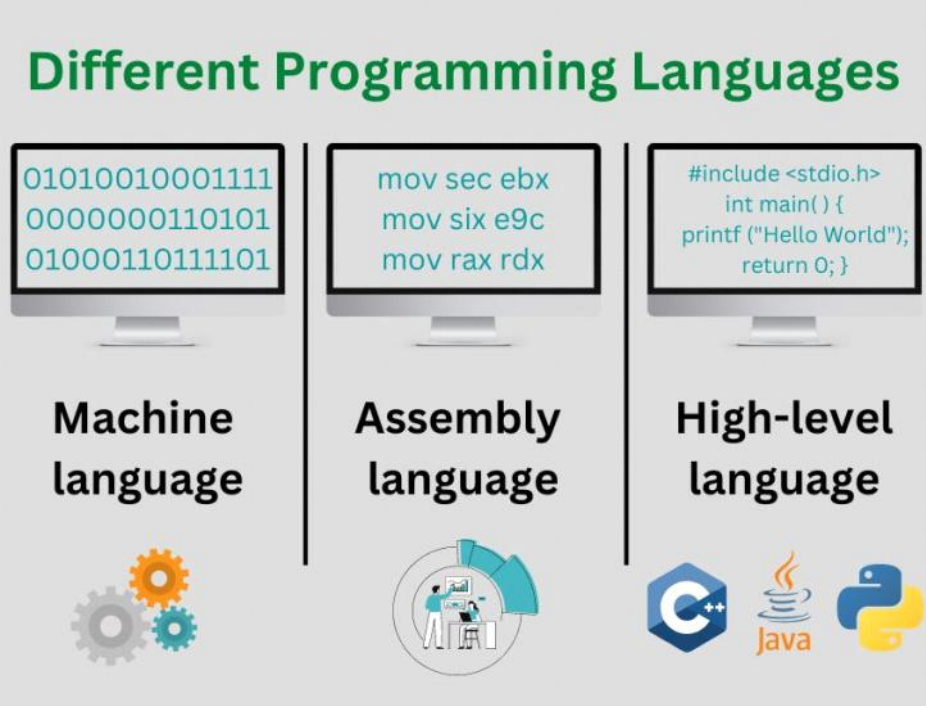
Programming Languages

A **programming language** is a formal language used to communicate instructions to a computer. These instructions tell the computer what to do, such as performing calculations, processing data, or interacting with hardware.



Python Code (High-level)
↓
Python Bytecode (Low-level) (platform independent)
↓
Machine Code (Binary 0s and 1s)
↓
CPU Executes

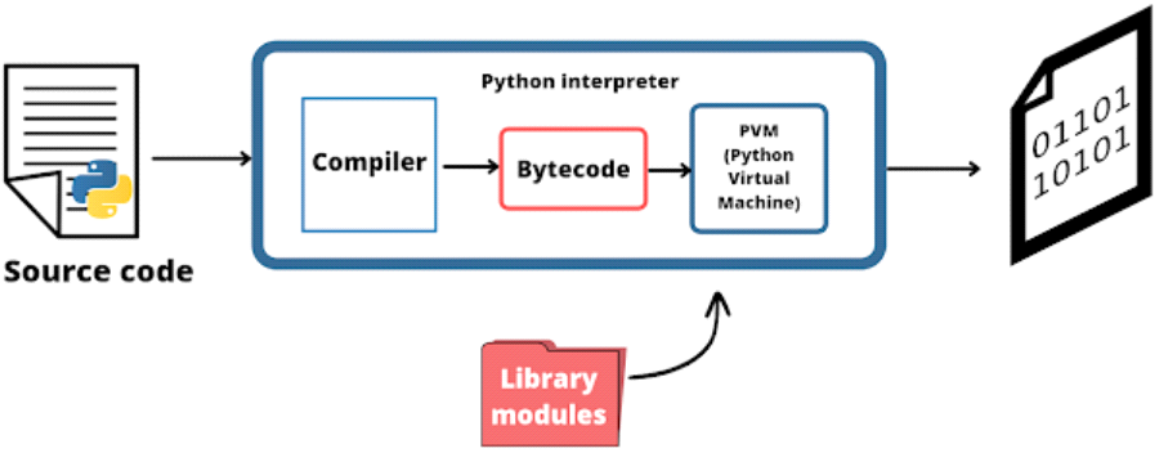
🔁 What Happens When You Run a Python Program?

1. **You write Python code** (high-level language):

   print("Hello, world!")

2. **Python interpreter converts it to bytecode (an intermediate, low-level form)**:
   - Bytecode is not machine code yet, but it's closer than Python.
   - It's platform-independent and runs on the **Python Virtual Machine (PVM)**.
   - Example (conceptually): LOAD_NAME 'print', LOAD_CONST 'Hello, world!', CALL_FUNCTION

3. **The Python Virtual Machine (PVM)** executes the bytecode:
   - Under the hood, the PVM uses a mix of C code and system-level instructions.
   - This eventually gets translated into machine code that the CPU understands (via the interpreter, or sometimes via a Just-In-Time (JIT) compiler in implementations like PyPy).


Python interpreter
Compiler
Bytecode
PVM
(Python
Virtual
Machine)
Source code
01101
10101
Library
modules