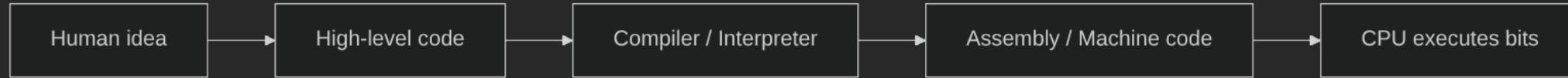


What is Programming?

Programming is the process of giving instructions to a computer in a language it understands.

Computers themselves only understand **machine code**, so programming languages allow humans to write instructions more easily.



Think of it as translation layers that convert human steps into electrical signals.

Programming is used for:

- Automation
- Web development
- **Cybersecurity**
- Data analysis
- System administration

Real-world examples:

- ATMs
- Browsers
- Mobile apps
- Network scanners (Nmap, etc.)

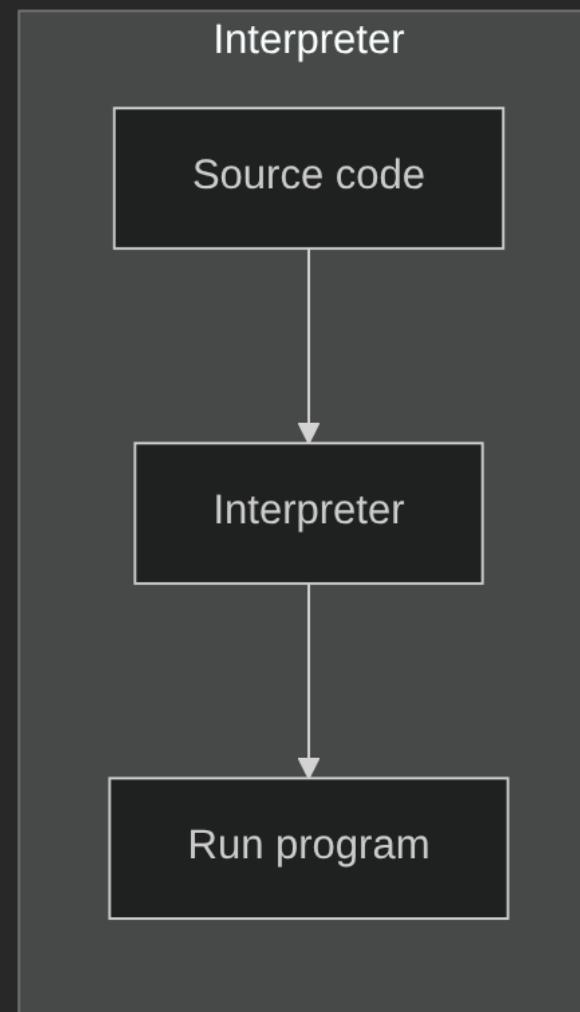
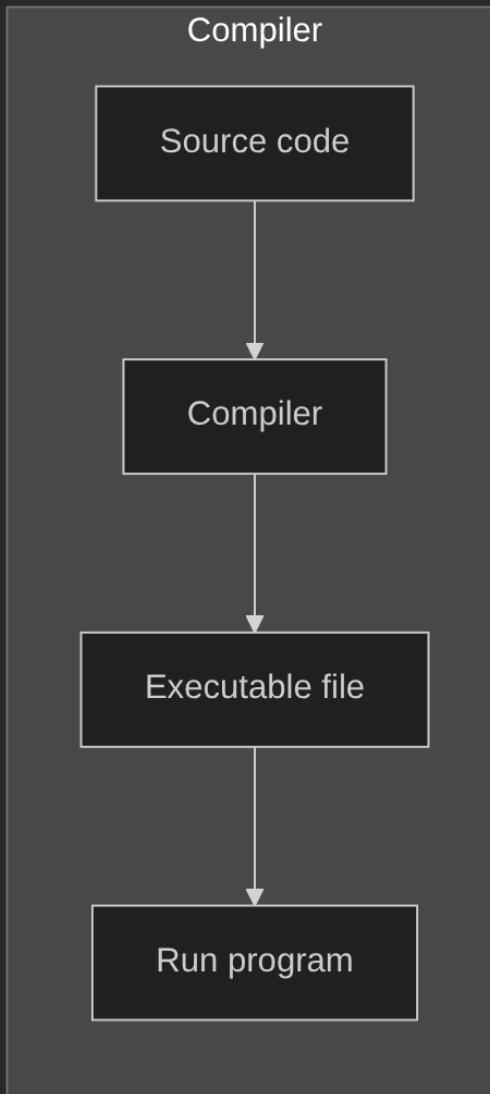
Why Programming Matters

Programming allows you to:

- Solve problems
- Automate repetitive tasks
- Build software
- Understand how computers actually work
- Strengthen cybersecurity skills (scripting, automation)

It is a foundational skill for modern IT and cybersecurity professionals.

Compilers vs Interpreters



Compiler

A **compiler** converts the entire source code into machine code **before** the program runs.

Characteristics:

- Produces a standalone executable
- Faster execution
- Errors found before running

Examples:

- C
- C++
- Go
- Rust



Example:

hello.c

```
#include <stdio.h>

int main() {
    printf("Hello, world!\n");
    return 0;
}
```

```
# compile
gcc hello.c -o hello
# run
chmod +x hello
./hello
# Result: Hello, world!
```

Interpreter

An **interpreter** executes code **line by line**.

Characteristics:

- More flexible
- Easier to test small parts
- Slower execution
- Errors show up while running

Examples:

- Python
- JavaScript
- Ruby



Example:

hello.py

```
print("Hello, world!")
```

```
# run
python hello.py
# Result: Hello, world!
```

Algorithms – Introduction

An **algorithm** is a step-by-step procedure to solve a problem.

Characteristics of good algorithms:

- Clarity
- Efficiency
- Consistency
- Finite steps

Common examples in daily life:

- Sorting items
 - Making tea
 - Following a recipe
 - Unlocking your phone
-

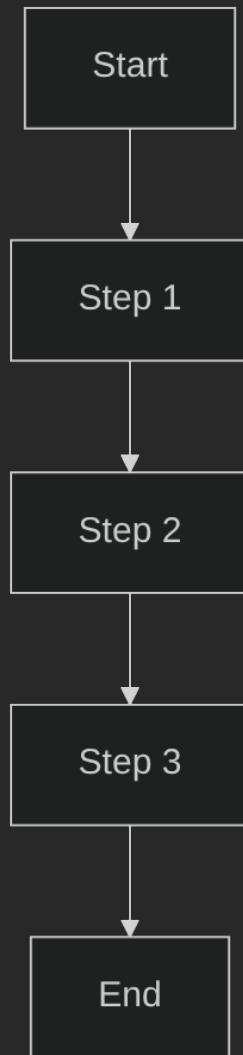
Algorithm Building Blocks

All algorithms are built from a few fundamental building blocks:

1. **Sequence** – steps executed in order
2. **Selection** – making decisions (if/else)
3. **Iteration** – repeating steps (loops)
4. **Variables** – storing data
5. **Input/Output** – getting and displaying data

These building blocks can be combined to solve any computational problem.

Sequence



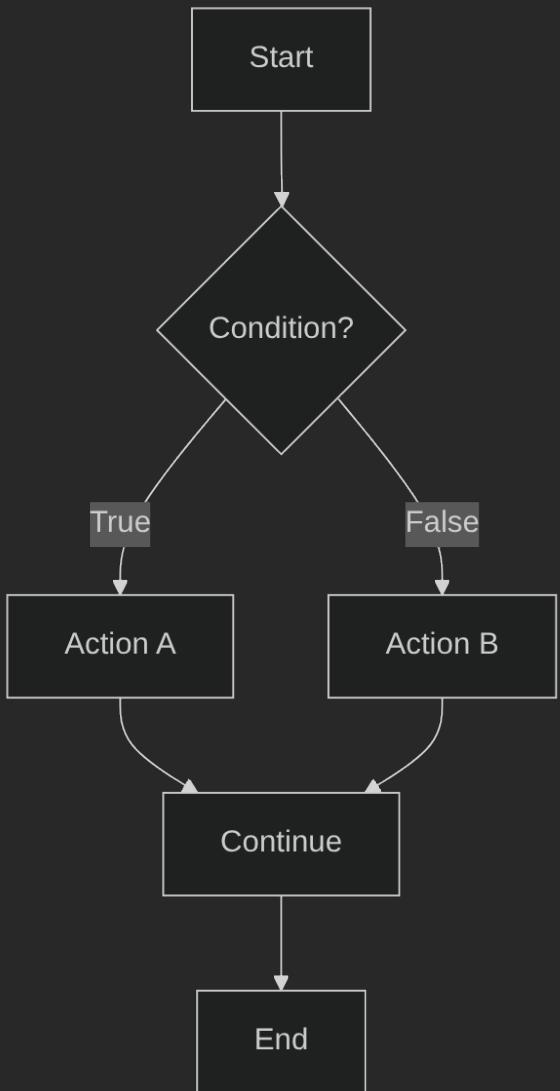
Sequence means executing steps one after another, in order.

Example (Making coffee):

1. Grind coffee beans
2. Boil water
3. Pour water over coffee
4. Serve

Each step must complete before the next begins.

Selection (Conditionals)



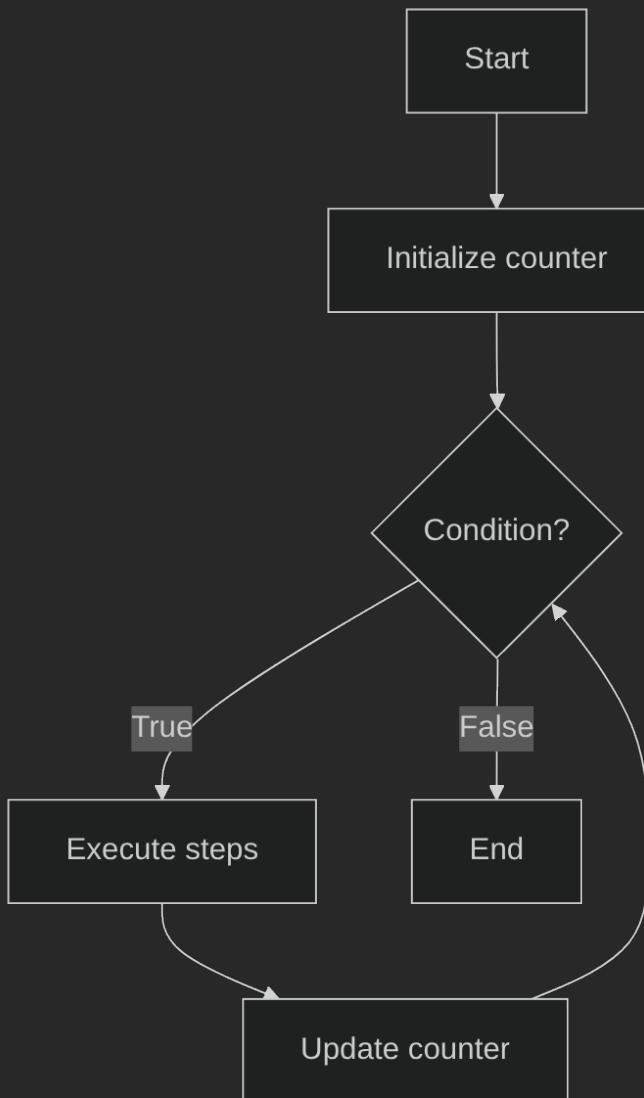
Selection allows algorithms to make decisions based on conditions.

Example:

```
if temperature > 30:  
    print("It's hot!")  
else:  
    print("It's cool!")
```

The algorithm chooses different paths based on the condition.

Iteration (Loops)



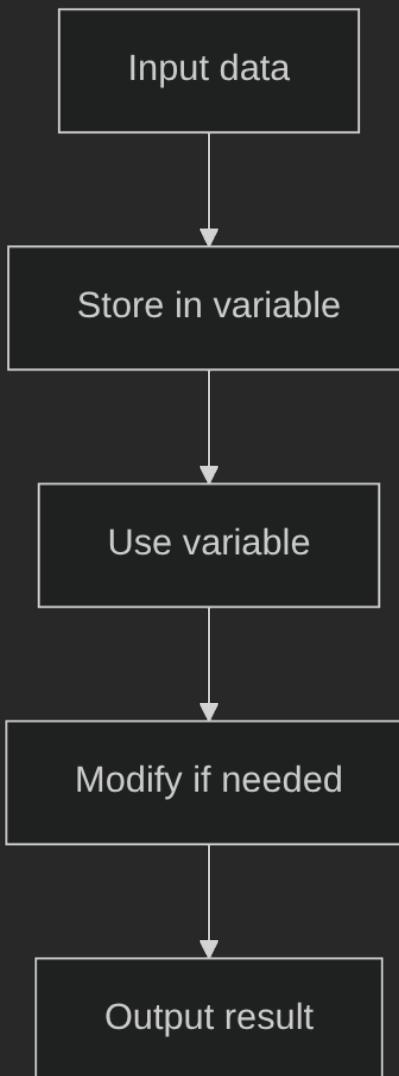
Iteration repeats a set of steps until a condition is met.

Example (Count to 5):

```
count = 1
while count <= 5:
    print(count)
    count = count + 1
```

Loops help automate repetitive tasks efficiently.

Variables and Data Storage



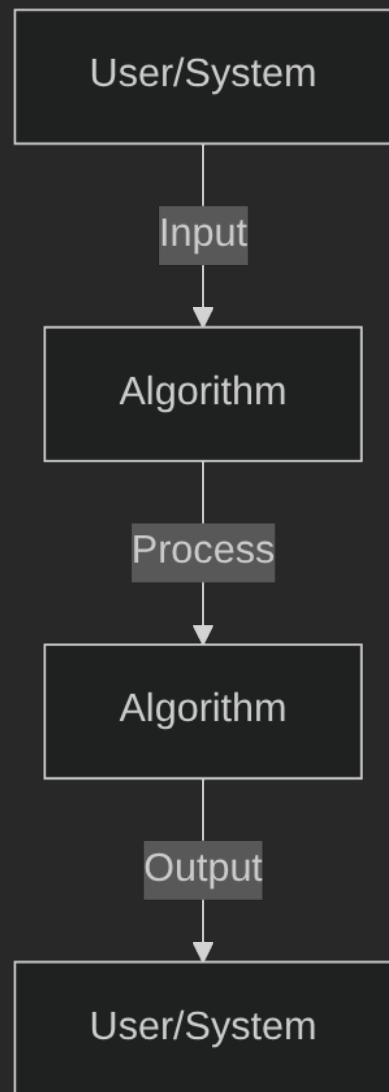
Variables store data that can be used and modified during algorithm execution.

Example:

```
name = "Alice"  
age = 25  
message = "Hello, " + name  
print(message)
```

Variables act as containers that hold values for later use.

Input and Output



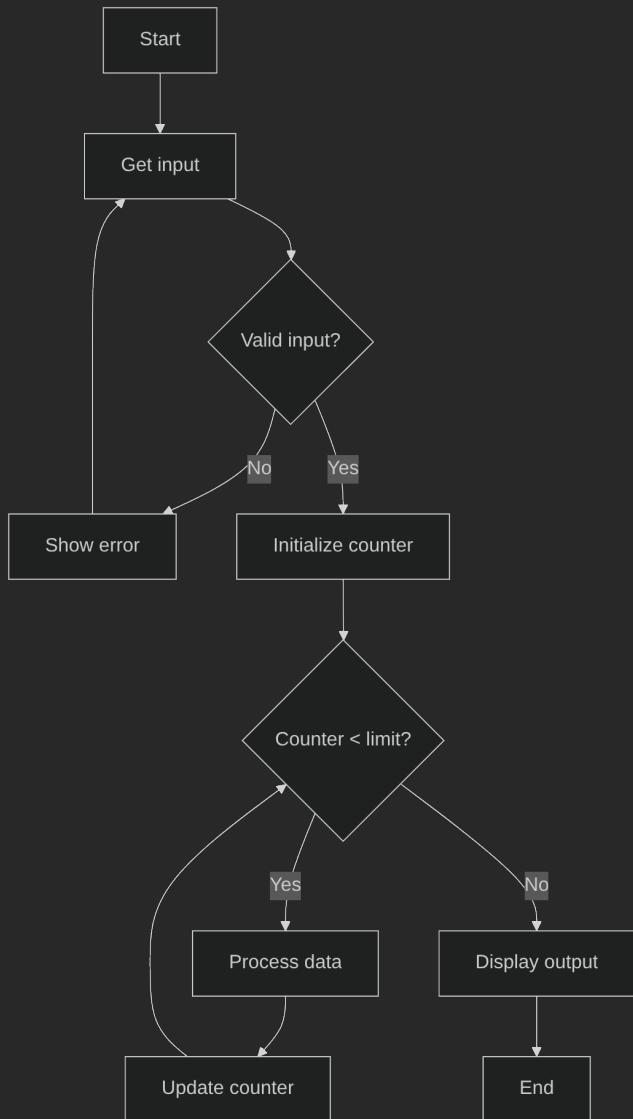
Input gets data from the user or system. **Output** displays or returns results.

Example:

```
name = input("Enter your name: ")  
print("Hello, " + name)
```

Input provides data to work with; output shows the results.

Combining Building Blocks



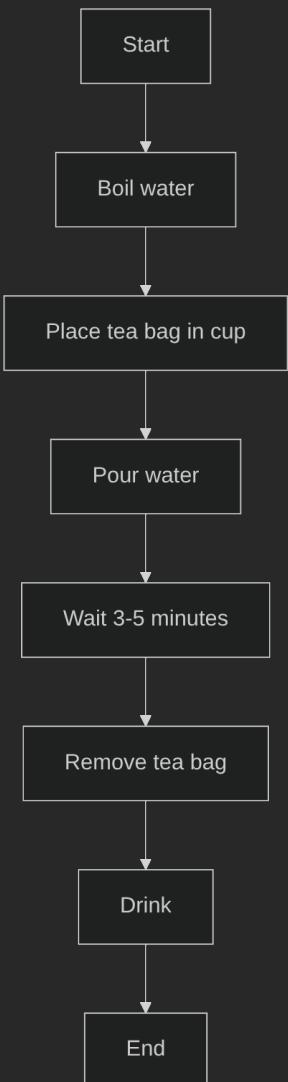
Real algorithms combine multiple building blocks:

This combines:

- **Sequence:** steps in order
- **Selection:** validation check
- **Iteration:** processing loop
- **Variables:** storing counter and data
- **Input/Output:** getting data and displaying results

Algorithm Examples

Making Tea (Sequential Algorithm):



Real-life algorithm example (Making Tea):

1. Boil water
2. Place tea bag in cup
3. Pour water
4. Wait 3-5 minutes
5. Remove tea bag
6. Drink

Create a Simple Algorithm – Activity

Write an algorithm for:

1. Logging into a website
2. Buying a product online
3. Starting a computer

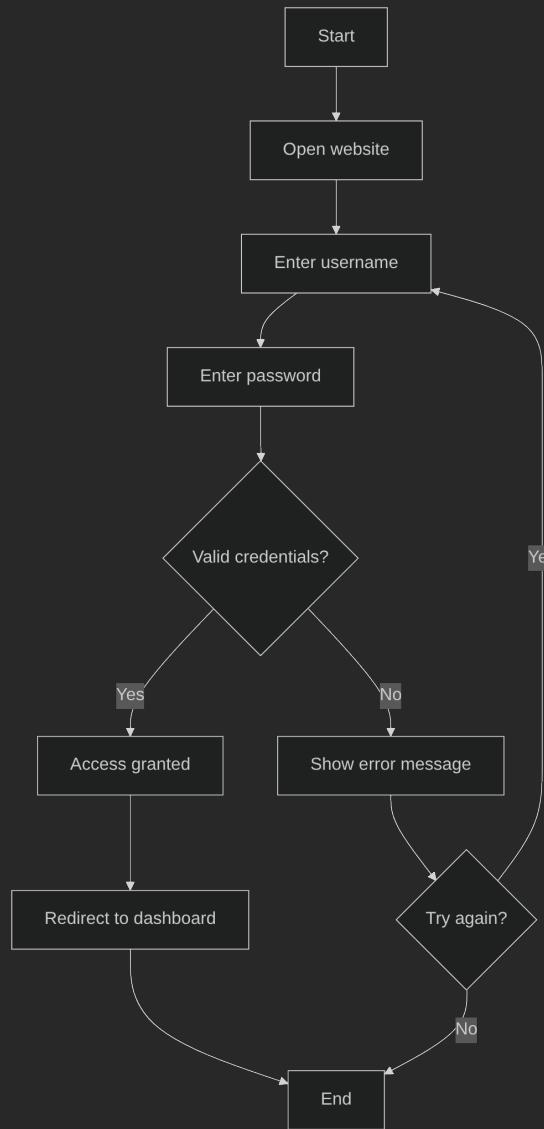
Goal: describe steps **clearly** so that even a computer could follow them.

Logging into a Website – Solution

Logging into a Website (Algorithm with Selection and Iteration):

This algorithm demonstrates:

- **Sequence:** steps executed in order
- **Selection:** checking if credentials are valid
- **Iteration:** option to try again if login fails



Algorithm Design Checklist

Step	Questions to ask
Inputs	What data do I need? What format?
Outputs	What should be produced?
Steps	In what order? Any loops or decisions?
Edge cases	What if input is missing/invalid?
Representation	Pseudocode, flowchart, or plain text?

Comparison:

- **Pseudocode** – quick, language-agnostic
- **Flowchart** – great for visual branching
- **Plain text** – fast brainstorming, less structure

Installing Python

Check whether Python is installed:

```
python3 --version
```

Install on Linux (Debian/Ubuntu):

```
sudo apt update  
sudo apt install python3
```

Install on macOS (Homebrew):

```
brew install python
```

Install on Windows:

- Use Microsoft Store
- Or download installer from python.org

Enter interactive mode (REPL):

```
python3
```

Exit REPL with:

```
exit()  
# or press Ctrl+D on Linux/macOS
```

Running Python Code

Run a script file:

```
python3 script.py
```

Simple script example (`hello.py`):

```
print("Hello, world!")
```

Then run:

```
python3 hello.py
```

Virtual Environments

Later modules will install packages like `requests`, `Flask`, etc.

Without virtual environments:

- Different projects may **fight over versions**
- You may not remember which scripts require which packages

With virtual environments:

- Each project can have its **own dependencies**
- You can safely experiment without breaking other projects

We start using this pattern now so it feels natural later.

Creating and Activating a venv

Inside `projects/module1_hello/`:

```
python3 -m venv .venv
```

Activate it:

```
source .venv/bin/activate # Linux/macOS  
# or on Windows (PowerShell):  
# .venv\Scripts\Activate.ps1
```

Your prompt should now show something like:

```
(.venv) user@machine:~/.../module1_hello$
```

To deactivate later:

```
deactivate
```

Installing a Test Package

While still inside the (.venv):

```
pip install --upgrade pip  
pip install requests  
pip freeze
```

You should see `requests` and its dependencies listed.

Optional: save them to `requirements.txt`:

```
pip freeze > requirements.txt
```

Now this project knows exactly `which versions` it uses.
