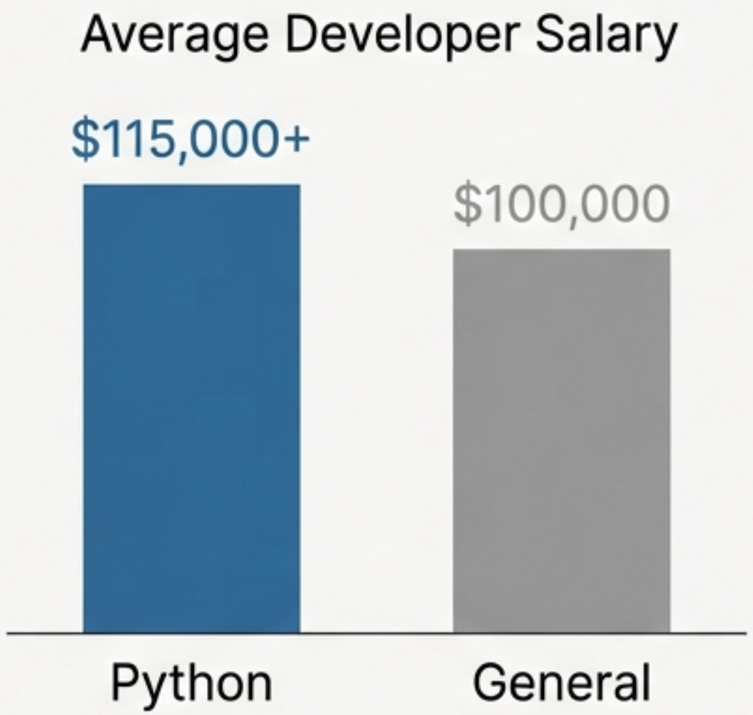
Python Mastery

From Zero to Hero: A Comprehensive Guide

Designed for beginners, engineered for professionals. Learn the syntax, the logic, and the "Clean Code" habits of top software engineers.

Why Python? The Language of Giants



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Trusted by Industry Leaders

The "Hello World" Test

C Code (The Hard Way)

```
#include <stdio.h>
int main() {
   printf("Hello, World!");
   return 0;
}
```

Python Code (The Smart Way)

```
print('Hello World')
```

Solve complex problems in less time **with fewer lines of code.**

The Toolkit: Setting Up Your Environment

The Engine

Interpreter (CPython)

The default implementation written in C. Translates Python code into machine instructions.

The Workshop

VS Code + Python Extension

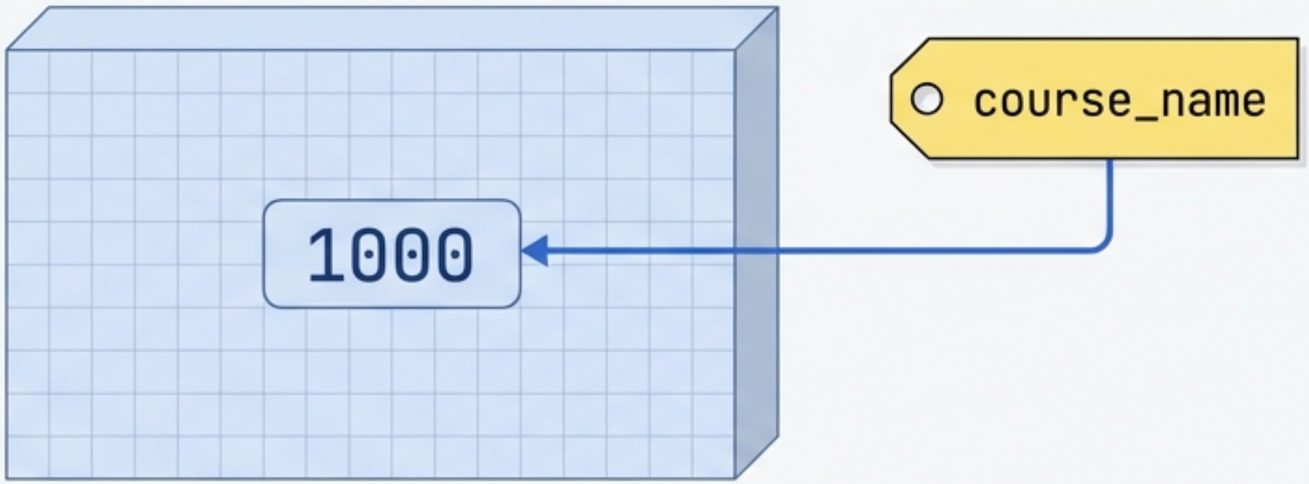
The industry-standard editor. Enhanced with Microsoft's Python extension for IntelliSense and debugging.

The Safety Net

Linting & Formatting

Analyzes code for errors before execution. Use 'Autopep8' to format on save.

Variables: Labels, Not Boxes



A variable is a reference pointing to data in memory.

Amateur Code

```
cn = 'Python' # Mystical
c = 1         # Ambiguous
```

Pro Code

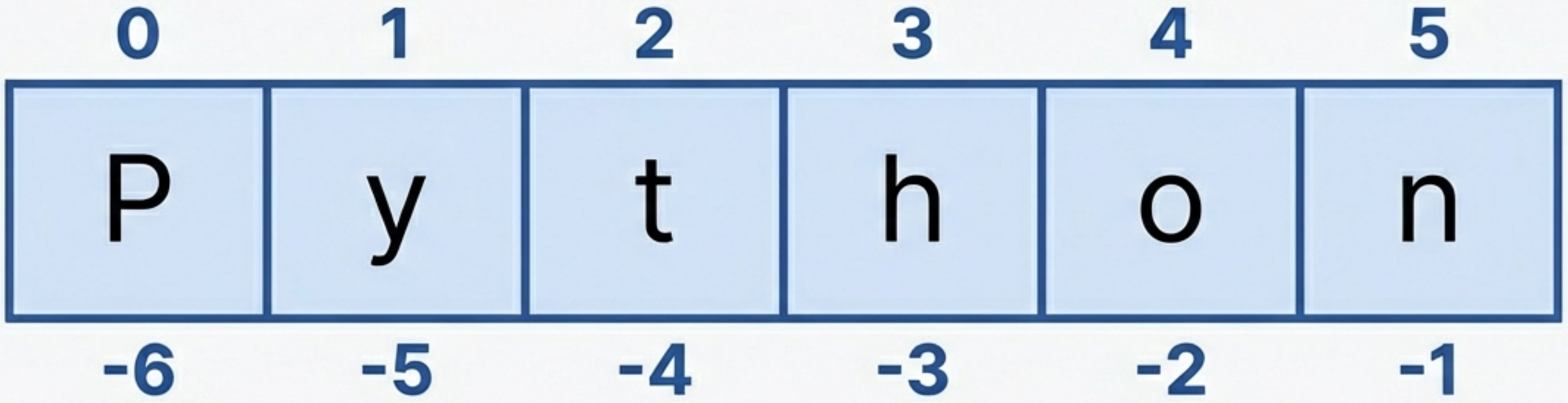
```
course_name = 'Python' # Descriptive
student_count = 1      # Meaningful
```

PEP 8 Rules

1. Use snake_case (lowercase_with_underscores)
2. Put spaces around operators (x = 1)
3. Names must tell a story

Anatomy of a String

Zero-Indexing and Slicing



Access

```
course[0]  ⟶ 'P'
course[-1] ⟶ 'n'
```

Slicing

```
course[0:3] ⟶ 'Pyt'
```

Start index inclusive,
end index exclusive.

Defaults

```
course[1:] ⟶ 'ython'
```

(To the end)

String Power Tools

Formatted Strings (f-strings)

Concatenation (The Old Way)

```
full = first + ' ' + last
```

f-strings (The Pro Way)

```
full = f'{first} {last}'
```

Expressions inside {} are evaluated at runtime.

Essential Methods

`.upper() / .lower()`	Converts case.
`.strip()`	Removes whitespace (vital for input).
`.replace('p', 'j')`	Swaps characters.
`'Pro' in course`	Returns Boolean True/False.

Numbers & Math

Data Types, Nuances, and Syntax

Integer
Whole numbers (e.g., 10)

Float
Decimals (e.g., 4.99)

Complex
a + bj (e.g., 1 + 2j)

Arithmetic Nuances

Standard Division - Float

`10 / 3 = 3.3333`

Float result

Floor Division - Integer

`10 // 3 = 3`

Integer result

Modulus - Remainder

`10 % 3 = 1`

Integer result

Professional Syntax

The Math Module

```
import math
print(math.ceil(2.2)) # Output: 3
```

Accessing mathematical functions.

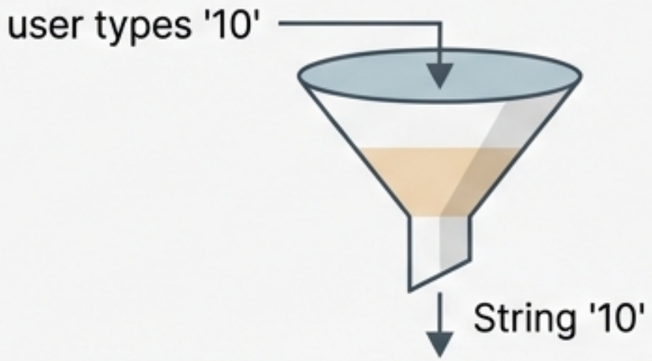
Augmented Assignment

```
x = 10
x += 3 # Equivalent to x = x + 3
```

Concise value updates.

Type Conversion & The Input Trap

The Trap




```
x = input('Enter x') # x is '10'
y = x + 1 # Error! Cannot add String + Int
```

The Fix & Logic

```
x = int(input('Enter x'))
y = x + 1 # Success
```

Python Boolean Interpretation

Falsy Values	0, '' (empty string), None	Evaluates to False
Truthy Values	Everything else (including 'False')	Evaluates to True

Comparison & Logic

The Syntax

= is Assignment → x = 10

== is Comparison → x == 10 → True/False

> (Greater)	**<=** (Less/Equal)	**!=** (Not Equal)

Lexicographical Comparison

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```
'bag' > 'apple'
```

→ True

‘b’ comes after ‘a’

Roboto

JetBrains Mono

```
'bag' == 'BAG'
```

→ False

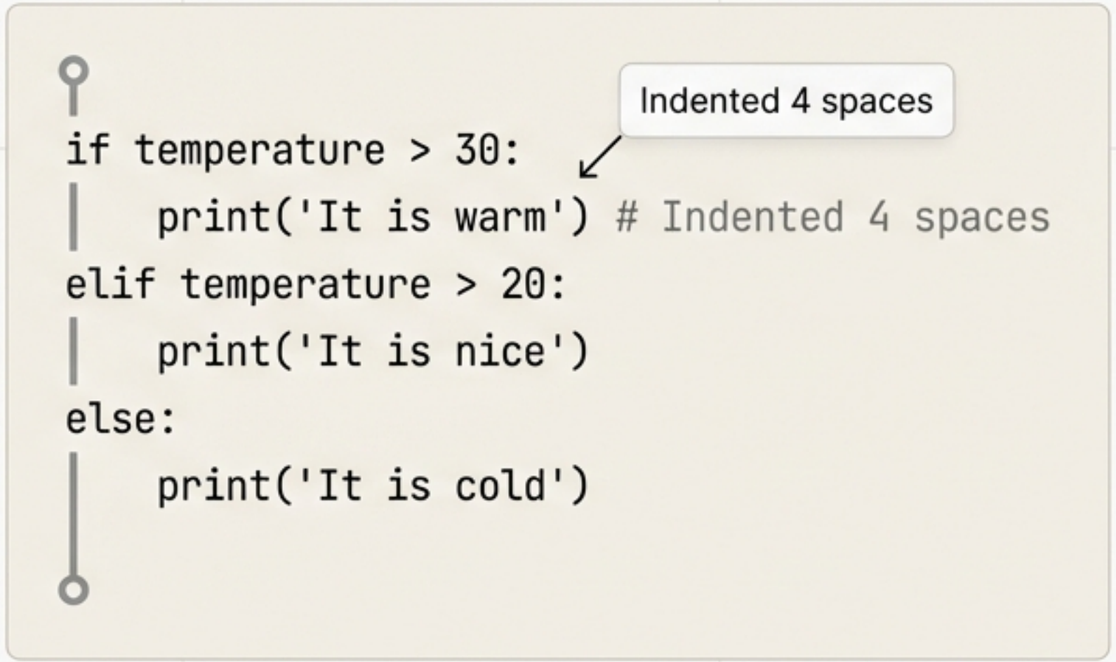
Case sensitive. ‘b’ (98) != ‘B’ (66)

Roboto

Python compares strings character by character based on their numeric (ASCII) value.

Conditional Statements

The Structure



The Ternary Operator (Pro Tip)

Writing cleaner one-liners.

Old Way:

```
if age >= 18:
    msg = 'Eligible'
else:
    msg = 'Not Eligible'
```

Pro Way:

```
msg = 'Eligible' if age >=
18 else 'Not Eligible'
```

Logical Operators

Operators

AND
Both True

OR
At least one True

NOT
Inverses

Short Circuit Evaluation

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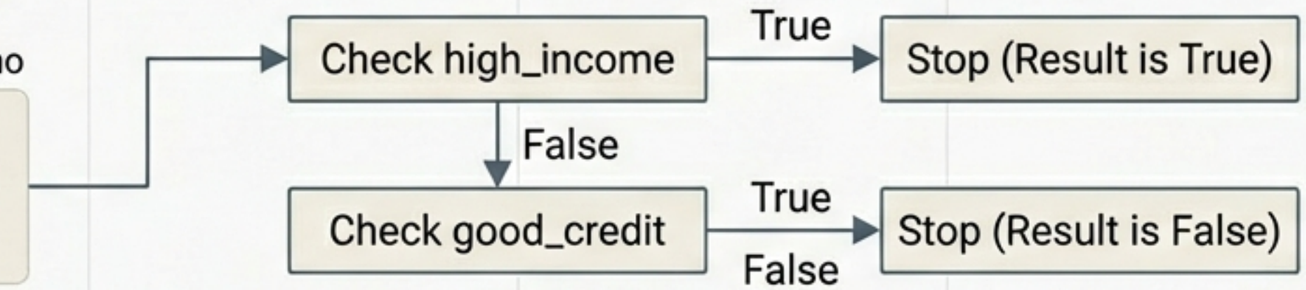
```
if high_income or
   good_credit:
```



Python optimizes by stopping evaluation as soon as the result is determined.

Chaining Comparison

Mathematical Syntax in Python

Bad:

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```
if age >= 18 and age < 65:
```

Good:

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```
if 18 <= age < 65:
```

Loops: The Engine of Repetition

For Loops

Iterating over sequences.

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```
for number in range(3):
    print(number)
```

```
0
1
2
```

range(start, end) e.g., range(0, 3) → 0, 1, 2

start, inclusive end, exclusive

While Loops

Condition-based iteration.

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```
while command != 'quit':
    command = input('> ')
```

Warning:

Ensure a termination condition to avoid Infinite Loops.

Advanced Loop Controls

Keywords

break
Terminates the loop immediately.

continue
Skips current iteration, moves to next.

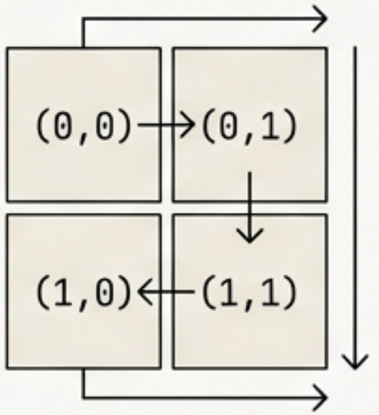
The For-Else Block

```
for name in names:
    if name.startswith('J'):
        print('Found')
        break
else:
    print('Not Found')
```

Executes ONLY if the loop completes without a break.

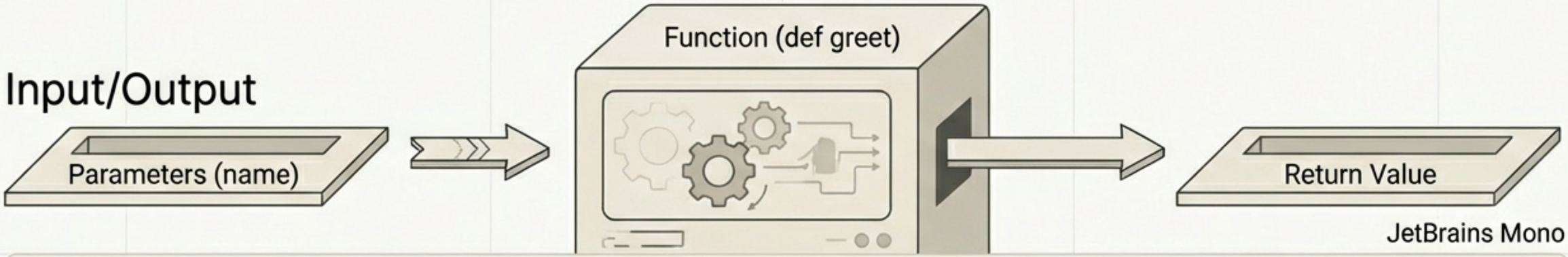
Nested Loops

```
for x in range(2):
    for y in range(2):
        print(f'({x}, {y})')
```



Functions: The Building Blocks

Input/Output



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```
1  def greet(name):      ⟵ Parameter
2      return f'Hi {name}'
3
4  print(greet('Mosh')) ⟵ Argument
```

Return vs. Print

Print
Displays text to the console (A task).

Return
Sends a value back to the caller (A calculation).

Note: Functions return 'None' by default if no return statement is used.

Advanced Arguments

Keyword Arguments (Readability)

```
increment(2, by=1)
```

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Explicitly names the argument for clarity.

Default Arguments (Flexibility)

```
def increment(number, by=1):
```

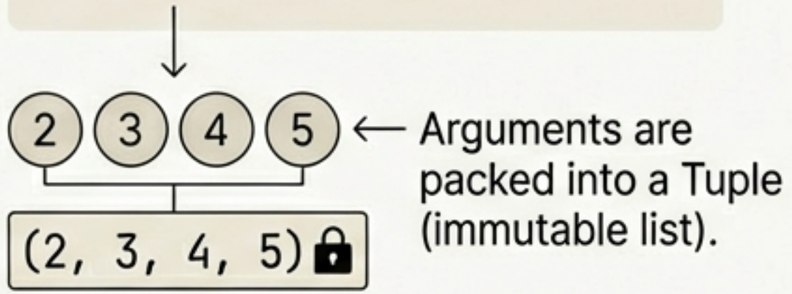
The 'by' parameter is optional. If missing, it defaults to 1.

Variable Arguments (Tuples)

```
def multiply(*numbers):
```

The * allows passing any number of arguments.

```
multiply(2, 3, 4, 5)
```



Arguments are packed into a Tuple (immutable list).