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Introduction to Python

What Is Python?

- High-level, interpreted, general-purpose programming language.
- Known for its clear syntax, readability, and simplicity.

Key Features

- Easy to learn and write.
- Versatile for web development, data analysis, automation, and more.
- Large standard library and active community support.

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Key characteristics

High-Level

Simple, abstracted coding

Object-Oriented

Classes, objects support

Interpreted

Runs without compilation

General-Purpose

Versatile, multi-domain use

Conti...

Extensible Integrates external code

Vast Ecosystem Rich libraries, tools

Dynamically Typed Flexible variable types

Cross-Platform Runs on all OS

Large Community Active, supportive network

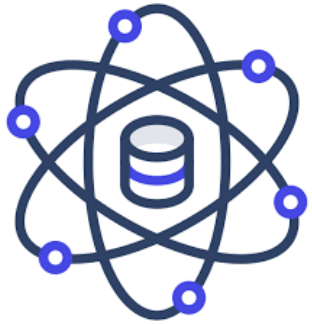
Python Programming

Applications

- Web Development
- Data Science
- Data Analytics
- Machine Learning & AI
- Automation and Scripting
- Software Development and Prototyping
- Desktop GUI applications
- Scientific and Numeric Computing
- Game Development
- Education and Research





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Setting Up the Python Environment

1

Download Python

Setting Up the Python Environment

1

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Install Python

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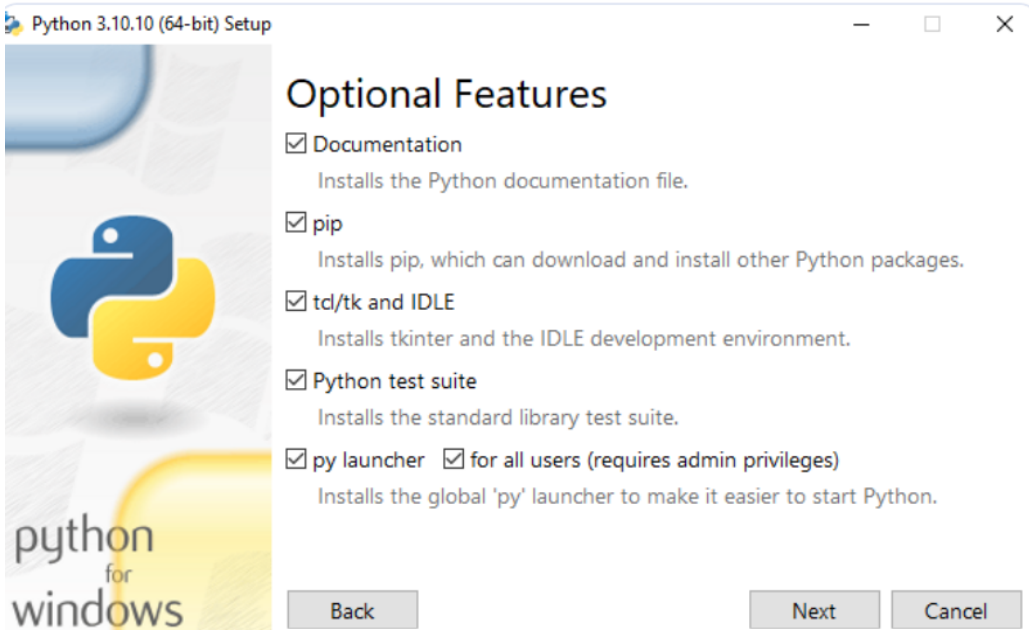

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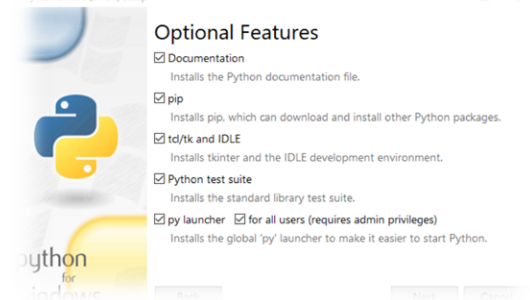

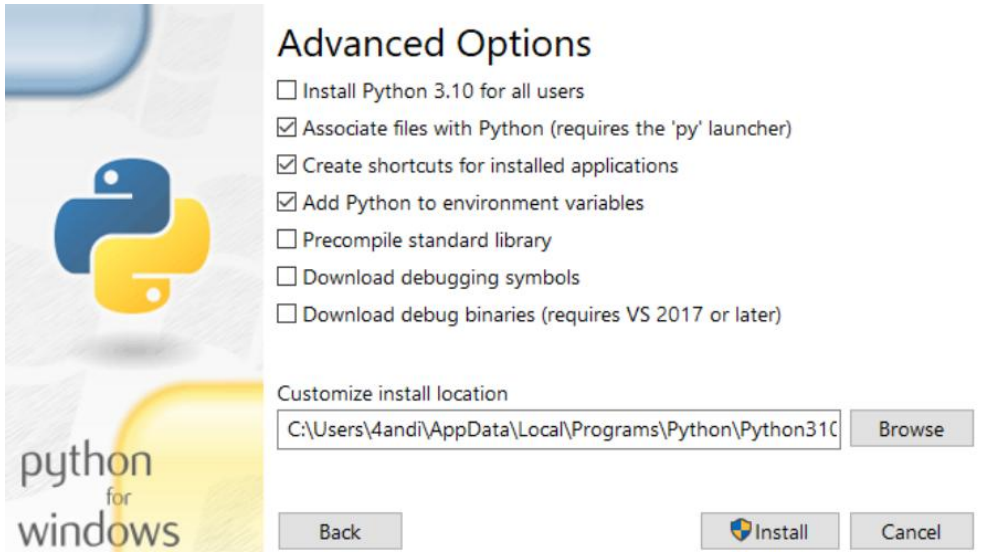

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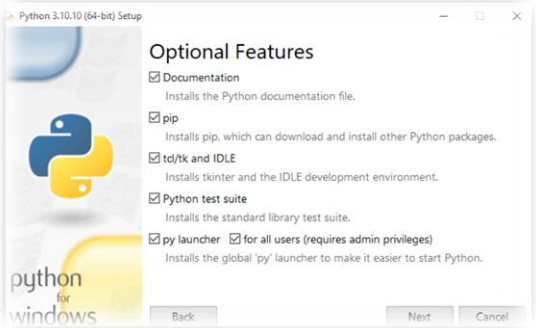

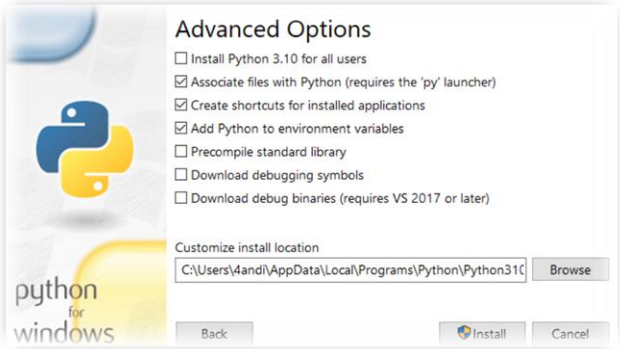

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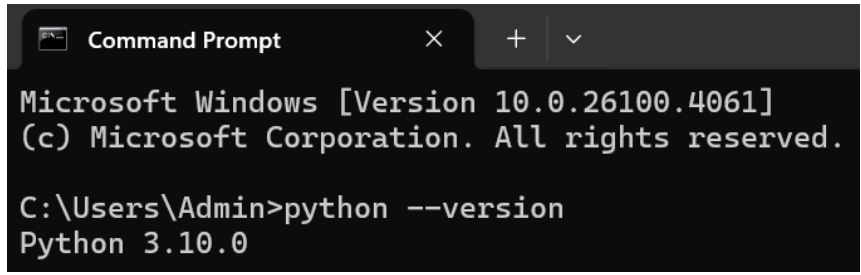
Verify the Python Installation

Go to **Start**

Enter **cmd** in the search bar

Click Command Prompt
Enter **python -version.**



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Install Python via Anaconda

Why Anaconda?

- Includes Python, Jupyter Notebook, and key libraries.
- Simplifies setup for immediate coding.

ANACONDA.

ANACONDA.

Download Anaconda

- Visit the official Anaconda website.
- Select the installer for your OS.

Installation Process

- Run the setup file.
- Follow default installation options (Windows/Mac/Linux).

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Set Up Jupyter Notebook

1

Open Anaconda Navigator

Launch from your system after installation.

2

Start Jupyter Notebook

In Navigator, click the Jupyter Notebook icon.

3

Create a New Notebook

Opens in your web browser.
Click New > Python 3 in top-right.

4

Start Coding

Write Python code in notebook cells.
Press Shift + Enter to execute.

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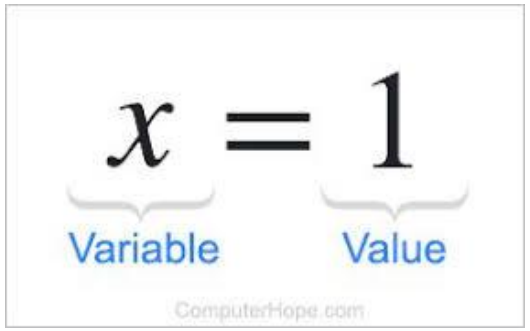
Variables in Python



What is a Variable?

A named container to store data in memory.
Holds values that can be changed during program execution.

Syntax

```
variable_name = value
```

Key Rules

Names are case-sensitive (x ≠ X).
Can include letters, digits, _ (no spaces).
Cannot start with a digit.
Avoid Python keywords (if, for, etc.).

Example

```
age = 25
name = "Alice"
```

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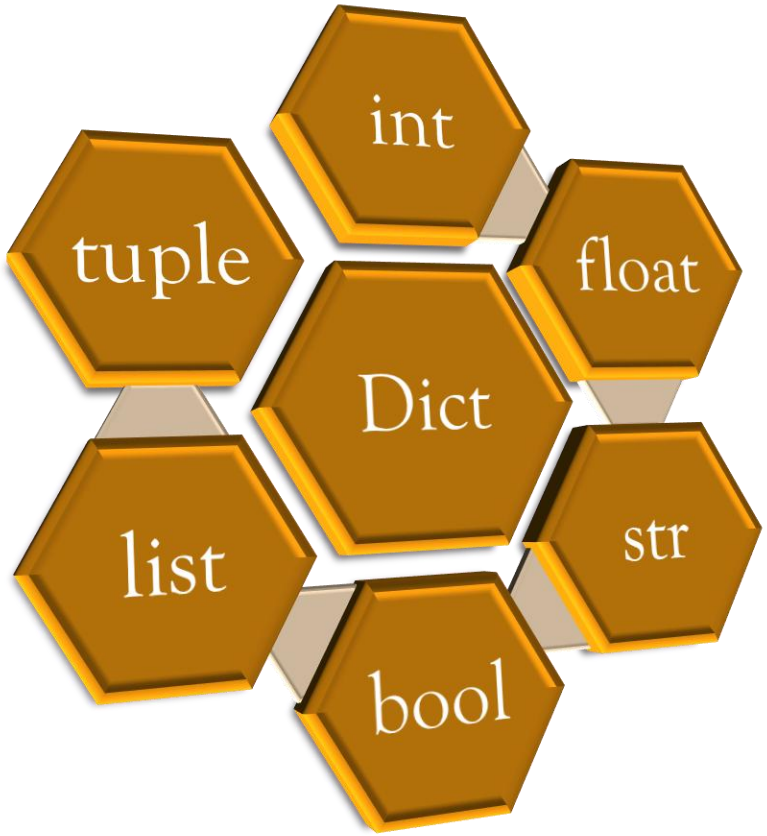
Data Types



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Integers in Python

What is a Integers?

- A whole number (positive, negative, or zero) without decimals.
- Used for counting, indexing, and mathematical operations.

Syntax

```
variable_name = integer_value
```

Key Properties

Immutable: Cannot be changed after creation (a new object is created on modification).
Unlimited Size: Python handles large numbers seamlessly.

Example

```
age = 30
temperature = -10
count = 0
```

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Floating-Point Numbers (Floats) in Python

What is a Floats?

- Represents real numbers (with decimal points or scientific notation).
- Used for measurements, scientific calculations, and fractional values.

Syntax

```
variable_name = float_value
```

Key Properties

Precision: Limited by hardware (64-bit double-precision).
Immutable: Like integers, floats are immutable objects.

Example

```
pi = 3.14159
temperature = -12.5
scientific_notation =
2.5e3  # 2500.0
```

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Strings in Python

What is a String?

- A sequence of characters enclosed in quotes (' ' or " ").
- Used to represent text data in Python.

Syntax

```
string_name = "text"  # or 'text'
```

Key Properties

Immutable: Cannot be changed after creation.
Indexed: Access characters using indices (starts at 0).
Iterable: Can loop through characters.

Example

```
name = "Alice"
greeting = 'Hello, World!'
multiline = """This is a multi-line string"""
```

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Boolean (bool)

Definition

Represent True or False values.

Key Uses:

- Control flow in if and while statements.
- Result of logical operations (e.g., 5 > 3 → True).
- Represent states (e.g., on/off, open/closed).

Conversions:

bool(0) → False,

bool(1) → True.

Example

```
is_logged_in = True
if is_logged_in:
    print("User is logged in")
# Output: User is logged in
```

Working with boolean data type in python

List

Definition: Ordered, mutable collections of items.

Key Features:

Can store mixed data types (e.g., integers, strings, lists).

Indexed from 0.

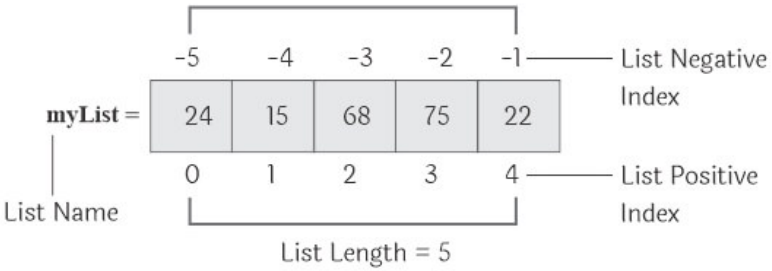
Supports operations: .append(), .remove(), .sort().

Use Cases:

Store sequences (e.g., names, numbers, objects).

Example

```
fruits = ["apple", "banana", "cherry"]
fruits.append("orange")
print(fruits)
# Output: ['apple', 'banana', 'cherry', 'orange']
```



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Tuple

Definition: Ordered, immutable collections of items.

Key Features:

Values cannot be changed after creation.

Indexed from 0, like lists.

Can store mixed data types (e.g., integers, strings, tuples).

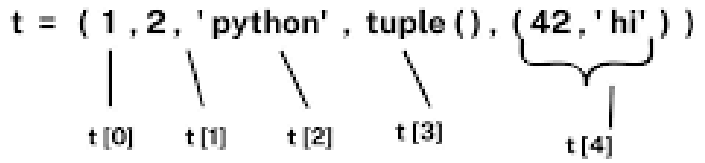
Use Cases:

Fixed data sets (e.g., coordinates, color values).

Unpacking: x, y = (10, 20).

Example

```
coordinates = (34.0522, -118.2437)
print(coordinates[0])  # Output: 34.0522
```



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Dictionary

Definition: Stores data in key-value pairs for fast lookups.

Keys: Unique, immutable (e.g., strings, numbers, tuples).

Values: Any data type, mutable.

Use Cases: Structured data (e.g., user profiles, settings, JSON).

Key Operations

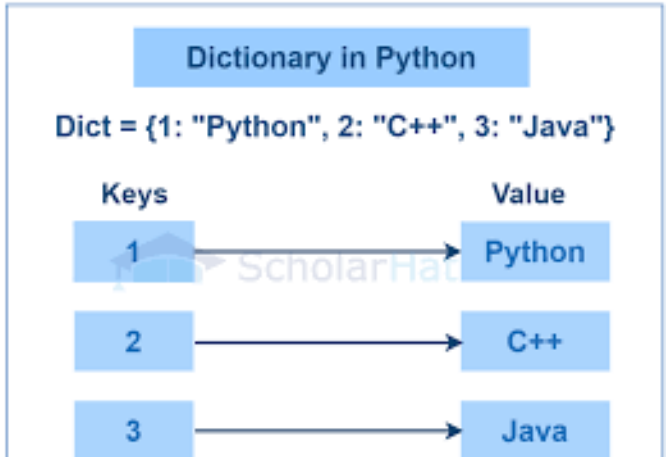
Add: dict['key'] = value

Remove: del dict['key']

Advantage: Fast key-based access via hashing.

Example

```
student = {"name": "Alice", "age": 22}
print(student["name"])  # Output: Alice
```



Set

Definition: Stores unique, unordered elements..

Keys: Unique, immutable (e.g., strings, numbers, tuples).

Values: Elements must be immutable (e.g., strings, numbers, tuples).

Use Cases: Membership testing, removing duplicates, mathematical set operations (union, intersection, difference).

Example

```
numbers = {1, 2, 3, 3, 4}
print(numbers)
# Output: {1, 2, 3, 4} (order may vary)
print(2 in numbers)
# Output: True
```

Key Operations

Add: set.add(element)

Remove: set.remove(element)

Advantage: Fast membership testing via hashing; automatic duplicate removal.

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Comparison of Mutability and Use Case

Data Type	Example	Mutable	Use Case
Int	x = 5	-	Whole numbers
Float	y = 3.24	-	Decimals
Str	s = ‘text’	❌	Text
Bool	Flag = True	-	True/False
List	[1,2,3]	☑	Modifiable collection
Tuple	(1,2)	❌	Fixed Collection
Dict	{“key” : “value”	☑	Key-Value Pairs
Set	{1,2,3}	☑	Unique elements

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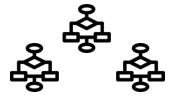
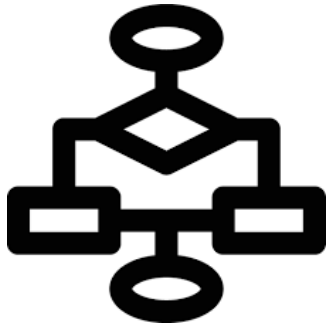
Conditional Statements

Definition

Conditional statements enable programs to execute different actions based on whether a condition evaluates to True or False.



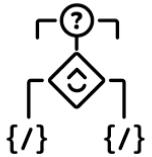


Condition

A logical expression resulting in a boolean (True or False).

Purpose

Controls program flow by enabling decision-making.

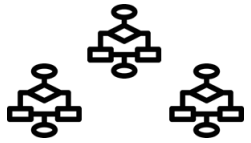


Real-Life Analogy

- **Traffic light:**
  Green → Cars go.
  Red → Cars stop.

Why Use Them?

- Execute actions when a condition is True.
- Skip actions when a condition is False.



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Conditions in Python

Definition

Expressions evaluating to True or False

Usage

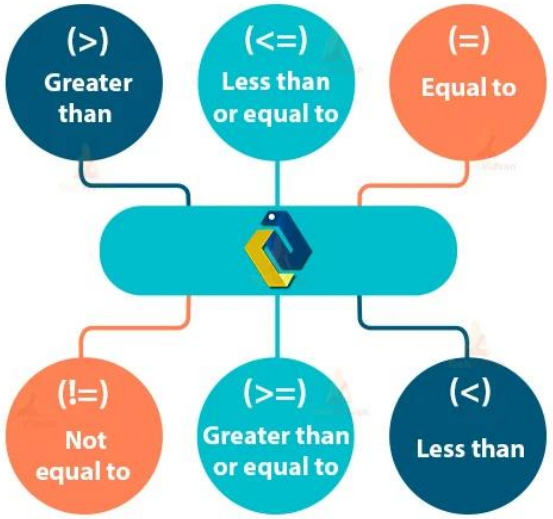
Control flow in if, if-else, if-elif-else statements

Example

How It Works: x > 5 evaluates to True, triggering the print statement.

```
x = 5
if x > 5:
    print("x is greater than 5")
```

Comparison Operators



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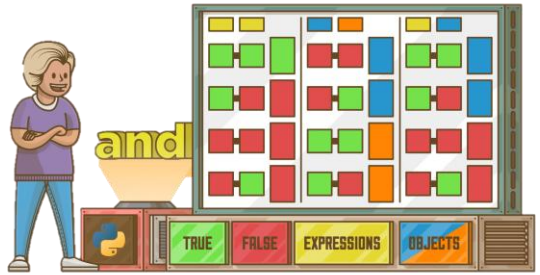
Logical Operators in Python

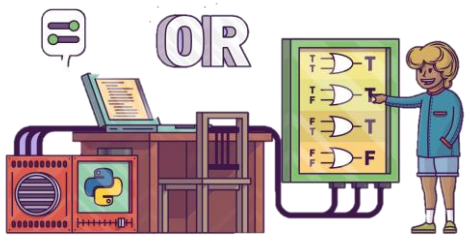
Purpose

Combine multiple conditions to return True or False



Types

and: True if both conditions are True
or: True if at least one condition is True
not: Reverses a condition
(True → False, False → True)



Example

and: Both age > 18 and age < 30 must be True to print.

or: Either grade == 'A' or grade == 'B' being True triggers the print.

```
# and operator
age = 20
if age > 18 and age < 30:
    print("You're a young adult")

# or operator
grade = 'B'
if grade == 'A' or grade == 'B':
    print("You passed")
```

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If Statements in Python

Purpose

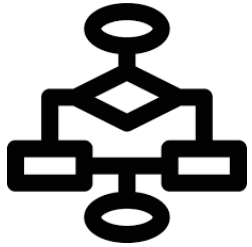
Execute a code block only if a condition is True

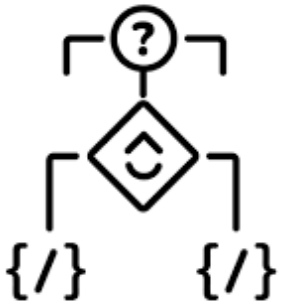
Syntax

if keyword, followed by a condition, then a colon :

Behavior

True condition: Code block executes
False condition: Code block is skipped

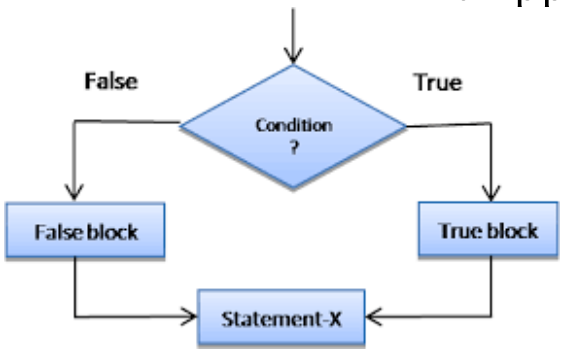




Example

```
num = 10
if num > 5:
    print("The number is greater than 5")
```

num > 5 evaluates to True, so the message is printed.
If num <= 5, the print statement is skipped.



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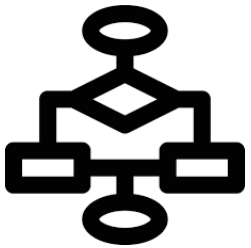
If-else Statements in Python

Purpose

Execute one code block if a condition is True, otherwise execute a different code block.

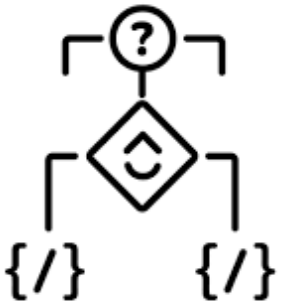
Syntax

If a condition is True, then execute a code block; else, execute a different code block.



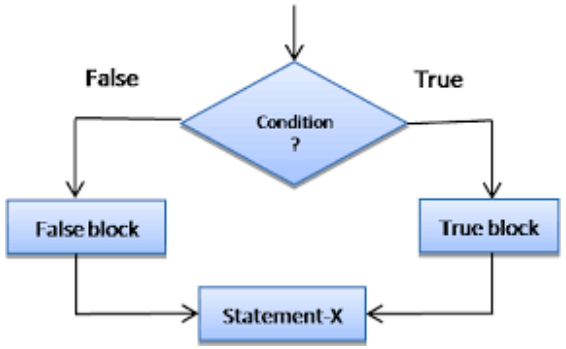
Behavior

True condition: Code block 1 executes
False condition: Code block 2 executes



Example

```
num = 10
if num > 5:
    print("The number is greater than 5")
else:
    print("The number is not greater than 5")
```



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If-Elif-Else Statements in Python

Purpose

Evaluate multiple conditions sequentially

Syntax

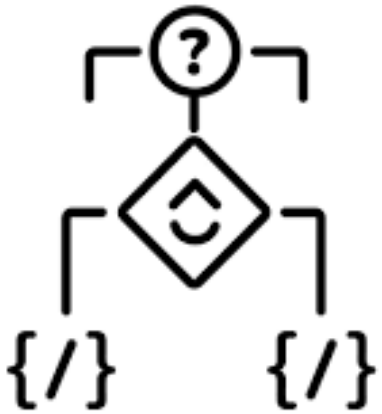
if: Checks the first condition
elif: Checks additional conditions if previous ones are **False**
else: Runs if no conditions are **True** (optional fallback)

Behavior

Executes the first True condition's block or the else block if none are True

Example

```
score = 75
if score >= 90:
    print("Grade: A")
elif score >= 80:
    print("Grade: B")
elif score >= 70:
    print("Grade: C")
else:
    print("Grade: D")
```



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Introduction to Loops in Python

What Are Loops?

- Programming structures that repeat instructions until a condition is met.
- Enable iteration over data structures or repetitive task automation.

Why Use Loops?

- Reduce code redundancy
- Automate repetitive tasks
- Improve code efficiency and readability

Types of Loops

- **while Loop:** Repeats while a condition is `True`
- **for Loop**: Iterates over a sequence (e.g., lists, tuples, strings)

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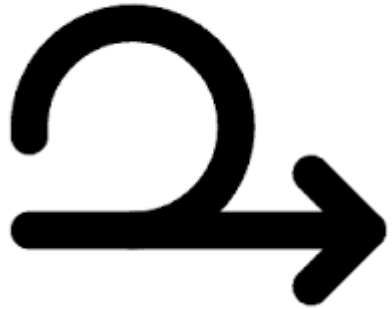
Iterating with Python Loops

What Is Iteration?

- Accessing each item in a collection (e.g., list, tuple, string) one by one.



How Loops Work

- Iterate over Python data structures: lists, dictionaries, sets, strings.
- Enable sequential processing of items in an iterable.

Key Points

- Loops provide sequential access to elements.
- Use loops to read or modify items in sequences (e.g., lists, strings).

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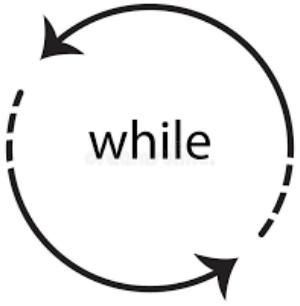
The while Loop in Python

How It Works

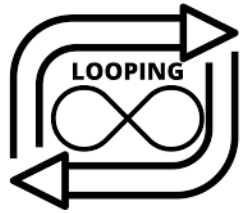
- Executes a code block as long as a condition is True.
- Stops when the condition becomes False.



Useful Scenarios

- When the number of iterations is unknown (e.g., reading a file until its end).

Example




```
count = 0
while count < 3:
    print("Counting:", count)
    count += 1
```

Explanation

- Checks if count < 3 (True initially).
- Prints count and increments by 1.
- Stops when count reaches 3 (False).

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The for Loop in Python

How It Works

Iterates over each item in an iterable
(e.g., list, string, dictionary) until all items are processed.

Useful Scenarios

When the number of iterations is known or iterating over a collection (e.g., lists, strings).

Example

```
colors = ["red", "green", "blue"]
for color in colors:
    print("Color:", color)
```

Explanation

- List: Loops through colors, printing each item.

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The range() Function in Python

Purpose

Generates a sequence of numbers for iterating a specific number of times.

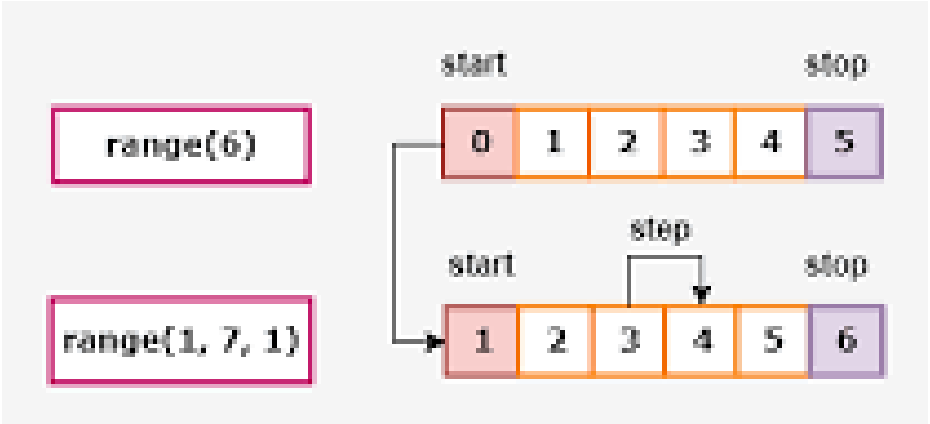
Example

```
for i in range(1, 6):
    print(i)
```

```
for i in range(5, 0, -1):
    print(i)
```

Parameters

Start: starting number (default: 0)
Stop: end number (non-inclusive)
Step: increment/decrement (default: 1)



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The break Statement in Python

Purpose

Exits a loop prematurely when a specific condition is met.

When to Use

To stop a loop immediately (e.g., when finding a target element in a list).

Example

```
for number in range(10):
    if number == 5:
        break
    print(number)
```

Explanation

Loops through numbers 0 to 9.
When number == 5, break stops the loop.
Output: Prints 0, 1, 2, 3, 4.

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The continue Statement in Python

Purpose

Skips the current iteration and proceeds to the next one without exiting the loop.

When to Use

To bypass specific iterations (e.g., skipping unwanted values in a dataset).

Example

```
for i in range(5):
    if i == 2:
        continue
    print(i)
```

Explanation

- Loops through numbers 0 to 4.
- When i == 2, continue skips the print statement.

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The Pass Statement in Python

Purpose

- A null operation; acts as a placeholder when no action is needed.
- Used where code is syntactically required but not yet implemented.

When to Use

As a temporary placeholder (e.g., in empty loops, functions, or try blocks).

Example

```
for i in range(5):
    if i < 3:
        pass
    print(i)
```

Explanation

- Loops through numbers 0 to 4.
- When i < 3, pass does nothing, and the loop continues.
- Output: Prints 0, 1, 2, 3, 4.

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Introduction to Function in Python

Definition

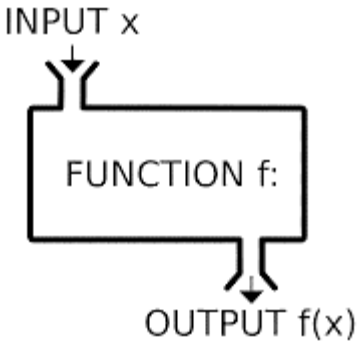
Named, reusable code blocks for specific tasks.

Purpose

- Organize code into manageable parts.
- Promote reusability, reduce redundancy.
- Enable multiple calls throughout a program.

Syntax

Use def keyword, function name, and parameters in ().



Example

```
def greet(name):
    print(f"Hello, {name}!")
greet("Alice")  # Output: Hello, Alice!
```

Explanation

greet function takes **name** parameter and prints a greeting.

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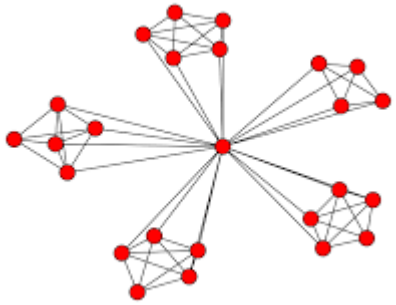
Functions: Modularity & Reusability

Modularity

- Encapsulate functionality for organized, navigable code.
- Develop, test, and debug functions independently.
- Enhances software quality and maintainability.



Code Reusability

- Reuse functions across programs or sections.
- Eliminates redundant code.
- Keeps codebase clean and maintainable.

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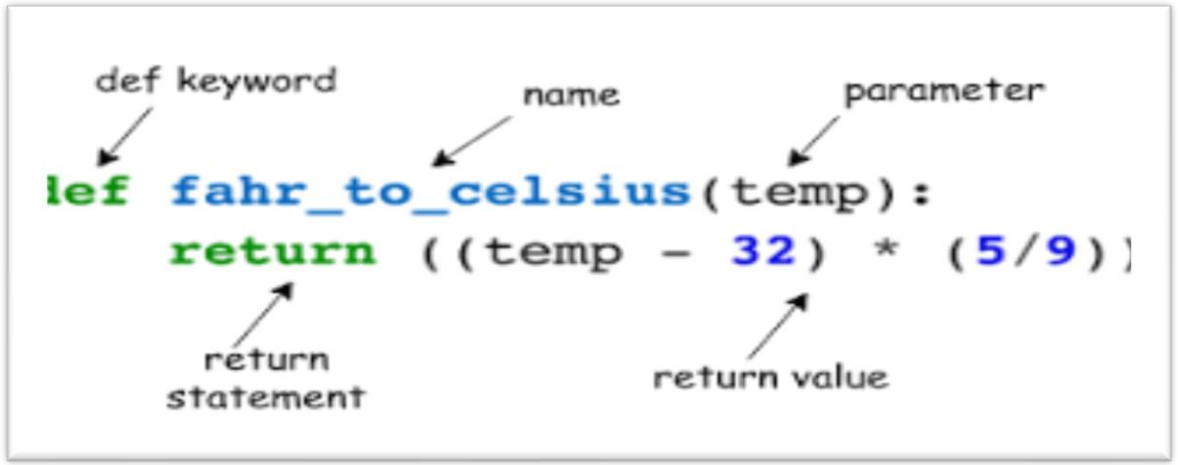
Function Definition in Python

Syntax

Use **def** keyword, function **name**, and () for parameters.
Parameters (optional) accept inputs for the function.

Purpose

- Define reusable code to perform specific tasks.
- Return results using return (optional).



Example

```
def add(a, b):
    return a + b
print(add(3, 4))  # Output: 7
```

Explanation

- add function takes parameters a and b.
- Returns their sum using return.

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Executing Functions in Python

Function Execution

Runs when called, executing the function's code body.

Calling Syntax

- Use function name followed by ().
- Include arguments in () if required.

Multiple Calls

Reuse functions by calling them multiple times.

Example


```
def greet(name):
    print(f"Hello, {name}!")
greet("Alice")    # Output: Hello, Alice!
greet("Bob")      # Output: Hello, Bob!
greet("Charlie")  # Output: Hello, Charlie!
```

Explanation

greet function is called multiple times with different arguments.

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Function Arguments in Python

Definition

Values (arguments) passed to a function for processing.
Used as inputs for calculations or manipulations.

Importance

Enable generic, flexible functions.
Avoid hardcoding, work with varied data.

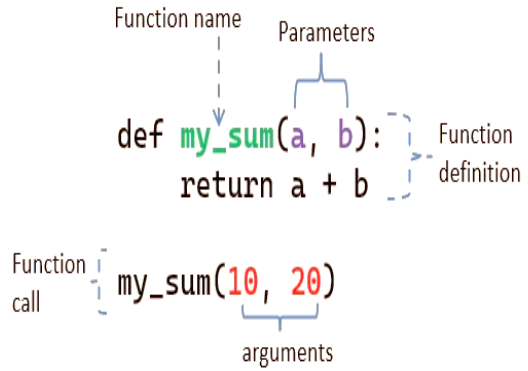
Benefits

Dynamic functionality with different inputs.
Improves code readability and maintainability.

Example

Functions

```
def multiply(a, b):
    return a * b
result = multiply(4, 5)
print(result)  # Output: 20
```



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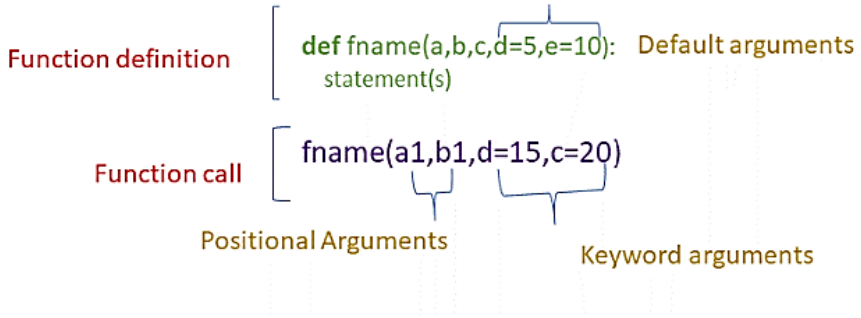
Positional Arguments in Python

Definition

Arguments passed in the order of function parameters.
First argument matches first parameter, and so on.

Key Point

Order matters; incorrect order causes logical errors.



Example

Functions

```
def divide(numerator, denominator):
    if denominator == 0:
        return "Error: Cannot divide by zero."
    return numerator / denominator
result1 = divide(10, 2)  # Output: 5.0
result2 = divide(2, 10)  # Output: 0.2
print(result1)
print(result2)
```

Explanation

Correct: divide(10, 2) → 10 / 2 = 5.0.
Incorrect order: divide(2, 10) → 2 / 10 = 0.2.

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Keyword Arguments in Python

Functions

Definition

Specify parameter names and values when calling a function.
Allows arguments to be passed in any order.

Example

```
def profile(name, age, city):
    return f"{name} is {age} years old and lives in {city}."
info = profile(age=30, name="Alice", city="New York")
print(info)  # Output: Alice is 30 years old and lives in New York.
```

Benefits

Clarity: Clearly indicates what each argument represents.
Flexibility: Order-independent, ideal for optional parameters.

```
def num(a,b):
    print(a,b)
num(b=3,a=5)
```

Keyword Arguments

Explanation

Arguments passed using parameter names, ignoring order.

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*args in Python

Definition

Allows a function to accept any number of positional arguments.
Arguments are collected as a tuple.

Benefits

Ideal when the number of arguments is unknown.

Example

Functions

```
def concatenate_strings(*args):
    return " ".join(args)
result = concatenate_strings("Hello", "world",
"from", "Python!")
print(result)  # Output: Hello world from Python!
```

Explanation

- *args gathers all arguments into a tuple.
- join() combines them into a single string.

```
def num(a,b):
    print(a,b)
num(b=3,a=5)
```

Keyword Arguments

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Global vs. Local Variables in Python

Global Variables

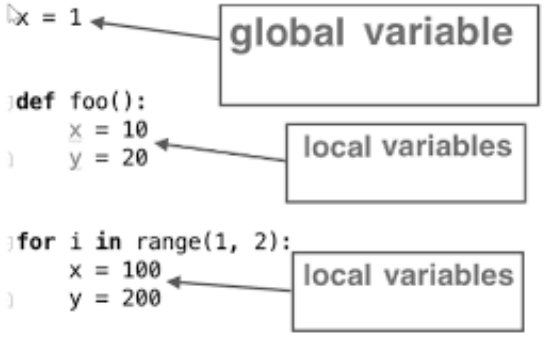
- Defined outside functions.
- Accessible anywhere in the code.

Local Variables

- Defined inside a function.
- Accessible only within that function's scope.

Example

```
global_var = 10  # Global variable
def function():
    local_var = 5  # Local variable
    print(global_var)  # Output: 10
function()
# print(local_var)  # Error: local_var is not accessible
```



Explanation

- global_var is accessible everywhere.
- local_var is limited to the function; accessing it outside raises an error.

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