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What is Python

- Python is a high-level, general-purpose programming language.
- It is known for its clear syntax, readability, and versatility.
- Python is widely used for [web development](#), [data science](#), [machine learning](#), and [automation](#).

Getting Started

- Install Python: Download and install it from <https://www.python.org/downloads/>.
- Choose a text editor: A program to write code, like [Visual Studio Code](#), [Jupyter Notebook](#), [PyCharm](#), or even a simple text editor like [Notepad](#).
- Text editor for Android: [Pydroid 3 - IDE for Python 3](#)
 - [Video: How to: Install Jupyter Notebook on an Android device](#)
- Interactive mode: Experiment with Python directly in your terminal or command prompt using the `python` command.

Important: Python source code files always use the `.py` extension.

How To Use Print() Function in Python

- It is used to display text to the console, or to a file. The `print()` function can take one or more arguments, and it can be used to format text in a variety of ways.

Example #1:

```
message = 'Python is fun'  
  
# print the string message  
print(message)
```

Output:

```
Python is fun
```

Example #2:

```
# Print a string:  
print("Hello, World!")  
  
# Print a number:  
print(10)  
  
# Print a variable:  
x = 5  
print(x)  
  
# Print multiple objects on the same line:  
print("Hello", "World")  
  
# Print multiple objects on separate lines:  
print("Hello")  
print("World")  
  
# Print with a custom separator:  
print("Hello", "World", sep=", ")  
  
# Print with a custom ending character:  
print("Hello", "World", end="!")
```

See also:

- [Video: How to print multiple lines](#)
- [Video: 100 times "hello world" without loop](#)

[Learn more...](#)

Comments

Comments

- Comments are important for making code more readable and understandable, especially for other programmers who may need to read or modify the code.
- Comments in Python are non-executable lines of code and ignored by the Python interpreter when the code is executed.
- **Single-line comments:** These comments start with the hash symbol (#) and extend to the end of the line.

```
# This is a single-line comment  
print("Hello, World!")
```

[Learn more...](#)

Variables

- Storage containers for data (numbers, text, etc.).

What is a variable

- A variable is a named storage location in a computer's memory that is used to hold data or values. It allows programmers to store and manipulate data within a program.

Purpose: Variables provide a way to store and manage data that can be used and manipulated throughout a program. They make programs more flexible and allow for dynamic data storage.

Assignment statement: in Python is used to assign a value to a variable. Its primary purpose is to store and manage data within a program.

Imagine variables as labeled boxes:

- You have boxes for storing different things (numbers, words, etc.).
- Each box has a name (label) to identify what's inside.
- You can put things in, take them out, and change what's inside.

Example #3: Storing a name

```
name = "Muhammad Hamza"  
print(name)
```

Example #4: Tracking a score:

```
score = 0  
score = score + 10 # adds 10 to the score  
print(score)
```

Example #5: Remembering a favorite color

```
favorite_color = "blue" #stores "blue" in variable
print(favorite_color)
```

Example #6: Calculating the area of a rectangle

```
length = 10
width = 5

# calculates the area
area = length * width
print(area)
```

Key Points:

- **Choose meaningful names:** Use names that describe what the variable stores (e.g., pizza_slices instead of x).
- **Assign values using =:** The equals sign is used to put a value into a variable.
- **Change values:** You can update a variable's value later in your code.
- **Use variables in calculations and operations:** Variables can be used just like regular numbers or text in expressions.
- **Think of variables as placeholders:** They hold information that can change as your program runs.

See also:

- [Variables in Python](#)

[Learn more...](#)

Types of Data

- Numbers (integers, floats), strings (text), booleans (True/False)

String (str)

- Stores text or characters.
- Enclosed in single or double quotes.

Example #7:

```
name = "Ahmad"
greeting = 'Hello, world!'
favorite_song = "Let It Go" # Double quotes can also contain single quotes
```

Integer (int)

- Stores whole numbers (without decimals).
- Used for counting and representing quantities.

Example #8:

```
age = 25
num_pets = 3
lucky_number = 7
```

Float (float)

- Stores decimal numbers.
- Used for representing precise measurements or values with fractions

Example #9:

```
height = 1.70 # meters
price = 19.99
distance = 3.14159 # Pi
```

Boolean (bool)

- Stores True or False values.
- Used for representing logical conditions or decisions.

Example #10:

```
is_hungry = True
is_raining = False
has_finished = True
```

Key Points

- Each data type has specific purposes and operations.
- Python automatically determines the data type when you assign a value.
- You can check the data type using the `type()` function:

```
print(type(name)) # Output: <class 'str'>
print(type(age)) # Output: <class 'int'>
print(type(height)) # Output: <class 'float'>
print(type(is_hungry)) # Output: <class 'bool'>
```

See also:

- [Video: Use of type\(\) function in Python](#)

[Learn more...](#)

Operators

- Perform calculations and comparisons (e.g., +, -, *, /, ==, !=).

1. Arithmetic Operators:

- Used for performing basic mathematical calculations.
- Operators: + (addition), - (subtraction), * (multiplication), / (division), // (floor division), % (modulo), ** (exponentiation)

Example #11:

```
result = 10 + 5 # Addition
difference = 15 - 7 # Subtraction
product = 4 * 6 # Multiplication
quotient = 12 / 3 # Division
integer_quotient = 17 // 4 # Floor division
remainder = 25 % 4 # Modulo
square = 5 ** 2 # Exponentiation
```

2. Comparison Operators:

- Used to compare values and return a Boolean result (True or False).
- Operators: == (equal to), != (not equal to), > (greater than), < (less than), >= (greater than or equal to), <= (less than or equal to)

Example #12:

```
is_equal = 7 == 7 # True
is_greater = 12 > 9 # True
is_less_or_equal = 5 <= 5 # True
```

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Input and Output

- Get user input with input() and display output with print().

Input in Python:

- **The input() function:**
 - Takes a prompt as an argument (optional)

- Reads user input from the keyboard
- Returns the input as a string

- **Example #13:**

```
name = input("Enter your name: ")
age = int(input("Enter your age: ")) # Convert string input to integer
```

Output in Python:

- **The `print()` function:**
 - Prints values to the console
 - Can display multiple values, separated by commas
 - Can format output using string methods

- **Examples:**

```
print("Hello, world!")
print("Your name is", name, "and you are", age, "years old.")
print("The answer is:", 42)
```

F-Strings in Python

1. What are F-Strings?

F-strings (formatted string literals) are a feature introduced in Python 3.6 that provide a concise and readable way to embed expressions inside string literals. The "f" stands for "formatted" - these strings are evaluated at runtime.

2. Why Use F-Strings?

1. **Readability:** Much cleaner syntax compared to older formatting methods
2. **Performance:** Faster than %-formatting and `str.format()`
3. **Expressiveness:** Can include any valid Python expression
4. **Less Error-Prone:** Fewer moving parts than other formatting methods

Syntax

The basic syntax is simple - prefix your string with 'f' or 'F' and include expressions in curly braces {}:

```
f"string text {expression} more text"
```

3. Basic Examples for Beginners

1. Simple variable insertion

```
name = "Alice"  
age = 25  
print(f"My name is {name} and I'm {age} years old.")
```

2. Simple calculations

```
a = 5  
b = 10  
print(f"The sum of {a} and {b} is {a + b}.")
```

See also:

- [Python print Function](#)
- [F-Strings in Python](#)
- [Python input\(\) Function](#)

Control Flow

Conditional Statements

if statement

- The if statement in MATLAB is a conditional statement that allows you to execute a block of code only if a certain condition is met.
- Make decisions using `if`, `elif`, and `else` statements.

The general **syntax** of the if statement is as follows:

```
if condition  
    statements
```

The `condition` can be any logical expression. If the condition is evaluated to `true`, the block of `statements` is executed. Otherwise, the block of `statements` is skipped.

Here is a simple example of an if statement in MATLAB:

Example #14:

```
x = 10  
  
if x > 5:  
    print('x is greater than 5.')
```

This code will print the message `x is greater than 5.` to the console.

You can also use `elif` statements to check for multiple conditions. The general **syntax** of the **elif statement** is as follows:

```
elif condition
    statements
end
```

If the `condition` for the if statement is evaluated to `false`, the python interpreter will check the `condition` for the first `elif` statement. If the condition for the `elif` statement is evaluated to `true`, the corresponding block of `statements` is executed. Otherwise, the python interpreter will check the `condition` for the next `elif` statement, and so on.

Here is an example of an if statement with an `elif` statement:

Example #15:

```
x = 3

if x > 5:
    print('x is greater than 5.')
elif x < 5:
    print('x is less than 5.')
```

This code will print the message "x is less than 5." to the console.

You can also use an `else` statement to check for all other conditions. The general syntax of the `else` statement is as follows:

```
else
    statements
end
```

If all of the conditions for the if and `elseif` statements are evaluated to `false`, the block of `statements` in the `else` statement is executed.

Here is an example of an if statement with an `elif` statement and an `else` statement:

Example #16:

```
x = 2

if x > 5:
```

```
print('x is greater than 5.')
elif x == 5:
    print('x is equal to 5.')
else:
    print('x is less than 5.')
```

This code will print the message "x is less than 5." to the console.

[Learn more...](#)

Loops

- Repeat actions using `for` and `while` loops.

for loop

- A for loop in Python is a programming statement that repeats a block of code a certain number of times.

Example #17:

```
for i in range(5):
    print(i)
```

Example #18:

```
for i in range(5):
    print("Python")
```

See also:

- [Video: Calculate the sum of the first N natural numbers](#)
- [Video: String as an iterable using for loop](#)

[Learn more...](#)

while loop

- A while loop in python is a control flow statement that repeatedly executes a block of code until a specified condition is met.

Example #19: Counting Up to a Number:

```
count = 1 # Start counting at 1
while count <= 10: # Keep counting as long as we're less than or equal to 10
    print(count) # Print the current number
    count += 1 # Add 1 to the count for the next round
```

[Learn more...](#)

Defining Functions

1. What is a Function?

A function is a block of reusable code that performs a specific task. It's reusable, which means you can call it multiple times in your program. This helps to organize your code, make it more readable, and avoid repetition.

Why Do We Use Functions?

We use functions in Python for several reasons:

- **Code Reusability:** You can call a function multiple times instead of repeating code. This saves time and effort.
- **Modularity:** Breaking down a large program into smaller, manageable chunks (functions) makes it easier to understand and maintain.
- **Avoiding Repetition:** Functions prevent you from writing the same code over and over, reducing errors and improving efficiency."

2. How to Write a Function

To define a function, you use the `def` keyword followed by the function name, parentheses for parameters, and a colon. The code block that defines the function is indented.

Syntax:

```
def function_name(parameters):  
    # Function body  
    # Code to be executed
```

Example 1: Defining and Calling a Function

```
def greet(name):  
    print("Hello,", name + "!")  
  
# Calling the function  
greet("Ahmad") # Output: Hello, Ahmad!
```

Explanation:

- `def greet(name):` defines a function named `greet` that takes one parameter, `name`.
- `print("Hello,", name + "!")` is the function body, which prints a greeting message using the provided name.

- `greet("Ahmad")` calls the function with the argument "Ahmad".

Key Points:

- **Parameters:** These are variables passed to the function when it's called. For more details, See [Parameters and Arguments in Python Functions](#)
- **Return Value:** A function can optionally return a value using the `return` statement.
- **Docstrings:** It's good practice to include a docstring (a string that explains the function's purpose) after the function definition.

3. Return Statement

- Functions can return values using the `return` keyword.

Example 2: Function with a Return Value

```
def add(x, y):  
    return x + y  
  
result = add(3, 5)  
print(result) # Output: 8
```

4. Default Arguments

- You can assign default values to parameters, which makes them optional when calling the function.

Video: [Learn How to Use Default Parameters in Function Definition](#)

Example 3:

```
def greet(name, message="Hello"):  
    print(f"{message}, {name}!")  
  
greet("Alice") # Uses default message "Hello"  
greet("Alice", "Hi") # Overrides default with "Hi"
```

for more details, see [Functions in Python:\ Complete Guide with Syntax, Examples, and Practice Tasks](#)

Multiple Choice (Select the best answer)

Which of the following is the correct syntax for the print statement in Python?

1. `print ("text")`
2. `println ("text")`
3. `echo ("text")`

Which of the following statements will print the value of the variable x?

- print(x)
- print "x"
- println(x)
- echo x

What will be the output of the following code?

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

- Hello
- world
- Hello, world!
- There will be no output

What is the purpose of the sep argument in the print function?

- To specify the separator between multiple values printed on the same line.
- To specify the end character for the printed line.
- To specify the file to which the output should be printed.
- To specify the format of the output.

What is the purpose of the end argument in the print function?

- To specify the separator between multiple values printed on the same line.
- To specify the end character for the printed line.
- To specify the file to which the output should be printed.
- To specify the format of the output.

What is the primary purpose of comments in Python code?

- To execute instructions for the computer
- To temporarily disable lines of code
- To make the code more readable and understandable for humans
- To create errors for debugging

Which of the following is the correct syntax for a single-line comment in Python?

- // This is a comment
- /* This is a comment */
- # This is a comment
- { This is a comment }

What is the difference between == and = in Python?

- == is the comparison operator, = is the assignment operator
- == is the assignment operator, = is the comparison operator
- They are the same operator
- There is no difference

Which operator checks if two values are greater than or equal to each other?

- >
- <=
- >=
- <

What is the result of `5 <= 5`?

- True
- False
- 5
- None of the above

What is the output of `x = 10; x //= 3`?

- 3
- 3.33
- 3.5
- 4

Which operator is used to raise a number to a power?

- **
- ^
- pow()
- ** and ^ are both correct

What is the output of `45 // 7`?

- 5.0
- 6
- 5
- 6.428571428571429

What is the difference between `==` and `=` in Python?

- `==` is the comparison operator, `=` is the assignment operator
- `==` is the assignment operator, `=` is the comparison operator
- They are the same operator
- There is no difference

What is the result of the expression `3 + 5 * 2` in Python?

- 16
- 13
- 11
- 26

Which data type is used to represent decimal numbers in Python?

- int

2. float
3. complex
4. str

Which of the following is an example of a boolean value in Python?

1. "True"
2. 1
3. 3.14
4. False

Which scalar data type is used to represent textual data in Python?

1. str
2. char
3. text
4. string

What is the default type of a numerical literal without a decimal point in Python?

1. int
2. float
3. complex
4. bool

Which of the following is NOT a scalar data type in Python?

1. Integer
2. Float
3. String
4. List

What is the output of `type(42)`?

1. int
2. float
3. str
4. None

What is the result of `3 + 4.5`?

1. 7
2. 7.5
3. Error
4. None of the above

How do you create a string in Python?

1. Using single quotes (')
2. Using double quotes (")
3. Both a and b

4. None of the above

What is the result of `5 > 3` and `not (2 == 2)`?

1. True
2. False
3. Error
4. None of the above

What is the correct syntax for a for loop in Python?

1. `for (int i = 0; i < 10; i++):`
2. `for i in range(10):`
3. `for i = 0 to 9:`
4. `for i in 10:`

What will be the output of the following code?

```
for i in range(5):  
    print(i* 2)
```

1. 0 1 2 3 4
2. 2 4 6 8 10
3. 10 8 6 4 2
4. 0 2 4 6 8

What is the output of the following code?

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

1. 0 1 2
2. 0 1
3. 1 2 3
4. The code will run indefinitely.

Which of the following correctly represents the syntax of an if statement in Python?

1. `if condition { block of code }`
2. `if(condition) { block of code }`
3. `if condition: block of code`

What is the purpose of the else block in an if statement?

1. To execute a code block when the if condition is True
2. To execute a code block when the if condition is False

3. To create an infinite loop
4. To define a function

What will be the output of the following code?

```
x = 10
y = 5
if x < y:
    print("x is greater than y")
```

1. "x is greater than y"
2. "x is less than y"
3. Nothing will be printed
4. An error will occur

Review Questions

- What is a variable?
- How do you display the text "Hello, world!" in the console?
- How do you ask the user to enter their name and store it in a variable?
- What are the operators used for addition, multiplication, floor division, and exponentiation in Python and provide an example of each operation?
- What is the difference between the division operator (/) and the floor division operator (//)?
- What is the modulus operator (%) used for?
- What are the operators used to compare values (e.g., greater than, less than, equal to)?
- How do you create a variable in Python?
- What are the common data types in Python?

Control Flow:

- How do you create a for loop that iterates from 1 to 10 using the range() function?
- What is the purpose of an if statement?
- What is the difference between a for loop and a while loop in Python?

References and Bibliography

- Automate the Boring Stuff with Python - Practical Programming for Total Beginners by Al Sweigart [website](#) | [ebook](#) (free to read)
- Python One-Liners by Christian Mayer teaches you how to read and write "one-liners": concise statements of useful functionality packed into a single line of code. | [website with free one-liner explainer videos](#)
- [Python for Data Analysis, 3E](#) | [ebook](#) (free to read)
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- [Google's Python Class](#)
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