**Python Strings**

**✅ What is a String?**

* A **sequence of Unicode characters**.
* Strings are **immutable** like tuples.
* Strings are defined using **quotes**: ' ', " ", or ''' '''.

**📍 Syntax:**

s = "Hello World"

**✨ String Examples:**

s = "Python"

print(s[0]) # Output: P

print(s[-1]) # Output: n

**🔧 String Built-in Functions:**

| **Function** | **Description** | **Example** |
| --- | --- | --- |
| len() | Returns length of string | len("abc") → 3 |
| lower() | Converts to lowercase | "ABC".lower() → "abc" |
| upper() | Converts to uppercase | "abc".upper() → "ABC" |
| capitalize() | Capitalizes first letter | "python".capitalize() → "Python" |
| title() | Capitalizes each word | "my name".title() → "My Name" |
| count() | Counts how many times a value appears | "apple".count("p") → 2 |
| find() | Returns index of first match | "apple".find("p") → 1 |
| replace() | Replaces a substring | "apple".replace("p", "b") → "abble" |
| split() | Splits by spaces (or given delimiter) | "a b c".split() → ['a','b','c'] |
| join() | Joins elements using string as separator | " ".join(['a','b']) → "a b" |
| strip() | Removes whitespace from both ends | " hi ".strip() → "hi" |
| startswith() | Checks if string starts with a substring | "hello".startswith("he") → True |
| endswith() | Checks if string ends with a substring | "hello".endswith("lo") → True |
| isalnum() | Checks if all characters are alphanumeric | "abc123".isalnum() → True |
| isalpha() | Checks if all characters are alphabets | "abc".isalpha() → True |
| isdigit() | Checks if all characters are digits | "123".isdigit() → True |
| encode() | Returns encoded string (UTF-8 by default) | "hello".encode() → b'hello' |

**🔐 Encodings (for Strings):**

* Encoding converts string into **bytes**.
* Common encodings: 'utf-8', 'utf-16', 'ascii'.

text = "hello"

encoded = text.encode("utf-8")

print(encoded) # Output: b'hello'

**Python Strings – Complete Notes**

**🔹 What is a String?**

A **string** is a sequence of characters enclosed within single quotes ' ', double quotes " ", or triple quotes ''' ''' or """ """.

s1 = 'Hello'

s2 = "World"

s3 = '''Python is fun'''

**🔹 Properties of Strings**

| **Property** | **Description** |
| --- | --- |
| Ordered | Elements have a fixed position |
| Immutable | Cannot be changed after creation |
| Iterable | You can loop through each char |
| Indexable | Can access individual characters |

**🔹 Accessing Characters**

s = "Talha"

print(s[0]) # Output: T

print(s[-1]) # Output: a

**🔹 String Slicing**

s = "Python"

print(s[0:3]) # Output: Pyt

print(s[::2]) # Output: Pto

**🔹 Common String Operations**

s1 = "Hello"

s2 = "World"

print(s1 + " " + s2) # Concatenation

print(s1 \* 3) # Repetition

print("H" in s1) # Membership test

**🔹 String Methods (with Examples)**

| **Method** | **Description** | **Example** |
| --- | --- | --- |
| upper() | Converts to uppercase | 'talha'.upper() → 'TALHA' |
| lower() | Converts to lowercase | 'TALHA'.lower() → 'talha' |
| capitalize() | Capitalizes first letter | 'python'.capitalize() → 'Python' |
| title() | Capitalizes each word | 'hello world'.title() → 'Hello World' |
| strip() | Removes whitespace from ends | ' hello '.strip() → 'hello' |
| replace(old, new) | Replaces substring | 'hi hi'.replace('hi', 'bye') → 'bye bye' |
| find(sub) | Returns index of first occurrence | 'talha'.find('a') → 1 |
| count(sub) | Counts occurrences of substring | 'banana'.count('a') → 3 |
| split() | Splits into list by space | 'a b c'.split() → ['a', 'b', 'c'] |
| join(list) | Joins list into string | ' '.join(['a', 'b']) → 'a b' |
| startswith(prefix) | Checks if starts with a prefix | 'talha'.startswith('ta') → True |
| endswith(suffix) | Checks if ends with a suffix | 'hello'.endswith('o') → True |
| isalpha() | All letters | 'abc'.isalpha() → True |
| isdigit() | All digits | '123'.isdigit() → True |
| isalnum() | Letters and numbers | 'abc123'.isalnum() → True |

**🔹 Escape Characters**

| **Code** | **Meaning** |
| --- | --- |
| \n | New line |
| \t | Tab |
| \' | Single quote |
| \" | Double quote |
| \\ | Backslash |

Example:

print("Hello\nWorld")

**🔹 String Encoding**

* Strings are **Unicode** in Python.
* You can encode them in formats like UTF-8, UTF-16, etc.

s = "سلام"

encoded = s.encode("utf-8")

print(encoded) # b'\xd8\xb3\xd9\x84\xd8\xa7\xd9\x85'

**🔹 Formatting Strings**

**1. Using f-strings:**

name = "Talha"

age = 21

print(f"My name is {name} and I am {age} years old.")

**2. Using format():**

print("My name is {} and I am {} years old.".format(name, age))

**🔹 Why Use Strings?**

* Strings store text data in apps, websites, databases, etc.
* Used in everything from **user input**, **data files**, to **APIs** and **interfaces**.

**🔹 String Immutability**

Once created, you **cannot change** a string. Example:

s = "Talha"

s[0] = 'M' # ❌ Error: 'str' object does not support item assignment

Instead, create a new string:

s = "Talha"

s = "M" + s[1:]