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Tuples in Python

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C14: Fundamentals of Programming

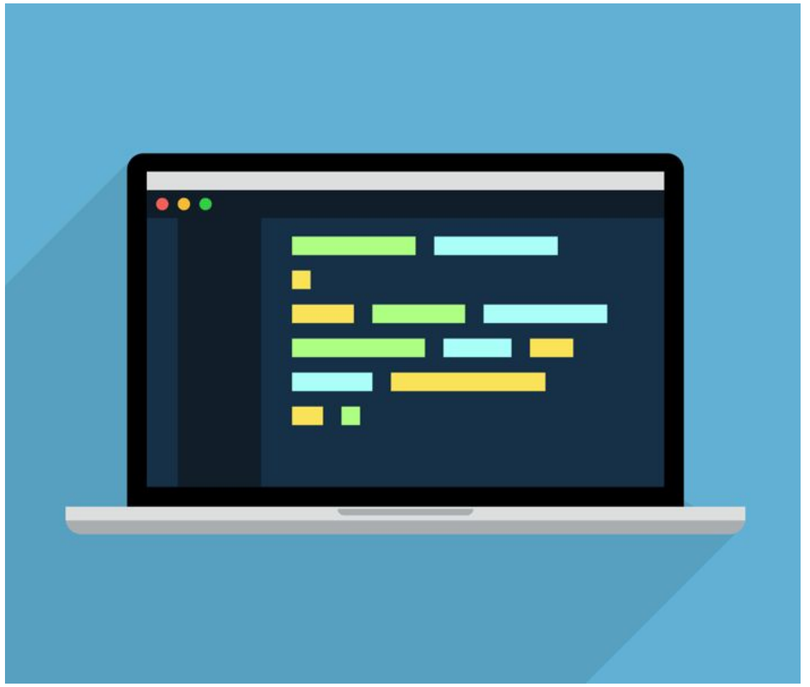
Quick Recap :

- **Iterating Lists**
- **Built-in List Functions:**

  min(), max(), any(), all(), sum()

- **List Methods:**

  sort(), sorted(), reverse(), count(), index()



Introduction to Tuples

Aman is one of the best cooks in Newton Restaurant.

Introduction to Tuples

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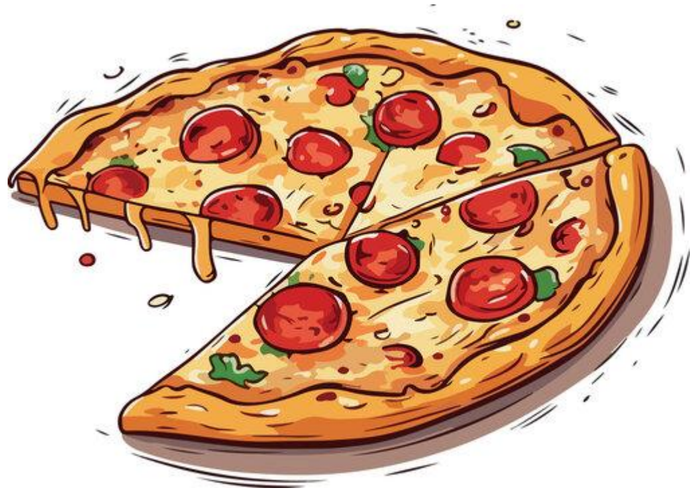
- He has invented a recipe for making a very tasty pizza.
- To implement this he has listed down some ingredients.
- He decides to store these items in a list for his teammates to access and use.



Introduction to Tuples

But there is a mischievous chef who wants to change the items on this list and spoil his recipe.

Introduction to Tuples

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Being aware of his plans Aman decides to store his recipe in a data structure which is immutable!

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Yes its tuples!

Definition :

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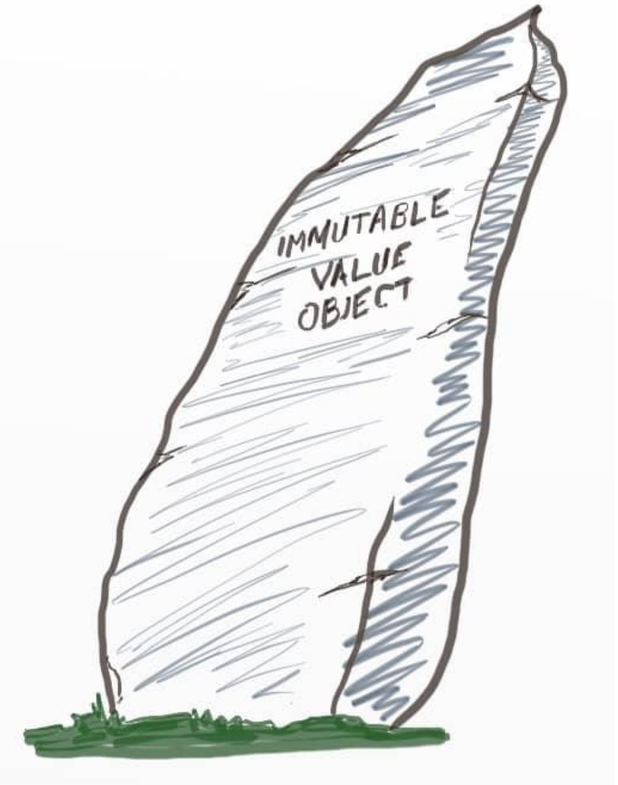
- In Python, a tuple is an immutable sequence of elements.
- This means that once a tuple is created, its contents cannot be modified—no elements can be added, removed, or changed.



Syntax:

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Tuples are defined using **parentheses ()** to enclose their elements, whereas lists use s**quare brackets []**. Here's a simple comparison:

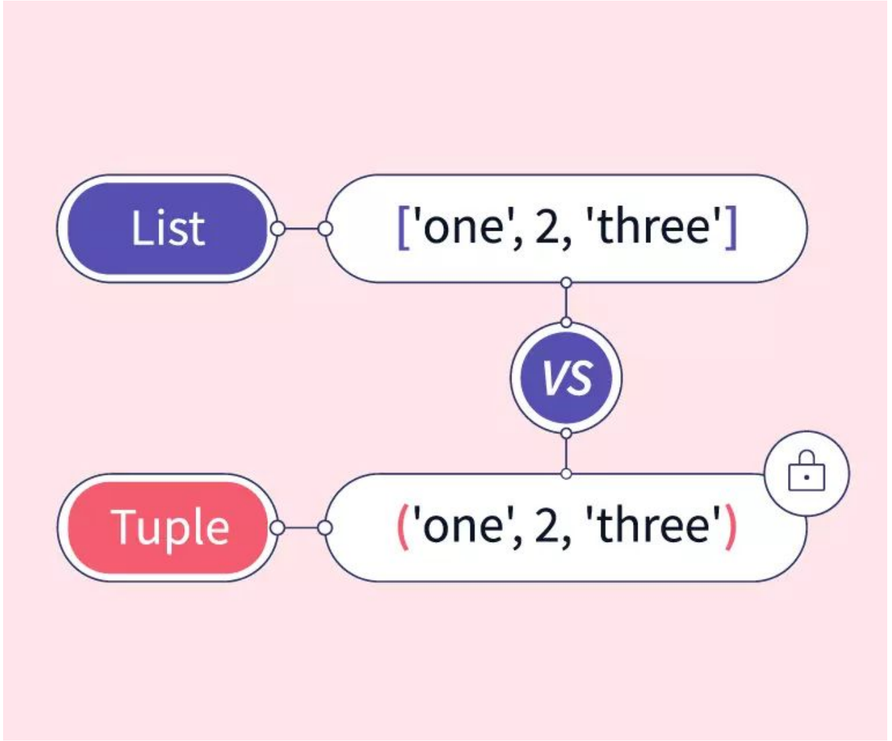
- **Tuple Syntax**: `(element1, element2, element3)`
- **List Syntax**: `[element1, element2, element3]`

python Copy code

```python
my_tuple = (1, 2, 3)
my_list = [1, 2, 3]
```

Mutability :

- **List:** Mutable, meaning you can modify it (e.g., add, remove, or change elements).
- **Tuple:** Immutable, meaning once created, it cannot be altered.



Tuples usability

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Using a Tuple for Fixed Data

Tuples are ideal when dealing with data that should remain constant throughout your program, like coordinates, dates, or configuration settings.

Scenario: Storing Coordinates

Coordinates are often fixed and don’t need to be modified, making tuples a good choice.

```
# Tuple example: coordinates
coordinates = (40.7128, -74.0060)  # New York City latitude and longitude
print("Coordinates of NYC:", coordinates)

# Attempting to modify the coordinates would raise an error
# coordinates[0] = 41.0  # This would result in a TypeError
```

Tuples usability

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- **Safety:** When you want to ensure that the data cannot be altered by any part of the program, tuples provide a way to safeguard this data, avoiding unintended side effects.

- **Hashability** : Because tuples are immutable, they can be used as keys in dictionaries or elements in sets, unlike lists. This is a result of their hashable nature, which relies on their fixed structure.

Tuples usability

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- **Multiple Return Values:** Tuples are often used to return multiple values from a function.

Example :

```python
def get_coordinates():
    return (40.7128, 74.0060)

lat, lon = get_coordinates()
```

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Creating Tuples

Empty Tuple

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An empty tuple is a tuple that contains no elements. It is created by simply using a pair of parentheses with no content inside.

```python
# Creating an empty tuple
empty_tuple = ()
print(empty_tuple)  # Output: ()
```

Multiple Elements Tuple

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- A tuple with multiple elements is created by placing the elements within **parentheses and separating them with commas**.
- Tuples can contain any number of elements and can include different **data types**.

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```python
# Creating a tuple with multiple elements
multi_element_tuple = (1, "hello", 3.14)
print(multi_element_tuple)  # Output: (1, 'hello', 3.14)
```

Single Element Tuple

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- To create a tuple with a single element, you must include a trailing comma after the element.
- **Without the comma, Python will interpret the parentheses as just enclosing the element, not creating a tuple.**

```python
# Creating a single-element tuple
single_element_tuple = (5,)
print(single_element_tuple)  # Output: (5,)
```

Single Element Tuple

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Let’s see what will happen if we omit the **comma**.

```python
not_a_tuple = (5)
print(type(not_a_tuple))  # Output: <class 'int'>
```

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Accessing Elements in Tuple

Indexing

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Indexing allows you to retrieve elements from a tuple by specifying their **position**. Python uses **zero-based** indexing, meaning the first element has an index of `0`, the second has an index of `1`, and so on.

python

```python
# Creating a tuple
my_tuple = (10, 20, 30, 40, 50)

# Accessing elements using indexing
first_element = my_tuple[0]  # 10
third_element = my_tuple[2]  # 30

print(first_element)  # Output: 10
print(third_element)  # Output: 30
```

Negative Indexing

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Negative indexing allows you to access elements **from the end** of the tuple. The last element has an index of `-1`, the second-to-last element has an index of `-2`, and so on.

python

```python
# Creating a tuple
my_tuple = ('a', 'b', 'c', 'd', 'e')

# Accessing elements using negative indexing
last_element = my_tuple[-1]   # 'e'
second_last_element = my_tuple[-2]  # 'd'

print(last_element)  # Output: 'e'
print(second_last_element)  # Output: 'd'
```

Slicing Tuples

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Slicing allows you to access a range of elements from a tuple. You can specify a starting index, a stopping index, and a **step value**. The syntax for slicing is `tuple[start:stop:step]`, where:

- **start:** The index where the slice begins (inclusive).
- **stop:** The index where the slice ends (exclusive).
- **step:** The interval between elements in the slice (optional).

Slicing Tuple

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```python
# Creating a tuple
my_tuple = (1, 2, 3, 4, 5, 6, 7, 8, 9)

# Slicing the tuple
slice1 = my_tuple[2:5]   # (3, 4, 5)
slice2 = my_tuple[:4]    # (1, 2, 3, 4)
slice3 = my_tuple[5:]    # (6, 7, 8, 9)
slice4 = my_tuple[::2]   # (1, 3, 5, 7, 9)

print(slice1)  # Output: (3, 4, 5)
print(slice2)  # Output: (1, 2, 3, 4)
print(slice3)  # Output: (6, 7, 8, 9)
print(slice4)  # Output: (1, 3, 5, 7, 9)
```

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Tuple Operations

Concatenation

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- Concatenation allows you to join two tuples together into a single, larger tuple.
- This is done using the + operator.
- This operation does not modify the original tuples but produces a new one that combines their contents.

```python
tuple1 = (1, 2, 3)
tuple2 = (4, 5, 6)
concatenated_tuple = tuple1 + tuple2
print(concatenated_tuple)  # Output: (1, 2, 3, 4, 5, 6)
```

Repetition

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- Repetition allows you to create a new tuple by repeating the elements of an existing tuple a specified number of times.
- This is done using the * operator.

```python
tuple1 = (1, 2, 3)
repeated_tuple = tuple1 * 3
print(repeated_tuple)  # Output: (1, 2, 3, 1, 2, 3, 1, 2, 3)
```

Membership Test (in keyword)

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- The membership test allows you to check whether a specific element exists within a tuple.
- This is achieved using the **in** keyword, which returns **True** if the element is found in the tuple and **False** otherwise.

```
# Tuple of weekend days
weekends = ("Saturday", "Sunday")

# Day to check
day = "Saturday"

# Membership test
if day in weekends:
    print(f"{day} is a weekend!")
else:
    print(f"{day} is a weekday.")
```

python

```
tuple1 = (1, 2, 3, 4)
print(2 in tuple1)  # Output: True
print(5 in tuple1)  # Output: False
```

len() Function

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- The **length operation** allows you to determine the number of elements present in a tuple.
- This is done using the **len()** function, which returns an integer representing the **number of items** in the tuple.

```python
tuple1 = (1, 2, 3, 4)
length = len(tuple1)
print(length)  # Output: 4
```

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Tuple Methods

Count method

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- This method takes a single argument, which is the value whose occurrences you want to count.
- It returns an integer representing how many times that value appears in the tuple.

```python
tuple1 = (1, 2, 3, 2, 4, 2)
count_of_2 = tuple1.count(2)
print(count_of_2)  # Output: 3
```

Index method

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- The index method helps you find the **first occurrence** of a specific value within a tuple.
- This method takes the value you want to find and returns its **index** (position) in the tuple.
- If the value is not present, it raises a **ValueError**.

```python
tuple1 = (10, 20, 30, 40, 30)
index_of_30 = tuple1.index(30)
print(index_of_30)  # Output: 2
```

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Iteration in Tuples

Using ‘for’ loop

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A **for loop** in Python provides a simple and intuitive way to iterate through **each item** in a tuple. This method allows you to access **each element** one by one and perform operations on it.

Syntax:

```
for item in tuple:
    #perform operations with item
```

Example using ‘for’ loop

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python

```python
fruits = ('apple', 'banana', 'cherry', 'date')

for fruit in fruits:
    print(fruit)
```

bash

```
apple
banana
cherry
date
```

Using enumerate() for iteration

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- In Python, enumerate() is a built-in function that allows you to loop over a list (or any iterable) while keeping track of both the index and the value of each item.
- This is especially useful when you need to work with both the position and content of each element in a list.

```
fruits = ["apple", "banana", "cherry", "date"]

for index, fruit in enumerate(fruits, start=1):
    print(f"{index}: {fruit}")
```

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Tuple Packing and Unpacking

Packing and Unpacking

Packing : One person gets all the melody’s.

Unpacking : Each person gets one melody.

Packing

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- **Packing** refers to the process of assigning multiple values to a single variable, which creates a tuple. This is a straightforward and efficient way to group related values together.
- Tuples are automatically created when multiple values are **separated by commas**, even if parentheses are omitted.

```python
packed_tuple = 1, 2, 'a'
print(packed_tuple)  # Output: (1, 2, 'a')
```

Unpacking

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- **Unpacking** refers to the process of **extracting** the values from a tuple and assigning them to **individual variables**.
- This is useful for when you need to work with each value separately after it has been grouped into a tuple.
- Tuples are automatically created when multiple values are **separated by commas**, even if parentheses are omitted.

```
packed_tuple = 1, 2, 'a'
a, b, c = packed_tuple
print(a)  # Output: 1
print(b)  # Output: 2
print(c)  # Output: 'a'
```

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Nested Tuples

Nested Tuples

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- A nested tuple is essentially a tuple that contains one or more tuples as its elements.
- This allows you to create multi-dimensional data structures and manage related groups of data efficiently.

Example:

```python
nested_tuple = (1, (2, 3), 4)
```

Nested Tuples Examples

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```python
nested_tuple = (1, (2, 3), 4)
nested_element = nested_tuple[1][0]
print(nested_element)  # Output: 2
```

- In this example: **nested_tuple[1]** accesses the second element of nested_tuple, which is the tuple **(2, 3)**.
- **nested_tuple[1][0]** accesses the first element of the nested tuple (2, 3), which is **2**.

Thank You!