Online Workshop on ‘How to develop Pythonic coding rather than Python coding – Logic Perspective’

22.7.20 Day2 session 1

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Lists and Tuples

Objectives of the Day 2 session 1

To acquire a basic knowledge in List and Tuple

To comprehend the in-built functions and operations in List and Tuple

To practice the simple programs in List and Tuple

To introduce the Pythonic way of writing the code

- **Python offers a range of compound data types often referred to as sequences.**
- **List is one of the most frequently used and very versatile datatypes used in Python.**

Mutable object is the one which can be modified

Mutable ordered sequence of items of mixed types

How to create a list?

- **Ex: L=[1,2,3,4,5]**
- **It can have any number of items and they may be of different types (integer, float, string etc.).**

```
# empty list

my_list = []

# list of integers

my_list = [1, 2, 3]

# list with mixed datatypes

my_list = [1, "Hello", 3.4]
```

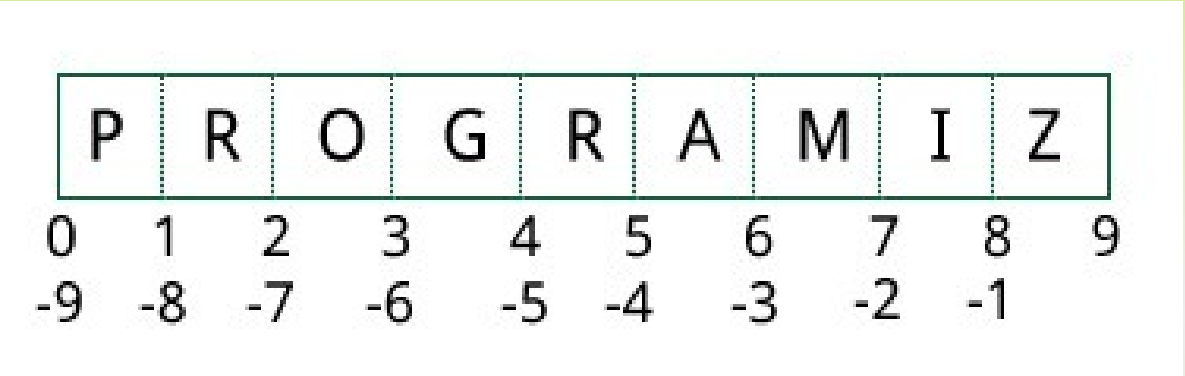
Also, a list can even have another list as an item. This is called nested list.

```
# nested list

my_list = ["mouse", [8, 4, 6], ['a']]
```

List Index

```
my_list = ['p','r','o','b','e']
print(my_list[0])
# Output: p

print(my_list[2])
# Output: o

print(my_list[4])
# Output: e

# my_list[4.0]
# Error! Only integer can be used for indexing

# Nested List
n_list = ["Happy", [2,0,1,5]]
# Nested indexing
print(n_list[0][1])
# Output: a

print(n_list[1][3])
# Output: 5
```

Python allows negative indexing for its sequences. The index of -1 refers to the last item, -2 to the second last item and so on.




```
my_list = ['p','r','o','b','e']

print(my_list[-1])
# Output: e

print(my_list[-5])
# Output: p
```

How to slice lists in Python?

```
my_list = ['p','r','o','g','r','a','m','i','z']

print(my_list[2:5])
# o/p: ['o', 'g', 'r']


print(my_list[:-5])
# o/p: ['p', 'r', 'o', 'g']

print(my_list[5:])
# o/p :['a','m','i','z']

print(my_list[:])
# o/p :['p','r','o','g','r','a','m','i','z']
```

```
odd = [2, 4, 6, 8]

# change the 1st item
odd[0] = 1
# o/p:  [1, 4, 6, 8]


# change 2nd to 4th items
odd[1:4] = [3, 5, 7]
print(odd)
# Output: [1, 3, 5, 7]
```

```
odd = [1, 3, 5]
odd.append(7)
print(odd)
# Output: [1, 3, 5, 7]

odd.extend([9, 11, 13])
print(odd)
# Output: [1, 3, 5, 7, 9, 11, 13]
odd = [1, 3, 5]
print(odd + [9, 7, 5])
# Output: [1, 3, 5, 9, 7, 5]

print(["re"] * 3)
#Output: ["re", "re", "re"]

odd = [1, 9]
#odd.insert(index,element added)
odd.insert(1,3)
print(odd)
# Output: [1, 3, 9]

odd[2:2] = [5, 7]
print(odd)
# Output: [1, 3, 5, 7, 9]
```

```
my_list = ['p','r','o','b','l','e','m']

# delete one item
del my_list[2]
print(my_list)
# Output: ['p', 'r', 'b', 'l', 'e', 'm']


# delete multiple items
del my_list[1:5]
print(my_list)
# Output: ['p', 'm']

# delete entire list
del my_list

print(my_list)
# Error: List not defined
```

```
my_list = ['p','r','o','b','l','e','m']
my_list.remove('p')
print(my_list)
# Output: ['r', 'o', 'b', 'l', 'e', 'm']

print(my_list.pop(1))
# Output: 'o'

print(my_list)
# Output: ['r', 'b', 'l', 'e', 'm']

print(my_list.pop())
# Output: 'm'

print(my_list)
# Output: ['r', 'b', 'l', 'e']

my_list.clear()
print(my_list)
# Output: []
```

```
my_list = [3, 8, 1, 6, 0, 8, 4]
print(my_list.index(8))
# Output: 1


print(my_list.count(8))
# Output: 2

my_list.sort()
print(my_list)
# Output: [0, 1, 3, 4, 6, 8, 8]

my_list.reverse()
print(my_list)
# Output: [8, 8, 6, 4, 3, 1, 0]
```

Summary of List Functions

Append()- Add an element into list

extend()- Add all elements of a list to the another list

Insert() - Insert an item at the defined index

Remove()- removes an item from the list

Pop()- removes and returns an element at the given index

Clear()- removes all items from the list

Index()- returns the index of the first matched item

Count()- returns the count of number of items passed as an argument

Built-in List Functions

SN	Function with Description
1	len(list)-Gives the total length of the list.
2	max(list)-Returns item from the list with max value.
3	min(list)-Returns item from the list with min value.
4	list(seq)-Converts a tuple into list.
5	sum(list)-Adds the all the elements in the list (elements should be numerical)

Lists and functions

```
print(len(nums))
print(max(nums))
print(min(nums))
print(sum(nums))
print(sum(nums)/len(nums))#average
```

Note: The sum() function only works when the list elements are numbers

Basic List Operations:

Lists respond to the + and * operators much like strings; .

In fact, lists respond to all of the general sequence operations we used on strings

Python Expression	Results	Description
len([1, 2, 3])	3	Length
[1, 2, 3] + [4, 5, 6]	[1, 2, 3, 4, 5, 6]	Concatenation
['Hi!'] * 4	['Hi!', 'Hi!', 'Hi!', 'Hi!']	Repetition
3 in [1, 2, 3]	True	Membership
for x in [1, 2, 3]: print x,	1 2 3	Iteration

List Comprehension

List comprehension consists of an expression followed by for statement inside square brackets.

```
pow2 = [2 ** x for x in range(10)]

# Output: [1, 2, 4, 8, 16, 32, 64, 128, 256, 512]

print(pow2)
```

This code is equivalent to the following codes

```
pow2 = []
for x in range(10):
    pow2.append(2 ** x)
```

```
pow2 = [2 ** x for x in range(10) if x > 5]
print(pow2)
#output : [64, 128, 256, 512]

odd = [x for x in range(20) if x % 2 == 1]
print(odd)
#output : [1, 3, 5, 7, 9, 11, 13, 15, 17, 19]

my_list = ['p','r','o','b','l','e','m']

print('p' in my_list)
# Output: True

print('a' in my_list)
# Output: False

print('c' not in my_list)
# Output: True
```

What is tuple?

In Python programming, a tuple is similar to a list. The difference between the two is that we cannot change the elements of a tuple once it is assigned whereas in a list, elements can be changed.

A simple ***immutable*** ordered sequence of items

Items can be of mixed types, including collection types

listlist

immutable object is the one which can not be modified

Sequence Types

1. Tuple

   - A simple ***immutable*** ordered sequence of items
   - Items can be of mixed types, including collection types

1. Strings
   - ***Immutable object is the one which can not be modified***
   - **Conceptually very much like a tuple**

2. List

   Mutable object is the one which can be modified

   Mutable ordered sequence of items of mixed types

Similar Syntax

- All three sequence types (tuples, strings, and lists) share much of the same syntax and functionalities.

- Key difference:
  - **Tuples and strings are *immutable***
  - **Lists are *mutable***
- The operations shown in this section can be applied to *all* sequence types
  - **most examples will just show the operation performed on one**

Lists: Mutable

```
>>> li = ['abc', 23, 4.34, 23]
>>> li[1] = 45
>>> li
   ['abc', 45, 4.34, 23]
```

- **We can change lists *in place.***
- **Name li still points to the same memory reference when we're done.**

Tuples: Immutable

```
>>> t = (23, ‘abc’, 4.56, (2,3), ‘def’)
>>> t[2] = 3.14

Traceback (most recent call last):
  File "<pyshell#75>", line 1, in -toplevel-
    tu[2] = 3.14
TypeError: object doesn't support item assignment
```

You can’t change a tuple.

You can make a fresh tuple and assign its reference to a previously used name.

```
>>> t = (23, ‘abc’, 3.14, (2,3), ‘def’)
```

Sequence structures

- **Tuples are defined using parentheses (and commas).**

```
>>> tu = (23, ‘abc’, 4.56, (2,3), ‘def’)
```

- **Lists are defined using square brackets (and commas).**

```
>>> li = [“abc”, 34, 4.34, 23]
```

- **Strings are defined using quotes (“, ‘, or “““).**

```
>>> st = “Hello World”
>>> st = ‘Hello World’
>>> st = “““This is a multi-line
string that uses triple quotes.”””
```

Sequence access

- **We can access individual members of a tuple, list, or string using square bracket “array” notation.**

```
>>> tu = (23, ‘abc’, 4.56, (2,3), ‘def’)
>>> tu[1]     # Second item in the tuple.
 ‘abc’

>>> li = [“abc”, 34, 4.34, 23]
>>> li[1]      # Second item in the list.
 34

>>> st = “Hello World”
>>> st[1]   # Second character in string.
 ‘e’
```

Positive and negative indices

```
>>> t = (23, ‘abc’, 4.56, (2,3), ‘def’)
```

Positive index: count from the left, starting with 0.

```
>>> t[1]
‘abc’
```

Negative lookup: count from right, starting with –1.

```
>>> t[-3]
4.56
```

Slicing Operations

```
>>> t = (23, 'abc', 4.56, (2,3), 'def')
```

Return a copy of the container with a subset of the original members. Start copying at the first index, and stop copying *before* the second index.

```
>>> t[1:4]
('abc', 4.56, (2,3))
```

You can also use negative indices when slicing.

```
>>> t[1:-1]
('abc', 4.56, (2,3))
```

Slicing Operations

```
>>> t = (23, 'abc', 4.56, (2,3), 'def')
```

Omit the first index to make a copy starting from the beginning of the container.

```
>>> t[:2]
(23, 'abc')
```

Omit the second index to make a copy starting at the first index and going to the end of the container.

```
>>> t[2:]
(4.56, (2,3), 'def')
```

The ‘in’ Operator

- Boolean test whether a value is inside a container:

```
>>> t = [1, 2, 4, 5]
>>> 3 in t
False
>>> 4 in t
True
>>> 4 not in t
False
```

- For strings, tests for substrings

```
>>> a = 'abcde'
>>> 'c' in a
True
>>> 'cd' in a
True
>>> 'ac' in a
False
```

- Be careful: the *in* keyword is also used in the syntax of *for loops* and *list comprehensions*.

The + Operator

- The + operator produces a *new* tuple, list, or string whose value is the concatenation of its arguments.

```
>>> (1, 2, 3) + (4, 5, 6)
 (1, 2, 3, 4, 5, 6)

>>> [1, 2, 3] + [4, 5, 6]
 [1, 2, 3, 4, 5, 6]

>>> “Hello” + “ ” + “World”
 ‘Hello World’
```

The * Operator

- **The * operator produces a *new* tuple, list, or string that "repeats" the original content.**

```
>>> (1, 2, 3) * 3
(1, 2, 3, 1, 2, 3, 1, 2, 3)

>>> [1, 2, 3] * 3
[1, 2, 3, 1, 2, 3, 1, 2, 3]

>>> "Hello" * 3
'HelloHelloHello'
```

Concluding Tips

List- mutable (changeable) Tuple – immutable (unchangeable)

list with mixed datatypes my_list = [1, "Hello", 3.4]

List and Tuple starts with 0 index

Extend() - a list is to be included as elements

Append() - to be included as single element

+ is concatenation operator for list,tuple and string.