🐍 Session 4: Lists & Tuples in Python

Welcome to Session 4 of our Python course.
We will learn about lists and tuples, two of Python's most important data structures.
Each section has definitions, examples, errors with fixes, and practice problems.

1. Lists – Definition & Creation

Definition:
A list is a collection in Python which is:
- Ordered
- Mutable (can be changed)
- Allows duplicate values

We use square brackets [] to define lists.

Example (Python code):
```python
my_list = [1, 2, 3, 4]
print(my_list)
```

2. Indexing & Slicing in Lists

Definition:
- Indexing allows you to access elements by their position.
- Slicing allows you to extract a range of elements.
Index starts at 0 in Python.

Example (Python code):
```python
my_list = [1, 2, 3, 4, 5]
print(my_list[0])
print(my_list[-1])
print(my_list[1:4])
```

3. Arithmetic Operations on Lists

Definition:
Lists support arithmetic-like operations such as:
- + → Concatenation (joins lists)
- * → Repetition (repeats list)
- min() / max() → Smallest & largest element
- sum() → Sum of all elements

Example (Python code):
```python
list1 = [1, 2, 3]
list2 = [4, 5, 6]
print(list1 + list2)
print(list1 * 3)
```

```python
print(min(list1))
print(max(list1))
print(sum(list1))
```

4. List Methods

Definition:
Lists have built-in methods that allow adding, removing, sorting, etc.

Example (Python code):
```python
numbers = [5, 2, 9, 1, 7]
numbers.append(10)
numbers.sort()
numbers.reverse()
print(numbers.count(2))
print(numbers.index(7))
```

5. Common Errors in Lists

Common Errors:
1. IndexError – When you try to access an index that doesn't exist.
2. ValueError – When you try to remove a value that isn't in the list.

Example (Python code):
```python
my_list = [1, 2, 3]
try:
    print(my_list[5])
except IndexError:
    print('Index out of range')
try:
    my_list.remove(10)
except ValueError:
    print('Value not found')
```

6. List Comprehensions

Definition:
List comprehensions provide a shorter way to create lists.
Syntax: [expression for item in iterable if condition]

Example (Python code):
```python
[x**2 for x in range(1, 11)]
[x**2 for x in range(1, 11) if x % 2 == 0]
```

7. Tuples – Definition & Creation

Definition:
A tuple is a collection in Python which is:
- Ordered

- Immutable (cannot be changed)
- Allows duplicate values

We use parentheses () to define tuples.

Example (Python code):
```
my_tuple = (10, 20, 30, 20)
print(my_tuple)
print(my_tuple.count(20))
```

8. Arithmetic Operations on Tuples

Definition:
Tuples also support arithmetic-like operations:
- + → Concatenation
- * → Repetition
- min() / max() → Smallest & largest element
- sum() → Sum of elements

Example (Python code):
```
t1 = (1, 2, 3)
t2 = (4, 5, 6)
print(t1 + t2)
print(t1 * 2)
print(min(t1))
print(max(t1))
print(sum(t1))
```

9. Common Errors in Tuples

Error:
Tuples are immutable – you cannot change their elements after creation.

Example (Python code):
```
t = (1, 2, 3)
try:
    t[0] = 100
except TypeError:
    print('Tuples cannot be modified')
```

10. Assignment

Task:
Create a list of numbers.
Use a list comprehension to create a new list containing only the squares of even numbers.

Example solution:
numbers = [1,2,3,4,5,6,7,8,9,10]
[x**2 for x in numbers if x % 2 == 0]

11. Practice Questions

HackerRank:
- Python Lists
- Tuples

LeetCode:
- Two Sum
- Remove Duplicates from Sorted Array

Extra Challenges:
- Find the second largest number in a list
- Reverse a list without using reverse()
- Find the sum of digits in a tuple of numbers