Python List

A **list** in Python is an ordered, mutable (changeable) collection of items. Lists can store **different data types** in a single variable.

1️⃣ Creating a List

```
my_list = [10, 20, 30, 40]
```

Mixed data types:

```
data = [1, "Python", 3.5, True]
```

2️⃣ Accessing List Elements

```
numbers = [10, 20, 30, 40]


print(numbers[0])    # 10
print(numbers[-1])   # 40
```

3️⃣ Modifying a List

```
numbers[1] = 25
print(numbers)   # [10, 25, 30, 40]
```

4️⃣ Common List Operations

Operation	Example
Add element	list.append(50)
Insert element	list.insert(1, 15)
Remove element	list.remove(30)
Remove by index	list.pop(2)
Length	len(list)
Sort	list.sort()
Reverse	list.reverse()

5️⃣ Looping Through a List

```
for item in numbers:
    print(item)
```

Using index:

```
for i in range(len(numbers)):
    print(numbers[i])
```

6️⃣ List Slicing

```
numbers = [10, 20, 30, 40, 50]

print(numbers[1:4])   # [20, 30, 40]
print(numbers[:3])    # [10, 20, 30]
print(numbers[::2])   # [10, 30, 50]
```

7️⃣ List Functions

```
numbers = [4, 2, 9, 1]

print(max(numbers))  # 9
print(min(numbers))  # 1
print(sum(numbers))  # 16
```

8️⃣ List Comprehension

```
squares = [x*x for x in range(1, 6)]
print(squares)
```

9️⃣ Nested List

```
matrix = [[1, 2], [3, 4], [5, 6]]
print(matrix[1][0])  # 3
```

Python Dictionary

A **dictionary** in Python is an **unordered, mutable** collection of data stored in **key–value pairs**.

1️⃣ Creating a Dictionary

```
student = {
   "name": "Amit",
   "roll": 101,
   "marks": 85
}
```

Empty dictionary:

```
d = {}
```

2️⃣ Accessing Values

```
print(student["name"])     # Amit
print(student.get("marks"))  # 85
```

3️⃣ Modifying Dictionary

```
student["marks"] = 90      # update
student["grade"] = "A"     # add new key
```

4️⃣ Removing Elements

```
student.pop("roll")
del student["grade"]
student.clear()   # removes all items
```

5️⃣ Looping Through Dictionary

Keys:

```
for key in student:
    print(key)
```

Values:

```
for value in student.values():
    print(value)
```

Key–Value pairs:

```
for k, v in student.items():
    print(k, v)
```

6️⃣ Dictionary Functions

```
print(len(student))
print(student.keys())
print(student.values())
print(student.items())
```

7️⃣ Checking Key Existence

```
if "name" in student:
    print("Key exists")
```

8️⃣ Dictionary Comprehension

```
squares = {x: x*x for x in range(1, 6)}
print(squares)
```

9️⃣ Nested Dictionary

```
students = {
    1: {"name": "Amit", "marks": 85},
    2: {"name": "Neha", "marks": 92}
}
print(students[2]["name"])   # Neha
```

A **tuple** in Python is an **ordered, immutable** (unchangeable) collection of elements.
Once created, a tuple **cannot be modified**.

1️⃣ Creating a Tuple

```
t = (10, 20, 30)
```

Single element tuple:

```
t = (10,)   # comma is mandatory
```

Mixed data types:

```
data = (1, "Python", 3.5, True)
```

2️⃣ Accessing Tuple Elements

```
t = (10, 20, 30, 40)

print(t[0])    # 10
print(t[-1])   # 40
```

3️⃣ Tuple is Immutable

```
t = (10, 20, 30)
# t[1] = 25   ❌ Error (not allowed)
```

4️⃣ Tuple Operations

```
t1 = (1, 2, 3)
t2 = (4, 5)

print(t1 + t2)   # (1, 2, 3, 4, 5)
print(t1 * 2)    # (1, 2, 3, 1, 2, 3)
```

5️⃣ Looping Through Tuple

```
for item in t:
    print(item)
```

6️⃣ Tuple Functions

```
t = (5, 2, 9, 1)


print(len(t))   # 4
print(max(t))   # 9
print(min(t))   # 1
print(sum(t))   # 17
```

7️⃣ Tuple Slicing

```
t = (10, 20, 30, 40, 50)


print(t[1:4])   # (20, 30, 40)
print(t[:3])    # (10, 20, 30)
```

8️⃣ Tuple Packing & Unpacking

```
t = 10, 20, 30   # packing


a, b, c = t      # unpacking
print(a, b, c)
```

9️⃣ Nested Tuple

```
t = ((1, 2), (3, 4))
print(t[1][0])   # 3
```

Python Set

A **set** in Python is an **unordered, mutable** collection of **unique elements**.
Duplicate values are **automatically removed**.

1️⃣ Creating a Set

```
s = {10, 20, 30, 40}
```

Empty set (⚠️ not {}):

```
s = set()
```

2️⃣ Set Properties

- Unordered (no index)
- Mutable (can change elements)
- No duplicate values
- Written using { }

3️⃣ Adding Elements

```
s.add(50)

s.update([60, 70])
```

4️⃣ Removing Elements

```
s.remove(30)   # Error if element not present

s.discard(40)  # No error

s.pop()        # Removes random element
```

5️⃣ Set Operations

```
A = {1, 2, 3, 4}

B = {3, 4, 5, 6}


print(A | B)  # Union

print(A & B)  # Intersection

print(A - B)  # Difference
print(A ^ B)   # Symmetric Difference
```

6️⃣ Looping Through a Set

```
for item in s:
    print(item)
```

7️⃣ Set Functions

```
print(len(s))
print(max(s))
print(min(s))
print(sum(s))
```

8️⃣ Membership Testing

```
if 20 in s:
    print("Present")
```

9️⃣ Set Comprehension

```
squares = {x*x for x in range(1, 6)}
print(squares)
```

🔟 Frozen Set (Immutable Set)

```
fs = frozenset([1, 2, 3])
```