Data Structures

Python Course · Module 3

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Data Structures — Overview

Python provides multiple built-in structures for organizing data:

- **Lists**
- **Strings**
- **Tuples**
- **Sets**
- **Dictionaries**
- Choosing the right structure

Each structure has unique properties and use-cases.

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Lists

Lists store **ordered, changeable** sequences.

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

# Operations:
numbers.append(40)
numbers[1] = 99
numbers.remove(10)
print(numbers)

# List indexing:
print(numbers[0])
print(numbers[-1])
print(numbers[1:3])
```

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```
[99, 30, 40]
99
40
[30, 40]
```

List Characteristics

Advantages:

- Mutable
- Dynamic size
- Supports duplicates

Use-cases:

- Collections
- Queues
- Storing ordered items

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Strings

Strings represent **text**.

Properties:

- Ordered
- Immutable
- Indexable
- Iterable

```
s = "Hello"

a = s[0]        # first character
b = s[-1]       # last character
c = s.upper()   # all upper chars
d = len(s)      # Length of the string

print(a, b, c, d)
```

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```
H o HELLO 5
```

Tuples

Tuples store **ordered, immutable** sequences.

```
point = (10, 20)
```

Benefits:

- Fast
- Secure from modification
- Memory-efficient

Tuple unpacking:

```
x, y = point
```

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Tuple vs List

- Need modification → **List**
- Need fixed, reliable structure → **Tuple**
- Performance required → **Tuple**

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Sets

Sets store **unordered, unique** elements.

```
colors = {"red", "blue", "green"}
```

Operations:

```
colors.add("yellow")
colors.remove("red")
```

Useful for:

- membership checks
- removing duplicates
- mathematical operations

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Set Operations

```python
a = {1, 2, 3}
b = {3, 4, 5}

x1 = a | b      # union
x2 = a & b      # intersection
x3 = a - b      # difference
x4 = a ^ b      # symmetric difference

print(x1, x2, x3, x4)
```

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```
{1, 2, 3, 4, 5} {3} {1, 2} {1, 2, 4, 5}
```

Dictionaries

Dictionaries store **key : value** pairs.

```python
user = {
    "name": "Alice",
    "age": 25,
    "city": "Baku"
}

# Access:
n = user["name"]
print(n)
print()

# Modify:
user["age"] = 26
user["country"] = "Azerbaijan"
print(user)
```

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```
Alice

{'name': 'Alice', 'age': 26, 'city': 'Baku', 'country':
'Azerbaijan'}
```

Dictionary Operations

```python
user = {
    "name": "Alice",
    "age": 25,
    "city": "Baku"
}

a = user.keys()
b = user.values()
c = user.items()
d = "city" in user  # check key existence
e = "Baku" in user

print(a)
print(b)
print(c)
print(d)
print(e)
```

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```
dict_keys(['name', 'age', 'city'])
dict_values(['Alice', 25, 'Baku'])
dict_items([('name', 'Alice'), ('age', 25), ('city',
'Baku')])
True
False
```

Dictionaries are ideal for structured data.
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Example

```
1 student = {
2     "name": "Elnur",
3     "scores": [90, 85, 97],
4     "passed": True
5 }
6
7 average = sum(student["scores"]) / len(student["scores"])
8
9 print(student["name"], "average:", average)
```

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```
Elnur average: 90.66666666666667
```

Choosing the Right Data Structure

Type	Ordered	Mutable	Unique	Best For
String	Yes	No	N/A	Text
List	Yes	Yes	No	General collections
Tuple	Yes	No	No	Fixed data
Set	No	Yes	Yes	Unique items
Dict	Keys no	Yes	Keys unique	Structured data

Mini Task — Apply Everything

Create a script that:

1. Stores student info in a dictionary
2. Contains: name, age, list of grades
3. Calculates average grade
4. Prints a formatted summary

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