Fundamentos de Programação

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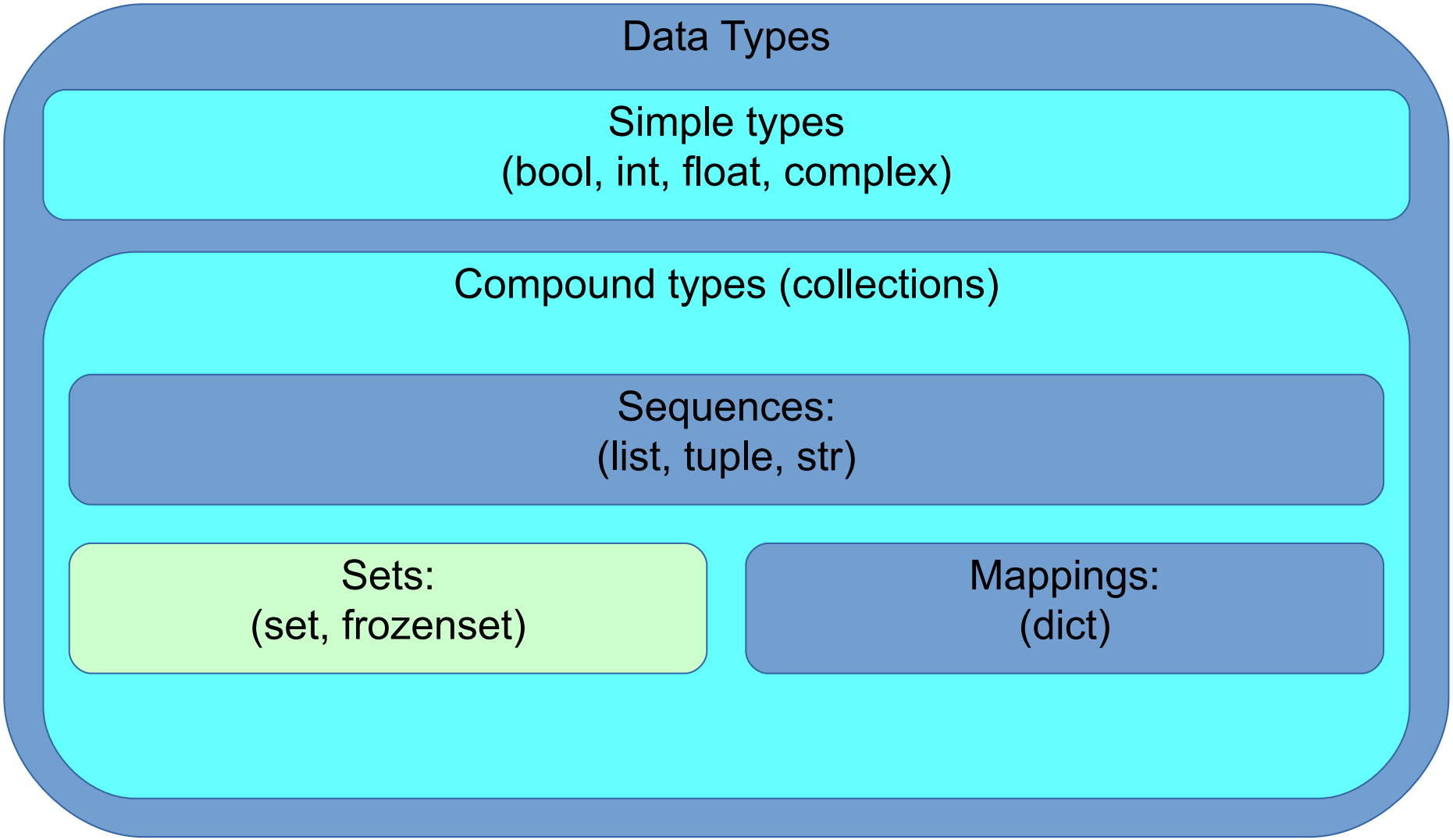
Summary

- Sets

Sets



Official documentation on sets.

Set types

- A **set** is an *unordered collection* of *unique* elements.
  - **Collection** because it may contain zero or more elements.
  - **Unordered** because elements are not in sequence.
  - **Unique** because elements cannot be repeated!
- Sets are a fundamental data type in Math and computing.
- In Python, a set may be created using braces.

Play ▸

```
fruits = {'pear', 'apple', 'banana', 'orange'}
S = { x for x in fruits if x<'c' }   # (by comprehension)
```

- The `set` constructor converts from other types.

```
numbers = set([3, 1, 3])    #-> {1, 3}
```

- The empty set must be created with `set()`, because `{}` creates a dictionary.

```
empty = set()
```

Elements in a set are unique

- An object either is or is not in a set. It cannot be in the set more than once!

```
{1, 2, 1} == {1, 2}      #-> True
len({4, 5, 4, 5, 5})     #-> 2
```

Play ▸

- Like *keys* in a dictionary.
- Unlike sequences.

```
[1, 2, 1] == [1, 2]      #-> False
```

- A common application of sets is for eliminating duplicate elements in sequences.

```
set([1, 2, 2, 2, 1])     #-> {1, 2}
set('banana')            #-> {'a', 'b', 'n'}
```

- This eliminates order, too.

Elements in a set are unordered

- Sets don't recall the position or order of entry of elements.

```
s = {3, 1, 2}
print(s)      # {1, 2, 3}, {2, 3, 1} or ...
s == {2, 3, 1} == {1, 2, 3}  #-> True
```

Play ▸

- So, indexing, slicing, and concatenation are not allowed!

```
s[0]        # TypeError
s[0:2]      # TypeError
s + {4}     # TypeError
```

Elements in a set must be hashable

- A set may contain elements of various types, but only *hashable* types are allowed.
- Just like dictionary *keys*.
- Simple immutable types (like numbers) are OK.
- Strings are OK.
- Tuples are OK, *if their elements are hashable*.

```
{ 23, 'eggs', (1997,10,23) }
```

- Lists, dictionaries, sets and other mutable types are not allowed!

```
{ [1,2] }          # TypeError
{ {1}, {1,2} }     # TypeError
```

- What are hashable types? (Read this description.)

Operations on sets

- Sets have a length and support the membership operator.

```
S = {23, 5, 12}
len(S)      # 3
5 in S      # True (This is a fast operation!)
```

Play ▸

- Sets support union, intersection, and differences.

```
{3,4,5} | {1,2,3}   #-> {1,2,3,4,5} (set.union)
{3,4,5} & {1,2,3}   #-> {3}         (set.intersection)
{3,4,5} - {1,2,3}   #-> {4,5}       (set.difference)
{3,4,5} ^ {1,2,3}   #-> {1,2,4,5}   (set.symmetric_difference)
```

Operations on sets (2)

- Sets may be compared for equality.

```
S = {1,2}
{2,2,1} == S    # True
```

Play ▸

- We may test subset or superset relations.

```
S <= {1,2}      # True = S.issubset({1,2})
S < {1,2,3}     # True
S >= {1,2}      # True = S.issuperset({1,2})
S > {2}         # True
```

- But this is *not a total ordering* relation! You can have two sets A and B such that:

```
A < B, A == B, A > B     # All are False!
```

Sets are mutable

- We can add or remove elements in sets.

```
S = {1,2,3}
S.add(4)          # S -> {1,2,3,4}
S.remove(2)       # S -> {1,3,4}
S.discard(7)      # No error!
```

Play ▸

- We can update the set by union, intersection or differences.

```
S |= {3,5,7}     # S.update({3,5,7})
S &= {1,2,3,4}   # S.intersection_update({1,2,3,4})
S -= {4,5,6}     # S.difference_update({4,5,6})
S ^= {1,2,4}     # S.symmetric_difference_update({1,2,4})
```

- Python also has immutable sets: the `frozenset` type.

```
T = frozenset({1,2,3})
```

How to select the proper data type?

- Choosing the right type to store your data is very important.
- First, consider the different characteristics of the types.

Type	Type identifier	Collection?	Sequence?	Mutable?	Element type
Simple types	`bool, int, float, complex`	No (scalar)	---	No	---
String	`str`	Yes	Yes	No	Character
Tuple	`tuple`	Yes	Yes	No	Any type
List	`list`	Yes	Yes	Yes	Any type
Dictionary	`dict`	Yes	No (unorderable)	Yes	Key: Hashable Value: Any type
Set	`set`	Yes	No (unorderable)	Yes	Hashable
Immutable set	`frozenset`	Yes	No (unorderable)	No	Hashable

Some questions to help deciding

- Are the data simple (scalar) or compound (several elements)?
  - Compound => collection.
- Does element order/position matter?
  - Yes => sequence.
- Will the contents grow, shrink or change?
  - Yes => mutable.
- Need to quickly map a key to a value?
  - Yes => dictionary.