



Fundamentos de Programação

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Summary

- Sets

Python data types

Data Types

Simple types
(bool, int, float, complex)

Compound types (collections)

Sequences:
(list, tuple, str)

Sets:
(set, frozenset)

Mappings:
(dict)



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 may not be repeated!
- Sets are a fundamental data type in Math and computing.
- In Python, a set may be created using braces.

```
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 `{ }` is 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
```

- 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}
```

```
s                                #-> {1, 2, 3}
```

```
s == {2, 3, 1} == {1, 2, 3}    #-> True
```

- So, indexing, slicing, 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 and tuples (*if their elements are hashable*) are OK, too.

```
{ 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!)
```

- Sets support intersection, union, set subtraction.

```
{3, 4, 5} & {1, 2, 3}    #-> {3}
```

```
{3, 4, 5} | {1, 2, 3}    #-> {1, 2, 3, 4, 5}
```

```
{3, 4, 5} - {1, 2, 3}    #-> {4, 5}
```

```
{3, 4, 5} ^ {1, 2, 3}    #-> {1, 2, 4, 5}
```




Operations on sets (2)

- Sets may be compared for equality.

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

- We may test subset or superset relations.

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

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

```
S < {1, 2} # False
```

```
S >= {2} # True = S.issuperset({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}
```

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

```
S |= {3, 5, 7}      # S -> {1, 3, 4, 5, 7}
S.update({3, 5, 7}) # Same thing
S &= {1, 2, 3, 4}    # S -> {1, 3, 4}
S -= {4, 5, 6}       # S -> {1, 3}
S ^= {1, 2, 4}       # S -> {2, 3, 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	<code>bool, int, float, complex</code>	No (scalar)	---	No	---
String	<code>str</code>	Yes	Yes	No	Character
Tuple	<code>tuple</code>	Yes	Yes	No	Any type
List	<code>list</code>	Yes	Yes	Yes	Any type
Dictionary	<code>dict</code>	Yes	No (unorderable)	Yes	Key: Hashable Value: Any type
Set	<code>set</code>	Yes	No (unorderable)	Yes	Hashable
Immutable set	<code>frozenset</code>	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.