

# Collections Module

The collections module is a built-in module that implements specialized container data types providing alternatives to Python's general purpose built-in containers. We've already gone over the basics: dict, list, set, and tuple.

Now we'll learn about the alternatives that the collections module provides.

## Counter

*Counter* is a *dict* subclass which helps count hashable objects. Inside of it elements are stored as dictionary keys and the counts of the objects are stored as the value.

Let's see how it can be used:

In [1]:

```
from collections import Counter
```

### Counter() with lists

In [2]:

```
lst = [1,2,2,2,2,3,3,3,1,2,1,12,3,2,32,1,21,1,223,1]  
Counter(lst)
```

Out[2]:

```
Counter({1: 6, 2: 6, 3: 4, 12: 1, 21: 1, 32: 1, 223: 1})
```

### Counter with strings

In [3]:

```
Counter('aabsbsbsbhshhbbsbs')
```

Out[3]:

```
Counter({'a': 2, 'b': 7, 'h': 3, 's': 6})
```

### Counter with words in a sentence

In [4]:

```
s = 'How many times does each word show up in this sentence word times each
words = s.split()
Counter(words)
```

Out[4]:

```
Counter({'How': 1,
        'does': 1,
        'each': 3,
        'in': 1,
        'many': 1,
        'sentence': 1,
        'show': 1,
        'this': 1,
        'times': 2,
        'up': 1,
        'word': 3})
```

In [5]:

```
# Methods with Counter()
c = Counter(words)
c.most_common(2)
```

Out[5]:

```
[('each', 3), ('word', 3)]
```

## Common patterns when using the Counter() object

<code>sum(c.values())</code>	<code># total of all counts</code>
<code>c.clear()</code>	<code># reset all counts</code>
<code>list(c)</code>	<code># list unique elements</code>
<code>set(c)</code>	<code># convert to a set</code>
<code>dict(c)</code>	<code># convert to a regular dictionary</code>
<code>c.items()</code>	<code># convert to a list of (elem, cnt)</code>
<code>pairs</code>	
<code>Counter(dict(list_of_pairs))</code>	<code># convert from a list of (elem, cnt) pairs</code>
<code>c.most_common()[:n]</code>	<code># n most common elements</code>
<code>c -= Counter()</code>	<code># remove zero and negative counts</code>

## defaultdict

`defaultdict` is a dictionary-like object which provides all methods provided by a dictionary but takes a first argument (`default_factory`) as a default data type for the dictionary. Using `defaultdict` is faster than doing the same using `dict.setdefault` method.

**A defaultdict will never raise a KeyError. Any key that does not exist gets the value returned by the default factory.**

In [6]:

```
from collections import defaultdict
```

In [7]:

```
d = {}
```

In [8]:

```
d['one']
```

```
-----
-----
KeyError                                Traceback (most recent call last)
<ipython-input-8-924453a5f45e> in <module>()
----> 1 d['one']
```

**KeyError: 'one'**

In [9]:

```
d = defaultdict(object)
```

In [10]:

```
d['one']
```

Out[10]:

```
<object at 0x1792df202e0>
```

In [11]:

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

```
one
```

Can also initialize with default values:

In [12]:

```
d = defaultdict(lambda: 0)
```

In [13]:

```
d['one']
```

Out[13]:

```
0
```

# OrderedDict

An OrderedDict is a dictionary subclass that remembers the order in which its contents are added.

For example a normal dictionary:

In [14]:

```
print('Normal dictionary:')

d = {}

d['a'] = 'A'
d['b'] = 'B'
d['c'] = 'C'
d['d'] = 'D'
d['e'] = 'E'

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

Normal dictionary:

```
a A
b B
c C
d D
e E
```

An Ordered Dictionary:

In [15]:

```
from collections import OrderedDict

print('OrderedDict:')

d = OrderedDict()

d['a'] = 'A'
d['b'] = 'B'
d['c'] = 'C'
d['d'] = 'D'
d['e'] = 'E'

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

OrderedDict:

```
a A
b B
c C
d D
e E
```

## Equality with an Ordered Dictionary

A regular dict looks at its contents when testing for equality. An OrderedDict also considers the order the items were added.

A normal Dictionary:

In [16]:

```
print('Dictionaries are equal?')

d1 = {}
d1['a'] = 'A'
d1['b'] = 'B'

d2 = {}
d2['b'] = 'B'
d2['a'] = 'A'

print(d1==d2)
```

Dictionaries are equal?  
True

An Ordered Dictionary:

In [17]:

```
print('Dictionaries are equal?')

d1 = OrderedDict()
d1['a'] = 'A'
d1['b'] = 'B'

d2 = OrderedDict()

d2['b'] = 'B'
d2['a'] = 'A'

print(d1==d2)
```

Dictionaries are equal?  
False

## namedtuple

The standard tuple uses numerical indexes to access its members, for example:

In [18]:

```
t = (12,13,14)
```

In [19]:

```
t[0]
```

Out[19]:

12

For simple use cases, this is usually enough. On the other hand, remembering which index should be used for each value can lead to errors, especially if the tuple has a lot of fields and is constructed far from where it is used. A `namedtuple` assigns names, as well as the numerical index, to each member.

Each kind of `namedtuple` is represented by its own class, created by using the `namedtuple()` factory function. The arguments are the name of the new class and a string containing the names of the elements.

You can basically think of `namedtuples` as a very quick way of creating a new object/class type with some attribute fields. For example:

In [20]:

```
from collections import namedtuple
```

In [21]:

```
Dog = namedtuple('Dog', 'age breed name')  
sam = Dog(age=2, breed='Lab', name='Sammy')  
frank = Dog(age=2, breed='Shepard', name="Frankie")
```

We construct the `namedtuple` by first passing the object type name (`Dog`) and then passing a string with the variety of fields as a string with spaces between the field names. We can then call on the various attributes:

In [22]:

```
sam
```

Out[22]:

```
Dog(age=2, breed='Lab', name='Sammy')
```

In [23]:

```
sam.age
```

Out[23]:

```
2
```

In [24]:

```
sam.breed
```

Out[24]:

```
'Lab'
```

In [25]:

```
sam[0]
```

Out[25]:

2

## Conclusion

Hopefully you now see how incredibly useful the collections module is in Python and it should be your go-to module for a variety of common tasks!