Dictionary All Versions

Examples

Introduction to Dictionary

A dictionary is an example of a *key value store* also known as *Mapping* in Python. It allows you to store and retrieve elements by referencing a key. As dictionaries are referenced by key, they have very fast lookups. As they are primarily used for referencing items by key, they are not sorted.

creating a dict

Dictionaries can be initiated in many ways:

literal syntax

```
d = {}                          # empty dict
d = {'key': 'value'}            # dict with initial values
```

Python 3.x ≥3.5

```
# Also unpacking one or multiple dictionaries with the literal syntax is possible

# makes a shallow copy of otherdict
d = {**otherdict}
# also updates the shallow copy with the contents of the yetanotherdict.
d = {**otherdict, **yetanotherdict}
```

dict comprehension

```
d = {k:v for k,v in [('key', 'value',)]}
```

see also: Comprehensions

built-in class: `dict()`

```
d = dict()                      # emtpy dict
d = dict(key='value')           # explicit keyword arguments
d = dict([('key', 'value')])  # passing in a list of key/value pairs
# make a shallow copy of another dict (only possible if keys are only strings!)
d = dict(**otherdict)
```

modifying a dict

To add items to a dictionary, simply create a new key with a value:

```
d['newkey'] = 42
```

It also possible to add `list` and `dictionary` as value:

```
d['new_list'] = [1, 2, 3]
d['new_dict'] = {'nested_dict': 1}
```

To delete an item, delete the key from the dictionary:

```
del d['newkey']
```

Avoiding KeyError Exceptions

One common pitfall when using dictionaries is to access a non-existent key. This typically results in a `KeyError` exception

```
mydict = {}
mydict['not there']
```

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
KeyError: 'not there'
```

One way to avoid key errors is to use the `dict.get` method, which allows you to specify a default value to return in the case of an absent key.

```
value = mydict.get(key, default_value)
```

Which returns `mydict[key]` if it exists, but otherwise returns `default_value` . Note that this doesn't add `key` to `mydict` . So if you want to retain that key value pair, you should use `mydict.setdefault(key, default_value)` , which *does* store the key value pair.

```
mydict = {}
print(mydict)
# {}
print(mydict.get("foo", "bar"))
# bar
print(mydict)
# {}
print(mydict.setdefault("foo", "bar"))
# bar
print(mydict)
# {'foo': 'bar'}
```

An alternative way to deal with the problem is catching the exception

```
try:
    value = mydict[key]
except KeyError:
    value = default_value
```

You could also check if the key is `in` the dictionary.

```
if key in mydict:
    value = mydict[key]
else:
    value = default_value
```

Do note, however, that in multi-threaded environments it is possible for the key to be removed from the dictionary after you check, creating a race condition where the exception can still be thrown.

Another option is to use a subclass of dict, collections.defaultdict, that has a default_factory to create new entries in the dict when given a new_key.

Iterating Over a Dictionary

If you use a dictionary as an iterator (e.g. in a `for` statement), it traverses the **keys** of the dictionary. For example:

```
d = {'a': 1, 'b': 2, 'c':3}
for key in d:
    print(key, d[key])
# c 3
# b 2
# a 1
```

The same is true when used in a comprehension

```
print([key for key in d])
# ['c', 'b', 'a']
```

Python 3.x ≥3.0

The `items()` method can be used to loop over both the **key** and **value** simultaneously:

```
for key, value in d.items():
    print(key, value)
# c 3
# b 2
# a 1
```

While the `values()` method can be used to iterate over only the values, as would be expected:

```
for key, value in d.values():
    print(key, value)
    # 3
    # 2
    # 1
```

Python 2.x ≥2.2

Here, the methods `keys()` , `values()` and `items()` return lists, and there are the three extra methods `iterkeys()` `itervalues()` and `iteritems()` to return iteraters.

Dictionary with default values

Available in the standard library as defaultdict

```
from collections import defaultdict

d = defaultdict(int)
d['key']                        # 0
d['key'] = 5
d['key']                        # 5

d = defaultdict(lambda: 'empty')
d['key']                        # 'empty'
d['key'] = 'full'
d['key']                        # 'full'
```

[*] Alternatively, if you must use the built-in dict class, using dict.setdefault() will allow you to create a default whenever you access a key that did not exist before:

```
>>> d = {}
{}
>>> d.setdefault('Another_key', []).append("This worked!")
>>> d
{'Another_key': ['This worked!']}
```

Keep in mind that if you have many values to add, dict.setdefault() will create a new instance of the initial value (in this example a []) every time it's called - which may create unnecessary workloads.

[*] *Python Cookbook, 3rd edition, by David Beazley and Brian K. Jones (O'Reilly). Copyright 2013 David Beazley and Brian Jones, 978-1-449-34037-7.*

Merging dictionaries

Consider the following dictionaries:

```
>>> fish = {'name': "Nemo", 'hands': "fins", 'special': "gills"}
>>> dog = {'name': "Clifford", 'hands': "paws", 'color': "red"}
```

Python 3.5+

```
>>> fishdog = {**fish, **dog}
>>> fishdog
{'hands': 'paws', 'color': 'red', 'name': 'Clifford', 'special': 'gills'}
```

As this example demonstrates, duplicate keys map to their lattermost value (for example "Clifford" overrides "Nemo").

Python 3.3+

```
>>> from collections import ChainMap
>>> dict(ChainMap(fish, dog))
{'hands': 'fins', 'color': 'red', 'special': 'gills', 'name': 'Nemo'}
```

With this technique the foremost value takes precedence for a given key rather than the last ("Clifford" is thrown out in favor of "Nemo").

Python 2.x, 3.x

```
>>> from itertools import chain
>>> dict(chain(fish.items(), dog.items()))
{'hands': 'paws', 'color': 'red', 'name': 'Clifford', 'special': 'gills'}
```

This uses the lattermost value, as with the ** -based technique for merging ("Clifford" overrides "Nemo").

```
>>> fish.update(dog)
>>> fish
{'color': 'red', 'hands': 'paws', 'name': 'Clifford', 'special': 'gills'}
```

dict.update uses the latter dict to overwrite the previous one.

Accessing keys and values

When working with dictionaries, it's often necessary to access all the keys and values in the dictionary, either in a `for` loop, a list comprehension, or just as a plain list.

Given a dictionary like:

```
mydict = {
    'a': '1',
    'b': '2'
}
```

You can get a list of keys using the `keys()` method:

```
print(mydict.keys())
# Python2: ['a', 'b']
# Python3: dict_keys(['b', 'a'])
```

If instead you want a list of values, use the `values()` method:

```
print(mydict.values())
# Python2: ['1', '2']
# Python3: dict_values(['2', '1'])
```

If you want to work with both the key and its corresponding value, you can use the `items()` method:

```
print(mydict.items())
# Python2: [('a', '1'), ('b', '2')]
# Python3: dict_items([('b', '2'), ('a', '1')])
```

NOTE: Because a `dict` is unsorted, `keys()` , `values()` , and `items()` have no sort order. Use `sort()` , `sorted()` , or an `OrderedDict` if you care about the order that these methods return.

Python 2/3 Difference: In Python 3, these methods return special iterable objects, not lists, and are the equivalent of the Python 2 `iterkeys()` , `itervalues()` , and `iteritems()` methods. These objects can be used like lists for the most part, though there are some differences. See PEP 3106 for more details.

Accessing values of a dictionary

```
dictionary = {"Hello": 1234, "World": 5678}
print(dictionary["Hello"])
```

The above code will print `1234` .

The string `"Hello"` in this example is called a *key* . It is used to lookup a value in the `dict` by placing the key in square brackets.

The number `1234` is seen after the respective colon in the `dict` definition. This is called the *value* that `"Hello"` *maps to* in this `dict` .

Looking up a value like this with a key that does not exist will raise a `KeyError` exception, halting execution if uncaught. If we want to access a value without risking a `KeyError` , we can use the `dictionary.get` method. By default if the key does not exist, the method will return `None` . We can pass it a second value to return instead of `None` in the event of a failed lookup.

```
w = dictionary.get("whatever")
x = dictionary.get("whatever", "nuh-uh")
```

In this example `w` will get the value `None` and `x` will get the value `"nuh-uh"` .

Creating an ordered dictionary

You can create an ordered dictionary which will follow a determined order when iterating over the keys in the dictionary.

Use `OrderedDict` from the `collections` module. This will always return the dictionary elements in the original insertion order when iterated over.

```
from collections import OrderedDict

d = OrderedDict()
d['first'] = 1
d['second'] = 2
d['third'] = 3
d['last'] = 4
```

```
# Outputs "first 1", "second 2", "third 3", "last 4"
for key in d:
    print(key, d[key])
```

Creating a dictionary

Rules for creating a dictionary:

- Every key must be **unique** (otherwise it will be overridden)
- Every key must be **hashable** (can use the `hash` function to hash it; otherwise `TypeError` will be thrown)
- There is no particular order for the keys.

```
# Creating and populating it with values
stock = {'eggs': 5, 'milk': 2}

# Or creating an empty dictionary
dictionary = {}

# And populating it after
dictionary['eggs'] = 5
dictionary['milk'] = 2

# Values can also be lists
mydict = {'a': [1, 2, 3], 'b': ['one', 'two', 'three']}

# Use list.append() method to add new elements to the values list
mydict['a'].append(4)   # => {'a': [1, 2, 3, 4], 'b': ['one', 'two', 'three']}
mydict['b'].append('four')  # => {'a': [1, 2, 3, 4], 'b': ['one', 'two', 'three', 'four']}

# We can also create a dictionary using a list of two-items tuples
iterable = [('eggs', 5), ('milk', 2)]
dictionary = dict(iterables)

# Or using keyword argument:
dictionary = dict(eggs=5, milk=2)

# Another way will be to use the dict.fromkeys:
dictionary = dict.fromkeys((milk, eggs))  # => {'milk': None, 'eggs': None}
dictionary = dict.fromkeys((milk, eggs), (2, 5))  # => {'milk': 2, 'eggs': 5}
```

Unpacking dictionaries using the ** operator

You can use the `**` keyword argument unpacking operator to deliver the key-value pairs in a dictionary into a function's arguments. A simplified example from the official documentation :

```
>>>
>>> def parrot(voltage, state, action):
...     print("This parrot wouldn't", action, end=' ')
...     print("if you put", voltage, "volts through it.", end=' ')
...     print("E's", state, "!")
...
>>> d = {"voltage": "four million", "state": "bleedin' demised", "action": "VOOM"}
>>> parrot(**d)

This parrot wouldn't VOOM if you put four million volts through it. E's bleedin' demised !
```

As of Python 3.5 you can also use this syntax to merge an arbitrary number of `dict` objects.

```
>>> fish = {'name': "Nemo", 'hands': "fins", 'special': "gills"}
>>> dog = {'name': "Clifford", 'hands': "paws", 'color': "red"}
>>> fishdog = {**fish, **dog}
>>> fishdog

{'hands': 'paws', 'color': 'red', 'name': 'Clifford', 'special': 'gills'}
```

As this example demonstrates, duplicate keys map to their lattermost value (for example "Clifford" overrides "Nemo").

All combinations of dictionary values

```
options = {
    "x": ["a", "b"],
    "y": [10, 20, 30]
}
```

Given a dictionary such as the one shown above, where there is a list representing a set of values to explore for the corresponding key. Suppose you want to explore "x"="a" with "y"=10 , then "x"="a" with "y"=10 , and so on until you have explored all possible combinations.

You can create a list that returns all such combinations of values using the following code.

```
import itertools

options = {
    "x": ["a", "b"],
    "y": [10, 20, 30]}

keys = options.keys()
values = (options[key] for key in keys)
combinations = [dict(zip(keys, combination)) for combination in itertools.product(*values)]
print combinations
```

This gives us the following list stored in the variable combinations :

```
[{'x': 'a', 'y': 10},
 {'x': 'b', 'y': 10},
 {'x': 'a', 'y': 20},
 {'x': 'b', 'y': 20},
 {'x': 'a', 'y': 30},
 {'x': 'b', 'y': 30}]
```

Dictionaries Example

Dictionaries map keys to values.

```
car = {}
car["wheels"] = 4
car["color"] = "Red"
car["model"] = "Corvette"
```

Dictionary values can be accessed by their keys.

```
print "Little " + car["color"] + " " + car["model"] + "!"
# This would print out "Little Red Corvette!"
```

Dictionaries can also be created in a JSON style:

```
car = {"wheels": 4, "color": "Red", "model": "Corvette"}
```

Dictionary values can be iterated over:

```
for key in car:
  print key + ": " + car[key]

# wheels: 4
# color: Red
# model: Corvette
```

The dict() constructor

The dict() constructor can be used to create dictionaries from keyword arguments, or from a single iterable of key-value pairs, or from a single dictionary and keyword arguments.

```
dict(a=1, b=2, c=3)                  # {'a': 1, 'b': 2, 'c': 3}
dict([('d', 4), ('e', 5), ('f', 6)]) # {'d': 4, 'e': 5, 'f': 6}
dict([('a', 1)], b=2, c=3)           # {'a': 1, 'b': 2, 'c': 3}
dict({'a' : 1, 'b' : 2}, c=3)        # {'a': 1, 'b': 2, 'c': 3}
```

The trailing comma

Like lists and tuples, you can include a trailing comma in your dictionary.

```
role = {"By day": "A typical programmer",
        "By night": "Still a typical programmer", }
```

PEP 8 dictates that you should leave a space between the trailing comma and the closing brace.

Syntax

```
mydict = {}
mydict[k] = value
value = mydict[k]
value = mydict.get(k)
value = mydict.get(k, "default_value")
```

Parameters

Parameter	Details
key	The desired key to lookup
value	The value to set or return

Remarks

Helpful items to remember when creating a dictionary:

- Every key must be **unique** (otherwise it will be overridden)
- Every key must be **hashable** (can use the `hash` function to hash it; otherwise `TypeError` will be thrown)
- There is no particular order for the keys.