

# Itertools

[itertools](#) is a built-in Python library that creates iterators for efficient looping. This section will show you some useful methods of itertools.

## *itertools.combinations: A Better Way to Iterate Through a Pair of Values in a Python List*

If you want to iterate through a pair of values in a list and the order does not matter ((a,b) is the same as (b, a)), a naive approach is to use two for-loops.

```
num_list = [1, 2, 3]
```

```
for i in num_list:
    for j in num_list:
        if i < j:
            print((i, j))
```

```
(1, 2)
(1, 3)
(2, 3)
```

However, using two for-loops is lengthy and inefficient. Use `itertools.combinations` instead:

```
from itertools import combinations

comb = combinations(num_list, 2) # use this
for pair in list(comb):
    print(pair)
```

(1, 2)

(1, 3)

(2, 3)

## *itertools.product: Nested For-Loops in a Generator Expression*

Are you using nested for-loops to experiment with different combinations of parameters? If so, use `itertools.product` instead.

`itertools.product` is more efficient than nested loop because `product(A, B)` returns the same as `((x,y) for x in A for y in B)`.

```
from itertools import product

params = {
    "learning_rate": [1e-1, 1e-2, 1e-3],
    "batch_size": [16, 32, 64],
}

for vals in product(*params.values()):
    combination = dict(zip(params.keys(), vals))
    print(combination)
```

```
{'learning_rate': 0.1, 'batch_size': 16}
{'learning_rate': 0.1, 'batch_size': 32}
{'learning_rate': 0.1, 'batch_size': 64}
{'learning_rate': 0.01, 'batch_size': 16}
{'learning_rate': 0.01, 'batch_size': 32}
{'learning_rate': 0.01, 'batch_size': 64}
{'learning_rate': 0.001, 'batch_size': 16}
{'learning_rate': 0.001, 'batch_size': 32}
{'learning_rate': 0.001, 'batch_size': 64}
```

## *itertools.starmap: Apply a Function With More Than 2 Arguments to Elements in a List*

`map` is a useful method that allows you to apply a function to elements in a list. However, it can't apply a function with more than one argument to a list.

```
def multiply(x: float, y: float):  
    return x * y
```

```
nums = [(1, 2), (4, 2), (2, 5)]  
list(map(multiply, nums))
```

```
-----  
-----
```

```
TypeError                                Traceback (most  
recent call last)
```

```
/tmp/ipykernel_38110/240000324.py in <module>  
      1 nums = [(1, 2), (4, 2), (2, 5)]  
----> 2 list(map(multiply, nums))
```

```
TypeError: multiply() missing 1 required positional argument:  
'y'
```

To apply a function with more than 2 arguments to elements in a list, use `itertools.starmap`. With `starmap`, elements in each tuple of the list `nums` are used as arguments for the function `multiply`.

```
from itertools import starmap
```

```
list(starmap(multiply, nums))
```

```
[2, 8, 10]
```

## *itertools.compress: Filter a List Using Booleans*

Normally, you cannot filter a list using a list.

```
fruits = ['apple', 'orange', 'banana', 'grape', 'lemon']
chosen = [1, 0, 0, 1, 1]
fruits[chosen]
```

```
-----
-----

TypeError                                Traceback (most
recent call last)
```

```
/tmp/ipykernel_40588/2755098589.py in <module>
      1 fruits = ['apple', 'orange', 'banana', 'grape',
'lemon']
      2 chosen = [1, 0, 0, 1, 1]
----> 3 fruits[chosen]
```

```
TypeError: list indices must be integers or slices, not list
```

To filter a list using a list of booleans, use `itertools.compress` instead

```
from itertools import compress

list(compress(fruits, chosen))
```

```
['apple', 'grape', 'lemon']
```

## *itertools.groupby: Group Elements in an Iterable by a Key*

If you want to group elements in a list by a key, use `itertools.groupby`. In the example below, I grouped elements in the list by the first element in each tuple.

```
from itertools import groupby

prices = [('apple', 3), ('orange', 2), ('apple', 4),
          ('orange', 1), ('grape', 3)]

key_func = lambda x: x[0]

# Sort the elements in the list by the key
prices.sort(key=key_func)

# Group elements in the list by the key
for key, group in groupby(prices, key_func):
    print(key, ': ', list(group))
```

```
apple : [('apple', 3), ('apple', 4)]
grape  : [('grape', 3)]
orange : [('orange', 2), ('orange', 1)]
```

## *itertools.zip\_longest: Zip Iterables of Different Lengths*

`zip` allows you to aggregate elements from each of the iterables. However, `zip` doesn't show all pairs of elements when iterables have different lengths.

```
>>> fruits = ['apple', 'orange', 'grape']  
>>> prices = [1, 2]
```

```
>>> list(zip(fruits, prices))
```

```
[('apple', 1), ('orange', 2)]
```

To aggregate iterables of different lengths, use `itertools.zip_longest`. This method will fill missing values with `fillvalue`.

```
>>> from itertools import zip_longest
```

```
>>> list(zip_longest(fruits, prices, fillvalue='-'))
```

```
[('apple', 1), ('orange', 2), ('grape', '-')]
```