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# UBelt Documentation

*Release 1.2.1*

**Jon Crall**

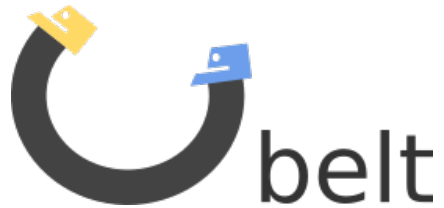
**Aug 06, 2022**



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UBelt is a “utility belt” of commonly needed utility and helper functions. It is a curated collection of top-level utilities with functionality that falls into a mixture of categories.

The source code is available at <https://github.com/Erotemic/ubelt>. We also have [Jupyter notebook demos](#).

The ubelt API is organized by submodules containing related functionality. Each submodule contains top level overview documentation, and each function contains a docstring with at least one example.

NOTE: The [README](#) on github contains information and examples complementary to these docs.



## THE API BY USEFULNESS

Perhaps the most useful way to learn this API is to sort by “usefulness”. I measure usefulness as the number of times I’ve used a particular function in my own code (excluding `ubelt` itself).

Function name	Usefulness
<code>ubelt.repr2</code>	2384
<code>ubelt.Path</code>	624
<code>ubelt.ProgIter</code>	539
<code>ubelt.expandpath</code>	419
<code>ubelt.paragraph</code>	358
<code>ubelt.take</code>	342
<code>ubelt.cmd</code>	283
<code>ubelt.codeblock</code>	273
<code>ubelt.ensuredir</code>	252
<code>ubelt.map_vals</code>	248
<code>ubelt.odict</code>	234
<code>ubelt.ddict</code>	225
<code>ubelt.flatten</code>	218
<code>ubelt.peek</code>	202
<code>ubelt.ensure_app_cache_dir</code>	201
<code>ubelt.NiceRepr</code>	195
<code>ubelt.group_items</code>	192
<code>ubelt.oiset</code>	182
<code>ubelt.dzip</code>	169
<code>ubelt.iterable</code>	159
<code>ubelt.dict_isect</code>	157
<code>ubelt.NoParam</code>	154
<code>ubelt.hash_data</code>	141
<code>ubelt.argflag</code>	136
<code>ubelt.dict_diff</code>	129
<code>ubelt.Timer</code>	125
<code>ubelt.augpath</code>	120
<code>ubelt.dict_hist</code>	115
<code>ubelt.grabdata</code>	114
<code>ubelt.color_text</code>	104
<code>ubelt.identity</code>	102
<code>ubelt.delete</code>	99
<code>ubelt.argval</code>	93
<code>ubelt.dict_union</code>	90

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Function name	Usefulness
<code>ubelt.memoize</code>	89
<code>ubelt.compress</code>	87
<code>ubelt.allsame</code>	81
<code>ubelt.unique</code>	64
<code>ubelt.named_product</code>	61
<code>ubelt.hzcat</code>	61
<code>ubelt.invert_dict</code>	61
<code>ubelt.JobPool</code>	60
<code>ubelt.timestamp</code>	48
<code>ubelt.dict_subset</code>	46
<code>ubelt.Cacher</code>	44
<code>ubelt.indent</code>	44
<code>ubelt.argsort</code>	43
<code>ubelt.IndexableWalker</code>	41
<code>ubelt.writeto</code>	41
<code>ubelt.iter_window</code>	40
<code>ubelt.chunks</code>	39
<code>ubelt.hash_file</code>	38
<code>ubelt.find_duplicates</code>	38
<code>ubelt.map_keys</code>	36
<code>ubelt.symlink</code>	34
<code>ubelt.sorted_vals</code>	33
<code>ubelt.ensure_unicode</code>	32
<code>ubelt.find_exe</code>	32
<code>ubelt.memoize_property</code>	31
<code>ubelt.modname_to_modpath</code>	29
<code>ubelt.WIN32</code>	28
<code>ubelt.CacheStamp</code>	27
<code>ubelt.import_module_from_name</code>	25
<code>ubelt.argmax</code>	23
<code>ubelt.highlight_code</code>	23
<code>ubelt.varied_values</code>	22
<code>ubelt.readfrom</code>	22
<code>ubelt.import_module_from_path</code>	21
<code>ubelt.compatible</code>	20
<code>ubelt.memoize_method</code>	20
<code>ubelt.sorted_keys</code>	20
<code>ubelt.Executor</code>	19
<code>ubelt.touch</code>	17
<code>ubelt.get_app_cache_dir</code>	14
<code>ubelt.AutoDict</code>	13
<code>ubelt.inject_method</code>	13
<code>ubelt.zopen</code>	11
<code>ubelt.shrinkuser</code>	11
<code>ubelt.userhome</code>	8
<code>ubelt.schedule_deprecation</code>	8
<code>ubelt.LINUX</code>	8
<code>ubelt.split_modpath</code>	7
<code>ubelt.modpath_to_modname</code>	7

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Table 1 – continued from previous page

Function name	Usefulness
<code>ubelt.CaptureStdout</code>	5
<code>ubelt.DARWIN</code>	5
<code>ubelt.argmax</code>	4
<code>ubelt.download</code>	3
<code>ubelt.find_path</code>	2
<code>ubelt.AutoOrderedDict</code>	2
<code>ubelt.argunique</code>	1
<code>ubelt.unique_flags</code>	1
<code>ubelt.udict</code>	0
<code>ubelt.timeparse</code>	0
<code>ubelt.split_archive</code>	0
<code>ubelt.sorted_values</code>	0
<code>ubelt.sdict</code>	0
<code>ubelt.platform_data_dir</code>	0
<code>ubelt.platform_config_dir</code>	0
<code>ubelt.platform_cache_dir</code>	0
<code>ubelt.map_values</code>	0
<code>ubelt.indexable_allclose</code>	0
<code>ubelt.get_app_data_dir</code>	0
<code>ubelt.get_app_config_dir</code>	0
<code>ubelt.ensure_app_data_dir</code>	0
<code>ubelt.ensure_app_config_dir</code>	0
<code>ubelt.boolmask</code>	0
<code>ubelt.UDict</code>	0
<code>ubelt.TempDir</code>	0
<code>ubelt.TeeStringIO</code>	0
<code>ubelt.SetDict</code>	0
<code>ubelt.POSIX</code>	0
<code>ubelt.OrderedSet</code>	0
<code>ubelt.NO_COLOR</code>	0
<code>ubelt.FormatterExtensions</code>	0
<code>ubelt.DownloadManager</code>	0
<code>ubelt.CaptureStream</code>	0

```
usage stats = {
    'mean': 95.18104,
    'std': 240.17876,
    'min': 0.0,
    'max': 2384.0,
    'q_0.25': 2.75,
    'q_0.50': 31.5,
    'q_0.75': 106.5,
    'med': 31.5,
    'sum': 11041,
    'shape': (116,),
}
```

## 1.1 ubelt.orderedset

`<ubelt.OrderedSet>` `<ubelt.oaset>`

## 1.2 ubelt.progiter

`<ubelt.ProgIter>`

## 1.3 ubelt.util\_arg

`<ubelt.argval>` `<ubelt.argflag>`

## 1.4 ubelt.util\_cache

`<ubelt.Cacher>` `<ubelt.CacheStamp>`

## 1.5 ubelt.util\_cmd

`<ubelt.cmd>`

## 1.6 ubelt.util\_colors

`<ubelt.NO_COLOR>` `<ubelt.highlight_code>` `<ubelt.color_text>`

## 1.7 ubelt.util\_const

`<ubelt.NoParam>`

## 1.8 ubelt.util\_deprecate

`<ubelt.schedule_deprecation>`

## 1.9 ubelt.util\_dict

`<ubelt.AutoDict>` `<ubelt.AutoOrderedDict>` `<ubelt.dzip>` `<ubelt.ddict>` `<ubelt.dict_hist>`  
`<ubelt.dict_subset>` `<ubelt.dict_union>` `<ubelt.dict_isect>` `<ubelt.dict_diff>` `<ubelt.find_duplicates>`  
`<ubelt.group_items>` `<ubelt.invert_dict>` `<ubelt.map_keys>` `<ubelt.map_vals>`  
`<ubelt.map_values>` `<ubelt.sorted_keys>` `<ubelt.sorted_vals>` `<ubelt.sorted_values>` `<ubelt.odict>`  
`<ubelt.named_product>` `<ubelt.varied_values>` `<ubelt.SetDict>` `<ubelt.UDict>` `<ubelt.sdict>` `<ubelt.udict>`

## 1.10 ubelt.util\_download

`<ubelt.download>` `<ubelt.grabdata>`

## 1.11 ubelt.util\_download\_manager

`<ubelt.DownloadManager>`

## 1.12 ubelt.util\_format

`<ubelt.repr2>` `<ubelt.FormatterExtensions>`

## 1.13 ubelt.util\_func

`<ubelt.identity>` `<ubelt.inject_method>` `<ubelt.compatible>`

## 1.14 ubelt.util\_futures

`<ubelt.Executor>` `<ubelt.JobPool>`

## 1.15 ubelt.util\_hash

`<ubelt.hash_data>` `<ubelt.hash_file>`

## 1.16 ubelt.util\_import

`<ubelt.split_modpath>` `<ubelt.modname_to_modpath>` `<ubelt.modpath_to_modname>` `<ubelt.import_module_from_name>`  
`<ubelt.import_module_from_path>`

## 1.17 ubelt.util\_indexable

`<ubelt.IndexableWalker>` `<ubelt.indexable_allclose>`

## 1.18 ubelt.util\_io

`<ubelt.readfrom>` `<ubelt.writeto>` `<ubelt.touch>` `<ubelt.delete>`

## 1.19 ubelt.util\_links

`<ubelt.symlink>`

## 1.20 ubelt.util\_list

`<ubelt.allsame>` `<ubelt.argmax>` `<ubelt.argmin>` `<ubelt.argsort>` `<ubelt.argunique>` `<ubelt.boolmask>` `<ubelt.chunks>` `<ubelt.compress>` `<ubelt.flatten>` `<ubelt.iter_window>` `<ubelt.iterable>` `<ubelt.peek>` `<ubelt.take>` `<ubelt.unique>` `<ubelt.unique_flags>`

## 1.21 ubelt.util\_memoize

`<ubelt.memoize>` `<ubelt.memoize_method>` `<ubelt.memoize_property>`

## 1.22 ubelt.util\_mixins

`<ubelt.NiceRepr>`

## 1.23 ubelt.util\_path

`<ubelt.Path>` `<ubelt.TempDir>` `<ubelt.augpath>` `<ubelt.shrinkuser>` `<ubelt.userhome>` `<ubelt.ensuredir>` `<ubelt.expandpath>`

## 1.24 ubelt.util\_platform

`<ubelt.WIN32>` `<ubelt.LINUX>` `<ubelt.DARWIN>` `<ubelt.POSIX>` `<ubelt.find_exe>` `<ubelt.find_path>` `<ubelt.ensure_app_cache_dir>` `<ubelt.ensure_app_config_dir>` `<ubelt.ensure_app_data_dir>` `<ubelt.get_app_cache_dir>` `<ubelt.get_app_config_dir>` `<ubelt.get_app_data_dir>` `<ubelt.platform_cache_dir>` `<ubelt.platform_config_dir>` `<ubelt.platform_data_dir>`

## 1.25 ubelt.util\_str

<ubelt.indent> <ubelt.codeblock> <ubelt.paragraph> <ubelt.hzcat> <ubelt.ensure\_unicode>

## 1.26 ubelt.util\_stream

<ubelt.TeeStringIO> <ubelt.CaptureStdout> <ubelt.CaptureStream>

## 1.27 ubelt.util\_time

<ubelt.timestamp> <ubelt.timeparse> <ubelt.Timer>

## 1.28 ubelt.util\_zip

<ubelt.zopen> <ubelt.split\_archive>

### 1.28.1 ubelt package

#### 1.28.1.1 Submodules

##### 1.28.1.1.1 ubelt.orderedset module

This module exposes the *OrderedSet* class, which is a collection of unique items that maintains the order in which the items were added. An *OrderedSet* (or its alias *oset*) behaves very similarly to Python's builtin *set* object, the main difference being that an *OrderedSet* can efficiently lookup its items by index.

#### Example

```
>>> import ubelt as ub
>>> ub.oset([1, 2, 3])
OrderedSet([1, 2, 3])
>>> (ub.oset([1, 2, 3]) - {2}) | {2}
OrderedSet([1, 3, 2])
>>> [ub.oset([1, 2, 3])[i] for i in [1, 0, 2]]
[2, 1, 3]
```

As of version (0.8.5), *ubelt* contains its own internal copy of *OrderedSet* in order to reduce external dependencies. The original standalone implementation lives in <https://github.com/LuminosoInsight/ordered-set>.

The original documentation is as follows:

An *OrderedSet* is a custom *MutableSet* that remembers its order, so that every entry has an index that can be looked up.

Based on a recipe originally posted to ActiveState Recipes by Raymond Hettiger, and released under the MIT license.

**class** `ubelt.orderedset.OrderedSet`(*iterable=None*)

Bases: `MutableSet`, `Sequence`

An `OrderedSet` is a custom `MutableSet` that remembers its order, so that every entry has an index that can be looked up.

### Example

```
>>> OrderedSet([1, 1, 2, 3, 2])
OrderedSet([1, 2, 3])
```

**copy()**

Return a shallow copy of this object.

### Example

```
>>> this = OrderedSet([1, 2, 3])
>>> other = this.copy()
>>> this == other
True
>>> this is other
False
```

**add**(*key*)

Add *key* as an item to this `OrderedSet`, then return its index.

If *key* is already in the `OrderedSet`, return the index it already had.

### Example

```
>>> oset = OrderedSet()
>>> oset.append(3)
0
>>> print(oset)
OrderedSet([3])
```

**append**(*key*)

Add *key* as an item to this `OrderedSet`, then return its index.

If *key* is already in the `OrderedSet`, return the index it already had.

### Example

```
>>> oset = OrderedSet()
>>> oset.append(3)
0
>>> print(oset)
OrderedSet([3])
```

**update**(*sequence*)

Update the set with the given iterable sequence, then return the index of the last element inserted.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.update([3, 1, 5, 1, 4])
4
>>> print(oset)
OrderedSet([1, 2, 3, 5, 4])
```

#### **index**(key)

Get the index of a given entry, raising an `IndexError` if it's not present.

*key* can be an iterable of entries that is not a string, in which case this returns a list of indices.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.index(2)
1
```

#### **get\_loc**(key)

Get the index of a given entry, raising an `IndexError` if it's not present.

*key* can be an iterable of entries that is not a string, in which case this returns a list of indices.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.index(2)
1
```

#### **get\_indexer**(key)

Get the index of a given entry, raising an `IndexError` if it's not present.

*key* can be an iterable of entries that is not a string, in which case this returns a list of indices.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.index(2)
1
```

#### **pop**()

Remove and return the last element from the set.

Raises `KeyError` if the set is empty.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.pop()
3
```

### `discard(key)`

Remove an element. Do not raise an exception if absent.

The MutableSet mixin uses this to implement the `.remove()` method, which *does* raise an error when asked to remove a non-existent item.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.discard(2)
>>> print(oset)
OrderedSet([1, 3])
>>> oset.discard(2)
>>> print(oset)
OrderedSet([1, 3])
```

### `clear()`

Remove all items from this OrderedSet.

### `union(*sets)`

Combines all unique items. Each items order is defined by its first appearance.

### Example

```
>>> oset = OrderedSet.union(OrderedSet([3, 1, 4, 1, 5]), [1, 3], [2, 0])
>>> print(oset)
OrderedSet([3, 1, 4, 5, 2, 0])
>>> oset.union([8, 9])
OrderedSet([3, 1, 4, 5, 2, 0, 8, 9])
>>> oset | {10}
OrderedSet([3, 1, 4, 5, 2, 0, 10])
```

### `intersection(*sets)`

Returns elements in common between all sets. Order is defined only by the first set.

### Example

```
>>> from ubelt.orderedset import * # NOQA
>>> oset = OrderedSet.intersection(OrderedSet([0, 1, 2, 3]), [1, 2, 3])
>>> print(oset)
OrderedSet([1, 2, 3])
>>> oset.intersection([2, 4, 5], [1, 2, 3, 4])
OrderedSet([2])
>>> oset.intersection()
OrderedSet([1, 2, 3])
```



**difference(\*sets)**

Returns all elements that are in this set but not the others.

**Example**

```
>>> OrderedSet([1, 2, 3]).difference(OrderedSet([2]))
OrderedSet([1, 3])
>>> OrderedSet([1, 2, 3]).difference(OrderedSet([2]), OrderedSet([3]))
OrderedSet([1])
>>> OrderedSet([1, 2, 3]) - OrderedSet([2])
OrderedSet([1, 3])
>>> OrderedSet([1, 2, 3]).difference()
OrderedSet([1, 2, 3])
```

**issubset(other)**

Report whether another set contains this set.

**Example**

```
>>> OrderedSet([1, 2, 3]).issubset({1, 2})
False
>>> OrderedSet([1, 2, 3]).issubset({1, 2, 3, 4})
True
>>> OrderedSet([1, 2, 3]).issubset({1, 4, 3, 5})
False
```

**issuperset(other)**

Report whether this set contains another set.

**Example**

```
>>> OrderedSet([1, 2]).issuperset([1, 2, 3])
False
>>> OrderedSet([1, 2, 3, 4]).issuperset({1, 2, 3})
True
>>> OrderedSet([1, 4, 3, 5]).issuperset({1, 2, 3})
False
```

**symmetric\_difference(other)**

Return the symmetric difference of two OrderedSets as a new set. That is, the new set will contain all elements that are in exactly one of the sets.

Their order will be preserved, with elements from *self* preceding elements from *other*.

### Example

```
>>> this = OrderedSet([1, 4, 3, 5, 7])
>>> other = OrderedSet([9, 7, 1, 3, 2])
>>> this.symmetric_difference(other)
OrderedSet([4, 5, 9, 2])
```

### **difference\_update**(\*sets)

Update this OrderedSet to remove items from one or more other sets.

### Example

```
>>> this = OrderedSet([1, 2, 3])
>>> this.difference_update(OrderedSet([2, 4]))
>>> print(this)
OrderedSet([1, 3])
```

```
>>> this = OrderedSet([1, 2, 3, 4, 5])
>>> this.difference_update(OrderedSet([2, 4]), OrderedSet([1, 4, 6]))
>>> print(this)
OrderedSet([3, 5])
```

### **intersection\_update**(other)

Update this OrderedSet to keep only items in another set, preserving their order in this set.

### Example

```
>>> this = OrderedSet([1, 4, 3, 5, 7])
>>> other = OrderedSet([9, 7, 1, 3, 2])
>>> this.intersection_update(other)
>>> print(this)
OrderedSet([1, 3, 7])
```

### **symmetric\_difference\_update**(other)

Update this OrderedSet to remove items from another set, then add items from the other set that were not present in this set.

### Example

```
>>> this = OrderedSet([1, 4, 3, 5, 7])
>>> other = OrderedSet([9, 7, 1, 3, 2])
>>> this.symmetric_difference_update(other)
>>> print(this)
OrderedSet([4, 5, 9, 2])
```

`ubelt.orderedset.aset`

alias of *OrderedSet*

### 1.28.1.1.2 ubelt.progiter module

A Progress Iterator

ProgIter lets you measure and print the progress of an iterative process. This can be done either via an iterable interface or using the manual API. Using the iterable interface is most common.

ProgIter was originally developed independently of tqdm, but the newer versions of this library have been designed to be compatible with tqdm-API. *ProgIter* is now a (mostly) drop-in alternative to `tqdm.tqdm()`. The `tqdm` library may be more appropriate in some cases. *The main advantage of `:class: 'ProgIter'` is that it does not use any python threading*, and therefore can be safer with code that makes heavy use of multiprocessing. *The reason* for this is that threading before forking may cause locks to be duplicated across processes, which may lead to deadlocks.

ProgIter is simpler than tqdm, which may be desirable for some applications. However, this also means ProgIter is not as extensible as tqdm. If you want a pretty bar or need something fancy, use tqdm; if you want useful information about your iteration by default, use progiter.

The basic usage of ProgIter is simple and intuitive. Just wrap a python iterable. The following example wraps a `range` iterable and prints reported progress to stdout as the iterable is consumed.

#### Example

```
>>> for n in ProgIter(range(1000)):
>>>     # do some work
>>>     pass
```

Note that by default ProgIter reports information about iteration-rate, fraction-complete, estimated time remaining, time taken so far, and the current wall time.

#### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> def is_prime(n):
...     return n >= 2 and not any(n % i == 0 for i in range(2, n))
>>> for n in ProgIter(range(1000), verbose=1):
>>>     # do some work
>>>     is_prime(n)
1000/1000... rate=114326.51 Hz, eta=0:00:00, total=0:00:00
```

For more complex applications it may sometimes be desirable to manually use the ProgIter API. This is done as follows:

#### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> n = 3
>>> prog = ProgIter(desc='manual', total=n, verbose=3)
>>> prog.begin() # Manually begin progress iteration
>>> for _ in range(n):
...     prog.step(inc=1) # specify the number of steps to increment
>>> prog.end() # Manually end progress iteration
manual 0/3... rate=0 Hz, eta=?, total=0:00:00
manual 1/3... rate=14454.63 Hz, eta=0:00:00, total=0:00:00
```

(continues on next page)

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```
manual 2/3... rate=17485.42 Hz, eta=0:00:00, total=0:00:00
manual 3/3... rate=21689.78 Hz, eta=0:00:00, total=0:00:00
```

When working with ProgIter in either iterable or manual mode you can use the `prog.ensure_newline` method to guarantee that the next call you make to stdout will start on a new line. You can also use the `prog.set_extra` method to update a dynamci “extra” message that is shown in the formatted output. The following example demonstrates this.

### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> def is_prime(n):
...     return n >= 2 and not any(n % i == 0 for i in range(2, n))
>>> _iter = range(1000)
>>> prog = ProgIter(_iter, desc='check primes', verbose=2, show_wall=True)
>>> for n in prog:
>>>     if n == 97:
>>>         print('!!! Special print at n=97 !!!')
>>>     if is_prime(n):
>>>         prog.set_extra('Biggest prime so far: {}'.format(n))
>>>         prog.ensure_newline()
check primes    0/1000... rate=0 Hz, eta=?, total=0:00:00, wall=2020-10-23 17:27 EST
check primes    1/1000... rate=95547.49 Hz, eta=0:00:00, total=0:00:00, wall=2020-10-23
↪17:27 EST
check primes    4/1000...Biggest prime so far: 3 rate=41062.28 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
check primes   16/1000...Biggest prime so far: 13 rate=85340.61 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
check primes   64/1000...Biggest prime so far: 61 rate=164739.98 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
!!! Special print at n=97 !!!
check primes  256/1000...Biggest prime so far: 251 rate=206287.91 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
check primes  512/1000...Biggest prime so far: 509 rate=165271.92 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
check primes  768/1000...Biggest prime so far: 761 rate=136480.12 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
check primes 1000/1000...Biggest prime so far: 997 rate=115214.95 Hz, eta=0:00:00,
↪total=0:00:00, wall=2020-10-23 17:27 EST
```

### Todo:

- [ ] Specify callback that occurs whenever progress is written?

```
class ubelt.progiter.ProgIter(iterable=None, desc=None, total=None, freq=1, initial=0, eta_window=64,
                              clearline=True, adjust=True, time_thresh=2.0, show_times=True,
                              show_wall=False, enabled=True, verbose=None, stream=None,
                              chunksize=None, rel_adjust_limit=4.0, **kwargs)
```

Bases: `_TQDMCompat`, `_BackwardsCompat`

Prints progress as an iterator progresses

ProgIter is an alternative to *tqdm*. ProgIter implements much of the tqdm-API. The main difference between *ProgIter* and *tqdm* is that ProgIter does not use threading where as *tqdm* does.

#### Variables

- **iterable** (*List* | *Iterable*) – A list or iterable to loop over
- **desc** (*str*) – description label to show with progress
- **total** (*int*) – Maximum length of the process. If not specified, we estimate it from the iterable, if possible.
- **freq** (*int*) – How many iterations to wait between messages. Defaults to 1.
- **adjust** (*bool*) – if True freq is adjusted based on time\_thresh Defaults to True.
- **eta\_window** (*int*) – number of previous measurements to use in eta calculation, default=64
- **clearline** (*bool*) – if True messages are printed on the same line otherwise each new progress message is printed on new line. default=True
- **adjust** – if True *freq* is adjusted based on time\_thresh. This may be overwritten depending on the setting of verbose. default=True
- **time\_thresh** (*float*) – desired amount of time to wait between messages if adjust is True otherwise does nothing, default=2.0
- **show\_times** (*bool*) – shows rate and eta, default=True
- **show\_wall** (*bool*) – show wall time, default=False
- **initial** (*int*) – starting index offset, default=0
- **stream** (*IO*) – stream where progress information is written to, default=sys.stdout
- **enabled** (*bool*) – if False nothing happens. default=True
- **chunksize** (*int* | *None*) – indicates that each iteration processes a batch of this size. Iteration rate is displayed in terms of single-items.
- **rel\_adjust\_limit** (*float*) – Maximum factor update frequency can be adjusted by in a single step. default=4.0
- **verbose** (*int*) – verbosity mode, which controls clearline, adjust, and enabled. The following maps the value of *verbose* to its effect. 0: enabled=False, 1: enabled=True with clearline=True and adjust=True, 2: enabled=True with clearline=False and adjust=True, 3: enabled=True with clearline=False and adjust=False

---

**Note:** Either use ProgIter in a with statement or call prog.end() at the end of the computation if there is a possibility that the entire iterable may not be exhausted.

---

---

**Note:** ProgIter is an alternative to *tqdm*. The main difference between *ProgIter* and *tqdm* is that ProgIter does not use threading where as *tqdm* does. *ProgIter* is simpler than *tqdm* and thus more stable in certain circumstances.

---

#### SeeAlso:

tqdm - <https://pypi.python.org/pypi/tqdm>

## References

<http://datagenetics.com/blog/february12017/index.html>

## Example

```
>>>
>>> def is_prime(n):
...     return n >= 2 and not any(n % i == 0 for i in range(2, n))
>>> for n in ProgIter(range(100), verbose=1, show_wall=True):
>>>     # do some work
>>>     is_prime(n)
100/100... rate=... Hz, total=..., wall=...
```

### **set\_extra**(*extra*)

specify a custom info appended to the end of the next message

---

#### Todo:

- [ ] *extra* is a bad name; come up with something better and rename
- 

## Example

```
>>> prog = ProgIter(range(100, 300, 100), show_times=False, verbose=3)
>>> for n in prog:
>>>     prog.set_extra('processesing num {}'.format(n))
0/2...
1/2...processesing num 100
2/2...processesing num 200
```

### **step**(*inc=1*, *force=False*)

Manually step progress update, either directly or by an increment.

#### Parameters

- **inc** (*int*, *default=1*) – number of steps to increment
- **force** (*bool*, *default=False*) – if True forces progress display

## Example

```
>>> n = 3
>>> prog = ProgIter(desc='manual', total=n, verbose=3)
>>> # Need to manually begin and end in this mode
>>> prog.begin()
>>> for _ in range(n):
...     prog.step()
>>> prog.end()
```

### Example

```
>>> n = 3
>>> # can be used as a context manager in manual mode
>>> with ProgIter(desc='manual', total=n, verbose=3) as prog:
...     for _ in range(n):
...         prog.step()
```

#### start()

Alias of `ubelt.progiter.ProgIter.begin()`

#### begin()

Initializes information used to measure progress

This only needs to be used if this ProgIter is not wrapping an iterable. Does nothing if the this ProgIter is disabled.

##### Returns

a chainable self-reference

##### Return type

*ProgIter*

#### end()

Signals that iteration has ended and displays the final message.

This only needs to be used if this ProgIter is not wrapping an iterable. Does nothing if the this ProgIter object is disabled or has already finished.

#### format\_message()

builds a formatted progress message with the current values. This contains the special characters needed to clear lines.

### Example

```
>>> self = ProgIter(clearline=False, show_times=False)
>>> print(repr(self.format_message()))
' 0/?... \n'
>>> self.begin()
>>> self.step()
>>> print(repr(self.format_message()))
' 1/?... \n'
```

### Example

```
>>> self = ProgIter(chunksize=10, total=100, clearline=False,
>>>                 show_times=False, microseconds=True)
>>> # hack, microseconds=True for coverage, needs real test
>>> print(repr(self.format_message()))
' 0.00% of 10x100... \n'
>>> self.begin()
>>> self.update() # tqdm alternative to step
>>> print(repr(self.format_message()))
' 1.00% of 10x100... \n'
```

### **ensure\_newline()**

use before any custom printing when using the progress iter to ensure your print statement starts on a new line instead of at the end of a progress line

#### **Example**

```
>>> # Unsafe version may write your message on the wrong line
>>> prog = ProgIter(range(3), show_times=False, freq=2, adjust=False)
>>> for n in prog:
...     print('unsafe message')
0/3... unsafe message
unsafe message
2/3... unsafe message
3/3...
>>> # apparently the safe version does this too.
>>> print('---')
---
>>> prog = ProgIter(range(3), show_times=False, freq=2, adjust=False)
>>> for n in prog:
...     prog.ensure_newline()
...     print('safe message')
0/3...
safe message
safe message
2/3...
safe message
3/3...
```

### **display\_message()**

Writes current progress to the output stream

#### **1.28.1.1.3 ubelt.util\_arg module**

Simple ways to interact with the commandline without defining a full blown CLI. These are usually used for developer hacks. Any real interface should probably be defined using `argparse`, `click`, or `scriptconfig`. Be sure to ignore unknown arguments if you use them in conjunction with these functions.

The `argflag()` function checks if a boolean `--flag` style CLI argument exists on the command line.

The `argval()` function returns the value of a `--key=value` style CLI argument.

`ubelt.util_arg.argval(key, default=None, argv=None)`

Get the value of a keyword argument specified on the command line.

Values can be specified as `<key> <value>` or `<key>=<value>`

The use-case for this function is to add hidden command line feature where a developer can pass in a special value. This can be used to prototype a command line interface, provide an easter egg, or add some other command line parsing that wont be exposed in CLI help docs.

#### **Parameters**

- **key** (`str` | `Tuple[str, ...]`) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. `--`)



- **default** (*T | NoParamType*, *default=NoParam*) – a value to return if not specified.
- **argv** (*Optional[List[str]]*, *default=None*) – uses `sys.argv` if unspecified

**Returns**

value - the value specified after the key. If the key is specified multiple times, then the first value is returned.

**Return type**

`str | T`

**Todo:**

- [x] Can we handle the case where the value is a list of long paths? - No
- [ ] Should we default the first or last specified instance of the flag.

**CommandLine**

```
xdoctest -m ubelt.util_arg argval:0
xdoctest -m ubelt.util_arg argval:0 --devval
xdoctest -m ubelt.util_arg argval:0 --devval=1
xdoctest -m ubelt.util_arg argval:0 --devval=2
xdoctest -m ubelt.util_arg argval:0 --devval 3
xdoctest -m ubelt.util_arg argval:0 --devval "4 5 6"
```

**Example**

```
>>> # Everyday usage of this function might look like this where
>>> import ubelt as ub
>>> # grab a key/value pair if is given on the command line
>>> value = ub.argval('--devval', default='1')
>>> print('Checking if the hidden CLI key/value pair is given')
>>> if value != '1':
>>>     print(ub.color_text(
>>>         'A hidden developer secret: {!r}'.format(value), 'yellow'))
>>> print('Pass the hidden CLI key/value pair to see a secret message')
```

**Example**

```
>>> import ubelt as ub
>>> argv = ['--ans', '42', '--quest=the grail', '--ans=6', '--bad']
>>> assert ub.argval('--spam', argv=argv) == ub.NoParam
>>> assert ub.argval('--quest', argv=argv) == 'the grail'
>>> assert ub.argval('--ans', argv=argv) == '42'
>>> assert ub.argval('--bad', argv=argv) == ub.NoParam
>>> assert ub.argval(('--bad', '--bar'), argv=argv) == ub.NoParam
```

### Example

```
>>> # Test fix for GH Issue #41
>>> import ubelt as ub
>>> argv = ['--path=/path/with/k=3']
>>> ub.argval('--path', argv=argv) == '/path/with/k=3'
```

`ubelt.util_arg.argflag(key, argv=None)`

Determines if a key is specified on the command line.

This is a functional alternative to `key in sys.argv`, but it also allows for multiple aliases of the same flag to be specified.

#### Parameters

- **key** (*str* | *Tuple[str, ...]*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. `--`).
- **argv** (*List[str]*, *default=None*) – overrides `sys.argv` if specified

#### Returns

flag - True if the key (or any of the keys) was specified

#### Return type

`bool`

### CommandLine

```
xdoctest -m ubelt.util_arg argflag:0
xdoctest -m ubelt.util_arg argflag:0 --devflag
xdoctest -m ubelt.util_arg argflag:0 -df
xdoctest -m ubelt.util_arg argflag:0 --devflag2
xdoctest -m ubelt.util_arg argflag:0 -df2
```

### Example

```
>>> # Everyday usage of this function might look like this
>>> import ubelt as ub
>>> # Check if either of these strings are in sys.argv
>>> flag = ub.argflag(['-df', '--devflag'])
>>> if flag:
>>>     print(ub.color_text(
>>>         'A hidden developer flag was given!', 'blue'))
>>> print('Pass the hidden CLI flag to see a secret message')
```

### Example

```
>>> import ubelt as ub
>>> argv = ['--spam', '--eggs', 'foo']
>>> assert ub.argflag('--eggs', argv=argv) is True
>>> assert ub.argflag('--ans', argv=argv) is False
>>> assert ub.argflag('foo', argv=argv) is True
>>> assert ub.argflag(('bar', '--spam'), argv=argv) is True
```

#### 1.28.1.1.4 ubelt.util\_cache module

This module exposes *Cacher* and *CacheStamp* classes, which provide a simple API for on-disk caching.

The *Cacher* class is the simplest and most direct method of caching. In fact, it only requires four lines of boilerplate, which is the smallest general and robust way that I (Jon Crall) have achieved, and I don't think its possible to do better. These four lines implement the following necessary and sufficient steps for general robust on-disk caching.

1. Defining the cache dependencies
2. Checking if the cache missed
3. Loading the cache on a hit
4. Executing the process and saving the result on a miss.

The following example illustrates these four points.

### Example

```
>>> import ubelt as ub
>>> # Define a cache name and dependencies (which is fed to `ub.hash_data`)
>>> cacher = ub.Cacher('name', depends='set-of-deps') # boilerplate:1
>>> # Calling tryload will return your data on a hit and None on a miss
>>> data = cacher.tryload(on_error='clear') # boilerplate:2
>>> # Check if you need to recompute your data
>>> if data is None: # boilerplate:3
>>>     # Your code to recompute data goes here (this is not boilerplate).
>>>     data = 'mydata'
>>>     # Cache the computation result (via pickle)
>>>     cacher.save(data) # boilerplate:4
```

Surprisingly this uses just as many boilerplate lines as a decorator style cacher, but it is much more extensible. It is possible to use *Cacher* in more sophisticated ways (e.g. metadata), but the simple in-line use is often easier and cleaner. The following example illustrates this:

### Example

```
>>> import ubelt as ub
```

```
>>> @ub.Cacher('name', depends={'dep1': 1, 'dep2': 2}) # boilerplate:1
>>> def func():                                         # boilerplate:2
>>>     data = 'mydata'
>>>     return data                                    # boilerplate:3
>>> data = func()                                       # boilerplate:4
```

```
>>> cacher = ub.Cacher('name', depends=['dependencies']) # boilerplate:1
>>> data = cacher.tryload(on_error='clear')              # boilerplate:2
>>> if data is None:                                     # boilerplate:3
>>>     data = 'mydata'
>>>     cacher.save(data)                               # boilerplate:4
```

While the above two are equivalent, the second version provides a simpler traceback, explicit procedures, and makes it easier to use breakpoint debugging (because there is no closure scope).

While `Cacher` is used to store direct results of in-line code in a pickle format, the `CacheStamp` object is used to cache processes that produces an on-disk side effects other than the main return value. For instance, consider the following example:

### Example

```
>>> import ubelt as ub
>>> def compute_many_files(dpath):
...     for i in range(10):
...         fpath = '{}/file{}.txt'.format(dpath, i)
...         with open(fpath, 'w') as file:
...             file.write('foo' + str(i))
>>> dpath = ub.Path.appdir('ubelt/demo/cache').delete().ensuredir()
>>> # You must specify a directory, unlike in Cacher where it is optional
>>> self = ub.CacheStamp('name', dpath=dpath, depends={'a': 1, 'b': 2})
>>> if self.expired():
>>>     compute_many_files(dpath)
>>>     # Instead of caching the whole processes, we just write a file
>>>     # that signals the process has been done.
>>>     self.renew()
>>> assert not self.expired()
```

The `CacheStamp` is lightweight in that it simply marks that a process has been completed, but the job of saving / loading the actual data is left to the developer. The `expired` method checks if the stamp exists, and `renew` writes the stamp to disk.

In `ubelt` version 1.1.0, several additional features were added to `CacheStamp`. In addition to specifying parameters via `depends`, it is also possible for `CacheStamp` to determine if an associated file has been modified. To do this, the paths of the files must be known a-priori and passed to `CacheStamp` via the `product` argument. This will allow the `CacheStamp` to detect if the files have been modified since the `renew` method was called. It does this by remembering the size, modified time, and checksum of each file. If the hash of the expected hash of the product is known in advance, it is also possible to specify the expected `hash_prefix` of each product. In this case, `renew` will raise an `Exception` if this specified hash prefix does not match the files on disk. Lastly, it is possible to specify an expiration time via

expires, after which the CacheStamp will always be marked as invalid. This is now the mechanism via which the cache in `ubelt.util_download.grabdata()` works.

### Example

```
>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt/demo/cache').delete().ensuredir()
>>> params = {'a': 1, 'b': 2}
>>> expected_fpaths = [dpath / 'file{}.txt'.format(i) for i in range(2)]
>>> hash_prefix = ['a7a8a91659601590e17191301dc1',
...                '55ae75d991c770d8f3ef07cbfde1']
>>> self = ub.CacheStamp('name', dpath=dpath, depends=params,
>>>                        hash_prefix=hash_prefix, hasher='sha256',
>>>                        product=expected_fpaths, expires='2101-01-01T000000Z')
>>> if self.expired():
>>>     for fpath in expected_fpaths:
...         fpath.write_text(fpath.name)
>>>     self.renew()
>>> # modifying or removing the file will cause the stamp to expire
>>> expected_fpaths[0].write_text('corrupted')
>>> assert self.expired()
```

### RelatedWork:

<https://github.com/shaypal5/cachier>

```
class ubelt.util_cache.Cacher(fname, depends=None, dpath=None, appname='ubelt', ext='.pkl',
                             meta=None, verbose=None, enabled=True, log=None, hasher='sha1',
                             protocol=-1, cfgstr=None, backend='auto')
```

Bases: `object`

Saves data to disk and reloads it based on specified dependencies.

Cacher uses pickle to save/load data to/from disk. Dependencies of the cached process can be specified, which ensures the cached data is recomputed if the dependencies change. If the location of the cache is not specified, it will default to the system user's cache directory.

### Parameters

- **fname** (*str*) – A file name. This is the prefix that will be used by the cache. It will always be used as-is.
- **depends** (*str* | *List[str]* | *None*) – Indicate dependencies of this cache. If the dependencies change, then the cache is recomputed. New in version 0.8.9, replaces `cfgstr`.
- **dpath** (*str* | *PathLike* | *None*) – Specifies where to save the cache. If unspecified, Cacher defaults to an application cache dir as given by `appname`. See `ub.get_app_cache_dir()` for more details.
- **appname** (*str*, *default*='ubelt') – Application name Specifies a folder in the application cache directory where to cache the data if `dpath` is not specified.
- **ext** (*str*, *default*='.pkl') – File extension for the cache format. Can be '.pkl' or '.json'.
- **meta** (*object* | *None*) – Metadata that is also saved with the `cfgstr`. This can be useful to indicate how the `cfgstr` was constructed. Note: this is a candidate for deprecation.
- **verbose** (*int*, *default*=1) – Level of verbosity. Can be 1, 2 or 3.
- **enabled** (*bool*, *default*=True) – If set to False, then the load and save methods will do nothing.

- **log** (*Callable*[[*str*], *Any*]) – Overloads the print function. Useful for sending output to loggers (e.g. logging.info, tqdm.tqdm.write, ...)
- **hasher** (*str*, *default*='sha1') – Type of hashing algorithm to use if *cfgstr* needs to be condensed to less than 49 characters.
- **protocol** (*int*, *default*=-1) – Protocol version used by pickle. Defaults to the -1 which is the latest protocol.
- **backend** (*str*) – Set to either 'pickle' or 'json' to force backend. Defaults to auto which chooses one based on the extension.
- **cfgstr** (*str* | *None*) – Deprecated in favor of *depends*.

### Example

```
>>> import ubelt as ub
>>> depends = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = ub.Cacher('demo_process', depends, verbose=4)
>>> cacher.clear()
>>> print(f'cacher.fpath={cacher.fpath}')
>>> data = cacher.tryload()
>>> if data is None:
>>>     # Put expensive functions in if block when cacher misses
>>>     myvar1 = 'result of expensive process'
>>>     myvar2 = 'another result'
>>>     # Tell the cacher to write at the end of the if block
>>>     # It is idomatic to put results in an object named data
>>>     data = myvar1, myvar2
>>>     cacher.save(data)
>>> # Last part of the Cacher pattern is to unpack the data object
>>> myvar1, myvar2 = data
>>> #
>>> # If we know the data exists, we can also simply call load
>>> data = cacher.tryload()
```

### Example

```
>>> # The previous example can be shorted if only a single value
>>> from ubelt.util_cache import Cacher
>>> depends = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = Cacher('demo_process', depends)
>>> myvar = cacher.tryload()
>>> if myvar is None:
>>>     myvar = ('result of expensive process', 'another result')
>>>     cacher.save(myvar)
>>> assert cacher.exists(), 'should now exist'
```

VERBOSE = 1

FORCE\_DISABLE = False

**property fpath****get\_fpath**(*cfgstr=None*)

Reports the filepath that the cacher will use.

It will attempt to use '{fname}\_{cfgstr}{ext}' unless that is too long. Then *cfgstr* will be hashed.**Parameters****cfgstr** (*str* | *None*) – overrides the instance-level *cfgstr***Returns***str* | *PathLike***Example**

```

>>> # xdoctest: +REQUIRES(module:pytest)
>>> from ubelt.util_cache import Cacher
>>> import pytest
>>> #with pytest.warns(UserWarning):
>>> if 1: # we no longer warn here
>>>     cacher = Cacher('test_cacher1')
>>>     cacher.get_fpath()
>>> self = Cacher('test_cacher2', depends='cfg1')
>>> self.get_fpath()
>>> self = Cacher('test_cacher3', depends='cfg1' * 32)
>>> self.get_fpath()

```

**exists**(*cfgstr=None*)

Check to see if the cache exists

**Parameters****cfgstr** (*str* | *None*) – overrides the instance-level *cfgstr***Returns***bool***existing\_versions**()Returns data with different *cfgstr* values that were previously computed with this cacher.**Yields***str* – paths to cached files corresponding to this cacher**Example**

```

>>> # Ensure that some data exists
>>> import ubelt as ub
>>> dpath = ub.Path.appdir(
>>>     'ubelt/tests/util_cache',
>>>     'test-existing-versions').delete().ensuredir()
>>> cacher = ub.Cacher('versioned_data_v2', depends='1', dpath=dpath)
>>> cacher.ensure(lambda: 'data1')
>>> known_fpaths = set()
>>> known_fpaths.add(cacher.get_fpath())
>>> cacher = ub.Cacher('versioned_data_v2', depends='2', dpath=dpath)

```

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```

>>> cacher.ensure(lambda: 'data2')
>>> known_fpaths.add(cacher.get_fpath())
>>> # List previously computed configs for this type
>>> from os.path import basename
>>> cacher = ub.Cacher('versioned_data_v2', depends='2', dpath=dpath)
>>> exist_fpaths = set(cacher.existing_versions())
>>> exist_fnames = list(map(basename, exist_fpaths))
>>> print('exist_fnames = {!r}'.format(exist_fnames))
>>> print('exist_fpaths = {!r}'.format(exist_fpaths))
>>> print('known_fpaths={!r}'.format(known_fpaths))
>>> assert exist_fpaths.issubset(known_fpaths)

```

**clear**(cfgstr=None)

Removes the saved cache and metadata from disk

**Parameters**

**cfgstr** (str | None) – overrides the instance-level cfgstr

**tryload**(cfgstr=None, on\_error='raise')

Like load, but returns None if the load fails due to a cache miss.

**Parameters**

- **cfgstr** (str | None) – overrides the instance-level cfgstr
- **on\_error** (str, default='raise') – How to handle non-io errors. Either 'raise', which re-raises the exception, or 'clear' which deletes the cache and returns None.

**Returns**

the cached data if it exists, otherwise returns None

**Return type**

None | object

**load**(cfgstr=None)

Load the data cached and raise an error if something goes wrong.

**Parameters**

**cfgstr** (str | None) – overrides the instance-level cfgstr

**Returns**

the cached data

**Return type**

object

**Raises**

**IOError** – if the data is unable to be loaded. This could be due to – a cache miss or because the cache is disabled.



### Example

```
>>> from ubelt.util_cache import * # NOQA
>>> # Setting the cacher as enabled=False turns it off
>>> cacher = Cacher('test_disabled_load', '', enabled=True,
>>>                 appname='ubelt/tests/util_cache')
>>> cacher.save('data')
>>> assert cacher.load() == 'data'
>>> cacher.enabled = False
>>> assert cacher.tryload() is None
```

**save**(data, cfgstr=None)

Writes data to path specified by self.fpath.

Metadata containing information about the cache will also be appended to an adjacent file with the .meta suffix.

#### Parameters

- **data** (*object*) – arbitrary pickleable object to be cached
- **cfgstr** (*str* | *None*) – overrides the instance-level cfgstr

### Example

```
>>> from ubelt.util_cache import * # NOQA
>>> # Normal functioning
>>> depends = 'long-cfg' * 32
>>> cacher = Cacher('test_enabled_save', depends=depends,
>>>                 appname='ubelt/tests/util_cache')
>>> cacher.save('data')
>>> assert exists(cacher.get_fpath()), 'should be enabled'
>>> assert exists(cacher.get_fpath() + '.meta'), 'missing metadata'
>>> # Setting the cacher as enabled=False turns it off
>>> cacher2 = Cacher('test_disabled_save', 'params', enabled=False,
>>>                  appname='ubelt/tests/util_cache')
>>> cacher2.save('data')
>>> assert not exists(cacher2.get_fpath()), 'should be disabled'
```

**ensure**(func, \*args, \*\*kwargs)

Wraps around a function. A cfgstr must be stored in the base cacher.

#### Parameters

- **func** (*Callable*) – function that will compute data on cache miss
- **\*args** – passed to func
- **\*\*kwargs** – passed to func

### Example

```
>>> from ubelt.util_cache import * # NOQA
>>> def func():
>>>     return 'expensive result'
>>> fname = 'test_cacher_ensure'
>>> depends = 'func params'
>>> cacher = Cacher(fname, depends=depends)
>>> cacher.clear()
>>> data1 = cacher.ensure(func)
>>> data2 = cacher.ensure(func)
>>> assert data1 == 'expensive result'
>>> assert data1 == data2
>>> cacher.clear()
```

```
class ubelt.util_cache.CacheStamp(fname, dpath, cfgstr=None, product=None, hasher='sha1',
                                   verbose=None, enabled=True, depends=None, meta=None,
                                   hash_prefix=None, expires=None, ext='.pkl')
```

Bases: `object`

Quickly determine if a file-producing computation has been done.

Check if the computation needs to be redone by calling `expired`. If the stamp is not expired, the user can expect that the results exist and could be loaded. If the stamp is expired, the computation should be redone. After the result is updated, the calls `renew`, which writes a “stamp” file to disk that marks that the procedure has been done.

There are several ways to control how a stamp expires. At a bare minimum, removing the stamp file will force expiration. However, in this circumstance `CacheStamp` only knows that something has been done, but it doesn’t have any information about what was done, so in general this is not sufficient.

To achieve more robust expiration behavior, the user should specify the `product` argument, which is a list of file paths that are expected to exist whenever the stamp is renewed. When this is specified the `CacheStamp` will expire if any of these products are deleted, their size changes, their modified timestamp changes, or their hash (i.e. checksum) changes. Note that by setting `hasher=None`, running and verifying checksums can be disabled.

If the user knows what the hash of the file should be this can be specified to prevent renewal of the stamp unless these match the files on disk. This can be useful for security purposes.

The stamp can also be set to expire at a specified time or after a specified duration using the `expires` argument.

#### Parameters

- **fname** (*str*) – Name of the stamp file
- **dpath** (*str* | *PathLike* | *None*) – Where to store the cached stamp file
- **product** (*str* | *PathLike* | *Sequence[str | PathLike]* | *None*) – Path or paths that we expect the computation to produce. If specified the hash of the paths are stored.
- **hasher** (*str*, *default*='sha1') – The type of hasher used to compute the file hash of product. If *None*, then we assume the file has not been corrupted or changed if the mtime and size are the same. Defaults to sha1.
- **verbose** (*bool*, *default*=*None*) – Passed to internal `ubelt.Cacher` object
- **enabled** (*bool*, *default*=*True*) – if *False*, expired always returns *True*
- **depends** (*str* | *List[str]* | *None*) – Indicate dependencies of this cache. If the dependencies change, then the cache is recomputed. New to `CacheStamp` in version 0.9.2, replaces `cfgstr`.

- **meta** (*object* | *None*) – Metadata that is also saved with the `cfgstr`. This can be useful to indicate how the `cfgstr` was constructed. New to CacheStamp in version 0.9.2. Note: this is a candidate for deprecation.
- **expires** (*str* | *int* | *datetime.datetime* | *datetime.timedelta* | *None*) – If specified, sets an expiration date for the certificate. This can be an absolute datetime or a timedelta offset. If specified as an int, this is interpreted as a time delta in seconds. If specified as a str, this is interpreted as an absolute timestamp. Time delta offsets are coerced to absolute times at “renew” time.
- **hash\_prefix** (*None* | *str* | *List[str]*) – If specified, we verify that these match the hash(s) of the product(s) in the stamp certificate.
- **ext** (*str*, *default*='.pkl') – File extension for the cache format. Can be '.pkl' or '.json'.
- **cfgstr** (*str* | *None*) – DEPRECATED in favor of `depends`.

## Notes

The size, mtime, and hash mechanism is similar to how Makefile and redo caches work.

## Example

```
>>> import ubelt as ub
>>> # Stamp the computation of expensive-to-compute.txt
>>> dpath = ub.Path.appdir('ubelt/tests/cache-stamp')
>>> dpath.delete().ensuredir()
>>> product = dpath / 'expensive-to-compute.txt'
>>> self = ub.CacheStamp('somedata', depends='someconfig', dpath=dpath,
>>>                        product=product, hasher='sha256')
>>> self.clear()
>>> print(f'self.fpath={self.fpath}')
>>> if self.expired():
>>>     product.write_text('very expensive')
>>>     self.renew()
>>> assert not self.expired()
>>> # corrupting the output will cause the stamp to expire
>>> product.write_text('very corrupted')
>>> assert self.expired()
```

## property fpath

### clear()

Delete the stamp (the products are untouched)

### expired(cfgstr=None, product=None)

Check to see if a previously existing stamp is still valid, if the expected result of that computation still exists, and if all other expiration criteria are met.

### Parameters

- **cfgstr** (*str* | *None*) – overrides the instance-level `cfgstr`. DEPRECATED do not use.
- **product** (*str* | *PathLike* | *Sequence[str | PathLike]* | *None*) – override the default product if specified. DEPRECATED do not use.

**Returns**

True(-thy) if the stamp is invalid, expired, or does not exist. When the stamp is expired, the reason for expiration is returned as a string. If the stamp is still valid, False is returned.

**Return type**

bool | str

**Example**

```
>>> import ubelt as ub
>>> import time
>>> import os
>>> # Stamp the computation of expensive-to-compute.txt
>>> dpath = ub.Path.appdir('ubelt/tests/cache-stamp-expired')
>>> dpath.delete().ensuredir()
>>> products = [
>>>     dpath / 'product1.txt',
>>>     dpath / 'product2.txt',
>>> ]
>>> self = ub.CacheStamp('myname', depends='myconfig', dpath=dpath,
>>>                       product=products, hasher='sha256',
>>>                       expires=0)
>>> if self.expired():
>>>     for fpath in products:
>>>         fpath.write_text(fpath.name)
>>>         self.renew()
>>> fpath = products[0]
>>> # Because we set the expiration delta to 0, we should already be expired
>>> assert self.expired() == 'expired_cert'
>>> # Disable the expiration date, renew and we should be ok
>>> self.expires = None
>>> self.renew()
>>> assert not self.expired()
>>> # Modify the mtime to cause expiration
>>> orig_atime = fpath.stat().st_atime
>>> orig_mtime = fpath.stat().st_mtime
>>> os.utime(fpath, (orig_atime, orig_mtime + 200))
>>> assert self.expired() == 'mtime_diff'
>>> self.renew()
>>> assert not self.expired()
>>> # rewriting the file will cause the size constraint to fail
>>> # even if we hack the mtime to be the same
>>> orig_atime = fpath.stat().st_atime
>>> orig_mtime = fpath.stat().st_mtime
>>> fpath.write_text('corrupted')
>>> os.utime(fpath, (orig_atime, orig_mtime))
>>> assert self.expired() == 'size_diff'
>>> self.renew()
>>> assert not self.expired()
>>> # Force a situation where the hash is the only thing
>>> # that saves us, write a different file with the same
>>> # size and mtime.
>>> orig_atime = fpath.stat().st_atime
```

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```

>>> orig_mtime = fpath.stat().st_mtime
>>> fpath.write_text('corrApted')
>>> os.utime(fpath, (orig_atime, orig_mtime))
>>> assert self.expired() == 'hash_diff'
>>> # Test what a wrong hash prefix causes expiration
>>> certificate = self.renew()
>>> self.hash_prefix = certificate['hash']
>>> self.expired()
>>> self.hash_prefix = ['bad', 'hashes']
>>> self.expired()
>>> # A bad hash will not allow us to renew
>>> import pytest
>>> with pytest.raises(RuntimeError):
...     self.renew()

```

**renew**(cfgstr=None, product=None)

Recertify that the product has been recomputed by writing a new certificate to disk.

**Returns**

certificate information

**Return type**

dict

#### 1.28.1.1.5 ubelt.util\_cmd module

This module exposes the `ubelt.cmd()` command, which provides a simple means for interacting with the command-line. This uses `subprocess.Popen` under the hood, but improves upon existing `subprocess` functionality by:

- (1) Adding the option to “tee” the output, i.e. simultaneously capture and write to stdout and stderr.
- (2) Always specify the command as a string. The `subprocess` module expects the command as either a `List[str]` if `shell=False` and `str` if `shell=True`. If necessary, `ubelt.util_cmd.cmd()` will automatically convert from one format to the other, so passing in either case will work.
- (3) Specify if the process blocks or not by setting `detach`. Note: when `detach` is `True` it is not possible to tee the output.

#### Example

```

>>> import ubelt as ub
>>> # Running with verbose=1 will write to stdout in real time
>>> info = ub.cmd('echo "write your command naturally"', verbose=1)
write your command naturally
>>> # Unless `detach=True`, `cmd` always returns an info dict.
>>> print('info = ' + ub.repr2(info))
info = {
  'command': 'echo "write your command naturally"',
  'cwd': None,
  'err': '',
  'out': 'write your command naturally\n',
  'proc': <...Popen...>,

```

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```
'ret': 0,
}
```

`ubelt.util_cmd.cmd(command, shell=False, detach=False, verbose=0, tee=None, cwd=None, env=None, tee_backend='auto', check=False, system=False, timeout=None)`

Executes a command in a subprocess.

The advantage of this wrapper around subprocess is that (1) you control if the subprocess prints to stdout, (2) the text written to stdout and stderr is returned for parsing, (3) cross platform behavior that lets you specify the command as a string or tuple regardless of whether or not `shell=True`. (4) ability to detach, return the process object and allow the process to run in the background (eventually we may return a Future object instead).

### Parameters

- **command** (*str* | *List[str]*) – command string, tuple of executable and args, or shell command.
- **shell** (*bool*, *default=False*) – if True, process is run in shell.
- **detach** (*bool*, *default=False*) – if True, process is detached and run in background.
- **verbose** (*int*, *default=0*) – verbosity mode. Can be 0, 1, 2, or 3.
- **tee** (*bool* | *None*) – if True, simultaneously writes to stdout while capturing output from the command. If not specified, defaults to True if `verbose > 0`. If `detach` is True, then this argument is ignored.
- **cwd** (*str* | *PathLike* | *None*) – Path to run command. Defaults to current working directory if unspecified.
- **env** (*Dict[str, str]* | *None*) – environment passed to Popen
- **tee\_backend** (*str*, *default='auto'*) – backend for tee output. Valid choices are: “auto”, “select” (POSIX only), and “thread”.
- **check** (*bool*, *default=False*) – if True, check that the return code was zero before returning, otherwise raise a `subprocess.CallProcessError`. Does nothing if `detach` is True.
- **system** (*bool*, *default=False*) – if True, most other considerations are dropped, and `os.system()` is used to execute the command in a platform dependant way. Other arguments such as `env`, `tee`, `timeout`, and `shell` are all ignored. (new in version 1.1.0)
- **timeout** (*float*) – If the process does not complete in `timeout` seconds, raises a `subprocess.TimeoutExpired`. (new in version 1.1.0) Currently unhandled when `tee` is True.
- **log** (*Callable* | *None*) – If specified, verbose output is written using this function, otherwise the builtin print function is used.

### Returns

`info` - information about command status. if `detach` is False `info` contains captured standard out, standard error, and the return code if `detach` is True `info` contains a reference to the process.

### Return type

`dict`

### Raises

- **ValueError** - on an invalid configuration –
- **subprocess.TimeoutExpired** - if the timeout limit is exceeded –
- **subprocess.CallProcessError** - if `check` and the return value is non zero –

**Note:** Inputs can either be text or tuple based. On UNIX we ensure conversion to text if shell=True, and to tuple if shell=False. On windows, the input is always text based. See [SO\_33560364] for a potential cross-platform shlex solution for windows.

When using the tee output, the stdout and stderr may be shuffled from what they would be on the command line.

#### Related Work:

<https://github.com/pycontribs/subprocess-tee> <https://github.com/mortoray/shelljob> [https://github.com/netinvent/command\\_runner](https://github.com/netinvent/command_runner)

## References

### CommandLine

```
xdoctest -m ubelt.util_cmd cmd:6
python -c "import ubelt as ub; ub.cmd('ping localhost -c 2', verbose=2)"
pytest "$(python -c 'import ubelt; print(ubelt.util_cmd.__file__)')" -sv --xdoctest-
↳ verbose 2
```

### Example

```
>>> import ubelt as ub
>>> info = ub.cmd(('echo', 'simple cmdline interface'), verbose=1)
simple cmdline interface
>>> assert info['ret'] == 0
>>> assert info['out'].strip() == 'simple cmdline interface'
>>> assert info['err'].strip() == ''
```

### Example

```
>>> import ubelt as ub
>>> info = ub.cmd('echo str noshell', verbose=0)
>>> assert info['out'].strip() == 'str noshell'
```

### Example

```
>>> # windows echo will output extra single quotes
>>> import ubelt as ub
>>> info = ub.cmd(('echo', 'tuple noshell'), verbose=0)
>>> assert info['out'].strip().strip('"') == 'tuple noshell'
```

### Example

```
>>> # Note this command is formatted to work on win32 and unix
>>> import ubelt as ub
>>> info = ub.cmd('echo str&&echo shell', verbose=0, shell=True)
>>> assert info['out'].strip() == 'str' + chr(10) + 'shell'
```

### Example

```
>>> import ubelt as ub
>>> info = ub.cmd(('echo', 'tuple shell'), verbose=0, shell=True)
>>> assert info['out'].strip().strip('"') == 'tuple shell'
```

### Example

```
>>> import pytest
>>> import ubelt as ub
>>> info = ub.cmd('echo hi', check=True)
>>> import subprocess
>>> with pytest.raises(subprocess.CalledProcessError):
>>>     ub.cmd('exit 1', check=True, shell=True)
```

### Example

```
>>> import ubelt as ub
>>> from os.path import join, exists
>>> fpath1 = join(ub.get_app_cache_dir('ubelt'), 'cmdout1.txt')
>>> fpath2 = join(ub.get_app_cache_dir('ubelt'), 'cmdout2.txt')
>>> ub.delete(fpath1)
>>> ub.delete(fpath2)
>>> # Start up two processes that run simultaneously in the background
>>> info1 = ub.cmd(('touch', fpath1), detach=True)
>>> info2 = ub.cmd('echo writing2 > ' + fpath2, shell=True, detach=True)
>>> # Detached processes are running in the background
>>> # We can run other code while we wait for them.
>>> while not exists(fpath1):
>>>     pass
>>> while not exists(fpath2):
>>>     pass
>>> # communicate with the process before you finish
>>> # (otherwise you may leak a text wrapper)
>>> info1['proc'].communicate()
>>> info2['proc'].communicate()
>>> # Check that the process actually did finish
>>> assert (info1['proc'].wait()) == 0
>>> assert (info2['proc'].wait()) == 0
>>> # Check that the process did what we expect
>>> assert ub.readfrom(fpath1) == ''
>>> assert ub.readfrom(fpath2).strip() == 'writing2'
```



### Example

```
>>> # Can also use ub.cmd to call os.system
>>> import pytest
>>> import ubelt as ub
>>> import subprocess
>>> info = ub.cmd('echo hi', check=True, system=True)
>>> with pytest.raises(subprocess.CalledProcessError):
>>>     ub.cmd('exit 1', check=True, shell=True)
```

#### 1.28.1.1.6 ubelt.util\_colors module

This module defines simple functions to color your text and highlight your code using ANSI escape sequences. This works using the `Pygments` library, which is an optional requirement. Therefore, these functions only work properly if `Pygments` is installed, otherwise these functions will return the unmodified text and a warning will be printed.

The `highlight_code()` function uses `pygments` to highlight syntax of a programming language.

The `color_text()` function colors text with a solid color.

Note the functions in this module require the optional `pygments` library to work correctly. These functions will warn if `pygments` is not installed.

This module contains a global variable `NO_COLOR`, which if set to `True` will force all ANSI text coloring functions to become no-ops. This defaults to the value of the `bool(os.environ.get('NO_COLOR'))` flag, which is compliant with `[NoColor]`.

#### Related work:

<https://github.com/Textualize/rich>

### References

#### Requirements:

`pip install pygments`

`ubelt.util_colors.highlight_code(text, lexer_name='python', **kwargs)`

Highlights a block of text using ANSI tags based on language syntax.

#### Parameters

- **text** (*str*) – plain text to highlight
- **lexer\_name** (*str*) – name of language. eg: `python`, `docker`, `c++`
- **\*\*kwargs** – passed to `pygments.lexers.get_lexer_by_name`

#### Returns

text - highlighted text If `pygments` is not installed, the plain text is returned.

#### Return type

`str`

### Example

```
>>> import ubelt as ub
>>> text = 'import ubelt as ub; print(ub)'
>>> new_text = ub.highlight_code(text)
>>> print(new_text)
```

`ubelt.util_colors.color_text(text, color)`

Colorizes text a single color using ansi tags.

#### Parameters

- **text** (*str*) – text to colorize
- **color** (*str*) – color code. different systems may have different colors. commonly available colors are: ‘red’, ‘brown’, ‘yellow’, ‘green’, ‘blue’, ‘black’, and ‘white’.

#### Returns

text - colorized text. If pygments is not installed plain text is returned.

#### Return type

str

### Example

```
>>> text = 'raw text'
>>> import pytest
>>> import ubelt as ub
>>> if ub.modname_to_modpath('pygments'):
>>>     # Colors text only if pygments is installed
>>>     ansi_text = ub.ensure_unicode(ub.color_text(text, 'red'))
>>>     prefix = ub.ensure_unicode('\x1b[31')
>>>     print('prefix = {!r}'.format(prefix))
>>>     print('ansi_text = {!r}'.format(ansi_text))
>>>     assert ansi_text.startswith(prefix)
>>>     assert ub.color_text(text, None) == 'raw text'
>>> else:
>>>     # Otherwise text passes through unchanged
>>>     assert ub.color_text(text, 'red') == 'raw text'
>>>     assert ub.color_text(text, None) == 'raw text'
```

### Example

```
>>> # xdoctest: +REQUIRES(module:pygments)
>>> import pygments.console
>>> import ubelt as ub
>>> known_colors = pygments.console.codes.keys()
>>> for color in known_colors:
>>>     print(ub.color_text(color, color))
```

### 1.28.1.1.7 ubelt.util\_const module

This module defines `ub.NoParam`. This is a robust sentinel value that can act like `None` when `None` might be a valid value. The value of `NoParam` is robust to reloading, pickling, and copying (i.e. `var is ub.NoParam` will return `True` after these operations).

Use cases that demonstrate the value of `NoParam` can be found in `ubelt.util_dict`, where it simplifies the implementation of methods that behave like `dict.get()`.

#### Example

```
>>> import ubelt as ub
>>> def func(a=ub.NoParam):
>>>     if a is ub.NoParam:
>>>         print('no param specified')
>>>     else:
>>>         print('a = {}'.format(a))
>>> func()
no param specified
>>> func(a=None)
a = None
>>> func(a=1)
a = 1
>>> # note: typically it is bad practice to use NoParam as an actual
>>> # (non-default) parameter. It goes against the spirit of the idea.
>>> func(a=ub.NoParam)
no param specified
```

### 1.28.1.1.8 ubelt.util\_dict module

Functions for working with dictionaries.

The `UDict` is a subclass of `dict` with quality of life improvements. It contains methods for n-ary key-wise set operations as well as support for the binary operators in addition to other methods for mapping, inversion, subdicts, and peeking. It can be accessed via the alias `ubelt.udict`.

The `SetDict` only contains the key-wise set extensions to `dict`. It can be accessed via the alias `ubelt.sdict`.

The `dict_hist()` function counts the number of discrete occurrences of hashable items. Similarly `find_duplicates()` looks for indices of items that occur more than  $k=1$  times.

The `map_keys()` and `map_values()` functions are useful for transforming the keys and values of a dictionary with less syntax than a dict comprehension.

The `dict_union()`, `dict_isect()`, and `dict_diff()` functions are similar to the set equivalents.

The `dzip()` function zips two iterables and packs them into a dictionary where the first iterable is used to generate keys and the second generates values.

The `group_items()` function takes two lists and returns a dict mapping values in the second list to all items in corresponding locations in the first list.

The `invert_dict()` function swaps keys and values. See the function docs for details on dealing with unique and non-unique values.

The `ddict()` and `odict()` functions are alias for the commonly used `collections.defaultdict()` and `collections.OrderedDict()` classes.

#### Related Work:

- Note that Python does support set operations on dictionary **views** [[DictView](#)] [[Pep3106](#)], but these methods can be inflexible and often leave you only with keys (and no dictionary subset operation), whereas the ubelt definition of these operations is more straightforward.
- There are several recipes for dictionaries that support set operations [[SetDictRecipe1](#)] [[SetDictRecipe2](#)].
- The `:module:`dictmap`` package contains a function similar to `map_values()` [[GHDictMap](#)].
- The `:module:`dictdiffer`` package contains tools for nested difference operations [[PypiDictDiffer](#)].
- There are lots of other python dictionary utility libraries [[PyPIAddict](#)].

#### References

**class** `ubelt.util_dict.AutoDict`

Bases: `dict`

An infinitely nested default dict of dicts.

Implementation of Perl's autovivification feature that follows [[SO\\_651794](#)].

#### SeeAlso:

[`AutoOrderedDict`](#) - the ordered version

#### References

#### Example

```
>>> import ubelt as ub
>>> auto = ub.AutoDict()
>>> auto[0][10][100] = None
>>> assert str(auto) == '{0: {10: {100: None}}}'
```

#### `to_dict()`

Recursively casts a `AutoDict` into a regular dictionary. All nested `AutoDict` values are also converted.

#### Returns

a copy of this dict without autovivification

#### Return type

`dict`

#### Example

```
>>> from ubelt.util_dict import AutoDict
>>> auto = AutoDict()
>>> auto[1] = 1
>>> auto['n1'] = AutoDict()
>>> static = auto.to_dict()
>>> assert not isinstance(static, AutoDict)
>>> assert not isinstance(static['n1'], AutoDict)
```

**class** `ubelt.util_dict.AutoOrderedDict`Bases: `OrderedDict`, `AutoDict`

An infinitely nested default dict of dicts that maintains the ordering of items.

**SeeAlso:**`AutoDict` - the unordered version of this class**Example**

```
>>> import ubelt as ub
>>> auto = ub.AutoOrderedDict()
>>> auto[0][3] = 3
>>> auto[0][2] = 2
>>> auto[0][1] = 1
>>> assert list(auto[0].values()) == [3, 2, 1]
```

`ubelt.util_dict.dzip(items1, items2, cls=<class 'dict'>)`

Zips elementwise pairs between items1 and items2 into a dictionary.

Values from items2 can be broadcast onto items1.

**Parameters**

- **items1** (*Iterable[KT]*) – full sequence
- **items2** (*Iterable[VT]*) – can either be a sequence of one item or a sequence of equal length to items1
- **cls** (*Type[dict]*, *default=dict*) – dictionary type to use.

**Returns**similar to `dict(zip(items1, items2))`.**Return type**`Dict[KT, VT]`**Example**

```
>>> import ubelt as ub
>>> assert ub.dzip([1, 2, 3], [4]) == {1: 4, 2: 4, 3: 4}
>>> assert ub.dzip([1, 2, 3], [4, 4, 4]) == {1: 4, 2: 4, 3: 4}
>>> assert ub.dzip([], [4]) == {}
```

`ubelt.util_dict.ddict`alias of `defaultdict``ubelt.util_dict.dict_hist(items, weights=None, ordered=False, labels=None)`

Builds a histogram of items, counting the number of time each item appears in the input.

**Parameters**

- **items** (*Iterable[T]*) – hashable items (usually containing duplicates)
- **weights** (*Iterable[float]*, *default=None*) – Corresponding weights for each item.
- **ordered** (*bool*, *default=False*) – If True the result is ordered by frequency.

- **labels** (*Iterable[T]*, *default=None*) – Expected labels. Allows this function to pre-initialize the histogram. If specified the frequency of each label is initialized to zero and **items** can only contain items specified in labels.

#### Returns

dictionary where the keys are unique elements from **items**, and the values are the number of times the item appears in **items**.

#### Return type

`dict[T, int]`

#### Example

```
>>> import ubelt as ub
>>> items = [1, 2, 39, 900, 1232, 900, 1232, 2, 2, 2, 900]
>>> hist = ub.dict_hist(items)
>>> print(ub.repr2(hist, nl=0))
{1: 1, 2: 4, 39: 1, 900: 3, 1232: 2}
```

#### Example

```
>>> import ubelt as ub
>>> items = [1, 2, 39, 900, 1232, 900, 1232, 2, 2, 2, 900]
>>> hist1 = ub.dict_hist(items)
>>> hist2 = ub.dict_hist(items, ordered=True)
>>> try:
>>>     hist3 = ub.dict_hist(items, labels=[])
>>> except KeyError:
>>>     pass
>>> else:
>>>     raise AssertionError('expected key error')
>>> weights = [1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1]
>>> hist4 = ub.dict_hist(items, weights=weights)
>>> print(ub.repr2(hist1, nl=0))
{1: 1, 2: 4, 39: 1, 900: 3, 1232: 2}
>>> print(ub.repr2(hist4, nl=0))
{1: 1, 2: 4, 39: 1, 900: 1, 1232: 0}
```

`ubelt.util_dict.dict_subset(dict_, keys, default=NoParam, cls=<class 'collections.OrderedDict'>)`

Get a subset of a dictionary

#### Parameters

- **dict\_** (*Dict[KT, VT]*) – superset dictionary
- **keys** (*Iterable[KT]*) – keys to take from **dict\_**
- **default** (*Optional[object] | NoParamType*) – if specified uses default if keys are missing.
- **cls** (*Type[Dict]*, *default=OrderedDict*) – type of the returned dictionary.

#### Returns

subset dictionary

#### Return type

`Dict[KT, VT]`

**SeeAlso:**

`dict_isect()` - similar functionality, but ignores missing keys

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'K': 3, 'dcvs_clip_max': 0.2, 'p': 0.1}
>>> keys = ['K', 'dcvs_clip_max']
>>> subdict_ = ub.dict_subset(dict_, keys)
>>> print(ub.repr2(subdict_, nl=0))
{'K': 3, 'dcvs_clip_max': 0.2}
```

`ubelt.util_dict.dict_union(*args)`

Dictionary set extension for `set.union`

Combines items with from multiple dictionaries. For items with intersecting keys, dictionaries towards the end of the sequence are given precedence.

**Parameters**

**\*args** (*List[Dict]*) – A sequence of dictionaries. Values are taken from the last

**Returns**

OrderedDict if the first argument is an OrderedDict, otherwise dict

**Return type**

Dict | OrderedDict

**Notes**

In Python 3.8+, the bitwise or operator “|” operator performs a similar operation, but as of 2022-06-01 there is still no public method for dictionary union (or any other dictionary set operator).

**References**

<https://stackoverflow.com/questions/38987/merge-two-dict>

**SeeAlso:**

`collections.ChainMap()` - a standard python builtin data structure that provides a view that treats multiple dicts as a single dict. <https://docs.python.org/3/library/collections.html#chainmap-objects>

**Example**

```
>>> import ubelt as ub
>>> result = ub.dict_union({'a': 1, 'b': 1}, {'b': 2, 'c': 2})
>>> assert result == {'a': 1, 'b': 2, 'c': 2}
>>> ub.dict_union(
>>>     ub.odict([('a', 1), ('b', 2)]),
>>>     ub.odict([('c', 3), ('d', 4)]))
OrderedDict([('a', 1), ('b', 2), ('c', 3), ('d', 4)])
>>> ub.dict_union()
{}
```

`ubelt.util_dict.dict_isect(*args)`

Dictionary set extension for `set.intersection()`

Constructs a dictionary that contains keys common between all inputs. The returned values will only belong to the first dictionary.

**Parameters**

**\*args** (*List[Dict[KT, VT] | Iterable[KT]]*) – A sequence of dictionaries (or sets of keys). The first argument should always be a dictionary, but the subsequent arguments can just be sets of keys.

**Returns**

OrderedDict if the first argument is an OrderedDict, otherwise dict

**Return type**

Dict[KT, VT] | OrderedDict[KT, VT]

---

**Note:** This function can be used as an alternative to `dict_subset()` where any key not in the dictionary is ignored. See the following example:

```
>>> import ubelt as ub
>>> # xdoctest: +IGNORE_WANT
>>> ub.dict_isect({'a': 1, 'b': 2, 'c': 3}, ['a', 'c', 'd'])
{'a': 1, 'c': 3}
```

**Example**

```
>>> import ubelt as ub
>>> ub.dict_isect({'a': 1, 'b': 1}, {'b': 2, 'c': 2})
{'b': 1}
>>> ub.dict_isect(odict([('a', 1), ('b', 2)]), odict([('c', 3)]))
OrderedDict()
>>> ub.dict_isect()
{}
```

`ubelt.util_dict.dict_diff(*args)`

Dictionary set extension for `set.difference()`

Constructs a dictionary that contains any of the keys in the first arg, which are not in any of the following args.

**Parameters**

**\*args** (*List[Dict[KT, VT] | Iterable[KT]]*) – A sequence of dictionaries (or sets of keys). The first argument should always be a dictionary, but the subsequent arguments can just be sets of keys.

**Returns**

OrderedDict if the first argument is an OrderedDict, otherwise dict

**Return type**

Dict[KT, VT] | OrderedDict[KT, VT]

---

**Todo:**

- [ ] Add inplace keyword argument, which modifies the first dictionary inplace.
-



### Example

```
>>> import ubelt as ub
>>> ub.dict_diff({'a': 1, 'b': 1}, {'a'}, {'c'})
{'b': 1}
>>> ub.dict_diff(odict([('a', 1), ('b', 2)]), odict([('c', 3)]))
OrderedDict([('a', 1), ('b', 2)])
>>> ub.dict_diff()
{}
>>> ub.dict_diff({'a': 1, 'b': 2}, {'c'})
```

`ubelt.util_dict.find_duplicates(items, k=2, key=None)`

Find all duplicate items in a list.

Search for all items that appear more than `k` times and return a mapping from each (k)-duplicate item to the positions it appeared in.

#### Parameters

- **items** (*Iterable[T]*) – hashable items possibly containing duplicates
- **k** (*int, default=2*) – only return items that appear at least `k` times.
- **key** (*Callable[[T], Any], default=None*) – Returns indices where `key(items[i])` maps to a particular value at least `k` times.

#### Returns

maps each duplicate item to the indices at which it appears

#### Return type

`dict[T, List[int]]`

### Notes

Similar to `more_itertools.duplicates_everseen()`, `more_itertools.duplicates_justseen()`.

### Example

```
>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> duplicates = ub.find_duplicates(items)
>>> # Duplicates are a mapping from each item that occurs 2 or more
>>> # times to the indices at which they occur.
>>> assert duplicates == {0: [0, 1, 6], 2: [3, 8], 3: [4, 5]}
>>> # You can set k=3 if you want to don't mind duplicates but you
>>> # want to find triplicates or quadruplets etc.
>>> assert ub.find_duplicates(items, k=3) == {0: [0, 1, 6]}
```

### Example

```
>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> # note: k can less then 2
>>> duplicates = ub.find_duplicates(items, k=0)
>>> print(ub.repr2(duplicates, nl=0))
{0: [0, 1, 6], 1: [2], 2: [3, 8], 3: [4, 5], 9: [9], 12: [7]}
```

### Example

```
>>> import ubelt as ub
>>> items = [10, 11, 12, 13, 14, 15, 16]
>>> duplicates = ub.find_duplicates(items, key=lambda x: x // 2)
>>> print(ub.repr2(duplicates, nl=0))
{5: [0, 1], 6: [2, 3], 7: [4, 5]}
```

`ubelt.util_dict.group_items(items, key)`

Groups a list of items by group id.

#### Parameters

- **items** (*Iterable[VT]*) – a list of items to group
- **key** (*Iterable[KT] | Callable[[VT], KT]*) – either a corresponding list of group-ids for each item or a function used to map each item to a group-id.

#### Returns

a mapping from each group id to the list of corresponding items

#### Return type

`dict[KT, List[VT]]`

### Example

```
>>> import ubelt as ub
>>> items = ['ham', 'jam', 'spam', 'eggs', 'cheese', 'banana']
>>> groupids = ['protein', 'fruit', 'protein', 'protein', 'dairy', 'fruit']
>>> id_to_items = ub.group_items(items, groupids)
>>> print(ub.repr2(id_to_items, nl=0))
{'dairy': ['cheese'], 'fruit': ['jam', 'banana'], 'protein': ['ham', 'spam', 'eggs', '']}
↪
```

`ubelt.util_dict.invert_dict(dict_, unique_vals=True, cls=None)`

Swaps the keys and values in a dictionary.

#### Parameters

- **dict\_** (*Dict[KT, VT]*) – dictionary to invert
- **unique\_vals** (*bool, default=True*) – if False, the values of the new dictionary are sets of the original keys.
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

**Returns**

the inverted dictionary

**Return type**

Dict[VT, KT] | Dict[VT, Set[KT]]

---

**Note:** The must values be hashable.

If the original dictionary contains duplicate values, then only one of the corresponding keys will be returned and the others will be discarded. This can be prevented by setting `unique_vals=False`, causing the inverted keys to be returned in a set.

---

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'a': 1, 'b': 2}
>>> inverted = ub.invert_dict(dict_)
>>> assert inverted == {1: 'a', 2: 'b'}
```

**Example**

```
>>> import ubelt as ub
>>> dict_ = ub.odict([(2, 'a'), (1, 'b'), (0, 'c'), (None, 'd')])
>>> inverted = ub.invert_dict(dict_)
>>> assert list(inverted.keys())[0] == 'a'
```

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'a': 1, 'b': 0, 'c': 0, 'd': 0, 'f': 2}
>>> inverted = ub.invert_dict(dict_, unique_vals=False)
>>> assert inverted == {0: {'b', 'c', 'd'}, 1: {'a'}, 2: {'f'}}
```

`ubelt.util_dict.map_keys(func, dict_, cls=None)`

Apply a function to every key in a dictionary.

Creates a new dictionary with the same values and modified keys. An error is raised if the new keys are not unique.

**Parameters**

- **func** (*Callable[[KT], T] | Mapping[KT, T]*) – a function or indexable object
- **dict\_** (*Dict[KT, VT]*) – a dictionary
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

**Returns**

transformed dictionary

**Return type**

Dict[T, VT]

### Raises

**Exception** – if multiple keys map to the same value

### Example

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> func = ord
>>> newdict = ub.map_keys(func, dict_)
>>> print(newdict)
>>> assert newdict == {97: [1, 2, 3], 98: []}
>>> dict_ = {0: [1, 2, 3], 1: []}
>>> func = ['a', 'b']
>>> newdict = ub.map_keys(func, dict_)
>>> print(newdict)
>>> assert newdict == {'a': [1, 2, 3], 'b': []}
```

`ubelt.util_dict.map_vals(func, dict_, cls=None)`

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

### Parameters

- **func** (*Callable[[VT], T] | Mapping[VT, T]*) – a function or indexable object
- **dict\_** (*Dict[KT, VT]*) – a dictionary
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

### Returns

transformed dictionary

### Return type

Dict[KT, T]

### Notes

Similar to `:module:`dictmap.dict_map``

### Example

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> newdict = ub.map_values(len, dict_)
>>> assert newdict == {'a': 3, 'b': 0}
```

### Example

```
>>> # Can also use an indexable as ``func``
>>> import ubelt as ub
>>> dict_ = {'a': 0, 'b': 1}
>>> func = [42, 21]
>>> newdict = ub.map_values(func, dict_)
>>> assert newdict == {'a': 42, 'b': 21}
>>> print(newdict)
```

`ubelt.util_dict.map_values(func, dict_, cls=None)`

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

#### Parameters

- **func** (*Callable[[VT], T] | Mapping[VT, T]*) – a function or indexable object
- **dict\_** (*Dict[KT, VT]*) – a dictionary
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

#### Returns

transformed dictionary

#### Return type

Dict[KT, T]

### Notes

Similar to `:module:`dictmap.dict_map``

### Example

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> newdict = ub.map_values(len, dict_)
>>> assert newdict == {'a': 3, 'b': 0}
```

### Example

```
>>> # Can also use an indexable as ``func``
>>> import ubelt as ub
>>> dict_ = {'a': 0, 'b': 1}
>>> func = [42, 21]
>>> newdict = ub.map_values(func, dict_)
>>> assert newdict == {'a': 42, 'b': 21}
>>> print(newdict)
```

`ubelt.util_dict.sorted_keys(dict_, key=None, reverse=False, cls=<class 'collections.OrderedDict'>)`

Return an ordered dictionary sorted by its keys

#### Parameters

- **dict\_** (*Dict*[*KT*, *VT*]) – dictionary to sort. The keys must be of comparable types.
- **key** (*Callable*[[*KT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed keys.
- **reverse** (*bool*, *default=False*) – if True returns in descending order
- **cls** (*type*) – specifies the dict return type

#### Returns

new dictionary where the keys are ordered

#### Return type

OrderedDict[KT, VT]

### Example

```
>>> import ubelt as ub
>>> dict_ = {'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}
>>> newdict = sorted_keys(dict_)
>>> print(ub.repr2(newdict, nl=0))
{'eggs': 1.2, 'jam': 2.92, 'spam': 2.62}
>>> newdict = sorted_keys(dict_, reverse=True)
>>> print(ub.repr2(newdict, nl=0))
{'spam': 2.62, 'jam': 2.92, 'eggs': 1.2}
>>> newdict = sorted_keys(dict_, key=lambda x: sum(map(ord, x)))
>>> print(ub.repr2(newdict, nl=0))
{'jam': 2.92, 'eggs': 1.2, 'spam': 2.62}
```

`ubelt.util_dict.sorted_vals(dict_, key=None, reverse=False, cls=<class 'collections.OrderedDict'>)`

Return an ordered dictionary sorted by its values

#### Parameters

- **dict\_** (*Dict*[*KT*, *VT*]) – dictionary to sort. The values must be of comparable types.
- **key** (*Callable*[[*VT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed values.
- **reverse** (*bool*, *default=False*) – if True returns in descending order
- **cls** (*type*) – specifies the dict return type

#### Returns

new dictionary where the values are ordered

#### Return type

OrderedDict[KT, VT]

### Example

```
>>> import ubelt as ub
>>> dict_ = {'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}
>>> newdict = sorted_values(dict_)
>>> print(ub.repr2(newdict, nl=0))
{'eggs': 1.2, 'spam': 2.62, 'jam': 2.92}
>>> newdict = sorted_values(dict_, reverse=True)
>>> print(ub.repr2(newdict, nl=0))
{'jam': 2.92, 'spam': 2.62, 'eggs': 1.2}
>>> newdict = sorted_values(dict_, key=lambda x: x % 1.6)
>>> print(ub.repr2(newdict, nl=0))
{'spam': 2.62, 'eggs': 1.2, 'jam': 2.92}
```

`ubelt.util_dict.sorted_values(dict_, key=None, reverse=False, cls=<class 'collections.OrderedDict'>)`

Return an ordered dictionary sorted by its values

#### Parameters

- **dict\_** (*Dict*[*KT*, *VT*]) – dictionary to sort. The values must be of comparable types.
- **key** (*Callable*[[*VT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed values.
- **reverse** (*bool*, *default=False*) – if True returns in descending order
- **cls** (*type*) – specifies the dict return type

#### Returns

new dictionary where the values are ordered

#### Return type

`OrderedDict`[*KT*, *VT*]

### Example

```
>>> import ubelt as ub
>>> dict_ = {'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}
>>> newdict = sorted_values(dict_)
>>> print(ub.repr2(newdict, nl=0))
{'eggs': 1.2, 'spam': 2.62, 'jam': 2.92}
>>> newdict = sorted_values(dict_, reverse=True)
>>> print(ub.repr2(newdict, nl=0))
{'jam': 2.92, 'spam': 2.62, 'eggs': 1.2}
>>> newdict = sorted_values(dict_, key=lambda x: x % 1.6)
>>> print(ub.repr2(newdict, nl=0))
{'spam': 2.62, 'eggs': 1.2, 'jam': 2.92}
```

`ubelt.util_dict.odict`

alias of `OrderedDict`

`ubelt.util_dict.named_product(_=None, **basis)`

Generates the Cartesian product of the `basis.values()`, where each generated item labeled by `basis.keys()`.

In other words, given a dictionary that maps each “axes” (i.e. some variable) to its “basis” (i.e. the possible values that it can take), generate all possible points in that grid (i.e. unique assignments of variables to values).

### Parameters

- `_ (Dict[str, List[VT]] | None, default=None)` – Use of this positional argument is not recommended. Instead specify all arguments as keyword args.

If specified, this should be a dictionary is unioned with the keyword args. This exists to support ordered dictionaries before Python 3.6, and may eventually be removed.

- `basis (Dict[str, List[VT]])` – A dictionary where the keys correspond to “columns” and the values are a list of possible values that “column” can take.

I.E. each key corresponds to an “axes”, the values are the list of possible values for that “axes”.

### Yields

`Dict[str, VT]` – a “row” in the “longform” data containing a point in the Cartesian product.

---

**Note:** This function is similar to `itertools.product()`, the only difference is that the generated items are a dictionary that retains the input keys instead of an tuple.

This function used to be called “basis\_product”, but “named\_product” might be more appropriate. This function exists in other places ([`minstrel271_namedproduct`], [`pytb_namedproduct`], and [`Hettinger_namedproduct`]).

---

## References

### Example

```
>>> # An example use case is looping over all possible settings in a
>>> # configuration dictionary for a grid search over parameters.
>>> import ubelt as ub
>>> basis = {
>>>     'arg1': [1, 2, 3],
>>>     'arg2': ['A1', 'B1'],
>>>     'arg3': [9999, 'Z2'],
>>>     'arg4': ['always'],
>>> }
>>> import ubelt as ub
>>> # sort input data for older python versions
>>> basis = ub.odict(sorted(basis.items()))
>>> got = list(ub.named_product(basis))
>>> print(ub.repr2(got, nl=-1))
[
    {'arg1': 1, 'arg2': 'A1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 1, 'arg2': 'A1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 1, 'arg2': 'B1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 1, 'arg2': 'B1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'A1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'A1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'B1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'B1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'A1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'A1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'B1', 'arg3': 9999, 'arg4': 'always'},
```

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```
{'arg1': 3, 'arg2': 'B1', 'arg3': 'Z2', 'arg4': 'always'}
]
```

### Example

```
>>> import ubelt as ub
>>> list(ub.named_product(a=[1, 2, 3]))
[{'a': 1}, {'a': 2}, {'a': 3}]
>>> # xdoctest: +IGNORE_WANT
>>> list(ub.named_product(a=[1, 2, 3], b=[4, 5]))
[{'a': 1, 'b': 4},
 {'a': 1, 'b': 5},
 {'a': 2, 'b': 4},
 {'a': 2, 'b': 5},
 {'a': 3, 'b': 4},
 {'a': 3, 'b': 5}]
```

`ubelt.util_dict.varied_values(longform, min_variations=0, default=NoParam)`

Given a list of dictionaries, find the values that differ between them.

#### Parameters

- **longform** (*List[Dict[KT, VT]]*) – This is longform data, as described in [\[SeabornLongform\]](#). It is a list of dictionaries.  
  
Each item in the list - or row - is a dictionary and can be thought of as an observation. The keys in each dictionary are the columns. The values of the dictionary must be hashable. Lists will be converted into tuples.
- **min\_variations** (*int, default=0*) – “columns” with fewer than `min_variations` unique values are removed from the result.
- **default** (*VT | NoParamType*) – if specified, unspecified columns are given this value. Defaults to `NoParam`.

#### Returns

a mapping from each “column” to the set of unique values it took over each “row”. If a column is not specified for each row, it is assumed to take a *default* value, if it is specified.

#### Return type

`Dict[KT, List[VT]]`

#### Raises

**KeyError** – If `default` is unspecified and all the rows do not contain the same columns.

## References

### Example

```
>>> # An example use case is to determine what values of a
>>> # configuration dictionary were tried in a random search
>>> # over a parameter grid.
>>> import ubelt as ub
>>> longform = [
>>>     {'col1': 1, 'col2': 'foo', 'col3': None},
>>>     {'col1': 1, 'col2': 'foo', 'col3': None},
>>>     {'col1': 2, 'col2': 'bar', 'col3': None},
>>>     {'col1': 3, 'col2': 'bar', 'col3': None},
>>>     {'col1': 9, 'col2': 'bar', 'col3': None},
>>>     {'col1': 1, 'col2': 'bar', 'col3': None},
>>> ]
>>> varied = ub.varied_values(longform)
>>> print('varied = {}'.format(ub.repr2(varied, nl=1)))
varied = {
    'col1': {1, 2, 3, 9},
    'col2': {'bar', 'foo'},
    'col3': {None},
}
```

### Example

```
>>> import ubelt as ub
>>> import random
>>> longform = [
>>>     {'col1': 1, 'col2': 'foo', 'col3': None},
>>>     {'col1': 1, 'col2': [1, 2], 'col3': None},
>>>     {'col1': 2, 'col2': 'bar', 'col3': None},
>>>     {'col1': 3, 'col2': 'bar', 'col3': None},
>>>     {'col1': 9, 'col2': 'bar', 'col3': None},
>>>     {'col1': 1, 'col2': 'bar', 'col3': None, 'extra_col': 3},
>>> ]
>>> # Operation fails without a default
>>> import pytest
>>> with pytest.raises(KeyError):
>>>     varied = ub.varied_values(longform)
>>> #
>>> # Operation works with a default
>>> varied = ub.varied_values(longform, default='<unset>')
>>> expected = {
>>>     'col1': {1, 2, 3, 9},
>>>     'col2': {'bar', 'foo', (1, 2)},
>>>     'col3': set([None]),
>>>     'extra_col': {'<unset>', 3},
>>> }
>>> print('varied = {!r}'.format(varied))
>>> assert varied == expected
```

### Example

```

>>> # xdoctest: +REQUIRES(PY3)
>>> # Random numbers are different in Python2, so skip in that case
>>> import ubelt as ub
>>> import random
>>> num_cols = 11
>>> num_rows = 17
>>> rng = random.Random(0)
>>> # Generate a set of columns
>>> columns = sorted(ub.hash_data(i)[0:8] for i in range(num_cols))
>>> # Generate rows for each column
>>> longform = [
>>>     {key: ub.hash_data(key)[0:8] for key in columns}
>>>     for _ in range(num_rows)
>>> ]
>>> # Add in some varied values in random positions
>>> for row in longform:
>>>     if rng.random() > 0.5:
>>>         for key in sorted(row.keys()):
>>>             if rng.random() > 0.95:
>>>                 row[key] = 'special-' + str(rng.randint(1, 32))
>>> varied = ub.varied_values(longform, min_variations=1)
>>> print('varied = {}'.format(ub.repr2(varied, nl=1, sort=True)))
varied = {
    '095f3e44': {'8fb4d4c9', 'special-23'},
    '365d11a1': {'daa409da', 'special-31', 'special-32'},
    '5815087d': {'1b823610', 'special-3'},
    '7b54b668': {'349a782c', 'special-10'},
    'b8244d02': {'d57bca90', 'special-8'},
    'f27b5bf8': {'fa0f90d1', 'special-19'},
}

```

### class ubelt.util\_dict.SetDict

Bases: dict

A dictionary subclass where all set operations are defined.

All of the set operations are defined in a key-wise fashion, that is it is like performing the operation on sets of keys.

---

**Note:** The SetDict class only defines key-wise set operations. Value-wise or item-wise operations are in general not hashable and therefore not supported. A heavier extension would be needed for that.

---

## Example

```
>>> import ubelt as ub
>>> primes = ub.sdict({v: f'prime_{v}' for v in [2, 3, 5, 7, 11]})
>>> evens = ub.sdict({v: f'even_{v}' for v in [0, 2, 4, 6, 8, 10]})
>>> odds = ub.sdict({v: f'odd_{v}' for v in [1, 3, 5, 7, 9, 11]})
>>> squares = ub.sdict({v: f'square_{v}' for v in [0, 1, 4, 9]})
>>> div3 = ub.sdict({v: f'div3_{v}' for v in [0, 3, 6, 9]})
>>> # All of the set methods are defined
>>> results1 = {}
>>> results1['ints'] = ints = odds.union(evens)
>>> results1['composites'] = ints.difference(primes)
>>> results1['even_primes'] = evens.intersection(primes)
>>> results1['odd_nonprimes_and_two'] = odds.symmetric_difference(primes)
>>> print('results1 = {}'.format(ub.repr2(results1, nl=2, sort=True)))
results1 = {
    'composites': {
        0: 'even_0',
        1: 'odd_1',
        4: 'even_4',
        6: 'even_6',
        8: 'even_8',
        9: 'odd_9',
        10: 'even_10',
    },
    'even_primes': {
        2: 'even_2',
    },
    'ints': {
        0: 'even_0',
        1: 'odd_1',
        2: 'even_2',
        3: 'odd_3',
        4: 'even_4',
        5: 'odd_5',
        6: 'even_6',
        7: 'odd_7',
        8: 'even_8',
        9: 'odd_9',
        10: 'even_10',
        11: 'odd_11',
    },
    'odd_nonprimes_and_two': {
        1: 'odd_1',
        2: 'prime_2',
        9: 'odd_9',
    },
}
>>> # As well as their corresponding binary operators
>>> assert results1['ints'] == odds | evens
>>> assert results1['composites'] == ints - primes
>>> assert results1['even_primes'] == evens & primes
>>> assert results1['odd_nonprimes_and_two'] == odds ^ primes
```

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```

>>> # These can also be used as classmethods
>>> assert results1['ints'] == ub.sdict.union(odds, evens)
>>> assert results1['composites'] == ub.sdict.difference(ints, primes)
>>> assert results1['even_primes'] == ub.sdict.intersection(evens, primes)
>>> assert results1['odd_nonprimes_and_two'] == ub.sdict.symmetric_difference(odds,
↳primes)
>>> # The nary variants are also implemented
>>> results2 = {}
>>> results2['nary_union'] = ub.sdict.union(primes, div3, odds)
>>> results2['nary_difference'] = ub.sdict.difference(primes, div3, odds)
>>> results2['nary_intersection'] = ub.sdict.intersection(primes, div3, odds)
>>> # Note that the definition of symmetric difference might not be what you think
↳in the nary case.
>>> results2['nary_symmetric_difference'] = ub.sdict.symmetric_difference(primes,
↳div3, odds)
>>> print('results2 = {}'.format(ub.repr2(results2, nl=2, sort=True)))
results2 = {
    'nary_difference': {
        2: 'prime_2',
    },
    'nary_intersection': {
        3: 'prime_3',
    },
    'nary_symmetric_difference': {
        0: 'div3_0',
        1: 'odd_1',
        2: 'prime_2',
        3: 'odd_3',
        6: 'div3_6',
    },
    'nary_union': {
        0: 'div3_0',
        1: 'odd_1',
        2: 'prime_2',
        3: 'odd_3',
        5: 'odd_5',
        6: 'div3_6',
        7: 'odd_7',
        9: 'odd_9',
        11: 'odd_11',
    },
}

```

### Example

```
>>> # A neat thing about our implementation is that often the right
>>> # hand side is not required to be a dictionary, just something
>>> # that can be cast to a set.
>>> import ubelt as ub
>>> primes = ub.sdict({2: 'a', 3: 'b', 5: 'c', 7: 'd', 11: 'e'})
>>> assert primes - {2, 3} == {5: 'c', 7: 'd', 11: 'e'}
>>> assert primes & {2, 3} == {2: 'a', 3: 'b'}
>>> # Union does need to have a second dictionary
>>> import pytest
>>> with pytest.raises(AttributeError):
>>>     primes | {2, 3}
```

`copy()`

### Example

```
>>> import ubelt as ub
>>> a = ub.sdict({1: 1, 2: 2, 3: 3})
>>> b = ub.udict({1: 1, 2: 2, 3: 3})
>>> c = a.copy()
>>> d = b.copy()
>>> assert c is not a
>>> assert d is not b
>>> assert d == b
>>> assert c == a
>>> list(map(type, [a, b, c, d]))
>>> assert isinstance(c, ub.sdict)
>>> assert isinstance(d, ub.udict)
```

`union(*others)`

Return the key-wise union of two or more dictionaries.

For items with intersecting keys, dictionaries towards the end of the sequence are given precedence.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.
- **\*others** – other dictionary like objects that have an `items` method. (i.e. it must return an iterable of 2-tuples where the first item is hashable.)

#### Returns

whatever the dictionary type of the first argument is

#### Return type

`dict`

### Example

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> assert a | b == {2: 'B_c', 3: 'A_d', 5: 'A_f', 7: 'B_h', 4: 'B_e', 0: 'B_a'}
>>> a.union(b)
>>> a | b | c
>>> res = ub.SetDict.union(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{0: B_a, 2: C_c, 3: C_d, 4: B_e, 5: A_f, 7: B_h, 8: C_i, 9: D_j, 10: D_k, 11: D_
↪l}
```

### intersection(\*others)

Return the key-wise intersection of two or more dictionaries.

All items returned will be from the first dictionary for keys that exist in all other dictionaries / sets provided.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.
- **\*others** – other dictionary or set like objects that can be coerced into a set of keys.

#### Returns

whatever the dictionary type of the first argument is

#### Return type

*dict*

### Example

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> assert a & b == {2: 'A_c', 7: 'A_h'}
>>> a.intersection(b)
>>> a & b & c
>>> res = ub.SetDict.intersection(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{}
```

### difference(\*others)

Return the key-wise difference between this dictionary and one or more other dictionary / keys.

The returned items will be from the first dictionary, and will only contain keys that do not appear in any of the other dictionaries / sets.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.

- **\*others** – other dictionary or set like objects that can be coerced into a set of keys.

#### Returns

whatever the dictionary type of the first argument is

#### Return type

dict

### Example

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> assert a - b == {3: 'A_d', 5: 'A_f'}
>>> a.difference(b)
>>> a - b - c
>>> res = ub.SetDict.difference(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{5: A_f}
```

#### **symmetric\_difference**(\*others)

Return the key-wise symmetric difference between this dictionary and one or more other dictionaries.

Returns items that are (key-wise) in an odd number of the given dictionaries. This is consistent with the standard n-ary definition of symmetric difference [[WikiSymDiff](#)] and corresponds with the xor operation.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.
- **\*others** – other dictionary or set like objects that can be coerced into a set of keys.

#### Returns

whatever the dictionary type of the first argument is

#### Return type

dict

### References

### Example

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> a ^ b
{3: 'A_d', 5: 'A_f', 4: 'B_e', 0: 'B_a'}
>>> a.symmetric_difference(b)
>>> a - b - c
```

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```
>>> res = ub.SetDict.symmetric_difference(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{0: B_a, 2: C_c, 4: B_e, 5: A_f, 8: C_i, 9: D_j, 10: D_k, 11: D_l}
```

**class ubelt.util\_dict.UDict**Bases: *SetDict*

A subclass of dict with ubelt enhancements

This builds on top of *SetDict* which itself is a simple extension that contains only that extra functionality. The extra invert, map, sorted, and peek functions are less fundamental and there are at least reasonable workarounds when they are not available.

The UDict class is a simple subclass of dict that provides the following upgrades:

- **set operations - inherited from *SetDict***
  - intersection - find items in common
  - union - merge dicts
  - difference - find items in one but not the other
  - symmetric\_difference - find items that appear an odd number of times
- **subdict** - take a subset with optional default values. (similar to intersection, but the later ignores non-common values)
- **inversion** -
  - invert - swaps a dictionary keys and values (with options for dealing with duplicates).
- **mapping** -
  - map\_keys - applies a function over each key and keeps the values the same
  - map\_values - applies a function over each key and keeps the values the same
- **sorting** -
  - sorted\_keys - returns a dictionary ordered by the keys
  - sorted\_values - returns a dictionary ordered by the values

IMO key-wise set operations on dictionaries are fundamental and sorely missing from the stdlib, mapping is super convinient, sorting and inversion are less common, but still useful to have.

**Todo:**

- [ ] UbeltDict, UltraDict, not sure what the name is. We may just rename this to Dict,

### Example

```
>>> import ubelt as ub
>>> a = ub.udict({1: 20, 2: 20, 3: 30, 4: 40})
>>> b = ub.udict({0: 0, 2: 20, 4: 42})
>>> c = ub.udict({3: -1, 5: -1})
>>> # Demo key-wise set operations
>>> assert a & b == {2: 20, 4: 40}
>>> assert a - b == {1: 20, 3: 30}
>>> assert a ^ b == {1: 20, 3: 30, 0: 0}
>>> assert a | b == {1: 20, 2: 20, 3: 30, 4: 42, 0: 0}
>>> # Demo new n-ary set methods
>>> a.union(b, c) == {1: 20, 2: 20, 3: -1, 4: 42, 0: 0, 5: -1}
>>> a.intersection(b, c) == {}
>>> a.difference(b, c) == {1: 20}
>>> a.symmetric_difference(b, c) == {1: 20, 0: 0, 5: -1}
>>> # Demo new quality of life methods
>>> assert a.subdict({2, 4, 6, 8}, default=None) == {8: None, 2: 20, 4: 40, 6: None}
>>> assert a.invert() == {20: 2, 30: 3, 40: 4}
>>> assert a.invert(unique_vals=0) == {20: {1, 2}, 30: {3}, 40: {4}}
>>> assert a.peek_key() == ub.peek(a.keys())
>>> assert a.peek_value() == ub.peek(a.values())
>>> assert a.map_keys(lambda x: x * 10) == {10: 20, 20: 20, 30: 30, 40: 40}
>>> assert a.map_values(lambda x: x * 10) == {1: 200, 2: 200, 3: 300, 4: 400}
```

**subdict**(keys, default=NoneParam)

Get a subset of a dictionary

#### Parameters

- **self** (*Dict[KT, VT]*) – dictionary or the implicit instance
- **keys** (*Iterable[KT]*) – keys to take from self
- **default** (*Optional[object] | NoParamType*) – if specified uses default if keys are missing.

#### Raises

**KeyError** – if a key does not exist and default is not specified

### Example

```
>>> import ubelt as ub
>>> a = ub.udict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> s = a.subdict({2, 5})
>>> print('s = {}'.format(ub.repr2(s, nl=0)))
s = {2: 'A_c', 5: 'A_f'}
>>> import pytest
>>> with pytest.raises(KeyError):
>>>     s = a.subdict({2, 5, 100})
>>> s = a.subdict({2, 5, 100}, default='DEF')
>>> print('s = {}'.format(ub.repr2(s, nl=0)))
s = {2: 'A_c', 5: 'A_f', 100: 'DEF'}
```

**invert**(unique\_vals=True)

Swaps the keys and values in a dictionary.

**Parameters**

- **self** (*Dict[KT, VT]*) – dictionary or the implicit instance to invert
- **unique\_vals** (*bool, default=True*) – if False, the values of the new dictionary are sets of the original keys.
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

**Returns**

the inverted dictionary

**Return type**

`Dict[VT, KT] | Dict[VT, Set[KT]]`

---

**Note:** The must values be hashable.

If the original dictionary contains duplicate values, then only one of the corresponding keys will be returned and the others will be discarded. This can be prevented by setting `unique_vals=False`, causing the inverted keys to be returned in a set.

---

**Example**

```
>>> import ubelt as ub
>>> inverted = ub.udict({'a': 1, 'b': 2}).invert()
>>> assert inverted == {1: 'a', 2: 'b'}
```

**map\_keys(func)**

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

**Parameters**

- **self** (*Dict[KT, VT]*) – a dictionary or the implicit instance.
- **func** (*Callable[[VT], T] | Mapping[VT, T]*) – a function or indexable object

**Returns**

transformed dictionary

**Return type**

`Dict[KT, T]`

**Example**

```
>>> import ubelt as ub
>>> new = ub.udict({'a': [1, 2, 3], 'b': []}).map_keys(ord)
>>> assert new == {97: [1, 2, 3], 98: []}
```

**map\_values(func)**

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – a dictionary or the implicit instance.
- **func** (*Callable*[[*VT*], *T*] | *Mapping*[*VT*, *T*]) – a function or indexable object

**Returns**

transformed dictionary

**Return type**

*Dict*[*KT*, *T*]

**Example**

```
>>> import ubelt as ub
>>> newdict = ub.udict({'a': [1, 2, 3], 'b': []}).map_values(len)
>>> assert newdict == {'a': 3, 'b': 0}
```

**sorted\_keys**(*key=None*, *reverse=False*)

Return an ordered dictionary sorted by its keys

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – dictionary to sort or the implicit instance. The keys must be of comparable types.
- **key** (*Callable*[[*KT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed keys.
- **reverse** (*bool*, *default=False*) – if True returns in descending order

**Returns**

new dictionary where the keys are ordered

**Return type**

*OrderedDict*[*KT*, *VT*]

**Example**

```
>>> import ubelt as ub
>>> new = ub.udict({'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}).sorted_keys()
>>> assert new == ub.odict([('eggs', 1.2), ('jam', 2.92), ('spam', 2.62)])
```

**sorted\_values**(*key=None*, *reverse=False*)

Return an ordered dictionary sorted by its values

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – dictionary to sort or the implicit instance. The values must be of comparable types.
- **key** (*Callable*[[*VT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed values.
- **reverse** (*bool*, *default=False*) – if True returns in descending order

**Returns**

new dictionary where the values are ordered

**Return type**

*OrderedDict*[*KT*, *VT*]

### Example

```
>>> import ubelt as ub
>>> new = ub.udict({'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}).sorted_values()
>>> assert new == ub.odict([('eggs', 1.2), ('spam', 2.62), ('jam', 2.92)])
```

**peek\_key**(*default=NoParam*)

Get the first key in the dictionary

**Parameters**

- **self** (*Dict*) – a dictionary or the implicit instance
- **default** (*T | NoParamType*) – default item to return if the iterable is empty, otherwise a `StopIteration` error is raised

**Returns**

the first value or the default

**Return type**

KT

### Example

```
>>> import ubelt as ub
>>> assert ub.udict({1: 2}).peek_key() == 1
```

**peek\_value**(*default=NoParam*)

Get the first value in the dictionary

**Parameters**

- **self** (*Dict[KT, VT]*) – a dictionary or the implicit instance
- **default** (*T | NoParamType*) – default item to return if the iterable is empty, otherwise a `StopIteration` error is raised

**Returns**

the first value or the default

**Return type**

VT

### Example

```
>>> import ubelt as ub
>>> assert ub.udict({1: 2}).peek_value() == 2
```

**ubelt.util\_dict.sdict**alias of *SetDict***ubelt.util\_dict.udict**alias of *UDict*

### 1.28.1.1.9 ubelt.util\_download module

Helpers for downloading data

The `download()` function access the network and requests the content at a specific url using `urllib` or `urllib2`. You can either specify where the data goes or download it to the default location in ubelt cache. Either way this function returns the location of the downloaded data. You can also specify the expected hash in order to check the validity of the data. By default downloading is verbose.

The `grabdata()` function is almost identical to `download()`, but it checks if the data already exists in the download location, and only downloads if it needs to.

```
ubelt.util_download.download(url, fpath=None, dpath=None, fname=None, appname=None,
                             hash_prefix=None, hasher='sha512', chunksize=8192, verbose=1,
                             timeout=None, progkw=None)
```

Downloads a url to a file on disk.

If unspecified the location and name of the file is chosen automatically. A `hash_prefix` can be specified to verify the integrity of the downloaded data. This function will download the data every time its called. For cached downloading see `grabdata`.

#### Parameters

- **url** (*str*) – The url to download.
- **fpath** (*Optional[str | PathLike | io.BytesIO]*) – The path to download to. Defaults to base-name of url and ubelt’s application cache. If this is a `io.BytesIO` object then information is directly written to this object (note this prevents the use of temporary files).
- **dpath** (*Optional[PathLike]*) – where to download the file. If unspecified `appname` is used to determine this. Mutually exclusive with `fpath`.
- **fname** (*Optional[str]*) – What to name the downloaded file. Defaults to the url basename. Mutually exclusive with `fpath`.
- **appname** (*str*) – set `dpath` to `ub.get_app_cache_dir(appname or 'ubelt')` if `dpath` and `fpath` are not given.
- **hash\_prefix** (*None | str*) – If specified, download will retry / error if the file hash does not match this value. Defaults to `None`.
- **hasher** (*str | Hasher*) – If `hash_prefix` is specified, this indicates the hashing algorithm to apply to the file. Defaults to `sha512`.
- **chunksize** (*int*) – Download chunksize. Default to `2 ** 13`
- **verbose** (*int | bool*) – Verbosity flag. Quiet is 0, higher is more verbose. Defaults to 1.
- **timeout** (*float | NoParamType*) – Specify timeout in seconds for `urllib.request.urlopen()`. (if not specified, the global default timeout setting will be used) This only works for HTTP, HTTPS and FTP connections for blocking operations like the connection attempt.
- **progkw** (*Dict | NoParamType*) – if specified provides extra arguments to the progress iterator. See `ubelt.progiter.ProgIter` for available options.

#### Returns

`fpath` - path to the downloaded file.

#### Return type

`str | PathLike`

#### Raises

- `URLError` - if there is problem downloading the url -
- `RuntimeError` - if the hash does not match the `hash_prefix` -

---

**Note:** Based largely on code in pytorch [[TorchDL](#)] with modifications influenced by other resources [[Shichao\\_2012](#)] [[SO\\_15644964](#)] [[SO\\_16694907](#)].

---

## References

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> from ubelt.util_download import * # NOQA
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> fpath = download(url)
>>> print(basename(fpath))
rqwaDag.png
```

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> import io
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> file = io.BytesIO()
>>> fpath = ub.download(url, file)
>>> file.seek(0)
>>> data = file.read()
>>> assert ub.hash_data(data, hasher='sha1').startswith('f79ea24571')
```

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> fpath = download(url, hasher='sha1', hash_prefix=
↳ 'f79ea24571da6ddd2ba12e3d57b515249ecb8a35')
Downloading url='http://i.imgur.com/rqwaDag.png' to fpath=...rqwaDag.png
...
...1233/1233... rate=... Hz, eta=..., total=...
```

## Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import pytest
>>> import ubelt as ub
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> #fpath = download(url, hasher='sha1', hash_prefix=
↳ 'f79ea24571da6ddd2ba12e3d57b515249ecb8a35')
>>> # test download from girder
>>> #url = 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/download'
>>> #ub.download(url, hasher='sha512', hash_prefix='c98a46cb31205cf')
>>> with pytest.raises(RuntimeError):
>>>     ub.download(url, hasher='sha512', hash_prefix='BAD_HASH')
```

```
ubelt.util_download.grabdata(url, fpath=None, dpath=None, fname=None, redo=False, verbose=1,
                             appname=None, hash_prefix=None, hasher='sha512', expires=None,
                             **download_kw)
```

Downloads a file, caches it, and returns its local path.

If unspecified the location and name of the file is chosen automatically. A `hash_prefix` can be specified to verify the integrity of the downloaded data.

### Parameters

- **url** (*str*) – url of the file to download
- **fpath** (*Optional[str | PathLike]*) – The full path to download the file to. If unspecified, the arguments *dpath* and *fname* are used to determine this.
- **dpath** (*Optional[str | PathLike]*) – where to download the file. If unspecified *appname* is used to determine this. Mutually exclusive with *fpath*.
- **fname** (*Optional[str]*) – What to name the downloaded file. Defaults to the url basename. Mutually exclusive with *fpath*.
- **redo** (*bool, default=False*) – if True forces redownload of the file
- **verbose** (*int*) – Verbosity flag. Quiet is 0, higher is more verbose. Defaults to 1.
- **appname** (*str*) – set *dpath* to `ub.get_app_cache_dir(appname or 'ubelt')` if *dpath* and *fpath* are not given.
- **hash\_prefix** (*None | str*) – If specified, `grabdata` verifies that this matches the hash of the file, and then saves the hash in a adjacent file to certify that the download was successful. Defaults to `None`.
- **hasher** (*str | Hasher*) – If `hash_prefix` is specified, this indicates the hashing algorithm to apply to the file. Defaults to `sha512`. NOTE: Only pass hasher as a string. Passing as an instance is deprecated and can cause unexpected results.
- **expires** (*str | int | datetime.datetime*) – when the cache should expire and redownload or the number of seconds to wait before the cache should expire.
- **\*\*download\_kw** – additional kwargs to pass to `ubelt.util_download.download()`

### Returns

*fpath* - path to downloaded or cached file.

### Return type

*str | PathLike*



## CommandLine

```
xdoctest -m ubelt.util_download grabdata --network
```

## Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> fpath = ub.grabdata(url, fname='mario.png')
>>> result = basename(fpath)
>>> print(result)
mario.png
```

## Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> import json
>>> fname = 'foo.bar'
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> prefix1 = '944389a39dfb8fa9'
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1, verbose=3)
>>> stamp_fpath = ub.Path(fpath + '.stamp_sha512.json')
>>> assert json.loads(stamp_fpath.read_text())['hash'][0].startswith(prefix1)
>>> # Check that the download doesn't happen again
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> # todo: check file timestamps have not changed
>>> #
>>> # Check redo works with hash
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1, redo=True)
>>> # todo: check file timestamps have changed
>>> #
>>> # Check that a redownload occurs when the stamp is changed
>>> with open(stamp_fpath, 'w') as file:
>>>     file.write('corrupt-stamp')
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> assert json.loads(stamp_fpath.read_text())['hash'][0].startswith(prefix1)
>>> #
>>> # Check that a redownload occurs when the stamp is removed
>>> ub.delete(stamp_fpath)
>>> with open(fpath, 'w') as file:
>>>     file.write('corrupt-data')
>>> assert not ub.hash_file(fpath, base='hex', hasher='sha512').startswith(prefix1)
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> assert ub.hash_file(fpath, base='hex', hasher='sha512').startswith(prefix1)
>>> #
>>> # Check that requesting new data causes redownload
>>> #url2 = 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/download'
>>> #prefix2 = 'c98a46cb31205cf' # hack SSL
```

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```
>>> url2 = 'http://i.imgur.com/rqwaDag.png'
>>> prefix2 = '944389a39dfb8fa9'
>>> fpath = ub.grabdata(url2, fname=fname, hash_prefix=prefix2)
>>> assert json.loads(stamp_fpath.read_text())['hash'][0].startswith(prefix2)
```

### 1.28.1.1.10 ubelt.util\_download\_manager module

A simple download manager

**class** `ubelt.util_download_manager.DownloadManager`(*download\_root=None, mode='thread', max\_workers=None, cache=True*)

Bases: `object`

Simple implementation of the download manager

#### Variables

- **download\_root** (*str* / *PathLike*) – default download location
- **jobs** (*List[concurrent.futures.Future]*) – list of jobs

#### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> # Download a file with a known hash
>>> manager = ub.DownloadManager()
>>> job = manager.submit(
>>>     'http://i.imgur.com/rqwaDag.png',
>>>     hash_prefix=
↪ '31a129618c87dd667103e7154182e3c39a605eefe90f84f2283f3c87efee8e40'
>>> )
>>> fpath = job.result()
>>> print('fpath = {!r}'.format(fpath))
```

#### Example

```
>>> # Does not require network
>>> import ubelt as ub
>>> manager = ub.DownloadManager()
>>> for i in range(100):
...     job = manager.submit('localhost/might-not-exist-i-{}'.format(i))
>>> file_paths = []
>>> for job in manager.as_completed(prog=True):
...     try:
...         fpath = job.result()
...         file_paths += [fpath]
...     except Exception:
...         pass
>>> print('file_paths = {!r}'.format(file_paths))
```

## Example

```

>>> # xdoctest: +REQUIRES(--network)
>>> import pytest
>>> import ubelt as ub
>>> manager = ub.DownloadManager()
>>> item1 = {
>>>     'url': 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/
↳download',
>>>     'dst': 'forgot_what_the_name_really_is',
>>>     'hash_prefix': 'c98a46cb31205cf',
>>>     'hasher': 'sha512',
>>> }
>>> item2 = {
>>>     'url': 'http://i.imgur.com/rqwaDag.png',
>>>     'hash_prefix': 'f79ea24571da6ddd2ba12e3d57b515249ecb8a35',
>>>     'hasher': 'sha1',
>>> }
>>> item1 = item2 # hack around SSL error
>>> manager.submit(**item1)
>>> manager.submit(**item2)
>>> for job in manager.as_completed(prog=True, verbose=3):
>>>     fpath = job.result()
>>>     print('fpath = {!r}'.format(fpath))

```

**submit**(url, dst=None, hash\_prefix=None, hasher='sha256')

Add a job to the download Queue

### Parameters

- **url** (*str* | *PathLike*) – pointer to the data to download
- **dst** (*str* | *None*) – The relative or absolute path to download to. If unspecified, the destination name is derived from the url.
- **hash\_prefix** (*str* | *None*) – If specified, verifies that the hash of the downloaded file starts with this.
- **hasher** (*str*; *default*='sha256') – hashing algorithm to use if hash\_prefix is specified.

### Returns

a Future object that will point to the downloaded location.

### Return type

`concurrent.futures.Future`

**as\_completed**(prog=None, desc=None, verbose=1)

Generate completed jobs as they become available

### Example

```
>>> import pytest
>>> import ubelt as ub
>>> download_root = ub.ensure_app_config_dir('ubelt', 'dlman')
>>> manager = ub.DownloadManager(download_root=download_root,
>>>                               cache=False)
>>> for i in range(3):
>>>     manager.submit('localhost')
>>> results = list(manager)
>>> print('results = {!r}'.format(results))
>>> manager.shutdown()
```

#### shutdown()

Cancel all jobs and close all connections.

#### 1.28.1.1.11 ubelt.util\_format module

Defines the function `repr2()`, which allows for a bit more customization than `repr()` or `pprint()`. See the docstring for more details.

Two main goals of `repr2` are to provide nice string representations of nested data structures and make those “eval-able” whenever possible. As an example take the value `float('inf')`, which normally has a non-evalable repr of `inf`:

```
>>> import ubelt as ub
>>> ub.repr2(float('inf'))
"float('inf')"
```

The newline (or `nl`) keyword argument can control how deep in the nesting newlines are allowed.

```
>>> print(ub.repr2({1: float('nan'), 2: float('inf'), 3: 3.0}))
{
    1: float('nan'),
    2: float('inf'),
    3: 3.0,
}
```

```
>>> print(ub.repr2({1: float('nan'), 2: float('inf'), 3: 3.0}, nl=0))
{1: float('nan'), 2: float('inf'), 3: 3.0}
```

You can also define or overwrite how representations for different types are created. You can either create your own extension object, or you can monkey-patch `ub.util_format.FORMATTER_EXTENSIONS` without specifying the `extensions` keyword argument (although this will be a global change).

```
>>> extensions = ub.util_format.FormatterExtensions()
>>> @extensions.register(float)
>>> def my_float_formatter(data, **kw):
>>>     return "monkey({})".format(data)
>>> print(ub.repr2({1: float('nan'), 2: float('inf'), 3: 3.0}, nl=0,
↳ extensions=extensions))
{1: monkey(nan), 2: monkey(inf), 3: monkey(3.0)}
```

As of `ubelt 1.1.0` you can now access and update the default extensions via the `repr2` function itself.

```
>>> # xdoctest: +SKIP
>>> # We skip this at test time to not modify global state
>>> @ub.repr2.EXTENSIONS.register(float)
>>> def my_float_formatter(data, **kw):
>>>     return "monkey2({})".format(data)
>>> print(ub.repr2({1: float('nan'), 2: float('inf'), 3: 3.0}, nl=0))
```

`ubelt.util_format.repr2(data, **kwargs)`

Makes a pretty string representation of data.

Makes a pretty and easy-to-doctest string representation. Has nice handling of common nested datatypes. This is an alternative to `repr`, and `pprint.pformat()`.

This output of this function are configurable. By default it aims to produce strings that are consistent, compact, and executable. This makes them great for doctests.

---

**Note:** This function has many keyword arguments that can be used to customize the final representation. For convenience some of the more frequently used kwargs have short aliases. See “Kwargs” for more details.

---

#### Parameters

**data** (*object*) – an arbitrary python object to form the string “representation” of

#### Kwargs:

##### **si, stritems, (bool):**

dict/list items use str instead of repr

##### **strkeys, sk (bool):**

dict keys use str instead of repr

##### **strvals, sv (bool):**

dict values use str instead of repr

##### **nl, newlines (int | bool):**

number of top level nestings to place a newline after. If true all items are followed by newlines regardless of nesting level. Defaults to 1 for lists and True for dicts.

##### **nobr, nobraces (bool, default=False):**

if True, text will not contain outer braces for containers

##### **cbr, compact\_brace (bool, default=False):**

if True, braces are compactified (i.e. they will not have newlines placed directly after them, think java / K&R / 1TBS)

##### **trailsep, trailing\_sep (bool):**

if True, a separator is placed after the last item in a sequence. By default this is True if there are any `nl > 0`.

##### **explicit (bool, default=False):**

changes dict representation from `{k1: v1, ...}` to `dict(k1=v1, ...)`.

##### **Modifies:**

default kvsep is modified to '=' dict braces from `{}` to `dict()`.

##### **compact (bool, default=False):**

Produces values more suitable for space constrained environments

**Modifies:**

default kvsep is modified to '=' default itemsep is modified to ' ' default nobraces is modified to 1. default newlines is modified to 0. default strkeys to True default strvals to True

**precision (int, default=None):**

if specified floats are formatted with this precision

**kvsep (str, default=': '):**

separator between keys and values

**itemsep (str, default=' '):**

separator between items. This separator is placed after commas, which are currently not configurable. This may be modified in the future.

**sort (bool | callable, default=None):**

if None, then sort unordered collections, but keep the ordering of ordered collections. This option attempts to be deterministic in most cases.

New in 0.8.0: if sort is callable, it will be used as a key-function to sort all collections.

if False, then nothing will be sorted, and the representation of unordered collections will be arbitrary and possibly non-deterministic.

if True, attempts to sort all collections in the returned text. Currently if True this WILL sort lists. Currently if True this WILL NOT sort OrderedDicts.

**NOTE:**

The previous behavior may not be intuitive, as such the behavior of this arg is subject to change.

**suppress\_small (bool):**

passed to `numpy.array2string()` for ndarrays

**max\_line\_width (int):**

passed to `numpy.array2string()` for ndarrays

**with\_dtype (bool):**

only relevant to `numpy.ndarrays`. if True includes the dtype. Defaults to *not strvals*.

**align (bool | str, default=False):**

if True, will align multi-line dictionaries by the kvsep

**extensions (FormatterExtensions):**

a custom [FormatterExtensions](#) instance that can overwrite or define how different types of objects are formatted.

**Returns**

outstr - output string

**Return type**

`str`

---

**Note:** There are also internal kwargs, which should not be used:

`_return_info` (bool): return information about child context

`_root_info` (depth): information about parent context

---

**RelatedWork:**

`rich.pretty.pretty_repr()` `pprint.pformat()`

## Example

```
>>> import ubelt as ub
>>> dict_ = {
...     'custom_types': [slice(0, 1, None), 1/3],
...     'nest_dict': {'k1': [1, 2, {3: {4, 5}}],
...                   'key2': [1, 2, {3: {4, 5}}],
...                   'key3': [1, 2, {3: {4, 5}}],
...                   },
...     'nest_dict2': {'k': [1, 2, {3: {4, 5}}]},
...     'nested_tuples': [tuple([1]), tuple([2, 3]), frozenset([4, 5, 6])],
...     'one_tup': tuple([1]),
...     'simple_dict': {'spam': 'eggs', 'ham': 'jam'},
...     'simple_list': [1, 2, 'red', 'blue'],
...     'odict': ub.odict([(1, '1'), (2, '2')]),
... }
>>> # In the interest of saving space we are only going to show the
>>> # output for the first example.
>>> result = ub.repr2(dict_, nl=1, precision=2)
>>> print(result)
{
  'custom_types': [slice(0, 1, None), 0.33],
  'nest_dict': {'k1': [1, 2, {3: {4, 5}}], 'key2': [1, 2, {3: {4, 5}}], 'key3': ↵
↵[1, 2, {3: {4, 5}}]},
  'nest_dict2': {'k': [1, 2, {3: {4, 5}}]},
  'nested_tuples': [(1,), (2, 3), {4, 5, 6}],
  'odict': {1: '1', 2: '2'},
  'one_tup': (1,),
  'simple_dict': {'ham': 'jam', 'spam': 'eggs'},
  'simple_list': [1, 2, 'red', 'blue'],
}
>>> # You can try the rest yourself.
>>> result = ub.repr2(dict_, nl=3, precision=2); print(result)
>>> result = ub.repr2(dict_, nl=2, precision=2); print(result)
>>> result = ub.repr2(dict_, nl=1, precision=2, itemsep=' ', explicit=True); ↵
↵print(result)
>>> result = ub.repr2(dict_, nl=1, precision=2, nobr=1, itemsep=' ', explicit=True); ↵
↵print(result)
>>> result = ub.repr2(dict_, nl=3, precision=2, cbr=True); print(result)
>>> result = ub.repr2(dict_, nl=3, precision=2, si=True); print(result)
>>> result = ub.repr2(dict_, nl=3, sort=True); print(result)
>>> result = ub.repr2(dict_, nl=3, sort=False, trailing_sep=False); print(result)
>>> result = ub.repr2(dict_, nl=3, sort=False, trailing_sep=False, nobr=True); ↵
↵print(result)
```

### Example

```
>>> import ubelt as ub
>>> def _nest(d, w):
...     if d == 0:
...         return {}
...     else:
...         return {'n{0}'.format(d): _nest(d - 1, w + 1), 'm{0}'.format(d): _nest(d -
↪ 1, w + 1)}
>>> dict_ = _nest(d=4, w=1)
>>> result = ub.repr2(dict_, nl=6, precision=2, cbr=1)
>>> print('---')
>>> print(result)
>>> result = ub.repr2(dict_, nl=-1, precision=2)
>>> print('---')
>>> print(result)
```

### Example

```
>>> import ubelt as ub
>>> data = {'a': 100, 'b': [1, '2', 3], 'c': {20:30, 40: 'five'}}
>>> print(ub.repr2(data, nl=1))
{
    'a': 100,
    'b': [1, '2', 3],
    'c': {20: 30, 40: 'five'},
}
>>> # Compact is useful for things like timerit.Timerit labels
>>> print(ub.repr2(data, compact=True))
a=100,b=[1,2,3],c={20=30,40=five}
>>> print(ub.repr2(data, compact=True, nobr=False))
{a=100,b=[1,2,3],c={20=30,40=five}}
```

### class ubelt.util\_format.FormatterExtensions

Bases: `object`

Helper class for managing non-builtin (e.g. numpy) format types.

This module (`ubelt.util_format`) maintains a global set of basic extensions, but it is also possible to create a locally scoped set of extensions and explicitly pass it to `repr2`. The following example demonstrates this.

### Example

```
>>> import ubelt as ub
>>> class MyObject(object):
>>>     pass
>>> data = {'a': [1, 2.2222, MyObject()], 'b': MyObject()}
>>> # Create a custom set of extensions
>>> extensions = ub.FormatterExtensions()
>>> # Register a function to format your specific type
>>> @extensions.register(MyObject)
```

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```

>>> def format_myobject(data, **kwargs):
>>>     return 'I can do anything here'
>>> # Repr2 will now respect the passed custom extensions
>>> # Note that the global extensions will still be respected
>>> # unless they are overloaded.
>>> print(ub.repr2(data, nl=-1, precision=1, extensions=extensions))
{
  'a': [1, 2.2, I can do anything here],
  'b': I can do anything here
}
>>> # Overload the formatter for float and int
>>> @extensions.register((float, int))
>>> def format_myobject(data, **kwargs):
>>>     return str((data + 10) // 2)
>>> print(ub.repr2(data, nl=-1, precision=1, extensions=extensions))
{
  'a': [5, 6.0, I can do anything here],
  'b': I can do anything here
}

```

**register(key)**Registers a custom formatting function with `ub.repr2`**Parameters****key** (*Type* | *Tuple[Type]* | *str*) – indicator of the type**Returns**

decorator function

**Return type**

Callable

**lookup(data)**

Returns an appropriate function to format data if one has been registered.

**1.28.1.1.12 ubelt.util\_func module**

Helpers for functional programming.

The `identity()` function simply returns its own inputs. This is useful for bypassing print statements and many other cases. I also think it looks a little nicer than `lambda x: x`.

The `inject_method()` function “injects” another function into a class instance as a method. This is useful for monkey patching.

The `compatible()` introspects a functions signature for accepted keyword arguments and returns the subset of a configuration dictionary that agrees with that signature.

`ubelt.util_func.identity(arg=None, *args, **kwargs)`

Return the value of the first argument unchanged.

All other positional and keyword inputs are ignored. Defaults to `None` if called without any args.

The name `identity` is used in the mathematical sense [[WikiIdentity](#)]. This is slightly different than the pure identity function, which is defined strictly with a single argument. This implementation allows but ignores extra

arguments, making it easier to use as a drop in replacement for functions that accept extra configuration arguments that change their behavior and aren't true inputs.

The value of this utility is a cleaner way to write `lambda x: x` or more precisely `lambda x=None, *a, **k: x` or writing the function inline. Unlike the lambda variant, this does not trigger common linter errors when assigning it to a value.

#### Parameters

- **arg** (*Any, default=None*) – The value to return unchanged.
- **\*args** – Ignored
- **\*\*kwargs** – Ignored

#### Returns

arg - The same value of the first positional argument.

#### Return type

Any

### References

#### Example

```
>>> import ubelt as ub
>>> ub.identity(42)
42
>>> ub.identity(42, 43)
42
>>> ub.identity()
None
```

`ubelt.util_func.inject_method(self, func, name=None)`

Injects a function into an object instance as a bound method

The main use case of this function is for monkey patching. While monkey patching is sometimes necessary it should generally be avoided. Thus, we simply remind the developer that there might be a better way.

#### Parameters

- **self** (*T*) – Instance to inject a function into.
- **func** (*Callable[... Any]*) – The function to inject (must contain an arg for self).
- **name** (*str, default=None*) – Name of the method. optional. If not specified the name of the function is used.

#### Example

```
>>> import ubelt as ub
>>> class Foo(object):
>>>     def bar(self):
>>>         return 'bar'
>>>     def baz(self):
>>>         return 'baz'
>>> self = Foo()
```

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```

>>> assert self.bar() == 'bar'
>>> assert not hasattr(self, 'baz')
>>> ub.inject_method(self, baz)
>>> assert not hasattr(Foo, 'baz'), 'should only change one instance'
>>> assert self.baz() == 'baz'
>>> ub.inject_method(self, baz, 'bar')
>>> assert self.bar() == 'baz'

```

`ubelt.util_func.compatible(config, func, start=0, keywords=True)`

Take the “compatible” subset of a dictionary that a function will accept as keyword arguments.

A common pattern is to track the configuration of a program in a single dictionary. Often there will be functions that only require subsets of this dictionary, and they will be written such that those items are passed via keyword arguments. The `ubelt.compatible()` utility makes it easier select only the relevant config variables. It does this by inspecting the signature of the function to determine what keyword arguments it accepts, and returns the dictionary intersection of the full config and the allowed keywords. The user can then call the function with the normal `**` mechanism.

#### Parameters

- **config** (*Dict[str, Any]*) – A dictionary that contains keyword arguments that might be passed to a function.
- **func** (*Callable*) – A function or method to check the arguments of
- **start** (*int*) – Only take args after this position. Set to 1 if calling with an unbound method to avoid the `self` argument. Defaults to 0.
- **keywords** (*bool | Iterable[str]*) – If True (default), and `**kwargs` is in the signature, prevent any filtering of the `config` dictionary. If False, then ignore that `**kwargs` is in the signature and only return the subset of `config` that matches the explicit signature. Otherwise if specified as a non-string iterable of strings, assume these are the allowed keys that are compatible with the way `kwargs` is handled in the function.

#### Returns

A subset of `config` that only contains items compatible with the signature of `func`.

#### Return type

`Dict[str, Any]`

#### Example

```

>>> # An example use case is to select a subset of of a config
>>> # that can be passed to some function as kwargs
>>> import ubelt as ub
>>> # Define a function with args that match some keys in a config.
>>> def func(a, e, f):
>>>     return a * e * f
>>> # Define a config that has a superset of items needed by the func
>>> config = {
...     'a': 2, 'b': 3, 'c': 7,
...     'd': 11, 'e': 13, 'f': 17,
... }
>>> # Call the function only with keys that are compatible

```

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```
>>> func(**ub.compatible(config, func))
442
```

### Example

```
>>> # Test case with kwargs
>>> import ubelt as ub
>>> def func(a, e, f, *args, **kwargs):
>>>     return a * e * f
>>> config = {
...     'a': 2, 'b': 3, 'c': 7,
...     'd': 11, 'e': 13, 'f': 17,
... }
>>> func(**ub.compatible(config, func))
442
>>> print(sorted(ub.compatible(config, func)))
['a', 'b', 'c', 'd', 'e', 'f']
>>> print(sorted(ub.compatible(config, func, keywords=False)))
['a', 'e', 'f']
>>> print(sorted(ub.compatible(config, func, keywords={'b'})))
['a', 'b', 'e', 'f']
```

#### 1.28.1.1.13 ubelt.util\_futures module

Introduces the *Executor* class that wraps the standard `ThreadPoolExecutor`, `ProcessPoolExecutor`, and the new `SerialExecutor` with a common interface and a configurable backend. This makes is easy to test if your code benefits from parallism, how much it benefits, and gives you the ability to disable if if you need to.

The *Executor* class lets you choose the right level of concurrency (which might be no concurrency). An excellent blog post on when to use threads, processes, or asyncio [[ChooseTheRightConcurrency](#)].

Note that executor does not currently support asyncio, but this might be a feature added in the future, but its unclear how interoperable this would be.

### References

### Example

```
>>> # xdoctest: +SKIP
>>> # Note: while this works in IPython, this does not work when running
>>> # in xdoctest. https://github.com/Erotemic/xdoctest/issues/101
>>> # xdoctest: +REQUIRES(module:timerit)
>>> # Does my function benefit from parallelism?
>>> def my_function(arg1, arg2):
...     return (arg1 + arg2) * 3
>>> #
>>> def run_process(inputs, mode='serial', max_workers=0):
...     from concurrent.futures import as_completed
...     import ubelt as ub
```

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```

...     # The executor interface is the same regardless of modes
...     executor = ub.Executor(mode=mode, max_workers=max_workers)
...     # submit returns a Future object
...     jobs = [executor.submit(my_function, *args) for args in inputs]
...     # future objects will contain results when they are done
...     results = [job.result() for job in as_completed(jobs)]
...     return results
>>> # The same code tests our method in serial, thread, or process mode
>>> import timerit
>>> ti = timerit.Timerit(100, bestof=10, verbose=2)
>>> # Setup test data
>>> import random
>>> rng = random.Random(0)
>>> max_workers = 4
>>> inputs = [(rng.random(), rng.random()) for _ in range(100)]
>>> for mode in ['serial', 'process', 'thread']:
>>>     for timer in ti.reset('mode={} max_workers={}'.format(mode, max_workers)):
>>>         with timer:
>>>             run_process(inputs, mode=mode, max_workers=max_workers)
>>> print(ub.repr2(ti))

```

**class** ubelt.util\_futures.**Executor**(mode='thread', max\_workers=0)

Bases: `object`

Wrapper around a specific executor.

Abstracts Serial, Thread, and Process Executor via arguments.

#### Parameters

- **mode** (*str*, default='thread') – either thread, serial, or process
- **max\_workers** (*int*, default=0) – number of workers. If 0, serial is forced.

#### Example

```

>>> import platform
>>> import sys
>>> # The process backend breaks pyp3 when using coverage
>>> if 'pypy' in platform.python_implementation().lower():
...     import pytest
...     pytest.skip('not testing process on pypy')
>>> if sys.platform.startswith('win32'):
...     import pytest
...     pytest.skip('not running this test on win32 for now')
>>> import ubelt as ub
>>> # Fork before threading!
>>> # https://pybay.com/site_media/slides/raymond2017-keynote/combo.html
>>> self1 = ub.Executor(mode='serial', max_workers=0)
>>> self1.__enter__()
>>> self2 = ub.Executor(mode='process', max_workers=2)
>>> self2.__enter__()
>>> self3 = ub.Executor(mode='thread', max_workers=2)

```

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```

>>> self3.__enter__()
>>> jobs = []
>>> jobs.append(self1.submit(sum, [1, 2, 3]))
>>> jobs.append(self1.submit(sum, [1, 2, 3]))
>>> jobs.append(self2.submit(sum, [10, 20, 30]))
>>> jobs.append(self2.submit(sum, [10, 20, 30]))
>>> jobs.append(self3.submit(sum, [4, 5, 5]))
>>> jobs.append(self3.submit(sum, [4, 5, 5]))
>>> for job in jobs:
>>>     result = job.result()
>>>     print('result = {!r}'.format(result))
>>> self1.__exit__(None, None, None)
>>> self2.__exit__(None, None, None)
>>> self3.__exit__(None, None, None)

```

### Example

```

>>> import ubelt as ub
>>> self1 = ub.Executor(mode='serial', max_workers=0)
>>> with self1:
>>>     jobs = []
>>>     for i in range(10):
>>>         jobs.append(self1.submit(sum, [i + 1, i]))
>>>     for job in jobs:
>>>         job.add_done_callback(lambda x: print('done callback got x = {}'.
↪format(x)))
>>>         result = job.result()
>>>         print('result = {!r}'.format(result))

```

**submit**(*func*, \**args*, \*\**kw*)

Calls the submit function of the underlying backend.

#### Returns

a future representing the job

#### Return type

`concurrent.futures.Future`

**shutdown**()

Calls the shutdown function of the underlying backend.

**map**(*fn*, \**iterables*, \*\**kwargs*)

Calls the map function of the underlying backend.

## CommandLine

```
xdoctest -m ubelt.util_futures Executor.map
```

## Example

```
>>> import ubelt as ub
>>> import concurrent.futures
>>> import string
>>> with ub.Executor(mode='serial') as executor:
...     result_iter = executor.map(int, string.digits)
...     results = list(result_iter)
>>> print('results = {!r}'.format(results))
results = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> with ub.Executor(mode='thread', max_workers=2) as executor:
...     result_iter = executor.map(int, string.digits)
...     results = list(result_iter)
>>> # xdoctest: +IGNORE_WANT
>>> print('results = {!r}'.format(results))
results = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

```
class ubelt.util_futures.JobPool(mode='thread', max_workers=0)
```

Bases: `object`

Abstracts away boilerplate of submitting and collecting jobs

This is a basic wrapper around `ubelt.util_futures.Executor` that simplifies the most basic case.

## Example

```
>>> import ubelt as ub
>>> def worker(data):
>>>     return data + 1
>>> pool = ub.JobPool('thread', max_workers=16)
>>> for data in ub.ProgIter(range(10), desc='submit jobs'):
>>>     pool.submit(worker, data)
>>> final = []
>>> for job in pool.as_completed(desc='collect jobs'):
>>>     info = job.result()
>>>     final.append(info)
>>> print('final = {!r}'.format(final))
```

```
submit(func, *args, **kwargs)
```

Submit a job managed by the pool

### Parameters

- **func** (*Callable*[... , Any]) – A callable that will take as many arguments as there are passed iterables.
- **\*args** – positional arguments to pass to the function
- **\*kwargs** – keyword arguments to pass to the function

**Returns**

a future representing the job

**Return type**

`concurrent.futures.Future`

**shutdown()**

**as\_completed(timeout=None, desc=None, progkw=None)**

Generates completed jobs in an arbitrary order

**Parameters**

- **timeout** (*float* | *None*) – Specify the the maximum number of seconds to wait for a job.
- **desc** (*str* | *None*) – if specified, reports progress with a `ubelt.progiter.ProgIter` object.
- **progkw** (*dict* | *None*) – extra keyword arguments to `ubelt.progiter.ProgIter`.

**Yields**

`concurrent.futures.Future` – The completed future object containing the results of a job.

**CommandLine**

```
xdoctest -m ubelt.util_futures JobPool.as_completed
```

**Example**

```
>>> import ubelt as ub
>>> pool = ub.JobPool('thread', max_workers=8)
>>> text = ub.paragraph(
...     """
...     UDP is a cool protocol, check out the wiki:
...
...     UDP-based Data Transfer Protocol (UDT), is a high-performance
...     data transfer protocol designed for transferring large
...     volumetric datasets over high-speed wide area networks. Such
...     settings are typically disadvantageous for the more common TCP
...     protocol.
...     """)
>>> for word in text.split(' '):
...     pool.submit(print, word)
>>> for _ in pool.as_completed():
...     pass
>>> pool.shutdown()
```

**join(\*\*kwargs)**

Like `JobPool.as_completed()`, but executes the `result` method of each future and returns only after all processes are complete. This allows for lower-boilerplate prototyping.

**Parameters**

**\*\*kwargs** – passed to `JobPool.as_completed()`

**Returns**

list of results



**Return type**  
List[Any]

### Example

```
>>> import ubelt as ub
>>> # We just want to try replacing our simple iterative algorithm
>>> # with the embarassingly parallel version
>>> arglist = list(zip(range(1000), range(1000)))
>>> func = ub.identity
>>> #
>>> # Original version
>>> for args in arglist:
>>>     func(*args)
>>> #
>>> # Potentially parallel version
>>> jobs = ub.JobPool(max_workers=0)
>>> for args in arglist:
>>>     jobs.submit(func, *args)
>>> _ = jobs.join(desc='running')
```

#### 1.28.1.14 ubelt.util\_hash module

Wrappers around hashlib functions to generate hash signatures for common data.

The hashes are deterministic across python versions and operating systems. This is verified by CI testing on Windows, Linux, Python with 2.7, 3.4, and greater, and on 32 and 64 bit versions.

Use Case #1: You have data that you want to hash. If we assume the data is in standard python scalars or ordered sequences: e.g. tuple, list, odict, oset, int, str, etc..., then the solution is [`hash\_data\(\)`](#).

Use Case #2: You have a file you want to hash, but your system doesn't have a `sha1sum` executable (or you don't want to use `Popen`). The solution is [`hash\_file\(\)`](#)

The [`ubelt.util\_hash.hash\_data\(\)`](#) function recursively hashes most builtin python data structures. This is similar to the `deephash` functionality provided in [PypiDeepDiff].

The [`ubelt.util\_hash.hash\_file\(\)`](#) function hashes data on disk. Both of the aforementioned functions have options for different hashers and alphabets.

### References

### Example

```
>>> import ubelt as ub
>>> data = ub.odict(sorted({
>>>     'param1': True,
>>>     'param2': 0,
>>>     'param3': [None],
>>>     'param4': ('str', 4.2),
>>> }.items()))
>>> # hash_data can hash any ordered builtin object
```

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```
>>> ub.hash_data(data, hasher='sha256')
0b101481e4b894dddf6de57...
```

## Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> fpath = ub.touch(join(ub.ensure_app_cache_dir('ubelt'), 'empty_file'))
>>> ub.hash_file(fpath, hasher='sha1')
da39a3ee5e6b4b0d3255bfe95601890afd80709
```

---

**Note:** The exact hashes generated for data object and files may change in the future. When this happens the `HASH_VERSION` attribute will be incremented.

---

---

**Note:** [util\_hash.Note.1] pre 0.10.2, the protected function `_hashable_sequence` defaulted to `types=True` setting to `True` here for backwards compat. This means that extensions using the `_hashable_sequence` helper will always include types in their hashable encoding regardless of the argument setting. We may change this in the future, to be more consistent. This is a minor detail unless you are getting into the weeds of how we coerce technically non-hashable sequences into a hashable encoding.

---

`ubelt.util_hash.hash_data(data, hasher=NoParam, base=NoParam, types=False, convert=False, extensions=None)`

Get a unique hash depending on the state of the data.

### Parameters

- **data** (*object*) – Any sort of loosely organized data
- **hasher** (*str* | *Hasher* | *NoParamType*) – string code or a hash algorithm from `hashlib`. Valid hashing algorithms are defined by `hashlib.algorithms_guaranteed` (e.g. 'sha1', 'sha512', 'md5') as well as 'xxh32' and 'xxh64' if `xxhash` is installed. Defaults to 'sha512'.
- **base** (*List[str]* | *str* | *NoParamType*) – list of symbols or shorthand key. Valid keys are 'abc', 'hex', and 'dec'. Defaults to 'hex'
- **types** (*bool*) – If `True` data types are included in the hash, otherwise only the raw data is hashed. Defaults to `False`.
- **convert** (*bool*, *default=True*) – if `True`, try and convert the data to json and the json is hashed instead. This can improve runtime in some instances, however the hash may differ from the case where `convert=False`.
- **extensions** (*HashableExtensions*) – a custom `HashableExtensions` instance that can overwrite or define how different types of objects are hashed.

---

**Note:** The types allowed are specified by the `HashableExtensions` object. By default `ubelt` will register:

`OrderedDict`, `uuid.UUID`, `np.random.RandomState`, `np.int64`, `np.int32`, `np.int16`, `np.int8`, `np.uint64`, `np.uint32`, `np.uint16`, `np.uint8`, `np.float16`, `np.float32`, `np.float64`, `np.float128`, `np.ndarray`, `bytes`, `str`, `int`, `float`, `long` (in python2), `list`, `tuple`, `set`, and `dict`

---

**Returns**

text representing the hashed data

**Return type**

str

---

**Note:** The alphabet26 base is a pretty nice base, I recommend it. However we default to base='hex' because it is standard. You can try the alphabet26 base by setting base='abc'.

---

**Example**

```
>>> import ubelt as ub
>>> print(ub.hash_data([1, 2, (3, '4')], convert=False))
60b758587f599663931057e6ebdf185a...
>>> print(ub.hash_data([1, 2, (3, '4')], base='abc', hasher='sha512')[:32])
hsrgqvfiuxvvhcdnypivhhthmrolkzej
```

`ubelt.util_hash.hash_file(fpath, blocksize=1048576, stride=1, maxbytes=None, hasher=NoParam, base=NoParam)`

Hashes the data in a file on disk.

The results of this function agree with the standard UNIX commands (e.g. `sha1sum`, `sha512sum`, `md5sum`, etc...)

**Parameters**

- **fpath** (*PathLike*) – location of the file to be hashed.
  - **blocksize** (*int*) – Amount of data to read and hash at a time. There is a trade off and the optimal number will depend on specific hardware. This number was chosen to be optimal on a developer system. See “dev/bench\_hash\_file” for methodology to choose this number for your use case. Defaults to `2 ** 20`.
  - **stride** (*int*) – strides > 1 skip data to hash, useful for faster hashing, but less accurate, also makes hash dependent on blocksize. Defaults to 1.
  - **maxbytes** (*int | None*) – if specified, only hash the leading *maxbytes* of data in the file.
  - **hasher** (*str | Hasher | NoParamType*) – string code or a hash algorithm from hashlib. Valid hashing algorithms are defined by `hashlib.algorithms_guaranteed` (e.g. ‘sha1’, ‘sha512’, ‘md5’) as well as ‘xxh32’ and ‘xxh64’ if `xxhash` is installed. Defaults to ‘sha512’.
- TODO: add logic such that you can update an existing hasher
- **base** (*List[str] | str | NoParamType*) – list of symbols or shorthand key. Valid keys are ‘abc’, ‘hex’, and ‘dec’. Defaults to ‘hex’.

---

**Note:** For better hashes keep stride = 1. For faster hashes set stride > 1. Blocksize matters when stride > 1.

---

## References

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> dpath = ub.Path.appdir('ubelt/tests/test-hash').ensuredir()
>>> fpath = dpath / 'tmp1.txt'
>>> fpath.write_text('foobar')
>>> print(ub.hash_file(fpath, hasher='sha1', base='hex'))
8843d7f92416211de9ebb963ff4ce28125932878
```

### Example

```
>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt/tests/test-hash').ensuredir()
>>> fpath = dpath / 'tmp2.txt'
>>> # We have the ability to only hash at most `maxbytes` in a file
>>> fpath.write_text('abcdefghijklmnop')
>>> h0 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=11, blocksize=3)
>>> h1 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=3)
>>> h2 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=32)
>>> h3 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=1)
>>> h4 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=18)
>>> assert h1 == h2 == h3 == h4
>>> assert h1 != h0
```

```
>>> # Using a stride makes the result dependent on the blocksize
>>> h0 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=11, blocksize=3,
↳ stride=2)
>>> h1 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=3,
↳ stride=2)
>>> h2 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=32,
↳ stride=2)
>>> h3 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=1,
↳ stride=2)
>>> h4 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=18,
↳ stride=2)
>>> assert h1 != h2 != h3
>>> assert h1 == h0
>>> assert h2 == h4
```

### Example

```

>>> import ubelt as ub
>>> from os.path import join
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/test-hash')
>>> fpath = ub.touch(join(dpath, 'empty_file'))
>>> # Test that the output is the same as shasum executable
>>> if ub.find_exe('shasum'):
>>>     want = ub.cmd(['shasum', fpath], verbose=2)['out'].split(' ')[0]
>>>     got = ub.hash_file(fpath, hasher='sha1')
>>>     print('want = {!r}'.format(want))
>>>     print('got = {!r}'.format(got))
>>>     assert want.endswith(got)
>>> # Do the same for sha512 sum and md5sum
>>> if ub.find_exe('sha512sum'):
>>>     want = ub.cmd(['sha512sum', fpath], verbose=2)['out'].split(' ')[0]
>>>     got = ub.hash_file(fpath, hasher='sha512')
>>>     print('want = {!r}'.format(want))
>>>     print('got = {!r}'.format(got))
>>>     assert want.endswith(got)
>>> if ub.find_exe('md5sum'):
>>>     want = ub.cmd(['md5sum', fpath], verbose=2)['out'].split(' ')[0]
>>>     got = ub.hash_file(fpath, hasher='md5')
>>>     print('want = {!r}'.format(want))
>>>     print('got = {!r}'.format(got))
>>>     assert want.endswith(got)

```

#### 1.28.1.1.15 ubelt.util\_import module

Expose functions to simplify importing from module names and paths.

The `ubelt.import_module_from_path()` function does its best to load a python file into the current set of global modules.

The `ubelt.import_module_from_name()` works similarly.

The `ubelt.modname_to_modpath()` and `ubelt.modpath_to_modname()` work statically and convert between module names and file paths on disk.

The `ubelt.split_modpath()` function separates modules into a root and base path depending on where the first `__init__.py` file is.

`ubelt.util_import.split_modpath(modpath, check=True)`

Splits the modpath into the dir that must be in PYTHONPATH for the module to be imported and the modulepath relative to this directory.

##### Parameters

- **modpath** (*str*) – module filepath
- **check** (*bool*) – if False, does not raise an error if modpath is a directory and does not contain an `__init__.py` file.

##### Returns

(directory, rel\_modpath)

**Return type**

Tuple[str, str]

**Raises**

**ValueError** – if modpath does not exist or is not a package

**Example**

```
>>> from xdoctest import static_analysis
>>> modpath = static_analysis.__file__.replace('.pyc', '.py')
>>> modpath = abspath(modpath)
>>> dpath, rel_modpath = split_modpath(modpath)
>>> recon = join(dpath, rel_modpath)
>>> assert recon == modpath
>>> assert rel_modpath == join('xdoctest', 'static_analysis.py')
```

ubelt.util\_import.modname\_to\_modpath(modname, hide\_init=True, hide\_main=False, sys\_path=None)

Finds the path to a python module from its name.

Determines the path to a python module without directly import it

Converts the name of a module (\_\_name\_\_) to the path (\_\_file\_\_) where it is located without importing the module. Returns None if the module does not exist.

**Parameters**

- **modname** (str) – The name of a module in sys\_path.
- **hide\_init** (bool) – if False, \_\_init\_\_.py will be returned for packages. Defaults to True.
- **hide\_main** (bool) – if False, and hide\_init is True, \_\_main\_\_.py will be returned for packages, if it exists. Defaults to False.
- **sys\_path** (None | List[str | PathLike]) – The paths to search for the module. If unspecified, defaults to sys.path.

**Returns**

modpath - path to the module, or None if it doesn't exist

**Return type**

str | None

**Example**

```
>>> modname = 'xdoctest.__main__'
>>> modpath = modname_to_modpath(modname, hide_main=False)
>>> assert modpath.endswith('__main__.py')
>>> modname = 'xdoctest'
>>> modpath = modname_to_modpath(modname, hide_init=False)
>>> assert modpath.endswith('__init__.py')
>>> # xdoctest: +REQUIRES(CPython)
>>> modpath = basename(modname_to_modpath('_ctypes'))
>>> assert 'ctypes' in modpath
```

ubelt.util\_import.modpath\_to\_modname(modpath, hide\_init=True, hide\_main=False, check=True, relativeto=None)

Determines importable name from file path

Converts the path to a module (`__file__`) to the importable python name (`__name__`) without importing the module.

The filename is converted to a module name, and parent directories are recursively included until a directory without an `__init__.py` file is encountered.

#### Parameters

- **modpath** (*str*) – module filepath
- **hide\_init** (*bool*, *default=True*) – removes the `__init__` suffix
- **hide\_main** (*bool*, *default=False*) – removes the `__main__` suffix
- **check** (*bool*, *default=True*) – if False, does not raise an error if modpath is a dir and does not contain an `__init__` file.
- **relativeto** (*str*, *default=None*) – if specified, all checks are ignored and this is considered the path to the root module.

---

#### Todo:

- [ ] Does this need modification to support PEP 420?  
<https://www.python.org/dev/peps/pep-0420/>
- 

#### Returns

modname

#### Return type

str

#### Raises

**ValueError** – if check is True and the path does not exist

#### Example

```
>>> from xdoctest import static_analysis
>>> modpath = static_analysis.__file__.replace('.pyc', '.py')
>>> modpath = modpath.replace('.pyc', '.py')
>>> modname = modpath_to_modname(modpath)
>>> assert modname == 'xdoctest.static_analysis'
```

#### Example

```
>>> import xdoctest
>>> assert modpath_to_modname(xdoctest.__file__.replace('.pyc', '.py')) == 'xdoctest
↳ '
>>> assert modpath_to_modname(dirname(xdoctest.__file__.replace('.pyc', '.py'))) ==
↳ 'xdoctest'
```

### Example

```
>>> # xdoctest: +REQUIRES(CPython)
>>> modpath = modname_to_modpath('_ctypes')
>>> modname = modpath_to_modname(modpath)
>>> assert modname == '_ctypes'
```

### Example

```
>>> modpath = '/foo/libfoobar.linux-x86_64-3.6.so'
>>> modname = modpath_to_modname(modpath, check=False)
>>> assert modname == 'libfoobar'
```

`ubelt.util_import.import_module_from_name(modname)`

Imports a module from its string name (i.e. `__name__`)

This is a simple wrapper around `importlib.import_module()`, but is provided as a companion function to `import_module_from_path()`, which contains functionality not provided in the Python standard library.

#### Parameters

**modname** (*str*) – module name

#### Returns

module

#### Return type

ModuleType

#### SeeAlso:

`import_module_from_path()`

### Example

```
>>> # test with modules that won't be imported in normal circumstances
>>> # todo write a test where we guarantee this
>>> modname_list = [
>>>     'pickletools',
>>>     'lib2to3.fixes.fix_apply',
>>> ]
>>> #assert not any(m in sys.modules for m in modname_list)
>>> modules = [import_module_from_name(modname) for modname in modname_list]
>>> assert [m.__name__ for m in modules] == modname_list
>>> assert all(m in sys.modules for m in modname_list)
```

`ubelt.util_import.import_module_from_path(modpath, index=-1)`

Imports a module via a filesystem path.

This works by modifying `sys.path`, importing the module name, and then attempting to undo the change to `sys.path`. This function may produce unexpected results in the case where the imported module itself modifies `sys.path` or if there is another conflicting module with the same name.

#### Parameters



- **modpath** (*str* | *PathLike*) – Path to the module on disk or within a zipfile. Paths within a zipfile can be given by <path-to>.zip/<path-inside-zip>.py.
- **index** (*int*) – Location at which we modify PYTHONPATH if necessary. If your module name does not conflict, the safest value is -1, However, if there is a conflict, then use an index of 0. The default may change to 0 in the future.

**Returns**

the imported module

**Return type**

ModuleType

**References****Raises**

- **IOError** – when the path to the module does not exist –
- **ImportError** – when the module is unable to be imported –

**Note:** If the module is part of a package, the package will be imported first. These modules may cause problems when reloading via IPython magic

This can import a module from within a zipfile. To do this modpath should specify the path to the zipfile and the path to the module within that zipfile separated by a colon or pathsep. E.g. “/path/to/archive.zip:mymodule.pl”

**Warning:** It is best to use this with paths that will not conflict with previously existing modules.

If the modpath conflicts with a previously existing module name. And the target module does imports of its own relative to this conflicting path. In this case, the module that was loaded first will win.

For example if you try to import ‘/foo/bar/pkg/mod.py’ from the folder structure:

```
- foo/
+- bar/
  +- pkg/
    + __init__.py
    | - mod.py
    | - helper.py
```

If there exists another module named `pkg` already in `sys.modules` and `mod.py` does something like `from . import helper`, Python will assume `helper` belongs to the `pkg` module already in `sys.modules`. This can cause a `NameError` or worse — a incorrect helper module.

**SeeAlso:**

[`import\_module\_from\_name\(\)`](#)

### Example

```
>>> import xdoctest
>>> modpath = xdoctest.__file__
>>> module = import_module_from_path(modpath)
>>> assert module is xdoctest
```

### Example

```
>>> # Test importing a module from within a zipfile
>>> import zipfile
>>> from xdoctest import utils
>>> from os.path import join, expanduser, normpath
>>> dpath = expanduser('~/.cache/xdoctest')
>>> dpath = utils.ensuredir(dpath)
>>> #dpath = utils.TempDir().ensure()
>>> # Write to an external module named bar
>>> external_modpath = join(dpath, 'bar.py')
>>> # For pypy support we have to write this using with
>>> with open(external_modpath, 'w') as file:
>>>     file.write('testvar = 1')
>>> internal = 'folder/bar.py'
>>> # Move the external bar module into a zipfile
>>> zippath = join(dpath, 'myzip.zip')
>>> with zipfile.ZipFile(zippath, 'w') as myzip:
>>>     myzip.write(external_modpath, internal)
>>> # Import the bar module from within the zipfile
>>> modpath = zippath + ':' + internal
>>> modpath = zippath + os.path.sep + internal
>>> module = import_module_from_path(modpath)
>>> assert normpath(module.__name__) == normpath('folder/bar')
>>> assert module.testvar == 1
```

### Example

```
>>> import pytest
>>> with pytest.raises(IOError):
>>>     import_module_from_path('does-not-exist')
>>> with pytest.raises(IOError):
>>>     import_module_from_path('does-not-exist.zip/')
```

### 1.28.1.1.16 ubelt.util\_indexable module

The util\_indexable module defines `IndexableWalker` which is a powerful way to iterate through nested Python containers.

#### RelatedWork:

- [PypiDictDigger]

#### References

**class** `ubelt.util_indexable.IndexableWalker`(*data*, *dict\_cls*=(<class 'dict'>, ), *list\_cls*=(<class 'list'>, <class 'tuple'>))

Bases: `Generator`

Traverses through a nested tree-liked indexable structure.

Generates a path and value to each node in the structure. The path is a list of indexes which if applied in order will reach the value.

The `__setitem__` method can be used to modify a nested value based on the path returned by the generator.

When generating values, you can use “send” to prevent traversal of a particular branch.

#### RelatedWork:

- <https://pypi.org/project/python-benedict/> - implements a dictionary subclass with similar nested indexing abilities.

#### Example

```
>>> # Given Nested Data
>>> data = {
>>>     'foo': {'bar': 1},
>>>     'baz': [{'biz': 3}, {'buz': [4, 5, 6]}],
>>> }
>>> # Create an IndexableWalker
>>> walker = IndexableWalker(data)
>>> # We iterate over the data as if it was flat
>>> # ignore the <want> string due to order issues on older Pythons
>>> # xdoctest: +IGNORE_WANT
>>> for path, val in walker:
>>>     print(path)
['foo']
['baz']
['baz', 0]
['baz', 1]
['baz', 1, 'buz']
['baz', 1, 'buz', 0]
['baz', 1, 'buz', 1]
['baz', 1, 'buz', 2]
['baz', 0, 'biz']
['foo', 'bar']
>>> # We can use "paths" as keys to getitem into the walker
>>> path = ['baz', 1, 'buz', 2]
```

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```
>>> val = walker[path]
>>> assert val == 6
>>> # We can use "paths" as keys to setitem into the walker
>>> assert data['baz'][1]['buz'][2] == 6
>>> walker[path] = 7
>>> assert data['baz'][1]['buz'][2] == 7
>>> # We can use "paths" as keys to delitem into the walker
>>> assert data['baz'][1]['buz'][1] == 5
>>> del walker[['baz', 1, 'buz', 1]]
>>> assert data['baz'][1]['buz'][1] == 7
```

### Example

```
>>> # Create nested data
>>> # xdoctest: +REQUIRES(module:numpy)
>>> import numpy as np
>>> import ubelt as ub
>>> data = ub.ddict(lambda: int)
>>> data['foo'] = ub.ddict(lambda: int)
>>> data['bar'] = np.array([1, 2, 3])
>>> data['foo']['a'] = 1
>>> data['foo']['b'] = np.array([1, 2, 3])
>>> data['foo']['c'] = [1, 2, 3]
>>> data['baz'] = 3
>>> print('data = {}'.format(ub.repr2(data, nl=True)))
>>> # We can walk through every node in the nested tree
>>> walker = IndexableWalker(data)
>>> for path, value in walker:
>>>     print('walk path = {}'.format(ub.repr2(path, nl=0)))
>>>     if path[-1] == 'c':
>>>         # Use send to prevent traversing this branch
>>>         got = walker.send(False)
>>>         # We can modify the value based on the returned path
>>>         walker[path] = 'changed the value of c'
>>> print('data = {}'.format(ub.repr2(data, nl=True)))
>>> assert data['foo']['c'] == 'changed the value of c'
```

### Example

```
>>> # Test sending false for every data item
>>> # xdoctest: +REQUIRES(CPython)
>>> # xdoctest: +REQUIRES(module:numpy)
>>> import ubelt as ub
>>> import numpy as np
>>> data = {1: 1}
>>> walker = IndexableWalker(data)
>>> for path, value in walker:
>>>     print('walk path = {}'.format(ub.repr2(path, nl=0)))
>>>     walker.send(False)
```

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```
>>> data = {}
>>> walker = IndexableWalker(data)
>>> for path, value in walker:
>>>     walker.send(False)
```

**send**(*arg*) → send 'arg' into generator,  
return next yielded value or raise StopIteration.

**throw**(*typ*[, *val*[, *tb*]]) → raise exception in generator,  
return next yielded value or raise StopIteration.

`ubelt.util_indexable.indexable_allclose(dct1, dct2, rel_tol=1e-09, abs_tol=0.0, return_info=False)`

Walks through two nested data structures and ensures that everything is roughly the same.

#### Parameters

- **dct1** (*dict*) – a nested indexable item
- **dct2** (*dict*) – a nested indexable item
- **rel\_tol** (*float*) – maximum difference for being considered “close”, relative to the magnitude of the input values
- **abs\_tol** (*float*) – maximum difference for being considered “close”, regardless of the magnitude of the input values
- **return\_info** (*bool*, *default=False*) – if true, return extra info

#### Returns

A boolean result if `return_info` is false, otherwise a tuple of the boolean result and an “info” dict containing detailed results indicating what matched and what did not.

#### Return type

`bool` | `Tuple[bool, Dict]`

### Example

```
>>> import ubelt as ub
>>> dct1 = {
>>>     'foo': [1.222222, 1.333],
>>>     'bar': 1,
>>>     'baz': [],
>>> }
>>> dct2 = {
>>>     'foo': [1.222222, 1.333],
>>>     'bar': 1,
>>>     'baz': [],
>>> }
>>> flag, return_info = ub.indexable_allclose(dct1, dct2, return_info=True)
>>> print('return_info = {}'.format(ub.repr2(return_info, nl=1)))
>>> print('flag = {!r}'.format(flag))
```

```
>>> walker1 = return_info['walker1']
>>> for p1, v1, v2 in return_info['faillist']:
>>>     v1_ = walker1[p1]
```

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```
>>> print('*fail p1, v1, v2 = {}, {}, {}'.format(p1, v1, v2))
>>> for p1 in return_info['passlist']:
>>>     v1_ = walker1[p1]
>>>     print('*pass p1, v1_ = {}, {}'.format(p1, v1_))
>>> assert not flag
```

[illegible]

### Example

```
>>> import ubelt as ub
>>> flag, return_info = ub.indexable_allclose([], [], return_info=True)
>>> print('return_info = {!r}'.format(return_info))
>>> print('flag = {!r}'.format(flag))
```

### Example

```
>>> import ubelt as ub
>>> flag = ub.indexable_allclose([], [], return_info=False)
>>> print('flag = {!r}'.format(flag))
```

### Example

```
>>> import ubelt as ub
>>> flag, return_info = ub.indexable_allclose([], [1], return_info=True)
>>> print('return_info = {!r}'.format(return_info))
>>> print('flag = {!r}'.format(flag))
```

### 1.28.1.1.17 ubelt.util\_io module

Functions for reading and writing files on disk.

`writeto()` and `readfrom()` wrap `open().write()` and `open().read()` and primarily serve to indicate that the type of data being written and read is unicode text.

`delete()` wraps `os.unlink()` and `shutil.rmtree()` and does not throw an error if the file or directory does not exist. It also contains workarounds for win32 issues with `shutil`.

`ubelt.util_io.readfrom(fpath, aslines=False, errors='replace', verbose=None)`

Reads (utf8) text from a file.

---

**Note:** You probably should use `ub.Path(<fpath>).read_text()` instead. This function exists as a convenience for writing in Python2. After 2020-01-01, we may consider deprecating the function.

---

#### Parameters

- **fpath** (*str* | *PathLike*) – file path
- **aslines** (*bool*) – if True returns list of lines
- **verbose** (*bool*) – verbosity flag

#### Returns

text from fpath (this is unicode)

#### Return type

*str*

`ubelt.util_io.writeto(fpath, to_write, aslines=False, verbose=None)`

Writes (utf8) text to a file.

#### Parameters

- **fpath** (*str* | *PathLike*) – file path
- **to\_write** (*str*) – text to write (must be unicode text)
- **aslines** (*bool*) – if True to\_write is assumed to be a list of lines
- **verbose** (*bool*) – verbosity flag

---

**Note:** In CPython you may want to use `open(<fpath>).write(<to_write>)` instead. This function exists as a convenience for writing in Python2. After 2020-01-01, we may consider deprecating the function.

**NOTE:** In PyPy `open(<fpath>).write(<to_write>)` does not work. See <https://pypy.org/compat.html>. This is an argument for keeping this function.

**NOTE:** With modern versions of Python, it is generally recommended to use `pathlib.Path.write_text()` instead. Although there does seem to be some corner case this handles better on win32, so maybe useful?

---

### Example

```
>>> import ubelt as ub
>>> import os
>>> from os.path import exists
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = dpath + '/' + 'testwrite.txt'
>>> if exists(fpath):
>>>     os.remove(fpath)
>>> to_write = 'utf-8 symbols , , , , , , , and .'
>>> ub.writeto(fpath, to_write)
>>> read_ = ub.readfrom(fpath)
>>> print('read_ = ' + read_)
>>> print('to_write = ' + to_write)
>>> assert read_ == to_write
```

### Example

```
>>> import ubelt as ub
>>> import os
>>> from os.path import exists
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = dpath + '/' + 'testwrite2.txt'
>>> if exists(fpath):
>>>     os.remove(fpath)
>>> to_write = ['a\n', 'b\n', 'c\n', 'd\n']
>>> ub.writeto(fpath, to_write, aslines=True)
>>> read_ = ub.readfrom(fpath, aslines=True)
>>> print('read_ = {}'.format(read_))
>>> print('to_write = {}'.format(to_write))
>>> assert read_ == to_write
```

### Example

```
>>> # With modern Python, use pathlib.Path (or ub.Path) instead
>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt/tests/io').ensuredir()
>>> fpath = (dpath / 'test_file.txt').delete()
>>> to_write = 'utf-8 symbols , , , , , , , and .'
>>> ub.writeto(fpath, to_write)
>>> fpath.write_bytes(to_write.encode('utf8'))
>>> assert fpath.read_bytes().decode('utf8') == to_write
```

`ubelt.util_io.touch(fpath, mode=438, dir_fd=None, verbose=0, **kwargs)`

change file timestamps

Works like the touch unix utility

#### Parameters

- **fpath** (*str* | *PathLike*) – name of the file



- **mode** (*int*) – file permissions (python3 and unix only)
- **dir\_fd** (*io.IOBase*) – optional directory file descriptor. If specified, fpath is interpreted as relative to this descriptor (python 3 only).
- **verbose** (*int*) – verbosity
- **\*\*kwargs** – extra args passed to `os.utime()` (python 3 only).

**Returns**

path to the file

**Return type**

str

**References****Example**

```
>>> import ubelt as ub
>>> from os.path import join
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = join(dpath, 'touch_file')
>>> assert not exists(fpath)
>>> ub.touch(fpath)
>>> assert exists(fpath)
>>> os.unlink(fpath)
```

`ubelt.util_io.delete(path, verbose=False)`

Removes a file or recursively removes a directory. If a path does not exist, then this does nothing.

**Parameters**

- **path** (*str* | *PathLike*) – file or directory to remove
- **verbose** (*bool*) – if True prints what is being done

**SeeAlso:****send2trash -**

A cross-platform Python package for sending files to the trash instead of irreversibly deleting them.

`ubelt.util_path.Path.delete()`

**Notes**

This can call `os.unlink()`, `os.rmdir()`, or `shutil.rmtree()`, depending on what path references on the filesystem. (On windows may also call a custom `ubelt._win32_links._win32_rmtree()`).

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> base = ub.ensure_app_cache_dir('ubelt', 'delete_test')
>>> dpath1 = ub.ensure_dir(join(base, 'dir'))
>>> ub.ensure_dir(join(base, 'dir', 'subdir'))
>>> ub.touch(join(base, 'dir', 'to_remove1.txt'))
>>> fpath1 = join(base, 'dir', 'subdir', 'to_remove3.txt')
>>> fpath2 = join(base, 'dir', 'subdir', 'to_remove2.txt')
>>> ub.touch(fpath1)
>>> ub.touch(fpath2)
>>> assert all(map(exists, (dpath1, fpath1, fpath2)))
>>> ub.delete(fpath1)
>>> assert all(map(exists, (dpath1, fpath2)))
>>> assert not exists(fpath1)
>>> ub.delete(dpath1)
>>> assert not any(map(exists, (dpath1, fpath1, fpath2)))
```

### Example

```
>>> import ubelt as ub
>>> from os.path import exists, join
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'delete_test2')
>>> dpath1 = ub.ensure_dir(join(dpath, 'dir'))
>>> fpath1 = ub.touch(join(dpath1, 'to_remove.txt'))
>>> assert exists(fpath1)
>>> ub.delete(dpath)
>>> assert not exists(fpath1)
```

#### 1.28.1.1.18 ubelt.util\_links module

Cross-platform logic for dealing with symlinks. Basic functionality should work on all operating systems including everyone's favorite pathological OS (note that there is an additional helper file for this case), but there are some corner cases depending on your version. Recent versions of Windows tend to work, but there certain system settings that cause issues. Any POSIX system works without difficulty.

### Example

```
>>> import ubelt as ub
>>> from os.path import normpath, join
>>> dpath = ub.ensure_app_cache_dir('ubelt', normpath('demo/symlink'))
>>> real_path = join(dpath, 'real_file.txt')
>>> link_path = join(dpath, 'link_file.txt')
>>> ub.touch(real_path)
>>> result = ub.symlink(real_path, link_path, overwrite=True, verbose=3)
>>> parts = result.split(os.path.sep)
>>> print(parts[-1])
link_file.txt
```

`ubelt.util_links.symlink(real_path, link_path, overwrite=False, verbose=0)`

Create a link `link_path` that mirrors `real_path`.

This function attempts to create a real symlink, but will fall back on a hard link or junction if symlinks are not supported.

#### Parameters

- **path** (*str* | *PathLike*) – path to real file or directory
- **link\_path** (*str* | *PathLike*) – path to desired location for symlink
- **overwrite** (*bool*, *default=False*) – overwrite existing symlinks. This will not overwrite real files on systems with proper symlinks. However, on older versions of windows junctions are indistinguishable from real files, so we cannot make this guarantee.
- **verbose** (*int*, *default=0*) – verbosity level

#### Returns

link path

#### Return type

*str* | *PathLike*

---

**Note:** On systems that do not contain support for symlinks (e.g. some versions / configurations of Windows), this function will fall back on hard links or junctions [[WikiNTFSLinks](#)], [[WikiHardLink](#)]. The differences between the two are explained in [[WikiSymLink](#)].

If symlinks are not available, then `link_path` and `real_path` must exist on the same filesystem. Given that, this function always works in the sense that (1) `link_path` will mirror the data from `real_path`, (2) updates to one will effect the other, and (3) no extra space will be used.

More details can be found in `ubelt._win32_links`. On systems that support symlinks (e.g. Linux), none of the above applies.

---

## References

### Example

```
>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt', 'test_symlink0').delete().ensuredir()
>>> real_path = (dpath / 'real_file.txt')
>>> link_path = (dpath / 'link_file.txt')
>>> real_path.write_text('foo')
>>> result = ub.symlink(real_path, link_path)
>>> assert ub.Path(result).read_text() == 'foo'
>>> dpath.delete() # cleanup
```

### Example

```
>>> import ubelt as ub
>>> from ubelt.util_links import _dirstats
>>> dpath = ub.Path.appdir('ubelt', 'test_symlink1').delete().ensuredir()
>>> _dirstats(dpath)
>>> real_dpath = (dpath / 'real_dpath').ensuredir()
>>> link_dpath = real_dpath.augment(stem='link_dpath')
>>> real_path = (dpath / 'afile.txt')
>>> link_path = (dpath / 'afile.txt')
>>> real_path.write_text('foo')
>>> result = ub.symlink(real_dpath, link_dpath)
>>> assert link_path.read_text() == 'foo', 'read should be same'
>>> link_path.write_text('bar')
>>> _dirstats(dpath)
>>> assert link_path.read_text() == 'bar', 'very bad bar'
>>> assert real_path.read_text() == 'bar', 'changing link did not change real'
>>> real_path.write_text('baz')
>>> _dirstats(dpath)
>>> assert real_path.read_text() == 'baz', 'very bad baz'
>>> assert link_path.read_text() == 'baz', 'changing real did not change link'
>>> ub.delete(link_dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not link_dpath.exists(), 'link should not exist'
>>> assert real_path.exists(), 'real path should exist'
>>> _dirstats(dpath)
>>> ub.delete(dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not real_path.exists()
```

### Example

```
>>> # Specifying bad paths should error.
>>> import ubelt as ub
>>> import pytest
>>> dpath = ub.Path.appdir('ubelt', 'test_symlink2').ensuredir()
>>> real_path = dpath / 'real_file.txt'
>>> link_path = dpath / 'link_file.txt'
>>> real_path.write_text('foo')
>>> with pytest.raises(ValueError, match='link_path .* cannot be empty'):
>>>     ub.symlink(real_path, '')
>>> with pytest.raises(ValueError, match='real_path .* cannot be empty'):
>>>     ub.symlink('', link_path)
```

### 1.28.1.1.19 ubelt.util\_list module

Utility functions for manipulating iterables, lists, and sequences.

The `chunks()` function splits a list into smaller parts. There are different strategies for how to do this.

The `flatten()` function take a list of lists and removes the inner lists. This only removes one level of nesting.

The `iterable()` function checks if an object is iterable or not. Similar to the `callable()` builtin function.

The `argmax()`, `argmin()`, and `argsort()` work similarly to the analogous numpy functions, except they operate on dictionaries and other Python builtin types.

The `take()` and `compress()` are generators, and also similar to their lesser known, but very useful numpy equivalents.

There are also other numpy inspired functions: `unique()`, `argunique()`, `unique_flags()`, and `boolmask()`.

`ubelt.util_list.allsame(iterable, eq=<built-in function eq>)`

Determine if all items in a sequence are the same

#### Parameters

- **iterable** (`Iterable[T]`) – items to determine if they are all the same
- **eq** (`Callable[[T, T], bool]`, `default=operator.eq`) – function used to test for equality

#### Returns

True if all items are equal, otherwise False

#### Return type

`bool`

#### Notes

Similar to `more_itertools.all_equal()`

#### Example

```
>>> import ubelt as ub
>>> ub.allsame([1, 1, 1, 1])
True
>>> ub.allsame([])
True
>>> ub.allsame([0, 1])
False
>>> iterable = iter([0, 1, 1, 1])
>>> next(iterable)
>>> ub.allsame(iterable)
True
>>> ub.allsame(range(10))
False
>>> ub.allsame(range(10), lambda a, b: True)
True
```

`ubelt.util_list.argmax(indexable, key=None)`

Returns index / key of the item with the largest value.

This is similar to `numpy.argmax()`, but it is written in pure python and works on both lists and dictionaries.

### Parameters

- **indexable** (*Iterable[VT] | Mapping[KT, VT]*) – indexable to sort by
- **key** (*Callable[[VT], Any], default=None*) – customizes the ordering of the indexable

### Returns

the index of the item with the maximum value.

### Return type

`int | KT`

### Example

```
>>> import ubelt as ub
>>> assert ub.argmax({'a': 3, 'b': 2, 'c': 100}) == 'c'
>>> assert ub.argmax(['a', 'c', 'b', 'z', 'f']) == 3
>>> assert ub.argmax([[0, 1], [2, 3, 4], [5]], key=len) == 1
>>> assert ub.argmax({'a': 3, 'b': 2, 3: 100, 4: 4}) == 3
>>> assert ub.argmax(iter(['a', 'c', 'b', 'z', 'f'])) == 3
```

`ubelt.util_list.argmaxin(indexable, key=None)`

Returns index / key of the item with the smallest value.

This is similar to `numpy.argmax()`, but it is written in pure python and works on both lists and dictionaries.

### Parameters

- **indexable** (*Iterable[VT] | Mapping[KT, VT]*) – indexable to sort by
- **key** (*Callable[[VT], VT], default=None*) – customizes the ordering of the indexable

### Returns

the index of the item with the minimum value.

### Return type

`int | KT`

### Example

```
>>> import ubelt as ub
>>> assert ub.argmin({'a': 3, 'b': 2, 'c': 100}) == 'b'
>>> assert ub.argmin(['a', 'c', 'b', 'z', 'f']) == 0
>>> assert ub.argmin([[0, 1], [2, 3, 4], [5]], key=len) == 2
>>> assert ub.argmin({'a': 3, 'b': 2, 3: 100, 4: 4}) == 'b'
>>> assert ub.argmin(iter(['a', 'c', 'A', 'z', 'f'])) == 2
```

`ubelt.util_list.argsort(indexable, key=None, reverse=False)`

Returns the indices that would sort a indexable object.

This is similar to `numpy.argsort()`, but it is written in pure python and works on both lists and dictionaries.

### Parameters

- **indexable** (*Iterable[VT] | Mapping[KT, VT]*) – indexable to sort by
- **key** (*Callable[[VT], VT] | None, default=None*) – customizes the ordering of the indexable
- **reverse** (*bool, default=False*) – if True returns in descending order

**Returns**

indices - list of indices that sorts the indexable

**Return type**

List[int] | List[KT]

**Example**

```
>>> import ubelt as ub
>>> # argsort works on dicts by returning keys
>>> dict_ = {'a': 3, 'b': 2, 'c': 100}
>>> indices = ub.argsort(dict_)
>>> assert list(ub.take(dict_, indices)) == sorted(dict_.values())
>>> # argsort works on lists by returning indices
>>> indexable = [100, 2, 432, 10]
>>> indices = ub.argsort(indexable)
>>> assert list(ub.take(indexable, indices)) == sorted(indexable)
>>> # Can use iterators, but be careful. It exhausts them.
>>> indexable = reversed(range(100))
>>> indices = ub.argsort(indexable)
>>> assert indices[0] == 99
>>> # Can use key just like sorted
>>> indexable = [[0, 1, 2], [3, 4], [5]]
>>> indices = ub.argsort(indexable, key=len)
>>> assert indices == [2, 1, 0]
>>> # Can use reverse just like sorted
>>> indexable = [0, 2, 1]
>>> indices = ub.argsort(indexable, reverse=True)
>>> assert indices == [1, 2, 0]
```

`ubelt.util_list.argunique(items, key=None)`

Returns indices corresponding to the first instance of each unique item.

**Parameters**

- **items** (*Sequence[VT]*) – indexable collection of items
- **key** (*Callable[[VT], Any], default=None*) – custom normalization function. If specified returns items where `key(item)` is unique.

**Returns**

indices of the unique items

**Return type**

Iterator[int]

### Example

```
>>> import ubelt as ub
>>> items = [0, 2, 5, 1, 1, 0, 2, 4]
>>> indices = list(ub.argunique(items))
>>> assert indices == [0, 1, 2, 3, 7]
>>> indices = list(ub.argunique(items, key=lambda x: x % 2 == 0))
>>> assert indices == [0, 2]
```

`ubelt.util_list.boolmask(indices, maxval=None)`

Constructs a list of booleans where an item is True if its position is in `indices` otherwise it is False.

#### Parameters

- **indices** (*List[int]*) – list of integer indices
- **maxval** (*int*) – length of the returned list. If not specified this is inferred using `max(indices)`

#### Returns

mask - a list of booleans. `mask[idx]` is True if `idx` in `indices`

#### Return type

`List[bool]`

---

**Note:** In the future the arg `maxval` may change its name to `shape`

---

### Example

```
>>> import ubelt as ub
>>> indices = [0, 1, 4]
>>> mask = ub.boolmask(indices, maxval=6)
>>> assert mask == [True, True, False, False, True, False]
>>> mask = ub.boolmask(indices)
>>> assert mask == [True, True, False, False, True]
```

**class** `ubelt.util_list.chunks(items, chunksize=None, nchunks=None, total=None, bordermode='none', legacy=False)`

Bases: `object`

Generates successive n-sized chunks from `items`.

If the last chunk has less than n elements, `bordermode` is used to determine fill values.

#### Parameters

- **items** (*Iterable[T]*) – input to iterate over
- **chunksize** (*int*) – size of each sublist yielded
- **nchunks** (*int*) – number of chunks to create ( cannot be specified if `chunksize` is specified)
- **bordermode** (*str*) – determines how to handle the last case if the length of the input is not divisible by `chunksize` valid values are: { 'none', 'cycle', 'replicate' }
- **total** (*int*) – hints about the length of the input



**Note:****FIXME:**

When `nchunks` is given, that's how many chunks we should get but the issue is that `chunksize` is not well defined in that instance. For instance how do we turn a list with 4 elements into 3 chunks where does the extra item go?

In `ubelt <= 0.10.3` there is a bug when specifying `nchunks`, where it chooses a `chunksize` that is too large. Specify `legacy=True` to get the old buggy behavior if needed.

**Notes**

This is similar to functionality provided by

`more_itertools.chunked()`, `more_itertools.chunked_even()`, `more_itertools.sliced()`, `more_itertools.divide()`,

**Yields**

*List[T]* – subsequent non-overlapping chunks of the input items

**References****Example**

```
>>> import ubelt as ub
>>> items = '1234567'
>>> genresult = ub.chunks(items, chunksize=3)
>>> list(genresult)
[['1', '2', '3'], ['4', '5', '6'], ['7']]
```

**Example**

```
>>> import ubelt as ub
>>> items = [1, 2, 3, 4, 5, 6, 7]
>>> genresult = ub.chunks(items, chunksize=3, bordermode='none')
>>> assert list(genresult) == [[1, 2, 3], [4, 5, 6], [7]]
>>> genresult = ub.chunks(items, chunksize=3, bordermode='cycle')
>>> assert list(genresult) == [[1, 2, 3], [4, 5, 6], [7, 1, 2]]
>>> genresult = ub.chunks(items, chunksize=3, bordermode='replicate')
>>> assert list(genresult) == [[1, 2, 3], [4, 5, 6], [7, 7, 7]]
```

### Example

```
>>> import ubelt as ub
>>> assert len(list(ub.chunks(range(2), nchunks=2))) == 2
>>> assert len(list(ub.chunks(range(3), nchunks=2))) == 2
>>> # Note: ub.chunks will not do the 2,1,1 split
>>> assert len(list(ub.chunks(range(4), nchunks=3))) == 3
>>> assert len(list(ub.chunks([], 2, bordermode='none'))) == 0
>>> assert len(list(ub.chunks([], 2, bordermode='cycle'))) == 0
>>> assert len(list(ub.chunks([], 2, None, bordermode='replicate'))) == 0
```

### Example

```
>>> from ubelt.util_list import * # NOQA
>>> def _check_len(self):
...     assert len(self) == len(list(self))
>>> _check_len(chunks(list(range(3)), nchunks=2))
>>> _check_len(chunks(list(range(2)), nchunks=2))
>>> _check_len(chunks(list(range(2)), nchunks=3))
```

### Example

```
>>> from ubelt.util_list import * # NOQA
>>> import pytest
>>> assert pytest.raises(ValueError, chunks, range(9))
>>> assert pytest.raises(ValueError, chunks, range(9), chunksize=2, nchunks=2)
>>> assert pytest.raises(TypeError, len, chunks((_ for _ in range(2)), 2))
```

### Example

```
>>> from ubelt.util_list import * # NOQA
>>> import ubelt as ub
>>> basis = {
>>>     'legacy': [False, True],
>>>     'chunker': [{ 'nchunks': 3}, { 'nchunks': 4}, { 'nchunks': 5}, { 'nchunks': 7},
>>>     ↪ { 'chunksize': 3}],
>>>     'items': [range(2), range(4), range(5), range(7), range(9)],
>>>     'bordermode': ['none', 'cycle', 'replicate'],
>>> }
>>> grid_items = list(ub.named_product(basis))
>>> rows = []
>>> for grid_item in ub.ProgIter(grid_items):
>>>     chunker = grid_item.get('chunker')
>>>     grid_item.update(chunker)
>>>     kw = ub.dict_diff(grid_item, {'chunker'})
>>>     self = chunk_iter = ub.chunks(**kw)
>>>     chunked = list(chunk_iter)
>>>     chunk_lens = list(map(len, chunked))
```

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```

>>> row = ub.dict_union(grid_item, {'chunk_lens': chunk_lens, 'chunks': chunked}
↪)
>>> row['chunker'] = str(row['chunker'])
>>> if not row['legacy'] and 'nchunks' in kw:
>>>     assert kw['nchunks'] == row['nchunks']
>>> row.update(chunk_iter.__dict__)
>>> rows.append(row)
>>> # xdoctest: +SKIP
>>> import pandas as pd
>>> df = pd.DataFrame(rows)
>>> for _, subdf in df.groupby('chunker'):
>>>     print(subdf)
    
```

**static noborder**(items, chunksize)

**static cycle**(items, chunksize)

**static replicate**(items, chunksize)

**ubelt.util\_list.compress**(items, flags)

Selects from items where the corresponding value in flags is True.

#### Parameters

- **items** (*Iterable[Any]*) – a sequence to select items from
- **flags** (*Iterable[bool]*) – corresponding sequence of bools

#### Returns

a subset of masked items

#### Return type

*Iterable[Any]*

### Notes

This function is based on `numpy.compress()`, but is pure Python and swaps the condition and array argument to be consistent with `ubelt.take()`.

This is equivalent to `itertools.compress()`.

### Example

```

>>> import ubelt as ub
>>> items = [1, 2, 3, 4, 5]
>>> flags = [False, True, True, False, True]
>>> list(ub.compress(items, flags))
[2, 3, 5]
    
```

**ubelt.util\_list.flatten**(nested)

Transforms a nested iterable into a flat iterable.

#### Parameters

**nested** (*Iterable[Iterable[Any]]*) – list of lists

### Returns

flattened items

### Return type

Iterable[Any]

### Notes

Equivalent to `more_itertools.flatten()` and `itertools.chain.from_iterable()`.

### Example

```
>>> import ubelt as ub
>>> nested = [['a', 'b'], ['c', 'd']]
>>> list(ub.flatten(nested))
['a', 'b', 'c', 'd']
```

`ubelt.util_list.iter_window(iterable, size=2, step=1, wrap=False)`

Iterates through iterable with a window size. This is essentially a 1D sliding window.

### Parameters

- **iterable** (*Iterable[T]*) – an iterable sequence
- **size** (*int, default=2*) – sliding window size
- **step** (*int, default=1*) – sliding step size
- **wrap** (*bool, default=False*) – wraparound flag

### Returns

returns a possibly overlapping windows in a sequence

### Return type

Iterable[T]

### Notes

Similar to `more_itertools.windowed()`, Similar to `more_itertools.pairwise()`, Similar to `more_itertools.triplewise()`, Similar to `more_itertools.sliding_window()`

### Example

```
>>> import ubelt as ub
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 1, True
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = %r' % (window_list,))
window_list = [(1, 2, 3), (2, 3, 4), (3, 4, 5), (4, 5, 6), (5, 6, 1), (6, 1, 2)]
```

### Example

```
>>> import ubelt as ub
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 2, True
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = {!r}'.format(window_list))
window_list = [(1, 2, 3), (3, 4, 5), (5, 6, 1)]
```

### Example

```
>>> import ubelt as ub
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 2, False
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = {!r}'.format(window_list))
window_list = [(1, 2, 3), (3, 4, 5)]
```

### Example

```
>>> import ubelt as ub
>>> iterable = []
>>> size, step, wrap = 3, 2, False
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = {!r}'.format(window_list))
window_list = []
```

`ubelt.util_list.iterable(obj, strok=False)`

Checks if the input implements the iterator interface. An exception is made for strings, which return `False` unless `strok` is `True`

#### Parameters

- **obj** (*object*) – a scalar or iterable input
- **strok** (*bool, default=False*) – if `True` allow strings to be interpreted as iterable

#### Returns

True if the input is iterable

#### Return type

`bool`

### Example

```
>>> import ubelt as ub
>>> obj_list = [3, [3], '3', (3,), [3, 4, 5], {}]
>>> result = [ub.iterable(obj) for obj in obj_list]
>>> assert result == [False, True, False, True, True, True]
>>> result = [ub.iterable(obj, strok=True) for obj in obj_list]
>>> assert result == [False, True, True, True, True, True]
```

`ubelt.util_list.peek(iterable, default=NoParam)`

Look at the first item of an iterable. If the input is an iterator, then the next element is exhausted (i.e. a pop operation).

#### Parameters

- **iterable** (*Iterable[T]*) – an iterable
- **default** (*T*) – default item to return if the iterable is empty, otherwise a `StopIteration` error is raised

#### Returns

**item** - the first item of ordered sequence, a popped item from an iterator, or an arbitrary item from an unordered collection.

#### Return type

*T*

### Notes

Similar to `more_itertools.peekable()`

### Example

```
>>> import ubelt as ub
>>> data = [0, 1, 2]
>>> ub.peek(data)
0
>>> iterator = iter(data)
>>> print(ub.peek(iterator))
0
>>> print(ub.peek(iterator))
1
>>> print(ub.peek(iterator))
2
>>> ub.peek(range(3))
0
>>> ub.peek([], 3)
3
```

`ubelt.util_list.take(items, indices, default=NoParam)`

Lookup a subset of an indexable object using a sequence of indices.

The `items` input is usually a list or dictionary. When `items` is a list, this should be a sequence of integers. When `items` is a dict, this is a list of keys to lookup in that dictionary.

For dictionaries, a default may be specified as a placeholder to use if a key from `indices` is not in `items`.

#### Parameters

- **items** (*Sequence[VT] | Mapping[KT, VT]*) – An indexable object to select items from.
- **indices** (*Iterable[int | KT]*) – A sequence of indexes into `items`.
- **default** (*Any, default=None*) – if specified `items` must support the `get` method.

#### Yields

*VT* – a selected item within the list

#### SeeAlso:

`ubelt.dict_subset()`

---

**Note:** `ub.take(items, indices)` is equivalent to `(items[i] for i in indices)` when `default` is unspecified.

---

#### Notes

This is based on the `numpy.take()` function, but written in pure python.

Do not confuse this with `more_itertools.take()`, the behavior is very different.

#### Example

```
>>> import ubelt as ub
>>> items = [0, 1, 2, 3]
>>> indices = [2, 0]
>>> list(ub.take(items, indices))
[2, 0]
```

#### Example

```
>>> import ubelt as ub
>>> dict_ = {1: 'a', 2: 'b', 3: 'c'}
>>> keys = [1, 2, 3, 4, 5]
>>> result = list(ub.take(dict_, keys, None))
>>> assert result == ['a', 'b', 'c', None, None]
```

#### Example

```
>>> import ubelt as ub
>>> dict_ = {1: 'a', 2: 'b', 3: 'c'}
>>> keys = [1, 2, 3, 4, 5]
>>> try:
>>>     print(list(ub.take(dict_, keys)))
>>>     raise AssertionError('did not get key error')
```

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```
>>> except KeyError:
>>>     print('correctly got key error')
```

`ubelt.util_list.unique(items, key=None)`

Generates unique items in the order they appear.

#### Parameters

- **items** (*Iterable[T]*) – list of items
- **key** (*Callable[[T], Any], default=None*) – custom normalization function. If specified returns items where `key(item)` is unique.

#### Yields

*T* – a unique item from the input sequence

#### Notes

Functionally equivalent to `more_itertools.unique_everseen()`.

#### Example

```
>>> import ubelt as ub
>>> items = [4, 6, 6, 0, 6, 1, 0, 2, 2, 1]
>>> unique_items = list(ub.unique(items))
>>> assert unique_items == [4, 6, 0, 1, 2]
```

#### Example

```
>>> import ubelt as ub
>>> items = ['A', 'a', 'b', 'B', 'C', 'c', 'D', 'e', 'D', 'E']
>>> unique_items = list(ub.unique(items, key=str.lower))
>>> assert unique_items == ['A', 'b', 'C', 'D', 'e']
>>> unique_items = list(ub.unique(items))
>>> assert unique_items == ['A', 'a', 'b', 'B', 'C', 'c', 'D', 'e', 'E']
```

`ubelt.util_list.unique_flags(items, key=None)`

Returns a list of booleans corresponding to the first instance of each unique item.

#### Parameters

- **items** (*Sequence[VT]*) – indexable collection of items
- **key** (*Callable[[VT], Any] | None, default=None*) – custom normalization function. If specified returns items where `key(item)` is unique.

#### Returns

flags the items that are unique

#### Return type

List[bool]



### Example

```
>>> import ubelt as ub
>>> items = [0, 2, 1, 1, 0, 9, 2]
>>> flags = ub.unique_flags(items)
>>> assert flags == [True, True, True, False, False, True, False]
>>> flags = ub.unique_flags(items, key=lambda x: x % 2 == 0)
>>> assert flags == [True, False, True, False, False, False, False]
```

#### 1.28.1.1.20 ubelt.util\_memoize module

This module exposes decorators for in-memory caching of functional results. This is particularly useful when prototyping dynamic programming algorithms.

Either `memoize()`, `memoize_method()`, and `memoize_property()` should be used depending on what type of function is being wrapped. The following example demonstrates this.

In Python 3.8+ `memoize()` and `memoize_method()` work similarly to the standard library `functools.cache()` and `functools.memoize_method()`, but the `ubelt` version makes use of `ubelt.util_hash.hash_data()`, which is slower, but handles inputs containing mutable containers.

### Example

```
>>> import ubelt as ub
>>> # Memoize a function, the args are hashed
>>> @ub.memoize
>>> def func(a, b):
>>>     return a + b
>>> #
>>> class MyClass:
>>>     # Memoize a class method, the args are hashed
>>>     @ub.memoize_method
>>>     def my_method(self, a, b):
>>>         return a + b
>>> #
>>> # Memoize a property: there can be no args,
>>> @ub.memoize_property
>>> @property
>>> def my_property1(self):
>>>     return 4
>>> #
>>> # The property decorator is optional
>>> def my_property2(self):
>>>     return 5
>>> #
>>> func(1, 2)
>>> func(1, 2)
>>> self = MyClass()
>>> self.my_method(1, 2)
>>> self.my_method(1, 2)
>>> self.my_property1
```

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```
>>> self.my_property1
>>> self.my_property2
>>> self.my_property2
```

`ubelt.util_memoize.memoize(func)`

memoization decorator that respects args and kwargs

In Python 3.9, The `functools` introduces the `cache` method, which is currently faster than `memoize` for simple functions [[FunctoolsCache](#)]. However, `memoize` can handle more general non-natively hashable inputs.

#### Parameters

**func** (*Callable*) – live python function

#### Returns

memoized wrapper

#### Return type

Callable

## References

## Example

```
>>> import ubelt as ub
>>> closure = {'a': 'b', 'c': 'd'}
>>> incr = [0]
>>> def foo(key):
>>>     value = closure[key]
>>>     incr[0] += 1
>>>     return value
>>> foo_memo = ub.memoize(foo)
>>> assert foo('a') == 'b' and foo('c') == 'd'
>>> assert incr[0] == 2
>>> print('Call memoized version')
>>> assert foo_memo('a') == 'b' and foo_memo('c') == 'd'
>>> assert incr[0] == 4
>>> assert foo_memo('a') == 'b' and foo_memo('c') == 'd'
>>> print('Counter should no longer increase')
>>> assert incr[0] == 4
>>> print('Closure changes result without memoization')
>>> closure = {'a': 0, 'c': 1}
>>> assert foo('a') == 0 and foo('c') == 1
>>> assert incr[0] == 6
>>> assert foo_memo('a') == 'b' and foo_memo('c') == 'd'
```

`class ubelt.util_memoize.memoize_method(func)`

Bases: `object`

memoization decorator for a method that respects args and kwargs

## References

### Example

```
>>> import ubelt as ub
>>> closure = {'a': 'b', 'c': 'd'}
>>> incr = [0]
>>> class Foo(object):
>>>     @ub.memoize_method
>>>     def foo_memo(self, key):
>>>         "Wrapped foo_memo docstr"
>>>         value = closure[key]
>>>         incr[0] += 1
>>>         return value
>>>     def foo(self, key):
>>>         value = closure[key]
>>>         incr[0] += 1
>>>         return value
>>> self = Foo()
>>> assert self.foo('a') == 'b' and self.foo('c') == 'd'
>>> assert incr[0] == 2
>>> print('Call memoized version')
>>> assert self.foo_memo('a') == 'b' and self.foo_memo('c') == 'd'
>>> assert incr[0] == 4
>>> assert self.foo_memo('a') == 'b' and self.foo_memo('c') == 'd'
>>> print('Counter should no longer increase')
>>> assert incr[0] == 4
>>> print('Closure changes result without memoization')
>>> closure = {'a': 0, 'c': 1}
>>> assert self.foo('a') == 0 and self.foo('c') == 1
>>> assert incr[0] == 6
>>> assert self.foo_memo('a') == 'b' and self.foo_memo('c') == 'd'
>>> print('Constructing a new object should get a new cache')
>>> self2 = Foo()
>>> self2.foo_memo('a')
>>> assert incr[0] == 7
>>> self2.foo_memo('a')
>>> assert incr[0] == 7
>>> assert self.foo_memo.__doc__ == 'Wrapped foo_memo docstr'
>>> assert self.foo_memo.__name__ == 'foo_memo'
```

`ubelt.util_memoize.memoize_property(fget)`

Return a property attribute for new-style classes that only calls its getter on the first access. The result is stored and on subsequent accesses is returned, preventing the need to call the getter any more.

This decorator can either be used by itself or by decorating another property. In either case the method will always become a property.

---

**Note:** implementation is a modified version of `[estebistec_memoize]`.

---

## References

### Example

```
>>> import ubelt as ub
>>> class C(object):
...     load_name_count = 0
...     @ub.memoize_property
...     def name(self):
...         "name's docstring"
...         self.load_name_count += 1
...         return "the name"
...     @ub.memoize_property
...     @property
...     def another_name(self):
...         "name's docstring"
...         self.load_name_count += 1
...         return "the name"
>>> c = C()
>>> c.load_name_count
0
>>> c.name
'the name'
>>> c.load_name_count
1
>>> c.name
'the name'
>>> c.load_name_count
1
>>> c.another_name
```

#### 1.28.1.1.21 ubelt.util\_mixins module

This module defines the *NiceRepr* mixin class, which defines a `__repr__` and `__str__` method that only depend on a custom `__nice__` method, which you must define. This means you only have to overload one function instead of two. Furthermore, if the object defines a `__len__` method, then the `__nice__` method defaults to something sensible, otherwise it is treated as abstract and raises `NotImplementedError`.

To use simply have your object inherit from *NiceRepr* (multi-inheritance should be ok).

### Example

```
>>> # Objects that define __nice__ have a default __str__ and __repr__
>>> import ubelt as ub
>>> class Student(ub.NiceRepr):
...     def __init__(self, name):
...         self.name = name
...     def __nice__(self):
...         return self.name
>>> s1 = Student('Alice')
>>> s2 = Student('Bob')
```

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```

>>> # The __str__ representation looks nice
>>> print('s1 = {}'.format(s1))
>>> print('s2 = {}'.format(s2))
s1 = <Student(Alice)>
s2 = <Student(Bob)>
>>> # xdoctest: +IGNORE_WANT
>>> # The __repr__ representation also looks nice
>>> print('s1 = {!r}'.format(s1))
>>> print('s2 = {!r}'.format(s2))
s1 = <Student(Alice) at 0x7f2c5460aad0>
s2 = <Student(Bob) at 0x7f2c5460ad10>

```

### Example

```

>>> # Objects that define __len__ have a default __nice__
>>> import ubelt as ub
>>> class Group(ub.NiceRepr):
...     def __init__(self, data):
...         self.data = data
...     def __len__(self):
...         return len(self.data)
>>> g = Group([1, 2, 3])
>>> print('g = {}'.format(g))
g = <Group(3)>

```

#### class ubelt.util\_mixins.NiceRepr

Bases: `object`

Inherit from this class and define `__nice__` to “nicely” print your objects.

Defines `__str__` and `__repr__` in terms of `__nice__` function. Classes that inherit from `NiceRepr` should redefine `__nice__`. If the inheriting class has a `__len__` method then the default `__nice__` method will return its length.

### Example

```

>>> import ubelt as ub
>>> class Foo(ub.NiceRepr):
...     def __nice__(self):
...         return 'info'
>>> foo = Foo()
>>> assert str(foo) == '<Foo(info)>'
>>> assert repr(foo).startswith('<Foo(info) at ')

```

### Example

```
>>> import ubelt as ub
>>> class Bar(ub.NiceRepr):
...     pass
>>> bar = Bar()
>>> import pytest
>>> with pytest.warns(RuntimeWarning) as record:
>>>     assert 'object at' in str(bar)
>>>     assert 'object at' in repr(bar)
```

### Example

```
>>> import ubelt as ub
>>> class Baz(ub.NiceRepr):
...     def __len__(self):
...         return 5
>>> baz = Baz()
>>> assert str(baz) == '<Baz(5)>'
```

### Example

```
>>> import ubelt as ub
>>> # If your nice message has a bug, it shouldn't bring down the house
>>> class Foo(ub.NiceRepr):
...     def __nice__(self):
...         assert False
>>> foo = Foo()
>>> import pytest
>>> with pytest.warns(RuntimeWarning) as record:
>>>     print('foo = {!r}'.format(foo))
foo = <...Foo ...>
```

#### 1.28.1.1.22 ubelt.util\_path module

Functions for working with filesystem paths.

The `expandpath()` function expands the tilde to \$HOME and environment variables to their values.

The `augpath()` function creates variants of an existing path without having to spend multiple lines of code splitting it up and stitching it back together.

The `shrinkuser()` function replaces your home directory with a tilde.

The `userhome()` function reports the home directory of the current user of the operating system.

The `ensuredir()` function operates like `mkdir -p` in unix.

The `Path` object is an extension of `pathlib.Path` that contains extra convenience methods corresponding to the extra functional methods in this module.

**class** `ubelt.util_path.Path(*args, **kwargs)`

Bases: `PosixPath`

An extension of `pathlib.Path` with extra convenience methods

---

**Note:**

**New methods are:**

- `augment`
- `ensuredir`
- `expand`
- `expandvars`
- `ls`
- `shrinkuser`
- `walk`

**New classmethods are:**

- `appdir`

**Modified methods are:**

- `touch`
- 

## Example

```
>>> # Ubelt extends pathlib functionality
>>> import ubelt as ub
>>> dpath = ub.Path('~/.cache/ubelt/demo_path').expand().ensuredir()
>>> fpath = dpath / 'text_file.txt'
>>> aug_fpath = fpath.augment(stemsuffix='.aux', ext='.jpg').touch()
>>> aug_dpath = dpath.augment(stemsuffix='demo_path2')
>>> assert aug_fpath.read_text() == ''
>>> fpath.write_text('text data')
>>> assert aug_fpath.exists()
>>> assert not aug_fpath.delete().exists()
>>> assert dpath.exists()
>>> assert not dpath.delete().exists()
>>> print(f'{str(fpath.shrinkuser()).replace(os.path.sep, "/")}')
>>> print(f'{str(dpath.shrinkuser()).replace(os.path.sep, "/")}')
>>> print(f'{str(aug_fpath.shrinkuser()).replace(os.path.sep, "/")}')
>>> print(f'{str(aug_dpath.shrinkuser()).replace(os.path.sep, "/")}')
~/cache/ubelt/demo_path/text_file.txt
~/cache/ubelt/demo_path
~/cache/ubelt/demo_path/text_file.aux.jpg
~/cache/ubelt/demo_pathdemo_path2
```

**classmethod** `appdir(appname, *args, type='cache')`

Returns an operating system appropriate writable directory for an application to be used for cache, configs, or data.

**Parameters**

- **appname** (*str*) – the name of the application
- **\*args[*str*]** – optional subdirs
- **type** (*str*) – can be ‘cache’, ‘config’, or ‘data’.

**Returns**

a new path object

**Return type**

*Path*

**Example**

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> print(ub.Path.appdir('ubelt', type='cache').shrinkuser())
>>> print(ub.Path.appdir('ubelt', type='config').shrinkuser())
>>> print(ub.Path.appdir('ubelt', type='data').shrinkuser())
~/cache/ubelt
~/config/ubelt
~/local/share/ubelt
>>> import pytest
>>> with pytest.raises(KeyError):
>>>     ub.Path.appdir('ubelt', type='other')
```

**augment** (*prefix=""*, *stemsuffix=""*, *ext=None*, *stem=None*, *dpath=None*, *tail=""*, *relative=None*, *multidot=False*, *suffix=""*)

Create a new path with a different extension, basename, directory, prefix, and/or suffix.

See [augpath\(\)](#) for more details.

**Parameters**

- **prefix** (*str*) – Text placed in front of the stem. Defaults to ‘.’.
- **stemsuffix** (*str*) – Text placed between the stem and extension. Default to ‘’. Note: this is just called suffix in [ub.augpath\(\)](#).
- **ext** (*str* | *None*) – If specified, replaces the extension
- **stem** (*str* | *None*) – If specified, replaces the stem (i.e. basename without extension). Note: named base in [augpath\(\)](#).
- **dpath** (*str* | *PathLike* | *None*) – If specified, replaces the specified “relative” directory, which by default is the parent directory.
- **tail** (*str* | *None*) – If specified, appends this text to the extension.
- **relative** (*str* | *PathLike* | *None*) – Replaces **relative** with **dpath** in **path**. Has no effect if **dpath** is not specified. Defaults to the **dirname** of the input **path**. *experimental* not currently implemented.
- **multidot** (*bool*) – Allows extensions to contain multiple dots. Specifically, if **False**, everything after the last dot in the **basename** is the extension. If **True**, everything after the first dot in the **basename** is the extension.
- **suffix** (*str*) – DEPRECAETD



**SeeAlso:**

# Stdlib ways of augmenting pathlib.Path.with\_stem pathlib.Path.with\_suffix

**Returns**

augmented path

**Return type**

*Path*

---

**Note:** NOTICE OF BACKWARDS INCOMPATABILITY.

THE INITIAL RELEASE OF Path.augment suffered from an unfortunate variable naming decision that conflicts with pathlib.Path

```
p = ub.Path('the.entire.fname.or.dname.is.the.name.exe') print(f'p = {p}') print(f'p.name={p.name}')
p = ub.Path('the.stem.ends.here.ext') print(f'p = {p}') print(f'p.stem={p.stem}') p =
ub.Path('only.the.last.dot.is.the.suffix') print(f'p = {p}') print(f'p.suffix={p.suffix}') p =
ub.Path('but.all.suffixes.can.be.recovered') print(f'p = {p}') print(f'p.suffixes={p.suffixes}')
```

p.name p.stem p.suffixes p.parts

---

**Example**

```
>>> import ubelt as ub
>>> path = ub.Path('foo.bar')
>>> suffix = '_suff'
>>> prefix = 'pref_'
>>> ext = '.baz'
>>> newpath = path.augment(prefix=prefix, stemsuffix=suffix, ext=ext, stem='bar
↪')
>>> print('newpath = {!r}'.format(newpath))
newpath = Path('pref_bar_suff.baz')
```

**Example**

```
>>> import ubelt as ub
>>> path = ub.Path('foo.bar')
>>> stemsuffix = '_suff'
>>> prefix = 'pref_'
>>> ext = '.baz'
>>> newpath = path.augment(prefix=prefix, stemsuffix=stemsuffix, ext=ext, stem=
↪'bar')
>>> print('newpath = {!r}'.format(newpath))
```

### Example

```
>>> # Compare our augpath(ext=...) versus pathlib with_suffix(...)
>>> import ubelt as ub
>>> cases = [
>>>     ub.Path('no_ext'),
>>>     ub.Path('one.ext'),
>>>     ub.Path('double..dot'),
>>>     ub.Path('two.many.cooks'),
>>>     ub.Path('path.with.three.dots'),
>>>     ub.Path('traildot.'),
>>>     ub.Path('doubletraildot..'),
>>>     ub.Path('.prefdot'),
>>>     ub.Path('..doubleprefdot'),
>>> ]
>>> for path in cases:
>>>     print('--')
>>>     print('path = {}'.format(ub.repr2(path, nl=1)))
>>>     ext = '.EXT'
>>>     method_pathlib = path.with_suffix(ext)
>>>     method_augment = path.augment(ext=ext)
>>>     if method_pathlib == method_augment:
>>>         print(ub.color_text('agree', 'green'))
>>>     else:
>>>         print(ub.color_text('disagree', 'red'))
>>>     print('path.with_suffix({}) = {}'.format(ext, ub.repr2(method_pathlib,
↵nl=1)))
>>>     print('path.augment(ext={}) = {}'.format(ext, ub.repr2(method_augment,
↵nl=1)))
>>>     print('--')
```

### delete()

Removes a file or recursively removes a directory. If a path does not exist, then this does nothing.

#### SeeAlso:

`ubelt.delete()`

#### Returns

reference to self

#### Return type

*Path*

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> base = ub.Path(ub.ensure_app_cache_dir('ubelt', 'delete_test2'))
>>> dpath1 = (base / 'dir').ensuredir()
>>> (base / 'dir' / 'subdir').ensuredir()
>>> (base / 'dir' / 'to_remove1.txt').touch()
>>> fpath1 = (base / 'dir' / 'subdir' / 'to_remove3.txt').touch()
>>> fpath2 = (base / 'dir' / 'subdir' / 'to_remove2.txt').touch()
```

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```
>>> assert all(p.exists() for p in [dpath1, fpath1, fpath2])
>>> fpath1.delete()
>>> assert all(p.exists() for p in [dpath1, fpath2])
>>> assert not fpath1.exists()
>>> dpath1.delete()
>>> assert not any(p.exists() for p in [dpath1, fpath1, fpath2])
```

**ensuredir**(mode=511)Concise alias of `self.mkdir(parents=True, exist_ok=True)`**Returns**

returns itself

**Return type***Path***Example**

```
>>> import ubelt as ub
>>> cache_dpath = ub.ensure_app_cache_dir('ubelt')
>>> dpath = ub.Path(join(cache_dpath, 'ensuredir'))
>>> if dpath.exists():
...     os.rmdir(dpath)
>>> assert not dpath.exists()
>>> dpath.ensuredir()
>>> assert dpath.exists()
>>> dpath.rmdir()
```

**expand()**

Expands user tilde and environment variables.

Concise alias of `Path(os.path.expandvars(self.expanduser()))`**Returns**

path with expanded environment variables and tildes

**Return type***Path***Example**

```
>>> import ubelt as ub
>>> #home_v1 = ub.Path('$HOME').expand()
>>> home_v2 = ub.Path('~').expand()
>>> assert isinstance(home_v2, ub.Path)
>>> home_v3 = ub.Path.home()
>>> #print('home_v1 = {!r}'.format(home_v1))
>>> print('home_v2 = {!r}'.format(home_v2))
>>> print('home_v3 = {!r}'.format(home_v3))
>>> assert home_v3 == home_v2 # == home_v1
```

**expandvars()**

As discussed in [CPythonIssue21301], CPython won't be adding `expandvars` to `pathlib`. I think this is a mistake, so I added it in this extension.

**Returns**

path with expanded environment variables

**Return type**

*Path*

**References****ls()**

A convenience function to list all paths in a directory.

This is simply a wrapper around `iterdir` that returns the results as a list instead of a generator. This is mainly for faster navigation in IPython. In production code `iterdir` should be used instead.

**Returns**

List[Path]

**Example**

```
>>> import ubelt as ub
>>> self = ub.Path.appdir('ubelt/tests/ls')
>>> (self / 'dir1').ensuredir()
>>> (self / 'dir2').ensuredir()
>>> (self / 'file1').touch()
>>> (self / 'file2').touch()
>>> (self / 'dir1/file3').touch()
>>> (self / 'dir2/file4').touch()
>>> children = self.ls()
>>> assert isinstance(children, list)
>>> print(ub.repr2(sorted([p.relative_to(self) for p in children])))
[
  Path('dir1'),
  Path('dir2'),
  Path('file1'),
  Path('file2'),
]
```

**shrinkuser(home='~')**

Inverse of `os.path.expanduser()`.

**Parameters**

**home** (*str*) – symbol used to replace the home path. Defaults to `'~'`, but you might want to use `'$HOME'` or `'%USERPROFILE%'` instead.

**Returns**

path - shortened path replacing the home directory with a symbol

**Return type**

*Path*

### Example

```
>>> import ubelt as ub
>>> path = ub.Path('~').expand()
>>> assert str(path.shrinkuser()) == '~'
>>> assert str(ub.Path(str(path) + '1').shrinkuser()) == str(path) + '1'
>>> assert str((path / '1').shrinkuser()) == join('~', '1')
>>> assert str((path / '1').shrinkuser('$HOME')) == join('$HOME', '1')
>>> assert str(ub.Path('.').shrinkuser()) == '.'
```

**touch**(mode=438, exist\_ok=True)

Create this file with the given access mode, if it doesn't exist.

#### Returns

returns itself

#### Return type

*Path*

### Notes

The `ubelt.util_io.touch()` function currently has a slightly different implementation. This uses whatever the pathlib version is. This may change in the future.

**walk**(topdown=True, onerror=None, followlinks=False)

A variant of os.walk for pathlib

#### Parameters

- **topdown** (*bool*) – if True starts yield nodes closer to the root first otherwise yield nodes closer to the leaves first.
- **onerror** (*Callable[[OSError], None]*) – A function with one argument of type OSError. If the error is raised the walk is aborted, otherwise it continues.
- **followlinks** (*bool*) – if True recurse into symbolic directory links

#### Yields

*Tuple[Path, List[str], List[str]]* – the root path, directory names, and file names

### Example

```
>>> import ubelt as ub
>>> self = ub.Path.appdir('ubelt/tests/ls')
>>> (self / 'dir1').ensuredir()
>>> (self / 'dir2').ensuredir()
>>> (self / 'file1').touch()
>>> (self / 'file2').touch()
>>> (self / 'dir1/file3').touch()
>>> (self / 'dir2/file4').touch()
>>> subdirs = list(self.walk())
>>> assert len(subdirs) == 3
```

### Example

```
>>> # Modified from the stdlib
>>> import os
>>> from os.path import join, getsize
>>> import email
>>> import ubelt as ub
>>> base = ub.Path(email.__file__).parent
>>> for root, dirs, files in base.walk():
>>>     print(root, " consumes", end="")
>>>     print(sum(getsize(join(root, name)) for name in files), end="")
>>>     print("bytes in ", len(files), " non-directory files")
>>>     if 'CVS' in dirs:
>>>         dirs.remove('CVS') # don't visit CVS directories
```

**class** `ubelt.util_path.TempDir`

Bases: `object`

Context for creating and cleaning up temporary directories.

---

**Note:** This class will be DEPRECATED. The exact deprecation version and mitigation plan has not yet been developed.

---



---

**Note:** This exists because `tempfile.TemporaryDirectory` was introduced in Python 3.2. Thus once ubelt no longer supports python 2.7, this class will be deprecated.

---

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> with TempDir() as self:
>>>     dpath = self.dpath
>>>     assert exists(dpath)
>>>     assert not exists(dpath)
```

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> self = TempDir()
>>> dpath = self.ensure()
>>> assert exists(dpath)
>>> self.cleanup()
>>> assert not exists(dpath)
```

**ensure()**

**cleanup()**

**start()**

`ubelt.util_path.augpath(path, suffix="", prefix="", ext=None, tail="", base=None, dpath=None, relative=None, multidot=False)`

Create a new path with a different extension, basename, directory, prefix, and/or suffix.

A prefix is inserted before the basename. A suffix is inserted between the basename and the extension. The base-name and extension can be replaced with a new one. Essentially a path is broken down into components (dpath, base, ext), and then recombined as (dpath, prefix, base, suffix, ext) after replacing any specified component.

#### Parameters

- **path** (*str* | *PathLike*) – a path to augment
- **suffix** (*str*) – placed between the basename and extension Note: this is referred to as stem-suffix in `ub.Path.augment()`.
- **prefix** (*str*) – placed in front of the basename
- **ext** (*str* | *None*) – if specified, replaces the extension
- **tail** (*str* | *None*) – If specified, appends this text to the extension
- **base** (*str* | *None*) – if specified, replaces the basename without extension. Note: this is referred to as stem in `ub.Path.augment()`.
- **dpath** (*str* | *PathLike* | *None*) – if specified, replaces the specified “relative” directory, which by default is the parent directory.
- **relative** (*str* | *PathLike* | *None*) – Replaces `relative` with `dpath` in `path`. Has no effect if `dpath` is not specified. Defaults to the `dirname` of the input `path`. *experimental* not currently implemented.
- **multidot** (*bool*) – Allows extensions to contain multiple dots. Specifically, if `False`, everything after the last dot in the basename is the extension. If `True`, everything after the first dot in the basename is the extension.

#### Returns

augmented path

#### Return type

`str`

#### Example

```
>>> import ubelt as ub
>>> path = 'foo.bar'
>>> suffix = '_suff'
>>> prefix = 'pref_'
>>> ext = '.baz'
>>> newpath = ub.augpath(path, suffix, prefix, ext=ext, base='bar')
>>> print('newpath = %s' % (newpath,))
newpath = pref_bar_suff.baz
```

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> augpath('foo.bar')
'foo.bar'
>>> augpath('foo.bar', ext='.BAZ')
'foo.BAZ'
>>> augpath('foo.bar', suffix='_')
'foo_.bar'
>>> augpath('foo.bar', prefix='_')
'_foo.bar'
>>> augpath('foo.bar', base='baz')
'baz.bar'
>>> augpath('foo.tar.gz', ext='.zip', multidot=True)
foo.zip
>>> augpath('foo.tar.gz', ext='.zip', multidot=False)
foo.tar.zip
>>> augpath('foo.tar.gz', suffix='_new', multidot=True)
foo_new.tar.gz
>>> augpath('foo.tar.gz', suffix='_new', tail='.cache', multidot=True)
foo_new.tar.gz.cache
```

`ubelt.util_path.shrinkuser(path, home='~')`

Inverse of `os.path.expanduser()`.

#### Parameters

- **path** (*str* | *PathLike*) – path in system file structure
- **home** (*str*) – symbol used to replace the home path. Defaults to `'~'`, but you might want to use `'$HOME'` or `'%USERPROFILE%'` instead.

#### Returns

path - shortened path replacing the home directory with a symbol

#### Return type

`str`

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> path = expanduser('~')
>>> assert path != '~'
>>> assert shrinkuser(path) == '~'
>>> assert shrinkuser(path + '1') == path + '1'
>>> assert shrinkuser(path + '/1') == join('~', '1')
>>> assert shrinkuser(path + '/1', '$HOME') == join('$HOME', '1')
>>> assert shrinkuser('.') == '.'
```

`ubelt.util_path.userhome(username=None)`

Returns the path to some user's home directory.

#### Parameters

**username** (*str* | *None*) – name of a user on the system. If not specified, the current user is inferred.



**Returns**

userhome\_dpath - path to the specified home directory

**Return type**

str

**Raises**

- **KeyError** – if the specified user does not exist on the system
- **OSError** – if username is unspecified and the current user cannot be inferred

**Example**

```
>>> from ubelt.util_path import * # NOQA
>>> import getpass
>>> username = getpass.getuser()
>>> assert userhome() == expanduser('~')
>>> assert userhome(username) == expanduser('~')
```

`ubelt.util_path.ensuredir(dpath, mode=1023, verbose=0, recreate=False)`

Ensures that directory will exist. Creates new dir with sticky bits by default

**Parameters**

- **dpath** (*str* | *PathLike* | *Tuple[str | PathLike]*) – dir to ensure. Can also be a tuple to send to join
- **mode** (*int*) – octal mode of directory
- **verbose** (*int*) – verbosity
- **recreate** (*bool*) – if True removes the directory and all of its contents and creates a fresh new directory. USE CAREFULLY.

**Returns**

path - the ensured directory

**Return type**

str

**SeeAlso:**

`ubelt.Path.ensuredir()`

---

**Note:** This function is not thread-safe in Python2

---

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> import ubelt as ub
>>> cache_dpath = ub.ensure_app_cache_dir('ubelt')
>>> dpath = join(cache_dpath, 'ensuredir')
>>> if exists(dpath):
...     os.rmdir(dpath)
>>> assert not exists(dpath)
>>> ub.ensuredir(dpath)
>>> assert exists(dpath)
>>> os.rmdir(dpath)
```

`ubelt.util_path.expandpath(path)`

Shell-like environment variable and tilde path expansion.

#### Parameters

**path** (*str* | *PathLike*) – string representation of a path

#### Returns

expanded path

#### Return type

`str`

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> import ubelt as ub
>>> assert normpath(ub.expandpath('~foo')) == join(ub.userhome(), 'foo')
>>> assert ub.expandpath('foo') == 'foo'
```

#### 1.28.1.1.23 ubelt.util\_platform module

The goal of this module is to provide an idiomatic cross-platform pattern of accessing platform dependent file systems.

Standard application directory structure: cache, config, and other XDG standards [XDG\_Spec]. This is similar to the more focused appdirs module [AS\_appdirs]. In the future ubelt may directly use appdirs.

---

**Note:** Table mapping the type of directory to the system default environment variable. Inspired by [SO\_43853548], [SO\_11113974], and [harawata\_appdirs].

---

	Linux	Win32	Darwin
data	\$XDG_DATA_HOME	%APPDATA%	~/Library/Application Support
config	\$XDG_CONFIG_HOME	%APPDATA%	~/Library/Application Support
cache	\$XDG_CACHE_HOME	%LOCALAPPDATA%	~/Library/Caches

If an environment variable is not specified the defaults are:

```
APPDATA      = ~/AppData/Roaming
LOCALAPPDATA = ~/AppData/Local
```

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```

XDG_DATA_HOME    = ~/.local/share
XDG_CACHE_HOME   = ~/.cache
XDG_CONFIG_HOME  = ~/.config

```

## References

`ubelt.util_platform.find_exe(name, multi=False, path=None)`

Locate a command.

Search your local filesystem for an executable and return the first matching file with executable permission.

### Parameters

- **name** (*str* | *PathLike*) – globstr of matching filename
- **multi** (*bool*, *default=False*) – if True return all matches instead of just the first.
- **path** (*str* | *PathLike* | *Iterable[str | PathLike]* | *None*, *default=None*) – overrides the system PATH variable.

### Returns

returns matching executable(s).

### Return type

*str* | *List[str]* | *None*

### SeeAlso:

`shutil.which()` - which is available in Python 3.3+.

---

**Note:** This is essentially the `which` UNIX command

---

## References

### Example

```

>>> # The following are programs commonly exposed via the PATH variable.
>>> # Exact results may differ between machines.
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> print(ub.find_exe('ls'))
>>> print(ub.find_exe('ping'))
>>> print(ub.find_exe('which'))
>>> print(ub.find_exe('which', multi=True))
>>> print(ub.find_exe('ping', multi=True))
>>> print(ub.find_exe('noexist', multi=True))
/usr/bin/ls
/usr/bin/ping
/usr/bin/which
['/usr/bin/which', '/bin/which']

```

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```
['/usr/bin/ping', '/bin/ping']
[]
```

### Example

```
>>> import ubelt as ub
>>> assert not ub.find_exe('!noexist', multi=False)
>>> assert ub.find_exe('ping', multi=False) or ub.find_exe('ls', multi=False)
>>> assert not ub.find_exe('!noexist', multi=True)
>>> assert ub.find_exe('ping', multi=True) or ub.find_exe('ls', multi=True)
```

### Benchmark:

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> import shutil
>>> from timerit import Timerit
>>> for timer in Timerit(1000, bestof=10, label='ub.find_exe'):
>>>     ub.find_exe('which')
>>> for timer in Timerit(1000, bestof=10, label='shutil.which'):
>>>     shutil.which('which')
Timed best=25.339 µs, mean=25.809 ± 0.3 µs for ub.find_exe
Timed best=28.600 µs, mean=28.986 ± 0.3 µs for shutil.which
```

`ubelt.util_platform.find_path(name, path=None, exact=False)`

Search for a file or directory on your local filesystem by name (file must be in a directory specified in a PATH environment variable)

#### Parameters

- **name** (*str* | *PathLike*) – file name to match. If `exact` is `False` this may be a glob pattern
- **path** (*str* | *Iterable*[*str* | *PathLike*], *default=None*) – list of directories to search either specified as an `os.pathsep` separated string or a list of directories. Defaults to environment PATH.
- **exact** (*bool*, *default=False*) – if `True`, only returns exact matches.

#### Yields

*str* – candidate - a path that matches name

---

**Note:** Running with `name=''` (i.e. `ub.find_path('')`) will simply yield all directories in your PATH.

---



---

**Note:** For recursive behavior set `path=(d for d, _, _ in os.walk('.'))`, where `'.'` might be replaced by the root directory of interest.

---

### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> print(list(ub.find_path('ping', exact=True)))
>>> print(list(ub.find_path('bin')))
>>> print(list(ub.find_path('gcc*')))
>>> print(list(ub.find_path('cmake*')))
['/usr/bin/ping', '/bin/ping']
[]
[... '/usr/bin/gcc-11', '/usr/bin/gcc-ranlib', ...]
[... '/usr/bin/cmake-gui', '/usr/bin/cmake', ...]
```

### Example

```
>>> import ubelt as ub
>>> from os.path import dirname
>>> path = dirname(dirname(ub.util_platform.__file__))
>>> res = sorted(ub.find_path('ubelt/util_*.py', path=path))
>>> assert len(res) >= 10
>>> res = sorted(ub.find_path('ubelt/util_platform.py', path=path, exact=True))
>>> print(res)
>>> assert len(res) == 1
```

`ubelt.util_platform.ensure_app_cache_dir(appname, *args)`

Calls `get_app_cache_dir()` but ensures the directory exists.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='cache').ensuredir()`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

the path to the ensured directory

#### Return type

`str`

#### SeeAlso:

`get_app_cache_dir()`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.util_platform.ensure_app_config_dir(appname, *args)`

Calls `get_app_config_dir()` but ensures the directory exists.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='config').ensuredir()`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

the path to the ensured directory

#### Return type

`str`

#### SeeAlso:

`get_app_config_dir()`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_config_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.util_platform.ensure_app_data_dir(appname, *args)`

Calls `get_app_data_dir()` but ensures the directory exists.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='data').ensuredir()`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

the path to the ensured directory

#### Return type

`str`

#### SeeAlso:

`get_app_data_dir()`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_data_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.util_platform.get_app_cache_dir(appname, *args)`

Returns a writable directory for an application. This should be used for temporary deletable data.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='cache')`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

the path to the ensured directory

#### Return type

`str`

#### Returns

dpath - writable cache directory for this application

#### Return type

`str`

#### SeeAlso:

`ensure_app_cache_dir()`

`ubelt.util_platform.get_app_config_dir(appname, *args)`

Returns a writable directory for an application This should be used for persistent configuration files.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='config')`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

dpath - writable config directory for this application

#### Return type

`str`

#### SeeAlso:

`ensure_app_config_dir()`

`ubelt.util_platform.get_app_data_dir(appname, *args)`

Returns a writable directory for an application. This should be used for temporary deletable data.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='data')`.

---

**Parameters**

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns**

dpath - writable data directory for this application

**Return type**

*str*

**SeeAlso:**

`ensure_app_data_dir()`

`ubelt.util_platform.platform_cache_dir()`

Returns a directory which should be writable for any application This should be used for temporary deletable data.

**Returns**

path to the cache dir used by the current operating system

**Return type**

*str*

`ubelt.util_platform.platform_config_dir()`

Returns a directory which should be writable for any application This should be used for persistent configuration files.

**Returns**

path to the cache dir used by the current operating system

**Return type**

*str*

`ubelt.util_platform.platform_data_dir()`

Returns path for user-specific data files

**Returns**

path to the data dir used by the current operating system

**Return type**

*str*



### 1.28.1.1.24 ubelt.util\_str module

Functions for working with text and strings.

The `ensure_unicode()` function does its best to coerce Python 2/3 bytes and text into a consistent unicode text representation.

The `codeblock()` and `paragraph()` wrap multiline strings to help write text blocks without hindering the surrounding code indentation.

The `hzcat()` function horizontally concatenates multiline text.

The `indent()` prefixes all lines in a text block with a given prefix. By default that prefix is 4 spaces.

`ubelt.util_str.indent(text, prefix='')`

Indents a block of text

#### Parameters

- **text** (*str*) – text to indent
- **prefix** (*str*, *default* = '') – prefix to add to each line

#### Returns

indented text

#### Return type

str

#### Example

```
>>> import ubelt as ub
>>> NL = chr(10) # newline character
>>> text = 'Lorem ipsum' + NL + 'dolor sit amet'
>>> prefix = ' '
>>> result = ub.indent(text, prefix)
>>> assert all(t.startswith(prefix) for t in result.split(NL))
```

`ubelt.util_str.codeblock(text)`

Create a block of text that preserves all newlines and relative indentation

Wraps multiline string blocks and returns unindented code. Useful for templated code defined in indented parts of code.

#### Parameters

**text** (*str*) – typically a multiline string

#### Returns

the unindented string

#### Return type

str

### Example

```
>>> import ubelt as ub
>>> # Simulate an indented part of code
>>> if True:
>>>     # notice the indentation on this will be normal
>>>     codeblock_version = ub.codeblock(
...         """
...         def foo():
...             return 'bar'
...         """
...     )
>>>     # notice the indentation and newlines on this will be odd
>>>     normal_version = (''
...         def foo():
...             return 'bar'
...         '')
>>> assert normal_version != codeblock_version
>>> print('Without codeblock')
>>> print(normal_version)
>>> print('With codeblock')
>>> print(codeblock_version)
```

`ubelt.util_str.paragraph(text)`

Wraps multi-line strings and restructures the text to remove all newlines, heading, trailing, and double spaces.

Useful for writing log messages

#### Parameters

**text** (*str*) – typically a multiline string

#### Returns

the reduced text block

#### Return type

`str`

### Example

```
>>> import ubelt as ub
>>> text = (
>>>     """
>>>     Lorem ipsum dolor sit amet, consectetur adipiscing
>>>     elit, sed do eiusmod tempor incididunt ut labore et
>>>     dolore magna aliqua.
>>>     """)
>>> out = ub.paragraph(text)
>>> assert chr(10) in text
>>> assert chr(10) not in out
>>> print('text = {!r}'.format(text))
>>> print('out = {!r}'.format(out))
```

`ubelt.util_str.hzcat(args, sep="")`

Horizontally concatenates strings preserving indentation

Concatenates a list of objects ensuring that the next item in the list is all the way to the right of any previous items.

#### Parameters

- **args** (*List[str]*) – strings to concatenate
- **sep** (*str*, *default=""*) – separator

#### Example1:

```
>>> import ubelt as ub
>>> B = ub.repr2([[1, 2], [3, 457]], nl=1, cbr=True, trailsep=False)
>>> C = ub.repr2([[5, 6], [7, 8]], nl=1, cbr=True, trailsep=False)
>>> args = ['A = ', B, ' * ', C]
>>> print(ub.hzcat(args))
A = [[1, 2],      * [[5, 6],
      [3, 457]]   [7, 8]]
```

#### Example2:

```
>>> import ubelt as ub
>>> import unicodedata
>>> aa = unicodedata.normalize('NFD', 'á') # a unicode char with len2
>>> B = ub.repr2(['', aa], [aa, aa, aa], nl=1, si=True, cbr=True,
↳ trailsep=False)
>>> C = ub.repr2([[5, 6], [7, '']], nl=1, si=True, cbr=True, trailsep=False)
>>> args = ['A', '=', B, '*', C]
>>> print(ub.hzcat(args, sep=''))
A=[[ , á],    * [[5, 6],
  [á, á, á]] [7, ]]
```

`ubelt.util_str.ensure_unicode(text)`

Casts bytes into utf8 (mostly for python2 compatibility)

#### Parameters

**text** (*str | bytes*) – text to ensure is decoded as unicode

#### Returns

*str*

## References

[SO\_12561063] <http://stackoverflow.com/questions/12561063/extract-data-from-file>

## Example

```
>>> from ubelt.util_str import *
>>> import codecs # NOQA
>>> assert ensure_unicode('my ûnicôdé string') == 'my ûnicôdé string'
>>> assert ensure_unicode('text1') == 'text1'
>>> assert ensure_unicode('text1'.encode('utf8')) == 'text1'
>>> assert ensure_unicode('i»¿text1'.encode('utf8')) == 'i»¿text1'
>>> assert (codecs.BOM_UTF8 + 'text»¿'.encode('utf8')).decode('utf8')
```

### 1.28.1.1.25 ubelt.util\_stream module

Functions for capturing and redirecting IO streams.

The *CaptureStdout* captures all text sent to stdout and optionally prevents it from actually reaching stdout.

The *TeeStringIO* does the same thing but for arbitrary streams. It is how the former is implemented.

**class** `ubelt.util_stream.TeeStringIO(redirect=None)`

Bases: `StringIO`

An IO object that writes to itself and another IO stream.

#### Variables

**redirect** (*io.IOBase*) – The other stream to write to.

## Example

```
>>> import ubelt as ub
>>> redirect = io.StringIO()
>>> self = ub.TeeStringIO(redirect)
```

#### **isatty()**

Returns true if the redirect is a terminal.

---

**Note:** Needed for `IPython.embed` to work properly when this class is used to override stdout / stderr.

---

#### **fileno()**

Returns underlying file descriptor of the redirected `IOBase` object if one exists.

### Example

```
>>> # Not sure the best way to test, this func is important for
>>> # capturing stdout when ipython embedding
>>> import pytest
>>> with pytest.raises(io.UnsupportedOperation):
>>>     TeeStringIO(redirect=io.StringIO()).fileno()
>>> with pytest.raises(io.UnsupportedOperation):
>>>     TeeStringIO(None).fileno()
```

### property encoding

Gets the encoding of the *redirect* IO object

### Example

```
>>> import ubelt as ub
>>> redirect = io.StringIO()
>>> assert ub.TeeStringIO(redirect).encoding is None
>>> assert ub.TeeStringIO(None).encoding is None
>>> assert ub.TeeStringIO(sys.stdout).encoding is sys.stdout.encoding
>>> redirect = io.TextIOWrapper(io.StringIO())
>>> assert ub.TeeStringIO(redirect).encoding is redirect.encoding
```

### write(msg)

Write to this and the redirected stream

### flush()

Flush to this and the redirected stream

**class** `ubelt.util_stream.CaptureStdout`(*suppress=True, enabled=True*)

Bases: `CaptureStream`

Context manager that captures stdout and stores it in an internal stream

#### Parameters

- **suppress** (*bool, default=True*) – if True, stdout is not printed while captured
- **enabled** (*bool, default=True*) – does nothing if this is False
- **\*\*kwargs** – used for backwards compatibility with misspelled deprecated params.

### SeeAlso:

`contextlib.redirect_stdout()`

### Example

```
>>> import ubelt as ub
>>> self = ub.CaptureStdout(suppress=True)
>>> print('dont capture the table flip (°° ')
>>> with self:
...     text = 'capture the heart '
...     print(text)
```

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```
>>> print('dont capture look of disapproval _')
>>> assert isinstance(self.text, str)
>>> assert self.text == text + '\n', 'failed capture text'
```

### Example

```
>>> import ubelt as ub
>>> self = ub.CaptureStdout(suppress=False)
>>> with self:
...     print('I am captured and printed in stdout')
>>> assert self.text.strip() == 'I am captured and printed in stdout'
```

### Example

```
>>> import ubelt as ub
>>> self = ub.CaptureStdout(suppress=True, enabled=False)
>>> with self:
...     print('dont capture')
>>> assert self.text is None
```

**log\_part()**

Log what has been captured so far

**start()**

**stop()**

### Example

```
>>> import ubelt as ub
>>> ub.CaptureStdout(enabled=False).stop()
>>> ub.CaptureStdout(enabled=True).stop()
```

**close()**

**class** `ubelt.util_stream.CaptureStream`

Bases: `object`

Generic class for capturing streaming output from stdout or stderr

### 1.28.1.1.26 ubelt.util\_time module

This is util\_time, it contains functions for handling time related code.

The `timestamp()` function returns an iso8601 timestamp without much fuss.

The `timeparse()` is the inverse of `timestamp`, and makes use of `dateutil` if it is available.

The `Timer` class is a context manager that times a block of indented code. It includes `tic` and `toc` methods a more matlab like feel.

Timerit is gone! Use the standalone and separate module `:module:`timerit``.

See also:

`tempora` - <https://github.com/jaraco/tempora> - time related utility functions from Jaraco `pendulum` - <https://github.com/sdispater/pendulum> - drop in replacement for `datetime`

`ubelt.util_time.timestamp(datetime=None, precision=0, default_timezone='local', allow_dateutil=True)`

Make a concise iso8601 timestamp suitable for use in filenames.

#### Parameters

- **datetime** (`datetime.datetime` | `datetime.date` | `None`) – A datetime to format into a timestamp. If unspecified, the current local time is used. If given as a date, the time 00:00 is used.
- **precision** (`int`) – if non-zero, adds up to 6 digits of sub-second precision.
- **default\_timezone** (`str` | `datetime.timezone`) – if the input does not specify a timezone, assume this one. Can be “local” or “utc”, or a standardized code if `dateutil` is installed.
- **allow\_dateutil** (`bool`) – if True, will use `dateutil` to lookup the default timezone if needed

#### Returns

The timestamp, which will always contain a date, time, and timezone.

#### Return type

`str`

---

**Note:** For more info see [WikiISO8601], [PyStrptime], [PyTime].

---

## References

## Example

```
>>> import ubelt as ub
>>> stamp = ub.timestamp()
>>> print('stamp = {!r}'.format(stamp))
stamp = ...-...-...T...
```

### Example

```
>>> import ubelt as ub
>>> import datetime as datetime_mod
>>> from datetime import datetime as datetime_cls
>>> # Create a datetime object with timezone information
>>> ast_tzinfo = datetime_mod.timezone(datetime_mod.timedelta(hours=-4), 'AST')
>>> datetime = datetime_cls.utctimestamp(123456789.123456789).
↳replace(tzinfo=ast_tzinfo)
>>> stamp = ub.timestamp(datetime, precision=2)
>>> print('stamp = {!r}'.format(stamp))
stamp = '1973-11-29T213309.12-4'
```

```
>>> # Demo with a fractional hour timezone
>>> act_tzinfo = datetime_mod.timezone(datetime_mod.timedelta(hours=+9.5), 'ACT')
>>> datetime = datetime_cls.utctimestamp(123456789.123456789).
↳replace(tzinfo=act_tzinfo)
>>> stamp = ub.timestamp(datetime, precision=2)
>>> print('stamp = {!r}'.format(stamp))
stamp = '1973-11-29T213309.12+0930'
```

```
>>> # Can accept datetime or date objects with local, utc, or custom default_
↳timezones
>>> act_tzinfo = datetime_mod.timezone(datetime_mod.timedelta(hours=+9.5), 'ACT')
>>> datetime_utc = ub.timeparse('2020-03-05T112233', default_timezone='utc')
>>> datetime_act = ub.timeparse('2020-03-05T112233', default_timezone=act_tzinfo)
>>> datetime_notz = datetime_utc.replace(tzinfo=None)
>>> date = datetime_utc.date()
>>> stamp_utc = ub.timestamp(datetime_utc)
>>> stamp_act = ub.timestamp(datetime_act)
>>> stamp_date_utc = ub.timestamp(date, default_timezone='utc')
>>> print(f'stamp_utc      = {stamp_utc}')
>>> print(f'stamp_act      = {stamp_act}')
>>> print(f'stamp_date_utc = {stamp_date_utc}')
stamp_utc      = 2020-03-05T112233+0
stamp_act      = 2020-03-05T112233+0930
stamp_date_utc = 2020-03-05T000000+0
```

### Example

```
>>> # xdoctest: +REQUIRES(module:dateutil)
>>> # Make sure we are compatible with dateutil
>>> import ubelt as ub
>>> from dateutil.tz import tzlocal
>>> import datetime as datetime_mod
>>> from datetime import datetime as datetime_cls
>>> tz_act = datetime_mod.timezone(datetime_mod.timedelta(hours=+9.5), 'ACT')
>>> tzinfo_list = [
>>>     tz_act,
>>>     datetime_mod.timezone(datetime_mod.timedelta(hours=-4), 'AST'),
>>>     datetime_mod.timezone(datetime_mod.timedelta(hours=0), 'UTC'),
```

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```

>>> datetime_mod.timezone.utc,
>>> None,
>>> tzlocal()
>>> ]
>>> # Note: there is a win32 bug here
>>> # https://bugs.python.org/issue37 that means we cant use
>>> # dates close to the epoch
>>> datetime_list = [
>>>     datetime_cls.utctimestamp(123456789.123456789 + 315360000),
>>>     datetime_cls.utctimestamp(0 + 315360000),
>>> ]
>>> basis = {
>>>     'precision': [0, 3, 9],
>>>     'tzinfo': tzinfo_list,
>>>     'datetime': datetime_list,
>>>     'default_timezone': ['local', 'utc', tz_act],
>>> }
>>> for params in ub.named_product(basis):
>>>     dttime = params['datetime'].replace(tzinfo=params['tzinfo'])
>>>     precision = params.get('precision', 0)
>>>     stamp = ub.timestamp(datetime=dttime, precision=precision)
>>>     recon = ub.timeparse(stamp)
>>>     alt = recon.strftime('%Y-%m-%dT%H%M%S.%f%z')
>>>     print('---')
>>>     print('params = {}'.format(ub.repr2(params, nl=1)))
>>>     print(f'dtime={dttime}')
>>>     print(f'stamp={stamp}')
>>>     print(f'recon={recon}')
>>>     print(f'alt = {alt}')
>>>     shift = 10 ** precision
>>>     a = int(dttime.timestamp() * shift)
>>>     b = int(recon.timestamp() * shift)
>>>     assert a == b, f'{a} != {b}'

```

`ubelt.util_time.timeparse(stamp, default_timezone='local', allow_dateutil=True)`

Create a `datetime.datetime` object from a string timestamp.

Without any extra dependencies this will parse the output of `ubelt.util_time.timestamp()` into a datetime object. In the case where the format differs, `dateutil.parser.parse` will be used if the `python-dateutil` package is installed.

#### Parameters

- **stamp** (*str*) – a string encoded timestamp
- **default\_timezone** (*str*) – if the input does not specify a timezone, assume this one. Can be “local” or “utc”.
- **allow\_dateutil** (*bool*) – if False we only use the minimal parsing and do not allow a fallback to dateutil.

#### Returns

the parsed datetime

#### Return type

`datetime.datetime`

**Raises**

**ValueError** – if parsing fails.

---

**Todo:**

- [ ] Allow defaulting to local or utm timezone (currently default is local)
- 

**Example**

```
>>> import ubelt as ub
>>> # Demonstrate a round trip of timestamp and timeparse
>>> stamp = ub.timestamp()
>>> datetime = ub.timeparse(stamp)
>>> assert ub.timestamp(datetime) == stamp
>>> # Round trip with precision
>>> stamp = ub.timestamp(precision=4)
>>> datetime = ub.timeparse(stamp)
>>> assert ub.timestamp(datetime, precision=4) == stamp
```

**Example**

```
>>> import ubelt as ub
>>> # We should always be able to parse these
>>> good_stamps = [
>>>     '2000-11-22',
>>>     '2000-11-22T111111.44444Z',
>>>     '2000-11-22T111111.44444+5',
>>>     '2000-11-22T111111.44444-05',
>>>     '2000-11-22T111111.44444-0500',
>>>     '2000-11-22T111111.44444+0530',
>>>     '2000-11-22T111111Z',
>>>     '2000-11-22T111111+5',
>>>     '2000-11-22T111111+0530',
>>> ]
>>> for stamp in good_stamps:
>>>     print(f'----')
>>>     print(f'stamp={stamp}')
>>>     result = ub.timeparse(stamp, allow_dateutil=0)
>>>     print(f'result={result!r}')
>>>     recon = ub.timestamp(result)
>>>     print(f'recon={recon!r}')
```

### Example

```

>>> import ubelt as ub
>>> # We require dateutil to handle these types of stamps
>>> import pytest
>>> conditional_stamps = [
>>>     '2000-01-02T11:23:58.12345+5:30',
>>>     '09/25/2003',
>>>     'Thu Sep 25 10:36:28 2003',
>>> ]
>>> for stamp in conditional_stamps:
>>>     with pytest.raises(ValueError):
>>>         result = ub.timeparse(stamp, allow_dateutil=False)
>>> have_dateutil = bool(ub.modname_to_modpath('dateutil'))
>>> if have_dateutil:
>>>     for stamp in conditional_stamps:
>>>         result = ub.timeparse(stamp)

```

**class** `ubelt.util_time.Timer(label="", verbose=None, newline=True)`

Bases: `object`

Measures time elapsed between a start and end point. Can be used as a with-statement context manager, or using the tic/toc api.

#### Parameters

- **label** (*str*, *default=""*) – identifier for printing
- **verbose** (*int*, *default=None*) – verbosity flag, defaults to True if label is given
- **newline** (*bool*, *default=True*) – if False and verbose, print tic and toc on the same line

#### Variables

- **elapsed** (*float*) – number of seconds measured by the context manager
- **tstart** (*float*) – time of last *tic* reported by *self.\_time()*

### Example

```

>>> # Create and start the timer using the context manager
>>> import math
>>> timer = Timer('Timer test!', verbose=1)
>>> with timer:
>>>     math.factorial(10)
>>> assert timer.elapsed > 0
tic('Timer test!')
...toc('Timer test!')=...

```

### Example

```
>>> # Create and start the timer using the tic/toc interface
>>> timer = Timer().tic()
>>> elapsed1 = timer.toc()
>>> elapsed2 = timer.toc()
>>> elapsed3 = timer.toc()
>>> assert elapsed1 <= elapsed2
>>> assert elapsed2 <= elapsed3
```

**tic()**

starts the timer

**toc()**

stops the timer

#### 1.28.1.1.27 ubelt.util\_zip module

Abstractions for working with zipfiles and archives

This may be renamed to util\_archive in the future.

The `ubelt.split_archive()` works with paths that reference a file inside of an archive (e.g. a zipfile). It splits it into two parts, the full path to the archive and then the path to the file inside of the archive. By convention these are separated with either a pathsep or a colon.

The `ubelt.zopen()` works to open a file that lives inside of an archive without the user needing to worry about extracting it first. When possible it will read it directly from the archive, but in some cases it may extract it to a temporary directory first.

**class** `ubelt.util_zip.zopen(fpath, mode='r', seekable=False, ext='.zip')`

Bases: `NiceRepr`

An abstraction of the normal `open()` function that can also handle reading data directly inside of zipfiles.

This is a file-object like interface [FileObj] — i.e. it supports the read and write methods to an underlying resource.

Can open a file normally or open a file within a zip file (readonly). Tries to read from memory only, but will extract to a tempfile if necessary.

Just treat the zipfile like a directory, e.g. `/path/to/myzip.zip/compressed/path.txt` OR? e.g. `/path/to/myzip.zip:compressed/path.txt`

### References

---

#### Todo:

- [ ] Fast way to open a base zipfile, query what is inside, and then choose a file to further zopen (and passing along the same open zipfile reference maybe?).
  - [ ] Write mode in some restricted setting?
- 

#### Parameters

- **fpath** (*str* | *PathLike*) – path to a file, or a special path that denotes both a path to a zipfile and a path to a archived file inside of the zipfile.
- **mode** (*str*) – Currently only “r” - readonly mode is supported
- **seekable** (*bool*) – If True, attempts to force “seekability” of the underlying file-object, for compressed files this will first extract the file to a temporary location on disk. If False, any underlying compressed file will be opened directly which may result in the object being non-seekable.
- **ext** (*str*) – The extension of the zipfile. Modify this is a non-standard extension is used (e.g. for torch packages).

### Example

```
>>> from ubelt.util_zip import * # NOQA
>>> import pickle
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> dpath = ub.Path(dpath)
>>> data_fpath = dpath / 'test.pkl'
>>> data = {'demo': 'data'}
>>> with open(str(data_fpath), 'wb') as file:
>>>     pickle.dump(data, file)
>>> # Write data
>>> import zipfile
>>> zip_fpath = dpath / 'test_zip.archive'
>>> stl_w_zfile = zipfile.ZipFile(os.fspath(zip_fpath), mode='w')
>>> stl_w_zfile.write(os.fspath(data_fpath), os.fspath(data_fpath.relative_
↳to(dpath)))
>>> stl_w_zfile.close()
>>> stl_r_zfile = zipfile.ZipFile(os.fspath(zip_fpath), mode='r')
>>> stl_r_zfile.namelist()
>>> stl_r_zfile.close()
>>> # Test zopen
>>> self = zopen(zip_fpath / 'test.pkl', mode='rb', ext='.archive')
>>> print(self._split_archive())
>>> print(self.namelist())
>>> self.close()
>>> self = zopen(zip_fpath / 'test.pkl', mode='rb', ext='.archive')
>>> recon1 = pickle.loads(self.read())
>>> self.close()
>>> self = zopen(zip_fpath / 'test.pkl', mode='rb', ext='.archive')
>>> recon2 = pickle.load(self)
>>> self.close()
>>> assert recon1 == recon2
>>> assert recon1 is not recon2
```

### Example

```
>>> # Test we can load json data from a zipfile
>>> from ubelt.util_zip import * # NOQA
>>> import ubelt as ub
>>> import json
>>> import zipfile
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> infopath = join(dpath, 'info.json')
>>> ub.writeto(infopath, '{"x": "1"}')
>>> zippath = join(dpath, 'infozip.zip')
>>> internal = 'folder/info.json'
>>> with zipfile.ZipFile(zippath, 'w') as myzip:
>>>     myzip.write(infopath, internal)
>>> fpath = zippath + '/' + internal
>>> # Test context manager
>>> with zopen(fpath, 'r') as self:
>>>     info2 = json.load(self)
>>>     assert info2['x'] == '1'
>>> # Test outside of context manager
>>> self = zopen(fpath, 'r')
>>> print(self._split_archive())
>>> info2 = json.load(self)
>>> assert info2['x'] == '1'
>>> # Test nice repr (with zfile)
>>> print('self = {!r}'.format(self))
>>> self.close()
```

### Example

```
>>> # Coverage tests --- move to unit-test
>>> from ubelt.util_zip import * # NOQA
>>> import ubelt as ub
>>> import json
>>> import zipfile
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> textpath = join(dpath, 'seekable_test.txt')
>>> text = chr(10).join(['line{}'.format(i) for i in range(10)])
>>> ub.writeto(textpath, text)
>>> zippath = join(dpath, 'seekable_test.zip')
>>> internal = 'folder/seekable_test.txt'
>>> with zipfile.ZipFile(zippath, 'w') as myzip:
>>>     myzip.write(textpath, internal)
>>> ub.delete(textpath)
>>> fpath = zippath + '/' + internal
>>> # Test seekable
>>> self_seekable = zopen(fpath, 'r', seekable=True)
>>> assert self_seekable.seekable()
>>> self_seekable.seek(8)
>>> assert self_seekable.readline() == 'ne1' + chr(10)
>>> assert self_seekable.readline() == 'line2' + chr(10)
```

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```

>>> self_seekable.seek(8)
>>> assert self_seekable.readline() == 'ne1' + chr(10)
>>> assert self_seekable.readline() == 'line2' + chr(10)
>>> # Test non-seekable?
>>> # Sometimes non-seekable files are still seekable
>>> maybe_seekable = zopen(fpath, 'r', seekable=False)
>>> if maybe_seekable.seekable():
>>>     maybe_seekable.seek(8)
>>>     assert maybe_seekable.readline() == 'ne1' + chr(10)
>>>     assert maybe_seekable.readline() == 'line2' + chr(10)
>>>     maybe_seekable.seek(8)
>>>     assert maybe_seekable.readline() == 'ne1' + chr(10)
>>>     assert maybe_seekable.readline() == 'line2' + chr(10)

```

### Example

```

>>> # More coverage tests --- move to unit-test
>>> from ubelt.util_zip import * # NOQA
>>> import ubelt as ub
>>> import pytest
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> with pytest.raises(NotFoundError):
>>>     self = zopen('', 'r')
>>> # Test open non-zip existing file
>>> existing_fpath = join(dpath, 'exists.json')
>>> ub.writeto(existing_fpath, '{"x": "1"}')
>>> self = zopen(existing_fpath, 'r')
>>> assert self.read() == '{"x": "1"}'
>>> # Test dir
>>> dir(self)
>>> # Test nice
>>> print(self)
>>> print('self = {!r}'.format(self))
>>> self.close()
>>> # Test open non-zip non-existing file
>>> nonexisting_fpath = join(dpath, 'does-not-exist.txt')
>>> ub.delete(nonexisting_fpath)
>>> with pytest.raises(NotFoundError):
>>>     self = zopen(nonexisting_fpath, 'r')
>>> with pytest.raises(NotImplementedError):
>>>     self = zopen(nonexisting_fpath, 'w')
>>> # Test nice-repr
>>> self = zopen(existing_fpath, 'r')
>>> print('self = {!r}'.format(self))
>>> # pathological
>>> self = zopen(existing_fpath, 'r')
>>> self._handle = None
>>> dir(self)

```

### property zfile

Access the underlying archive file

**namelist()**

Lists the contents of this zipfile

`ubelt.util_zip.split_archive(fpath, ext='.zip')`

If `fpath` specifies a file inside a zipfile, it breaks it into two parts the path to the zipfile and the internal path in the zipfile.

**Example**

```
>>> split_archive('/a/b/foo.txt')
>>> split_archive('/a/b/foo.zip/bar.txt')
>>> split_archive('/a/b/foo.zip/baz/biz.zip/bar.py')
>>> split_archive('archive.zip')
>>> import ubelt as ub
>>> split_archive(ub.Path('/a/b/foo.zip/baz/biz.zip/bar.py'))
>>> split_archive('/a/b/foo.zip/baz.pt/bar.zip/bar.zip', '.pt')
```

---

**Todo:** Fix got/want for win32

(None, None) ('/a/b/foo.zip', 'bar.txt') ('/a/b/foo.zip/baz/biz.zip', 'bar.py') ('archive.zip', None)  
( '/a/b/foo.zip/baz/biz.zip', 'bar.py') ('/a/b/foo.zip/baz.pt', 'bar.zip/bar.zip')

---

**1.28.1.2 Module contents**

UBelt is a “utility belt” of commonly needed utility and helper functions. It is a curated collection of top-level utilities with functionality that falls into a mixture of categories.

The source code is available at <https://github.com/Erotemic/ubelt>. We also have [Jupyter notebook demos](#).

The ubelt API is organized by submodules containing related functionality. Each submodule contains top level overview documentation, and each function contains a docstring with at least one example.

NOTE: The [README](#) on github contains information and examples complementary to these docs.

**class ubelt.AutoDict**

Bases: `dict`

An infinitely nested default dict of dicts.

Implementation of Perl’s autovivification feature that follows [\[SO\\_651794\]](#).

**SeeAlso:**

[`AutoOrderedDict`](#) - the ordered version



## References

### Example

```
>>> import ubelt as ub
>>> auto = ub.AutoDict()
>>> auto[0][10][100] = None
>>> assert str(auto) == '{0: {10: {100: None}}}'
```

#### to\_dict()

Recursively casts a AutoDict into a regular dictionary. All nested AutoDict values are also converted.

##### Returns

a copy of this dict without autovivification

##### Return type

dict

### Example

```
>>> from ubelt.util_dict import AutoDict
>>> auto = AutoDict()
>>> auto[1] = 1
>>> auto['n1'] = AutoDict()
>>> static = auto.to_dict()
>>> assert not isinstance(static, AutoDict)
>>> assert not isinstance(static['n1'], AutoDict)
```

#### class ubelt.AutoOrderedDict

Bases: [OrderedDict](#), [AutoDict](#)

An infinitely nested default dict of dicts that maintains the ordering of items.

##### SeeAlso:

[AutoDict](#) - the unordered version of this class

### Example

```
>>> import ubelt as ub
>>> auto = ub.AutoOrderedDict()
>>> auto[0][3] = 3
>>> auto[0][2] = 2
>>> auto[0][1] = 1
>>> assert list(auto[0].values()) == [3, 2, 1]
```

#### class ubelt.CacheStamp(*fname, dpath, cfgstr=None, product=None, hasher='sha1', verbose=None, enabled=True, depends=None, meta=None, hash\_prefix=None, expires=None, ext='.pkl'*)

Bases: [object](#)

Quickly determine if a file-producing computation has been done.

Check if the computation needs to be redone by calling `expired`. If the stamp is not expired, the user can expect that the results exist and could be loaded. If the stamp is expired, the computation should be redone. After the

result is updated, the calls `renew`, which writes a “stamp” file to disk that marks that the procedure has been done.

There are several ways to control how a stamp expires. At a bare minimum, removing the stamp file will force expiration. However, in this circumstance `CacheStamp` only knows that something has been done, but it doesn’t have any information about what was done, so in general this is not sufficient.

To achieve more robust expiration behavior, the user should specify the `product` argument, which is a list of file paths that are expected to exist whenever the stamp is renewed. When this is specified the `CacheStamp` will expire if any of these products are deleted, their size changes, their modified timestamp changes, or their hash (i.e. checksum) changes. Note that by setting `hasher=None`, running and verifying checksums can be disabled.

If the user knows what the hash of the file should be this can be specified to prevent renewal of the stamp unless these match the files on disk. This can be useful for security purposes.

The stamp can also be set to expire at a specified time or after a specified duration using the `expires` argument.

### Parameters

- **fname** (*str*) – Name of the stamp file
- **dpath** (*str* | *PathLike* | *None*) – Where to store the cached stamp file
- **product** (*str* | *PathLike* | *Sequence*[*str* | *PathLike*] | *None*) – Path or paths that we expect the computation to produce. If specified the hash of the paths are stored.
- **hasher** (*str*, *default*=`'sha1'`) – The type of hasher used to compute the file hash of product. If `None`, then we assume the file has not been corrupted or changed if the mtime and size are the same. Defaults to `sha1`.
- **verbose** (*bool*, *default*=`None`) – Passed to internal `ubelt.Cacher` object
- **enabled** (*bool*, *default*=`True`) – if `False`, expired always returns `True`
- **depends** (*str* | *List*[*str*] | *None*) – Indicate dependencies of this cache. If the dependencies change, then the cache is recomputed. New to `CacheStamp` in version 0.9.2, replaces `cfgstr`.
- **meta** (*object* | *None*) – Metadata that is also saved with the `cfgstr`. This can be useful to indicate how the `cfgstr` was constructed. New to `CacheStamp` in version 0.9.2. Note: this is a candidate for deprecation.
- **expires** (*str* | *int* | *datetime.datetime* | *datetime.timedelta* | *None*) – If specified, sets an expiration date for the certificate. This can be an absolute datetime or a timedelta offset. If specified as an `int`, this is interpreted as a time delta in seconds. If specified as a `str`, this is interpreted as an absolute timestamp. Time delta offsets are coerced to absolute times at “renew” time.
- **hash\_prefix** (*None* | *str* | *List*[*str*]) – If specified, we verify that these match the hash(s) of the product(s) in the stamp certificate.
- **ext** (*str*, *default*=`'pkl'`) – File extension for the cache format. Can be `'pkl'` or `'.json'`.
- **cfgstr** (*str* | *None*) – DEPRECATED in favor of `depends`.

## Notes

The size, mtime, and hash mechanism is similar to how Makefile and redo caches work.

## Example

```
>>> import ubelt as ub
>>> # Stamp the computation of expensive-to-compute.txt
>>> dpath = ub.Path.appdir('ubelt/tests/cache-stamp')
>>> dpath.delete().ensuredir()
>>> product = dpath / 'expensive-to-compute.txt'
>>> self = ub.CacheStamp('somedata', depends='someconfig', dpath=dpath,
>>>                      product=product, hasher='sha256')
>>> self.clear()
>>> print(f'self.fpath={self.fpath}')
>>> if self.expired():
>>>     product.write_text('very expensive')
>>>     self.renew()
>>> assert not self.expired()
>>> # corrupting the output will cause the stamp to expire
>>> product.write_text('very corrupted')
>>> assert self.expired()
```

### property `fpath`

### `clear()`

Delete the stamp (the products are untouched)

### `expired(cfgstr=None, product=None)`

Check to see if a previously existing stamp is still valid, if the expected result of that computation still exists, and if all other expiration criteria are met.

#### Parameters

- **cfgstr** (*str* | *None*) – overrides the instance-level `cfgstr`. DEPRECATED do not use.
- **product** (*str* | *PathLike* | *Sequence[str | PathLike]* | *None*) – override the default product if specified. DEPRECATED do not use.

#### Returns

True(-thy) if the stamp is invalid, expired, or does not exist. When the stamp is expired, the reason for expiration is returned as a string. If the stamp is still valid, False is returned.

#### Return type

`bool | str`

### Example

```
>>> import ubelt as ub
>>> import time
>>> import os
>>> # Stamp the computation of expensive-to-compute.txt
>>> dpath = ub.Path.appdir('ubelt/tests/cache-stamp-expired')
>>> dpath.delete().ensuredir()
>>> products = [
>>>     dpath / 'product1.txt',
>>>     dpath / 'product2.txt',
>>> ]
>>> self = ub.CacheStamp('myname', depends='myconfig', dpath=dpath,
>>>                        product=products, hasher='sha256',
>>>                        expires=0)
>>> if self.expired():
>>>     for fpath in products:
>>>         fpath.write_text(fpath.name)
>>>     self.renew()
>>> fpath = products[0]
>>> # Because we set the expiration delta to 0, we should already be expired
>>> assert self.expired() == 'expired_cert'
>>> # Disable the expiration date, renew and we should be ok
>>> self.expires = None
>>> self.renew()
>>> assert not self.expired()
>>> # Modify the mtime to cause expiration
>>> orig_atime = fpath.stat().st_atime
>>> orig_mtime = fpath.stat().st_mtime
>>> os.utime(fpath, (orig_atime, orig_mtime + 200))
>>> assert self.expired() == 'mtime_diff'
>>> self.renew()
>>> assert not self.expired()
>>> # rewriting the file will cause the size constraint to fail
>>> # even if we hack the mtime to be the same
>>> orig_atime = fpath.stat().st_atime
>>> orig_mtime = fpath.stat().st_mtime
>>> fpath.write_text('corrupted')
>>> os.utime(fpath, (orig_atime, orig_mtime))
>>> assert self.expired() == 'size_diff'
>>> self.renew()
>>> assert not self.expired()
>>> # Force a situation where the hash is the only thing
>>> # that saves us, write a different file with the same
>>> # size and mtime.
>>> orig_atime = fpath.stat().st_atime
>>> orig_mtime = fpath.stat().st_mtime
>>> fpath.write_text('corrApted')
>>> os.utime(fpath, (orig_atime, orig_mtime))
>>> assert self.expired() == 'hash_diff'
>>> # Test what a wrong hash prefix causes expiration
>>> certificate = self.renew()
>>> self.hash_prefix = certificate['hash']
```

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```

>>> self.expired()
>>> self.hash_prefix = ['bad', 'hashes']
>>> self.expired()
>>> # A bad hash will not allow us to renew
>>> import pytest
>>> with pytest.raises(RuntimeError):
...     self.renew()

```

**renew**(*cfgstr=None, product=None*)

Recertify that the product has been recomputed by writing a new certificate to disk.

#### Returns

certificate information

#### Return type

dict

**class** `ubelt.Cacher`(*fname, depends=None, dpath=None, appname='ubelt', ext='.pkl', meta=None, verbose=None, enabled=True, log=None, hasher='sha1', protocol=-1, cfgstr=None, backend='auto'*)

Bases: `object`

Saves data to disk and reloads it based on specified dependencies.

Cacher uses pickle to save/load data to/from disk. Dependencies of the cached process can be specified, which ensures the cached data is recomputed if the dependencies change. If the location of the cache is not specified, it will default to the system user's cache directory.

#### Parameters

- **fname** (*str*) – A file name. This is the prefix that will be used by the cache. It will always be used as-is.
- **depends** (*str | List[str] | None*) – Indicate dependencies of this cache. If the dependencies change, then the cache is recomputed. New in version 0.8.9, replaces `cfgstr`.
- **dpath** (*str | PathLike | None*) – Specifies where to save the cache. If unspecified, Cacher defaults to an application cache dir as given by `appname`. See `ub.get_app_cache_dir()` for more details.
- **appname** (*str, default='ubelt'*) – Application name Specifies a folder in the application cache directory where to cache the data if `dpath` is not specified.
- **ext** (*str, default='.pkl'*) – File extension for the cache format. Can be `'.pkl'` or `'.json'`.
- **meta** (*object | None*) – Metadata that is also saved with the `cfgstr`. This can be useful to indicate how the `cfgstr` was constructed. Note: this is a candidate for deprecation.
- **verbose** (*int, default=1*) – Level of verbosity. Can be 1, 2 or 3.
- **enabled** (*bool, default=True*) – If set to False, then the load and save methods will do nothing.
- **log** (*Callable[[str], Any]*) – Overloads the print function. Useful for sending output to loggers (e.g. `logging.info`, `tqdm.tqdm.write`, ...)
- **hasher** (*str, default='sha1'*) – Type of hashing algorithm to use if `cfgstr` needs to be condensed to less than 49 characters.
- **protocol** (*int, default=-1*) – Protocol version used by pickle. Defaults to the -1 which is the latest protocol.

- **backend** (*str*) – Set to either 'pickle' or 'json' to force backend. Defaults to auto which chooses one based on the extension.
- **cfgstr** (*str* | *None*) – Deprecated in favor of `depends`.

### Example

```
>>> import ubelt as ub
>>> depends = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = ub.Cacher('demo_process', depends, verbose=4)
>>> cacher.clear()
>>> print(f'cacher.fpath={cacher.fpath}')
>>> data = cacher.tryload()
>>> if data is None:
>>>     # Put expensive functions in if block when cacher misses
>>>     myvar1 = 'result of expensive process'
>>>     myvar2 = 'another result'
>>>     # Tell the cacher to write at the end of the if block
>>>     # It is idiomatic to put results in an object named data
>>>     data = myvar1, myvar2
>>>     cacher.save(data)
>>> # Last part of the Cacher pattern is to unpack the data object
>>> myvar1, myvar2 = data
>>> #
>>> # If we know the data exists, we can also simply call load
>>> data = cacher.tryload()
```

### Example

```
>>> # The previous example can be shorted if only a single value
>>> from ubelt.util_cache import Cacher
>>> depends = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = Cacher('demo_process', depends)
>>> myvar = cacher.tryload()
>>> if myvar is None:
>>>     myvar = ('result of expensive process', 'another result')
>>>     cacher.save(myvar)
>>> assert cacher.exists(), 'should now exist'
```

**VERBOSE** = 1

**FORCE\_DISABLE** = False

**property fpath**

**get\_fpath**(*cfgstr=None*)

Reports the filepath that the cacher will use.

It will attempt to use '{fname}\_{cfgstr}{ext}' unless that is too long. Then `cfgstr` will be hashed.

#### Parameters

**cfgstr** (*str* | *None*) – overrides the instance-level `cfgstr`

**Returns**

str | PathLike

**Example**

```
>>> # xdoctest: +REQUIRES(module:pytest)
>>> from ubelt.util_cache import Cacher
>>> import pytest
>>> #with pytest.warns(UserWarning):
>>> if 1: # we no longer warn here
>>>     cacher = Cacher('test_cacher1')
>>>     cacher.get_fpath()
>>> self = Cacher('test_cacher2', depends='cfg1')
>>> self.get_fpath()
>>> self = Cacher('test_cacher3', depends='cfg1' * 32)
>>> self.get_fpath()
```

**exists(cfgstr=None)**

Check to see if the cache exists

**Parameters****cfgstr** (str | None) – overrides the instance-level cfgstr**Returns**

bool

**existing\_versions()**

Returns data with different cfgstr values that were previously computed with this cacher.

**Yields**

str – paths to cached files corresponding to this cacher

**Example**

```
>>> # Ensure that some data exists
>>> import ubelt as ub
>>> dpath = ub.Path.appdir(
>>>     'ubelt/tests/util_cache',
>>>     'test-existing-versions').delete().ensuredir()
>>> cacher = ub.Cacher('versioned_data_v2', depends='1', dpath=dpath)
>>> cacher.ensure(lambda: 'data1')
>>> known_fpaths = set()
>>> known_fpaths.add(cacher.get_fpath())
>>> cacher = ub.Cacher('versioned_data_v2', depends='2', dpath=dpath)
>>> cacher.ensure(lambda: 'data2')
>>> known_fpaths.add(cacher.get_fpath())
>>> # List previously computed configs for this type
>>> from os.path import basename
>>> cacher = ub.Cacher('versioned_data_v2', depends='2', dpath=dpath)
>>> exist_fpaths = set(cacher.existing_versions())
>>> exist_fnames = list(map(basename, exist_fpaths))
>>> print('exist_fnames = {!r}'.format(exist_fnames))
>>> print('exist_fpaths = {!r}'.format(exist_fpaths))
```

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```
>>> print('known_fpaths={!r}'.format(known_fpaths))
>>> assert exist_fpaths.issubset(known_fpaths)
```

**clear**(*cfgstr=None*)

Removes the saved cache and metadata from disk

**Parameters**

**cfgstr** (*str* | *None*) – overrides the instance-level *cfgstr*

**tryload**(*cfgstr=None*, *on\_error='raise'*)

Like load, but returns None if the load fails due to a cache miss.

**Parameters**

- **cfgstr** (*str* | *None*) – overrides the instance-level *cfgstr*
- **on\_error** (*str*, *default='raise'*) – How to handle non-io errors. Either 'raise', which re-raises the exception, or 'clear' which deletes the cache and returns None.

**Returns**

the cached data if it exists, otherwise returns None

**Return type**

None | object

**load**(*cfgstr=None*)

Load the data cached and raise an error if something goes wrong.

**Parameters**

**cfgstr** (*str* | *None*) – overrides the instance-level *cfgstr*

**Returns**

the cached data

**Return type**

object

**Raises**

**IOError** - if the data is unable to be loaded. This could be due to – a cache miss or because the cache is disabled.

## Example

```
>>> from ubelt.util_cache import * # NOQA
>>> # Setting the cacher as enabled=False turns it off
>>> cacher = Cacher('test_disabled_load', '', enabled=True,
>>>                 appname='ubelt/tests/util_cache')
>>> cacher.save('data')
>>> assert cacher.load() == 'data'
>>> cacher.enabled = False
>>> assert cacher.tryload() is None
```

**save**(*data*, *cfgstr=None*)

Writes data to path specified by *self.fpath*.

Metadata containing information about the cache will also be appended to an adjacent file with the *.meta* suffix.



**Parameters**

- **data** (*object*) – arbitrary pickleable object to be cached
- **cfgstr** (*str* | *None*) – overrides the instance-level cfgstr

**Example**

```
>>> from ubelt.util_cache import * # NOQA
>>> # Normal functioning
>>> depends = 'long-cfg' * 32
>>> cacher = Cacher('test_enabled_save', depends=depends,
>>>                 appname='ubelt/tests/util_cache')
>>> cacher.save('data')
>>> assert exists(cacher.get_fpath()), 'should be enabled'
>>> assert exists(cacher.get_fpath() + '.meta'), 'missing metadata'
>>> # Setting the cacher as enabled=False turns it off
>>> cacher2 = Cacher('test_disabled_save', 'params', enabled=False,
>>>                 appname='ubelt/tests/util_cache')
>>> cacher2.save('data')
>>> assert not exists(cacher2.get_fpath()), 'should be disabled'
```

**ensure**(*func*, \**args*, \*\**kwargs*)

Wraps around a function. A cfgstr must be stored in the base cacher.

**Parameters**

- **func** (*Callable*) – function that will compute data on cache miss
- **\*args** – passed to func
- **\*\*kwargs** – passed to func

**Example**

```
>>> from ubelt.util_cache import * # NOQA
>>> def func():
>>>     return 'expensive result'
>>> fname = 'test_cacher_ensure'
>>> depends = 'func params'
>>> cacher = Cacher(fname, depends=depends)
>>> cacher.clear()
>>> data1 = cacher.ensure(func)
>>> data2 = cacher.ensure(func)
>>> assert data1 == 'expensive result'
>>> assert data1 == data2
>>> cacher.clear()
```

**class** `ubelt.CaptureStdout`(*suppress=True*, *enabled=True*)

Bases: `CaptureStream`

Context manager that captures stdout and stores it in an internal stream

**Parameters**

- **suppress** (*bool*, *default=True*) – if True, stdout is not printed while captured

- **enabled** (*bool, default=True*) – does nothing if this is False
- **\*\*kwargs** – used for backwards compatibility with misspelled deprecated params.

SeeAlso:

`contextlib.redirect_stdout()`

### Example

```
>>> import ubelt as ub
>>> self = ub.CaptureStdout(suppress=True)
>>> print('dont capture the table flip (°° ')
>>> with self:
...     text = 'capture the heart '
...     print(text)
>>> print('dont capture look of disapproval _')
>>> assert isinstance(self.text, str)
>>> assert self.text == text + '\n', 'failed capture text'
```

### Example

```
>>> import ubelt as ub
>>> self = ub.CaptureStdout(suppress=False)
>>> with self:
...     print('I am captured and printed in stdout')
>>> assert self.text.strip() == 'I am captured and printed in stdout'
```

### Example

```
>>> import ubelt as ub
>>> self = ub.CaptureStdout(suppress=True, enabled=False)
>>> with self:
...     print('dont capture')
>>> assert self.text is None
```

**log\_part()**

Log what has been captured so far

**start()**

**stop()**

### Example

```
>>> import ubelt as ub
>>> ub.CaptureStdout(enabled=False).stop()
>>> ub.CaptureStdout(enabled=True).stop()
```

```
close()
```

```
class ubelt.CaptureStream
```

```
Bases: object
```

Generic class for capturing streaming output from stdout or stderr

```
class ubelt.DownloadManager(download_root=None, mode='thread', max_workers=None, cache=True)
```

```
Bases: object
```

Simple implementation of the download manager

#### Variables

- **download\_root** (*str* | *PathLike*) – default download location
- **jobs** (*List[concurrent.futures.Future]*) – list of jobs

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> # Download a file with a known hash
>>> manager = ub.DownloadManager()
>>> job = manager.submit(
>>>     'http://i.imgur.com/rqwaDag.png',
>>>     hash_prefix=
↪ '31a129618c87dd667103e7154182e3c39a605eefe90f84f2283f3c87efee8e40'
>>> )
>>> fpath = job.result()
>>> print('fpath = {!r}'.format(fpath))
```

### Example

```
>>> # Does not require network
>>> import ubelt as ub
>>> manager = ub.DownloadManager()
>>> for i in range(100):
...     job = manager.submit('localhost/might-not-exist-i-{}'.format(i))
>>> file_paths = []
>>> for job in manager.as_completed(prog=True):
...     try:
...         fpath = job.result()
...         file_paths += [fpath]
...     except Exception:
...         pass
>>> print('file_paths = {!r}'.format(file_paths))
```

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import pytest
>>> import ubelt as ub
>>> manager = ub.DownloadManager()
>>> item1 = {
>>>     'url': 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/
↳download',
>>>     'dst': 'forgot_what_the_name_really_is',
>>>     'hash_prefix': 'c98a46cb31205cf',
>>>     'hasher': 'sha512',
>>> }
>>> item2 = {
>>>     'url': 'http://i.imgur.com/rqwaDag.png',
>>>     'hash_prefix': 'f79ea24571da6ddd2ba12e3d57b515249ecb8a35',
>>>     'hasher': 'sha1',
>>> }
>>> item1 = item2 # hack around SSL error
>>> manager.submit(**item1)
>>> manager.submit(**item2)
>>> for job in manager.as_completed(prog=True, verbose=3):
>>>     fpath = job.result()
>>>     print('fpath = {!r}'.format(fpath))
```

**submit**(url, dst=None, hash\_prefix=None, hasher='sha256')

Add a job to the download Queue

#### Parameters

- **url** (*str* | *PathLike*) – pointer to the data to download
- **dst** (*str* | *None*) – The relative or absolute path to download to. If unspecified, the destination name is derived from the url.
- **hash\_prefix** (*str* | *None*) – If specified, verifies that the hash of the downloaded file starts with this.
- **hasher** (*str*; *default*='sha256') – hashing algorithm to use if hash\_prefix is specified.

#### Returns

a Future object that will point to the downloaded location.

#### Return type

`concurrent.futures.Future`

**as\_completed**(prog=None, desc=None, verbose=1)

Generate completed jobs as they become available

### Example

```
>>> import pytest
>>> import ubelt as ub
>>> download_root = ub.ensure_app_config_dir('ubelt', 'dlman')
>>> manager = ub.DownloadManager(download_root=download_root,
>>>                               cache=False)
>>> for i in range(3):
>>>     manager.submit('localhost')
>>> results = list(manager)
>>> print('results = {!r}'.format(results))
>>> manager.shutdown()
```

#### shutdown()

Cancel all jobs and close all connections.

**class** `ubelt.Executor(mode='thread', max_workers=0)`

Bases: `object`

Wrapper around a specific executor.

Abstracts Serial, Thread, and Process Executor via arguments.

#### Parameters

- **mode** (*str*, *default='thread'*) – either thread, serial, or process
- **max\_workers** (*int*, *default=0*) – number of workers. If 0, serial is forced.

### Example

```
>>> import platform
>>> import sys
>>> # The process backend breaks pyp3 when using coverage
>>> if 'pypy' in platform.python_implementation().lower():
...     import pytest
...     pytest.skip('not testing process on pypy')
>>> if sys.platform.startswith('win32'):
...     import pytest
...     pytest.skip('not running this test on win32 for now')
>>> import ubelt as ub
>>> # Fork before threading!
>>> # https://pybay.com/site_media/slides/raymond2017-keynote/combo.html
>>> self1 = ub.Executor(mode='serial', max_workers=0)
>>> self1.__enter__()
>>> self2 = ub.Executor(mode='process', max_workers=2)
>>> self2.__enter__()
>>> self3 = ub.Executor(mode='thread', max_workers=2)
>>> self3.__enter__()
>>> jobs = []
>>> jobs.append(self1.submit(sum, [1, 2, 3]))
>>> jobs.append(self1.submit(sum, [1, 2, 3]))
>>> jobs.append(self2.submit(sum, [10, 20, 30]))
>>> jobs.append(self2.submit(sum, [10, 20, 30]))
```

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```

>>> jobs.append(self3.submit(sum, [4, 5, 5]))
>>> jobs.append(self3.submit(sum, [4, 5, 5]))
>>> for job in jobs:
>>>     result = job.result()
>>>     print('result = {!r}'.format(result))
>>> self1.__exit__(None, None, None)
>>> self2.__exit__(None, None, None)
>>> self3.__exit__(None, None, None)

```

### Example

```

>>> import ubelt as ub
>>> self1 = ub.Executor(mode='serial', max_workers=0)
>>> with self1:
>>>     jobs = []
>>>     for i in range(10):
>>>         jobs.append(self1.submit(sum, [i + 1, i]))
>>>     for job in jobs:
>>>         job.add_done_callback(lambda x: print('done callback got x = {}'.
→format(x)))
>>>         result = job.result()
>>>         print('result = {!r}'.format(result))

```

**submit**(*func*, \**args*, \*\**kw*)

Calls the submit function of the underlying backend.

#### Returns

a future representing the job

#### Return type

`concurrent.futures.Future`

**shutdown**()

Calls the shutdown function of the underlying backend.

**map**(*fn*, \**iterables*, \*\**kwargs*)

Calls the map function of the underlying backend.

### CommandLine

```
xdoctest -m ubelt.util_futures Executor.map
```

### Example

```

>>> import ubelt as ub
>>> import concurrent.futures
>>> import string
>>> with ub.Executor(mode='serial') as executor:
...     result_iter = executor.map(int, string.digits)
...     results = list(result_iter)
>>> print('results = {!r}'.format(results))
results = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> with ub.Executor(mode='thread', max_workers=2) as executor:
...     result_iter = executor.map(int, string.digits)
...     results = list(result_iter)
>>> # xdoctest: +IGNORE_WANT
>>> print('results = {!r}'.format(results))
results = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

```

### class ubelt.FormatterExtensions

Bases: object

Helper class for managing non-builtin (e.g. numpy) format types.

This module (`ubelt.util_format`) maintains a global set of basic extensions, but it is also possible to create a locally scoped set of extensions and explicitly pass it to `repr2`. The following example demonstrates this.

### Example

```

>>> import ubelt as ub
>>> class MyObject(object):
>>>     pass
>>> data = {'a': [1, 2.2222, MyObject()], 'b': MyObject()}
>>> # Create a custom set of extensions
>>> extensions = ub.FormatterExtensions()
>>> # Register a function to format your specific type
>>> @extensions.register(MyObject)
>>> def format_myobject(data, **kwargs):
>>>     return 'I can do anything here'
>>> # Repr2 will now respect the passed custom extensions
>>> # Note that the global extensions will still be respected
>>> # unless they are overloaded.
>>> print(ub.repr2(data, nl=-1, precision=1, extensions=extensions))
{
    'a': [1, 2.2, I can do anything here],
    'b': I can do anything here
}
>>> # Overload the formatter for float and int
>>> @extensions.register((float, int))
>>> def format_myobject(data, **kwargs):
>>>     return str((data + 10) // 2)
>>> print(ub.repr2(data, nl=-1, precision=1, extensions=extensions))
{
    'a': [5, 6.0, I can do anything here],

```

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```
'b': I can do anything here
}
```

### **register**(key)

Registers a custom formatting function with `ub.repr2`

#### **Parameters**

**key** (*Type* | *Tuple*[*Type*] | *str*) – indicator of the type

#### **Returns**

decorator function

#### **Return type**

Callable

### **lookup**(data)

Returns an appropriate function to format data if one has been registered.

**class** `ubelt.IndexableWalker`(data, dict\_cls=(`<class 'dict'>`), list\_cls=(`<class 'list'>`, `<class 'tuple'>`))

Bases: `Generator`

Traverses through a nested tree-liked indexable structure.

Generates a path and value to each node in the structure. The path is a list of indexes which if applied in order will reach the value.

The `__setitem__` method can be used to modify a nested value based on the path returned by the generator.

When generating values, you can use “send” to prevent traversal of a particular branch.

#### **Related Work:**

- <https://pypi.org/project/python-benedict/> - implements a dictionary subclass with similar nested indexing abilities.

### **Example**

```
>>> # Given Nested Data
>>> data = {
>>>     'foo': {'bar': 1},
>>>     'baz': [{'biz': 3}, {'buz': [4, 5, 6]}],
>>> }
>>> # Create an IndexableWalker
>>> walker = IndexableWalker(data)
>>> # We iterate over the data as if it was flat
>>> # ignore the <want> string due to order issues on older Pythons
>>> # xdoctest: +IGNORE_WANT
>>> for path, val in walker:
>>>     print(path)
['foo']
['baz']
['baz', 0]
['baz', 1]
['baz', 1, 'buz']
['baz', 1, 'buz', 0]
['baz', 1, 'buz', 1]
```

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```

['baz', 1, 'buz', 2]
['baz', 0, 'biz']
['foo', 'bar']
>>> # We can use "paths" as keys to getitem into the walker
>>> path = ['baz', 1, 'buz', 2]
>>> val = walker[path]
>>> assert val == 6
>>> # We can use "paths" as keys to setitem into the walker
>>> assert data['baz'][1]['buz'][2] == 6
>>> walker[path] = 7
>>> assert data['baz'][1]['buz'][2] == 7
>>> # We can use "paths" as keys to delitem into the walker
>>> assert data['baz'][1]['buz'][1] == 5
>>> del walker[['baz', 1, 'buz', 1]]
>>> assert data['baz'][1]['buz'][1] == 7

```

### Example

```

>>> # Create nested data
>>> # xdoctest: +REQUIRES(module:numpy)
>>> import numpy as np
>>> import ubelt as ub
>>> data = ub.ddict(lambda: int)
>>> data['foo'] = ub.ddict(lambda: int)
>>> data['bar'] = np.array([1, 2, 3])
>>> data['foo']['a'] = 1
>>> data['foo']['b'] = np.array([1, 2, 3])
>>> data['foo']['c'] = [1, 2, 3]
>>> data['baz'] = 3
>>> print('data = {}'.format(ub.repr2(data, nl=True)))
>>> # We can walk through every node in the nested tree
>>> walker = IndexableWalker(data)
>>> for path, value in walker:
>>>     print('walk path = {}'.format(ub.repr2(path, nl=0)))
>>>     if path[-1] == 'c':
>>>         # Use send to prevent traversing this branch
>>>         got = walker.send(False)
>>>         # We can modify the value based on the returned path
>>>         walker[path] = 'changed the value of c'
>>> print('data = {}'.format(ub.repr2(data, nl=True)))
>>> assert data['foo']['c'] == 'changed the value of c'

```

### Example

```
>>> # Test sending false for every data item
>>> # xdoctest: +REQUIRES(CPython)
>>> # xdoctest: +REQUIRES(module:numpy)
>>> import ubelt as ub
>>> import numpy as np
>>> data = {1: 1}
>>> walker = IndexableWalker(data)
>>> for path, value in walker:
>>>     print('walk path = {}'.format(ub.repr2(path, nl=0)))
>>>     walker.send(False)
>>> data = {}
>>> walker = IndexableWalker(data)
>>> for path, value in walker:
>>>     walker.send(False)
```

**send**(*arg*) → send 'arg' into generator,  
return next yielded value or raise StopIteration.

**throw**(*typ*[, *val*[, *tb*]]) → raise exception in generator,  
return next yielded value or raise StopIteration.

**class** `ubelt.JobPool(mode='thread', max_workers=0)`

Bases: `object`

Abstracts away boilerplate of submitting and collecting jobs

This is a basic wrapper around `ubelt.util_futures.Executor` that simplifies the most basic case.

### Example

```
>>> import ubelt as ub
>>> def worker(data):
>>>     return data + 1
>>> pool = ub.JobPool('thread', max_workers=16)
>>> for data in ub.ProgIter(range(10), desc='submit jobs'):
>>>     pool.submit(worker, data)
>>> final = []
>>> for job in pool.as_completed(desc='collect jobs'):
>>>     info = job.result()
>>>     final.append(info)
>>> print('final = {!r}'.format(final))
```

**submit**(*func*, \**args*, \*\**kwargs*)

Submit a job managed by the pool

#### Parameters

- **func** (*Callable*[... , *Any*]) – A callable that will take as many arguments as there are passed iterables.
- **\*args** – positional arguments to pass to the function
- **\*kwargs** – keyword arguments to pass to the function

**Returns**

a future representing the job

**Return type**

`concurrent.futures.Future`

**shutdown()**
**as\_completed(timeout=None, desc=None, progkw=None)**

Generates completed jobs in an arbitrary order

**Parameters**

- **timeout** (*float* | *None*) – Specify the the maximum number of seconds to wait for a job.
- **desc** (*str* | *None*) – if specified, reports progress with a `ubelt.progiter.ProgIter` object.
- **progkw** (*dict* | *None*) – extra keyword arguments to `ubelt.progiter.ProgIter`.

**Yields**

`concurrent.futures.Future` – The completed future object containing the results of a job.

**CommandLine**

```
xdoctest -m ubelt.util_futures JobPool.as_completed
```

**Example**

```
>>> import ubelt as ub
>>> pool = ub.JobPool('thread', max_workers=8)
>>> text = ub.paragraph(
...     """
...     UDP is a cool protocol, check out the wiki:
...
...     UDP-based Data Transfer Protocol (UDT), is a high-performance
...     data transfer protocol designed for transferring large
...     volumetric datasets over high-speed wide area networks. Such
...     settings are typically disadvantageous for the more common TCP
...     protocol.
...     """)
>>> for word in text.split(' '):
...     pool.submit(print, word)
>>> for _ in pool.as_completed():
...     pass
>>> pool.shutdown()
```

**join(\*\*kwargs)**

Like `JobPool.as_completed()`, but executes the `result` method of each future and returns only after all processes are complete. This allows for lower-boilerplate prototyping.

**Parameters**

**\*\*kwargs** – passed to `JobPool.as_completed()`

**Returns**

list of results

**Return type**  
List[Any]

### Example

```
>>> import ubelt as ub
>>> # We just want to try replacing our simple iterative algorithm
>>> # with the embarassingly parallel version
>>> arglist = list(zip(range(1000), range(1000)))
>>> func = ub.identity
>>> #
>>> # Original version
>>> for args in arglist:
>>>     func(*args)
>>> #
>>> # Potentially parallel version
>>> jobs = ub.JobPool(max_workers=0)
>>> for args in arglist:
>>>     jobs.submit(func, *args)
>>> _ = jobs.join(desc='running')
```

### class ubelt.NiceRepr

Bases: `object`

Inherit from this class and define `__nice__` to “nicely” print your objects.

Defines `__str__` and `__repr__` in terms of `__nice__` function. Classes that inherit from `NiceRepr` should redefine `__nice__`. If the inheriting class has a `__len__` method then the default `__nice__` method will return its length.

### Example

```
>>> import ubelt as ub
>>> class Foo(ub.NiceRepr):
>>>     def __nice__(self):
>>>         return 'info'
>>> foo = Foo()
>>> assert str(foo) == '<Foo(info)>'
>>> assert repr(foo).startswith('<Foo(info) at ')
```

### Example

```
>>> import ubelt as ub
>>> class Bar(ub.NiceRepr):
>>>     pass
>>> bar = Bar()
>>> import pytest
>>> with pytest.warns(RuntimeWarning) as record:
>>>     assert 'object at' in str(bar)
>>>     assert 'object at' in repr(bar)
```

### Example

```
>>> import ubelt as ub
>>> class Baz(ub.NiceRepr):
...     def __len__(self):
...         return 5
>>> baz = Baz()
>>> assert str(baz) == '<Baz(5)>'
```

### Example

```
>>> import ubelt as ub
>>> # If your nice message has a bug, it shouldn't bring down the house
>>> class Foo(ub.NiceRepr):
...     def __nice__(self):
...         assert False
>>> foo = Foo()
>>> import pytest
>>> with pytest.warns(RuntimeWarning) as record:
>>>     print('foo = {!r}'.format(foo))
foo = <...Foo ...>
```

**class** `ubelt.OrderedSet`(*iterable=None*)

Bases: `MutableSet`, `Sequence`

An `OrderedSet` is a custom `MutableSet` that remembers its order, so that every entry has an index that can be looked up.

### Example

```
>>> OrderedSet([1, 1, 2, 3, 2])
OrderedSet([1, 2, 3])
```

**copy()**

Return a shallow copy of this object.

### Example

```
>>> this = OrderedSet([1, 2, 3])
>>> other = this.copy()
>>> this == other
True
>>> this is other
False
```

**add**(*key*)

Add *key* as an item to this `OrderedSet`, then return its index.

If *key* is already in the `OrderedSet`, return the index it already had.

### Example

```
>>> oset = OrderedSet()
>>> oset.append(3)
0
>>> print(oset)
OrderedSet([3])
```

#### **append(*key*)**

Add *key* as an item to this OrderedSet, then return its index.

If *key* is already in the OrderedSet, return the index it already had.

### Example

```
>>> oset = OrderedSet()
>>> oset.append(3)
0
>>> print(oset)
OrderedSet([3])
```

#### **update(*sequence*)**

Update the set with the given iterable sequence, then return the index of the last element inserted.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.update([3, 1, 5, 1, 4])
4
>>> print(oset)
OrderedSet([1, 2, 3, 5, 4])
```

#### **index(*key*)**

Get the index of a given entry, raising an IndexError if it's not present.

*key* can be an iterable of entries that is not a string, in which case this returns a list of indices.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.index(2)
1
```

#### **get\_loc(*key*)**

Get the index of a given entry, raising an IndexError if it's not present.

*key* can be an iterable of entries that is not a string, in which case this returns a list of indices.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.index(2)
1
```

#### **get\_indexer**(key)

Get the index of a given entry, raising an `IndexError` if it's not present.

*key* can be an iterable of entries that is not a string, in which case this returns a list of indices.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.index(2)
1
```

#### **pop**()

Remove and return the last element from the set.

Raises `KeyError` if the set is empty.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.pop()
3
```

#### **discard**(key)

Remove an element. Do not raise an exception if absent.

The `MutableSet` mixin uses this to implement the `.remove()` method, which *does* raise an error when asked to remove a non-existent item.

### Example

```
>>> oset = OrderedSet([1, 2, 3])
>>> oset.discard(2)
>>> print(oset)
OrderedSet([1, 3])
>>> oset.discard(2)
>>> print(oset)
OrderedSet([1, 3])
```

#### **clear**()

Remove all items from this `OrderedSet`.

#### **union**(\*sets)

Combines all unique items. Each items order is defined by its first appearance.

### Example

```
>>> oset = OrderedSet.union(OrderedSet([3, 1, 4, 1, 5]), [1, 3], [2, 0])
>>> print(oset)
OrderedSet([3, 1, 4, 5, 2, 0])
>>> oset.union([8, 9])
OrderedSet([3, 1, 4, 5, 2, 0, 8, 9])
>>> oset | {10}
OrderedSet([3, 1, 4, 5, 2, 0, 10])
```

### **intersection**(\*sets)

Returns elements in common between all sets. Order is defined only by the first set.

### Example

```
>>> from ubelt.orderedset import * # NOQA
>>> oset = OrderedSet.intersection(OrderedSet([0, 1, 2, 3]), [1, 2, 3])
>>> print(oset)
OrderedSet([1, 2, 3])
>>> oset.intersection([2, 4, 5], [1, 2, 3, 4])
OrderedSet([2])
>>> oset.intersection()
OrderedSet([1, 2, 3])
```

### **difference**(\*sets)

Returns all elements that are in this set but not the others.

### Example

```
>>> OrderedSet([1, 2, 3]).difference(OrderedSet([2]))
OrderedSet([1, 3])
>>> OrderedSet([1, 2, 3]).difference(OrderedSet([2]), OrderedSet([3]))
OrderedSet([1])
>>> OrderedSet([1, 2, 3]) - OrderedSet([2])
OrderedSet([1, 3])
>>> OrderedSet([1, 2, 3]).difference()
OrderedSet([1, 2, 3])
```

### **issubset**(other)

Report whether another set contains this set.



### Example

```
>>> OrderedSet([1, 2, 3]).issubset({1, 2})
False
>>> OrderedSet([1, 2, 3]).issubset({1, 2, 3, 4})
True
>>> OrderedSet([1, 2, 3]).issubset({1, 4, 3, 5})
False
```

### **issuperset**(*other*)

Report whether this set contains another set.

### Example

```
>>> OrderedSet([1, 2]).issuperset([1, 2, 3])
False
>>> OrderedSet([1, 2, 3, 4]).issuperset({1, 2, 3})
True
>>> OrderedSet([1, 4, 3, 5]).issuperset({1, 2, 3})
False
```

### **symmetric\_difference**(*other*)

Return the symmetric difference of two OrderedSets as a new set. That is, the new set will contain all elements that are in exactly one of the sets.

Their order will be preserved, with elements from *self* preceding elements from *other*.

### Example

```
>>> this = OrderedSet([1, 4, 3, 5, 7])
>>> other = OrderedSet([9, 7, 1, 3, 2])
>>> this.symmetric_difference(other)
OrderedSet([4, 5, 9, 2])
```

### **difference\_update**(\**sets*)

Update this OrderedSet to remove items from one or more other sets.

### Example

```
>>> this = OrderedSet([1, 2, 3])
>>> this.difference_update(OrderedSet([2, 4]))
>>> print(this)
OrderedSet([1, 3])
```

```
>>> this = OrderedSet([1, 2, 3, 4, 5])
>>> this.difference_update(OrderedSet([2, 4]), OrderedSet([1, 4, 6]))
>>> print(this)
OrderedSet([3, 5])
```

### **intersection\_update**(*other*)

Update this OrderedSet to keep only items in another set, preserving their order in this set.

### Example

```
>>> this = OrderedSet([1, 4, 3, 5, 7])
>>> other = OrderedSet([9, 7, 1, 3, 2])
>>> this.intersection_update(other)
>>> print(this)
OrderedSet([1, 3, 7])
```

### `symmetric_difference_update(other)`

Update this `OrderedSet` to remove items from another set, then add items from the other set that were not present in this set.

### Example

```
>>> this = OrderedSet([1, 4, 3, 5, 7])
>>> other = OrderedSet([9, 7, 1, 3, 2])
>>> this.symmetric_difference_update(other)
>>> print(this)
OrderedSet([4, 5, 9, 2])
```

**class** `ubelt.Path(*args, **kwargs)`

Bases: `PosixPath`

An extension of `pathlib.Path` with extra convenience methods

---

#### Note:

#### New methods are:

- `augment`
- `ensuredir`
- `expand`
- `expandvars`
- `ls`
- `shrinkuser`
- `walk`

#### New classmethods are:

- `appdir`

#### Modified methods are:

- `touch`
-

### Example

```

>>> # Ubelt extends pathlib functionality
>>> import ubelt as ub
>>> dpath = ub.Path('~/.cache/ubelt/demo_path').expand().ensuredir()
>>> fpath = dpath / 'text_file.txt'
>>> aug_fpath = fpath.augment(stemsuffix='.aux', ext='.jpg').touch()
>>> aug_dpath = dpath.augment(stemsuffix='demo_path2')
>>> assert aug_fpath.read_text() == ''
>>> fpath.write_text('text data')
>>> assert aug_fpath.exists()
>>> assert not aug_fpath.delete().exists()
>>> assert dpath.exists()
>>> assert not dpath.delete().exists()
>>> print(f'{str(fpath.shrinkuser()).replace(os.path.sep, "/")}')
>>> print(f'{str(dpath.shrinkuser()).replace(os.path.sep, "/")}')
>>> print(f'{str(aug_fpath.shrinkuser()).replace(os.path.sep, "/")}')
>>> print(f'{str(aug_dpath.shrinkuser()).replace(os.path.sep, "/")}')
~/cache/ubelt/demo_path/text_file.txt
~/cache/ubelt/demo_path
~/cache/ubelt/demo_path/text_file.aux.jpg
~/cache/ubelt/demo_pathdemo_path2

```

**classmethod** `appdir(appname, *args, type='cache')`

Returns an operating system appropriate writable directory for an application to be used for cache, configs, or data.

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args[*str*]** – optional subdirs
- **type** (*str*) – can be ‘cache’, ‘config’, or ‘data’.

#### Returns

a new path object

#### Return type

*Path*

### Example

```

>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> print(ub.Path.appdir('ubelt', type='cache').shrinkuser())
>>> print(ub.Path.appdir('ubelt', type='config').shrinkuser())
>>> print(ub.Path.appdir('ubelt', type='data').shrinkuser())
~/cache/ubelt
~/config/ubelt
~/local/share/ubelt
>>> import pytest
>>> with pytest.raises(KeyError):
>>>     ub.Path.appdir('ubelt', type='other')

```

**augment** (*prefix*="", *stemsuffix*="", *ext*=None, *stem*=None, *dpath*=None, *tail*="", *relative*=None, *multidot*=False, *suffix*="")

Create a new path with a different extension, basename, directory, prefix, and/or suffix.

See [augpath\(\)](#) for more details.

#### Parameters

- **prefix** (*str*) – Text placed in front of the stem. Defaults to ‘’.
- **stemsuffix** (*str*) – Text placed between the stem and extension. Default to ‘’. Note: this is just called suffix in `ub.augpath()`.
- **ext** (*str* | *None*) – If specified, replaces the extension
- **stem** (*str* | *None*) – If specified, replaces the stem (i.e. basename without extension). Note: named base in [augpath\(\)](#).
- **dpath** (*str* | *PathLike* | *None*) – If specified, replaces the specified “relative” directory, which by default is the parent directory.
- **tail** (*str* | *None*) – If specified, appends this text to the extension.
- **relative** (*str* | *PathLike* | *None*) – Replaces **relative** with **dpath** in path. Has no effect if **dpath** is not specified. Defaults to the `dirname` of the input path. *experimental* not currently implemented.
- **multidot** (*bool*) – Allows extensions to contain multiple dots. Specifically, if False, everything after the last dot in the basename is the extension. If True, everything after the first dot in the basename is the extension.
- **suffix** (*str*) – DEPRECAETD

#### SeeAlso:

# Stdlib ways of augmenting `pathlib.Path.with_stem` `pathlib.Path.with_suffix`

#### Returns

augmented path

#### Return type

[Path](#)

---

**Note:** NOTICE OF BACKWARDS INCOMPATABILITY.

THE INITIAL RELEASE OF `Path.augment` suffered from an unfortunate variable naming decision that conflicts with `pathlib.Path`

```
p = ub.Path('the.entire.fname.or.dname.is.the.name.exe') print(f'p = {p}') print(f'p.name={p.name}')
p = ub.Path('the.stem.ends.here.ext') print(f'p = {p}') print(f'p.stem={p.stem}') p =
ub.Path('only.the.last.dot.is.the.suffix') print(f'p = {p}') print(f'p.suffix={p.suffix}') p =
ub.Path('but.all.suffixes.can.be.recovered') print(f'p = {p}') print(f'p.suffixes={p.suffixes}')
```

```
p.name p.stem p.suffixes p.parts
```

---

### Example

```
>>> import ubelt as ub
>>> path = ub.Path('foo.bar')
>>> suffix = '_suff'
>>> prefix = 'pref_'
>>> ext = '.baz'
>>> newpath = path.augment(prefix=prefix, stemsuffix=suffix, ext=ext, stem='bar'
↳)
>>> print('newpath = {!r}'.format(newpath))
newpath = Path('pref_bar_suff.baz')
```

### Example

```
>>> import ubelt as ub
>>> path = ub.Path('foo.bar')
>>> stemsuffix = '_suff'
>>> prefix = 'pref_'
>>> ext = '.baz'
>>> newpath = path.augment(prefix=prefix, stemsuffix=stemsuffix, ext=ext, stem=
↳'bar')
>>> print('newpath = {!r}'.format(newpath))
```

### Example

```
>>> # Compare our augpath(ext=...) versus pathlib with_suffix(...)
>>> import ubelt as ub
>>> cases = [
>>>     ub.Path('no_ext'),
>>>     ub.Path('one.ext'),
>>>     ub.Path('double..dot'),
>>>     ub.Path('two.many.cooks'),
>>>     ub.Path('path.with.three.dots'),
>>>     ub.Path('traildot.'),
>>>     ub.Path('doubletraildot..'),
>>>     ub.Path('.prefdot'),
>>>     ub.Path('..doubleprefdot'),
>>> ]
>>> for path in cases:
>>>     print('--')
>>>     print('path = {}'.format(ub.repr2(path, nl=1)))
>>>     ext = '.EXT'
>>>     method_pathlib = path.with_suffix(ext)
>>>     method_augment = path.augment(ext=ext)
>>>     if method_pathlib == method_augment:
>>>         print(ub.color_text('agree', 'green'))
>>>     else:
>>>         print(ub.color_text('disagree', 'red'))
>>>     print('path.with_suffix({}) = {}'.format(ext, ub.repr2(method_pathlib,
↳nl=1)))
```

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```
>>> print('path.augment(ext={}) = {}'.format(ext, ub.repr2(method_augment,
    ↪nl=1)))
>>> print('--')
```

### delete()

Removes a file or recursively removes a directory. If a path does not exist, then this does nothing.

#### SeeAlso:

`ubelt.delete()`

#### Returns

reference to self

#### Return type

*Path*

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> base = ub.Path(ub.ensure_app_cache_dir('ubelt', 'delete_test2'))
>>> dpath1 = (base / 'dir').ensuredir()
>>> (base / 'dir' / 'subdir').ensuredir()
>>> (base / 'dir' / 'to_remove1.txt').touch()
>>> fpath1 = (base / 'dir' / 'subdir' / 'to_remove3.txt').touch()
>>> fpath2 = (base / 'dir' / 'subdir' / 'to_remove2.txt').touch()
>>> assert all(p.exists() for p in [dpath1, fpath1, fpath2])
>>> fpath1.delete()
>>> assert all(p.exists() for p in [dpath1, fpath2])
>>> assert not fpath1.exists()
>>> dpath1.delete()
>>> assert not any(p.exists() for p in [dpath1, fpath1, fpath2])
```

### ensuredir(mode=511)

Concise alias of `self.mkdir(parents=True, exist_ok=True)`

#### Returns

returns itself

#### Return type

*Path*

### Example

```
>>> import ubelt as ub
>>> cache_dpath = ub.ensure_app_cache_dir('ubelt')
>>> dpath = ub.Path(join(cache_dpath, 'ensuredir'))
>>> if dpath.exists():
...     os.rmdir(dpath)
>>> assert not dpath.exists()
>>> dpath.ensuredir()
```

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```
>>> assert dpath.exists()
>>> dpath.rmdir()
```

**expand()**

Expands user tilde and environment variables.

Concise alias of *Path(os.path.expandvars(self.expanduser()))*

**Returns**

path with expanded environment variables and tildes

**Return type**

*Path*

**Example**

```
>>> import ubelt as ub
>>> #home_v1 = ub.Path('$HOME').expand()
>>> home_v2 = ub.Path('~').expand()
>>> assert isinstance(home_v2, ub.Path)
>>> home_v3 = ub.Path.home()
>>> #print('home_v1 = {!r}'.format(home_v1))
>>> print('home_v2 = {!r}'.format(home_v2))
>>> print('home_v3 = {!r}'.format(home_v3))
>>> assert home_v3 == home_v2 # == home_v1
```

**expandvars()**

As discussed in [CPythonIssue21301], CPython won't be adding `expandvars` to `pathlib`. I think this is a mistake, so I added it in this extension.

**Returns**

path with expanded environment variables

**Return type**

*Path*

**References****ls()**

A convenience function to list all paths in a directory.

This is simply a wrapper around `iterdir` that returns the results as a list instead of a generator. This is mainly for faster navigation in IPython. In production code *iterdir* should be used instead.

**Returns**

List[Path]

### Example

```
>>> import ubelt as ub
>>> self = ub.Path.appdir('ubelt/tests/ls')
>>> (self / 'dir1').ensuredir()
>>> (self / 'dir2').ensuredir()
>>> (self / 'file1').touch()
>>> (self / 'file2').touch()
>>> (self / 'dir1/file3').touch()
>>> (self / 'dir2/file4').touch()
>>> children = self.ls()
>>> assert isinstance(children, list)
>>> print(ub.repr2(sorted([p.relative_to(self) for p in children])))
[
  Path('dir1'),
  Path('dir2'),
  Path('file1'),
  Path('file2'),
]
```

**shrinkuser**(*home*='~')

Inverse of `os.path.expanduser()`.

#### Parameters

**home** (*str*) – symbol used to replace the home path. Defaults to '~', but you might want to use '\$HOME' or '%USERPROFILE%' instead.

#### Returns

path - shortened path replacing the home directory with a symbol

#### Return type

*Path*

### Example

```
>>> import ubelt as ub
>>> path = ub.Path('~').expand()
>>> assert str(path.shrinkuser()) == '~'
>>> assert str(ub.Path((str(path) + '1')).shrinkuser()) == str(path) + '1'
>>> assert str((path / '1').shrinkuser()) == join('~', '1')
>>> assert str((path / '1').shrinkuser('$HOME')) == join('$HOME', '1')
>>> assert str(ub.Path('.').shrinkuser()) == '.'
```

**touch**(*mode*=438, *exist\_ok*=True)

Create this file with the given access mode, if it doesn't exist.

#### Returns

returns itself

#### Return type

*Path*



## Notes

The `ubelt.util_io.touch()` function currently has a slightly different implementation. This uses whatever the `pathlib` version is. This may change in the future.

**walk**(*topdown=True, onerror=None, followlinks=False*)

A variant of `os.walk` for `pathlib`

### Parameters

- **topdown** (*bool*) – if `True` starts yield nodes closer to the root first otherwise yield nodes closer to the leaves first.
- **onerror** (*Callable[[OSError], None]*) – A function with one argument of type `OSError`. If the error is raised the walk is aborted, otherwise it continues.
- **followlinks** (*bool*) – if `True` recurse into symbolic directory links

### Yields

*Tuple['Path', List[str], List[str]]* – the root path, directory names, and file names

## Example

```
>>> import ubelt as ub
>>> self = ub.Path.appdir('ubelt/tests/ls')
>>> (self / 'dir1').ensuredir()
>>> (self / 'dir2').ensuredir()
>>> (self / 'file1').touch()
>>> (self / 'file2').touch()
>>> (self / 'dir1/file3').touch()
>>> (self / 'dir2/file4').touch()
>>> subdirs = list(self.walk())
>>> assert len(subdirs) == 3
```

## Example

```
>>> # Modified from the stdlib
>>> import os
>>> from os.path import join, getsize
>>> import email
>>> import ubelt as ub
>>> base = ub.Path(email.__file__).parent
>>> for root, dirs, files in base.walk():
>>>     print(root, " consumes", end="")
>>>     print(sum(getsize(join(root, name)) for name in files), end="")
>>>     print("bytes in ", len(files), " non-directory files")
>>>     if 'CVS' in dirs:
>>>         dirs.remove('CVS') # don't visit CVS directories
```

```
class ubelt.ProgIter(iterable=None, desc=None, total=None, freq=1, initial=0, eta_window=64,
                    clearline=True, adjust=True, time_thresh=2.0, show_times=True, show_wall=False,
                    enabled=True, verbose=None, stream=None, chunksize=None, rel_adjust_limit=4.0,
                    **kwargs)
```

Bases: `_TQDMCompat`, `_BackwardsCompat`

Prints progress as an iterator progresses

`ProgIter` is an alternative to `tqdm`. `ProgIter` implements much of the `tqdm`-API. The main difference between `ProgIter` and `tqdm` is that `ProgIter` does not use threading where as `tqdm` does.

#### Variables

- **iterable** (*List | Iterable*) – A list or iterable to loop over
- **desc** (*str*) – description label to show with progress
- **total** (*int*) – Maximum length of the process. If not specified, we estimate it from the iterable, if possible.
- **freq** (*int*) – How many iterations to wait between messages. Defaults to 1.
- **adjust** (*bool*) – if True `freq` is adjusted based on `time_thresh` Defaults to True.
- **eta\_window** (*int*) – number of previous measurements to use in eta calculation, default=64
- **clearline** (*bool*) – if True messages are printed on the same line otherwise each new progress message is printed on new line. default=True
- **adjust** – if True `freq` is adjusted based on `time_thresh`. This may be overwritten depending on the setting of `verbose`. default=True
- **time\_thresh** (*float*) – desired amount of time to wait between messages if `adjust` is True otherwise does nothing, default=2.0
- **show\_times** (*bool*) – shows rate and eta, default=True
- **show\_wall** (*bool*) – show wall time, default=False
- **initial** (*int*) – starting index offset, default=0
- **stream** (*IO*) – stream where progress information is written to, default=sys.stdout
- **enabled** (*bool*) – if False nothing happens. default=True
- **chunksize** (*int | None*) – indicates that each iteration processes a batch of this size. Iteration rate is displayed in terms of single-items.
- **rel\_adjust\_limit** (*float*) – Maximum factor update frequency can be adjusted by in a single step. default=4.0
- **verbose** (*int*) – verbosity mode, which controls `clearline`, `adjust`, and `enabled`. The following maps the value of `verbose` to its effect. 0: `enabled=False`, 1: `enabled=True` with `clearline=True` and `adjust=True`, 2: `enabled=True` with `clearline=False` and `adjust=True`, 3: `enabled=True` with `clearline=False` and `adjust=False`

---

**Note:** Either use `ProgIter` in a `with` statement or call `prog.end()` at the end of the computation if there is a possibility that the entire iterable may not be exhausted.

---

---

**Note:** `ProgIter` is an alternative to `tqdm`. The main difference between `ProgIter` and `tqdm` is that `ProgIter` does not use threading where as `tqdm` does. `ProgIter` is simpler than `tqdm` and thus more stable in certain circumstances.

---

#### SeeAlso:

`tqdm` - <https://pypi.python.org/pypi/tqdm>

## References

<http://datagenetics.com/blog/february12017/index.html>

## Example

```
>>>
>>> def is_prime(n):
...     return n >= 2 and not any(n % i == 0 for i in range(2, n))
>>> for n in ProgIter(range(100), verbose=1, show_wall=True):
>>>     # do some work
>>>     is_prime(n)
100/100... rate=... Hz, total=..., wall=...
```

**set\_extra**(*extra*)

specify a custom info appended to the end of the next message

---

### Todo:

- [ ] *extra* is a bad name; come up with something better and rename
- 

## Example

```
>>> prog = ProgIter(range(100, 300, 100), show_times=False, verbose=3)
>>> for n in prog:
>>>     prog.set_extra('processesing num {}'.format(n))
0/2...
1/2...processesing num 100
2/2...processesing num 200
```

**step**(*inc=1, force=False*)

Manually step progress update, either directly or by an increment.

### Parameters

- **inc** (*int, default=1*) – number of steps to increment
- **force** (*bool, default=False*) – if True forces progress display

## Example

```
>>> n = 3
>>> prog = ProgIter(desc='manual', total=n, verbose=3)
>>> # Need to manually begin and end in this mode
>>> prog.begin()
>>> for _ in range(n):
...     prog.step()
>>> prog.end()
```

### Example

```
>>> n = 3
>>> # can be used as a context manager in manual mode
>>> with ProgIter(desc='manual', total=n, verbose=3) as prog:
...     for _ in range(n):
...         prog.step()
```

#### start()

Alias of `ubelt.progiter.ProgIter.begin()`

#### begin()

Initializes information used to measure progress

This only needs to be used if this ProgIter is not wrapping an iterable. Does nothing if the this ProgIter is disabled.

#### Returns

a chainable self-reference

#### Return type

*ProgIter*

#### end()

Signals that iteration has ended and displays the final message.

This only needs to be used if this ProgIter is not wrapping an iterable. Does nothing if the this ProgIter object is disabled or has already finished.

#### format\_message()

builds a formatted progress message with the current values. This contains the special characters needed to clear lines.

### Example

```
>>> self = ProgIter(clearline=False, show_times=False)
>>> print(repr(self.format_message()))
' 0/?... \n'
>>> self.begin()
>>> self.step()
>>> print(repr(self.format_message()))
' 1/?... \n'
```

### Example

```
>>> self = ProgIter(chunksize=10, total=100, clearline=False,
>>>                 show_times=False, microseconds=True)
>>> # hack, microseconds=True for coverage, needs real test
>>> print(repr(self.format_message()))
' 0.00% of 10x100... \n'
>>> self.begin()
>>> self.update() # tqdm alternative to step
>>> print(repr(self.format_message()))
' 1.00% of 10x100... \n'
```

**ensure\_newline()**

use before any custom printing when using the progress iter to ensure your print statement starts on a new line instead of at the end of a progress line

**Example**

```
>>> # Unsafe version may write your message on the wrong line
>>> prog = ProgIter(range(3), show_times=False, freq=2, adjust=False)
>>> for n in prog:
...     print('unsafe message')
0/3... unsafe message
unsafe message
2/3... unsafe message
3/3...
>>> # apparently the safe version does this too.
>>> print('---')
---
>>> prog = ProgIter(range(3), show_times=False, freq=2, adjust=False)
>>> for n in prog:
...     prog.ensure_newline()
...     print('safe message')
0/3...
safe message
safe message
2/3...
safe message
3/3...
```

**display\_message()**

Writes current progress to the output stream

**class ubelt.SetDict**

Bases: `dict`

A dictionary subclass where all set operations are defined.

All of the set operations are defined in a key-wise fashion, that is it is like performing the operation on sets of keys.

---

**Note:** The SetDict class only defines key-wise set operations. Value-wise or item-wise operations are in general not hashable and therefore not supported. A heavier extension would be needed for that.

---

**Example**

```
>>> import ubelt as ub
>>> primes = ub.sdict({v: f'prime_{v}' for v in [2, 3, 5, 7, 11]})
>>> evens = ub.sdict({v: f'even_{v}' for v in [0, 2, 4, 6, 8, 10]})
>>> odds = ub.sdict({v: f'odd_{v}' for v in [1, 3, 5, 7, 9, 11]})
>>> squares = ub.sdict({v: f'square_{v}' for v in [0, 1, 4, 9]})
>>> div3 = ub.sdict({v: f'div3_{v}' for v in [0, 3, 6, 9]})
```

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```

>>> # All of the set methods are defined
>>> results1 = {}
>>> results1['ints'] = ints = odds.union(evens)
>>> results1['composites'] = ints.difference(primes)
>>> results1['even_primes'] = evens.intersection(primes)
>>> results1['odd_nonprimes_and_two'] = odds.symmetric_difference(primes)
>>> print('results1 = {}'.format(ub.repr2(results1, nl=2, sort=True)))
results1 = {
    'composites': {
        0: 'even_0',
        1: 'odd_1',
        4: 'even_4',
        6: 'even_6',
        8: 'even_8',
        9: 'odd_9',
        10: 'even_10',
    },
    'even_primes': {
        2: 'even_2',
    },
    'ints': {
        0: 'even_0',
        1: 'odd_1',
        2: 'even_2',
        3: 'odd_3',
        4: 'even_4',
        5: 'odd_5',
        6: 'even_6',
        7: 'odd_7',
        8: 'even_8',
        9: 'odd_9',
        10: 'even_10',
        11: 'odd_11',
    },
    'odd_nonprimes_and_two': {
        1: 'odd_1',
        2: 'prime_2',
        9: 'odd_9',
    },
}
>>> # As well as their corresponding binary operators
>>> assert results1['ints'] == odds | evens
>>> assert results1['composites'] == ints - primes
>>> assert results1['even_primes'] == evens & primes
>>> assert results1['odd_nonprimes_and_two'] == odds ^ primes
>>> # These can also be used as classmethods
>>> assert results1['ints'] == ub.sdict.union(odds, evens)
>>> assert results1['composites'] == ub.sdict.difference(ints, primes)
>>> assert results1['even_primes'] == ub.sdict.intersection(evens, primes)
>>> assert results1['odd_nonprimes_and_two'] == ub.sdict.symmetric_difference(odds, ↵
↵primes)
>>> # The narry variants are also implemented

```

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```

>>> results2 = {}
>>> results2['nary_union'] = ub.sdict.union(primes, div3, odds)
>>> results2['nary_difference'] = ub.sdict.difference(primes, div3, odds)
>>> results2['nary_intersection'] = ub.sdict.intersection(primes, div3, odds)
>>> # Note that the definition of symmetric difference might not be what you think,
    ↪in the nary case.
>>> results2['nary_symmetric_difference'] = ub.sdict.symmetric_difference(primes,
    ↪div3, odds)
>>> print('results2 = {}'.format(ub.repr2(results2, nl=2, sort=True)))
results2 = {
    'nary_difference': {
        2: 'prime_2',
    },
    'nary_intersection': {
        3: 'prime_3',
    },
    'nary_symmetric_difference': {
        0: 'div3_0',
        1: 'odd_1',
        2: 'prime_2',
        3: 'odd_3',
        6: 'div3_6',
    },
    'nary_union': {
        0: 'div3_0',
        1: 'odd_1',
        2: 'prime_2',
        3: 'odd_3',
        5: 'odd_5',
        6: 'div3_6',
        7: 'odd_7',
        9: 'odd_9',
        11: 'odd_11',
    },
}

```

### Example

```

>>> # A neat thing about our implementation is that often the right
>>> # hand side is not required to be a dictionary, just something
>>> # that can be cast to a set.
>>> import ubelt as ub
>>> primes = ub.sdict({2: 'a', 3: 'b', 5: 'c', 7: 'd', 11: 'e'})
>>> assert primes - {2, 3} == {5: 'c', 7: 'd', 11: 'e'}
>>> assert primes & {2, 3} == {2: 'a', 3: 'b'}
>>> # Union does need to have a second dictionary
>>> import pytest
>>> with pytest.raises(AttributeError):
>>>     primes | {2, 3}

```

copy()

### Example

```
>>> import ubelt as ub
>>> a = ub.sdict({1: 1, 2: 2, 3: 3})
>>> b = ub.udict({1: 1, 2: 2, 3: 3})
>>> c = a.copy()
>>> d = b.copy()
>>> assert c is not a
>>> assert d is not b
>>> assert d == b
>>> assert c == a
>>> list(map(type, [a, b, c, d]))
>>> assert isinstance(c, ub.sdict)
>>> assert isinstance(d, ub.udict)
```

### `union(*others)`

Return the key-wise union of two or more dictionaries.

For items with intersecting keys, dictionaries towards the end of the sequence are given precedence.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.
- **\*others** – other dictionary like objects that have an `items` method. (i.e. it must return an iterable of 2-tuples where the first item is hashable.)

#### Returns

whatever the dictionary type of the first argument is

#### Return type

`dict`

### Example

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> assert a | b == {2: 'B_c', 3: 'A_d', 5: 'A_f', 7: 'B_h', 4: 'B_e', 0: 'B_a'}
>>> a.union(b)
>>> a | b | c
>>> res = ub.SetDict.union(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{0: B_a, 2: C_c, 3: C_d, 4: B_e, 5: A_f, 7: B_h, 8: C_i, 9: D_j, 10: D_k, 11: D_
↪l}
```

### `intersection(*others)`

Return the key-wise intersection of two or more dictionaries.

All items returned will be from the first dictionary for keys that exist in all other dictionaries / sets provided.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.



- **\*others** – other dictionary or set like objects that can be coerced into a set of keys.

**Returns**

whatever the dictionary type of the first argument is

**Return type**

dict

**Example**

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> assert a & b == {2: 'A_c', 7: 'A_h'}
>>> a.intersection(b)
>>> a & b & c
>>> res = ub.SetDict.intersection(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{}

```

**difference(\*others)**

Return the key-wise difference between this dictionary and one or more other dictionary / keys.

The returned items will be from the first dictionary, and will only contain keys that do not appear in any of the other dictionaries / sets.

**Parameters**

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.
- **\*others** – other dictionary or set like objects that can be coerced into a set of keys.

**Returns**

whatever the dictionary type of the first argument is

**Return type**

dict

**Example**

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> assert a - b == {3: 'A_d', 5: 'A_f'}
>>> a.difference(b)
>>> a - b - c
>>> res = ub.SetDict.difference(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{5: A_f}

```

### `symmetric_difference(*others)`

Return the key-wise symmetric difference between this dictionary and one or more other dictionaries.

Returns items that are (key-wise) in an odd number of the given dictionaries. This is consistent with the standard n-ary definition of symmetric difference [[WikiSymDiff](#)] and corresponds with the xor operation.

#### Parameters

- **self** (*SetDict* | *dict*) – if called as a static method this must be provided.
- **\*others** – other dictionary or set like objects that can be coerced into a set of keys.

#### Returns

whatever the dictionary type of the first argument is

#### Return type

`dict`

### References

#### Example

```
>>> import ubelt as ub
>>> a = ub.SetDict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> b = ub.SetDict({k: 'B_' + chr(97 + k) for k in [2, 4, 0, 7]})
>>> c = ub.SetDict({k: 'C_' + chr(97 + k) for k in [2, 8, 3]})
>>> d = ub.SetDict({k: 'D_' + chr(97 + k) for k in [9, 10, 11]})
>>> e = ub.SetDict({k: 'E_' + chr(97 + k) for k in []})
>>> a ^ b
{3: 'A_d', 5: 'A_f', 4: 'B_e', 0: 'B_a'}
>>> a.symmetric_difference(b)
>>> a - b - c
>>> res = ub.SetDict.symmetric_difference(a, b, c, d, e)
>>> print(ub.repr2(res, sort=1, nl=0, si=1))
{0: B_a, 2: C_c, 4: B_e, 5: A_f, 8: C_i, 9: D_j, 10: D_k, 11: D_l}
```

### `class ubelt.TeeStringIO(redirect=None)`

Bases: `StringIO`

An IO object that writes to itself and another IO stream.

#### Variables

**redirect** (*io.IOBase*) – The other stream to write to.

#### Example

```
>>> import ubelt as ub
>>> redirect = io.StringIO()
>>> self = ub.TeeStringIO(redirect)
```

### `isatty()`

Returns true if the redirect is a terminal.

---

**Note:** Needed for `IPython.embed` to work properly when this class is used to override `stdout` / `stderr`.

---

**fileno()**

Returns underlying file descriptor of the redirected IOBase object if one exists.

**Example**

```
>>> # Not sure the best way to test, this func is important for
>>> # capturing stdout when ipython embedding
>>> import pytest
>>> with pytest.raises(io.UnsupportedOperation):
>>>     TeeStringIO(redirect=io.StringIO()).fileno()
>>> with pytest.raises(io.UnsupportedOperation):
>>>     TeeStringIO(None).fileno()
```

**property encoding**

Gets the encoding of the *redirect* IO object

**Example**

```
>>> import ubelt as ub
>>> redirect = io.StringIO()
>>> assert ub.TeeStringIO(redirect).encoding is None
>>> assert ub.TeeStringIO(None).encoding is None
>>> assert ub.TeeStringIO(sys.stdout).encoding is sys.stdout.encoding
>>> redirect = io.TextIOWrapper(io.StringIO())
>>> assert ub.TeeStringIO(redirect).encoding is redirect.encoding
```

**write(msg)**

Write to this and the redirected stream

**flush()**

Flush to this and the redirected stream

**class ubelt.TempDir**

Bases: `object`

Context for creating and cleaning up temporary directories.

---

**Note:** This class will be DEPRECATED. The exact deprecation version and mitigation plan has not yet been developed.

---



---

**Note:** This exists because `tempfile.TemporaryDirectory` was introduced in Python 3.2. Thus once ubelt no longer supports python 2.7, this class will be deprecated.

---

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> with TempDir() as self:
>>>     dpath = self.dpath
>>>     assert exists(dpath)
>>> assert not exists(dpath)
```

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> self = TempDir()
>>> dpath = self.ensure()
>>> assert exists(dpath)
>>> self.cleanup()
>>> assert not exists(dpath)
```

**ensure()**

**cleanup()**

**start()**

**class** `ubelt.Timer`(*label=""*, *verbose=None*, *newline=True*)

Bases: `object`

Measures time elapsed between a start and end point. Can be used as a with-statement context manager, or using the tic/toc api.

#### Parameters

- **label** (*str*, *default=""*) – identifier for printing
- **verbose** (*int*, *default=None*) – verbosity flag, defaults to True if label is given
- **newline** (*bool*, *default=True*) – if False and verbose, print tic and toc on the same line

#### Variables

- **elapsed** (*float*) – number of seconds measured by the context manager
- **tstart** (*float*) – time of last *tic* reported by *self.\_time()*

### Example

```
>>> # Create and start the timer using the context manager
>>> import math
>>> timer = Timer('Timer test!', verbose=1)
>>> with timer:
>>>     math.factorial(10)
>>> assert timer.elapsed > 0
tic('Timer test!')
...toc('Timer test!')=...
```

## Example

```
>>> # Create and start the timer using the tic/toc interface
>>> timer = Timer().tic()
>>> elapsed1 = timer.toc()
>>> elapsed2 = timer.toc()
>>> elapsed3 = timer.toc()
>>> assert elapsed1 <= elapsed2
>>> assert elapsed2 <= elapsed3
```

**tic()**

starts the timer

**toc()**

stops the timer

**class** ubelt.UDict

Bases: *SetDict*

A subclass of dict with ubelt enhancements

This builds on top of *SetDict* which itself is a simple extension that contains only that extra functionality. The extra invert, map, sorted, and peek functions are less fundamental and there are at least reasonable workarounds when they are not available.

The UDict class is a simple subclass of dict that provides the following upgrades:

- **set operations - inherited from *SetDict***
  - intersection - find items in common
  - union - merge dicts
  - difference - find items in one but not the other
  - symmetric\_difference - find items that appear an odd number of times
- **subdict** - take a subset with optional default values. (similar to intersection, but the later ignores non-common values)
- **inversion** -
  - invert - swaps a dictionary keys and values (with options for dealing with duplicates).
- **mapping** -
  - map\_keys - applies a function over each key and keeps the values the same
  - map\_values - applies a function over each key and keeps the values the same
- **sorting** -
  - sorted\_keys - returns a dictionary ordered by the keys
  - sorted\_values - returns a dictionary ordered by the values

IMO key-wise set operations on dictionaries are fundamentally and sorely missing from the stdlib, mapping is super convinient, sorting and inversion are less common, but still useful to have.

---

### Todo:

- [ ] UbeltDict, UltraDict, not sure what the name is. We may just rename this to Dict,
-

## Example

```
>>> import ubelt as ub
>>> a = ub.udict({1: 20, 2: 20, 3: 30, 4: 40})
>>> b = ub.udict({0: 0, 2: 20, 4: 42})
>>> c = ub.udict({3: -1, 5: -1})
>>> # Demo key-wise set operations
>>> assert a & b == {2: 20, 4: 40}
>>> assert a - b == {1: 20, 3: 30}
>>> assert a ^ b == {1: 20, 3: 30, 0: 0}
>>> assert a | b == {1: 20, 2: 20, 3: 30, 4: 42, 0: 0}
>>> # Demo new n-ary set methods
>>> a.union(b, c) == {1: 20, 2: 20, 3: -1, 4: 42, 0: 0, 5: -1}
>>> a.intersection(b, c) == {}
>>> a.difference(b, c) == {1: 20}
>>> a.symmetric_difference(b, c) == {1: 20, 0: 0, 5: -1}
>>> # Demo new quality of life methods
>>> assert a.subdict({2, 4, 6, 8}, default=None) == {8: None, 2: 20, 4: 40, 6: None}
>>> assert a.invert() == {20: 2, 30: 3, 40: 4}
>>> assert a.invert(unique_vals=0) == {20: {1, 2}, 30: {3}, 40: {4}}
>>> assert a.peek_key() == ub.peek(a.keys())
>>> assert a.peek_value() == ub.peek(a.values())
>>> assert a.map_keys(lambda x: x * 10) == {10: 20, 20: 20, 30: 30, 40: 40}
>>> assert a.map_values(lambda x: x * 10) == {1: 200, 2: 200, 3: 300, 4: 400}
```

**subdict**(*keys*, *default=NoParam*)

Get a subset of a dictionary

### Parameters

- **self** (*Dict[KT, VT]*) – dictionary or the implicit instance
- **keys** (*Iterable[KT]*) – keys to take from self
- **default** (*Optional[object] | NoParamType*) – if specified uses default if keys are missing.

### Raises

**KeyError** – if a key does not exist and default is not specified

## Example

```
>>> import ubelt as ub
>>> a = ub.udict({k: 'A_' + chr(97 + k) for k in [2, 3, 5, 7]})
>>> s = a.subdict({2, 5})
>>> print('s = {}'.format(ub.repr2(s, nl=0)))
s = {2: 'A_c', 5: 'A_f'}
>>> import pytest
>>> with pytest.raises(KeyError):
>>>     s = a.subdict({2, 5, 100})
>>> s = a.subdict({2, 5, 100}, default='DEF')
>>> print('s = {}'.format(ub.repr2(s, nl=0)))
s = {2: 'A_c', 5: 'A_f', 100: 'DEF'}
```

**invert**(*unique\_vals=True*)

Swaps the keys and values in a dictionary.

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – dictionary or the implicit instance to invert
- **unique\_vals** (*bool*, *default=True*) – if *False*, the values of the new dictionary are sets of the original keys.
- **cls** (*type* | *None*) – specifies the dict subclass of the result. if unspecified will be *dict* or *OrderedDict*. This behavior may change.

**Returns**

the inverted dictionary

**Return type**

*Dict*[*VT*, *KT*] | *Dict*[*VT*, *Set*[*KT*]]

---

**Note:** The must values be hashable.

If the original dictionary contains duplicate values, then only one of the corresponding keys will be returned and the others will be discarded. This can be prevented by setting `unique_vals=False`, causing the inverted keys to be returned in a set.

---

**Example**

```
>>> import ubelt as ub
>>> inverted = ub.udict({'a': 1, 'b': 2}).invert()
>>> assert inverted == {1: 'a', 2: 'b'}
```

**map\_keys(func)**

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – a dictionary or the implicit instance.
- **func** (*Callable*[[*VT*], *T*] | *Mapping*[*VT*, *T*]) – a function or indexable object

**Returns**

transformed dictionary

**Return type**

*Dict*[*KT*, *T*]

**Example**

```
>>> import ubelt as ub
>>> new = ub.udict({'a': [1, 2, 3], 'b': []}).map_keys(ord)
>>> assert new == {97: [1, 2, 3], 98: []}
```

**map\_values(func)**

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – a dictionary or the implicit instance.
- **func** (*Callable*[[*VT*], *T*] | *Mapping*[*VT*, *T*]) – a function or indexable object

**Returns**

transformed dictionary

**Return type**

*Dict*[*KT*, *T*]

**Example**

```
>>> import ubelt as ub
>>> newdict = ub.udict({'a': [1, 2, 3], 'b': []}).map_values(len)
>>> assert newdict == {'a': 3, 'b': 0}
```

**sorted\_keys**(*key=None*, *reverse=False*)

Return an ordered dictionary sorted by its keys

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – dictionary to sort or the implicit instance. The keys must be of comparable types.
- **key** (*Callable*[[*KT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed keys.
- **reverse** (*bool*, *default=False*) – if True returns in descending order

**Returns**

new dictionary where the keys are ordered

**Return type**

*OrderedDict*[*KT*, *VT*]

**Example**

```
>>> import ubelt as ub
>>> new = ub.udict({'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}).sorted_keys()
>>> assert new == ub.odict([('eggs', 1.2), ('jam', 2.92), ('spam', 2.62)])
```

**sorted\_values**(*key=None*, *reverse=False*)

Return an ordered dictionary sorted by its values

**Parameters**

- **self** (*Dict*[*KT*, *VT*]) – dictionary to sort or the implicit instance. The values must be of comparable types.
- **key** (*Callable*[[*VT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed values.
- **reverse** (*bool*, *default=False*) – if True returns in descending order

**Returns**

new dictionary where the values are ordered

**Return type**

*OrderedDict*[*KT*, *VT*]



### Example

```
>>> import ubelt as ub
>>> new = ub.udict({'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}).sorted_values()
>>> assert new == ub.odict([('eggs', 1.2), ('spam', 2.62), ('jam', 2.92)])
```

**peek\_key**(*default=NoParam*)

Get the first key in the dictionary

**Parameters**

- **self** (*Dict*) – a dictionary or the implicit instance
- **default** (*T | NoParamType*) – default item to return if the iterable is empty, otherwise a `StopIteration` error is raised

**Returns**

the first value or the default

**Return type**

KT

### Example

```
>>> import ubelt as ub
>>> assert ub.udict({1: 2}).peek_key() == 1
```

**peek\_value**(*default=NoParam*)

Get the first value in the dictionary

**Parameters**

- **self** (*Dict[KT, VT]*) – a dictionary or the implicit instance
- **default** (*T | NoParamType*) – default item to return if the iterable is empty, otherwise a `StopIteration` error is raised

**Returns**

the first value or the default

**Return type**

VT

### Example

```
>>> import ubelt as ub
>>> assert ub.udict({1: 2}).peek_value() == 2
```

**ubelt.allsame**(*iterable, eq=<built-in function eq>*)

Determine if all items in a sequence are the same

**Parameters**

- **iterable** (*Iterable[T]*) – items to determine if they are all the same
- **eq** (*Callable[[T, T], bool]*, *default=operator.eq*) – function used to test for equality

### Returns

True if all items are equal, otherwise False

### Return type

`bool`

### Notes

Similar to `more_itertools.all_equal()`

### Example

```
>>> import ubelt as ub
>>> ub.allsame([1, 1, 1, 1])
True
>>> ub.allsame([])
True
>>> ub.allsame([0, 1])
False
>>> iterable = iter([0, 1, 1, 1])
>>> next(iterable)
>>> ub.allsame(iterable)
True
>>> ub.allsame(range(10))
False
>>> ub.allsame(range(10), lambda a, b: True)
True
```

`ubelt.argflag(key, argv=None)`

Determines if a key is specified on the command line.

This is a functional alternative to `key in sys.argv`, but it also allows for multiple aliases of the same flag to be specified.

### Parameters

- **key** (*str* | *Tuple[str, ...]*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. `--`).
- **argv** (*List[str]*, *default=None*) – overrides `sys.argv` if specified

### Returns

flag - True if the key (or any of the keys) was specified

### Return type

`bool`

## CommandLine

```
xdoctest -m ubelt.util_arg argflag:0
xdoctest -m ubelt.util_arg argflag:0 --devflag
xdoctest -m ubelt.util_arg argflag:0 -df
xdoctest -m ubelt.util_arg argflag:0 --devflag2
xdoctest -m ubelt.util_arg argflag:0 -df2
```

## Example

```
>>> # Everyday usage of this function might look like this
>>> import ubelt as ub
>>> # Check if either of these strings are in sys.argv
>>> flag = ub.argflag(['-df', '--devflag'])
>>> if flag:
>>>     print(ub.color_text(
>>>         'A hidden developer flag was given!', 'blue'))
>>> print('Pass the hidden CLI flag to see a secret message')
```

## Example

```
>>> import ubelt as ub
>>> argv = ['--spam', '--eggs', 'foo']
>>> assert ub.argflag('--eggs', argv=argv) is True
>>> assert ub.argflag('--ans', argv=argv) is False
>>> assert ub.argflag('foo', argv=argv) is True
>>> assert ub.argflag(('bar', '--spam'), argv=argv) is True
```

`ubelt.argmax(indexable, key=None)`

Returns index / key of the item with the largest value.

This is similar to `numpy.argmax()`, but it is written in pure python and works on both lists and dictionaries.

### Parameters

- **indexable** (*Iterable*[VT] | *Mapping*[KT, VT]) – indexable to sort by
- **key** (*Callable*[[VT], Any], *default=None*) – customizes the ordering of the indexable

### Returns

the index of the item with the maximum value.

### Return type

`int` | KT

### Example

```
>>> import ubelt as ub
>>> assert ub.argmax({'a': 3, 'b': 2, 'c': 100}) == 'c'
>>> assert ub.argmax(['a', 'c', 'b', 'z', 'f']) == 3
>>> assert ub.argmax([[0, 1], [2, 3, 4], [5]], key=len) == 1
>>> assert ub.argmax({'a': 3, 'b': 2, 3: 100, 4: 4}) == 3
>>> assert ub.argmax(iter(['a', 'c', 'b', 'z', 'f'])) == 3
```

`ubelt.argmax(indexable, key=None)`

Returns index / key of the item with the smallest value.

This is similar to `numpy.argmax()`, but it is written in pure python and works on both lists and dictionaries.

#### Parameters

- **indexable** (*Iterable[VT] | Mapping[KT, VT]*) – indexable to sort by
- **key** (*Callable[[VT], VT], default=None*) – customizes the ordering of the indexable

#### Returns

the index of the item with the minimum value.

#### Return type

`int | KT`

### Example

```
>>> import ubelt as ub
>>> assert ub.argmin({'a': 3, 'b': 2, 'c': 100}) == 'b'
>>> assert ub.argmin(['a', 'c', 'b', 'z', 'f']) == 0
>>> assert ub.argmin([[0, 1], [2, 3, 4], [5]], key=len) == 2
>>> assert ub.argmin({'a': 3, 'b': 2, 3: 100, 4: 4}) == 'b'
>>> assert ub.argmin(iter(['a', 'c', 'A', 'z', 'f'])) == 2
```

`ubelt.argsort(indexable, key=None, reverse=False)`

Returns the indices that would sort a indexable object.

This is similar to `numpy.argsort()`, but it is written in pure python and works on both lists and dictionaries.

#### Parameters

- **indexable** (*Iterable[VT] | Mapping[KT, VT]*) – indexable to sort by
- **key** (*Callable[[VT], VT] | None, default=None*) – customizes the ordering of the indexable
- **reverse** (*bool, default=False*) – if True returns in descending order

#### Returns

indices - list of indices that sorts the indexable

#### Return type

`List[int] | List[KT]`

### Example

```

>>> import ubelt as ub
>>> # argsort works on dicts by returning keys
>>> dict_ = {'a': 3, 'b': 2, 'c': 100}
>>> indices = ub.argsort(dict_)
>>> assert list(ub.take(dict_, indices)) == sorted(dict_.values())
>>> # argsort works on lists by returning indices
>>> indexable = [100, 2, 432, 10]
>>> indices = ub.argsort(indexable)
>>> assert list(ub.take(indexable, indices)) == sorted(indexable)
>>> # Can use iterators, but be careful. It exhausts them.
>>> indexable = reversed(range(100))
>>> indices = ub.argsort(indexable)
>>> assert indices[0] == 99
>>> # Can use key just like sorted
>>> indexable = [[0, 1, 2], [3, 4], [5]]
>>> indices = ub.argsort(indexable, key=len)
>>> assert indices == [2, 1, 0]
>>> # Can use reverse just like sorted
>>> indexable = [0, 2, 1]
>>> indices = ub.argsort(indexable, reverse=True)
>>> assert indices == [1, 2, 0]

```

`ubelt.argsort(items, key=None)`

Returns indices corresponding to the first instance of each unique item.

#### Parameters

- **items** (*Sequence[VT]*) – indexable collection of items
- **key** (*Callable[[VT], Any]*, *default=None*) – custom normalization function. If specified returns items where `key(item)` is unique.

#### Returns

indices of the unique items

#### Return type

`Iterator[int]`

### Example

```

>>> import ubelt as ub
>>> items = [0, 2, 5, 1, 1, 0, 2, 4]
>>> indices = list(ub.argsort(items))
>>> assert indices == [0, 1, 2, 3, 7]
>>> indices = list(ub.argsort(items, key=lambda x: x % 2 == 0))
>>> assert indices == [0, 2]

```

`ubelt.argval(key, default=None, argv=None)`

Get the value of a keyword argument specified on the command line.

Values can be specified as `<key> <value>` or `<key>=<value>`

The use-case for this function is to add hidden command line feature where a developer can pass in a special value. This can be used to prototype a command line interface, provide an easter egg, or add some other command line parsing that wont be exposed in CLI help docs.

#### Parameters

- **key** (*str* | *Tuple[str, ...]*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. --)
- **default** (*T* | *NoParamType*, *default=NoParam*) – a value to return if not specified.
- **argv** (*Optional[List[str]]*, *default=None*) – uses `sys.argv` if unspecified

#### Returns

value - the value specified after the key. If the key is specified multiple times, then the first value is returned.

#### Return type

*str* | *T*

---

#### Todo:

- [x] Can we handle the case where the value is a list of long paths? - No
  - [ ] Should we default the first or last specified instance of the flag.
- 

## CommandLine

```
xdoctest -m ubelt.util_arg argval:0
xdoctest -m ubelt.util_arg argval:0 --devval
xdoctest -m ubelt.util_arg argval:0 --devval=1
xdoctest -m ubelt.util_arg argval:0 --devval=2
xdoctest -m ubelt.util_arg argval:0 --devval 3
xdoctest -m ubelt.util_arg argval:0 --devval "4 5 6"
```

## Example

```
>>> # Everyday usage of this function might look like this where
>>> import ubelt as ub
>>> # grab a key/value pair if is given on the command line
>>> value = ub.argval('--devval', default='1')
>>> print('Checking if the hidden CLI key/value pair is given')
>>> if value != '1':
>>>     print(ub.color_text(
>>>         'A hidden developer secret: {!r}'.format(value), 'yellow'))
>>> print('Pass the hidden CLI key/value pair to see a secret message')
```

### Example

```
>>> import ubelt as ub
>>> argv = ['--ans', '42', '--quest=the grail', '--ans=6', '--bad']
>>> assert ub.argval('--spam', argv=argv) == ub.NoParam
>>> assert ub.argval('--quest', argv=argv) == 'the grail'
>>> assert ub.argval('--ans', argv=argv) == '42'
>>> assert ub.argval('--bad', argv=argv) == ub.NoParam
>>> assert ub.argval('--bad', '--bar', argv=argv) == ub.NoParam
```

### Example

```
>>> # Test fix for GH Issue #41
>>> import ubelt as ub
>>> argv = ['--path=/path/with/k=3']
>>> ub.argval('--path', argv=argv) == '/path/with/k=3'
```

`ubelt.augpath(path, suffix="", prefix="", ext=None, tail="", base=None, dpath=None, relative=None, multidot=False)`

Create a new path with a different extension, basename, directory, prefix, and/or suffix.

A prefix is inserted before the basename. A suffix is inserted between the basename and the extension. The basename and extension can be replaced with a new one. Essentially a path is broken down into components (dpath, base, ext), and then recombined as (dpath, prefix, base, suffix, ext) after replacing any specified component.

#### Parameters

- **path** (*str* | *PathLike*) – a path to augment
- **suffix** (*str*) – placed between the basename and extension Note: this is referred to as stem-suffix in `ub.Path.augment()`.
- **prefix** (*str*) – placed in front of the basename
- **ext** (*str* | *None*) – if specified, replaces the extension
- **tail** (*str* | *None*) – If specified, appends this text to the extension
- **base** (*str* | *None*) – if specified, replaces the basename without extension. Note: this is referred to as stem in `ub.Path.augment()`.
- **dpath** (*str* | *PathLike* | *None*) – if specified, replaces the specified “relative” directory, which by default is the parent directory.
- **relative** (*str* | *PathLike* | *None*) – Replaces **relative** with **dpath** in **path**. Has no effect if **dpath** is not specified. Defaults to the `dirname` of the input **path**. *experimental* not currently implemented.
- **multidot** (*bool*) – Allows extensions to contain multiple dots. Specifically, if `False`, everything after the last dot in the basename is the extension. If `True`, everything after the first dot in the basename is the extension.

#### Returns

augmented path

#### Return type

`str`

### Example

```
>>> import ubelt as ub
>>> path = 'foo.bar'
>>> suffix = '_suff'
>>> prefix = 'pref_'
>>> ext = '.baz'
>>> newpath = ub.augpath(path, suffix, prefix, ext=ext, base='bar')
>>> print('newpath = %s' % (newpath,))
newpath = pref_bar_suff.baz
```

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> augpath('foo.bar')
'foo.bar'
>>> augpath('foo.bar', ext='.BAZ')
'foo.BAZ'
>>> augpath('foo.bar', suffix='_')
'foo_.bar'
>>> augpath('foo.bar', prefix='_')
'_foo.bar'
>>> augpath('foo.bar', base='baz')
'baz.bar'
>>> augpath('foo.tar.gz', ext='.zip', multidot=True)
foo.zip
>>> augpath('foo.tar.gz', ext='.zip', multidot=False)
foo.tar.zip
>>> augpath('foo.tar.gz', suffix='_new', multidot=True)
foo_new.tar.gz
>>> augpath('foo.tar.gz', suffix='_new', tail='.cache', multidot=True)
foo_new.tar.gz.cache
```

`ubelt.boolmask(indices, maxval=None)`

Constructs a list of booleans where an item is True if its position is in indices otherwise it is False.

#### Parameters

- **indices** (*List[int]*) – list of integer indices
- **maxval** (*int*) – length of the returned list. If not specified this is inferred using `max(indices)`

#### Returns

mask - a list of booleans. `mask[idx]` is True if `idx` in indices

#### Return type

`List[bool]`

---

**Note:** In the future the arg `maxval` may change its name to `shape`

---



## Example

```
>>> import ubelt as ub
>>> indices = [0, 1, 4]
>>> mask = ub.boolmask(indices, maxval=6)
>>> assert mask == [True, True, False, False, True, False]
>>> mask = ub.boolmask(indices)
>>> assert mask == [True, True, False, False, True]
```

**class** `ubelt.chunks`(*items*, *chunksize=None*, *nchunks=None*, *total=None*, *bordermode='none'*, *legacy=False*)

Bases: `object`

Generates successive n-sized chunks from *items*.

If the last chunk has less than n elements, *bordermode* is used to determine fill values.

### Parameters

- **items** (*Iterable[T]*) – input to iterate over
- **chunksize** (*int*) – size of each sublist yielded
- **nchunks** (*int*) – number of chunks to create ( cannot be specified if chunksize is specified)
- **bordermode** (*str*) – determines how to handle the last case if the length of the input is not divisible by chunksize valid values are: {'none', 'cycle', 'replicate'}
- **total** (*int*) – hints about the length of the input

### Note:

#### FIXME:

When *nchunks* is given, that's how many chunks we should get but the issue is that *chunksize* is not well defined in that instance For instance how do we turn a list with 4 elements into 3 chunks where does the extra item go?

In *ubelt* <= 0.10.3 there is a bug when specifying *nchunks*, where it chooses a *chunksize* that is too large. Specify *legacy=True* to get the old buggy behavior if needed.

## Notes

**This is similar to functionality provided by**

`more_itertools.chunked()`, `more_itertools.chunked_even()`, `more_itertools.sliced()`, `more_itertools.divide()`,

### Yields

*List[T]* – subsequent non-overlapping chunks of the input items

## References

### Example

```
>>> import ubelt as ub
>>> items = '1234567'
>>> genresult = ub.chunks(items, chunksize=3)
>>> list(genresult)
[['1', '2', '3'], ['4', '5', '6'], ['7']]
```

### Example

```
>>> import ubelt as ub
>>> items = [1, 2, 3, 4, 5, 6, 7]
>>> genresult = ub.chunks(items, chunksize=3, bordermode='none')
>>> assert list(genresult) == [[1, 2, 3], [4, 5, 6], [7]]
>>> genresult = ub.chunks(items, chunksize=3, bordermode='cycle')
>>> assert list(genresult) == [[1, 2, 3], [4, 5, 6], [7, 1, 2]]
>>> genresult = ub.chunks(items, chunksize=3, bordermode='replicate')
>>> assert list(genresult) == [[1, 2, 3], [4, 5, 6], [7, 7, 7]]
```

### Example

```
>>> import ubelt as ub
>>> assert len(list(ub.chunks(range(2), nchunks=2))) == 2
>>> assert len(list(ub.chunks(range(3), nchunks=2))) == 2
>>> # Note: ub.chunks will not do the 2,1,1 split
>>> assert len(list(ub.chunks(range(4), nchunks=3))) == 3
>>> assert len(list(ub.chunks([], 2, bordermode='none'))) == 0
>>> assert len(list(ub.chunks([], 2, bordermode='cycle'))) == 0
>>> assert len(list(ub.chunks([], 2, None, bordermode='replicate'))) == 0
```

### Example

```
>>> from ubelt.util_list import * # NOQA
>>> def _check_len(self):
...     assert len(self) == len(list(self))
>>> _check_len(chunks(list(range(3)), nchunks=2))
>>> _check_len(chunks(list(range(2)), nchunks=2))
>>> _check_len(chunks(list(range(2)), nchunks=3))
```

### Example

```
>>> from ubelt.util_list import * # NOQA
>>> import pytest
>>> assert pytest.raises(ValueError, chunks, range(9))
>>> assert pytest.raises(ValueError, chunks, range(9), chunksize=2, nchunks=2)
>>> assert pytest.raises(TypeError, len, chunks((_ for _ in range(2)), 2))
```

### Example

```
>>> from ubelt.util_list import * # NOQA
>>> import ubelt as ub
>>> basis = {
>>>     'legacy': [False, True],
>>>     'chunker': [{ 'nchunks': 3}, { 'nchunks': 4}, { 'nchunks': 5}, { 'nchunks': 7},
↪ { 'chunksize': 3}],
>>>     'items': [range(2), range(4), range(5), range(7), range(9)],
>>>     'bordermode': ['none', 'cycle', 'replicate'],
>>> }
>>> grid_items = list(ub.named_product(basis))
>>> rows = []
>>> for grid_item in ub.ProgIter(grid_items):
>>>     chunker = grid_item.get('chunker')
>>>     grid_item.update(chunker)
>>>     kw = ub.dict_diff(grid_item, {'chunker'})
>>>     self = chunk_iter = ub.chunks(**kw)
>>>     chunked = list(chunk_iter)
>>>     chunk_lens = list(map(len, chunked))
>>>     row = ub.dict_union(grid_item, {'chunk_lens': chunk_lens, 'chunks': chunked}
↪ )
>>>     row['chunker'] = str(row['chunker'])
>>>     if not row['legacy'] and 'nchunks' in kw:
>>>         assert kw['nchunks'] == row['nchunks']
>>>     row.update(chunk_iter.__dict__)
>>>     rows.append(row)
>>> # xdoctest: +SKIP
>>> import pandas as pd
>>> df = pd.DataFrame(rows)
>>> for _, subdf in df.groupby('chunker'):
>>>     print(subdf)
```

**static noborder**(items, chunksize)

**static cycle**(items, chunksize)

**static replicate**(items, chunksize)

**ubelt.cmd**(command, shell=False, detach=False, verbose=0, tee=None, cwd=None, env=None, tee\_backend='auto', check=False, system=False, timeout=None)

Executes a command in a subprocess.

The advantage of this wrapper around subprocess is that (1) you control if the subprocess prints to stdout, (2) the text written to stdout and stderr is returned for parsing, (3) cross platform behavior that lets you specify the

command as a string or tuple regardless of whether or not `shell=True`. (4) ability to detach, return the process object and allow the process to run in the background (eventually we may return a Future object instead).

#### Parameters

- **command** (*str* | *List[str]*) – command string, tuple of executable and args, or shell command.
- **shell** (*bool*, *default=False*) – if True, process is run in shell.
- **detach** (*bool*, *default=False*) – if True, process is detached and run in background.
- **verbose** (*int*, *default=0*) – verbosity mode. Can be 0, 1, 2, or 3.
- **tee** (*bool* | *None*) – if True, simultaneously writes to stdout while capturing output from the command. If not specified, defaults to True if verbose > 0. If detach is True, then this argument is ignored.
- **cwd** (*str* | *PathLike* | *None*) – Path to run command. Defaults to current working directory if unspecified.
- **env** (*Dict[str, str]* | *None*) – environment passed to Popen
- **tee\_backend** (*str*, *default='auto'*) – backend for tee output. Valid choices are: “auto”, “select” (POSIX only), and “thread”.
- **check** (*bool*, *default=False*) – if True, check that the return code was zero before returning, otherwise raise a `subprocess.CallProcessError`. Does nothing if detach is True.
- **system** (*bool*, *default=False*) – if True, most other considerations are dropped, and `os.system()` is used to execute the command in a platform dependant way. Other arguments such as env, tee, timeout, and shell are all ignored. (new in version 1.1.0)
- **timeout** (*float*) – If the process does not complete in *timeout* seconds, raises a `subprocess.TimeoutExpired`. (new in version 1.1.0) Currently unhandled when tee is True.
- **log** (*Callable* | *None*) – If specified, verbose output is written using this function, otherwise the builtin print function is used.

#### Returns

`info` - information about command status. if detach is False `info` contains captured standard out, standard error, and the return code if detach is True `info` contains a reference to the process.

#### Return type

`dict`

#### Raises

- **ValueError** - on an invalid configuration –
- **subprocess.TimeoutExpired** - if the timeout limit is exceeded –
- **subprocess.CallProcessError** - if check and the return value is non zero –

---

**Note:** Inputs can either be text or tuple based. On UNIX we ensure conversion to text if `shell=True`, and to tuple if `shell=False`. On windows, the input is always text based. See [SO\_33560364] for a potential cross-platform shlex solution for windows.

When using the tee output, the stdout and stderr may be shuffled from what they would be on the command line.

---

**Related Work:**

<https://github.com/pycontribs/subprocess-tee> <https://github.com/mortoray/shelljob> [https://github.com/netinvent/command\\_runner](https://github.com/netinvent/command_runner)

**References****CommandLine**

```
xdoctest -m ubelt.util_cmd cmd:6
python -c "import ubelt as ub; ub.cmd('ping localhost -c 2', verbose=2)"
pytest "$(python -c 'import ubelt; print(ubelt.util_cmd.__file__)')" -sv --xdoctest-
↳ verbose 2
```

**Example**

```
>>> import ubelt as ub
>>> info = ub.cmd(('echo', 'simple cmdline interface'), verbose=1)
simple cmdline interface
>>> assert info['ret'] == 0
>>> assert info['out'].strip() == 'simple cmdline interface'
>>> assert info['err'].strip() == ''
```

**Example**

```
>>> import ubelt as ub
>>> info = ub.cmd('echo str noshell', verbose=0)
>>> assert info['out'].strip() == 'str noshell'
```

**Example**

```
>>> # windows echo will output extra single quotes
>>> import ubelt as ub
>>> info = ub.cmd(('echo', 'tuple noshell'), verbose=0)
>>> assert info['out'].strip().strip('"') == 'tuple noshell'
```

**Example**

```
>>> # Note this command is formatted to work on win32 and unix
>>> import ubelt as ub
>>> info = ub.cmd('echo str&&echo shell', verbose=0, shell=True)
>>> assert info['out'].strip() == 'str' + chr(10) + 'shell'
```

### Example

```
>>> import ubelt as ub
>>> info = ub.cmd(('echo', 'tuple shell'), verbose=0, shell=True)
>>> assert info['out'].strip().strip('"') == 'tuple shell'
```

### Example

```
>>> import pytest
>>> import ubelt as ub
>>> info = ub.cmd('echo hi', check=True)
>>> import subprocess
>>> with pytest.raises(subprocess.CalledProcessError):
>>>     ub.cmd('exit 1', check=True, shell=True)
```

### Example

```
>>> import ubelt as ub
>>> from os.path import join, exists
>>> fpath1 = join(ub.get_app_cache_dir('ubelt'), 'cmdout1.txt')
>>> fpath2 = join(ub.get_app_cache_dir('ubelt'), 'cmdout2.txt')
>>> ub.delete(fpath1)
>>> ub.delete(fpath2)
>>> # Start up two processes that run simultaneously in the background
>>> info1 = ub.cmd(('touch', fpath1), detach=True)
>>> info2 = ub.cmd('echo writing2 > ' + fpath2, shell=True, detach=True)
>>> # Detached processes are running in the background
>>> # We can run other code while we wait for them.
>>> while not exists(fpath1):
>>>     pass
>>> while not exists(fpath2):
>>>     pass
>>> # communicate with the process before you finish
>>> # (otherwise you may leak a text wrapper)
>>> info1['proc'].communicate()
>>> info2['proc'].communicate()
>>> # Check that the process actually did finish
>>> assert (info1['proc'].wait()) == 0
>>> assert (info2['proc'].wait()) == 0
>>> # Check that the process did what we expect
>>> assert ub.readfrom(fpath1) == ''
>>> assert ub.readfrom(fpath2).strip() == 'writing2'
```

### Example

```
>>> # Can also use ub.cmd to call os.system
>>> import pytest
>>> import ubelt as ub
>>> import subprocess
>>> info = ub.cmd('echo hi', check=True, system=True)
>>> with pytest.raises(subprocess.CallProcessError):
>>>     ub.cmd('exit 1', check=True, shell=True)
```

`ubelt.codeblock(text)`

Create a block of text that preserves all newlines and relative indentation

Wraps multiline string blocks and returns unindented code. Useful for templated code defined in indented parts of code.

#### Parameters

**text** (*str*) – typically a multiline string

#### Returns

the unindented string

#### Return type

str

### Example

```
>>> import ubelt as ub
>>> # Simulate an indented part of code
>>> if True:
>>>     # notice the indentation on this will be normal
>>>     codeblock_version = ub.codeblock(
>>>         """
>>>         def foo():
>>>             return 'bar'
>>>         """
>>>     )
>>>     # notice the indentation and newlines on this will be odd
>>>     normal_version = (
>>>         def foo():
>>>             return 'bar'
>>>         )
>>> assert normal_version != codeblock_version
>>> print('Without codeblock')
>>> print(normal_version)
>>> print('With codeblock')
>>> print(codeblock_version)
```

`ubelt.color_text(text, color)`

Colorizes text a single color using ansi tags.

#### Parameters

- **text** (*str*) – text to colorize

- **color** (*str*) – color code. different systems may have different colors. commonly available colors are: ‘red’, ‘brown’, ‘yellow’, ‘green’, ‘blue’, ‘black’, and ‘white’.

#### Returns

text - colored text. If pygments is not installed plain text is returned.

#### Return type

str

#### Example

```
>>> text = 'raw text'
>>> import pytest
>>> import ubelt as ub
>>> if ub.modname_to_modpath('pygments'):
>>>     # Colors text only if pygments is installed
>>>     ansi_text = ub.ensure_unicode(ub.color_text(text, 'red'))
>>>     prefix = ub.ensure_unicode('\x1b[31')
>>>     print('prefix = {!r}'.format(prefix))
>>>     print('ansi_text = {!r}'.format(ansi_text))
>>>     assert ansi_text.startswith(prefix)
>>>     assert ub.color_text(text, None) == 'raw text'
>>> else:
>>>     # Otherwise text passes through unchanged
>>>     assert ub.color_text(text, 'red') == 'raw text'
>>>     assert ub.color_text(text, None) == 'raw text'
```

#### Example

```
>>> # xdoctest: +REQUIRES(module:pygments)
>>> import pygments.console
>>> import ubelt as ub
>>> known_colors = pygments.console.codes.keys()
>>> for color in known_colors:
...     print(ub.color_text(color, color))
```

`ubelt.compatible(config, func, start=0, keywords=True)`

Take the “compatible” subset of a dictionary that a function will accept as keyword arguments.

A common pattern is to track the configuration of a program in a single dictionary. Often there will be functions that only require subsets of this dictionary, and they will be written such that those items are passed via keyword arguments. The `ubelt.compatible()` utility makes it easier select only the relevant config variables. It does this by inspecting the signature of the function to determine what keyword arguments it accepts, and returns the dictionary intersection of the full config and the allowed keywords. The user can then call the function with the normal `**` mechanism.

#### Parameters

- **config** (*Dict[str, Any]*) – A dictionary that contains keyword arguments that might be passed to a function.
- **func** (*Callable*) – A function or method to check the arguments of
- **start** (*int*) – Only take args after this position. Set to 1 if calling with an unbound method to avoid the self argument. Defaults to 0.



- **keywords** (*bool* | *Iterable[str]*) – If True (default), and **\*\*kwargs** is in the signature, prevent any filtering of the **config** dictionary. If False, then ignore that **\*\*kwargs** is in the signature and only return the subset of **config** that matches the explicit signature. Otherwise if specified as a non-string iterable of strings, assume these are the allowed keys that are compatible with the way **kwargs** is handled in the function.

**Returns**

A subset of **config** that only contains items compatible with the signature of **func**.

**Return type**

`Dict[str, Any]`

**Example**

```
>>> # An example use case is to select a subset of of a config
>>> # that can be passed to some function as kwargs
>>> import ubelt as ub
>>> # Define a function with args that match some keys in a config.
>>> def func(a, e, f):
>>>     return a * e * f
>>> # Define a config that has a superset of items needed by the func
>>> config = {
...     'a': 2, 'b': 3, 'c': 7,
...     'd': 11, 'e': 13, 'f': 17,
... }
>>> # Call the function only with keys that are compatible
>>> func(**ub.compatible(config, func))
442
```

**Example**

```
>>> # Test case with kwargs
>>> import ubelt as ub
>>> def func(a, e, f, *args, **kwargs):
>>>     return a * e * f
>>> config = {
...     'a': 2, 'b': 3, 'c': 7,
...     'd': 11, 'e': 13, 'f': 17,
... }
>>> func(**ub.compatible(config, func))
442
>>> print(sorted(ub.compatible(config, func)))
['a', 'b', 'c', 'd', 'e', 'f']
>>> print(sorted(ub.compatible(config, func, keywords=False)))
['a', 'e', 'f']
>>> print(sorted(ub.compatible(config, func, keywords={'b'})))
['a', 'b', 'e', 'f']
```

`ubelt.compress(items, flags)`

Selects from **items** where the corresponding value in **flags** is True.

**Parameters**

- **items** (*Iterable[Any]*) – a sequence to select items from
- **flags** (*Iterable[bool]*) – corresponding sequence of bools

**Returns**

a subset of masked items

**Return type**

`Iterable[Any]`

**Notes**

This function is based on `numpy.compress()`, but is pure Python and swaps the condition and array argument to be consistent with `ubelt.take()`.

This is equivalent to `itertools.compress()`.

**Example**

```
>>> import ubelt as ub
>>> items = [1, 2, 3, 4, 5]
>>> flags = [False, True, True, False, True]
>>> list(ub.compress(items, flags))
[2, 3, 5]
```

**ubelt.ddict**

alias of `defaultdict`

**ubelt.delete(path, verbose=False)**

Removes a file or recursively removes a directory. If a path does not exist, then this does nothing.

**Parameters**

- **path** (*str* | *PathLike*) – file or directory to remove
- **verbose** (*bool*) – if True prints what is being done

**SeeAlso:****send2trash -**

A cross-platform Python package for sending files to the trash instead of irreversibly deleting them.

`ubelt.util_path.Path.delete()`

**Notes**

This can call `os.unlink()`, `os.rmdir()`, or `shutil.rmtree()`, depending on what path references on the filesystem. (On windows may also call a custom `ubelt._win32_links._win32_rmtree()`).

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> base = ub.ensure_app_cache_dir('ubelt', 'delete_test')
>>> dpath1 = ub.ensuredir(join(base, 'dir'))
>>> ub.ensuredir(join(base, 'dir', 'subdir'))
>>> ub.touch(join(base, 'dir', 'to_remove1.txt'))
>>> fpath1 = join(base, 'dir', 'subdir', 'to_remove3.txt')
>>> fpath2 = join(base, 'dir', 'subdir', 'to_remove2.txt')
>>> ub.touch(fpath1)
>>> ub.touch(fpath2)
>>> assert all(map(exists, (dpath1, fpath1, fpath2)))
>>> ub.delete(fpath1)
>>> assert all(map(exists, (dpath1, fpath2)))
>>> assert not exists(fpath1)
>>> ub.delete(dpath1)
>>> assert not any(map(exists, (dpath1, fpath1, fpath2)))
```

### Example

```
>>> import ubelt as ub
>>> from os.path import exists, join
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'delete_test2')
>>> dpath1 = ub.ensuredir(join(dpath, 'dir'))
>>> fpath1 = ub.touch(join(dpath1, 'to_remove.txt'))
>>> assert exists(fpath1)
>>> ub.delete(dpath)
>>> assert not exists(fpath1)
```

`ubelt.dict_diff(*args)`

Dictionary set extension for `set.difference()`

Constructs a dictionary that contains any of the keys in the first arg, which are not in any of the following args.

#### Parameters

**\*args** (*List[Dict[KT, VT] | Iterable[KT]]*) – A sequence of dictionaries (or sets of keys). The first argument should always be a dictionary, but the subsequent arguments can just be sets of keys.

#### Returns

OrderedDict if the first argument is an OrderedDict, otherwise dict

#### Return type

Dict[KT, VT] | OrderedDict[KT, VT]

#### Todo:

- [ ] Add inplace keyword argument, which modifies the first dictionary inplace.

### Example

```
>>> import ubelt as ub
>>> ub.dict_diff({'a': 1, 'b': 1}, {'a'}, {'c'})
{'b': 1}
>>> ub.dict_diff(odict([('a', 1), ('b', 2)]), odict([('c', 3)]))
OrderedDict([('a', 1), ('b', 2)])
>>> ub.dict_diff()
{}
>>> ub.dict_diff({'a': 1, 'b': 2}, {'c'})
```

`ubelt.dict_hist(items, weights=None, ordered=False, labels=None)`

Builds a histogram of items, counting the number of time each item appears in the input.

#### Parameters

- **items** (*Iterable[T]*) – hashable items (usually containing duplicates)
- **weights** (*Iterable[float]*, *default=None*) – Corresponding weights for each item.
- **ordered** (*bool*, *default=False*) – If True the result is ordered by frequency.
- **labels** (*Iterable[T]*, *default=None*) – Expected labels. Allows this function to pre-initialize the histogram. If specified the frequency of each label is initialized to zero and **items** can only contain items specified in labels.

#### Returns

dictionary where the keys are unique elements from **items**, and the values are the number of times the item appears in **items**.

#### Return type

`dict[T, int]`

### Example

```
>>> import ubelt as ub
>>> items = [1, 2, 39, 900, 1232, 900, 1232, 2, 2, 2, 900]
>>> hist = ub.dict_hist(items)
>>> print(ub.repr2(hist, nl=0))
{1: 1, 2: 4, 39: 1, 900: 3, 1232: 2}
```

### Example

```
>>> import ubelt as ub
>>> items = [1, 2, 39, 900, 1232, 900, 1232, 2, 2, 2, 900]
>>> hist1 = ub.dict_hist(items)
>>> hist2 = ub.dict_hist(items, ordered=True)
>>> try:
>>>     hist3 = ub.dict_hist(items, labels=[])
>>> except KeyError:
>>>     pass
>>> else:
>>>     raise AssertionError('expected key error')
>>> weights = [1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1]
```

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```
>>> hist4 = ub.dict_hist(items, weights=weights)
>>> print(ub.repr2(hist1, nl=0))
{1: 1, 2: 4, 39: 1, 900: 3, 1232: 2}
>>> print(ub.repr2(hist4, nl=0))
{1: 1, 2: 4, 39: 1, 900: 1, 1232: 0}
```

**ubelt.dict\_isect(\*args)**

Dictionary set extension for `set.intersection()`

Constructs a dictionary that contains keys common between all inputs. The returned values will only belong to the first dictionary.

#### Parameters

**\*args** (*List[Dict[KT, VT] | Iterable[KT]]*) – A sequence of dictionaries (or sets of keys). The first argument should always be a dictionary, but the subsequent arguments can just be sets of keys.

#### Returns

OrderedDict if the first argument is an OrderedDict, otherwise dict

#### Return type

Dict[KT, VT] | OrderedDict[KT, VT]

**Note:** This function can be used as an alternative to `dict_subset()` where any key not in the dictionary is ignored. See the following example:

```
>>> import ubelt as ub
>>> # xdoctest: +IGNORE_WANT
>>> ub.dict_isect({'a': 1, 'b': 2, 'c': 3}, ['a', 'c', 'd'])
{'a': 1, 'c': 3}
```

### Example

```
>>> import ubelt as ub
>>> ub.dict_isect({'a': 1, 'b': 1}, {'b': 2, 'c': 2})
{'b': 1}
>>> ub.dict_isect(odict([('a', 1), ('b', 2)]), odict([('c', 3)]))
OrderedDict()
>>> ub.dict_isect()
{}
```

**ubelt.dict\_subset(dict\_, keys, default=NoParam, cls=<class 'collections.OrderedDict'>)**

Get a subset of a dictionary

#### Parameters

- **dict\_** (*Dict[KT, VT]*) – superset dictionary
- **keys** (*Iterable[KT]*) – keys to take from dict\_
- **default** (*Optional[object] | NoParamType*) – if specified uses default if keys are missing.
- **cls** (*Type[Dict]*, *default=OrderedDict*) – type of the returned dictionary.

**Returns**

subset dictionary

**Return type**

Dict[KT, VT]

**SeeAlso:**

`dict_isect()` - similar functionality, but ignores missing keys

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'K': 3, 'dcvs_clip_max': 0.2, 'p': 0.1}
>>> keys = ['K', 'dcvs_clip_max']
>>> subdict_ = ub.dict_subset(dict_, keys)
>>> print(ub.repr2(subdict_, nl=0))
{'K': 3, 'dcvs_clip_max': 0.2}
```

`ubelt.dict_union(*args)`

Dictionary set extension for `set.union`

Combines items with from multiple dictionaries. For items with intersecting keys, dictionaries towards the end of the sequence are given precedence.

**Parameters**

`*args (List[Dict])` – A sequence of dictionaries. Values are taken from the last

**Returns**

OrderedDict if the first argument is an OrderedDict, otherwise dict

**Return type**

Dict | OrderedDict

**Notes**

In Python 3.8+, the bitwise or operator “|” operator performs a similar operation, but as of 2022-06-01 there is still no public method for dictionary union (or any other dictionary set operator).

**References**

<https://stackoverflow.com/questions/38987/merge-two-dict>

**SeeAlso:**

`collections.ChainMap()` - a standard python builtin data structure that provides a view that treats multiple dicts as a single dict. <https://docs.python.org/3/library/collections.html#chainmap-objects>

### Example

```

>>> import ubelt as ub
>>> result = ub.dict_union({'a': 1, 'b': 1}, {'b': 2, 'c': 2})
>>> assert result == {'a': 1, 'b': 2, 'c': 2}
>>> ub.dict_union(
>>>     ub.odict([('a', 1), ('b', 2)]),
>>>     ub.odict([('c', 3), ('d', 4)]))
OrderedDict([('a', 1), ('b', 2), ('c', 3), ('d', 4)])
>>> ub.dict_union()
{}

```

`ubelt.download(url, fpath=None, dpath=None, fname=None, appname=None, hash_prefix=None, hasher='sha512', chunksize=8192, verbose=1, timeout=None, progkw=None)`

Downloads a url to a file on disk.

If unspecified the location and name of the file is chosen automatically. A `hash_prefix` can be specified to verify the integrity of the downloaded data. This function will download the data every time its called. For cached downloading see `grabdata`.

#### Parameters

- **url** (*str*) – The url to download.
- **fpath** (*Optional[str | PathLike | io.BytesIO]*) – The path to download to. Defaults to base-name of url and ubelt's application cache. If this is a `io.BytesIO` object then information is directly written to this object (note this prevents the use of temporary files).
- **dpath** (*Optional[PathLike]*) – where to download the file. If unspecified `appname` is used to determine this. Mutually exclusive with `fpath`.
- **fname** (*Optional[str]*) – What to name the downloaded file. Defaults to the url basename. Mutually exclusive with `fpath`.
- **appname** (*str*) – set `dpath` to `ub.get_app_cache_dir(appname or 'ubelt')` if `dpath` and `fpath` are not given.
- **hash\_prefix** (*None | str*) – If specified, download will retry / error if the file hash does not match this value. Defaults to `None`.
- **hasher** (*str | Hasher*) – If `hash_prefix` is specified, this indicates the hashing algorithm to apply to the file. Defaults to `sha512`.
- **chunksize** (*int*) – Download chunksize. Default to `2 ** 13`
- **verbose** (*int | bool*) – Verbosity flag. Quiet is 0, higher is more verbose. Defaults to 1.
- **timeout** (*float | NoParamType*) – Specify timeout in seconds for `urllib.request.urlopen()`. (if not specified, the global default timeout setting will be used) This only works for HTTP, HTTPS and FTP connections for blocking operations like the connection attempt.
- **progkw** (*Dict | NoParamType*) – if specified provides extra arguments to the progress iterator. See `ubelt.progiter.ProgIter` for available options.

#### Returns

`fpath` - path to the downloaded file.

#### Return type

`str | PathLike`

**Raises**

- `URLError` - if there is problem downloading the url -
- `RuntimeError` - if the hash does not match the hash\_prefix -

---

**Note:** Based largely on code in pytorch [TorchDL] with modifications influenced by other resources [Shichao\_2012] [SO\_15644964] [SO\_16694907].

---

**References****Example**

```
>>> # xdoctest: +REQUIRES(--network)
>>> from ubelt.util_download import * # NOQA
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> fpath = download(url)
>>> print(basename(fpath))
rqwaDag.png
```

**Example**

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> import io
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> file = io.BytesIO()
>>> fpath = ub.download(url, file)
>>> file.seek(0)
>>> data = file.read()
>>> assert ub.hash_data(data, hasher='sha1').startswith('f79ea24571')
```

**Example**

```
>>> # xdoctest: +REQUIRES(--network)
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> fpath = download(url, hasher='sha1', hash_prefix=
↳ 'f79ea24571da6ddd2ba12e3d57b515249ecb8a35')
Downloading url='http://i.imgur.com/rqwaDag.png' to fpath=...rqwaDag.png
...
...1233/1233... rate=... Hz, eta=..., total=...
```



### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import pytest
>>> import ubelt as ub
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> #fpath = download(url, hasher='sha1', hash_prefix=
↳ 'f79ea24571da6ddd2ba12e3d57b515249ecb8a35')
>>> # test download from girder
>>> #url = 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/download'
>>> #ub.download(url, hasher='sha512', hash_prefix='c98a46cb31205cf')
>>> with pytest.raises(RuntimeError):
>>>     ub.download(url, hasher='sha512', hash_prefix='BAD_HASH')
```

`ubelt.dzip(items1, items2, cls=<class 'dict'>)`

Zips elementwise pairs between items1 and items2 into a dictionary.

Values from items2 can be broadcast onto items1.

#### Parameters

- **items1** (*Iterable[KT]*) – full sequence
- **items2** (*Iterable[VT]*) – can either be a sequence of one item or a sequence of equal length to items1
- **cls** (*Type[dict]*, *default=dict*) – dictionary type to use.

#### Returns

similar to `dict(zip(items1, items2))`.

#### Return type

`Dict[KT, VT]`

### Example

```
>>> import ubelt as ub
>>> assert ub.dzip([1, 2, 3], [4]) == {1: 4, 2: 4, 3: 4}
>>> assert ub.dzip([1, 2, 3], [4, 4, 4]) == {1: 4, 2: 4, 3: 4}
>>> assert ub.dzip([], [4]) == {}
```

`ubelt.ensure_app_cache_dir(appname, *args)`

Calls `get_app_cache_dir()` but ensures the directory exists.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='cache').ensuredir()`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

the path to the ensured directory

### Return type

str

### SeeAlso:

[`get\_app\_cache\_dir\(\)`](#)

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.ensure_app_config_dir(appname, *args)`

Calls [`get\_app\_config\_dir\(\)`](#) but ensures the directory exists.

---

**Note:** New applications should prefer [`ubelt.util\_path.Path.appdir\(\)`](#) i.e. `ubelt.Path.appdir(appname, *args, type='config').ensuredir()`.

---

### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

### Returns

the path to the ensured directory

### Return type

str

### SeeAlso:

[`get\_app\_config\_dir\(\)`](#)

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_config_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.ensure_app_data_dir(appname, *args)`

Calls [`get\_app\_data\_dir\(\)`](#) but ensures the directory exists.

---

**Note:** New applications should prefer [`ubelt.util\_path.Path.appdir\(\)`](#) i.e. `ubelt.Path.appdir(appname, *args, type='data').ensuredir()`.

---

### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns**

the path to the ensured directory

**Return type**

str

**SeeAlso:**

`get_app_data_dir()`

**Example**

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_data_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.ensure_unicode(text)`

Casts bytes into utf8 (mostly for python2 compatibility)

**Parameters**

**text** (*str* | *bytes*) – text to ensure is decoded as unicode

**Returns**

str

**References**

[SO\_12561063] <http://stackoverflow.com/questions/12561063/extract-data-from-file>

**Example**

```
>>> from ubelt.util_str import *
>>> import codecs # NOQA
>>> assert ensure_unicode('my unicôdé string') == 'my unicôdé string'
>>> assert ensure_unicode('text1') == 'text1'
>>> assert ensure_unicode('text1'.encode('utf8')) == 'text1'
>>> assert ensure_unicode('i»¿text1'.encode('utf8')) == 'i»¿text1'
>>> assert (codecs.BOM_UTF8 + 'text»¿'.encode('utf8')).decode('utf8')
```

`ubelt.ensure_dir(dpath, mode=1023, verbose=0, recreate=False)`

Ensures that directory will exist. Creates new dir with sticky bits by default

**Parameters**

- **dpath** (*str* | *PathLike* | *Tuple*[*str* | *PathLike*]) – dir to ensure. Can also be a tuple to send to join
- **mode** (*int*) – octal mode of directory
- **verbose** (*int*) – verbosity
- **recreate** (*bool*) – if True removes the directory and all of its contents and creates a fresh new directory. USE CAREFULLY.

**Returns**

path - the ensured directory

**Return type**

str

**SeeAlso:**

`ubelt.Path.ensuredir()`

---

**Note:** This function is not thread-safe in Python2

---

**Example**

```
>>> from ubelt.util_path import * # NOQA
>>> import ubelt as ub
>>> cache_dpath = ub.ensure_app_cache_dir('ubelt')
>>> dpath = join(cache_dpath, 'ensuredir')
>>> if exists(dpath):
...     os.rmdir(dpath)
>>> assert not exists(dpath)
>>> ub.ensuredir(dpath)
>>> assert exists(dpath)
>>> os.rmdir(dpath)
```

`ubelt.expandpath(path)`

Shell-like environment variable and tilde path expansion.

**Parameters**

**path** (*str* | *PathLike*) – string representation of a path

**Returns**

expanded path

**Return type**

str

**Example**

```
>>> from ubelt.util_path import * # NOQA
>>> import ubelt as ub
>>> assert normpath(ub.expandpath('~foo')) == join(ub.userhome(), 'foo')
>>> assert ub.expandpath('foo') == 'foo'
```

`ubelt.find_duplicates(items, k=2, key=None)`

Find all duplicate items in a list.

Search for all items that appear more than k times and return a mapping from each (k)-duplicate item to the positions it appeared in.

**Parameters**

- **items** (*Iterable[T]*) – hashable items possibly containing duplicates
- **k** (*int*, *default=2*) – only return items that appear at least k times.
- **key** (*Callable[[T], Any]*, *default=None*) – Returns indices where *key(items[i])* maps to a particular value at least k times.

**Returns**

maps each duplicate item to the indices at which it appears

**Return type**

`dict[T, List[int]]`

**Notes**

Similar to `more_itertools.duplicates_everseen()`, `more_itertools.duplicates_justseen()`.

**Example**

```
>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> duplicates = ub.find_duplicates(items)
>>> # Duplicates are a mapping from each item that occurs 2 or more
>>> # times to the indices at which they occur.
>>> assert duplicates == {0: [0, 1, 6], 2: [3, 8], 3: [4, 5]}
>>> # You can set k=3 if you want to don't mind duplicates but you
>>> # want to find triplicates or quadruplets etc.
>>> assert ub.find_duplicates(items, k=3) == {0: [0, 1, 6]}
```

**Example**

```
>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> # note: k can less then 2
>>> duplicates = ub.find_duplicates(items, k=0)
>>> print(ub.repr2(duplicates, nl=0))
{0: [0, 1, 6], 1: [2], 2: [3, 8], 3: [4, 5], 9: [9], 12: [7]}
```

**Example**

```
>>> import ubelt as ub
>>> items = [10, 11, 12, 13, 14, 15, 16]
>>> duplicates = ub.find_duplicates(items, key=lambda x: x // 2)
>>> print(ub.repr2(duplicates, nl=0))
{5: [0, 1], 6: [2, 3], 7: [4, 5]}
```

`ubelt.find_exe(name, multi=False, path=None)`

Locate a command.

Search your local filesystem for an executable and return the first matching file with executable permission.

**Parameters**

- **name** (*str* | *PathLike*) – globstr of matching filename
- **multi** (*bool*, *default=False*) – if True return all matches instead of just the first.
- **path** (*str* | *PathLike* | *Iterable[str | PathLike]* | *None*, *default=None*) – overrides the system PATH variable.

### Returns

returns matching executable(s).

### Return type

`str` | `List[str]` | `None`

### SeeAlso:

`shutil.which()` - which is available in Python 3.3+.

---

**Note:** This is essentially the `which` UNIX command

---

## References

### Example

```
>>> # The following are programs commonly exposed via the PATH variable.
>>> # Exact results may differ between machines.
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> print(ub.find_exe('ls'))
>>> print(ub.find_exe('ping'))
>>> print(ub.find_exe('which'))
>>> print(ub.find_exe('which', multi=True))
>>> print(ub.find_exe('ping', multi=True))
>>> print(ub.find_exe('noexist', multi=True))
/usr/bin/ls
/usr/bin/ping
/usr/bin/which
['/usr/bin/which', '/bin/which']
['/usr/bin/ping', '/bin/ping']
[]
```

### Example

```
>>> import ubelt as ub
>>> assert not ub.find_exe('!noexist', multi=False)
>>> assert ub.find_exe('ping', multi=False) or ub.find_exe('ls', multi=False)
>>> assert not ub.find_exe('!noexist', multi=True)
>>> assert ub.find_exe('ping', multi=True) or ub.find_exe('ls', multi=True)
```

### Benchmark:

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> import shutil
>>> from timerit import Timerit
>>> for timer in Timerit(1000, bestof=10, label='ub.find_exe'):
>>>     ub.find_exe('which')
>>> for timer in Timerit(1000, bestof=10, label='shutil.which'):
```

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```
>>>      shutil.which('which')
Timed best=25.339 µs, mean=25.809 ± 0.3 µs for ub.find_exe
Timed best=28.600 µs, mean=28.986 ± 0.3 µs for shutil.which
```

`ubelt.find_path(name, path=None, exact=False)`

Search for a file or directory on your local filesystem by name (file must be in a directory specified in a PATH environment variable)

#### Parameters

- **name** (*str* | *PathLike*) – file name to match. If `exact` is `False` this may be a glob pattern
- **path** (*str* | *Iterable*[*str* | *PathLike*], *default=None*) – list of directories to search either specified as an `os.pathsep` separated string or a list of directories. Defaults to environment PATH.
- **exact** (*bool*, *default=False*) – if `True`, only returns exact matches.

#### Yields

*str* – candidate - a path that matches name

---

**Note:** Running with `name=''` (i.e. `ub.find_path('')`) will simply yield all directories in your PATH.

---



---

**Note:** For recursive behavior set `path=(d for d, _, _ in os.walk('.'))`, where `'.'` might be replaced by the root directory of interest.

---

### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> print(list(ub.find_path('ping', exact=True)))
>>> print(list(ub.find_path('bin')))
>>> print(list(ub.find_path('gcc*')))
>>> print(list(ub.find_path('cmake*')))
['/usr/bin/ping', '/bin/ping']
[]
[... '/usr/bin/gcc-11', '/usr/bin/gcc-ranlib', ...]
[... '/usr/bin/cmake-gui', '/usr/bin/cmake', ...]
```

### Example

```
>>> import ubelt as ub
>>> from os.path import dirname
>>> path = dirname(dirname(ub.util_platform.__file__))
>>> res = sorted(ub.find_path('ubelt/util_*.py', path=path))
>>> assert len(res) >= 10
>>> res = sorted(ub.find_path('ubelt/util_platform.py', path=path, exact=True))
>>> print(res)
>>> assert len(res) == 1
```

`ubelt.flatten(nested)`

Transforms a nested iterable into a flat iterable.

**Parameters**

**nested** (*Iterable[Iterable[Any]]*) – list of lists

**Returns**

flattened items

**Return type**

`Iterable[Any]`

**Notes**

Equivalent to `more_itertools.flatten()` and `itertools.chain.from_iterable()`.

**Example**

```
>>> import ubelt as ub
>>> nested = [['a', 'b'], ['c', 'd']]
>>> list(ub.flatten(nested))
['a', 'b', 'c', 'd']
```

`ubelt.get_app_cache_dir(appname, *args)`

Returns a writable directory for an application. This should be used for temporary deletable data.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='cache')`.

---

**Parameters**

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns**

the path to the ensured directory

**Return type**

`str`

**Returns**

dpath - writable cache directory for this application

**Return type**

`str`

**SeeAlso:**

`ensure_app_cache_dir()`

`ubelt.get_app_config_dir(appname, *args)`

Returns a writable directory for an application This should be used for persistent configuration files.



---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='config')`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

dpath - writable config directory for this application

#### Return type

`str`

#### SeeAlso:

`ensure_app_config_dir()`

`ubelt.get_app_data_dir(appname, *args)`

Returns a writable directory for an application. This should be used for temporary deletable data.

---

**Note:** New applications should prefer `ubelt.util_path.Path.appdir()` i.e. `ubelt.Path.appdir(appname, *args, type='data')`.

---

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

#### Returns

dpath - writable data directory for this application

#### Return type

`str`

#### SeeAlso:

`ensure_app_data_dir()`

`ubelt.grabdata(url, fpath=None, dpath=None, fname=None, redo=False, verbose=1, appname=None, hash_prefix=None, hasher='sha512', expires=None, **download_kw)`

Downloads a file, caches it, and returns its local path.

If unspecified the location and name of the file is chosen automatically. A `hash_prefix` can be specified to verify the integrity of the downloaded data.

#### Parameters

- **url** (*str*) – url of the file to download
- **fpath** (*Optional[str | PathLike]*) – The full path to download the file to. If unspecified, the arguments `dpath` and `fname` are used to determine this.
- **dpath** (*Optional[str | PathLike]*) – where to download the file. If unspecified `appname` is used to determine this. Mutually exclusive with `fpath`.

- **fname** (*Optional[str]*) – What to name the downloaded file. Defaults to the url basename. Mutually exclusive with fpath.
- **redo** (*bool, default=False*) – if True forces redownload of the file
- **verbose** (*int*) – Verbosity flag. Quiet is 0, higher is more verbose. Defaults to 1.
- **appname** (*str*) – set dpath to `ub.get_app_cache_dir(appname or 'ubelt')` if dpath and fpath are not given.
- **hash\_prefix** (*None | str*) – If specified, grabdata verifies that this matches the hash of the file, and then saves the hash in a adjacent file to certify that the download was successful. Defaults to None.
- **hasher** (*str | Hasher*) – If hash\_prefix is specified, this indicates the hashing algorithm to apply to the file. Defaults to sha512. NOTE: Only pass hasher as a string. Passing as an instance is deprecated and can cause unexpected results.
- **expires** (*str | int | datetime.datetime*) – when the cache should expire and redownload or the number of seconds to wait before the cache should expire.
- **\*\*download\_kw** – additional kwargs to pass to `ubelt.util_download.download()`

#### Returns

fpath - path to downloaded or cached file.

#### Return type

`str` | `PathLike`

### CommandLine

```
xdoctest -m ubelt.util_download grabdata --network
```

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> fpath = ub.grabdata(url, fname='mario.png')
>>> result = basename(fpath)
>>> print(result)
mario.png
```

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> import json
>>> fname = 'foo.bar'
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> prefix1 = '944389a39dfb8fa9'
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1, verbose=3)
>>> stamp_fpath = ub.Path(fpath + '.stamp_sha512.json')
>>> assert json.loads(stamp_fpath.read_text())['hash'][0].startswith(prefix1)
```

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```

>>> # Check that the download doesn't happen again
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> # todo: check file timestamps have not changed
>>> #
>>> # Check redo works with hash
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1, redo=True)
>>> # todo: check file timestamps have changed
>>> #
>>> # Check that a redownload occurs when the stamp is changed
>>> with open(stamp_fpath, 'w') as file:
>>>     file.write('corrupt-stamp')
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> assert json.loads(stamp_fpath.read_text())['hash'][0].startswith(prefix1)
>>> #
>>> # Check that a redownload occurs when the stamp is removed
>>> ub.delete(stamp_fpath)
>>> with open(fpath, 'w') as file:
>>>     file.write('corrupt-data')
>>> assert not ub.hash_file(fpath, base='hex', hasher='sha512').startswith(prefix1)
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> assert ub.hash_file(fpath, base='hex', hasher='sha512').startswith(prefix1)
>>> #
>>> # Check that requesting new data causes redownload
>>> #url2 = 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/download'
>>> #prefix2 = 'c98a46cb31205cf' # hack SSL
>>> url2 = 'http://i.imgur.com/rqwaDag.png'
>>> prefix2 = '944389a39dfb8fa9'
>>> fpath = ub.grabdata(url2, fname=fname, hash_prefix=prefix2)
>>> assert json.loads(stamp_fpath.read_text())['hash'][0].startswith(prefix2)

```

`ubelt.group_items(items, key)`

Groups a list of items by group id.

#### Parameters

- **items** (*Iterable*[VT]) – a list of items to group
- **key** (*Iterable*[KT] | *Callable*[[VT], KT]) – either a corresponding list of group-ids for each item or a function used to map each item to a group-id.

#### Returns

a mapping from each group id to the list of corresponding items

#### Return type

`dict`[KT, `List`[VT]]

### Example

```
>>> import ubelt as ub
>>> items    = ['ham',      'jam',    'spam',    'eggs',    'cheese', 'banana']
>>> groupids = ['protein', 'fruit', 'protein', 'protein', 'dairy',  'fruit']
>>> id_to_items = ub.group_items(items, groupids)
>>> print(ub.repr2(id_to_items, nl=0))
{'dairy': ['cheese'], 'fruit': ['jam', 'banana'], 'protein': ['ham', 'spam', 'eggs
↪']}
```

`ubelt.hash_data(data, hasher=NoParam, base=NoParam, types=False, convert=False, extensions=None)`

Get a unique hash depending on the state of the data.

#### Parameters

- **data** (*object*) – Any sort of loosely organized data
- **hasher** (*str* | *Hasher* | *NoParamType*) – string code or a hash algorithm from hashlib. Valid hashing algorithms are defined by `hashlib.algorithms_guaranteed` (e.g. ‘sha1’, ‘sha512’, ‘md5’) as well as ‘xxh32’ and ‘xxh64’ if `xxhash` is installed. Defaults to ‘sha512’.
- **base** (*List[str]* | *str* | *NoParamType*) – list of symbols or shorthand key. Valid keys are ‘abc’, ‘hex’, and ‘dec’. Defaults to ‘hex’
- **types** (*bool*) – If True data types are included in the hash, otherwise only the raw data is hashed. Defaults to False.
- **convert** (*bool*, *default=True*) – if True, try and convert the data to json an the json is hashed instead. This can improve runtime in some instances, however the hash may differ from the case where `convert=False`.
- **extensions** (*HashableExtensions*) – a custom `HashableExtensions` instance that can overwrite or define how different types of objects are hashed.

---

**Note:** The types allowed are specified by the `HashableExtensions` object. By default ubelt will register:

OrderedDict, uuid.UUID, np.random.RandomState, np.int64, np.int32, np.int16, np.int8, np.uint64, np.uint32, np.uint16, np.uint8, np.float16, np.float32, np.float64, np.float128, np.ndarray, bytes, str, int, float, long (in python2), list, tuple, set, and dict

---

#### Returns

text representing the hashed data

#### Return type

`str`

---

**Note:** The alphabet26 base is a pretty nice base, I recommend it. However we default to `base='hex'` because it is standard. You can try the alphabet26 base by setting `base='abc'`.

---

## Example

```
>>> import ubelt as ub
>>> print(ub.hash_data([1, 2, (3, '4')], convert=False))
60b758587f599663931057e6ebdf185a...
>>> print(ub.hash_data([1, 2, (3, '4')], base='abc', hasher='sha512')[:32])
hsrgqvfiuxvvhcdnypivhhthmrolkzej
```

`ubelt.hash_file(fpath, blocksize=1048576, stride=1, maxbytes=None, hasher=NoParam, base=NoParam)`

Hashes the data in a file on disk.

The results of this function agree with the standard UNIX commands (e.g. `sha1sum`, `sha512sum`, `md5sum`, etc...)

### Parameters

- **fpath** (*PathLike*) – location of the file to be hashed.
  - **blocksize** (*int*) – Amount of data to read and hash at a time. There is a trade off and the optimal number will depend on specific hardware. This number was chosen to be optimal on a developer system. See “dev/bench\_hash\_file” for methodology to choose this number for your use case. Defaults to `2 ** 20`.
  - **stride** (*int*) – strides `> 1` skip data to hash, useful for faster hashing, but less accurate, also makes hash dependent on blocksize. Defaults to `1`.
  - **maxbytes** (*int | None*) – if specified, only hash the leading *maxbytes* of data in the file.
  - **hasher** (*str | Hasher | NoParamType*) – string code or a hash algorithm from `hashlib`. Valid hashing algorithms are defined by `hashlib.algorithms_guaranteed` (e.g. ‘sha1’, ‘sha512’, ‘md5’) as well as ‘xxh32’ and ‘xxh64’ if `xxhash` is installed. Defaults to ‘sha512’.
- TODO: add logic such that you can update an existing hasher
- **base** (*List[str] | str | NoParamType*) – list of symbols or shorthand key. Valid keys are ‘abc’, ‘hex’, and ‘dec’. Defaults to ‘hex’.

---

**Note:** For better hashes keep `stride = 1`. For faster hashes set `stride > 1`. Blocksize matters when `stride > 1`.

---

## References

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> dpath = ub.Path.appdir('ubelt/tests/test-hash').ensuredir()
>>> fpath = dpath / 'tmp1.txt'
>>> fpath.write_text('foobar')
>>> print(ub.hash_file(fpath, hasher='sha1', base='hex'))
8843d7f92416211de9ebb963ff4ce28125932878
```

### Example

```

>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt/tests/test-hash').ensuredir()
>>> fpath = dpath / 'tmp2.txt'
>>> # We have the ability to only hash at most `maxbytes` in a file
>>> fpath.write_text('abcdefghijklmnop')
>>> h0 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=11, blocksize=3)
>>> h1 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=3)
>>> h2 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=32)
>>> h3 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=1)
>>> h4 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=18)
>>> assert h1 == h2 == h3 == h4
>>> assert h1 != h0

```

```

>>> # Using a stride makes the result dependent on the blocksize
>>> h0 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=11, blocksize=3,
↳ stride=2)
>>> h1 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=3,
↳ stride=2)
>>> h2 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=32, blocksize=32,
↳ stride=2)
>>> h3 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=1,
↳ stride=2)
>>> h4 = ub.hash_file(fpath, hasher='sha1', base='hex', maxbytes=16, blocksize=18,
↳ stride=2)
>>> assert h1 != h2 != h3
>>> assert h1 == h0
>>> assert h2 == h4

```

### Example

```

>>> import ubelt as ub
>>> from os.path import join
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/test-hash')
>>> fpath = ub.touch(join(dpath, 'empty_file'))
>>> # Test that the output is the same as shasum executable
>>> if ub.find_exe('shasum'):
>>>     want = ub.cmd(['shasum', fpath], verbose=2)['out'].split(' ')[0]
>>>     got = ub.hash_file(fpath, hasher='sha1')
>>>     print('want = {!r}'.format(want))
>>>     print('got = {!r}'.format(got))
>>>     assert want.endswith(got)
>>> # Do the same for sha512 sum and md5sum
>>> if ub.find_exe('sha512sum'):
>>>     want = ub.cmd(['sha512sum', fpath], verbose=2)['out'].split(' ')[0]
>>>     got = ub.hash_file(fpath, hasher='sha512')
>>>     print('want = {!r}'.format(want))
>>>     print('got = {!r}'.format(got))
>>>     assert want.endswith(got)
>>> if ub.find_exe('md5sum'):

```

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```

>>> want = ub.cmd(['md5sum', fpath], verbose=2)['out'].split(' ')[0]
>>> got = ub.hash_file(fpath, hasher='md5')
>>> print('want = {!r}'.format(want))
>>> print('got = {!r}'.format(got))
>>> assert want.endswith(got)

```

`ubelt.highlight_code(text, lexer_name='python', **kwargs)`

Highlights a block of text using ANSI tags based on language syntax.

#### Parameters

- **text** (*str*) – plain text to highlight
- **lexer\_name** (*str*) – name of language. eg: python, docker, c++
- **\*\*kwargs** – passed to `pygments.lexers.get_lexer_by_name`

#### Returns

text - highlighted text If pygments is not installed, the plain text is returned.

#### Return type

`str`

### Example

```

>>> import ubelt as ub
>>> text = 'import ubelt as ub; print(ub)'
>>> new_text = ub.highlight_code(text)
>>> print(new_text)

```

`ubelt.hzcat(args, sep="")`

Horizontally concatenates strings preserving indentation

Concatenates a list of objects ensuring that the next item in the list is all the way to the right of any previous items.

#### Parameters

- **args** (*List[str]*) – strings to concatenate
- **sep** (*str*, *default=""*) – separator

#### Example1:

```

>>> import ubelt as ub
>>> B = ub.repr2([[1, 2], [3, 457]], nl=1, cbr=True, trailsep=False)
>>> C = ub.repr2([[5, 6], [7, 8]], nl=1, cbr=True, trailsep=False)
>>> args = ['A = ', B, ' * ', C]
>>> print(ub.hzcat(args))
A = [[1, 2],      * [[5, 6],
      [3, 457]]   [7, 8]]

```

#### Example2:

```
>>> import ubelt as ub
>>> import unicodedata
>>> aa = unicodedata.normalize('NFD', 'á') # a unicode char with len2
>>> B = ub.repr2(['', aa], [aa, aa, aa], nl=1, si=True, cbr=True,
↳ trailsep=False)
>>> C = ub.repr2([[5, 6], [7, '']], nl=1, si=True, cbr=True, trailsep=False)
>>> args = ['A', '=', B, '*', C]
>>> print(ub.hzcat(args, sep=''))
A=[[, á],    *[[5, 6],
  [á, á, á]] [7, ]]
```

**ubelt.identity**(arg=None, \*args, \*\*kwargs)

Return the value of the first argument unchanged.

All other positional and keyword inputs are ignored. Defaults to None if called without any args.

The name `identity` is used in the mathematical sense [\[WikiIdentity\]](#). This is slightly different than the pure identity function, which is defined strictly with a single argument. This implementation allows but ignores extra arguments, making it easier to use as a drop in replacement for functions that accept extra configuration arguments that change their behavior and aren't true inputs.

The value of this utility is a cleaner way to write `lambda x: x` or more precisely `lambda x=None, *a, **k: x` or writing the function inline. Unlike the lambda variant, this does not trigger common linter errors when assigning it to a value.

#### Parameters

- **arg** (Any, default=None) – The value to return unchanged.
- **\*args** – Ignored
- **\*\*kwargs** – Ignored

#### Returns

arg - The same value of the first positional argument.

#### Return type

Any

## References

### Example

```
>>> import ubelt as ub
>>> ub.identity(42)
42
>>> ub.identity(42, 43)
42
>>> ub.identity()
None
```

**ubelt.import\_module\_from\_name**(modname)

Imports a module from its string name (i.e. `__name__`)

This is a simple wrapper around `importlib.import_module()`, but is provided as a companion function to `import_module_from_path()`, which contains functionality not provided in the Python standard library.



**Parameters****modname** (*str*) – module name**Returns**

module

**Return type**

ModuleType

**SeeAlso:**`import_module_from_path()`**Example**

```

>>> # test with modules that won't be imported in normal circumstances
>>> # todo write a test where we guarantee this
>>> modname_list = [
>>>     'pickletools',
>>>     'lib2to3.fixes.fix_apply',
>>> ]
>>> #assert not any(m in sys.modules for m in modname_list)
>>> modules = [import_module_from_name(modname) for modname in modname_list]
>>> assert [m.__name__ for m in modules] == modname_list
>>> assert all(m in sys.modules for m in modname_list)

```

`ubelt.import_module_from_path(modpath, index=-1)`

Imports a module via a filesystem path.

This works by modifying `sys.path`, importing the module name, and then attempting to undo the change to `sys.path`. This function may produce unexpected results in the case where the imported module itself itself modifies `sys.path` or if there is another conflicting module with the same name.

**Parameters**

- **modpath** (*str* | *PathLike*) – Path to the module on disk or within a zipfile. Paths within a zipfile can be given by `<path-to>.zip/<path-inside-zip>.py`.
- **index** (*int*) – Location at which we modify `PYTHONPATH` if necessary. If your module name does not conflict, the safest value is `-1`, However, if there is a conflict, then use an index of `0`. The default may change to `0` in the future.

**Returns**

the imported module

**Return type**

ModuleType

## References

### Raises

- `IOError` - when the path to the module does not exist –
- `ImportError` - when the module is unable to be imported –

---

**Note:** If the module is part of a package, the package will be imported first. These modules may cause problems when reloading via IPython magic

This can import a module from within a zipfile. To do this modpath should specify the path to the zipfile and the path to the module within that zipfile separated by a colon or pathsep. E.g. “/path/to/archive.zip:mymodule.pl”

---

**Warning:** It is best to use this with paths that will not conflict with previously existing modules.

If the modpath conflicts with a previously existing module name. And the target module does imports of its own relative to this conflicting path. In this case, the module that was loaded first will win.

For example if you try to import ‘/foo/bar/pkg/mod.py’ from the folder structure:

```
- foo/  
+- bar/  
  +- pkg/  
    + __init__.py  
    | - mod.py  
    | - helper.py
```

If there exists another module named `pkg` already in `sys.modules` and `mod.py` does something like `from . import helper`, Python will assume `helper` belongs to the `pkg` module already in `sys.modules`. This can cause a `NameError` or worse — a incorrect helper module.

### SeeAlso:

`import_module_from_name()`

### Example

```
>>> import xdoctest
>>> modpath = xdoctest.__file__
>>> module = import_module_from_path(modpath)
>>> assert module is xdoctest
```

### Example

```
>>> # Test importing a module from within a zipfile
>>> import zipfile
>>> from xdoctest import utils
>>> from os.path import join, expanduser, normpath
>>> dpath = expanduser('~/.cache/xdoctest')
>>> dpath = utils.ensuredir(dpath)
>>> #dpath = utils.TempDir().ensure()
>>> # Write to an external module named bar
>>> external_modpath = join(dpath, 'bar.py')
>>> # For pypy support we have to write this using with
>>> with open(external_modpath, 'w') as file:
>>>     file.write('testvar = 1')
>>> internal = 'folder/bar.py'
>>> # Move the external bar module into a zipfile
>>> zippath = join(dpath, 'myzip.zip')
>>> with zipfile.ZipFile(zippath, 'w') as myzip:
>>>     myzip.write(external_modpath, internal)
>>> # Import the bar module from within the zipfile
>>> modpath = zippath + ':' + internal
>>> modpath = zippath + os.path.sep + internal
>>> module = import_module_from_path(modpath)
>>> assert normpath(module.__name__) == normpath('folder/bar')
>>> assert module.testvar == 1
```

### Example

```
>>> import pytest
>>> with pytest.raises(IOError):
>>>     import_module_from_path('does-not-exist')
>>> with pytest.raises(IOError):
>>>     import_module_from_path('does-not-exist.zip/')
```

`ubelt.indent(text, prefix='')`

Indents a block of text

#### Parameters

- **text** (*str*) – text to indent
- **prefix** (*str*, *default* = ' ') – prefix to add to each line

#### Returns

indented text

### Return type

str

### Example

```
>>> import ubelt as ub
>>> NL = chr(10) # newline character
>>> text = 'Lorem ipsum' + NL + 'dolor sit amet'
>>> prefix = ' '
>>> result = ub.indent(text, prefix)
>>> assert all(t.startswith(prefix) for t in result.split(NL))
```

`ubelt.indexable_allclose(dct1, dct2, rel_tol=1e-09, abs_tol=0.0, return_info=False)`

Walks through two nested data structures and ensures that everything is roughly the same.

### Parameters

- **dct1** (*dict*) – a nested indexable item
- **dct2** (*dict*) – a nested indexable item
- **rel\_tol** (*float*) – maximum difference for being considered “close”, relative to the magnitude of the input values
- **abs\_tol** (*float*) – maximum difference for being considered “close”, regardless of the magnitude of the input values
- **return\_info** (*bool, default=False*) – if true, return extra info

### Returns

A boolean result if `return_info` is false, otherwise a tuple of the boolean result and an “info” dict containing detailed results indicating what matched and what did not.

### Return type

bool | Tuple[bool, Dict]

### Example

```
>>> import ubelt as ub
>>> dct1 = {
>>>     'foo': [1.222222, 1.333],
>>>     'bar': 1,
>>>     'baz': [],
>>> }
>>> dct2 = {
>>>     'foo': [1.22222, 1.333],
>>>     'bar': 1,
>>>     'baz': [],
>>> }
>>> flag, return_info = ub.indexable_allclose(dct1, dct2, return_info=True)
>>> print('return_info = {}'.format(ub.repr2(return_info, nl=1)))
>>> print('flag = {!r}'.format(flag))
```

```
>>> walker1 = return_info['walker1']
>>> for p1, v1, v2 in return_info['faillist']:
>>>     v1_ = walker1[p1]
>>>     print('*fail p1, v1, v2 = {}, {}, {}'.format(p1, v1, v2))
>>> for p1 in return_info['passlist']:
>>>     v1_ = walker1[p1]
>>>     print('*pass p1, v1_ = {}, {}'.format(p1, v1_))
>>> assert not flag
```

```
>>> import ubelt as ub
>>> dct1 = {
>>>     'foo': [1.00000000000000000000000000000001, 1.],
>>>     'bar': 1,
>>>     'baz': [],
>>> }
>>> dct2 = {
>>>     'foo': [0.9999999999999999, 1.],
>>>     'bar': 1,
>>>     'baz': [],
>>> }
>>> flag, return_info = ub.indexable_allclose(dct1, dct2, return_info=True)
>>> print('return_info = {}'.format(ub.repr2(return_info, nl=1)))
>>> print('flag = {!r}'.format(flag))
```

### Example

```
>>> import ubelt as ub
>>> flag, return_info = ub.indexable_allclose([], [], return_info=True)
>>> print('return_info = {!r}'.format(return_info))
>>> print('flag = {!r}'.format(flag))
```

### Example

```
>>> import ubelt as ub
>>> flag = ub.indexable_allclose([], [], return_info=False)
>>> print('flag = {!r}'.format(flag))
```

### Example

```
>>> import ubelt as ub
>>> flag, return_info = ub.indexable_allclose([], [1], return_info=True)
>>> print('return_info = {!r}'.format(return_info))
>>> print('flag = {!r}'.format(flag))
```

```
ubelt.inject_method(self, func, name=None)
```

Injects a function into an object instance as a bound method

The main use case of this function is for monkey patching. While monkey patching is sometimes necessary it should generally be avoided. Thus, we simply remind the developer that there might be a better way.

### Parameters

- **self** (*T*) – Instance to inject a function into.
- **func** (*Callable[... Any]*) – The function to inject (must contain an arg for self).
- **name** (*str, default=None*) – Name of the method. optional. If not specified the name of the function is used.

### Example

```
>>> import ubelt as ub
>>> class Foo(object):
>>>     def bar(self):
>>>         return 'bar'
>>>     def baz(self):
>>>         return 'baz'
>>> self = Foo()
>>> assert self.bar() == 'bar'
>>> assert not hasattr(self, 'baz')
>>> ub.inject_method(self, baz)
>>> assert not hasattr(Foo, 'baz'), 'should only change one instance'
>>> assert self.baz() == 'baz'
>>> ub.inject_method(self, baz, 'bar')
>>> assert self.bar() == 'baz'
```

`ubelt.invert_dict(dict_, unique_vals=True, cls=None)`

Swaps the keys and values in a dictionary.

### Parameters

- **dict\_** (*Dict[KT, VT]*) – dictionary to invert
- **unique\_vals** (*bool, default=True*) – if False, the values of the new dictionary are sets of the original keys.
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

### Returns

the inverted dictionary

### Return type

`Dict[VT, KT] | Dict[VT, Set[KT]]`

---

**Note:** The must values be hashable.

If the original dictionary contains duplicate values, then only one of the corresponding keys will be returned and the others will be discarded. This can be prevented by setting `unique_vals=False`, causing the inverted keys to be returned in a set.

---

### Example

```
>>> import ubelt as ub
>>> dict_ = {'a': 1, 'b': 2}
>>> inverted = ub.invert_dict(dict_)
>>> assert inverted == {1: 'a', 2: 'b'}
```

### Example

```
>>> import ubelt as ub
>>> dict_ = ub.odict([(2, 'a'), (1, 'b'), (0, 'c'), (None, 'd')])
>>> inverted = ub.invert_dict(dict_)
>>> assert list(inverted.keys())[0] == 'a'
```

### Example

```
>>> import ubelt as ub
>>> dict_ = {'a': 1, 'b': 0, 'c': 0, 'd': 0, 'f': 2}
>>> inverted = ub.invert_dict(dict_, unique_vals=False)
>>> assert inverted == {0: {'b', 'c', 'd'}, 1: {'a'}, 2: {'f'}}
```

`ubelt.iter_window(iterable, size=2, step=1, wrap=False)`

Iterates through iterable with a window size. This is essentially a 1D sliding window.

#### Parameters

- **iterable** (*Iterable[T]*) – an iterable sequence
- **size** (*int, default=2*) – sliding window size
- **step** (*int, default=1*) – sliding step size
- **wrap** (*bool, default=False*) – wraparound flag

#### Returns

returns a possibly overlapping windows in a sequence

#### Return type

`Iterable[T]`

### Notes

Similar to `more_itertools.windowed()`, Similar to `more_itertools.pairwise()`, Similar to `more_itertools.triplewise()`, Similar to `more_itertools.sliding_window()`

### Example

```
>>> import ubelt as ub
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 1, True
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = %r' % (window_list,))
window_list = [(1, 2, 3), (2, 3, 4), (3, 4, 5), (4, 5, 6), (5, 6, 1), (6, 1, 2)]
```

### Example

```
>>> import ubelt as ub
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 2, True
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = {!r}'.format(window_list))
window_list = [(1, 2, 3), (3, 4, 5), (5, 6, 1)]
```

### Example

```
>>> import ubelt as ub
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 2, False
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = {!r}'.format(window_list))
window_list = [(1, 2, 3), (3, 4, 5)]
```

### Example

```
>>> import ubelt as ub
>>> iterable = []
>>> size, step, wrap = 3, 2, False
>>> window_iter = ub.iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = {!r}'.format(window_list))
window_list = []
```

`ubelt.iterable(obj, strok=False)`

Checks if the input implements the iterator interface. An exception is made for strings, which return False unless `strok` is True

#### Parameters

- **obj** (*object*) – a scalar or iterable input
- **strok** (*bool, default=False*) – if True allow strings to be interpreted as iterable



**Returns**

True if the input is iterable

**Return type**

bool

**Example**

```
>>> import ubelt as ub
>>> obj_list = [3, [3], '3', (3,), [3, 4, 5], {}]
>>> result = [ub.iterable(obj) for obj in obj_list]
>>> assert result == [False, True, False, True, True, True]
>>> result = [ub.iterable(obj, strok=True) for obj in obj_list]
>>> assert result == [False, True, True, True, True, True]
```

`ubelt.map_keys(func, dict_, cls=None)`

Apply a function to every key in a dictionary.

Creates a new dictionary with the same values and modified keys. An error is raised if the new keys are not unique.

**Parameters**

- **func** (*Callable[[KT], T] | Mapping[KT, T]*) – a function or indexable object
- **dict\_** (*Dict[KT, VT]*) – a dictionary
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

**Returns**

transformed dictionary

**Return type**

Dict[T, VT]

**Raises**

**Exception** – if multiple keys map to the same value

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> func = ord
>>> newdict = ub.map_keys(func, dict_)
>>> print(newdict)
>>> assert newdict == {97: [1, 2, 3], 98: []}
>>> dict_ = {0: [1, 2, 3], 1: []}
>>> func = ['a', 'b']
>>> newdict = ub.map_keys(func, dict_)
>>> print(newdict)
>>> assert newdict == {'a': [1, 2, 3], 'b': []}
```

`ubelt.map_vals(func, dict_, cls=None)`

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

#### Parameters

- **func** (*Callable[[VT], T] | Mapping[VT, T]*) – a function or indexable object
- **dict\_** (*Dict[KT, VT]*) – a dictionary
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

#### Returns

transformed dictionary

#### Return type

Dict[KT, T]

#### Notes

Similar to `:module:`dictmap.dict_map``

#### Example

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> newdict = ub.map_values(len, dict_)
>>> assert newdict == {'a': 3, 'b': 0}
```

#### Example

```
>>> # Can also use an indexable as ``func``
>>> import ubelt as ub
>>> dict_ = {'a': 0, 'b': 1}
>>> func = [42, 21]
>>> newdict = ub.map_values(func, dict_)
>>> assert newdict == {'a': 42, 'b': 21}
>>> print(newdict)
```

`ubelt.map_values(func, dict_, cls=None)`

Apply a function to every value in a dictionary.

Creates a new dictionary with the same keys and modified values.

#### Parameters

- **func** (*Callable[[VT], T] | Mapping[VT, T]*) – a function or indexable object
- **dict\_** (*Dict[KT, VT]*) – a dictionary
- **cls** (*type | None*) – specifies the dict subclass of the result. if unspecified will be dict or OrderedDict. This behavior may change.

#### Returns

transformed dictionary

#### Return type

Dict[KT, T]

## Notes

Similar to `:module:`dictmap.dict_map``

## Example

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> newdict = ub.map_values(len, dict_)
>>> assert newdict == {'a': 3, 'b': 0}
```

## Example

```
>>> # Can also use an indexable as ``func``
>>> import ubelt as ub
>>> dict_ = {'a': 0, 'b': 1}
>>> func = [42, 21]
>>> newdict = ub.map_values(func, dict_)
>>> assert newdict == {'a': 42, 'b': 21}
>>> print(newdict)
```

`ubelt.memoize(func)`

memoization decorator that respects args and kwargs

In Python 3.9. The `functools` introduces the `cache` method, which is currently faster than `memoize` for simple functions [[FunctoolsCache](#)]. However, `memoize` can handle more general non-natively hashable inputs.

### Parameters

**func** (*Callable*) – live python function

### Returns

memoized wrapper

### Return type

Callable

## References

## Example

```
>>> import ubelt as ub
>>> closure = {'a': 'b', 'c': 'd'}
>>> incr = [0]
>>> def foo(key):
>>>     value = closure[key]
>>>     incr[0] += 1
>>>     return value
>>> foo_memo = ub.memoize(foo)
>>> assert foo('a') == 'b' and foo('c') == 'd'
>>> assert incr[0] == 2
>>> print('Call memoized version')
```

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```
>>> assert foo_memo('a') == 'b' and foo_memo('c') == 'd'
>>> assert incr[0] == 4
>>> assert foo_memo('a') == 'b' and foo_memo('c') == 'd'
>>> print('Counter should no longer increase')
>>> assert incr[0] == 4
>>> print('Closure changes result without memoization')
>>> closure = {'a': 0, 'c': 1}
>>> assert foo('a') == 0 and foo('c') == 1
>>> assert incr[0] == 6
>>> assert foo_memo('a') == 'b' and foo_memo('c') == 'd'
```

**class** `ubelt.memoize_method(func)`

Bases: `object`

memoization decorator for a method that respects args and kwargs

## References

## Example

```
>>> import ubelt as ub
>>> closure = {'a': 'b', 'c': 'd'}
>>> incr = [0]
>>> class Foo(object):
>>>     @ub.memoize_method
>>>     def foo_memo(self, key):
>>>         "Wrapped foo_memo docstr"
>>>         value = closure[key]
>>>         incr[0] += 1
>>>         return value
>>>     def foo(self, key):
>>>         value = closure[key]
>>>         incr[0] += 1
>>>         return value
>>> self = Foo()
>>> assert self.foo('a') == 'b' and self.foo('c') == 'd'
>>> assert incr[0] == 2
>>> print('Call memoized version')
>>> assert self.foo_memo('a') == 'b' and self.foo_memo('c') == 'd'
>>> assert incr[0] == 4
>>> assert self.foo_memo('a') == 'b' and self.foo_memo('c') == 'd'
>>> print('Counter should no longer increase')
>>> assert incr[0] == 4
>>> print('Closure changes result without memoization')
>>> closure = {'a': 0, 'c': 1}
>>> assert self.foo('a') == 0 and self.foo('c') == 1
>>> assert incr[0] == 6
>>> assert self.foo_memo('a') == 'b' and self.foo_memo('c') == 'd'
>>> print('Constructing a new object should get a new cache')
>>> self2 = Foo()
>>> self2.foo_memo('a')
```

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```

>>> assert incr[0] == 7
>>> self2.foo_memo('a')
>>> assert incr[0] == 7
>>> assert self.foo_memo.__doc__ == 'Wrapped foo_memo docstr'
>>> assert self.foo_memo.__name__ == 'foo_memo'

```

`ubelt.memoize_property(fget)`

Return a property attribute for new-style classes that only calls its getter on the first access. The result is stored and on subsequent accesses is returned, preventing the need to call the getter any more.

This decorator can either be used by itself or by decorating another property. In either case the method will always become a property.

---

**Note:** implementation is a modified version of [estebistec\_memoize].

---

## References

### Example

```

>>> import ubelt as ub
>>> class C(object):
...     load_name_count = 0
...     @ub.memoize_property
...     def name(self):
...         "name's docstring"
...         self.load_name_count += 1
...         return "the name"
...     @ub.memoize_property
...     @property
...     def another_name(self):
...         "name's docstring"
...         self.load_name_count += 1
...         return "the name"
>>> c = C()
>>> c.load_name_count
0
>>> c.name
'the name'
>>> c.load_name_count
1
>>> c.name
'the name'
>>> c.load_name_count
1
>>> c.another_name

```

`ubelt.modname_to_modpath(modname, hide_init=True, hide_main=False, sys_path=None)`

Finds the path to a python module from its name.

Determines the path to a python module without directly import it

Converts the name of a module (`__name__`) to the path (`__file__`) where it is located without importing the module. Returns `None` if the module does not exist.

#### Parameters

- **modname** (*str*) – The name of a module in `sys.path`.
- **hide\_init** (*bool*) – if `False`, `__init__.py` will be returned for packages. Defaults to `True`.
- **hide\_main** (*bool*) – if `False`, and `hide_init` is `True`, `__main__.py` will be returned for packages, if it exists. Defaults to `False`.
- **sys\_path** (*None | List[str] | PathLike*) – The paths to search for the module. If unspecified, defaults to `sys.path`.

#### Returns

modpath - path to the module, or `None` if it doesn't exist

#### Return type

`str` | `None`

### Example

```
>>> modname = 'xdoctest.__main__'
>>> modpath = modname_to_modpath(modname, hide_main=False)
>>> assert modpath.endswith('__main__.py')
>>> modname = 'xdoctest'
>>> modpath = modname_to_modpath(modname, hide_init=False)
>>> assert modpath.endswith('__init__.py')
>>> # xdoctest: +REQUIRES(CPython)
>>> modpath = basename(modname_to_modpath('_ctypes'))
>>> assert 'ctypes' in modpath
```

`ubelt.modpath_to_modname(modpath, hide_init=True, hide_main=False, check=True, relativeto=None)`

Determines importable name from file path

Converts the path to a module (`__file__`) to the importable python name (`__name__`) without importing the module.

The filename is converted to a module name, and parent directories are recursively included until a directory without an `__init__.py` file is encountered.

#### Parameters

- **modpath** (*str*) – module filepath
- **hide\_init** (*bool, default=True*) – removes the `__init__` suffix
- **hide\_main** (*bool, default=False*) – removes the `__main__` suffix
- **check** (*bool, default=True*) – if `False`, does not raise an error if `modpath` is a dir and does not contain an `__init__` file.
- **relativeto** (*str, default=None*) – if specified, all checks are ignored and this is considered the path to the root module.

---

#### Todo:

- [ ] Does this need modification to support PEP 420?  
<https://www.python.org/dev/peps/pep-0420/>

**Returns**

modname

**Return type**

str

**Raises****ValueError** – if check is True and the path does not exist**Example**

```
>>> from xdoctest import static_analysis
>>> modpath = static_analysis.__file__.replace('.pyc', '.py')
>>> modpath = modpath.replace('.pyc', '.py')
>>> modname = modpath_to_modname(modpath)
>>> assert modname == 'xdoctest.static_analysis'
```

**Example**

```
>>> import xdoctest
>>> assert modpath_to_modname(xdoctest.__file__.replace('.pyc', '.py')) == 'xdoctest
↳ '
>>> assert modpath_to_modname(dirname(xdoctest.__file__.replace('.pyc', '.py'))) ==
↳ 'xdoctest'
```

**Example**

```
>>> # xdoctest: +REQUIRES(CPython)
>>> modpath = modname_to_modpath('_ctypes')
>>> modname = modpath_to_modname(modpath)
>>> assert modname == '_ctypes'
```

**Example**

```
>>> modpath = '/foo/libfoobar.linux-x86_64-3.6.so'
>>> modname = modpath_to_modname(modpath, check=False)
>>> assert modname == 'libfoobar'
```

`ubelt.named_product(_=None, **basis)`

Generates the Cartesian product of the `basis.values()`, where each generated item labeled by `basis.keys()`.

In other words, given a dictionary that maps each “axes” (i.e. some variable) to its “basis” (i.e. the possible values that it can take), generate all possible points in that grid (i.e. unique assignments of variables to values).

**Parameters**

- `_ (Dict[str, List[VT]] | None, default=None)` – Use of this positional argument is not recommend. Instead specify all arguments as keyword args.

If specified, this should be a dictionary is unioned with the keyword args. This exists to support ordered dictionaries before Python 3.6, and may eventually be removed.

- **basis** (*Dict[str, List[VT]]*) – A dictionary where the keys correspond to “columns” and the values are a list of possible values that “column” can take.

I.E. each key corresponds to an “axes”, the values are the list of possible values for that “axes”.

#### Yields

*Dict[str, VT]* – a “row” in the “longform” data containing a point in the Cartesian product.

---

**Note:** This function is similar to `itertools.product()`, the only difference is that the generated items are a dictionary that retains the input keys instead of an tuple.

This function used to be called “basis\_product”, but “named\_product” might be more appropriate. This function exists in other places ([`minstrel271_namedproduct`], [`pytb_namedproduct`], and [`Hettinger_namedproduct`]).

---

## References

### Example

```
>>> # An example use case is looping over all possible settings in a
>>> # configuration dictionary for a grid search over parameters.
>>> import ubelt as ub
>>> basis = {
>>>     'arg1': [1, 2, 3],
>>>     'arg2': ['A1', 'B1'],
>>>     'arg3': [9999, 'Z2'],
>>>     'arg4': ['always'],
>>> }
>>> import ubelt as ub
>>> # sort input data for older python versions
>>> basis = ub.odict(sorted(basis.items()))
>>> got = list(ub.named_product(basis))
>>> print(ub.repr2(got, nl=-1))
[
    {'arg1': 1, 'arg2': 'A1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 1, 'arg2': 'A1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 1, 'arg2': 'B1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 1, 'arg2': 'B1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'A1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'A1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'B1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 2, 'arg2': 'B1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'A1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'A1', 'arg3': 'Z2', 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'B1', 'arg3': 9999, 'arg4': 'always'},
    {'arg1': 3, 'arg2': 'B1', 'arg3': 'Z2', 'arg4': 'always'}
]
```



### Example

```
>>> import ubelt as ub
>>> list(ub.named_product(a=[1, 2, 3]))
[{'a': 1}, {'a': 2}, {'a': 3}]
>>> # xdoctest: +IGNORE_WANT
>>> list(ub.named_product(a=[1, 2, 3], b=[4, 5]))
[{'a': 1, 'b': 4},
 {'a': 1, 'b': 5},
 {'a': 2, 'b': 4},
 {'a': 2, 'b': 5},
 {'a': 3, 'b': 4},
 {'a': 3, 'b': 5}]
```

**ubelt.odict**

alias of `OrderedDict`

**ubelt.oset**

alias of `OrderedSet`

**ubelt.paragraph**(text)

Wraps multi-line strings and restructures the text to remove all newlines, heading, trailing, and double spaces.

Useful for writing log messages

**Parameters**

**text** (*str*) – typically a multiline string

**Returns**

the reduced text block

**Return type**

`str`

### Example

```
>>> import ubelt as ub
>>> text = (
>>>     """
>>>     Lorem ipsum dolor sit amet, consectetur adipiscing
>>>     elit, sed do eiusmod tempor incididunt ut labore et
>>>     dolore magna aliqua.
>>>     """)
>>> out = ub.paragraph(text)
>>> assert chr(10) in text
>>> assert chr(10) not in out
>>> print('text = {!r}'.format(text))
>>> print('out = {!r}'.format(out))
```

**ubelt.peek**(iterable, default=NoParam)

Look at the first item of an iterable. If the input is an iterator, then the next element is exhausted (i.e. a pop operation).

**Parameters**

- **iterable** (*Iterable[T]*) – an iterable

- **default** (*T*) – default item to return if the iterable is empty, otherwise a `StopIteration` error is raised

#### Returns

**item** - the first item of ordered sequence, a popped item from an iterator, or an arbitrary item from an unordered collection.

#### Return type

*T*

#### Notes

Similar to `more_itertools.peekable()`

#### Example

```
>>> import ubelt as ub
>>> data = [0, 1, 2]
>>> ub.peek(data)
0
>>> iterator = iter(data)
>>> print(ub.peek(iterator))
0
>>> print(ub.peek(iterator))
1
>>> print(ub.peek(iterator))
2
>>> ub.peek(range(3))
0
>>> ub.peek([], 3)
3
```

#### `ubelt.platform_cache_dir()`

Returns a directory which should be writable for any application This should be used for temporary deletable data.

#### Returns

path to the cache dir used by the current operating system

#### Return type

`str`

#### `ubelt.platform_config_dir()`

Returns a directory which should be writable for any application This should be used for persistent configuration files.

#### Returns

path to the cache dir used by the current operating system

#### Return type

`str`

#### `ubelt.platform_data_dir()`

Returns path for user-specific data files

**Returns**

path to the data dir used by the current operating system

**Return type**

`str`

`ubelt.readfrom(fpath, aslines=False, errors='replace', verbose=None)`

Reads (utf8) text from a file.

---

**Note:** You probably should use `ub.Path(<fpath>).read_text()` instead. This function exists as a convenience for writing in Python2. After 2020-01-01, we may consider deprecating the function.

---

**Parameters**

- **fpath** (*str* | *PathLike*) – file path
- **aslines** (*bool*) – if True returns list of lines
- **verbose** (*bool*) – verbosity flag

**Returns**

text from fpath (this is unicode)

**Return type**

`str`

`ubelt.repr2(data, **kwargs)`

Makes a pretty string representation of `data`.

Makes a pretty and easy-to-doctest string representation. Has nice handling of common nested datatypes. This is an alternative to `repr`, and `pprint.pformat()`.

This output of this function are configurable. By default it aims to produce strings that are consistent, compact, and executable. This makes them great for doctests.

---

**Note:** This function has many keyword arguments that can be used to customize the final representation. For convenience some of the more frequently used kwargs have short aliases. See “Kwargs” for more details.

---

**Parameters**

**data** (*object*) – an arbitrary python object to form the string “representation” of

**Kwargs:****si, stritems, (bool):**

dict/list items use str instead of repr

**strkeys, sk (bool):**

dict keys use str instead of repr

**strvals, sv (bool):**

dict values use str instead of repr

**nl, newlines (int | bool):**

number of top level nestings to place a newline after. If true all items are followed by newlines regardless of nesting level. Defaults to 1 for lists and True for dicts.

**nobr, nobraces (bool, default=False):**

if True, text will not contain outer braces for containers

**cbr, compact\_brace (bool, default=False):**

if True, braces are compactified (i.e. they will not have newlines placed directly after them, think java / K&R / 1TBS)

**trailsep, trailing\_sep (bool):**

if True, a separator is placed after the last item in a sequence. By default this is True if there are any `nl > 0`.

**explicit (bool, default=False):**

changes dict representation from `{k1: v1, ...}` to `dict(k1=v1, ...)`.

**Modifies:**

default `kvsep` is modified to `'='` dict braces from `{}` to `dict()`.

**compact (bool, default=False):**

Produces values more suitable for space constrained environments

**Modifies:**

default `kvsep` is modified to `'='` default `itemsep` is modified to `' '` default `nobraces` is modified to 1. default `newlines` is modified to 0. default `strkeys` to True default `strvals` to True

**precision (int, default=None):**

if specified floats are formatted with this precision

**kvsep (str, default=': '):**

separator between keys and values

**itemsep (str, default=' '):**

separator between items. This separator is placed after commas, which are currently not configurable. This may be modified in the future.

**sort (bool | callable, default=None):**

if None, then sort unordered collections, but keep the ordering of ordered collections. This option attempts to be deterministic in most cases.

New in 0.8.0: if `sort` is callable, it will be used as a key-function to sort all collections.

if False, then nothing will be sorted, and the representation of unordered collections will be arbitrary and possibly non-deterministic.

if True, attempts to sort all collections in the returned text. Currently if True this WILL sort lists. Currently if True this WILL NOT sort OrderedDicts.

**NOTE:**

The previous behavior may not be intuitive, as such the behavior of this arg is subject to change.

**suppress\_small (bool):**

passed to `numpy.array2string()` for ndarrays

**max\_line\_width (int):**

passed to `numpy.array2string()` for ndarrays

**with\_dtype (bool):**

only relevant to `numpy.ndarrays`. if True includes the dtype. Defaults to *not strvals*.

**align (bool | str, default=False):**

if True, will align multi-line dictionaries by the `kvsep`

**extensions (FormatterExtensions):**

a custom *FormatterExtensions* instance that can overwrite or define how different types of objects are formatted.

**Returns**

outstr - output string

**Return type**

str

---

**Note:** There are also internal kwargs, which should not be used:

`_return_info` (bool): return information about child context

`_root_info` (depth): information about parent context

---

**RelatedWork:**

`rich.pretty.pretty_repr()` `pprint.pformat()`

**Example**

```
>>> import ubelt as ub
>>> dict_ = {
...     'custom_types': [slice(0, 1, None), 1/3],
...     'nest_dict': {'k1': [1, 2, {3: {4, 5}}],
...                   'key2': [1, 2, {3: {4, 5}}],
...                   'key3': [1, 2, {3: {4, 5}}],
...                   },
...     'nest_dict2': {'k': [1, 2, {3: {4, 5}}]},
...     'nested_tuples': [tuple([1]), tuple([2, 3]), frozenset([4, 5, 6])],
...     'one_tup': tuple([1]),
...     'simple_dict': {'spam': 'eggs', 'ham': 'jam'},
...     'simple_list': [1, 2, 'red', 'blue'],
...     'odict': ub.odict([(1, '1'), (2, '2')]),
... }
>>> # In the interest of saving space we are only going to show the
>>> # output for the first example.
>>> result = ub.repr2(dict_, nl=1, precision=2)
>>> print(result)
{
  'custom_types': [slice(0, 1, None), 0.33],
  'nest_dict': {'k1': [1, 2, {3: {4, 5}}], 'key2': [1, 2, {3: {4, 5}}], 'key3': ↪
[1, 2, {3: {4, 5}}]},
  'nest_dict2': {'k': [1, 2, {3: {4, 5}}]},
  'nested_tuples': [(1,), (2, 3), {4, 5, 6}],
  'odict': {1: '1', 2: '2'},
  'one_tup': (1,),
  'simple_dict': {'ham': 'jam', 'spam': 'eggs'},
  'simple_list': [1, 2, 'red', 'blue'],
}
>>> # You can try the rest yourself.
>>> result = ub.repr2(dict_, nl=3, precision=2); print(result)
```

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```
>>> result = ub.repr2(dict_, nl=2, precision=2); print(result)
>>> result = ub.repr2(dict_, nl=1, precision=2, itemsep=',', explicit=True);
↳ print(result)
>>> result = ub.repr2(dict_, nl=1, precision=2, nobr=1, itemsep=',', explicit=True);
↳ print(result)
>>> result = ub.repr2(dict_, nl=3, precision=2, cbr=True); print(result)
>>> result = ub.repr2(dict_, nl=3, precision=2, si=True); print(result)
>>> result = ub.repr2(dict_, nl=3, sort=True); print(result)
>>> result = ub.repr2(dict_, nl=3, sort=False, trailing_sep=False); print(result)
>>> result = ub.repr2(dict_, nl=3, sort=False, trailing_sep=False, nobr=True);
↳ print(result)
```

### Example

```
>>> import ubelt as ub
>>> def _nest(d, w):
...     if d == 0:
...         return {}
...     else:
...         return {'n{0}'.format(d): _nest(d - 1, w + 1), 'm{0}'.format(d): _nest(d -
↳ 1, w + 1)}
>>> dict_ = _nest(d=4, w=1)
>>> result = ub.repr2(dict_, nl=6, precision=2, cbr=1)
>>> print('---')
>>> print(result)
>>> result = ub.repr2(dict_, nl=-1, precision=2)
>>> print('---')
>>> print(result)
```

### Example

```
>>> import ubelt as ub
>>> data = {'a': 100, 'b': [1, '2', 3], 'c': {20:30, 40: 'five'}}
>>> print(ub.repr2(data, nl=1))
{
    'a': 100,
    'b': [1, '2', 3],
    'c': {20: 30, 40: 'five'},
}
>>> # Compact is useful for things like timerit.Timerit labels
>>> print(ub.repr2(data, compact=True))
a=100,b=[1,2,3],c={20=30,40=five}
>>> print(ub.repr2(data, compact=True, nobr=False))
{a=100,b=[1,2,3],c={20=30,40=five}}
```

`ubelt.schedule_deprecation(modname, name='?', type='?', migration='', deprecate=None, error=None, remove=None, warncls=<class 'DeprecationWarning'>)`

Deprecation machinery to help provide users with a smoother transition.

This function provides a concise way to mark a feature as deprecated by providing a description of the deprecated feature, documentation on how to migrate away from the deprecated feature, and the versions that the feature is scheduled for deprecation and eventual removal. Based on the version of the library and the specified schedule this function will either do nothing, emit a warning, or raise an error with helpful messages for both users and developers.

### Parameters

- **modname** (*str*) – The name of the underlying module associated with the feature to be deprecated. The module must already be imported and have a passable `__version__` attribute.
- **name** (*str*) – The name of the feature to deprecate. This is usually a function or argument name.
- **type** (*str*) – A description of what the feature is. This is not a formal type, but rather a prose description: e.g. “argument to my\_func”.
- **migration** (*str*) – A description that lets users know what they should do instead of using the deprecated feature.
- **deprecate** (*str* | *None*) – The version when the feature is officially deprecated and this function should start to emit a deprecation warning.
- **error** (*str* | *None*) – The version when the feature is officially no longer supported, and will start to raise a `RuntimeError`.
- **remove** (*str* | *None*) – The version when the feature is completely removed. An `AssertionError` will be raised if this function is still present reminding the developer to remove the feature (or extend the remove version).
- **warncls** (*type*) – This is the category of warning to use. Defaults to `DeprecationWarning`.

---

**Note:** The `DeprecationWarning` is not visible by default. <https://docs.python.org/3/library/warnings.html>

---

### Example

```
>>> from ubelt import schedule_deprecation
>>> import sys
>>> import types
>>> import pytest
>>> dummy_module = sys.modules['dummy_module'] = types.ModuleType('dummy_module')
>>> # When less than the deprecated version this does nothing
>>> dummy_module.__version__ = '1.0.0'
>>> schedule_deprecation(
...     'dummy_module', 'myfunc', 'function', 'do something else',
...     deprecate='1.1.0', error='1.2.0', remove='1.3.0')
>>> # Now this raises warning
>>> with pytest.warns(DeprecationWarning):
...     dummy_module.__version__ = '1.1.0'
...     schedule_deprecation(
...         'dummy_module', 'myfunc', 'function', 'do something else',
...         deprecate='1.1.0', error='1.2.0', remove='1.3.0')
>>> # Now this raises an error for the user
>>> with pytest.raises(RuntimeError):
...     dummy_module.__version__ = '1.2.0'
```

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```
...     schedule_deprecation(
...         'dummy_module', 'myfunc', 'function', 'do something else',
...         deprecate='1.1.0', error='1.2.0', remove='1.3.0')
>>> # Now this raises an error for the developer
>>> with pytest.raises(AssertionError):
...     dummy_module.__version__ = '1.3.0'
...     schedule_deprecation(
...         'dummy_module', 'myfunc', 'function', 'do something else',
...         deprecate='1.1.0', error='1.2.0', remove='1.3.0')
>>> # When no versions are specified, it simply emits the warning
>>> with pytest.warns(DeprecationWarning):
...     dummy_module.__version__ = '1.1.0'
...     schedule_deprecation(
...         'dummy_module', 'myfunc', 'function', 'do something else')
```

**ubelt.sdict**

alias of *SetDict*

**ubelt.shrinkuser**(path, home='~')

Inverse of `os.path.expanduser()`.

#### Parameters

- **path** (*str* | *PathLike*) – path in system file structure
- **home** (*str*) – symbol used to replace the home path. Defaults to '~', but you might want to use '\$HOME' or '%USERPROFILE%' instead.

#### Returns

path - shortened path replacing the home directory with a symbol

#### Return type

*str*

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> path = expanduser('~')
>>> assert path != '~'
>>> assert shrinkuser(path) == '~'
>>> assert shrinkuser(path + '1') == path + '1'
>>> assert shrinkuser(path + '/1') == join('~', '1')
>>> assert shrinkuser(path + '/1', '$HOME') == join('$HOME', '1')
>>> assert shrinkuser('.') == '.'
```

**ubelt.sorted\_keys**(dict\_, key=None, reverse=False, cls=<class 'collections.OrderedDict'>)

Return an ordered dictionary sorted by its keys

#### Parameters

- **dict\_** (*Dict[KT, VT]*) – dictionary to sort. The keys must be of comparable types.
- **key** (*Callable[[KT], Any]* | *None*) – If given as a callable, customizes the sorting by ordering using transformed keys.
- **reverse** (*bool*, *default=False*) – if True returns in descending order



- **cls** (*type*) – specifies the dict return type

**Returns**

new dictionary where the keys are ordered

**Return type**

OrderedDict[KT, VT]

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}
>>> newdict = sorted_keys(dict_)
>>> print(ub.repr2(newdict, nl=0))
{'eggs': 1.2, 'jam': 2.92, 'spam': 2.62}
>>> newdict = sorted_keys(dict_, reverse=True)
>>> print(ub.repr2(newdict, nl=0))
{'spam': 2.62, 'jam': 2.92, 'eggs': 1.2}
>>> newdict = sorted_keys(dict_, key=lambda x: sum(map(ord, x)))
>>> print(ub.repr2(newdict, nl=0))
{'jam': 2.92, 'eggs': 1.2, 'spam': 2.62}
```

`ubelt.sorted_vals(dict_, key=None, reverse=False, cls=<class 'collections.OrderedDict'>)`

Return an ordered dictionary sorted by its values

**Parameters**

- **dict\_** (*Dict[KT, VT]*) – dictionary to sort. The values must be of comparable types.
- **key** (*Callable[[VT], Any] | None*) – If given as a callable, customizes the sorting by ordering using transformed values.
- **reverse** (*bool, default=False*) – if True returns in descending order
- **cls** (*type*) – specifies the dict return type

**Returns**

new dictionary where the values are ordered

**Return type**

OrderedDict[KT, VT]

**Example**

```
>>> import ubelt as ub
>>> dict_ = {'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}
>>> newdict = sorted_values(dict_)
>>> print(ub.repr2(newdict, nl=0))
{'eggs': 1.2, 'spam': 2.62, 'jam': 2.92}
>>> newdict = sorted_values(dict_, reverse=True)
>>> print(ub.repr2(newdict, nl=0))
{'jam': 2.92, 'spam': 2.62, 'eggs': 1.2}
>>> newdict = sorted_values(dict_, key=lambda x: x % 1.6)
>>> print(ub.repr2(newdict, nl=0))
{'spam': 2.62, 'eggs': 1.2, 'jam': 2.92}
```

`ubelt.sorted_values(dict_, key=None, reverse=False, cls=<class 'collections.OrderedDict'>)`

Return an ordered dictionary sorted by its values

#### Parameters

- **dict\_** (*Dict*[*KT*, *VT*]) – dictionary to sort. The values must be of comparable types.
- **key** (*Callable*[[*VT*], *Any*] | *None*) – If given as a callable, customizes the sorting by ordering using transformed values.
- **reverse** (*bool*, *default=False*) – if True returns in descending order
- **cls** (*type*) – specifies the dict return type

#### Returns

new dictionary where the values are ordered

#### Return type

OrderedDict[KT, VT]

#### Example

```
>>> import ubelt as ub
>>> dict_ = {'spam': 2.62, 'eggs': 1.20, 'jam': 2.92}
>>> newdict = sorted_values(dict_)
>>> print(ub.repr2(newdict, nl=0))
{'eggs': 1.2, 'spam': 2.62, 'jam': 2.92}
>>> newdict = sorted_values(dict_, reverse=True)
>>> print(ub.repr2(newdict, nl=0))
{'jam': 2.92, 'spam': 2.62, 'eggs': 1.2}
>>> newdict = sorted_values(dict_, key=lambda x: x % 1.6)
>>> print(ub.repr2(newdict, nl=0))
{'spam': 2.62, 'eggs': 1.2, 'jam': 2.92}
```

`ubelt.split_archive(fpath, ext='.zip')`

If `fpath` specifies a file inside a zipfile, it breaks it into two parts the path to the zipfile and the internal path in the zipfile.

#### Example

```
>>> split_archive('/a/b/foo.txt')
>>> split_archive('/a/b/foo.zip/bar.txt')
>>> split_archive('/a/b/foo.zip/baz/biz.zip/bar.py')
>>> split_archive('archive.zip')
>>> import ubelt as ub
>>> split_archive(ub.Path('/a/b/foo.zip/baz/biz.zip/bar.py'))
>>> split_archive('/a/b/foo.zip/baz.pt/bar.zip/bar.zip', '.pt')
```

---

**Todo:** Fix got/want for win32

(None, None) ('/a/b/foo.zip', 'bar.txt') ('/a/b/foo.zip/baz/biz.zip', 'bar.py') ('archive.zip', None)  
 ('/a/b/foo.zip/baz/biz.zip', 'bar.py') ('/a/b/foo.zip/baz.pt', 'bar.zip/bar.zip')

---

`ubelt.split_modpath(modpath, check=True)`

Splits the modpath into the dir that must be in PYTHONPATH for the module to be imported and the modulepath relative to this directory.

#### Parameters

- **modpath** (*str*) – module filepath
- **check** (*bool*) – if False, does not raise an error if modpath is a directory and does not contain an `__init__.py` file.

#### Returns

(directory, rel\_modpath)

#### Return type

Tuple[*str*, *str*]

#### Raises

**ValueError** – if modpath does not exist or is not a package

### Example

```
>>> from xdoctest import static_analysis
>>> modpath = static_analysis.__file__.replace('.pyc', '.py')
>>> modpath = abspath(modpath)
>>> dpath, rel_modpath = split_modpath(modpath)
>>> recon = join(dpath, rel_modpath)
>>> assert recon == modpath
>>> assert rel_modpath == join('xdoctest', 'static_analysis.py')
```

`ubelt.symlink(real_path, link_path, overwrite=False, verbose=0)`

Create a link `link_path` that mirrors `real_path`.

This function attempts to create a real symlink, but will fall back on a hard link or junction if symlinks are not supported.

#### Parameters

- **path** (*str* | *PathLike*) – path to real file or directory
- **link\_path** (*str* | *PathLike*) – path to desired location for symlink
- **overwrite** (*bool*, *default=False*) – overwrite existing symlinks. This will not overwrite real files on systems with proper symlinks. However, on older versions of windows junctions are indistinguishable from real files, so we cannot make this guarantee.
- **verbose** (*int*, *default=0*) – verbosity level

#### Returns

link path

#### Return type

*str* | *PathLike*

---

**Note:** On systems that do not contain support for symlinks (e.g. some versions / configurations of Windows), this function will fall back on hard links or junctions [WikiNTFSLinks], [WikiHardLink]. The differences between the two are explained in [WikiSymLink].

If symlinks are not available, then `link_path` and `real_path` must exist on the same filesystem. Given that, this function always works in the sense that (1) `link_path` will mirror the data from `real_path`, (2) updates to one will effect the other, and (3) no extra space will be used.

More details can be found in `ubelt._win32_links`. On systems that support symlinks (e.g. Linux), none of the above applies.

---

## References

### Example

```
>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt', 'test_symlink0').delete().ensuredir()
>>> real_path = (dpath / 'real_file.txt')
>>> link_path = (dpath / 'link_file.txt')
>>> real_path.write_text('foo')
>>> result = ub.symlink(real_path, link_path)
>>> assert ub.Path(result).read_text() == 'foo'
>>> dpath.delete() # cleanup
```

### Example

```
>>> import ubelt as ub
>>> from ubelt.util_links import _dirstats
>>> dpath = ub.Path.appdir('ubelt', 'test_symlink1').delete().ensuredir()
>>> _dirstats(dpath)
>>> real_dpath = (dpath / 'real_dpath').ensuredir()
>>> link_dpath = real_dpath.augment(stem='link_dpath')
>>> real_path = (dpath / 'afile.txt')
>>> link_path = (dpath / 'afile.txt')
>>> real_path.write_text('foo')
>>> result = ub.symlink(real_dpath, link_dpath)
>>> assert link_path.read_text() == 'foo', 'read should be same'
>>> link_path.write_text('bar')
>>> _dirstats(dpath)
>>> assert link_path.read_text() == 'bar', 'very bad bar'
>>> assert real_path.read_text() == 'bar', 'changing link did not change real'
>>> real_path.write_text('baz')
>>> _dirstats(dpath)
>>> assert real_path.read_text() == 'baz', 'very bad baz'
>>> assert link_path.read_text() == 'baz', 'changing real did not change link'
>>> ub.delete(link_dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not link_dpath.exists(), 'link should not exist'
>>> assert real_path.exists(), 'real path should exist'
>>> _dirstats(dpath)
>>> ub.delete(dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not real_path.exists()
```

### Example

```
>>> # Specifying bad paths should error.
>>> import ubelt as ub
>>> import pytest
>>> dpath = ub.Path.appdir('ubelt', 'test_symlink2').ensuredir()
>>> real_path = dpath / 'real_file.txt'
>>> link_path = dpath / 'link_file.txt'
>>> real_path.write_text('foo')
>>> with pytest.raises(ValueError, match='link_path .* cannot be empty'):
>>>     ub.symlink(real_path, '')
>>> with pytest.raises(ValueError, match='real_path .* cannot be empty'):
>>>     ub.symlink('', link_path)
```

`ubelt.take(items, indices, default=NoParam)`

Lookup a subset of an indexable object using a sequence of indices.

The `items` input is usually a list or dictionary. When `items` is a list, this should be a sequence of integers. When `items` is a dict, this is a list of keys to lookup in that dictionary.

For dictionaries, a default may be specified as a placeholder to use if a key from `indices` is not in `items`.

#### Parameters

- **items** (*Sequence[VT] | Mapping[KT, VT]*) – An indexable object to select items from.
- **indices** (*Iterable[int | KT]*) – A sequence of indexes into `items`.
- **default** (*Any, default=NoParam*) – if specified `items` must support the `get` method.

#### Yields

*VT* – a selected item within the list

#### SeeAlso:

`ubelt.dict_subset()`

---

**Note:** `ub.take(items, indices)` is equivalent to `(items[i] for i in indices)` when `default` is unspecified.

---

### Notes

This is based on the `numpy.take()` function, but written in pure python.

Do not confuse this with `more_itertools.take()`, the behavior is very different.

### Example

```
>>> import ubelt as ub
>>> items = [0, 1, 2, 3]
>>> indices = [2, 0]
>>> list(ub.take(items, indices))
[2, 0]
```

### Example

```
>>> import ubelt as ub
>>> dict_ = {1: 'a', 2: 'b', 3: 'c'}
>>> keys = [1, 2, 3, 4, 5]
>>> result = list(ub.take(dict_, keys, None))
>>> assert result == ['a', 'b', 'c', None, None]
```

### Example

```
>>> import ubelt as ub
>>> dict_ = {1: 'a', 2: 'b', 3: 'c'}
>>> keys = [1, 2, 3, 4, 5]
>>> try:
>>>     print(list(ub.take(dict_, keys)))
>>>     raise AssertionError('did not get key error')
>>> except KeyError:
>>>     print('correctly got key error')
```

`ubelt.timeparse(stamp, default_timezone='local', allow_dateutil=True)`

Create a `datetime.datetime` object from a string timestamp.

Without any extra dependencies this will parse the output of `ubelt.util_time.timestamp()` into a datetime object. In the case where the format differs, `dateutil.parser.parse` will be used if the `python-dateutil` package is installed.

#### Parameters

- **stamp** (*str*) – a string encoded timestamp
- **default\_timezone** (*str*) – if the input does not specify a timezone, assume this one. Can be “local” or “utc”.
- **allow\_dateutil** (*bool*) – if False we only use the minimal parsing and do not allow a fallback to dateutil.

#### Returns

the parsed datetime

#### Return type

`datetime.datetime`

#### Raises

**ValueError** – if if parsing fails.

---

Todo:

- [ ] Allow defaulting to local or utm timezone (currently default is local)

### Example

```
>>> import ubelt as ub
>>> # Demonstrate a round trip of timestamp and timeparse
>>> stamp = ub.timestamp()
>>> datetime = ub.timeparse(stamp)
>>> assert ub.timestamp(datetime) == stamp
>>> # Round trip with precision
>>> stamp = ub.timestamp(precision=4)
>>> datetime = ub.timeparse(stamp)
>>> assert ub.timestamp(datetime, precision=4) == stamp
```

### Example

```
>>> import ubelt as ub
>>> # We should always be able to parse these
>>> good_stamps = [
>>>     '2000-11-22',
>>>     '2000-11-22T111111.44444Z',
>>>     '2000-11-22T111111.44444+5',
>>>     '2000-11-22T111111.44444-05',
>>>     '2000-11-22T111111.44444-0500',
>>>     '2000-11-22T111111.44444+0530',
>>>     '2000-11-22T111111Z',
>>>     '2000-11-22T111111+5',
>>>     '2000-11-22T111111+0530',
>>> ]
>>> for stamp in good_stamps:
>>>     print(f'----')
>>>     print(f'stamp={stamp}')
>>>     result = ub.timeparse(stamp, allow_dateutil=0)
>>>     print(f'result={result!r}')
>>>     recon = ub.timestamp(result)
>>>     print(f'recon={recon}')
```

### Example

```
>>> import ubelt as ub
>>> # We require dateutil to handle these types of stamps
>>> import pytest
>>> conditional_stamps = [
>>>     '2000-01-02T11:23:58.12345+5:30',
>>>     '09/25/2003',
>>>     'Thu Sep 25 10:36:28 2003',
>>> ]
>>> for stamp in conditional_stamps:
```

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```
>>> with pytest.raises(ValueError):
>>>     result = ub.timeparse(stamp, allow_dateutil=False)
>>> have_dateutil = bool(ub.modname_to_modpath('dateutil'))
>>> if have_dateutil:
>>>     for stamp in conditional_stamps:
>>>         result = ub.timeparse(stamp)
```

`ubelt.timestamp(datetime=None, precision=0, default_timezone='local', allow_dateutil=True)`

Make a concise iso8601 timestamp suitable for use in filenames.

#### Parameters

- **datetime** (*datetime.datetime* | *datetime.date* | *None*) – A datetime to format into a timestamp. If unspecified, the current local time is used. If given as a date, the time 00:00 is used.
- **precision** (*int*) – if non-zero, adds up to 6 digits of sub-second precision.
- **default\_timezone** (*str* | *datetime.timezone*) – if the input does not specify a timezone, assume this one. Can be “local” or “utc”, or a standardized code if dateutil is installed.
- **allow\_dateutil** (*bool*) – if True, will use dateutil to lookup the default timezone if needed

#### Returns

The timestamp, which will always contain a date, time, and timezone.

#### Return type

`str`

---

**Note:** For more info see [[WikiISO8601](#)], [[PyStrptime](#)], [[PyTime](#)].

---

## References

### Example

```
>>> import ubelt as ub
>>> stamp = ub.timestamp()
>>> print('stamp = {!r}'.format(stamp))
stamp = ...-...-...T...
```

### Example

```
>>> import ubelt as ub
>>> import datetime as datetime_mod
>>> from datetime import datetime as datetime_cls
>>> # Create a datetime object with timezone information
>>> ast_tzinfo = datetime_mod.timezone(datetime_mod.timedelta(hours=-4), 'AST')
>>> datetime = datetime_cls.utctimestamp(123456789.123456789).
↳replace(tzinfo=ast_tzinfo)
>>> stamp = ub.timestamp(datetime, precision=2)
>>> print('stamp = {!r}'.format(stamp))
stamp = '1973-11-29T213309.12-4'
```



```
>>> # Demo with a fractional hour timezone
>>> act_tzinfo = datetime_mod.timezone(datetime_mod.timedelta(hours=+9.5), 'ACT')
>>> datetime = datetime_cls.utcfrotimestamp(123456789.123456789).
↳replace(tzinfo=act_tzinfo)
>>> stamp = ub.timestamp(datetime, precision=2)
>>> print('stamp = {!r}'.format(stamp))
stamp = '1973-11-29T213309.12+0930'
```

```
>>> # Can accept datetime or date objects with local, utc, or custom default_
↳timezones
>>> act_tzinfo = datetime_mod.timezone(datetime_mod.timedelta(hours=+9.5), 'ACT')
>>> datetime_utc = ub.timeparse('2020-03-05T112233', default_timezone='utc')
>>> datetime_act = ub.timeparse('2020-03-05T112233', default_timezone=act_tzinfo)
>>> datetime_notz = datetime_utc.replace(tzinfo=None)
>>> date = datetime_utc.date()
>>> stamp_utc = ub.timestamp(datetime_utc)
>>> stamp_act = ub.timestamp(datetime_act)
>>> stamp_date_utc = ub.timestamp(date, default_timezone='utc')
>>> print(f'stamp_utc      = {stamp_utc}')
>>> print(f'stamp_act      = {stamp_act}')
>>> print(f'stamp_date_utc = {stamp_date_utc}')
stamp_utc      = 2020-03-05T112233+0
stamp_act      = 2020-03-05T112233+0930
stamp_date_utc = 2020-03-05T000000+0
```

### Example

```
>>> # xdoctest: +REQUIRES(module:dateutil)
>>> # Make sure we are compatible with dateutil
>>> import ubelt as ub
>>> from dateutil.tz import tzlocal
>>> import datetime as datetime_mod
>>> from datetime import datetime as datetime_cls
>>> tz_act = datetime_mod.timezone(datetime_mod.timedelta(hours=+9.5), 'ACT')
>>> tzinfo_list = [
>>>     tz_act,
>>>     datetime_mod.timezone(datetime_mod.timedelta(hours=-4), 'AST'),
>>>     datetime_mod.timezone(datetime_mod.timedelta(hours=0), 'UTC'),
>>>     datetime_mod.timezone.utc,
>>>     None,
>>>     tzlocal()
>>> ]
>>> # Note: there is a win32 bug here
>>> # https://bugs.python.org/issue37 that means we cant use
>>> # dates close to the epoch
>>> datetime_list = [
>>>     datetime_cls.utcfrotimestamp(123456789.123456789 + 315360000),
>>>     datetime_cls.utcfrotimestamp(0 + 315360000),
>>> ]
>>> basis = {
>>>     'precision': [0, 3, 9],
```

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```
>>> 'tzinfo': tzinfo_list,
>>> 'datetime': datetime_list,
>>> 'default_timezone': ['local', 'utc', tz_act],
>>> }
>>> for params in ub.named_product(basis):
>>>     dttime = params['datetime'].replace(tzinfo=params['tzinfo'])
>>>     precision = params.get('precision', 0)
>>>     stamp = ub.timestamp(datetime=dttime, precision=precision)
>>>     recon = ub.timeparse(stamp)
>>>     alt = recon.strftime('%Y-%m-%dT%H%M%S.%f%z')
>>>     print('---')
>>>     print('params = {}'.format(ub.repr2(params, nl=1)))
>>>     print(f'dttime={dttime}')
>>>     print(f'stamp={stamp}')
>>>     print(f'recon={recon}')
>>>     print(f'alt = {alt}')
>>>     shift = 10 ** precision
>>>     a = int(dttime.timestamp() * shift)
>>>     b = int(recon.timestamp() * shift)
>>>     assert a == b, f'{a} != {b}'
```

`ubelt.touch(fpath, mode=438, dir_fd=None, verbose=0, **kwargs)`

change file timestamps

Works like the touch unix utility

#### Parameters

- **fpath** (*str* | *PathLike*) – name of the file
- **mode** (*int*) – file permissions (python3 and unix only)
- **dir\_fd** (*io.IOBase*) – optional directory file descriptor. If specified, fpath is interpreted as relative to this descriptor (python 3 only).
- **verbose** (*int*) – verbosity
- **\*\*kwargs** – extra args passed to `os.utime()` (python 3 only).

#### Returns

path to the file

#### Return type

`str`

## References

## Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = join(dpath, 'touch_file')
>>> assert not exists(fpath)
>>> ub.touch(fpath)
```

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```
>>> assert exists(fpath)
>>> os.unlink(fpath)
```

**ubelt.udict**alias of *UDict***ubelt.unique**(items, key=None)

Generates unique items in the order they appear.

**Parameters**

- **items** (*Iterable[T]*) – list of items
- **key** (*Callable[[T], Any], default=None*) – custom normalization function. If specified returns items where `key(item)` is unique.

**Yields***T* – a unique item from the input sequence**Notes**Functionally equivalent to `more_itertools.unique_everseen()`.**Example**

```
>>> import ubelt as ub
>>> items = [4, 6, 6, 0, 6, 1, 0, 2, 2, 1]
>>> unique_items = list(ub.unique(items))
>>> assert unique_items == [4, 6, 0, 1, 2]
```

**Example**

```
>>> import ubelt as ub
>>> items = ['A', 'a', 'b', 'B', 'C', 'c', 'D', 'e', 'D', 'E']
>>> unique_items = list(ub.unique(items, key=str.lower))
>>> assert unique_items == ['A', 'b', 'C', 'D', 'e']
>>> unique_items = list(ub.unique(items))
>>> assert unique_items == ['A', 'a', 'b', 'B', 'C', 'c', 'D', 'e', 'E']
```

**ubelt.unique\_flags**(items, key=None)

Returns a list of booleans corresponding to the first instance of each unique item.

**Parameters**

- **items** (*Sequence[VT]*) – indexable collection of items
- **key** (*Callable[[VT], Any] | None, default=None*) – custom normalization function. If specified returns items where `key(item)` is unique.

**Returns**

flags the items that are unique

**Return type**`List[bool]`

### Example

```
>>> import ubelt as ub
>>> items = [0, 2, 1, 1, 0, 9, 2]
>>> flags = ub.unique_flags(items)
>>> assert flags == [True, True, True, False, False, True, False]
>>> flags = ub.unique_flags(items, key=lambda x: x % 2 == 0)
>>> assert flags == [True, False, True, False, False, False, False]
```

`ubelt.userhome(username=None)`

Returns the path to some user’s home directory.

#### Parameters

**username** (*str* | *None*) – name of a user on the system. If not specified, the current user is inferred.

#### Returns

`userhome_dpath` - path to the specified home directory

#### Return type

`str`

#### Raises

- **KeyError** – if the specified user does not exist on the system
- **OSError** – if username is unspecified and the current user cannot be inferred

### Example

```
>>> from ubelt.util_path import * # NOQA
>>> import getpass
>>> username = getpass.getuser()
>>> assert userhome() == expanduser('~')
>>> assert userhome(username) == expanduser('~')
```

`ubelt.varied_values(longform, min_variations=0, default=NoParam)`

Given a list of dictionaries, find the values that differ between them.

#### Parameters

- **longform** (*List[Dict[KT, VT]]*) – This is longform data, as described in [\[SeabornLongform\]](#). It is a list of dictionaries.  
  
Each item in the list - or row - is a dictionary and can be thought of as an observation. The keys in each dictionary are the columns. The values of the dictionary must be hashable. Lists will be converted into tuples.
- **min\_variations** (*int*, *default=0*) – “columns” with fewer than `min_variations` unique values are removed from the result.
- **default** (*VT* | *NoParamType*) – if specified, unspecified columns are given this value. Defaults to `NoParam`.

#### Returns

a mapping from each “column” to the set of unique values it took over each “row”. If a column is not specified for each row, it is assumed to take a *default* value, if it is specified.

#### Return type

`Dict[KT, List[VT]]`

**Raises**

**KeyError** – If `default` is unspecified and all the rows do not contain the same columns.

**References****Example**

```
>>> # An example use case is to determine what values of a
>>> # configuration dictionary were tried in a random search
>>> # over a parameter grid.
>>> import ubelt as ub
>>> longform = [
>>>     {'col1': 1, 'col2': 'foo', 'col3': None},
>>>     {'col1': 1, 'col2': 'foo', 'col3': None},
>>>     {'col1': 2, 'col2': 'bar', 'col3': None},
>>>     {'col1': 3, 'col2': 'bar', 'col3': None},
>>>     {'col1': 9, 'col2': 'bar', 'col3': None},
>>>     {'col1': 1, 'col2': 'bar', 'col3': None},
>>> ]
>>> varied = ub.varied_values(longform)
>>> print('varied = {}'.format(ub.repr2(varied, nl=1)))
varied = {
    'col1': {1, 2, 3, 9},
    'col2': {'bar', 'foo'},
    'col3': {None},
}
```

**Example**

```
>>> import ubelt as ub
>>> import random
>>> longform = [
>>>     {'col1': 1, 'col2': 'foo', 'col3': None},
>>>     {'col1': 1, 'col2': [1, 2], 'col3': None},
>>>     {'col1': 2, 'col2': 'bar', 'col3': None},
>>>     {'col1': 3, 'col2': 'bar', 'col3': None},
>>>     {'col1': 9, 'col2': 'bar', 'col3': None},
>>>     {'col1': 1, 'col2': 'bar', 'col3': None, 'extra_col': 3},
>>> ]
>>> # Operation fails without a default
>>> import pytest
>>> with pytest.raises(KeyError):
>>>     varied = ub.varied_values(longform)
>>> #
>>> # Operation works with a default
>>> varied = ub.varied_values(longform, default='<unset>')
>>> expected = {
>>>     'col1': {1, 2, 3, 9},
>>>     'col2': {'bar', 'foo', (1, 2)},
>>>     'col3': set([None]),
>>>     'extra_col': {'<unset>', 3},
>>> }
```

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```
>>> }
>>> print('varied = {!r}'.format(varied))
>>> assert varied == expected
```

### Example

```
>>> # xdoctest: +REQUIRES(PY3)
>>> # Random numbers are different in Python2, so skip in that case
>>> import ubelt as ub
>>> import random
>>> num_cols = 11
>>> num_rows = 17
>>> rng = random.Random(0)
>>> # Generate a set of columns
>>> columns = sorted(ub.hash_data(i)[0:8] for i in range(num_cols))
>>> # Generate rows for each column
>>> longform = [
>>>     {key: ub.hash_data(key)[0:8] for key in columns}
>>>     for _ in range(num_rows)
>>> ]
>>> # Add in some varied values in random positions
>>> for row in longform:
>>>     if rng.random() > 0.5:
>>>         for key in sorted(row.keys()):
>>>             if rng.random() > 0.95:
>>>                 row[key] = 'special-' + str(rng.randint(1, 32))
>>> varied = ub.varied_values(longform, min_variations=1)
>>> print('varied = {}'.format(ub.repr2(varied, nl=1, sort=True)))
varied = {
    '095f3e44': {'8fb4d4c9', 'special-23'},
    '365d11a1': {'daa409da', 'special-31', 'special-32'},
    '5815087d': {'1b823610', 'special-3'},
    '7b54b668': {'349a782c', 'special-10'},
    'b8244d02': {'d57bca90', 'special-8'},
    'f27b5bf8': {'fa0f90d1', 'special-19'},
}
```

`ubelt.writeto(fpath, to_write, aslines=False, verbose=None)`

Writes (utf8) text to a file.

#### Parameters

- **fpath** (*str* | *PathLike*) – file path
- **to\_write** (*str*) – text to write (must be unicode text)
- **aslines** (*bool*) – if True `to_write` is assumed to be a list of lines
- **verbose** (*bool*) – verbosity flag

**Note:** In CPython you may want to use `open(<fpath>).write(<to_write>)` instead. This function exists as a convenience for writing in Python2. After 2020-01-01, we may consider deprecating the function.

NOTE: In PyPy `open(<fpath>).write(<to_write>)` does not work. See <https://pypy.org/compat.html>. This is an argument for keeping this function.

NOTE: With modern versions of Python, it is generally recommended to use `pathlib.Path.write_text()` instead. Although there does seem to be some corner case this handles better on win32, so maybe useful?

### Example

```
>>> import ubelt as ub
>>> import os
>>> from os.path import exists
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = dpath + '/' + 'testwrite.txt'
>>> if exists(fpath):
>>>     os.remove(fpath)
>>> to_write = 'utf-8 symbols , , , , , , , and .'
>>> ub.writeto(fpath, to_write)
>>> read_ = ub.readfrom(fpath)
>>> print('read_ = ' + read_)
>>> print('to_write = ' + to_write)
>>> assert read_ == to_write
```

### Example

```
>>> import ubelt as ub
>>> import os
>>> from os.path import exists
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = dpath + '/' + 'testwrite2.txt'
>>> if exists(fpath):
>>>     os.remove(fpath)
>>> to_write = ['a\n', 'b\n', 'c\n', 'd\n']
>>> ub.writeto(fpath, to_write, aslines=True)
>>> read_ = ub.readfrom(fpath, aslines=True)
>>> print('read_ = {}'.format(read_))
>>> print('to_write = {}'.format(to_write))
>>> assert read_ == to_write
```

### Example

```
>>> # With modern Python, use pathlib.Path (or ub.Path) instead
>>> import ubelt as ub
>>> dpath = ub.Path.appdir('ubelt/tests/io').ensuredir()
>>> fpath = (dpath / 'test_file.txt').delete()
>>> to_write = 'utf-8 symbols , , , , , , , and .'
>>> ub.writeto(fpath, to_write)
>>> fpath.write_bytes(to_write.encode('utf8'))
>>> assert fpath.read_bytes().decode('utf8') == to_write
```

**class** `ubelt.zopen(fpath, mode='r', seekable=False, ext='.zip')`

Bases: [NiceRepr](#)

An abstraction of the normal `open()` function that can also handle reading data directly inside of zipfiles.

This is a file-object like interface [FileObj] — i.e. it supports the read and write methods to an underlying resource.

Can open a file normally or open a file within a zip file (readonly). Tries to read from memory only, but will extract to a tempfile if necessary.

Just treat the zipfile like a directory, e.g. `/path/to/myzip.zip/compressed/path.txt` OR? e.g. `/path/to/myzip.zip:compressed/path.txt`

## References

---

### Todo:

- [ ] **Fast way to open a base zipfile, query what is inside, and**  
then choose a file to further zopen (and passing along the same open zipfile reference maybe?).
  - [ ] Write mode in some restricted setting?
- 

### Parameters

- **fpath** (*str* | *PathLike*) – path to a file, or a special path that denotes both a path to a zipfile and a path to a archived file inside of the zipfile.
- **mode** (*str*) – Currently only “r” - readonly mode is supported
- **seekable** (*bool*) – If True, attempts to force “seekability” of the underlying file-object, for compressed files this will first extract the file to a temporary location on disk. If False, any underlying compressed file will be opened directly which may result in the object being non-seekable.
- **ext** (*str*) – The extension of the zipfile. Modify this is a non-standard extension is used (e.g. for torch packages).

## Example

```
>>> from ubelt.util_zip import * # NOQA
>>> import pickle
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> dpath = ub.Path(dpath)
>>> data_fpath = dpath / 'test.pkl'
>>> data = {'demo': 'data'}
>>> with open(str(data_fpath), 'wb') as file:
>>>     pickle.dump(data, file)
>>> # Write data
>>> import zipfile
>>> zip_fpath = dpath / 'test_zip.archive'
>>> stl_w_zfile = zipfile.ZipFile(os.fspath(zip_fpath), mode='w')
>>> stl_w_zfile.write(os.fspath(data_fpath), os.fspath(data_fpath.relative_
```

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```

->to(dpath)))
>>> stl_w_zfile.close()
>>> stl_r_zfile = zipfile.ZipFile(os.fspath(zip_fpath), mode='r')
>>> stl_r_zfile.namelist()
>>> stl_r_zfile.close()
>>> # Test zopen
>>> self = zopen(zip_fpath / 'test.pkl', mode='rb', ext='.archive')
>>> print(self._split_archive())
>>> print(self.namelist())
>>> self.close()
>>> self = zopen(zip_fpath / 'test.pkl', mode='rb', ext='.archive')
>>> recon1 = pickle.loads(self.read())
>>> self.close()
>>> self = zopen(zip_fpath / 'test.pkl', mode='rb', ext='.archive')
>>> recon2 = pickle.load(self)
>>> self.close()
>>> assert recon1 == recon2
>>> assert recon1 is not recon2

```

### Example

```

>>> # Test we can load json data from a zipfile
>>> from ubelt.util_zip import * # NOQA
>>> import ubelt as ub
>>> import json
>>> import zipfile
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> infopath = join(dpath, 'info.json')
>>> ub.writeto(infopath, '{"x": "1"}')
>>> zippath = join(dpath, 'infozip.zip')
>>> internal = 'folder/info.json'
>>> with zipfile.ZipFile(zippath, 'w') as myzip:
>>>     myzip.write(infopath, internal)
>>> fpath = zippath + '/' + internal
>>> # Test context manager
>>> with zopen(fpath, 'r') as self:
>>>     info2 = json.load(self)
>>>     assert info2['x'] == '1'
>>> # Test outside of context manager
>>> self = zopen(fpath, 'r')
>>> print(self._split_archive())
>>> info2 = json.load(self)
>>> assert info2['x'] == '1'
>>> # Test nice repr (with zfile)
>>> print('self = {!r}'.format(self))
>>> self.close()

```

## Example

```

>>> # Coverage tests --- move to unit-test
>>> from ubelt.util_zip import * # NOQA
>>> import ubelt as ub
>>> import json
>>> import zipfile
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> textpath = join(dpath, 'seekable_test.txt')
>>> text = chr(10).join(['line{}'.format(i) for i in range(10)])
>>> ub.writeto(textpath, text)
>>> zippath = join(dpath, 'seekable_test.zip')
>>> internal = 'folder/seekable_test.txt'
>>> with zipfile.ZipFile(zippath, 'w') as myzip:
>>>     myzip.write(textpath, internal)
>>> ub.delete(textpath)
>>> fpath = zippath + '/' + internal
>>> # Test seekable
>>> self_seekable = zopen(fpath, 'r', seekable=True)
>>> assert self_seekable.seekable()
>>> self_seekable.seek(8)
>>> assert self_seekable.readline() == 'ne1' + chr(10)
>>> assert self_seekable.readline() == 'line2' + chr(10)
>>> self_seekable.seek(8)
>>> assert self_seekable.readline() == 'ne1' + chr(10)
>>> assert self_seekable.readline() == 'line2' + chr(10)
>>> # Test non-seekable?
>>> # Sometimes non-seekable files are still seekable
>>> maybe_seekable = zopen(fpath, 'r', seekable=False)
>>> if maybe_seekable.seekable():
>>>     maybe_seekable.seek(8)
>>>     assert maybe_seekable.readline() == 'ne1' + chr(10)
>>>     assert maybe_seekable.readline() == 'line2' + chr(10)
>>>     maybe_seekable.seek(8)
>>>     assert maybe_seekable.readline() == 'ne1' + chr(10)
>>>     assert maybe_seekable.readline() == 'line2' + chr(10)

```

## Example

```

>>> # More coverage tests --- move to unit-test
>>> from ubelt.util_zip import * # NOQA
>>> import ubelt as ub
>>> import pytest
>>> dpath = ub.ensure_app_cache_dir('ubelt/tests/util_zip')
>>> with pytest.raises(NotFoundError):
>>>     self = zopen('', 'r')
>>> # Test open non-zip existing file
>>> existing_fpath = join(dpath, 'exists.json')
>>> ub.writeto(existing_fpath, '{"x": "1"}')
>>> self = zopen(existing_fpath, 'r')
>>> assert self.read() == '{"x": "1"}'

```

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```

>>> # Test dir
>>> dir(self)
>>> # Test nice
>>> print(self)
>>> print('self = {!r}'.format(self))
>>> self.close()
>>> # Test open non-zip non-existing file
>>> nonexistent_fpath = join(dpath, 'does-not-exist.txt')
>>> ub.delete(nonexistent_fpath)
>>> with pytest.raises(OSError):
>>>     self = zopen(nonexistent_fpath, 'r')
>>> with pytest.raises(NotImplementedError):
>>>     self = zopen(nonexistent_fpath, 'w')
>>> # Test nice-repr
>>> self = zopen(existing_fpath, 'r')
>>> print('self = {!r}'.format(self))
>>> # pathological
>>> self = zopen(existing_fpath, 'r')
>>> self._handle = None
>>> dir(self)

```

**property** `zfile`

Access the underlying archive file

**namelist()**

Lists the contents of this zipfile



## INDICES AND TABLES

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- `modindex`



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