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# UBelt Documentation

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

- Timing
- Caching
- Hashing
- Command Line / Shell Interaction
- Cross-Platform Cache, Config, and Data Directories
- Symlinks
- Downloading Files
- Dictionary Histogram
- Find Duplicates
- Dictionary Manipulation
- AutoDict - Autovivification
- String-based imports
- Horizontal String Concatenation
- **Standalone modules.**
  - `progiter` for Loop Progress
  - `timerit` for Robust Timing and Benchmarking
  - `ordered-set` for ordered set collections

For more detailed high level documentation see the README on github: <https://github.com/Erotemic/ubelt>. For demos see the [Jupyter notebook](#).

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. Please see specific submodule documentation for more details.

**AutogenInit:** `mkinit ubelt -w # todo: get sphinx to ignore this`



## 1.1 ubelt package

### 1.1.1 Submodules

#### 1.1.1.1 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.

While *ubelt* exposes *OrderedSet*, the actual implementation lives in the standalone *ordered\_set* package. For more details on the implementation please reference <https://github.com/LuminosoInsight/ordered-set>.

#### 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]
```

```
class ubelt.orderedset.OrderedSet (iterable=None)
    Bases: collections.abc.MutableSet, collections.abc.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
```

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```
>>> print(oiset)
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**

```
>>> oiset = OrderedSet([1, 2, 3])
>>> oiset.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**

```
>>> oiset = OrderedSet([1, 2, 3])
>>> oiset.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**

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

**pop** ()

Remove and return the last element from the set.

Raises `KeyError` if the set is empty.

**Example**

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

```
>>> 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.oiset`  
alias of `ordered_set.OrderedSet`

### **1.1.1.2 ubelt.progiter module**

ProgIter now exists in a standalone pip-installable module. The source code lives in its own github repo here: <https://github.com/Erotemic/progiter>

#### **Example**

```
>>> import ubelt as ub
>>> for n in ub.ProgIter(range(1000)):
>>>     # do some work
>>>     pass
```

```
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, enabled=True, verbose=None, stream=None,
                             chunksize=None, **kwargs)
```

Bases: `progiter.progiter._TQDMCompat`, `progiter.progiter._BackwardsCompat`

Prints progress as an iterator progresses

#### **Variables**

- **iterable** (*iterable*) – An iterable iterable
- **desc** (*str*) – description label to show with progress
- **total** (*int*) – Maximum length of the process (estimated from iterable if not specified)
- **freq** (*int*) – How many iterations to wait between messages.

- **adjust** (*bool*) – if True freq is adjusted based on time\_thresh
- **eta\_window** (*int*) – number of previous measurements to use in eta calculation
- **clearline** (*bool*) – if true messages are printed on the same line
- **adjust** – if True *freq* is adjusted based on time\_thresh
- **time\_thresh** (*float*) – desired amount of time to wait between messages if adjust is True otherwise does nothing
- **show\_times** (*bool*) – shows rate, eta, and wall (defaults to True)
- **initial** (*int*) – starting index offset (defaults to 0)
- **stream** (*file*) – defaults to sys.stdout
- **enabled** (*bool*) – if False nothing happens.
- **chunksize** (*int*) – indicates that each iteration processes a batch of this size. Iteration rate is displayed in terms of single-items.
- **verbose** (*int*) – verbosity mode 0 - no verbosity, 1 - verbosity with clearline=True and adjust=True 2 - verbosity without clearline=False and adjust=True 3 - verbosity without 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.

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**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. However, *tqdm* is recommended for the majority of use cases.

---



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**Note:** The *ProgIter* API will change to become inter-compatible with *tqdm*.

---

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

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

## Example

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

**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

```
>>> import progiter
>>> prog = progiter.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)**

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

##### **Parameters**

- **idx** (*int*) – current step index (default None) if specified, takes precedence over *inc*
- **inc** (*int*) – number of steps to increment (defaults to 1)

### Example

```
>>> import progiter
>>> n = 3
>>> prog = progiter.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

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

#### **begin()**

Initializes information used to measure progress

#### **end()**

#### **format\_message()**

builds a formatted progres 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
>>> import progiter
>>> prog = progiter.ProgIter(range(4), show_times=False, verbose=1)
>>> for n in prog:
...     print('unsafe message')
0/4... unsafe message
1/4... unsafe message
unsafe message
unsafe message
4/4...
>>> # apparently the safe version does this too.
>>> print('---')
---
>>> prog = progiter.ProgIter(range(4), show_times=False, verbose=1)
>>> for n in prog:
...     prog.ensure_newline()
...     print('safe message')
0/4...
safe message
1/4...
safe message
safe message
safe message
4/4...
```

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

Writes current progress to the output stream

### 1.1.1.3 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* or *click*. 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>*

#### Parameters

- **key** (*str or tuple*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. *--*)
- **default** (*Optional[object]*) – value to return if not specified
- **argv** (*Optional[list]*) – overrides *sys.argv* if specified

#### Returns

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

**Return type** `str`

---

#### Todo:

- [ ] Can we handle the case where the value is a list of long paths?
  - [ ] Should we default the first or last specified instance of the flag.
- 

#### 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

#### Parameters



- **key** (*str or Tuple[str]*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. `--`)
- **argv** (*List[str], optional*) – overrides `sys.argv` if specified

**Returns** `flag` : True if the key (or any of the keys) was specified

**Return type** `bool`

### 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
```

#### 1.1.1.4 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 ever achieved. 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
>>> # Defines a cache name and dependencies, note the use of `ub.hash_data`.
>>> cacher = ub.Cacher('name', cfgstr=ub.hash_data('dependencies')) #_
↳boilerplate:1
>>> # Calling tryload will return your data on a hit and None on a miss
>>> data = cacher.tryload() #_
↳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 (pickle is used by default)
>>>     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 *ub.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', cfgstr=ub.hash_data('dependencies')) # boilerplate:1
>>> def func(): # boilerplate:2
>>>     data = 'mydata'
>>>     return data # boilerplate:3
>>> data = func() # boilerplate:4
```

```
>>> cacher = ub.Cacher('name', cfgstr=ub.hash_data('dependencies')) # boilerplate:1
>>> data = cacher.tryload() # 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 simpler tracebacks, explicit procedures, and makes it easier to use breakpoint debugging (because there is no closure scope).

While *Cacher* is used to store simple 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

```
>>> def compute_many_files(dpath):
...     for i in range(0):
...         fpath = '{}/file{}.txt'.format(dpath, i)
...         open(fpath).write('foo' + str(i))
>>> #
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt/demo/cache')
>>> # You must specify a directory, unlike in Cacher where it is optional
>>> self = ub.CacheStamp('name', dpath=dpath, cfgstr='dependencies')
>>> 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()
```

```
class ubelt.util_cache.Cacher (fname, cfgstr=None, dpath=None, appname='ubelt', ext='.pkl',
                               meta=None, verbose=None, enabled=True, log=None,
                               hasher='sha1', protocol=2)
```

Bases: object

Cacher designed to be quickly integrated into existing scripts.

### Parameters

- **fname** (*str*) – A file name. This is the prefix that will be used by the cache. It will always be used as-is.
- **cfgstr** (*str*) – Indicates the state. Either this string or a hash of this string will be used to identify the cache. A cfgstr should always be reasonably readable, thus it is good practice to hash extremely detailed cfgstrs to a reasonable readable level. Use meta to store make original details persist.

- **dpath** (*PathLike*) – Specifies where to save the cache. If unspecified, Cacher defaults to an application resource dir as given by appname.
- **appname** (*str*, *default='ubelt'*) – Application name Specifies a folder in the application resource directory where to cache the data if *dpath* is not specified.
- **ext** (*str*, *default='.pkl'*) – File extension for the cache format
- **meta** (*object*) – Metadata that is also saved with the *cfgstr*. This can be useful to indicate how the *cfgstr* was constructed.
- **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** (*func*) – Overloads the print function. Useful for sending output to loggers (e.g. logging.info, tqdm.tqdm.write, ...)
- **hasher** (*str*) – Type of hashing algorithm to use if *cfgstr* needs to be condensed to less than 49 characters.
- **protocol** (*int*, *default=2*) – Protocol version used by pickle. If python 2 compatibility is not required, then it is better to use protocol 4.

**CommandLine:** python -m ubelt.util\_cache Cacher

### Example

```
>>> import ubelt as ub
>>> cfgstr = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = ub.Cacher('test_process', cfgstr)
>>> cacher.clear()
>>> 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 a tuple named data
>>>     data = myvar1, myvar2
>>>     cacher.save(data)
>>> # Last part of the Cacher pattern is to unpack the data tuple
>>> myvar1, myvar2 = data
```

### Example

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

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```
>>>    cacher.save(myvar)
>>> assert cacher.exists(), 'should now exist'
```

**VERBOSE** = 1

**FORCE\_DISABLE** = False

**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, optional) – overrides the instance-level cfgstr

**Returns** PathLike

### Example

```
>>> from ubelt.util_cache import Cacher
>>> import pytest
>>> with pytest.warns(UserWarning):
>>>     cacher = Cacher('test_cacher1')
>>>     cacher.get_fpath()
>>> self = Cacher('test_cacher2', cfgstr='cfg1')
>>> self.get_fpath()
>>> self = Cacher('test_cacher3', cfgstr='cfg1' * 32)
>>> self.get_fpath()
```

**exists** (cfgstr=None)

Check to see if the cache exists

**Parameters** *cfgstr* (str, optional) – overrides the instance-level cfgstr

**existing\_versions** ()

Returns data with different cfgstr values that were previously computed with this cacher.

### Example

```
>>> from ubelt.util_cache import Cacher
>>> # Ensure that some data exists
>>> known_fnames = set()
>>> cacher = Cacher('versioned_data', cfgstr='1')
>>> cacher.ensure(lambda: 'data1')
>>> known_fnames.add(cacher.get_fpath())
>>> cacher = Cacher('versioned_data', cfgstr='2')
>>> cacher.ensure(lambda: 'data2')
>>> known_fnames.add(cacher.get_fpath())
>>> # List previously computed configs for this type
>>> from os.path import basename
>>> cacher = Cacher('versioned_data', cfgstr='2')
>>> exist_fpaths = set(cacher.existing_versions())
>>> exist_fnames = list(map(basename, exist_fpaths))
>>> print(exist_fnames)
>>> assert exist_fpaths == known_fnames
```

['versioned\_data\_1.pkl', 'versioned\_data\_2.pkl']

**clear** (*cfgstr=None*)

Removes the saved cache and metadata from disk

**Parameters** **cfgstr** (*str, optional*) – 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, optional*) – 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.

**load** (*cfgstr=None*)

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

**Parameters** **cfgstr** (*str, optional*) – overrides the instance-level *cfgstr*

**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)
>>> 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(cfgstr)*.

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, optional*) – overrides the instance-level *cfgstr*

### Example

```
>>> from ubelt.util_cache import * # NOQA
>>> # Normal functioning
>>> cfgstr = 'long-cfg' * 32
>>> cacher = Cacher('test_enabled_save', cfgstr)
>>> cacher.save('data')
>>> assert exists(cacher.get_fpath()), 'should be enabeled'
>>> 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)
>>> 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'
>>> cfgstr = 'func params'
>>> cacher = Cacher(fname, cfgstr)
>>> 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*)

Bases: `object`

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

Writes a file that marks that a procedure has been done by writing a “stamp” file to disk. Removing the stamp file will force recomputation. However, removing or changing the result of the computation may not trigger recomputation unless specific handling is done or the expected “product” of the computation is a file and registered with the stamper. If *hasher* is *None*, we only check if the product exists, and we ignore its hash, otherwise it checks that the hash of the product is the same.

#### Parameters

- **fname** (*str*) – Name of the stamp file
- **cfgstr** (*str*) – Configuration associated with the stamped computation. A common pattern is to call `ubelt.hash_data` on a dependency list.
- **dpath** (*PathLike*) – Where to store the cached stamp file
- **product** (*PathLike* or *Sequence[PathLike]*, *optional*) – 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. Defaults to `sha1`.
- **verbose** (*bool*, *default=None*) – Passed to internal `ub.Cacher` object
- **enabled** (*bool*, *default=True*) – if *False*, expired always returns *True*

## Example

```

>>> import ubelt as ub
>>> from os.path import join
>>> # Stamp the computation of expensive-to-compute.txt
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'test-cache-stamp')
>>> ub.delete(dpath)
>>> ub.ensuredir(dpath)
>>> product = join(dpath, 'expensive-to-compute.txt')
>>> self = CacheStamp('somedata', cfgstr='someconfig', dpath=dpath,
>>>                   product=product, hasher=None)
>>> self.hasher = None
>>> if self.expired():
>>>     ub.writeto(product, 'very expensive')
>>>     self.renew()
>>> assert not self.expired()
>>> # corrupting the output will not expire in non-robust mode
>>> ub.writeto(product, 'corrupted')
>>> assert not self.expired()
>>> self.hasher = 'sha1'
>>> # but it will expire if we are in robust mode
>>> assert self.expired()
>>> # deleting the product will cause expiration in any mode
>>> self.hasher = None
>>> ub.delete(product)
>>> assert self.expired()

```

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

Check to see if a previously existing stamp is still valid and if the expected result of that computation still exists.

### Parameters

- **cfgstr** (str, optional) – overrides the instance-level cfgstr
- **product** (PathLike or Sequence[PathLike], optional) – override the default product if specified

**Returns** True if the stamp is invalid or does not exist.

**Return type** bool

**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

### 1.1.1.5 ubelt.util\_cmd module

This module exposes the *ubelt.cmd* command, which provides a simple means for interacting with the commandline. While this does use *subprocess.Popen* under the hood, the key draw of *ubelt.cmd* is that you can capture stdout/stderr in your program while simultaneously printing it to the terminal in real time.

## 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': <subprocess.Popen object at ...>,
  'ret': 0,
}
```

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

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 or Sequence*) – bash-like command string or tuple of executable and args
- **shell** (*bool*) – if True, process is run in shell, defaults to False.
- **detach** (*bool*) – if True, process is detached and run in background, defaults to False.
- **verbose** (*int*) – verbosity mode. Can be 0, 1, 2, or 3. Defaults to 0.
- **tee** (*bool, optional*) – 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** (*PathLike, optional*) – path to run command
- **env** (*str, optional*) – environment passed to Popen
- **tee\_backend** (*str, optional*) – backend for tee output. Valid choices are: “auto”, “select” (POSIX only), and “thread”.
- **# TODO** – stdout, stderr - experimental - custom file to pipe stdout/stderr to
- **\*\*kwargs** – only used to support deprecated arguments

### Returns

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

**Return type** dict



## Notes

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 [3] for a potential cross-platform shlex solution for windows.

**CommandLine:** `python -m ubelt.util_cmd cmd python -c "import ubelt as ub; ub.cmd('ping localhost -c 2', verbose=2)"`

## References

- [1] <https://stackoverflow.com/questions/11495783/redirect-subprocess-stderr-to-stdout> [2] <https://stackoverflow.com/questions/7729336/how-can-i-print-and-display-subprocess-stdout-and-stderr-output-without-distorti>  
 [3] <https://stackoverflow.com/questions/33560364/python-windows-parsing-command-lines-with-shlex>

## Example

```
>>> info = 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() == ''
```

### Doctest:

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

### Doctest:

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

### Doctest:

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

### Doctest:

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

### Doctest:

```
>>> 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)
>>> info1 = ub.cmd(('touch', fpath1), detach=True)
```

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```
>>> info2 = ub.cmd('echo writing2 > ' + fpath2, shell=True, detach=True)
>>> while not exists(fpath1):
...     pass
>>> while not exists(fpath2):
...     pass
>>> assert ub.readfrom(fpath1) == ''
>>> assert ub.readfrom(fpath2).strip() == 'writing2'
>>> info1['proc'].wait()
>>> info2['proc'].wait()
```

### 1.1.1.6 ubelt.util\_colors module

This module exposes 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.

**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`

**CommandLine:** `python -c "import pygments.formatters; print(list(pygments.formatters.get_all_formatters()))"`  
`python -c "import pygments.lexers, ubelt; print(ubelt.repr2(pygments.lexers.__all__, nl=2))"`

### 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*) – may be one of the following: yellow, blink, lightgray, underline, darkyellow, blue, darkblue, faint, fuchsia, black, white, red, brown, turquoise, bold, darkred, darkgreen, reset, standout, darkteal, darkgray, overline, purple, green, teal, fuchsia

### Returns

**text** [colorized text.] If pygments is not installed plain text is returned.

**Return type** `str`

**CommandLine:** `python -c "import pygments.console; print(sorted(pygments.console.codes.keys()))"` python  
`-m ubelt.util_colors color_text`

### 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(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 color_text(text, None) == 'raw text'
>>> else:
>>>     # Otherwise text passes through unchanged
>>>     assert color_text(text, 'red') == 'raw text'
>>>     assert color_text(text, None) == 'raw text'
```

#### 1.1.1.7 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)

### 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
```

### 1.1.1.8 ubelt.util\_dict module

Functions for working with dictionaries.

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\_vals* 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\_subset* functions are similar to the set equivalents.

The *dict\_take* function works similarly to *ubelt.take* and *np.take*, except it allows for a default value to be specified.

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.

```
ubelt.util_dict.odict
    alias of collections.OrderedDict
```

```
ubelt.util_dict.ddict
    alias of collections.defaultdict
```

```
class ubelt.util_dict.AutoDict
    Bases: dict
```

An infinitely nested default dict of dicts.

Implementation of Perl's autovivification feature.

**SeeAlso:** `ub.AutoOrderedDict` - the ordered version

### References

<http://stackoverflow.com/questions/651794/init-dict-of-dicts>

### 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: `collections.OrderedDict`, `ubelt.util_dict.AutoDict`

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

**SeeAlso:** `ub.AutoDict` - the unordered version

### 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*) – full sequence
- **items2** (*Iterable*) – can either be a sequence of one item or a sequence of equal length to *items1*
- **cls** (*Type[dict]*) – dictionary type to use. Defaults to `dict`, but could be ordered dict instead.

**Returns** similar to `dict(zip(items1, items2))`

**Return type** `dict`

### Example

```
>>> assert dzip([1, 2, 3], [4]) == {1: 4, 2: 4, 3: 4}
>>> assert dzip([1, 2, 3], [4, 4, 4]) == {1: 4, 2: 4, 3: 4}
>>> assert dzip([], [4]) == {}
```

`ubelt.util_dict.group_items` (*items*, *groupids*)

Groups a list of items by group id.

#### Parameters

- **items** (*Iterable*) – a list of items to group
- **groupids** (*Iterable or Callable*) – a corresponding list of item groupids or a function mapping an item to a groupid.

**Returns** groupid\_to\_items: maps a groupid to a list of items

**Return type** dict

**CommandLine:** python -m ubelt.util\_dict group\_items

### Example

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

ubelt.util\_dict.**dict\_hist** (*item\_list*, *weight\_list=None*, *ordered=False*, *labels=None*)

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

#### Parameters

- **item\_list** (*Iterable*) – hashable items (usually containing duplicates)
- **weight\_list** (*Iterable*) – corresponding weights for each item
- **ordered** (*bool*) – if True the result is ordered by frequency
- **labels** (*Iterable, optional*) – expected labels (default None) Allows this function to pre-initialize the histogram. If specified the frequency of each label is initialized to zero and item\_list can only contain items specified in labels.

#### Returns

dictionary where the keys are items in item\_list, and the values are the number of times the item appears in item\_list.

**Return type** dict

**CommandLine:** python -m ubelt.util\_dict dict\_hist

### Example

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

### Example

```
>>> import ubelt as ub
>>> item_list = [1, 2, 39, 900, 1232, 900, 1232, 2, 2, 2, 900]
>>> hist1 = ub.dict_hist(item_list)
>>> hist2 = ub.dict_hist(item_list, ordered=True)
>>> try:
>>>     hist3 = ub.dict_hist(item_list, labels=[])
```

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```

>>> except KeyError:
>>>     pass
>>> else:
>>>     raise AssertionError('expected key error')
>>> #result = ub.repr2(hist_)
>>> weight_list = [1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1]
>>> hist4 = ub.dict_hist(item_list, weight_list=weight_list)
>>> 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.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*) – hashable items possibly containing duplicates
- **k** (*int*) – only return items that appear at least *k* times (default=2)
- **key** (*Callable, optional*) – 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

**CommandLine:** `python -m ubelt.util_dict find_duplicates`

#### Example

```

>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> duplicates = ub.find_duplicates(items)
>>> print('items = %r' % (items,))
>>> print('duplicates = %r' % (duplicates,))
>>> assert duplicates == {0: [0, 1, 6], 2: [3, 8], 3: [4, 5]}
>>> assert ub.find_duplicates(items, 3) == {0: [0, 1, 6]}

```

#### Example

```

>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> # note: k can be 0
>>> 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.dict_subset(dict_, keys, default=NoParam)`

Get a subset of a dictionary

#### Parameters

- **dict\_** (*Mapping*) – superset dictionary
- **keys** (*Iterable*) – keys to take from *dict\_*
- **default** (*object, optional*) – if specified uses default if keys are missing

**Returns** subset dictionary

**Return type** OrderedDict

**SeeAlso:** `dict_isect` - similar functionality, but will only take existing 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_take(dict_, keys, default=NoParam)`

Generates values from a dictionary

#### Parameters

- **dict\_** (*Mapping*) – a dictionary to take from
- **keys** (*Iterable*) – the keys to take
- **default** (*object, optional*) – if specified uses default if keys are missing

**CommandLine:** `python -m ubelt.util_dict dict_take_gen`

### Example

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

```

`ubelt.util_dict.dict_union(*args)`

Combines the disjoint keys in multiple dictionaries. For intersecting keys, dictionaries towards the end of the sequence are given precedence.

**Parameters** `*args` – a sequence of dictionaries

**Returns** `OrderedDict` if the first argument is an `OrderedDict`, otherwise `dict`

**Return type** `Dict | OrderedDict`

**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

```

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

```

`ubelt.util_dict.dict_diff(*args)`

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

**Parameters** `*args` – a sequence of dictionaries (or sets of keys)

**Returns** `OrderedDict` if the first argument is an `OrderedDict`, otherwise `dict`

**Return type** `Dict | OrderedDict`

**Ignore:** `python -c "import ubelt; print(len(ubelt.__all__))"`

### Example

```

>>> dict_diff({'a': 1, 'b': 1}, {'a'}, {'c'})
{'b': 1}
>>> dict_diff(odict([('a', 1), ('b', 2)]), odict([('c', 3)]))
OrderedDict([('a', 1), ('b', 2)])
>>> dict_diff()
{}
>>> dict_diff({'a': 1, 'b': 2}, {'c'})

```

`ubelt.util_dict.dict_isect(*args)`

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

**Parameters** `*args` – a sequence of dictionaries (or sets of keys)

**Returns** `OrderedDict` if the first argument is an `OrderedDict`, otherwise `dict`

**Return type** `Dict | OrderedDict`

## Notes

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

```
>>> dict_isect({'a': 1, 'b': 2, 'c': 3}, ['a', 'c', 'd'])
{'a': 1, 'c': 3}
```

## Example

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

`ubelt.util_dict.map_vals(func, dict_)`

Transform a dictionary by applying a function to each value, while keeping the keys the same.

**Parameters**

- **func** (*callable*) – a function or indexable object
- **dict\_** (*dict*) – a dictionary

**Returns** transformed dictionary

**Return type** `newdict`

**CommandLine:** `xdoctest -m ubelt.util_dict map_vals`

## Example

```
>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> func = len
>>> newdict = ub.map_vals(func, dict_)
>>> assert newdict == {'a': 3, 'b': 0}
>>> print(newdict)
>>> # Can also use indexables as `func`
>>> dict_ = {'a': 0, 'b': 1}
>>> func = [42, 21]
>>> newdict = ub.map_vals(func, dict_)
>>> assert newdict == {'a': 42, 'b': 21}
>>> print(newdict)
```

`ubelt.util_dict.map_keys(func, dict_)`

Transform a dictionary by applying a function to each key, while keeping the values the same.

#### Parameters

- **func** (*callable*) – a function or indexable object
- **dict\_** (*dict*) – a dictionary

**Returns** transformed dictionary

**Return type** newdict

**CommandLine:** `xdoctest -m ubelt.util_dict map_keys`

#### 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: []}
>>> #ut.assert_raises(AssertionError, map_keys, len, dict_)
>>> dict_ = {0: [1, 2, 3], 1: []}
>>> func = ['a', 'b']
>>> newdict = ub.map_keys(func, dict_)
>>> print(newdict)
>>> assert newdict == {'a': [1, 2, 3], 'b': []}
>>> #ut.assert_raises(AssertionError, map_keys, len, dict_)
```

`ubelt.util_dict.invert_dict(dict_, unique_vals=True)`

Swaps the keys and values in a dictionary.

#### Parameters

- **dict\_** (*dict*) – dictionary to invert
- **unique\_vals** (*bool*) – if False, inverted keys are returned in a set. The default is True.

**Returns** inverted

**Return type** dict

#### Notes

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=True`, causing the inverted keys to be returned in a set.

**CommandLine:** `python -m ubelt.util_dict invert_dict`

#### 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'}}
```

#### 1.1.1.9 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, hash_prefix=None, hasher='sha512', chunk-size=8192, verbose=1)`

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** (*PathLike* | *io.BytesIO* | *trio.IO*) – The path to download to. Defaults to basename 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).
- **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*, *default*=2 \* 13\*) – Download chunksize.
- **verbose** (*int*, *default*=1) – Verbosity level 0 or 1.

**Returns** fpath - path to the downloaded file.

**Return type** PathLike

**Raises**

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

## Notes

Based largely on code in `pytorch`<sup>4</sup> with modifications influenced by other resources<sup>123</sup>.

## References

---

### Todo:

- [ ] fine-grained control of progress
- 

## 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 = download(url, file)
>>> file.seek(0)
>>> data = file.read()
>>> assert ub.hash_data(data, hasher='sha1').startswith('f79ea24571')
```

## Example

---

<sup>4</sup> <https://github.com/pytorch/pytorch/blob/2787f1d8edbd4aadd4a8680d204341a1d7112e2d/torch/hub.py#L347>

<sup>1</sup> <http://blog.molecule.com/2012/10/04/urlretrieve-progres-indicator/>

<sup>2</sup> <http://stackoverflow.com/questions/15644964/python-progress-bar-and-downloads>

<sup>3</sup> <http://stackoverflow.com/questions/16694907/how-to-download-large-file-in-python-with-requests-py>

```
>>> # 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=..., wall=...
```

## Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> # test download from girder
>>> import pytest
>>> import ubelt as ub
>>> 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', *\*\*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 to the file to download
- **fpath** (*PathLike*) – The full path to download the file to. If unspecified, the arguments *dpath* and *fname* are used to determine this.
- **dpath** (*PathLike*) – where to download the file. If unspecified *appname* is used to determine this. Mutually exclusive with *fpath*.
- **fname** (*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** (*bool*, *default*=True) – verbosity flag
- **appname** (*str*) – set *dpath* to `ub.get_app_cache_dir(appname)`. Mutually exclusive with *dpath* and *fpath*.
- **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.
- **\*\*download\_kw** – additional kwargs to pass to `ub.download`

**Returns** *fpath* - path to downloaded or cached file.

**Return type** *PathLike*

### 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
>>> fname = 'foo.bar'
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> prefix1 = '944389a39dfb8fa9'
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> stamp_fpath = fpath + '.hash'
>>> assert open(stamp_fpath, 'r').read() == 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
>>> open(stamp_fpath, 'w').write('corrupt-stamp')
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> assert open(stamp_fpath, 'r').read() == prefix1
>>> #
>>> # Check that a redownload occurs when the stamp is removed
>>> ub.delete(stamp_fpath)
>>> open(fpath, 'w').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'
>>> fpath = ub.grabdata(url2, fname=fname, hash_prefix=prefix2)
>>> assert open(stamp_fpath, 'r').read() == prefix2
```

#### 1.1.1.10 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.

```
ubelt.util_format.repr2(data, **kwargs)
    Makes a pretty and easy-to-doctest string representation!
```

This is an alternative to `repr`, and `pprint.pformat` that attempts to be both more configurable and generate output that is consistent between python versions.

## Notes

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 *Args* for more details.

### Parameters

- **data** (*object*) – an arbitrary python object
- **\*\*kwargs** – see *the Kwargs* section

### 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  $\{kl: vl, \dots\}$  to  $dict(kl=vl, \dots)$ .

**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

**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 ndarrays. if True includes the dtype.

**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

## Notes

**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

**CommandLine:** `python -m ubelt.util_format repr2:0 python -m ubelt.util_format repr2:1`

## Example

```
>>> from ubelt.util_format import *
>>> 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')]),
... }
>>> result = repr2(dict_, nl=3, precision=2); print(result)
>>> result = repr2(dict_, nl=2, precision=2); print(result)
>>> result = repr2(dict_, nl=1, precision=2); print(result)
>>> result = repr2(dict_, nl=1, precision=2, itemsep=',', explicit=True);
↪print(result)
>>> result = repr2(dict_, nl=1, precision=2, nobr=1, itemsep=',', explicit=True);
↪print(result)
>>> result = repr2(dict_, nl=3, precision=2, cbr=True); print(result)
>>> result = repr2(dict_, nl=3, precision=2, si=True); print(result)
>>> result = repr2(dict_, nl=3, sort=True); print(result)
>>> result = repr2(dict_, nl=3, sort=False, trailing_sep=False); print(result)
>>> result = repr2(dict_, nl=3, sort=False, trailing_sep=False, nobr=True);
↪print(result)
```

## Example

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

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```
>>> print('---')
>>> print(result)
```

**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)
>>> 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** (*type*)

Registers a custom formatting function with `ub.repr2`

**lookup** (*data*)

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

#### 1.1.1.11 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* function “injects” another function into a class instance as a method. This is useful for monkey patching.

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

The identity function. Simply returns the value of its first input.

All other inputs are ignored. Defaults to None if called without args.

#### Parameters

- **arg** (*object*, *default=None*) – some value
- **\*args** – ignored
- **\*\*kwargs** – ignored

**Returns** arg: the same value

**Return type** object

**CommandLine:** `xdoctest -m ubelt.util_func identity`

#### Example

```
>>> import ubelt as ub
>>> ub.identity(42)
42
>>> ub.identity(42, 42)
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** (*object*) – instance to inject a function into
- **func** (*func*) – the function to inject (must contain an arg for self)
- **name** (*str*) – name of the method. optional. If not specified the name of the function is used.

#### Example

```
>>> class Foo(object):
>>>     def bar(self):
>>>         return 'bar'
>>>     def baz(self):
>>>         return 'baz'
>>> self = Foo()
>>> assert self.bar() == 'bar'
>>> assert not hasattr(self, 'baz')
>>> inject_method(self, baz)
>>> assert not hasattr(Foo, 'baz'), 'should only change one instance'
>>> assert self.baz() == 'baz'
>>> inject_method(self, baz, 'bar')
>>> assert self.bar() == 'baz'
```

### 1.1.1.12 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 *ub.hash\_data* function recursively hashes most builtin python data structures.

The *ub.hash\_file* function hashes data on disk. Both of the aforementioned functions have options for different hashers and alphabets.

#### 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
>>> ub.hash_data(data, convert=False, hasher='sha512')
2ff39d0ecbf6ecc740ca7d...
```

#### 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.

---

`ubelt.util_hash.hash_data(data, hasher=NoParam, base=NoParam, types=False, hashlen=NoParam, 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* | *HASH*, *default*='sha512') – string code or a hash algorithm from hashlib.
- **base** (*List[str]* | *str*, *default*='hex') – list of symbols or shorthand key. Valid keys are 'abc', 'hex', and 'dec'.

- **types** (*bool*) – If True data types are included in the hash, otherwise only the raw data is hashed. Defaults to False.
- **hashlen** (*int*) – Maximum number of symbols in the returned hash. If not specified, all are returned. DEPRECATED. Use slice syntax instead.
- **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 over-write or define how different types of objects are hashed.

**Returns** text representing the hashed data

**Return type** str

## Notes

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])
hsrgqvfiuxvvhcdnypivhthmrolkzej
```

`ubelt.util_hash.hash_file` (*fpath*, *blocksize=65536*, *stride=1*, *hasher=NoParam*,  
*hashlen=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, default=2 \* 16\**) – Affects speed of reading file
- **stride** (*int, default=1*) – strides > 1 skip data to hash, useful for faster hashing, but less accurate, also makes hash dependant on blocksize.
- **hasher** (*str | HASH, default='sha512'*) – string code or a hash algorithm from hashlib.
- **hashlen** (*int*) – maximum number of symbols in the returned hash. If not specified, all are returned.
- **base** (*List[str] | str, default='hex'*) – list of symbols or shorthand key. Valid keys are 'abc', 'hex', and 'dec'.

## Notes

For better hashes keep `stride = 1` For faster hashes set `stride > 1` blocksize matters when `stride > 1`

## References

<http://stackoverflow.com/questions/3431825/md5-checksum-of-a-file>  
5001893/when-to-use-sha-1-vs-sha-2

<http://stackoverflow.com/questions/>

## Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> fpath = join(ub.ensure_app_cache_dir('ubelt'), 'tmp.txt')
>>> ub.writeto(fpath, 'foobar')
>>> print(ub.hash_file(fpath, hasher='sha1', base='hex'))
8843d7f92416211de9ebb963ff4ce28125932878
```

## Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> fpath = ub.touch(join(ub.ensure_app_cache_dir('ubelt'), 'empty_file'))
>>> # Test that the output is the same as shasum
>>> 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)
```

### 1.1.1.13 ubelt.util\_import module

Expose functions to simplify importing from module names and paths.

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

The `ub.import_module_from_name` works similarly.

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

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

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

Imports a module via its path

#### Parameters

- **modpath** (*PathLike*) – path to the module on disk or within a zipfile.
- **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** module

#### References

<https://stackoverflow.com/questions/67631/import-module-given-path>

#### Notes

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.py*

**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.

#### 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
>>> 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')
>>> open(external_modpath, 'w').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 module.__name__ == os.path.normpath('folder/bar')
>>> assert module.testvar == 1
```

### Doctest:

```
>>> 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.util_import.import_module_from_name(modname)`

Imports a module from its string name (`__name__`)

**Parameters** `modname` (*str*) – module name

**Returns** module

**Return type** module

### Example

```
>>> # test with modules that wont be imported in normal circumstances
>>> # todo write a test where we gaurentee 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.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*) – module filepath
- **hide\_init** (*bool*) – if False, `__init__.py` will be returned for packages
- **hide\_main** (*bool*) – if False, and `hide_init` is True, `__main__.py` will be returned for packages, if it exists.
- **sys\_path** (*list, default=None*) – if specified overrides `sys.path`

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

**Return type** str

#### 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')
>>> 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.

**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

```
>>> modpath = modname_to_modpath('_ctypes')
>>> modname = modpath_to_modname(modpath)
>>> assert modname == '_ctypes'
```

### Example

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

`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

**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)
```

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```
>>> assert recon == modpath
>>> assert rel_modpath == join('xdoctest', 'static_analysis.py')
```

#### 1.1.1.14 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.writeto(fpath, to_write, aslines=False, verbose=None)`

Writes (utf8) text to a file.

##### Parameters

- **fpath** (*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

**CommandLine:** `python -m ubelt.util_io writeto --verbose`

##### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = dpath + '/' + 'testwrite.txt'
>>> if exists(fpath):
>>>     os.remove(fpath)
>>> to_write = 'utf-8 symbols Δ, , , , , , , and .'
>>> 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
>>> 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']
>>> 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
```

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

Reads (utf8) text from a file.

**Parameters**

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

change file timestamps

Works like the touch unix utility

**Parameters**

- **fpath** (*PathLike*) – name of the file
- **mode** (*int*) – file permissions (python3 and unix only)
- **dir\_fd** (*file*) – 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** PathLike

**References**

<https://stackoverflow.com/questions/1158076/implement-touch-using-python>

**Example**

```
>>> import ubelt as ub
>>> 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 is does nothing.

**Parameters**

- **path** (*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. <https://github.com/hsoft/send2trash>

Doctest:

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

Doctest:

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

### 1.1.1.15 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. Obviously, any POSIX system work without difficulty.

**CommandLine:** `xdoctest -m ubelt.util_links __doc__:0`

### 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 symbolic link.

This will work on linux or windows, however windows does have some corner cases. For more details see notes in `ubelt._win32_links`.

#### Parameters

- **path** (*PathLike*) – path to real file or directory
- **link\_path** (*PathLike*) – path to desired location for symlink
- **overwrite** (*bool*) – 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. (default = False)
- **verbose** (*int*) – verbosity level (default=0)

**Returns** link path

**Return type** PathLike

**CommandLine:** `python -m ubelt.util_links symlink:0`

#### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'test_symlink0')
>>> real_path = join(dpath, 'real_file.txt')
>>> link_path = join(dpath, 'link_file.txt')
>>> [ub.delete(p) for p in [real_path, link_path]]
>>> ub.writeto(real_path, 'foo')
>>> result = symlink(real_path, link_path)
>>> assert ub.readfrom(result) == 'foo'
>>> [ub.delete(p) for p in [real_path, link_path]]
```

#### Example

```
>>> import ubelt as ub
>>> from os.path import dirname
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'test_symlink1')
>>> ub.delete(dpath)
>>> ub.ensuredir(dpath)
>>> _dirstats(dpath)
>>> real_dpath = ub.ensuredir((dpath, 'real_dpath'))
>>> link_dpath = ub.augpath(real_dpath, base='link_dpath')
>>> real_path = join(dpath, 'afile.txt')
>>> link_path = join(dpath, 'afile.txt')
>>> [ub.delete(p) for p in [real_path, link_path]]
>>> ub.writeto(real_path, 'foo')
>>> result = symlink(real_dpath, link_dpath)
>>> assert ub.readfrom(link_path) == 'foo', 'read should be same'
>>> ub.writeto(link_path, 'bar')
>>> _dirstats(dpath)
>>> assert ub.readfrom(link_path) == 'bar', 'very bad bar'
>>> assert ub.readfrom(real_path) == 'bar', 'changing link did not change real'
>>> ub.writeto(real_path, 'baz')
>>> _dirstats(dpath)
>>> assert ub.readfrom(real_path) == 'baz', 'very bad baz'
>>> assert ub.readfrom(link_path) == 'baz', 'changing real did not change link'
```

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```

>>> ub.delete(link_dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not exists(link_dpath), 'link should not exist'
>>> assert exists(real_path), 'real path should exist'
>>> _dirstats(dpath)
>>> ub.delete(dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not exists(real_path)

```

### 1.1.1.16 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*.

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

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*) – 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

---

**Todo:** should this handle the case when sequence is a string?

---

#### References

<http://stackoverflow.com/questions/434287/iterate-over-a-list-in-chunks>

**CommandLine:** `python -m ubelt.util_list chunks`

## 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]]
```

## Doctest:

```
>>> 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))) == 2
>>> assert len(list(ub.chunks([], 2, None, 'none'))) == 0
>>> assert len(list(ub.chunks([], 2, None, 'cycle'))) == 0
>>> assert len(list(ub.chunks([], 2, None, 'replicate'))) == 0
```

## Doctest:

```
>>> 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))
```

## Doctest:

```
>>> 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))
```

**static noborder** (*items*, *chunksize*)

**static cycle** (*items*, *chunksize*)

**static replicate** (*items*, *chunksize*)

**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

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

`ubelt.util_list.take(items, indices)`

Selects a subset of a list based on a list of indices. This is similar to `np.take`, but pure python.

#### Parameters

- **items** (*Sequence*) – an indexable object to select items from
- **indices** (*Iterable*) – sequence of indexing objects

**Returns** subset of the list

**Return type** Iterable or scalar

**SeeAlso:** `ub.dict_subset`

### Example

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

`ubelt.util_list.compress(items, flags)`

Selects items where the corresponding value in flags is True This is similar to `np.compress` and `it.compress`

#### Parameters

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

**Returns** a subset of masked items

**Return type** Iterable

### 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_list)`

Transforms a nested iterable into a flat iterable.

This is simply an alias for `itertools.chain.from_iterable`

**Parameters** `nested_list` (*Iterable[Iterable]*) – list of lists

**Returns** flattened items

**Return type** Iterable

### Example

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

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

Generates unique items in the order they appear.

#### Parameters

- **items** (*Iterable*) – list of items
- **key** (*Callable, optional*) – custom normalization function. If specified returns items where `key(item)` is unique.

**Yields** *object* – a unique item from the input sequence

**CommandLine:** `python -m utool.util_list --exec-unique_ordered`

### 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=six.text_type.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.argunique(items, key=None)`

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

#### Parameters

- **items** (*Sequence*) – indexable collection of items
- **key** (*Callable, optional*) – custom normalization function. If specified returns items where `key(item)` is unique.

**Yields** *int* – indices of the unique items

### Example

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

`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*) – indexable collection of items
- **key** (*Callable, optional*) – 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 = unique_flags(items)
>>> assert flags == [True, True, True, False, False, True, False]
>>> flags = unique_flags(items, key=lambda x: x % 2 == 0)
>>> assert flags == [True, False, True, False, False, False, False]
```

`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*) – list of integer indices
- **maxval** (*int*) – length of the returned list. If not specified this is inferred from *indices*

---

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

---

**Returns** mask: list of booleans. mask[idx] is True if idx in indices

**Return type** list

### 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]
```

`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*) – an iterable sequence
- **size** (*int*) – sliding window size (default = 2)
- **step** (*int*) – sliding step size (default = 1)
- **wrap** (*bool*) – wraparound (default = False)

**Returns** returns windows in a sequence

**Return type** iter

#### Example

```
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 1, True
>>> window_iter = 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

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

#### Example

```
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 2, False
>>> window_iter = iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = %r' % (window_list,))
window_list = [(1, 2, 3), (3, 4, 5)]
```

#### Example

```
>>> iterable = []
>>> size, step, wrap = 3, 2, False
>>> window_iter = iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = %r' % (window_list,))
window_list = []
```

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

Determine if all items in a sequence are the same

#### Parameters

- **iterable** (*Iterable*) – items to determine if they are all the same
- **eq** (*Callable, optional*) – function to determine equality (default: `operator.eq`)

#### Example

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

`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 or Mapping*) – indexable to sort by
- **key** (*Callable, optional*) – customizes the ordering of the indexable
- **reverse** (*bool, optional*) – if `True` returns in descending order

**Returns** indices: list of indices such that sorts the indexable

**Return type** list

#### 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
```

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```
>>> # 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.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 or Mapping*) – indexable to sort by
- **key** (*Callable, optional*) – customizes the ordering of the indexable

**CommandLine:** `python -m ubelt.util_list argmax`

#### Example

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

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

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

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

#### Parameters

- **indexable** (*Iterable or Mapping*) – indexable to sort by
- **key** (*Callable, optional*) – customizes the ordering of the indexable

#### Example

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

`ubelt.util_list.peek(iterable)`

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 (List[T])` – an iterable

**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

### 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
```

#### 1.1.1.17 ubelt.util\_memoize module

This module exposes decorators for in-memory caching of functional results.

Either *memoize*, *memoize\_method*, and *memoize\_property* should be used depending on what type of function is being wrapped. The following example demonstrates this.

### 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)
```

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```
>>> self = MyClass()
>>> self.my_method(1, 2)
>>> self.my_method(1, 2)
>>> self.my_property1
>>> self.my_property1
>>> self.my_property2
>>> self.my_property2
```

`ubelt.util_memoize.memoize` (*func*)  
memoization decorator that respects args and kwargs

## References

<https://wiki.python.org/moin/PythonDecoratorLibrary#Memoize>

**Parameters** `func` (*Callable*) – live python function

**Returns** memoized wrapper

**Return type** `func`

**CommandLine:** `xdoctest -m ubelt.util_memoize memoize`

## 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

<http://code.activestate.com/recipes/577452-a-memoize-decorator-for-instance-methods/>



## Example

```
>>> import ubelt as ub
>>> closure = {'a': 'b', 'c': 'd'}
>>> incr = [0]
>>> class Foo(object):
>>>     @memoize_method
>>>     def foo_memo(self, key):
>>>         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
```

`ubelt.util_memoize.memoize_property` (*fgget*)

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.

## Notes

implementation is a modified version of [1].

## References

..[1] <https://github.com/estebistec/python-memoized-property>

**CommandLine:** `xdoctest -m ubelt.util_memoize memoize_property`

### Example

```
>>> class C(object):
...     load_name_count = 0
...     @memoize_property
...     def name(self):
...         "name's docstring"
...         self.load_name_count += 1
...         return "the name"
...     @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
```

#### 1.1.1.18 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).

**CommandLine:** `xdoctest -m ubelt.util_mixins __doc__`

### 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')
>>> print('s1 = {}'.format(s1))
>>> print('s2 = {}'.format(s2))
s1 = <Student(Alice)>
s2 = <Student(Bob)>
```

## 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`

Defines `__str__` and `__repr__` in terms of `__nice__` function. Classes that inherit from *NiceRepr* must define `__nice__`.

## 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(None) 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)>'
```

### 1.1.1.19 ubelt.util\_path module

Functions for working with filesystem paths.

The *ensuredir* function operates like *mkdir -p* in unix.

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 *compressuser* function replaces your home directory with a tilde.

The *userhome* function reports the home directory of the current user of the operating system.

Even though ubelt is not at a 1.0.0 release, the above functions can be relied upon as stable, backwards compatible, and maintained. Other functions defined in this file may be deprecated or modified or unmaintained in the future.

`ubelt.util_path.augpath(path, suffix="", prefix="", ext=None, base=None, dpath=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** (*PathLike*) – a path to augment
- **suffix** (*str*, *default=''*) – placed between the basename and extension
- **prefix** (*str*, *default=''*) – placed in front of the basename
- **ext** (*str*, *optional*) – if specified, replaces the extension
- **base** (*str*, *optional*) – if specified, replaces the basename without extension
- **dpath** (*PathLike*, *optional*) – if specified, replaces the directory
- **multidot** (*bool*, *default=False*) – 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** PathLike

#### 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

```
>>> augpath('foo.bar')
'foo.bar'
>>> augpath('foo.bar', ext='.BAZ')
'foo.BAZ'
```

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```

>>> 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

```

`ubelt.util_path.userhome` (*username=None*)

Returns the user's home directory. If *username* is None, this is the directory for the current user.

**Parameters** *username* (*str*) – name of a user on the system

**Returns** `userhome_dpath`: path to the home directory

**Return type** PathLike

### Example

```

>>> import getpass
>>> username = getpass.getuser()
>>> assert userhome() == expanduser('~')
>>> assert userhome(username) == expanduser('~')

```

`ubelt.util_path.compressuser` (*path, home='~'*)

Inverse of `os.path.expanduser`

**Parameters**

- **path** (*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 tilde

**Return type** PathLike

### Example

```

>>> path = expanduser('~')
>>> assert path != '~'
>>> assert compressuser(path) == '~'
>>> assert compressuser(path + '1') == path + '1'
>>> assert compressuser(path + '/1') == join('~', '1')
>>> assert compressuser(path + '/1', '$HOME') == join('$HOME', '1')

```

`ubelt.util_path.expandpath` (*path*)

Wrapper around `expanduser` and `expandvars`.

Less aggressive than `truepath`. Only expands environs and tilde. Does not change relative paths to absolute paths.

**Parameters** `path` (*PathLike*) – string representation of a path

**Returns** expanded path

**Return type** `PathLike`

### Example

```
>>> import ubelt as ub
>>> assert normpath(ub.expandpath('~foo')) == join(ub.userhome(), 'foo')
>>> assert ub.expandpath('foo') == 'foo'
```

`ubelt.util_path.truepath(path, real=False)`

Normalizes a string representation of a path and does shell-like expansion.

**Parameters**

- `path` (*PathLike*) – string representation of a path
- `real` (*bool*) – if True, all symbolic links are followed. (default: False)

**Returns** normalized path

**Return type** `PathLike`

---

**Note:** This function is similar to the composition of `expanduser`, `expandvars`, `normpath`, and (`realpath` if *real* else `abspath`). However, on windows backslashes are then replaced with forward slashes to offer a consistent unix-like experience across platforms.

On windows `expanduser` will expand environment variables formatted as `%name%`, whereas on unix, this will not occur.

---

### Example

```
>>> import ubelt as ub
>>> assert ub.truepath('~foo') == join(ub.userhome(), 'foo')
>>> assert ub.truepath('~foo') == ub.truepath('~foo/bar/..')
>>> assert ub.truepath('~foo', real=True) == ub.truepath('~foo')
```

`ubelt.util_path.ensuredir(dpath, mode=1023, verbose=None)`

Ensures that directory will exist. Creates new dir with sticky bits by default

**Parameters**

- `dpath` (*PathLike*) – dir to ensure. Can also be a tuple to send to join
- `mode` (*int*) – octal mode of directory (default 0o1777)
- `verbose` (*int*) – verbosity (default 0)

**Returns** path: the ensured directory

**Return type** `PathLike`

### Notes

This function is not thread-safe in Python2

### Example

```
>>> from ubelt.util_platform 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)
```

**class** `ubelt.util_path.TempDir`

Bases: `object`

Context for creating and cleaning up temporary directories.

### Example

```
>>> with TempDir() as self:
>>>     dpath = self.dpath
>>>     assert exists(dpath)
>>>     assert not exists(dpath)
```

### Example

```
>>> self = TempDir()
>>> dpath = self.ensure()
>>> assert exists(dpath)
>>> self.cleanup()
>>> assert not exists(dpath)
```

**ensure()**

**cleanup()**

**start()**

#### 1.1.1.20 ubelt.util\_platform module

The goal of this module is to provide an idomatic cross-platform pattern of accessing platform dependant file systems. Standard application directory structure: cache, config, and other XDG standards [1].

### Notes

Table mapping the type of directory to the system default environment variable. Inspired by [2,3,4].

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  
 XDG\_DATA\_HOME = ~/.local/share XDG\_CACHE\_HOME = ~/.cache XDG\_CONFIG\_HOME = ~/.config

## References

..[1] <https://specifications.freedesktop.org/basedir-spec/basedir-spec-latest.html> ..[2] <https://stackoverflow.com/questions/43853548/xdg-windows> ..[3] <https://stackoverflow.com/questions/11113974/cross-plat-path> ..[4] <https://github.com/harawata/appdirs#supported-directories>

`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** PathLike

`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 cahce dir used by the current operating system

**Return type** PathLike

`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** PathLike

`ubelt.util_platform.get_app_data_dir(appname, *args)`

Returns a writable directory for an application. This should be used for temporary deletable 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** PathLike

**SeeAlso:** `ensure_app_data_dir`

`ubelt.util_platform.ensure_app_data_dir(appname, *args)`

Calls `get_app_data_dir` but ensures the directory exists.

### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**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_config_dir(appname, *args)`

Returns a writable directory for an application. This should be used for persistent configuration files.

#### 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** PathLike

**SeeAlso:** `ensure_app_config_dir`

`ubelt.util_platform.ensure_app_config_dir(appname, *args)`

Calls `get_app_config_dir` but ensures the directory exists.

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**SeeAlso:** `get_app_config_dir`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_config_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.

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns** dpath: writable cache directory for this application

**Return type** PathLike

**SeeAlso:** `ensure_app_cache_dir`

`ubelt.util_platform.ensure_app_cache_dir(appname, *args)`

Calls `get_app_cache_dir` but ensures the directory exists.

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**SeeAlso:** `get_app_cache_dir`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.util_platform.startfile(fpath, verbose=True)`

Uses default program defined by the system to open a file. This is done via *os.startfile* on windows, *open* on mac, and *xdg-open* on linux.

#### Parameters

- **fpath** (*PathLike*) – a file to open using the program associated with the files extension type.
- **verbose** (*int*) – verbosity

### References

<http://stackoverflow.com/questions/2692873/quote-posix>

#### DisableExample:

```
>>> # This test interacts with a GUI frontend, not sure how to test.
>>> import ubelt as ub
>>> base = ub.ensure_app_cache_dir('ubelt')
>>> fpath1 = join(base, 'test_open.txt')
>>> ub.touch(fpath1)
>>> proc = ub.startfile(fpath1)
```

`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*) – globstr of matching filename
- **multi** (*bool*) – if True return all matches instead of just the first. Defaults to False.
- **path** (*str or Iterable[PathLike]*) – overrides the system PATH variable.

**Returns** returns matching executable(s).

**Return type** PathLike or List[PathLike] or None

**SeeAlso:** `shutil.which` - which is available in Python 3.3+.

### Notes

This is essentially the *which* UNIX command

### References

<https://stackoverflow.com/questions/377017/test-if-executable-exists-in-python/377028#377028> <https://docs.python.org/dev/library/shutil.html#shutil.which>

### Example

```
>>> find_exe('ls')
>>> find_exe('ping')
>>> assert find_exe('which') == find_exe(find_exe('which'))
>>> find_exe('which', multi=True)
>>> find_exe('ping', multi=True)
>>> find_exe('cmake', multi=True)
>>> find_exe('nvcc', multi=True)
>>> find_exe('noexist', multi=True)
```

### Example

```
>>> assert not find_exe('noexist', multi=False)
>>> assert find_exe('ping', multi=False)
>>> assert not find_exe('noexist', multi=True)
>>> assert find_exe('ping', multi=True)
```

### Benchmark:

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> import shutil
>>> for timer in ub.Timerit(100, bestof=10, label='ub.find_exe'):
>>>     ub.find_exe('which')
>>> for timer in ub.Timerit(100, bestof=10, label='shutil.which'):
>>>     shutil.which('which')
Timed best=58.71 µs, mean=59.64 ± 0.96 µs for ub.find_exe
Timed best=72.75 µs, mean=73.07 ± 0.22 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

- **fname** (*PathLike* or *str*) – file name to match. If `exact` is `False` this may be a glob pattern
- **path** (*str* or *Iterable[PathLike]*) – 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** *PathLike* – candidate: a path that matches *name*

### Notes

Running with `name=''` (i.e. `ub.find_path('')`) will simply yield all directories in your `PATH`.

### Notes

For recursive behavior set `path=(d for d, _, _ in os.walk('.'))`, where `'.'` might be replaced by the root directory of interest.

### Example

```
>>> list(find_path('ping', exact=True))
>>> list(find_path('bin'))
>>> list(find_path('bin'))
>>> list(find_path('*cc*'))
>>> list(find_path('cmake*'))
```

### Example

```
>>> import ubelt as ub
>>> from os.path import dirname
>>> path = dirname(dirname(ub.util_platform.__file__))
>>> res = sorted(find_path('ubelt/util_*.py', path=path))
>>> assert len(res) >= 10
>>> res = sorted(find_path('ubelt/util_platform.py', path=path, exact=True))
>>> print(res)
>>> assert len(res) == 1
```

`ubelt.util_platform.editfile(fpath, verbose=True)`

DEPRICATED: This has been ported to xdev, please use that version.

Opens a file or code corresponding to a live python object in your preferred visual editor. This function is mainly useful in an interactive IPython session.

The visual editor is determined by the *VISUAL* environment variable. If this is not specified it defaults to gvim.

#### Parameters

- **fpath** (*PathLike*) – a file path or python module / function
- **verbose** (*int*) – verbosity

#### DisableExample:

```
>>> # This test interacts with a GUI frontend, not sure how to test.
>>> import ubelt as ub
>>> ub.editfile(ub.util_platform.__file__)
>>> ub.editfile(ub)
>>> ub.editfile(ub.editfile)
```

`ubelt.util_platform.platform_resource_dir()`

Alias for `platform_cache_dir`

DEPRICATED in favor of `platform_config_dir` / `platform_data_dir`

Returns a directory which should be writable for any application This should be used for persistent configuration files.

**Returns** path to the resource dir used by the current operating system

**Return type** `PathLike`

`ubelt.util_platform.get_app_resource_dir(appname, *args)`

Returns a writable directory for an application This should be used for persistent configuration files.

DEPRICATED in favor of `get_app_config_dir` / `get_app_data_dir`

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns** dpath: writable resource directory for this application

**Return type** PathLike

**SeeAlso:** ensure\_app\_resource\_dir

`ubelt.util_platform.ensure_app_resource_dir(appname, *args)`  
Calls `get_app_resource_dir` but ensures the directory exists.

DEPRICATED in favor of `ensure_app_config_dir` / `ensure_app_data_dir`

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**SeeAlso:** get\_app\_resource\_dir

### 1.1.1.21 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*) – prefix to add to each line (default = '')

**Returns** indented text

**Return type** str

**CommandLine:** python -m util\_str indent

#### Example

```
>>> from ubelt.util_str import * # NOQA
>>> NL = chr(10) # newline character
>>> text = 'Lorem ipsum' + NL + 'dolor sit amet'
>>> prefix = '    '
>>> result = indent(text, prefix)
>>> assert all(t.startswith(prefix) for t in result.split(NL))
```

`ubelt.util_str.codeblock (block_str)`

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** `block_str (str)` – typically in the form of a multiline string

**Returns** the unindented string

**Return type** `str`

**CommandLine:** `python -m ubelt.util_str codeblock`

### Example

```
>>> from ubelt.util_str import * # NOQA
>>> # Simulate an indented part of code
>>> if True:
>>>     # notice the indentation on this will be normal
>>>     codeblock_version = 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 (block_str)`

Wraps multi-line strings and restructures the text to remove all newlines, heading, trailing, and double spaces.

Useful for writing log messages

**Parameters** `block_str (str)` – typically in the form of a multiline string

**Returns** the reduced text block

**Return type** `str`

**CommandLine:** `xdoctest -m ubelt.util_str paragraph`

### Example

```
>>> from ubelt.util_str import * # NOQA
>>> block_str = (
>>>     '''
>>>     Lorem ipsum dolor sit amet, consectetur adipiscing
>>>     elit, sed do eiusmod tempor incididunt ut labore et
```

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```

>>>     dolore magna aliqua.
>>>     '''
>>> out = paragraph(block_str)
>>> assert chr(10) in block_str
>>> assert chr(10) not in out
>>> print('block_str = {!r}'.format(block_str))
>>> 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*) – separator (defaults to “”)

**CommandLine:** `python -m ubelt.util_str hzcat`

#### 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:

```

>>> from ubelt.util_str import *
>>> import ubelt as ub
>>> import unicodedata
>>> aa = unicodedata.normalize('NFD', 'á') # a unicode char with len2
>>> B = ub.repr2(['θ', aa], [aa, aa, aa], nl=1, si=True, cbr=True,
↳trailsep=False)
>>> C = ub.repr2([[5, 6], [7, 'θ']], nl=1, si=True, cbr=True, trailsep=False)
>>> args = ['A', '=', B, '*', C]
>>> print(ub.hzcat(args, sep=' '))
A=[θ, á],      *[[5, 6],
  [á, á, á]]   [7, θ]]

```

`ubelt.util_str.ensure_unicode (text)`

Casts bytes into utf8 (mostly for python2 compatibility)

#### References

<http://stackoverflow.com/questions/12561063/extract-data-from-file>

## Example

```
>>> from ubelt.util_str import *
>>> import codecs # NOQA
>>> assert ensure_unicode('my ünïcôdé string') == 'my ünïcôdé 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')
```

### 1.1.1.22 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: `_io.StringIO`

An IO object that writes to itself and another IO stream.

**Variables** `redirect` (`io.IOBase`) – The other stream to write to.

## Example

```
>>> redirect = io.StringIO()
>>> self = TeeStringIO(redirect)
```

**isatty()**

Returns true if the redirect is a terminal.

## Notes

Needed for IPython.embed to work properly when this class is used to override stdout / stderr.

**encoding**

Gets the encoding of the *redirect* IO object

**Doctest:**

```
>>> redirect = io.StringIO()
>>> assert TeeStringIO(redirect).encoding is None
>>> assert TeeStringIO(None).encoding is None
>>> assert TeeStringIO(sys.stdout).encoding is sys.stdout.encoding
>>> redirect = io.TextIOWrapper(io.StringIO())
>>> assert 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.CaptureStream`

Bases: `object`

Generic class for capturing streaming output from stdout or stderr

**class** `ubelt.util_stream.CaptureStdout` (*supress=True, enabled=True*)

Bases: `ubelt.util_stream.CaptureStream`

Context manager that captures stdout and stores it in an internal stream

#### Parameters

- **supress** (*bool, default=True*) – if True, stdout is not printed while captured
- **enabled** (*bool, default=True*) – does nothing if this is False

#### Example

```
>>> self = CaptureStdout(supress=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, six.text_type)
>>> assert self.text == text + '\n', 'failed capture text'
```

#### Example

```
>>> self = CaptureStdout(supress=False)
>>> with self:
...     print('I am captured and printed in stdout')
>>> assert self.text.strip() == 'I am captured and printed in stdout'
```

#### Example

```
>>> self = CaptureStdout(supress=True, enabled=False)
>>> with self:
...     print('dont capture')
>>> assert self.text is None
```

**log\_part()**

Log what has been captured so far

**start()**

**stop()**

**Doctest:**

```
>>> CaptureStdout(enabled=False).stop()
>>> CaptureStdout(enabled=True).stop()
```

**close()**

### 1.1.1.23 ubelt.util\_time module

Timerit now exists in a standalone pip-installable module. The source code lives in its own github repo here: <https://github.com/Erotemic/timerit>

#### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> import math
>>> import ubelt as ub
>>> timer = ub.Timer('Timer demo!', verbose=1)
>>> with timer:
>>>     math.factorial(100000)
tic('Timer demo!')
...toc('Timer demo!')=0.1453s
```

#### Example

```
>>> # xdoctest: +IGNORE_WANT
>>> import math
>>> import ubelt as ub
>>> for _ in ub.Timerit(num=200, verbose=3):
>>>     math.factorial(10000)
Timing for 200 loops
Timed for: 200 loops, best of 3
    time per loop: best=2.055 ms, mean=2.145 ± 0.083 ms
```

`ubelt.util_time.timestamp(method='iso8601')`  
make an iso8601 timestamp suitable for use in filenames

**Parameters** `method` (*str*; *default='iso8601'*) – type of timestamp

#### Example

```
>>> stamp = timestamp()
>>> print('stamp = {!r}'.format(stamp))
stamp = ...-...-...T...
```

**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*) – identifier for printing, defaults to ""
- **verbose** (*int*) – verbosity flag, defaults to True if label is given
- **newline** (*bool*) – if False and verbose, print tic and toc on the same line, defaults to True

#### Variables

- **elapsed** (*float*) – number of seconds measured by the context manager
- **tstart** (*float*) – time of last *tic* reported by *self.\_time()*

**CommandLine:** python -m timerit.core Timer

### Example

```
>>> # Create and start the timer using the context manager
>>> import math
>>> from timerit import Timer
>>> timer = Timer('Timer test!', verbose=1)
>>> with timer:
>>>     math.factorial(10000)
>>> assert timer.elapsed > 0
tic('Timer test!')
...toc('Timer test!')=...
```

### Example

```
>>> # Create and start the timer using the tic/toc interface
>>> from timerit import Timer
>>> 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.util\_time.**Timerit** (*num=1, label=None, bestof=3, unit=None, verbose=None*)

Bases: object

Reports the average time to run a block of code.

Unlike *timeit*, *Timerit* can handle multiline blocks of code

#### Parameters

- **num** (*int*) – number of times to run the loop
- **label** (*str*) – identifier for printing
- **bestof** (*int*) – takes the max over this number of trials
- **verbose** (*int*) – verbosity flag, defaults to True if label is given

**CommandLine:** python -m timerit.core Timerit:0

### Example

```
>>> from timerit import Timerit
>>> import math
>>> num = 15
>>> t1 = Timerit(num, label='factorial', verbose=1)
```

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```

>>> for timer in t1:
>>>     # <write untimed setup code here> this example has no setup
>>>     with timer:
>>>         # <write code to time here> for example...
>>>         math.factorial(10000)
Timed best=..., mean=... for factorial
>>> # <you can now access Timerit attributes>
>>> assert t1.total_time > 0
>>> assert t1.n_loops == t1.num
>>> assert t1.n_loops == num

```

## Example

```

>>> # xdoc: +IGNORE_WANT
>>> import math
>>> from timerit import Timerit
>>> num = 10
>>> # If the timer object is unused, time will still be recorded,
>>> # but with less precision.
>>> for _ in Timerit(num, 'concise', verbose=2):
>>>     math.factorial(10000)
Timed concise for: 10 loops, best of 3
    time per loop: best=4.954 ms, mean=4.972 ± 0.018 ms
>>> # Using the timer object results in the most precise timings
>>> for timer in Timerit(num, 'precise', verbose=3):
>>>     with timer: math.factorial(10000)
Timing precise for: 15 loops, best of 3
Timed precise for: 15 loops, best of 3
    time per loop: best=2.474 ms, mean=2.54 ± 0.046 ms

```

**reset** (*label=None*)

clears all measurements, allowing the object to be reused

**Parameters** *label* (*str*; *optional*) – optionally change the label

## Example

```

>>> from timerit import Timerit
>>> import math
>>> ti = Timerit(num=10, unit='us', verbose=True)
>>> _ = ti.reset(label='10!').call(math.factorial, 10)
Timed best=...s, mean=...s for 10!
>>> _ = ti.reset(label='20!').call(math.factorial, 20)
Timed best=...s, mean=...s for 20!
>>> _ = ti.reset().call(math.factorial, 20)
Timed best=...s, mean=...s for 20!

```

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

Alternative way to time a simple function call using condensed syntax.

## Returns

Use *min*, or *mean* to get a scalar. Use *print* to output a report to stdout.

**Return type** self (*Timerit*)

### Example

```
>>> import math
>>> time = Timerit(num=10).call(math.factorial, 50).min()
>>> assert time > 0
```

#### **min()**

The best time overall.

This is typically the best metric to consider when evaluating the execution time of a function. To understand why consider this quote from the docs of the original timeit module:

“In a typical case, the lowest value gives a lower bound for how fast your machine can run the given code snippet; higher values in the result vector are typically not caused by variability in Python’s speed, but by other processes interfering with your timing accuracy. So the min() of the result is probably the only number you should be interested in.”

**Returns** minimum measured seconds over all trials

**Return type** float

### Example

```
>>> import math
>>> self = Timerit(num=10, verbose=0)
>>> self.call(math.factorial, 50)
>>> assert self.min() > 0
```

#### **mean()**

The mean of the best results of each trial.

**Returns** mean of measured seconds

**Return type** float

**Note:** This is typically less informative than simply looking at the min. It is recommended to use min as the expectation value rather than mean in most cases.

### Example

```
>>> import math
>>> self = Timerit(num=10, verbose=0)
>>> self.call(math.factorial, 50)
>>> assert self.mean() > 0
```

#### **std()**

The standard deviation of the best results of each trial.

**Returns** standard deviation of measured seconds

**Return type** float

**Note:** As mentioned in the timeit source code, the standard deviation is not often useful. Typically the minimum value is most informative.

### Example

```
>>> import math
>>> self = Timerit(num=10, verbose=1)
>>> self.call(math.factorial, 50)
>>> assert self.std() >= 0
```

**report** (*verbose=1*)

Creates a human readable report

**Parameters** **verbose** (*int*) – verbosity level. Either 1, 2, or 3.

**Returns** the report

**Return type** str

**SeeAlso:** Timerit.print

### Example

```
>>> import math
>>> ti = Timerit(num=1).call(math.factorial, 5)
>>> print(ti.report(verbose=1))
Timed best=...s, mean=...s
```

**print** (*verbose=1*)

Prints human readable report using the print function

**Parameters** **verbose** (*int*) – verbosity level

**SeeAlso:** Timerit.report

### Example

```
>>> import math
>>> Timerit(num=10).call(math.factorial, 50).print(verbose=1)
Timed best=...s, mean=...s
>>> Timerit(num=10).call(math.factorial, 50).print(verbose=2)
Timed for: 10 loops, best of 3
    time per loop: best=...s, mean=...s
>>> Timerit(num=10).call(math.factorial, 50).print(verbose=3)
Timed for: 10 loops, best of 3
    body took: ...
    time per loop: best=...s, mean=...s
```

## 1.1.2 Module contents

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

- Timing
- Caching
- Hashing

- Command Line / Shell Interaction
- Cross-Platform Cache, Config, and Data Directories
- Symlinks
- Downloading Files
- Dictionary Histogram
- Find Duplicates
- Dictionary Manipulation
- AutoDict - Autovivification
- String-based imports
- Horizontal String Concatenation
- **Standalone modules.**
  - `progiter` for Loop Progress
  - `timerit` for Robust Timing and Benchmarking
  - `ordered-set` for ordered set collections

For more detailed high level documentation see the README on github: <https://github.com/Erotemic/ubelt>. For demos see the [Jupyter notebook](#).

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. Please see specific submodule documentation for more details.

**AutogenInit:** `mkinit ubelt -w # todo: get sphinx to ignore this`

**class** `ubelt.AutoDict`

Bases: `dict`

An infinitely nested default dict of dicts.

Implementation of Perl's autovivification feature.

**SeeAlso:** `ub.AutoOrderedDict` - the ordered version

## References

<http://stackoverflow.com/questions/651794/init-dict-of-dicts>

## 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: `collections.OrderedDict`, `ubelt.util_dict.AutoDict`

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

**SeeAlso:** `ub.AutoDict` - the unordered version

### 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*)

Bases: `object`

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

Writes a file that marks that a procedure has been done by writing a “stamp” file to disk. Removing the stamp file will force recomputation. However, removing or changing the result of the computation may not trigger recomputation unless specific handling is done or the expected “product” of the computation is a file and registered with the stamper. If *hasher* is `None`, we only check if the product exists, and we ignore its hash, otherwise it checks that the hash of the product is the same.

#### Parameters

- **fname** (*str*) – Name of the stamp file
- **cfgstr** (*str*) – Configuration associated with the stamped computation. A common pattern is to call `ubelt.hash_data` on a dependency list.
- **dpath** (*PathLike*) – Where to store the cached stamp file
- **product** (*PathLike* or *Sequence[PathLike]*, *optional*) – 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. Defaults to `sha1`.
- **verbose** (*bool*, *default=None*) – Passed to internal `ub.Cacher` object
- **enabled** (*bool*, *default=True*) – if `False`, expired always returns `True`



## Example

```

>>> import ubelt as ub
>>> from os.path import join
>>> # Stamp the computation of expensive-to-compute.txt
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'test-cache-stamp')
>>> ub.delete(dpath)
>>> ub.ensuredir(dpath)
>>> product = join(dpath, 'expensive-to-compute.txt')
>>> self = CacheStamp('somedata', cfgstr='someconfig', dpath=dpath,
>>>                   product=product, hasher=None)
>>> self.hasher = None
>>> if self.expired():
>>>     ub.writeto(product, 'very expensive')
>>>     self.renew()
>>> assert not self.expired()
>>> # corrupting the output will not expire in non-robust mode
>>> ub.writeto(product, 'corrupted')
>>> assert not self.expired()
>>> self.hasher = 'sha1'
>>> # but it will expire if we are in robust mode
>>> assert self.expired()
>>> # deleting the product will cause expiration in any mode
>>> self.hasher = None
>>> ub.delete(product)
>>> assert self.expired()

```

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

Check to see if a previously existing stamp is still valid and if the expected result of that computation still exists.

### Parameters

- **cfgstr** (*str*, optional) – overrides the instance-level cfgstr
- **product** (*PathLike* or *Sequence[PathLike]*, optional) – override the default product if specified

**Returns** True if the stamp is invalid or does not exist.

**Return type** bool

**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, cfgstr=None, dpath=None, appname='ubelt', ext='.pkl', meta=None, verbose=None, enabled=True, log=None, hasher='sha1', protocol=2)

Bases: object

Cacher designed to be quickly integrated into existing scripts.

### Parameters

- **fname** (*str*) – A file name. This is the prefix that will be used by the cache. It will always be used as-is.
- **cfgstr** (*str*) – Indicates the state. Either this string or a hash of this string will be used to identify the cache. A cfgstr should always be reasonably readable, thus it is good practice

to hash extremely detailed *cfgstrs* to a reasonable readable level. Use *meta* to store make original details persist.

- **dpath** (*PathLike*) – Specifies where to save the cache. If unspecified, Cacher defaults to an application resource dir as given by *appname*.
- **appname** (*str*, *default*='ubelt') – Application name Specifies a folder in the application resource directory where to cache the data if *dpath* is not specified.
- **ext** (*str*, *default*='.pkl') – File extension for the cache format
- **meta** (*object*) – Metadata that is also saved with the *cfgstr*. This can be useful to indicate how the *cfgstr* was constructed.
- **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** (*func*) – Overloads the print function. Useful for sending output to loggers (e.g. logging.info, tqdm.tqdm.write, ...)
- **hasher** (*str*) – Type of hashing algorithm to use if *cfgstr* needs to be condensed to less than 49 characters.
- **protocol** (*int*, *default*=2) – Protocol version used by pickle. If python 2 compatibility is not required, then it is better to use protocol 4.

**CommandLine:** python -m ubelt.util\_cache Cacher

### Example

```
>>> import ubelt as ub
>>> cfgstr = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = ub.Cacher('test_process', cfgstr)
>>> cacher.clear()
>>> 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 a tuple named data
>>>     data = myvar1, myvar2
>>>     cacher.save(data)
>>> # Last part of the Cacher pattern is to unpack the data tuple
>>> myvar1, myvar2 = data
```

### Example

```
>>> # The previous example can be shorted if only a single value
>>> from ubelt.util_cache import Cacher
>>> cfgstr = 'repr-of-params-that-uniquely-determine-the-process'
>>> # Create a cacher and try loading the data
>>> cacher = Cacher('test_process', cfgstr)
>>> myvar = cacher.tryload()
```

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```
>>> 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

**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, optional*) – overrides the instance-level cfgstr

**Returns** PathLike

### Example

```
>>> from ubelt.util_cache import Cacher
>>> import pytest
>>> with pytest.warns(UserWarning):
>>>     cacher = Cacher('test_cacher1')
>>>     cacher.get_fpath()
>>> self = Cacher('test_cacher2', cfgstr='cfg1')
>>> self.get_fpath()
>>> self = Cacher('test_cacher3', cfgstr='cfg1' * 32)
>>> self.get_fpath()
```

**exists** (cfgstr=None)

Check to see if the cache exists

**Parameters** **cfgstr** (*str, optional*) – overrides the instance-level cfgstr

**existing\_versions** ()

Returns data with different cfgstr values that were previously computed with this cacher.

### Example

```
>>> from ubelt.util_cache import Cacher
>>> # Ensure that some data exists
>>> known_fnames = set()
>>> cacher = Cacher('versioned_data', cfgstr='1')
>>> cacher.ensure(lambda: 'data1')
>>> known_fnames.add(cacher.get_fpath())
>>> cacher = Cacher('versioned_data', cfgstr='2')
>>> cacher.ensure(lambda: 'data2')
>>> known_fnames.add(cacher.get_fpath())
>>> # List previously computed configs for this type
>>> from os.path import basename
>>> cacher = Cacher('versioned_data', cfgstr='2')
>>> exist_fpaths = set(cacher.existing_versions())
>>> exist_fnames = list(map(basename, exist_fpaths))
>>> print(exist_fnames)
>>> assert exist_fpaths == known_fnames
```

```
['versioned_data_1.pkl', 'versioned_data_2.pkl']
```

**clear** (*cfgstr=None*)

Removes the saved cache and metadata from disk

**Parameters** *cfgstr* (*str, optional*) – 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, optional*) – 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.

**load** (*cfgstr=None*)

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

**Parameters** *cfgstr* (*str, optional*) – overrides the instance-level *cfgstr*

**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)
>>> 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(cfgstr)*.

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, optional*) – overrides the instance-level *cfgstr*

### Example

```
>>> from ubelt.util_cache import * # NOQA
>>> # Normal functioning
>>> cfgstr = 'long-cfg' * 32
>>> cacher = Cacher('test_enabled_save', cfgstr)
>>> cacher.save('data')
>>> assert exists(cacher.get_fpath()), 'should be enabeled'
>>> 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)
>>> 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'
>>> cfgstr = 'func params'
>>> cacher = Cacher(fname, cfgstr)
>>> cacher.clear()
>>> data1 = cacher.ensure(func)
>>> data2 = cacher.ensure(func)
>>> assert data1 == 'expensive result'
>>> assert data1 == data2
>>> cacher.clear()
```

**class** `ubelt.CaptureStdout` (*supress=True, enabled=True*)

Bases: `ubelt.util_stream.CaptureStream`

Context manager that captures stdout and stores it in an internal stream

#### Parameters

- **supress** (*bool, default=True*) – if True, stdout is not printed while captured
- **enabled** (*bool, default=True*) – does nothing if this is False

#### Example

```
>>> self = CaptureStdout(supress=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, six.text_type)
>>> assert self.text == text + '\n', 'failed capture text'
```

#### Example

```
>>> self = CaptureStdout(supress=False)
>>> with self:
...     print('I am captured and printed in stdout')
>>> assert self.text.strip() == 'I am captured and printed in stdout'
```

## Example

```
>>> self = CaptureStdout(supress=True, enabled=False)
>>> with self:
...     print('dont capture')
>>> assert self.text is None
```

**log\_part()**

Log what has been captured so far

**start()**

**stop()**

**Doctest:**

```
>>> CaptureStdout(enabled=False).stop()
>>> CaptureStdout(enabled=True).stop()
```

**close()**

**class ubelt.CaptureStream**

Bases: object

Generic class for capturing streaming output from stdout or stderr

**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)
```

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```
>>> 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** (*type*)Registers a custom formatting function with `ub.repr2`**lookup** (*data*)Returns an appropriate function to format *data* if one has been registered.**class** `ubelt.NiceRepr`Bases: `object`Defines `__str__` and `__repr__` in terms of `__nice__` function. Classes that inherit from *NiceRepr* must define `__nice__`

### 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(None) 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)>'
```

**class** `ubelt.OrderedSet` (*iterable=None*)Bases: `collections.abc.MutableSet`, `collections.abc.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
```

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```
>>> print(oiset)
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**

```
>>> oiset = OrderedSet([1, 2, 3])
>>> oiset.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**

```
>>> oiset = OrderedSet([1, 2, 3])
>>> oiset.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**

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

**pop** ()

Remove and return the last element from the set.

Raises `KeyError` if the set is empty.

**Example**

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

```
>>> 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.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, enabled=True, verbose=None, stream=None, chunksize=None, \*\*kwargs*)

Bases: progiter.progiter.\_TQDMCompat, progiter.progiter.\_BackwardsCompat

Prints progress as an iterator progresses

### Variables

- **iterable** (*iterable*) – An iterable iterable
- **desc** (*str*) – description label to show with progress
- **total** (*int*) – Maximum length of the process (estimated from iterable if not specified)
- **freq** (*int*) – How many iterations to wait between messages.
- **adjust** (*bool*) – if True freq is adjusted based on time\_thresh
- **eta\_window** (*int*) – number of previous measurements to use in eta calculation
- **clearline** (*bool*) – if true messages are printed on the same line
- **adjust** – if True *freq* is adjusted based on time\_thresh
- **time\_thresh** (*float*) – desired amount of time to wait between messages if adjust is True otherwise does nothing
- **show\_times** (*bool*) – shows rate, eta, and wall (defaults to True)
- **initial** (*int*) – starting index offset (defaults to 0)
- **stream** (*file*) – defaults to sys.stdout
- **enabled** (*bool*) – if False nothing happens.
- **chunksize** (*int*) – indicates that each iteration processes a batch of this size. Iteration rate is displayed in terms of single-items.

- **verbose** (*int*) – verbosity mode 0 - no verbosity, 1 - verbosity with `clearline=True` and `adjust=True` 2 - verbosity without `clearline=False` and `adjust=True` 3 - verbosity without `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. However, `tqdm` is recommended for the majority of use cases.

---



---

**Note:** The `ProgIter` API will change to become inter-compatible with `tqdm`.

---

**SeeAlso:** `tqdm` - <https://pypi.python.org/pypi/tqdm>

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

## Example

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

**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

```
>>> import progiter
>>> prog = progiter.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*)

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

### Parameters

- **idx** (*int*) – current step index (default None) if specified, takes precedence over *inc*
- **inc** (*int*) – number of steps to increment (defaults to 1)

### Example

```
>>> import progiter
>>> n = 3
>>> prog = progiter.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

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

### **begin()**

Initializes information used to measure progress

### **end()**

### **format\_message()**

builds a formatted progres 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'
```

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```
>>> 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
>>> import progiter
>>> prog = progiter.ProgIter(range(4), show_times=False, verbose=1)
>>> for n in prog:
...     print('unsafe message')
0/4... unsafe message
1/4... unsafe message
unsafe message
unsafe message
4/4...
>>> # apparently the safe version does this too.
>>> print('---')
---
>>> prog = progiter.ProgIter(range(4), show_times=False, verbose=1)
>>> for n in prog:
...     prog.ensure_newline()
...     print('safe message')
0/4...
safe message
1/4...
safe message
safe message
safe message
safe message
4/4...
```

**display\_message()**

Writes current progress to the output stream

**class** `ubelt.TeeStringIO(redirect=None)`

Bases: `_io.StringIO`

An IO object that writes to itself and another IO stream.

**Variables** `redirect` (`io.IOBase`) – The other stream to write to.

**Example**

```
>>> redirect = io.StringIO()
>>> self = TeeStringIO(redirect)
```

**isatty()**

Returns true if the redirect is a terminal.

## Notes

Needed for IPython.embed to work properly when this class is used to override stdout / stderr.

### encoding

Gets the encoding of the *redirect* IO object

### Doctest:

```
>>> redirect = io.StringIO()
>>> assert TeeStringIO(redirect).encoding is None
>>> assert TeeStringIO(None).encoding is None
>>> assert TeeStringIO(sys.stdout).encoding is sys.stdout.encoding
>>> redirect = io.TextIOWrapper(io.StringIO())
>>> assert 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.

## Example

```
>>> with TempDir() as self:
>>>     dpath = self.dpath
>>>     assert exists(dpath)
>>>     assert not exists(dpath)
```

## Example

```
>>> 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*) – identifier for printing, defaults to ""
- **verbose** (*int*) – verbosity flag, defaults to True if label is given



- **newline** (*bool*) – if False and verbose, print tic and toc on the same line, defaults to True

#### Variables

- **elapsed** (*float*) – number of seconds measured by the context manager
- **tstart** (*float*) – time of last *tic* reported by *self.\_time()*

**CommandLine:** python -m timerit.core Timer

#### Example

```
>>> # Create and start the timer using the context manager
>>> import math
>>> from timerit import Timer
>>> timer = Timer('Timer test!', verbose=1)
>>> with timer:
>>>     math.factorial(10000)
>>> assert timer.elapsed > 0
tic('Timer test!')
...toc('Timer test!')=...
```

#### Example

```
>>> # Create and start the timer using the tic/toc interface
>>> from timerit import Timer
>>> 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.Timerit (*num=1, label=None, bestof=3, unit=None, verbose=None*)

Bases: object

Reports the average time to run a block of code.

Unlike *timeit*, *Timerit* can handle multiline blocks of code

#### Parameters

- **num** (*int*) – number of times to run the loop
- **label** (*str*) – identifier for printing
- **bestof** (*int*) – takes the max over this number of trials
- **verbose** (*int*) – verbosity flag, defaults to True if label is given

**CommandLine:** python -m timerit.core Timerit:0

### Example

```
>>> from timerit import Timerit
>>> import math
>>> num = 15
>>> t1 = Timerit(num, label='factorial', verbose=1)
>>> for timer in t1:
>>>     # <write untimed setup code here> this example has no setup
>>>     with timer:
>>>         # <write code to time here> for example...
>>>         math.factorial(10000)
Timed best=..., mean=... for factorial
>>> # <you can now access Timerit attributes>
>>> assert t1.total_time > 0
>>> assert t1.n_loops == t1.num
>>> assert t1.n_loops == num
```

### Example

```
>>> # xdoc: +IGNORE_WANT
>>> import math
>>> from timerit import Timerit
>>> num = 10
>>> # If the timer object is unused, time will still be recorded,
>>> # but with less precision.
>>> for _ in Timerit(num, 'concise', verbose=2):
>>>     math.factorial(10000)
Timed concise for: 10 loops, best of 3
    time per loop: best=4.954 ms, mean=4.972 ± 0.018 ms
>>> # Using the timer object results in the most precise timings
>>> for timer in Timerit(num, 'precise', verbose=3):
>>>     with timer: math.factorial(10000)
Timing precise for: 15 loops, best of 3
Timed precise for: 15 loops, best of 3
    time per loop: best=2.474 ms, mean=2.54 ± 0.046 ms
```

**reset** (*label=None*)

clears all measurements, allowing the object to be reused

**Parameters** *label* (*str; optional*) – optionally change the label

### Example

```
>>> from timerit import Timerit
>>> import math
>>> ti = Timerit(num=10, unit='us', verbose=True)
>>> _ = ti.reset(label='10!').call(math.factorial, 10)
Timed best=..., mean=...s for 10!
>>> _ = ti.reset(label='20!').call(math.factorial, 20)
Timed best=..., mean=...s for 20!
>>> _ = ti.reset().call(math.factorial, 20)
Timed best=..., mean=...s for 20!
```

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

Alternative way to time a simple function call using condensed syntax.

**Returns**

Use *min*, or *mean* to get a scalar. Use *print* to output a report to stdout.

**Return type** self (*Timerit*)

**Example**

```
>>> import math
>>> time = Timerit(num=10).call(math.factorial, 50).min()
>>> assert time > 0
```

**min()**

The best time overall.

This is typically the best metric to consider when evaluating the execution time of a function. To understand why consider this quote from the docs of the original timeit module:

“In a typical case, the lowest value gives a lower bound for how fast your machine can run the given code snippet; higher values in the result vector are typically not caused by variability in Python’s speed, but by other processes interfering with your timing accuracy. So the min() of the result is probably the only number you should be interested in.”

**Returns** minimum measured seconds over all trials

**Return type** float

**Example**

```
>>> import math
>>> self = Timerit(num=10, verbose=0)
>>> self.call(math.factorial, 50)
>>> assert self.min() > 0
```

**mean()**

The mean of the best results of each trial.

**Returns** mean of measured seconds

**Return type** float

---

**Note:** This is typically less informative than simply looking at the min. It is recommended to use min as the expectation value rather than mean in most cases.

---

**Example**

```
>>> import math
>>> self = Timerit(num=10, verbose=0)
>>> self.call(math.factorial, 50)
>>> assert self.mean() > 0
```

**std()**

The standard deviation of the best results of each trial.

**Returns** standard deviation of measured seconds

**Return type** float

---

**Note:** As mentioned in the `timeit` source code, the standard deviation is not often useful. Typically the minimum value is most informative.

---

### Example

```
>>> import math
>>> self = Timerit(num=10, verbose=1)
>>> self.call(math.factorial, 50)
>>> assert self.std() >= 0
```

**report** (*verbose=1*)

Creates a human readable report

**Parameters** **verbose** (*int*) – verbosity level. Either 1, 2, or 3.

**Returns** the report

**Return type** str

**SeeAlso:** `Timerit.print`

### Example

```
>>> import math
>>> ti = Timerit(num=1).call(math.factorial, 5)
>>> print(ti.report(verbose=1))
Timed best=...s, mean=...s
```

**print** (*verbose=1*)

Prints human readable report using the `print` function

**Parameters** **verbose** (*int*) – verbosity level

**SeeAlso:** `Timerit.report`

### Example

```
>>> import math
>>> Timerit(num=10).call(math.factorial, 50).print(verbose=1)
Timed best=...s, mean=...s
>>> Timerit(num=10).call(math.factorial, 50).print(verbose=2)
Timed for: 10 loops, best of 3
    time per loop: best=...s, mean=...s
>>> Timerit(num=10).call(math.factorial, 50).print(verbose=3)
Timed for: 10 loops, best of 3
    body took: ...
    time per loop: best=...s, mean=...s
```

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

Determine if all items in a sequence are the same

**Parameters**

- **iterable** (*Iterable*) – items to determine if they are all the same
- **eq** (*Callable, optional*) – function to determine equality (default: `operator.eq`)

**Example**

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

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

Determines if a key is specified on the command line

**Parameters**

- **key** (*str or Tuple[str]*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. `--`)
- **argv** (*List[str], optional*) – overrides `sys.argv` if specified

**Returns** `flag` : True if the key (or any of the keys) was specified

**Return type** `bool`

**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 or Mapping*) – indexable to sort by
- **key** (*Callable, optional*) – customizes the ordering of the indexable

**CommandLine:** `python -m ubelt.util_list argmax`

### Example

```
>>> assert argmax({'a': 3, 'b': 2, 'c': 100}) == 'c'
>>> assert argmax(['a', 'c', 'b', 'z', 'f']) == 3
>>> assert argmax([[0, 1], [2, 3, 4], [5]], key=len) == 1
>>> assert argmax({'a': 3, 'b': 2, 3: 100, 4: 4}) == 3
>>> assert 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 or Mapping*) – indexable to sort by
- **key** (*Callable, optional*) – customizes the ordering of the indexable

### Example

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

`ubelt.argmin(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 or Mapping*) – indexable to sort by
- **key** (*Callable, optional*) – customizes the ordering of the indexable
- **reverse** (*bool, optional*) – if True returns in descending order

**Returns** indices: list of indices such that sorts the indexable

**Return type** list

### 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)
```

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```

>>> 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.argunique` (*items*, *key=None*)

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

#### Parameters

- **items** (*Sequence*) – indexable collection of items
- **key** (*Callable, optional*) – custom normalization function. If specified returns items where *key(item)* is unique.

**Yields** *int* – indices of the unique items

#### Example

```

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

```

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

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

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

#### Parameters

- **key** (*str or tuple*) – string or tuple of strings. Each key should be prefixed with two hyphens (i.e. `--`)
- **default** (*Optional[object]*) – value to return if not specified
- **argv** (*Optional[list]*) – overrides `sys.argv` if specified

#### Returns

**value** [the value specified after the key. If the key is specified multiple times, then the first value is returned.]

**Return type** *str*

---

#### Todo:

- [ ] Can we handle the case where the value is a list of long paths?
  - [ ] Should we default the first or last specified instance of the flag.
-

### 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, base=None, dpath=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** (*PathLike*) – a path to augment
- **suffix** (*str*, *default=''*) – placed between the basename and extension
- **prefix** (*str*, *default=''*) – placed in front of the basename
- **ext** (*str*, *optional*) – if specified, replaces the extension
- **base** (*str*, *optional*) – if specified, replaces the basename without extension
- **dpath** (*PathLike*, *optional*) – if specified, replaces the directory
- **multidot** (*bool*, *default=False*) – 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** *PathLike*

### 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

```

>>> 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

```

`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*) – list of integer indices
- **maxval** (*int*) – length of the returned list. If not specified this is inferred from *indices*

---

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

---

**Returns** mask: list of booleans. mask[idx] is True if idx in indices

**Return type** list

### 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')`

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*) – 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

---

**Todo:** should this handle the case when sequence is a string?

---

## References

<http://stackoverflow.com/questions/434287/iterate-over-a-list-in-chunks>

**CommandLine:** python -m ubelt.util\_list chunks

## 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]]
```

## Doctest:

```
>>> 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))) == 2
>>> assert len(list(ub.chunks([], 2, None, 'none'))) == 0
>>> assert len(list(ub.chunks([], 2, None, 'cycle'))) == 0
>>> assert len(list(ub.chunks([], 2, None, 'replicate'))) == 0
```

## Doctest:

```
>>> 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))
```

## Doctest:

```
>>> 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))
```

**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', **kwargs)`

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 or Sequence*) – bash-like command string or tuple of executable and args
- **shell** (*bool*) – if True, process is run in shell, defaults to False.
- **detach** (*bool*) – if True, process is detached and run in background, defaults to False.
- **verbose** (*int*) – verbosity mode. Can be 0, 1, 2, or 3. Defaults to 0.
- **tee** (*bool, optional*) – 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** (*PathLike, optional*) – path to run command
- **env** (*str, optional*) – environment passed to Popen
- **tee\_backend** (*str, optional*) – backend for tee output. Valid choices are: “auto”, “select” (POSIX only), and “thread”.
- **# TODO** – stdout, stderr - experimental - custom file to pipe stdout/stderr to
- **\*\*kwargs** – only used to support deprecated arguments

#### Returns

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

**Return type** dict

#### Notes

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 [3] for a potential cross-platform shlex solution for windows.

**CommandLine:** `python -m ubelt.util_cmd cmd python -c “import ubelt as ub; ub.cmd(‘ping localhost -c 2’, verbose=2)”`

#### References

- [1] <https://stackoverflow.com/questions/11495783/redirect-subprocess-stderr-to-stdout> [2] <https://stackoverflow.com/questions/7729336/how-can-i-print-and-display-subprocess-stdout-and-stderr-output-without-distorti>  
 [3] <https://stackoverflow.com/questions/33560364/python-windows-parsing-command-lines-with-shlex>

### Example

```
>>> info = 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() == ''
```

### Doctest:

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

### Doctest:

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

### Doctest:

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

### Doctest:

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

### Doctest:

```
>>> 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)
>>> info1 = ub.cmd(('touch', fpath1), detach=True)
>>> info2 = ub.cmd('echo writing2 > ' + fpath2, shell=True, detach=True)
>>> while not exists(fpath1):
...     pass
>>> while not exists(fpath2):
...     pass
>>> assert ub.readfrom(fpath1) == ''
>>> assert ub.readfrom(fpath2).strip() == 'writing2'
>>> info1['proc'].wait()
>>> info2['proc'].wait()
```

`ubelt.codeblock(block_str)`

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** `block_str (str)` – typically in the form of a multiline string

**Returns** the unindented string

**Return type** str

**CommandLine:** python -m ubelt.util\_str codeblock

### Example

```
>>> from ubelt.util_str import * # NOQA
>>> # Simulate an indented part of code
>>> if True:
>>>     # notice the indentation on this will be normal
>>>     codeblock_version = 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) – may be one of the following: yellow, blink, lightgray, underline, darkyellow, blue, darkblue, faint, fuchsia, black, white, red, brown, turquoise, bold, darkred, darkgreen, reset, standout, darkteal, darkgray, overline, purple, green, teal, fuchsia

#### Returns

**text** [colorized text.] If pygments is not installed plain text is returned.

**Return type** str

**CommandLine:** python -c “import pygments.console; print(sorted(pygments.console.codes.keys()))” python -m ubelt.util\_colors color\_text

### 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(color_text(text, 'red'))
>>>     prefix = ub.ensure_unicode('\x1b[31')
```

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```

>>> print('prefix = {!r}'.format(prefix))
>>> print('ansi_text = {!r}'.format(ansi_text))
>>> assert ansi_text.startswith(prefix)
>>> assert color_text(text, None) == 'raw text'
>>> else:
>>>     # Otherwise text passes through unchanged
>>>     assert color_text(text, 'red') == 'raw text'
>>>     assert color_text(text, None) == 'raw text'

```

`ubelt.compress(items, flags)`

Selects items where the corresponding value in flags is True This is similar to `np.compress` and `it.compress`

#### Parameters

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

**Returns** a subset of masked items

**Return type** `Iterable`

#### 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.compressuser(path, home='~')`

Inverse of `os.path.expanduser`

#### Parameters

- **path** (*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 tilde

**Return type** `PathLike`

#### Example

```

>>> path = expanduser('~')
>>> assert path != '~'
>>> assert compressuser(path) == '~'
>>> assert compressuser(path + '1') == path + '1'
>>> assert compressuser(path + '/1') == join('~', '1')
>>> assert compressuser(path + '/1', '$HOME') == join('$HOME', '1')

```

`ubelt.ddict`

alias of `collections.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** (*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. <https://github.com/hsoft/send2trash>

**Doctest:**

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

**Doctest:**

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

`ubelt.dict_diff(*args)`

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

**Parameters** *\*args* – a sequence of dictionaries (or sets of keys)

**Returns** `OrderedDict` if the first argument is an `OrderedDict`, otherwise `dict`

**Return type** `Dict | OrderedDict`

**Ignore:** `python -c "import ubelt; print(len(ubelt.__all__))"`

**Example**

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

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```
{}
```

```
>>> dict_diff({'a': 1, 'b': 2}, {'c'})
```

`ubelt.dict_hist` (*item\_list*, *weight\_list=None*, *ordered=False*, *labels=None*)

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

#### Parameters

- **item\_list** (*Iterable*) – hashable items (usually containing duplicates)
- **weight\_list** (*Iterable*) – corresponding weights for each item
- **ordered** (*bool*) – if True the result is ordered by frequency
- **labels** (*Iterable, optional*) – expected labels (default None) Allows this function to pre-initialize the histogram. If specified the frequency of each label is initialized to zero and item\_list can only contain items specified in labels.

#### Returns

dictionary where the keys are items in *item\_list*, and the values are the number of times the item appears in *item\_list*.

**Return type** dict

**CommandLine:** python -m ubelt.util\_dict dict\_hist

#### Example

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

#### Example

```
>>> import ubelt as ub
>>> item_list = [1, 2, 39, 900, 1232, 900, 1232, 2, 2, 2, 900]
>>> hist1 = ub.dict_hist(item_list)
>>> hist2 = ub.dict_hist(item_list, ordered=True)
>>> try:
>>>     hist3 = ub.dict_hist(item_list, labels=[])
>>> except KeyError:
>>>     pass
>>> else:
>>>     raise AssertionError('expected key error')
>>> #result = ub.repr2(hist_)
>>> weight_list = [1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1]
>>> hist4 = ub.dict_hist(item_list, weight_list=weight_list)
>>> 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)`

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

**Parameters** *\*args* – a sequence of dictionaries (or sets of keys)

**Returns** OrderedDict if the first argument is an OrderedDict, otherwise dict

**Return type** Dict | OrderedDict

## Notes

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

```
>>> dict_isect({'a': 1, 'b': 2, 'c': 3}, ['a', 'c', 'd'])
{'a': 1, 'c': 3}
```

## Example

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

`ubelt.dict_subset(dict_, keys, default=NoParam)`

Get a subset of a dictionary

**Parameters**

- **dict\_** (*Mapping*) – superset dictionary
- **keys** (*Iterable*) – keys to take from *dict\_*
- **default** (*object, optional*) – if specified uses default if keys are missing

**Returns** subset dictionary

**Return type** OrderedDict

**SeeAlso:** `dict_isect` - similar functionality, but will only take existing 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_take(dict_, keys, default=NoParam)`

Generates values from a dictionary

**Parameters**

- **dict\_** (*Mapping*) – a dictionary to take from
- **keys** (*Iterable*) – the keys to take
- **default** (*object, optional*) – if specified uses default if keys are missing

**CommandLine:** `python -m ubelt.util_dict dict_take_gen`

### Example

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

`ubelt.dict_union(*args)`

Combines the disjoint keys in multiple dictionaries. For intersecting keys, dictionaries towards the end of the sequence are given precedence.

**Parameters** *\*args* – a sequence of dictionaries

**Returns** `OrderedDict` if the first argument is an `OrderedDict`, otherwise `dict`

**Return type** `Dict | OrderedDict`

**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

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

`ubelt.download(url, fpath=None, hash_prefix=None, hasher='sha512', chunksize=8192, verbose=1)`

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** (*PathLike* | *io.BytesIO* | *trio.IO*) – The path to download to. Defaults to basename 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).
- **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*, *default=2 \* 13\**) – Download chunksize.
- **verbose** (*int*, *default=1*) – Verbosity level 0 or 1.

**Returns** fpath - path to the downloaded file.

**Return type** PathLike

### Raises

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

### Notes

Based largely on code in *pytorch*<sup>4</sup> with modifications influenced by other resources<sup>123</sup>.

### References

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#### Todo:

- [ ] fine-grained control of progress
- 

### 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
```

<sup>4</sup> <https://github.com/pytorch/pytorch/blob/2787f1d8edbd4aadd4a8680d204341a1d7112e2d/torch/hub.py#L347>

<sup>1</sup> <http://blog.molecule.com/2012/10/04/urlretrieve-progres-indicator/>

<sup>2</sup> <http://stackoverflow.com/questions/15644964/python-progress-bar-and-downloads>

<sup>3</sup> <http://stackoverflow.com/questions/16694907/how-to-download-large-file-in-python-with-requests-py>

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> import ubelt as ub
>>> import io
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> file = io.BytesIO()
>>> fpath = 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=..., wall=...
```

### Example

```
>>> # xdoctest: +REQUIRES(--network)
>>> # test download from girder
>>> import pytest
>>> import ubelt as ub
>>> 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*) – full sequence
- **items2** (*Iterable*) – can either be a sequence of one item or a sequence of equal length to `items1`
- **cls** (*Type[dict]*) – dictionary type to use. Defaults to `dict`, but could be ordered dict instead.

**Returns** similar to `dict(zip(items1, items2))`

**Return type** `dict`

### Example

```
>>> assert dzip([1, 2, 3], [4]) == {1: 4, 2: 4, 3: 4}
>>> assert dzip([1, 2, 3], [4, 4, 4]) == {1: 4, 2: 4, 3: 4}
>>> assert dzip([], [4]) == {}
```

`ubelt.editfile(fpath, verbose=True)`

DEPRICATED: This has been ported to xdev, please use that version.

Opens a file or code corresponding to a live python object in your preferred visual editor. This function is mainly useful in an interactive IPython session.

The visual editor is determined by the *VISUAL* environment variable. If this is not specified it defaults to gvim.

#### Parameters

- **fpath** (*PathLike*) – a file path or python module / function
- **verbose** (*int*) – verbosity

#### DisableExample:

```
>>> # This test interacts with a GUI frontend, not sure how to test.
>>> import ubelt as ub
>>> ub.editfile(ub.util_platform.__file__)
>>> ub.editfile(ub)
>>> ub.editfile(ub.editfile)
```

`ubelt.ensure_app_cache_dir(appname, *args)`

Calls `get_app_cache_dir` but ensures the directory exists.

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**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.

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**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.

### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**SeeAlso:** `get_app_data_dir`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_data_dir('ubelt')
>>> assert exists(dpath)
```

`ubelt.ensure_app_resource_dir` (*appname*, *\*args*)

Calls `get_app_resource_dir` but ensures the directory exists.

DEPRICATED in favor of `ensure_app_config_dir` / `ensure_app_data_dir`

### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**SeeAlso:** `get_app_resource_dir`

`ubelt.ensure_unicode` (*text*)

Casts bytes into utf8 (mostly for python2 compatibility)

### References

<http://stackoverflow.com/questions/12561063/extract-data-from-file>

### Example

```
>>> from ubelt.util_str import *
>>> import codecs # NOQA
>>> assert ensure_unicode('my ünïcôdé string') == 'my ünïcôdé string'
>>> assert ensure_unicode('text1') == 'text1'
>>> assert ensure_unicode('text1'.encode('utf8')) == 'text1'
>>> assert ensure_unicode('ï»¿text1'.encode('utf8')) == 'ï»¿text1'
>>> assert (codecs.BOM_UTF8 + 'text»¿'.encode('utf8')).decode('utf8')
```

`ubelt.ensure_dir` (*dpath*, *mode=1023*, *verbose=None*)

Ensures that directory will exist. Creates new dir with sticky bits by default

### Parameters

- **dpath** (*PathLike*) – dir to ensure. Can also be a tuple to send to join
- **mode** (*int*) – octal mode of directory (default 0o1777)
- **verbose** (*int*) – verbosity (default 0)

**Returns** path: the ensured directory

**Return type** PathLike

## Notes

This function is not thread-safe in Python2

## Example

```
>>> from ubelt.util_platform 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)`

Wrapper around `expanduser` and `expandvars`.

Less aggressive than `truepath`. Only expands environs and tilde. Does not change relative paths to absolute paths.

**Parameters** `path` (*PathLike*) – string representation of a path

**Returns** expanded path

**Return type** `PathLike`

## Example

```
>>> 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*) – hashable items possibly containing duplicates
- **k** (*int*) – only return items that appear at least *k* times (default=2)
- **key** (*Callable, optional*) – 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`

**CommandLine:** `python -m ubelt.util_dict find_duplicates`

### Example

```
>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> duplicates = ub.find_duplicates(items)
>>> print('items = %r' % (items,))
>>> print('duplicates = %r' % (duplicates,))
>>> assert duplicates == {0: [0, 1, 6], 2: [3, 8], 3: [4, 5]}
>>> assert ub.find_duplicates(items, 3) == {0: [0, 1, 6]}
```

### Example

```
>>> import ubelt as ub
>>> items = [0, 0, 1, 2, 3, 3, 0, 12, 2, 9]
>>> # note: k can be 0
>>> 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*) – globstr of matching filename
- **multi** (*bool*) – if True return all matches instead of just the first. Defaults to False.
- **path** (*str or Iterable[PathLike]*) – overrides the system PATH variable.

**Returns** returns matching executable(s).

**Return type** PathLike or List[PathLike] or None

**SeeAlso:** `shutil.which` - which is available in Python 3.3+.

### Notes

This is essentially the *which* UNIX command

### References

<https://stackoverflow.com/questions/377017/test-if-executable-exists-in-python/377028#377028>  
<https://docs.python.org/dev/library/shutil.html#shutil.which>

[https:](https://docs.python.org/dev/library/shutil.html#shutil.which)



### Example

```
>>> find_exe('ls')
>>> find_exe('ping')
>>> assert find_exe('which') == find_exe(find_exe('which'))
>>> find_exe('which', multi=True)
>>> find_exe('ping', multi=True)
>>> find_exe('cmake', multi=True)
>>> find_exe('nvcc', multi=True)
>>> find_exe('noexist', multi=True)
```

### Example

```
>>> assert not find_exe('noexist', multi=False)
>>> assert find_exe('ping', multi=False)
>>> assert not find_exe('noexist', multi=True)
>>> assert find_exe('ping', multi=True)
```

### Benchmark:

```
>>> # xdoctest: +IGNORE_WANT
>>> import ubelt as ub
>>> import shutil
>>> for timer in ub.Timerit(100, bestof=10, label='ub.find_exe'):
>>>     ub.find_exe('which')
>>> for timer in ub.Timerit(100, bestof=10, label='shutil.which'):
>>>     shutil.which('which')
Timed best=58.71 µs, mean=59.64 ± 0.96 µs for ub.find_exe
Timed best=72.75 µs, mean=73.07 ± 0.22 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

- **fname** (*PathLike* or *str*) – file name to match. If *exact* is *False* this may be a glob pattern
- **path** (*str* or *Iterable[PathLike]*) – 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** *PathLike* – candidate: a path that matches *name*

### Notes

Running with *name=''* (i.e. `ub.find_path('')`) will simply yield all directories in your `PATH`.

### Notes

For recursive behavior set *path=(d for d, \_, \_ in os.walk('.'))*, where `'.'` might be replaced by the root directory of interest.

### Example

```
>>> list(find_path('ping', exact=True))
>>> list(find_path('bin'))
>>> list(find_path('bin'))
>>> list(find_path('*cc*'))
>>> list(find_path('cmake*'))
```

### Example

```
>>> import ubelt as ub
>>> from os.path import dirname
>>> path = dirname(dirname(ub.util_platform.__file__))
>>> res = sorted(find_path('ubelt/util_*.py', path=path))
>>> assert len(res) >= 10
>>> res = sorted(find_path('ubelt/util_platform.py', path=path, exact=True))
>>> print(res)
>>> assert len(res) == 1
```

`ubelt.flatten(nested_list)`

Transforms a nested iterable into a flat iterable.

This is simply an alias for `itertools.chain.from_iterable`

**Parameters** `nested_list` (*Iterable[Iterable]*) – list of lists

**Returns** flattened items

**Return type** `Iterable`

### Example

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

**Parameters**

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns** `dpath`: writable cache directory for this application

**Return type** `PathLike`

**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.

**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** PathLike

**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.

#### 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** PathLike

**SeeAlso:** ensure\_app\_data\_dir

`ubelt.get_app_resource_dir(appname, *args)`

Returns a writable directory for an application This should be used for persistent configuration files.

DEPRICATED in favor of get\_app\_config\_dir / get\_app\_data\_dir

#### Parameters

- **appname** (*str*) – the name of the application
- **\*args** – any other subdirectories may be specified

**Returns** dpath: writable resource directory for this application

**Return type** PathLike

**SeeAlso:** ensure\_app\_resource\_dir

`ubelt.grabdata(url, fpath=None, dpath=None, fname=None, redo=False, verbose=1, appname=None, hash_prefix=None, hasher='sha512', **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 to the file to download
- **fpath** (*PathLike*) – The full path to download the file to. If unspecified, the arguments *dpath* and *fname* are used to determine this.
- **dpath** (*PathLike*) – where to download the file. If unspecified *appname* is used to determine this. Mutually exclusive with *fpath*.
- **fname** (*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** (*bool*, *default=True*) – verbosity flag

- **appname** (*str*) – set dpath to `ub.get_app_cache_dir(appname)`. Mutually exclusive with dpath and fpath.
- **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.
- **\*\*download\_kw** – additional kwargs to pass to `ub.download`

**Returns** fpath - path to downloaded or cached file.

**Return type** PathLike

### 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
>>> fname = 'foo.bar'
>>> url = 'http://i.imgur.com/rqwaDag.png'
>>> prefix1 = '944389a39dfb8fa9'
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> stamp_fpath = fpath + '.hash'
>>> assert open(stamp_fpath, 'r').read() == 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
>>> open(stamp_fpath, 'w').write('corrupt-stamp')
>>> fpath = ub.grabdata(url, fname=fname, hash_prefix=prefix1)
>>> assert open(stamp_fpath, 'r').read() == prefix1
>>> #
>>> # Check that a redownload occurs when the stamp is removed
>>> ub.delete(stamp_fpath)
>>> open(fpath, 'w').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)
```

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```

>>> #
>>> # Check that requesting new data causes redownload
>>> url2 = 'https://data.kitware.com/api/v1/item/5b4039308d777f2e6225994c/download
↳ '
>>> prefix2 = 'c98a46cb31205cf'
>>> fpath = ub.grabdata(url2, fname=fname, hash_prefix=prefix2)
>>> assert open(stamp_fpath, 'r').read() == prefix2

```

`ubelt.group_items(items, groupids)`

Groups a list of items by group id.

#### Parameters

- **items** (*Iterable*) – a list of items to group
- **groupids** (*Iterable or Callable*) – a corresponding list of item groupids or a function mapping an item to a groupid.

**Returns** `groupid_to_items`: maps a groupid to a list of items

**Return type** `dict`

**CommandLine:** `python -m ubelt.util_dict group_items`

#### Example

```

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

```

`ubelt.hash_data(data, hasher=NoParam, base=NoParam, types=False, hashlen=NoParam, 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 | HASH, default='sha512'*) – string code or a hash algorithm from hashlib.
- **base** (*List[str] | str, default='hex'*) – list of symbols or shorthand key. Valid keys are 'abc', 'hex', and 'dec'.
- **types** (*bool*) – If True data types are included in the hash, otherwise only the raw data is hashed. Defaults to False.
- **hashlen** (*int*) – Maximum number of symbols in the returned hash. If not specified, all are returned. DEPRECATED. Use slice syntax instead.
- **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.

**Returns** text representing the hashed data

**Return type** str

## Notes

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=65536, stride=1, hasher=NoParam, hashlen=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*, *default=2 \* 16\**) – Affects speed of reading file
- **stride** (*int*, *default=1*) – strides > 1 skip data to hash, useful for faster hashing, but less accurate, also makes hash dependant on blocksize.
- **hasher** (*str | HASH*, *default='sha512'*) – string code or a hash algorithm from hashlib.
- **hashlen** (*int*) – maximum number of symbols in the returned hash. If not specified, all are returned.
- **base** (*List[str] | str*, *default='hex'*) – list of symbols or shorthand key. Valid keys are 'abc', 'hex', and 'dec'.

## Notes

For better hashes keep `stride = 1` For faster hashes set `stride > 1` blocksize matters when `stride > 1`

## References

<http://stackoverflow.com/questions/3431825/md5-checksum-of-a-file>  
5001893/when-to-use-sha-1-vs-sha-2

<http://stackoverflow.com/questions/>

## Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> fpath = join(ub.ensure_app_cache_dir('ubelt'), 'tmp.txt')
>>> ub.writeto(fpath, 'foobar')
>>> print(ub.hash_file(fpath, hasher='sha1', base='hex'))
8843d7f92416211de9ebb963ff4ce28125932878
```

### Example

```
>>> import ubelt as ub
>>> from os.path import join
>>> fpath = ub.touch(join(ub.ensure_app_cache_dir('ubelt'), 'empty_file'))
>>> # Test that the output is the same as shasum
>>> 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)
```

`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`

**CommandLine:** `python -c "import pygments.formatters; print(list(pygments.formatters.get_all_formatters()))"`  
`python -c "import pygments.lexers, ubelt; print(ubelt.repr2(pygments.lexers.__all__, nl=2))"`

### 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*) – separator (defaults to “”)

**CommandLine:** `python -m ubelt.util_str hzcat`

#### 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:

```
>>> from ubelt.util_str import *
>>> import ubelt as ub
>>> import unicodedata
>>> aa = unicodedata.normalize('NFD', 'á') # a unicode char with len2
>>> B = ub.repr2(['θ', aa], [aa, aa, aa], nl=1, si=True, cbr=True,
↳trailsep=False)
>>> C = ub.repr2([[5, 6], [7, 'θ']], nl=1, si=True, cbr=True, trailsep=False)
>>> args = ['A', '=', B, '*', C]
>>> print(ub.hzcat(args, sep=' '))
A=[θ, á],      *[[5, 6],
  [á, á, á]]   [7, θ]]
```

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

The identity function. Simply returns the value of its first input.

All other inputs are ignored. Defaults to None if called without args.

#### Parameters

- **arg** (*object*, *default=None*) – some value
- **\*args** – ignored
- **\*\*kwargs** – ignored

**Returns** *arg*: the same value

**Return type** *object*

**CommandLine:** `xdctest -m ubelt.util_func identity`



### Example

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

`ubelt.import_module_from_name(modname)`  
Imports a module from its string name (`__name__`)

**Parameters** `modname` (*str*) – module name

**Returns** module

**Return type** module

### Example

```
>>> # test with modules that wont be imported in normal circumstances
>>> # todo write a test where we gaurentee 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 its path

**Parameters**

- **modpath** (*PathLike*) – path to the module on disk or within a zipfile.
- **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** module

### References

<https://stackoverflow.com/questions/67631/import-module-given-path>

### Notes

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.py`

**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.

## 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
>>> 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')
>>> open(external_modpath, 'w').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 module.__name__ == os.path.normpath('folder/bar')
>>> assert module.testvar == 1
```

**Doctest:**

```
>>> 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*) – prefix to add to each line (default = '')

**Returns** indented text

**Return type** `str`

**CommandLine:** `python -m util_str indent`

#### Example

```
>>> from ubelt.util_str import * # NOQA
>>> NL = chr(10) # newline character
>>> text = 'Lorem ipsum' + NL + 'dolor sit amet'
>>> prefix = '    '
>>> result = indent(text, prefix)
>>> assert all(t.startswith(prefix) for t in result.split(NL))
```

`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** (*object*) – instance to inject a function into
- **func** (*func*) – the function to inject (must contain an arg for self)
- **name** (*str*) – name of the method. optional. If not specified the name of the function is used.

#### Example

```
>>> class Foo(object):
>>>     def bar(self):
>>>         return 'bar'
>>> def baz(self):
>>>     return 'baz'
>>> self = Foo()
>>> assert self.bar() == 'bar'
>>> assert not hasattr(self, 'baz')
>>> inject_method(self, baz)
>>> assert not hasattr(Foo, 'baz'), 'should only change one instance'
>>> assert self.baz() == 'baz'
```

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```
>>> inject_method(self, baz, 'bar')
>>> assert self.bar() == 'baz'
```

`ubelt.invert_dict(dict_, unique_vals=True)`

Swaps the keys and values in a dictionary.

#### Parameters

- **dict\_** (*dict*) – dictionary to invert
- **unique\_vals** (*bool*) – if False, inverted keys are returned in a set. The default is True.

**Returns** inverted

**Return type** dict

#### Notes

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=True`, causing the inverted keys to be returned in a set.

**CommandLine:** `python -m ubelt.util_dict invert_dict`

#### 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*) – an iterable sequence

- **size** (*int*) – sliding window size (default = 2)
- **step** (*int*) – sliding step size (default = 1)
- **wrap** (*bool*) – wraparound (default = False)

**Returns** returns windows in a sequence

**Return type** iter

### Example

```
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 1, True
>>> window_iter = 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

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

### Example

```
>>> iterable = [1, 2, 3, 4, 5, 6]
>>> size, step, wrap = 3, 2, False
>>> window_iter = iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = %r' % (window_list,))
window_list = [(1, 2, 3), (3, 4, 5)]
```

### Example

```
>>> iterable = []
>>> size, step, wrap = 3, 2, False
>>> window_iter = iter_window(iterable, size, step, wrap)
>>> window_list = list(window_iter)
>>> print('window_list = %r' % (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

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

`ubelt.map_keys` (*func, dict\_*)

Transform a dictionary by applying a function to each key, while keeping the values the same.

#### Parameters

- **func** (*callable*) – a function or indexable object
- **dict\_** (*dict*) – a dictionary

**Returns** transformed dictionary

**Return type** newdict

**CommandLine:** `xdoctest -m ubelt.util_dict map_keys`

### 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: []}
>>> #ut.assert_raises(AssertionError, map_keys, len, dict_)
>>> dict_ = {0: [1, 2, 3], 1: []}
>>> func = ['a', 'b']
>>> newdict = ub.map_keys(func, dict_)
>>> print(newdict)
>>> assert newdict == {'a': [1, 2, 3], 'b': []}
>>> #ut.assert_raises(AssertionError, map_keys, len, dict_)
```

`ubelt.map_vals` (*func, dict\_*)

Transform a dictionary by applying a function to each value, while keeping the keys the same.

#### Parameters

- **func** (*callable*) – a function or indexable object
- **dict\_** (*dict*) – a dictionary

**Returns** transformed dictionary

**Return type** newdict

**CommandLine:** `xdoctest -m ubelt.util_dict map_vals`

## Example

```

>>> import ubelt as ub
>>> dict_ = {'a': [1, 2, 3], 'b': []}
>>> func = len
>>> newdict = ub.map_vals(func, dict_)
>>> assert newdict == {'a': 3, 'b': 0}
>>> print(newdict)
>>> # Can also use indexables as `func`
>>> dict_ = {'a': 0, 'b': 1}
>>> func = [42, 21]
>>> newdict = ub.map_vals(func, dict_)
>>> assert newdict == {'a': 42, 'b': 21}
>>> print(newdict)

```

`ubelt.memoize(func)`  
memoization decorator that respects args and kwargs

## References

<https://wiki.python.org/moin/PythonDecoratorLibrary#Memoize>

**Parameters** `func` (*Callable*) – live python function

**Returns** memoized wrapper

**Return type** `func`

**CommandLine:** `xdoctest -m ubelt.util_memoize memoize`

## 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.memoize_method(func)`  
Bases: `object`

memoization decorator for a method that respects args and kwargs

## References

<http://code.activestate.com/recipes/577452-a-memoize-decorator-for-instance-methods/>

## Example

```
>>> import ubelt as ub
>>> closure = {'a': 'b', 'c': 'd'}
>>> incr = [0]
>>> class Foo(object):
>>>     @memoize_method
>>>     def foo_memo(self, key):
>>>         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
```

`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.

## Notes

implementation is a modified version of [1].



## References

..[1] <https://github.com/estebistec/python-memoized-property>

**CommandLine:** `xdoctest -m ubelt.util_memoize memoize_property`

## Example

```
>>> class C(object):
...     load_name_count = 0
...     @memoize_property
...     def name(self):
...         "name's docstring"
...         self.load_name_count += 1
...         return "the name"
...     @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*) – module filepath
- **hide\_init** (*bool*) – if False, `__init__.py` will be returned for packages
- **hide\_main** (*bool*) – if False, and `hide_init` is True, `__main__.py` will be returned for packages, if it exists.
- **sys\_path** (*list, default=None*) – if specified overrides `sys.path`

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

**Return type** `str`

### 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')
>>> 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.

**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

```
>>> 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.odict`

alias of `collections.OrderedDict`

`ubelt.aset`

alias of `ordered_set.OrderedSet`

`ubelt.paragraph` (*block\_str*)

Wraps multi-line strings and restructures the text to remove all newlines, heading, trailing, and double spaces.

Useful for writing log messages

**Parameters** `block_str` (*str*) – typically in the form of a multiline string

**Returns** the reduced text block

**Return type** `str`

**CommandLine:** `xdoctest -m ubelt.util_str paragraph`

### Example

```
>>> from ubelt.util_str import * # NOQA
>>> block_str = (
>>>     '''
>>>     Lorem ipsum dolor sit amet, consectetur adipiscing
>>>     elit, sed do eiusmod tempor incididunt ut labore et
>>>     dolore magna aliqua.
>>>     ''')
>>> out = paragraph(block_str)
>>> assert chr(10) in block_str
>>> assert chr(10) not in out
>>> print('block_str = {!r}'.format(block_str))
>>> print('out = {!r}'.format(out))
```

`ubelt.peek` (*iterable*)

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` (*List[T]*) – an iterable

**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`

## 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
```

`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** PathLike

`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 cahce dir used by the current operating system

**Return type** PathLike

`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** PathLike

`ubelt.platform_resource_dir()`

Alias for `platform_cache_dir`

DEPRICATED in favor of `platform_config_dir` / `platform_data_dir`

Returns a directory which should be writable for any application This should be used for persistent configuration files.

**Returns** path to the resource dir used by the current operating system

**Return type** PathLike

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

Reads (utf8) text from a file.

### Parameters

- **fpath** (*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 and easy-to-doctest string representation!

This is an alternative to `repr`, and `pprint.pformat` that attempts to be both more configurable and generate output that is consistent between python versions.

## Notes

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 *Args* for more details.

### Parameters

- **data** (*object*) – an arbitrary python object
- **\*\*kwargs** – see *the Kwargs* section

### 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, ...)`.

**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

**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 ndarrays. if True includes the dtype.

**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

## Notes

**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

**CommandLine:** `python -m ubelt.util_format repr2:0` `python -m ubelt.util_format repr2:1`

## Example

```
>>> from ubelt.util_format import *
>>> 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')]),
... }
>>> result = repr2(dict_, nl=3, precision=2); print(result)
>>> result = repr2(dict_, nl=2, precision=2); print(result)
>>> result = repr2(dict_, nl=1, precision=2); print(result)
>>> result = repr2(dict_, nl=1, precision=2, itemsep=',', explicit=True);
↳ print(result)
>>> result = repr2(dict_, nl=1, precision=2, nobr=1, itemsep=',', explicit=True);
↳ print(result)
>>> result = repr2(dict_, nl=3, precision=2, cbr=True); print(result)
>>> result = repr2(dict_, nl=3, precision=2, si=True); print(result)
>>> result = repr2(dict_, nl=3, sort=True); print(result)
>>> result = repr2(dict_, nl=3, sort=False, trailing_sep=False); print(result)
>>> result = repr2(dict_, nl=3, sort=False, trailing_sep=False, nobr=True);
↳ print(result)
```

## Example

```
>>> from ubelt.util_format import *
>>> def _nest(d, w):
...     if d == 0:
...         return {}
...     else:
...         return {'n{}'.format(d): _nest(d - 1, w + 1), 'm{}'.format(d): _
↳ nest(d - 1, w + 1)}
```

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```

>>> dict_ = _nest(d=4, w=1)
>>> result = repr2(dict_, nl=6, precision=2, cbr=1)
>>> print('---')
>>> print(result)
>>> result = repr2(dict_, nl=-1, precision=2)
>>> print('---')
>>> print(result)

```

`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

**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.startfile(fpath, verbose=True)`

Uses default program defined by the system to open a file. This is done via `os.startfile` on windows, `open` on mac, and `xdg-open` on linux.

#### Parameters

- **fpath** (*PathLike*) – a file to open using the program associated with the files extension type.
- **verbose** (*int*) – verbosity

#### References

<http://stackoverflow.com/questions/2692873/quote-posix>

#### DisableExample:

```

>>> # This test interacts with a GUI frontend, not sure how to test.
>>> import ubelt as ub
>>> base = ub.ensure_app_cache_dir('ubelt')
>>> fpath1 = join(base, 'test_open.txt')
>>> ub.touch(fpath1)
>>> proc = ub.startfile(fpath1)

```

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

Create a symbolic link.

This will work on linux or windows, however windows does have some corner cases. For more details see notes in `ubelt._win32_links`.

#### Parameters

- **path** (*PathLike*) – path to real file or directory
- **link\_path** (*PathLike*) – path to desired location for symlink
- **overwrite** (*bool*) – 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. (default = False)
- **verbose** (*int*) – verbosity level (default=0)

**Returns** link path

**Return type** PathLike

**CommandLine:** `python -m ubelt.util_links symlink:0`

#### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'test_symlink0')
>>> real_path = join(dpath, 'real_file.txt')
>>> link_path = join(dpath, 'link_file.txt')
>>> [ub.delete(p) for p in [real_path, link_path]]
>>> ub.writeto(real_path, 'foo')
>>> result = symlink(real_path, link_path)
>>> assert ub.readfrom(result) == 'foo'
>>> [ub.delete(p) for p in [real_path, link_path]]
```

#### Example

```
>>> import ubelt as ub
>>> from os.path import dirname
>>> dpath = ub.ensure_app_cache_dir('ubelt', 'test_symlink1')
>>> ub.delete(dpath)
>>> ub.ensuredir(dpath)
>>> _dirstats(dpath)
>>> real_dpath = ub.ensuredir((dpath, 'real_dpath'))
>>> link_dpath = ub.augpath(real_dpath, base='link_dpath')
>>> real_path = join(dpath, 'afile.txt')
>>> link_path = join(dpath, 'afile.txt')
>>> [ub.delete(p) for p in [real_path, link_path]]
>>> ub.writeto(real_path, 'foo')
>>> result = symlink(real_dpath, link_dpath)
>>> assert ub.readfrom(link_path) == 'foo', 'read should be same'
>>> ub.writeto(link_path, 'bar')
>>> _dirstats(dpath)
>>> assert ub.readfrom(link_path) == 'bar', 'very bad bar'
>>> assert ub.readfrom(real_path) == 'bar', 'changing link did not change real'
>>> ub.writeto(real_path, 'baz')
```

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```

>>> _dirstats(dpath)
>>> assert ub.readfrom(real_path) == 'baz', 'very bad baz'
>>> assert ub.readfrom(link_path) == 'baz', 'changing real did not change link'
>>> ub.delete(link_dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not exists(link_dpath), 'link should not exist'
>>> assert exists(real_path), 'real path should exist'
>>> _dirstats(dpath)
>>> ub.delete(dpath, verbose=1)
>>> _dirstats(dpath)
>>> assert not exists(real_path)

```

`ubelt.take(items, indices)`

Selects a subset of a list based on a list of indices. This is similar to `np.take`, but pure python.

#### Parameters

- **items** (*Sequence*) – an indexable object to select items from
- **indices** (*Iterable*) – sequence of indexing objects

**Returns** subset of the list

**Return type** Iterable or scalar

**SeeAlso:** `ub.dict_subset`

#### Example

```

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

```

`ubelt.timestamp(method='iso8601')`

make an iso8601 timestamp suitable for use in filenames

**Parameters** **method** (*str*, *default='iso8601'*) – type of timestamp

#### Example

```

>>> stamp = timestamp()
>>> print('stamp = {!r}'.format(stamp))
stamp = ...-...-...T...

```

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

change file timestamps

Works like the touch unix utility

#### Parameters

- **fpath** (*PathLike*) – name of the file
- **mode** (*int*) – file permissions (python3 and unix only)

- **dir\_fd** (*file*) – 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** PathLike

## References

<https://stackoverflow.com/questions/1158076/implement-touch-using-python>

## Example

```
>>> import ubelt as ub
>>> 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.truepath** (*path*, *real=False*)

Normalizes a string representation of a path and does shell-like expansion.

### Parameters

- **path** (*PathLike*) – string representation of a path
- **real** (*bool*) – if True, all symbolic links are followed. (default: False)

**Returns** normalized path

**Return type** PathLike

---

**Note:** This function is similar to the composition of *expanduser*, *expandvars*, *normpath*, and (*realpath* if *real* else *abspath*). However, on windows backslashes are then replaced with forward slashes to offer a consistent unix-like experience across platforms.

On windows *expanduser* will expand environment variables formatted as *%name%*, whereas on unix, this will not occur.

---

## Example

```
>>> import ubelt as ub
>>> assert ub.truepath('~foo') == join(ub.userhome(), 'foo')
>>> assert ub.truepath('~foo') == ub.truepath('~foo/bar/..')
>>> assert ub.truepath('~foo', real=True) == ub.truepath('~foo')
```

**ubelt.unique** (*items*, *key=None*)

Generates unique items in the order they appear.

### Parameters

- **items** (*Iterable*) – list of items
- **key** (*Callable, optional*) – custom normalization function. If specified returns items where *key(item)* is unique.

**Yields** *object* – a unique item from the input sequence

**CommandLine:** `python -m utool.util_list --exec-unique_ordered`

### 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=six.text_type.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*) – indexable collection of items
- **key** (*Callable, optional*) – 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 = unique_flags(items)
>>> assert flags == [True, True, True, False, False, True, False]
>>> flags = unique_flags(items, key=lambda x: x % 2 == 0)
>>> assert flags == [True, False, True, False, False, False, False]
```

`ubelt.userhome(username=None)`

Returns the user's home directory. If *username* is None, this is the directory for the current user.

**Parameters** *username* (*str*) – name of a user on the system

**Returns** *userhome\_dpath*: path to the home directory

**Return type** PathLike

### Example

```
>>> import getpass
>>> username = getpass.getuser()
>>> assert userhome() == expanduser('~')
>>> assert userhome(username) == expanduser('~')
```

`ubelt.writeto(fpath, to_write, aslines=False, verbose=None)`  
Writes (utf8) text to a file.

#### Parameters

- **fpath** (*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

**CommandLine:** `python -m ubelt.util_io writeto -verbose`

### Example

```
>>> import ubelt as ub
>>> dpath = ub.ensure_app_cache_dir('ubelt')
>>> fpath = dpath + '/' + 'testwrite.txt'
>>> if exists(fpath):
>>>     os.remove(fpath)
>>> to_write = 'utf-8 symbols Δ, , , , , , , and .'
>>> 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
>>> 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']
>>> 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
```

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