

3 Operator Module Functions

The key-function patterns shown above are very common, so Python provides convenience functions to make accessor functions easier and faster. The operator module has `itemgetter()`, `attrgetter()`, and a `methodcaller()` function.

Using those functions, the above examples become simpler and faster:

```
>>> from operator import itemgetter, attrgetter
```

```
>>> sorted(student_tuples, key=itemgetter(2))
[('dave', 'B', 10), ('jane', 'B', 12), ('john', 'A', 15)]
```

```
>>> sorted(student_objects, key=attrgetter('age'))
[('dave', 'B', 10), ('jane', 'B', 12), ('john', 'A', 15)]
```

The operator module functions allow multiple levels of sorting. For example, to sort by *grade* then by *age*:

```
>>> sorted(student_tuples, key=itemgetter(1,2))
[('john', 'A', 15), ('dave', 'B', 10), ('jane', 'B', 12)]
```

```
>>> sorted(student_objects, key=attrgetter('grade', 'age'))
[('john', 'A', 15), ('dave', 'B', 10), ('jane', 'B', 12)]
```

4 Ascending and Descending

Both `list.sort()` and `sorted()` accept a *reverse* parameter with a boolean value. This is used to flag descending sorts. For example, to get the student data in reverse *age* order:

```
>>> sorted(student_tuples, key=itemgetter(2), reverse=True)
[('john', 'A', 15), ('jane', 'B', 12), ('dave', 'B', 10)]
```

```
>>> sorted(student_objects, key=attrgetter('age'), reverse=True)
[('john', 'A', 15), ('jane', 'B', 12), ('dave', 'B', 10)]
```

5 Sort Stability and Complex Sorts

Sorts are guaranteed to be *stable*. That means that when multiple records have the same key, their original order is preserved.

```
>>> data = [('red', 1), ('blue', 1), ('red', 2), ('blue', 2)]
>>> sorted(data, key=itemgetter(0))
[('blue', 1), ('blue', 2), ('red', 1), ('red', 2)]
```

Notice how the two records for *blue* retain their original order so that `('blue', 1)` is guaranteed to precede `('blue', 2)`.

This wonderful property lets you build complex sorts in a series of sorting steps. For example, to sort the student data by descending *grade* and then ascending *age*, do the *age* sort first and then sort again using *grade*:

```
>>> s = sorted(student_objects, key=attrgetter('age'))      # sort on secondary key
>>> sorted(s, key=attrgetter('grade'), reverse=True)      # now sort on primary
↪key, descending
[('dave', 'B', 10), ('jane', 'B', 12), ('john', 'A', 15)]
```