CHAPTER

FOURTEEN

FILE FORMATS

The modules described in this chapter parse various miscellaneous file formats that aren't markup languages and are not related to e-mail.

14.1 csv — CSV File Reading and Writing

Source code: Lib/csv.py

The so-called CSV (Comma Separated Values) format is the most common import and export format for spreadsheets and databases. CSV format was used for many years prior to attempts to describe the format in a standardized way in **RFC 4180**. The lack of a well-defined standard means that subtle differences often exist in the data produced and consumed by different applications. These differences can make it annoying to process CSV files from multiple sources. Still, while the delimiters and quoting characters vary, the overall format is similar enough that it is possible to write a single module which can efficiently manipulate such data, hiding the details of reading and writing the data from the programmer.

The *csv* module implements classes to read and write tabular data in CSV format. It allows programmers to say, "write this data in the format preferred by Excel," or "read data from this file which was generated by Excel," without knowing the precise details of the CSV format used by Excel. Programmers can also describe the CSV formats understood by other applications or define their own special-purpose CSV formats.

The *csv* module's *reader* and *writer* objects read and write sequences. Programmers can also read and write data in dictionary form using the *DictReader* and *DictWriter* classes.

See also:

PEP 305 - CSV File API The Python Enhancement Proposal which proposed this addition to Python.

14.1.1 Module Contents

The *csv* module defines the following functions:

`csv.reader(`*csvfile*, *dialect='excel'*, ***fmtparams*`)`

Return a reader object which will iterate over lines in the given *csvfile*. *csvfile* can be any object which supports the *iterator* protocol and returns a string each time its `__next__()` method is called — *file objects* and list objects are both suitable. If *csvfile* is a file object, it should be opened with `newline=''`.[1] An optional *dialect* parameter can be given which is used to define a set of parameters specific to a particular CSV dialect. It may be an instance of a subclass of the *Dialect* class or one of the strings returned by the *list_dialects()* function. The other optional *fmtparams* keyword

[1] If `newline=''` is not specified, newlines embedded inside quoted fields will not be interpreted correctly, and on platforms that use `\r\n` linendings on write an extra `\r` will be added. It should always be safe to specify `newline=''`, since the csv module does its own (*universal*) newline handling.

arguments can be given to override individual formatting parameters in the current dialect. For full details about the dialect and formatting parameters, see section *Dialects and Formatting Parameters*.

Each row read from the csv file is returned as a list of strings. No automatic data type conversion is performed unless the `QUOTE_NONNUMERIC` format option is specified (in which case unquoted fields are transformed into floats).

A short usage example:

```
>>> import csv
>>> with open('eggs.csv', newline='') as csvfile:
...     spamreader = csv.reader(csvfile, delimiter=' ', quotechar='|')
...     for row in spamreader:
...         print(', '.join(row))
Spam, Spam, Spam, Spam, Spam, Baked Beans
Spam, Lovely Spam, Wonderful Spam
```

csv.writer(*csvfile*, *dialect='excel'*, ***fmtparams*)

Return a writer object responsible for converting the user's data into delimited strings on the given file-like object. *csvfile* can be any object with a `write()` method. If *csvfile* is a file object, it should be opened with `newline=''`[1]. An optional *dialect* parameter can be given which is used to define a set of parameters specific to a particular CSV dialect. It may be an instance of a subclass of the *Dialect* class or one of the strings returned by the *list_dialects()* function. The other optional *fmtparams* keyword arguments can be given to override individual formatting parameters in the current dialect. For full details about the dialect and formatting parameters, see section *Dialects and Formatting Parameters*. To make it as easy as possible to interface with modules which implement the DB API, the value *None* is written as the empty string. While this isn't a reversible transformation, it makes it easier to dump SQL NULL data values to CSV files without preprocessing the data returned from a `cursor.fetch*` call. All other non-string data are stringified with *str()* before being written.

A short usage example:

```
import csv
with open('eggs.csv', 'w', newline='') as csvfile:
    spamwriter = csv.writer(csvfile, delimiter=' ',
                            quotechar='|', quoting=csv.QUOTE_MINIMAL)
    spamwriter.writerow(['Spam'] * 5 + ['Baked Beans'])
    spamwriter.writerow(['Spam', 'Lovely Spam', 'Wonderful Spam'])
```

csv.register_dialect(*name*[, *dialect*[, ***fmtparams*]])

Associate *dialect* with *name*. *name* must be a string. The dialect can be specified either by passing a sub-class of *Dialect*, or by *fmtparams* keyword arguments, or both, with keyword arguments overriding parameters of the dialect. For full details about the dialect and formatting parameters, see section *Dialects and Formatting Parameters*.

csv.unregister_dialect(*name*)

Delete the dialect associated with *name* from the dialect registry. An *Error* is raised if *name* is not a registered dialect name.

csv.get_dialect(*name*)

Return the dialect associated with *name*. An *Error* is raised if *name* is not a registered dialect name. This function returns an immutable *Dialect*.

csv.list_dialects()

Return the names of all registered dialects.

csv.field_size_limit([*new_limit*])

Returns the current maximum field size allowed by the parser. If *new_limit* is given, this becomes the

new limit.

The *csv* module defines the following classes:

class csv.DictReader(*f*, *fieldnames=None*, *restkey=None*, *restval=None*, *dialect='excel'*, **args*, ***kwds*)

Create an object that operates like a regular reader but maps the information in each row to an *OrderedDict* whose keys are given by the optional *fieldnames* parameter.

The *fieldnames* parameter is a *sequence*. If *fieldnames* is omitted, the values in the first row of file *f* will be used as the fieldnames. Regardless of how the fieldnames are determined, the ordered dictionary preserves their original ordering.

If a row has more fields than fieldnames, the remaining data is put in a list and stored with the fieldname specified by *restkey* (which defaults to `None`). If a non-blank row has fewer fields than fieldnames, the missing values are filled-in with `None`.

All other optional or keyword arguments are passed to the underlying *reader* instance.

Changed in version 3.6: Returned rows are now of type `OrderedDict`.

A short usage example:

```
>>> import csv
>>> with open('names.csv', newline='') as csvfile:
...     reader = csv.DictReader(csvfile)
...     for row in reader:
...         print(row['first_name'], row['last_name'])
...
Eric Idle
John Cleese

>>> print(row)
OrderedDict([('first_name', 'John'), ('last_name', 'Cleese')])
```

class csv.DictWriter(*f*, *fieldnames*, *restval=''*, *extrasaction='raise'*, *dialect='excel'*, **args*, ***kwds*)

Create an object which operates like a regular writer but maps dictionaries onto output rows. The *fieldnames* parameter is a *sequence* of keys that identify the order in which values in the dictionary passed to the `writerow()` method are written to file *f*. The optional *restval* parameter specifies the value to be written if the dictionary is missing a key in *fieldnames*. If the dictionary passed to the `writerow()` method contains a key not found in *fieldnames*, the optional *extrasaction* parameter indicates what action to take. If it is set to `'raise'`, the default value, a *ValueError* is raised. If it is set to `'ignore'`, extra values in the dictionary are ignored. Any other optional or keyword arguments are passed to the underlying *writer* instance.

Note that unlike the *DictReader* class, the *fieldnames* parameter of the *DictWriter* class is not optional.

A short usage example:

```
import csv

with open('names.csv', 'w', newline='') as csvfile:
    fieldnames = ['first_name', 'last_name']
    writer = csv.DictWriter(csvfile, fieldnames=fieldnames)

    writer.writeheader()
    writer.writerow({'first_name': 'Baked', 'last_name': 'Beans'})
```

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```
    writer.writerow({'first_name': 'Lovely', 'last_name': 'Spam'})
    writer.writerow({'first_name': 'Wonderful', 'last_name': 'Spam'})
```

class csv.Dialect
The *Dialect* class is a container class relied on primarily for its attributes, which are used to define the parameters for a specific *reader* or *writer* instance.

class csv.excel
The *excel* class defines the usual properties of an Excel-generated CSV file. It is registered with the dialect name `'excel'`.

class csv.excel_tab
The *excel_tab* class defines the usual properties of an Excel-generated TAB-delimited file. It is registered with the dialect name `'excel-tab'`.

class csv.unix_dialect
The *unix_dialect* class defines the usual properties of a CSV file generated on UNIX systems, i.e. using `'\n'` as line terminator and quoting all fields. It is registered with the dialect name `'unix'`.

New in version 3.2.

class csv.Sniffer
The *Sniffer* class is used to deduce the format of a CSV file.

The *Sniffer* class provides two methods:

sniff(*sample*, *delimiters=None*)
Analyze the given *sample* and return a *Dialect* subclass reflecting the parameters found. If the optional *delimiters* parameter is given, it is interpreted as a string containing possible valid delimiter characters.

has_header(*sample*)
Analyze the sample text (presumed to be in CSV format) and return *True* if the first row appears to be a series of column headers.

An example for *Sniffer* use:

```
with open('example.csv', newline='') as csvfile:
    dialect = csv.Sniffer().sniff(csvfile.read(1024))
    csvfile.seek(0)
    reader = csv.reader(csvfile, dialect)
    # ... process CSV file contents here ...
```

The *csv* module defines the following constants:

csv.QUOTE_ALL
Instructs *writer* objects to quote all fields.

csv.QUOTE_MINIMAL
Instructs *writer* objects to only quote those fields which contain special characters such as *delimiter*, *quotechar* or any of the characters in *lineterminator*.

csv.QUOTE_NONNUMERIC
Instructs *writer* objects to quote all non-numeric fields.

Instructs the reader to convert all non-quoted fields to type *float*.

csv.QUOTE_NONE
Instructs *writer* objects to never quote fields. When the current *delimiter* occurs in output data it is preceded by the current *escapechar* character. If *escapechar* is not set, the writer will raise *Error* if any characters that require escaping are encountered.

Instructs *reader* to perform no special processing of quote characters.

The *csv* module defines the following exception:

exception csv.Error
Raised by any of the functions when an error is detected.

14.1.2 Dialects and Formatting Parameters

To make it easier to specify the format of input and output records, specific formatting parameters are grouped together into dialects. A dialect is a subclass of the *Dialect* class having a set of specific methods and a single `validate()` method. When creating *reader* or *writer* objects, the programmer can specify a string or a subclass of the *Dialect* class as the dialect parameter. In addition to, or instead of, the *dialect* parameter, the programmer can also specify individual formatting parameters, which have the same names as the attributes defined below for the *Dialect* class.

Dialects support the following attributes:

Dialect.delimiter
A one-character string used to separate fields. It defaults to `','`.

Dialect.doublequote
Controls how instances of *quotechar* appearing inside a field should themselves be quoted. When *True*, the character is doubled. When *False*, the *escapechar* is used as a prefix to the *quotechar*. It defaults to *True*.

On output, if *doublequote* is *False* and no *escapechar* is set, *Error* is raised if a *quotechar* is found in a field.

Dialect.escapechar
A one-character string used by the writer to escape the *delimiter* if *quoting* is set to *QUOTE_NONE* and the *quotechar* if *doublequote* is *False*. On reading, the *escapechar* removes any special meaning from the following character. It defaults to *None*, which disables escaping.

Dialect.lineterminator
The string used to terminate lines produced by the *writer*. It defaults to `'\r\n'`.

Note: The *reader* is hard-coded to recognise either `'\r'` or `'\n'` as end-of-line, and ignores *lineterminator*. This behavior may change in the future.

Dialect.quotechar
A one-character string used to quote fields containing special characters, such as the *delimiter* or *quotechar*, or which contain new-line characters. It defaults to `'"'`.

Dialect.quoting
Controls when quotes should be generated by the writer and recognised by the reader. It can take on any of the `QUOTE_*` constants (see section *Module Contents*) and defaults to *QUOTE_MINIMAL*.

Dialect.skipinitialspace
When *True*, whitespace immediately following the *delimiter* is ignored. The default is *False*.

Dialect.strict
When `True`, raise exception *Error* on bad CSV input. The default is `False`.

14.1.3 Reader Objects

Reader objects (*DictReader* instances and objects returned by the *reader()* function) have the following public methods:

csvreader.__next__()
: Return the next row of the reader's iterable object as a list (if the object was returned from *reader()*) or a dict (if it is a *DictReader* instance), parsed according to the current dialect. Usually you should call this as `next(reader)`.

Reader objects have the following public attributes:

csvreader.dialect
: A read-only description of the dialect in use by the parser.

csvreader.line_num
: The number of lines read from the source iterator. This is not the same as the number of records returned, as records can span multiple lines.

DictReader objects have the following public attribute:

csvreader.fieldnames
: If not passed as a parameter when creating the object, this attribute is initialized upon first access or when the first record is read from the file.

14.1.4 Writer Objects

`Writer` objects (*DictWriter* instances and objects returned by the *writer()* function) have the following public methods. A *row* must be an iterable of strings or numbers for `Writer` objects and a dictionary mapping fieldnames to strings or numbers (by passing them through *str()* first) for *DictWriter* objects. Note that complex numbers are written out surrounded by parens. This may cause some problems for other programs which read CSV files (assuming they support complex numbers at all).

csvwriter.writerow(*row*)
: Write the *row* parameter to the writer's file object, formatted according to the current dialect.

  Changed in version 3.5: Added support of arbitrary iterables.

csvwriter.writerows(*rows*)
: Write all elements in *rows* (an iterable of *row* objects as described above) to the writer's file object, formatted according to the current dialect.

Writer objects have the following public attribute:

csvwriter.dialect
: A read-only description of the dialect in use by the writer.

DictWriter objects have the following public method:

DictWriter.writeheader()
: Write a row with the field names (as specified in the constructor).

  New in version 3.2.

14.1.5 Examples

The simplest example of reading a CSV file:

```
import csv
with open('some.csv', newline='') as f:
    reader = csv.reader(f)
    for row in reader:
        print(row)
```

Reading a file with an alternate format:

```
import csv
with open('passwd', newline='') as f:
    reader = csv.reader(f, delimiter=':', quoting=csv.QUOTE_NONE)
    for row in reader:
        print(row)
```

The corresponding simplest possible writing example is:

```
import csv
with open('some.csv', 'w', newline='') as f:
    writer = csv.writer(f)
    writer.writerows(someiterable)
```

Since *open()* is used to open a CSV file for reading, the file will by default be decoded into unicode using the system default encoding (see *locale.getpreferredencoding()*). To decode a file using a different encoding, use the `encoding` argument of open:

```
import csv
with open('some.csv', newline='', encoding='utf-8') as f:
    reader = csv.reader(f)
    for row in reader:
        print(row)
```

The same applies to writing in something other than the system default encoding: specify the encoding argument when opening the output file.

Registering a new dialect:

```
import csv
csv.register_dialect('unixpwd', delimiter=':', quoting=csv.QUOTE_NONE)
with open('passwd', newline='') as f:
    reader = csv.reader(f, 'unixpwd')
```

A slightly more advanced use of the reader — catching and reporting errors:

```
import csv, sys
filename = 'some.csv'
with open(filename, newline='') as f:
    reader = csv.reader(f)
    try:
        for row in reader:
            print(row)
    except csv.Error as e:
        sys.exit('file {}, line {}: {}'.format(filename, reader.line_num, e))
```

And while the module doesn't directly support parsing strings, it can easily be done:

```
import csv
for row in csv.reader(['one,two,three']):
    print(row)
```

14.2 `configparser` — Configuration file parser

Source code: Lib/configparser.py

This module provides the *ConfigParser* class which implements a basic configuration language which provides a structure similar to what's found in Microsoft Windows INI files. You can use this to write Python programs which can be customized by end users easily.

Note: This library does *not* interpret or write the value-type prefixes used in the Windows Registry extended version of INI syntax.

See also:

Module *shlex* Support for creating Unix shell-like mini-languages which can be used as an alternate format for application configuration files.

Module *json* The json module implements a subset of JavaScript syntax which can also be used for this purpose.

14.2.1 Quick Start

Let's take a very basic configuration file that looks like this:

```
[DEFAULT]
ServerAliveInterval = 45
Compression = yes
CompressionLevel = 9
ForwardX11 = yes

[bitbucket.org]
User = hg

[topsecret.server.com]
Port = 50022
ForwardX11 = no
```

The structure of INI files is described *in the following section*. Essentially, the file consists of sections, each of which contains keys with values. *configparser* classes can read and write such files. Let's start by creating the above configuration file programmatically.

```
>>> import configparser
>>> config = configparser.ConfigParser()
>>> config['DEFAULT'] = {'ServerAliveInterval': '45',
...                      'Compression': 'yes',
...                      'CompressionLevel': '9'}
>>> config['bitbucket.org'] = {}
>>> config['bitbucket.org']['User'] = 'hg'
>>> config['topsecret.server.com'] = {}
>>> topsecret = config['topsecret.server.com']
>>> topsecret['Port'] = '50022'     # mutates the parser
>>> topsecret['ForwardX11'] = 'no'  # same here
>>> config['DEFAULT']['ForwardX11'] = 'yes'
>>> with open('example.ini', 'w') as configfile:
...   config.write(configfile)
...
```

As you can see, we can treat a config parser much like a dictionary. There are differences, *outlined later*, but the behavior is very close to what you would expect from a dictionary.

Now that we have created and saved a configuration file, let's read it back and explore the data it holds.

```
>>> config = configparser.ConfigParser()
>>> config.sections()
[]
>>> config.read('example.ini')
['example.ini']
>>> config.sections()
['bitbucket.org', 'topsecret.server.com']
>>> 'bitbucket.org' in config
True
>>> 'bytebong.com' in config
False
>>> config['bitbucket.org']['User']
'hg'
>>> config['DEFAULT']['Compression']
'yes'
>>> topsecret = config['topsecret.server.com']
>>> topsecret['ForwardX11']
'no'
>>> topsecret['Port']
'50022'
>>> for key in config['bitbucket.org']:
...     print(key)
user
compressionlevel
serveraliveinterval
compression
forwardx11
>>> config['bitbucket.org']['ForwardX11']
'yes'
```

As we can see above, the API is pretty straightforward. The only bit of magic involves the `DEFAULT` section which provides default values for all other sections[1]. Note also that keys in sections are case-insensitive and stored in lowercase[1].

14.2.2 Supported Datatypes

Config parsers do not guess datatypes of values in configuration files, always storing them internally as strings. This means that if you need other datatypes, you should convert on your own:

```
>>> int(topsecret['Port'])
50022
>>> float(topsecret['CompressionLevel'])
9.0
```

Since this task is so common, config parsers provide a range of handy getter methods to handle integers, floats and booleans. The last one is the most interesting because simply passing the value to `bool()` would do no good since `bool('False')` is still `True`. This is why config parsers also provide *`getboolean()`*. This

[1] Config parsers allow for heavy customization. If you are interested in changing the behaviour outlined by the footnote reference, consult the *Customizing Parser Behaviour* section.

method is case-insensitive and recognizes Boolean values from `'yes'`/`'no'`, `'on'`/`'off'`, `'true'`/`'false'` and `'1'`/`'0'`[1]. For example:

```
>>> topsecret.getboolean('ForwardX11')
False
>>> config['bitbucket.org'].getboolean('ForwardX11')
True
>>> config.getboolean('bitbucket.org', 'Compression')
True
```

Apart from *getboolean()*, config parsers also provide equivalent *getint()* and *getfloat()* methods. You can register your own converters and customize the provided ones.[1]

14.2.3 Fallback Values

As with a dictionary, you can use a section's `get()` method to provide fallback values:

```
>>> topsecret.get('Port')
'50022'
>>> topsecret.get('CompressionLevel')
'9'
>>> topsecret.get('Cipher')
>>> topsecret.get('Cipher', '3des-cbc')
'3des-cbc'
```

Please note that default values have precedence over fallback values. For instance, in our example the `'CompressionLevel'` key was specified only in the `'DEFAULT'` section. If we try to get it from the section `'topsecret.server.com'`, we will always get the default, even if we specify a fallback:

```
>>> topsecret.get('CompressionLevel', '3')
'9'
```

One more thing to be aware of is that the parser-level `get()` method provides a custom, more complex interface, maintained for backwards compatibility. When using this method, a fallback value can be provided via the `fallback` keyword-only argument:

```
>>> config.get('bitbucket.org', 'monster',
...            fallback='No such things as monsters')
'No such things as monsters'
```

The same `fallback` argument can be used with the *getint()*, *getfloat()* and *getboolean()* methods, for example:

```
>>> 'BatchMode' in topsecret
False
>>> topsecret.getboolean('BatchMode', fallback=True)
True
>>> config['DEFAULT']['BatchMode'] = 'no'
>>> topsecret.getboolean('BatchMode', fallback=True)
False
```

14.2.4 Supported INI File Structure

A configuration file consists of sections, each led by a `[section]` header, followed by key/value entries separated by a specific string (`=` or `:` by default[1]). By default, section names are case sensitive but keys are not[1]. Leading and trailing whitespace is removed from keys and values. Values can be omitted, in which case the key/value delimiter may also be left out. Values can also span multiple lines, as long as they are indented deeper than the first line of the value. Depending on the parser's mode, blank lines may be treated as parts of multiline values or ignored.

Configuration files may include comments, prefixed by specific characters (`#` and `;` by default[1]). Comments may appear on their own on an otherwise empty line, possibly indented.[1]

For example:

```
[Simple Values]
key=value
spaces in keys=allowed
spaces in values=allowed as well
spaces around the delimiter = obviously
you can also use : to delimit keys from values

[All Values Are Strings]
values like this: 1000000
or this: 3.14159265359
are they treated as numbers? : no
integers, floats and booleans are held as: strings
can use the API to get converted values directly: true

[Multiline Values]
chorus: I'm a lumberjack, and I'm okay
    I sleep all night and I work all day

[No Values]
key_without_value
empty string value here =

[You can use comments]
# like this
; or this

# By default only in an empty line.
# Inline comments can be harmful because they prevent users
# from using the delimiting characters as parts of values.
# That being said, this can be customized.

    [Sections Can Be Indented]
        can_values_be_as_well = True
        does_that_mean_anything_special = False
        purpose = formatting for readability
        multiline_values = are
            handled just fine as
            long as they are indented
            deeper than the first line
            of a value
        # Did I mention we can indent comments, too?
```

14.2.5 Interpolation of values

On top of the core functionality, *ConfigParser* supports interpolation. This means values can be preprocessed before returning them from `get()` calls.

class configparser.BasicInterpolation

The default implementation used by *ConfigParser*. It enables values to contain format strings which refer to other values in the same section, or values in the special default section[1]. Additional default values can be provided on initialization.

For example:

```
[Paths]
home_dir: /Users
my_dir: %(home_dir)s/lumberjack
my_pictures: %(my_dir)s/Pictures
```

In the example above, *ConfigParser* with *interpolation* set to `BasicInterpolation()` would resolve `%(home_dir)s` to the value of `home_dir` (`/Users` in this case). `%(my_dir)s` in effect would resolve to `/Users/lumberjack`. All interpolations are done on demand so keys used in the chain of references do not have to be specified in any specific order in the configuration file.

With `interpolation` set to `None`, the parser would simply return `%(my_dir)s/Pictures` as the value of `my_pictures` and `%(home_dir)s/lumberjack` as the value of `my_dir`.

class configparser.ExtendedInterpolation

An alternative handler for interpolation which implements a more advanced syntax, used for instance in `zc.buildout`. Extended interpolation is using `${section:option}` to denote a value from a foreign section. Interpolation can span multiple levels. For convenience, if the `section:` part is omitted, interpolation defaults to the current section (and possibly the default values from the special section).

For example, the configuration specified above with basic interpolation, would look like this with extended interpolation:

```
[Paths]
home_dir: /Users
my_dir: ${home_dir}/lumberjack
my_pictures: ${my_dir}/Pictures
```

Values from other sections can be fetched as well:

```
[Common]
home_dir: /Users
library_dir: /Library
system_dir: /System
macports_dir: /opt/local

[Frameworks]
Python: 3.2
path: ${Common:system_dir}/Library/Frameworks/

[Arthur]
nickname: Two Sheds
last_name: Jackson
my_dir: ${Common:home_dir}/twosheds
my_pictures: ${my_dir}/Pictures
python_dir: ${Frameworks:path}/Python/Versions/${Frameworks:Python}
```

14.2.6 Mapping Protocol Access

New in version 3.2.

Mapping protocol access is a generic name for functionality that enables using custom objects as if they were dictionaries. In case of *configparser*, the mapping interface implementation is using the `parser['section']['option']` notation.

`parser['section']` in particular returns a proxy for the section's data in the parser. This means that the values are not copied but they are taken from the original parser on demand. What's even more important is that when values are changed on a section proxy, they are actually mutated in the original parser.

configparser objects behave as close to actual dictionaries as possible. The mapping interface is complete and adheres to the *MutableMapping* ABC. However, there are a few differences that should be taken into account:

- By default, all keys in sections are accessible in a case-insensitive manner[1]. E.g. `for option in parser["section"]` yields only `optionxform`'ed option key names. This means lowercased keys by default. At the same time, for a section that holds the key `'a'`, both expressions return `True`:

```
"a" in parser["section"]
"A" in parser["section"]
```

- All sections include `DEFAULTSECT` values as well which means that `.clear()` on a section may not leave the section visibly empty. This is because default values cannot be deleted from the section (because technically they are not there). If they are overridden in the section, deleting causes the default value to be visible again. Trying to delete a default value causes a *KeyError*.
- `DEFAULTSECT` cannot be removed from the parser:
  - trying to delete it raises *ValueError*,
  - `parser.clear()` leaves it intact,
  - `parser.popitem()` never returns it.
- `parser.get(section, option, **kwargs)` - the second argument is **not** a fallback value. Note however that the section-level `get()` methods are compatible both with the mapping protocol and the classic configparser API.
- `parser.items()` is compatible with the mapping protocol (returns a list of *section_name*, *section_proxy* pairs including the DEFAULTSECT). However, this method can also be invoked with arguments: `parser.items(section, raw, vars)`. The latter call returns a list of *option*, *value* pairs for a specified `section`, with all interpolations expanded (unless `raw=True` is provided).

The mapping protocol is implemented on top of the existing legacy API so that subclasses overriding the original interface still should have mappings working as expected.

14.2.7 Customizing Parser Behaviour

There are nearly as many INI format variants as there are applications using it. *configparser* goes a long way to provide support for the largest sensible set of INI styles available. The default functionality is mainly dictated by historical background and it's very likely that you will want to customize some of the features.

The most common way to change the way a specific config parser works is to use the `__init__()` options:

- *defaults*, default value: `None`

  This option accepts a dictionary of key-value pairs which will be initially put in the `DEFAULT` section. This makes for an elegant way to support concise configuration files that don't specify values which are the same as the documented default.

Hint: if you want to specify default values for a specific section, use `read_dict()` before you read the actual file.

- *dict_type*, default value: *collections.OrderedDict*

  This option has a major impact on how the mapping protocol will behave and how the written configuration files look. With the default ordered dictionary, every section is stored in the order they were added to the parser. Same goes for options within sections.

  An alternative dictionary type can be used for example to sort sections and options on write-back. You can also use a regular dictionary for performance reasons.

  Please note: there are ways to add a set of key-value pairs in a single operation. When you use a regular dictionary in those operations, the order of the keys may be random. For example:

```
>>> parser = configparser.ConfigParser()
>>> parser.read_dict({'section1': {'key1': 'value1',
...                                'key2': 'value2',
...                                'key3': 'value3'},
...                   'section2': {'keyA': 'valueA',
...                                'keyB': 'valueB',
...                                'keyC': 'valueC'},
...                   'section3': {'foo': 'x',
...                                'bar': 'y',
...                                'baz': 'z'}
... })
>>> parser.sections()
['section3', 'section2', 'section1']
>>> [option for option in parser['section3']]
['baz', 'foo', 'bar']
```

In these operations you need to use an ordered dictionary as well:

```
>>> from collections import OrderedDict
>>> parser = configparser.ConfigParser()
>>> parser.read_dict(
...   OrderedDict((
...     ('s1',
...      OrderedDict((
...        ('1', '2'),
...        ('3', '4'),
...        ('5', '6'),
...      ))
...     ),
...     ('s2',
...      OrderedDict((
...        ('a', 'b'),
...        ('c', 'd'),
...        ('e', 'f'),
...      ))
...     ),
...   ))
... )
>>> parser.sections()
['s1', 's2']
>>> [option for option in parser['s1']]
```

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```
['1', '3', '5']
>>> [option for option in parser['s2'].values()]
['b', 'd', 'f']
```

- *allow_no_value*, default value: `False`

  Some configuration files are known to include settings without values, but which otherwise conform to the syntax supported by *configparser*. The *allow_no_value* parameter to the constructor can be used to indicate that such values should be accepted:

```
>>> import configparser

>>> sample_config = """
... [mysqld]
...   user = mysql
...   pid-file = /var/run/mysqld/mysqld.pid
...   skip-external-locking
...   old_passwords = 1
...   skip-bdb
...   # we don't need ACID today
...   skip-innodb
... """
>>> config = configparser.ConfigParser(allow_no_value=True)
>>> config.read_string(sample_config)

>>> # Settings with values are treated as before:
>>> config["mysqld"]["user"]
'mysql'

>>> # Settings without values provide None:
>>> config["mysqld"]["skip-bdb"]

>>> # Settings which aren't specified still raise an error:
>>> config["mysqld"]["does-not-exist"]
Traceback (most recent call last):
  ...
KeyError: 'does-not-exist'
```

- *delimiters*, default value: `('=', ':')`

  Delimiters are substrings that delimit keys from values within a section. The first occurrence of a delimiting substring on a line is considered a delimiter. This means values (but not keys) can contain the delimiters.

  See also the *space_around_delimiters* argument to *ConfigParser.write()*.

- *comment_prefixes*, default value: `('#', ';')`

- *inline_comment_prefixes*, default value: `None`

  Comment prefixes are strings that indicate the start of a valid comment within a config file. *comment_prefixes* are used only on otherwise empty lines (optionally indented) whereas *inline_comment_prefixes* can be used after every valid value (e.g. section names, options and empty lines as well). By default inline comments are disabled and `'#'` and `';'` are used as prefixes for whole line comments.

Changed in version 3.2: In previous versions of *configparser* behaviour matched `comment_prefixes=('#',';')` and `inline_comment_prefixes=(';',)`.

Please note that config parsers don't support escaping of comment prefixes so using *inline_comment_prefixes* may prevent users from specifying option values with characters used as comment prefixes. When in doubt, avoid setting *inline_comment_prefixes*. In any circumstances, the only way of storing comment prefix characters at the beginning of a line in multiline values is to interpolate the prefix, for example:

```
>>> from configparser import ConfigParser, ExtendedInterpolation
>>> parser = ConfigParser(interpolation=ExtendedInterpolation())
>>> # the default BasicInterpolation could be used as well
>>> parser.read_string("""
... [DEFAULT]
... hash = #
...
... [hashes]
... shebang =
...   ${hash}!/usr/bin/env python
...   ${hash} -*- coding: utf-8 -*-
...
... extensions =
...   enabled_extension
...   another_extension
...   #disabled_by_comment
...   yet_another_extension
...
... interpolation not necessary = if # is not at line start
... even in multiline values = line #1
...   line #2
...   line #3
... """)
>>> print(parser['hashes']['shebang'])

#!/usr/bin/env python
# -*- coding: utf-8 -*-
>>> print(parser['hashes']['extensions'])

enabled_extension
another_extension
yet_another_extension
>>> print(parser['hashes']['interpolation not necessary'])
if # is not at line start
>>> print(parser['hashes']['even in multiline values'])
line #1
line #2
line #3
```

- *strict*, default value: `True`

  When set to `True`, the parser will not allow for any section or option duplicates while reading from a single source (using `read_file()`, `read_string()` or `read_dict()`). It is recommended to use strict parsers in new applications.

  Changed in version 3.2: In previous versions of *configparser* behaviour matched `strict=False`.

- *empty_lines_in_values*, default value: `True`

In config parsers, values can span multiple lines as long as they are indented more than the key that holds them. By default parsers also let empty lines to be parts of values. At the same time, keys can be arbitrarily indented themselves to improve readability. In consequence, when configuration files get big and complex, it is easy for the user to lose track of the file structure. Take for instance:

```
[Section]
key = multiline
  value with a gotcha

 this = is still a part of the multiline value of 'key'
```

This can be especially problematic for the user to see if she's using a proportional font to edit the file. That is why when your application does not need values with empty lines, you should consider disallowing them. This will make empty lines split keys every time. In the example above, it would produce two keys, `key` and `this`.

- *default_section*, default value: `configparser.DEFAULTSECT` (that is: `"DEFAULT"`)

  The convention of allowing a special section of default values for other sections or interpolation purposes is a powerful concept of this library, letting users create complex declarative configurations. This section is normally called `"DEFAULT"` but this can be customized to point to any other valid section name. Some typical values include: `"general"` or `"common"`. The name provided is used for recognizing default sections when reading from any source and is used when writing configuration back to a file. Its current value can be retrieved using the `parser_instance.default_section` attribute and may be modified at runtime (i.e. to convert files from one format to another).

- *interpolation*, default value: `configparser.BasicInterpolation`

  Interpolation behaviour may be customized by providing a custom handler through the *interpolation* argument. `None` can be used to turn off interpolation completely, `ExtendedInterpolation()` provides a more advanced variant inspired by `zc.buildout`. More on the subject in the *dedicated documentation section*. *`RawConfigParser`* has a default value of `None`.

- *converters*, default value: not set

  Config parsers provide option value getters that perform type conversion. By default *`getint()`*, *`getfloat()`*, and *`getboolean()`* are implemented. Should other getters be desirable, users may define them in a subclass or pass a dictionary where each key is a name of the converter and each value is a callable implementing said conversion. For instance, passing `{'decimal': decimal.Decimal}` would add `getdecimal()` on both the parser object and all section proxies. In other words, it will be possible to write both `parser_instance.getdecimal('section', 'key', fallback=0)` and `parser_instance['section'].getdecimal('key', 0)`.

  If the converter needs to access the state of the parser, it can be implemented as a method on a config parser subclass. If the name of this method starts with `get`, it will be available on all section proxies, in the dict-compatible form (see the `getdecimal()` example above).

More advanced customization may be achieved by overriding default values of these parser attributes. The defaults are defined on the classes, so they may be overridden by subclasses or by attribute assignment.

`ConfigParser.BOOLEAN_STATES`

By default when using *`getboolean()`*, config parsers consider the following values `True`: `'1'`, `'yes'`, `'true'`, `'on'` and the following values `False`: `'0'`, `'no'`, `'false'`, `'off'`. You can override this by specifying a custom dictionary of strings and their Boolean outcomes. For example:

```
>>> custom = configparser.ConfigParser()
>>> custom['section1'] = {'funky': 'nope'}
>>> custom['section1'].getboolean('funky')
Traceback (most recent call last):
```

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```
...
ValueError: Not a boolean: nope
>>> custom.BOOLEAN_STATES = {'sure': True, 'nope': False}
>>> custom['section1'].getboolean('funky')
False
```

Other typical Boolean pairs include `accept`/`reject` or `enabled`/`disabled`.

`ConfigParser.optionxform`(*option*)

This method transforms option names on every read, get, or set operation. The default converts the name to lowercase. This also means that when a configuration file gets written, all keys will be lowercase. Override this method if that's unsuitable. For example:

```
>>> config = """
... [Section1]
... Key = Value
...
... [Section2]
... AnotherKey = Value
... """
>>> typical = configparser.ConfigParser()
>>> typical.read_string(config)
>>> list(typical['Section1'].keys())
['key']
>>> list(typical['Section2'].keys())
['anotherkey']
>>> custom = configparser.RawConfigParser()
>>> custom.optionxform = lambda option: option
>>> custom.read_string(config)
>>> list(custom['Section1'].keys())
['Key']
>>> list(custom['Section2'].keys())
['AnotherKey']
```

`ConfigParser.SECTCRE`

A compiled regular expression used to parse section headers. The default matches `[section]` to the name `"section"`. Whitespace is considered part of the section name, thus `[ larch ]` will be read as a section of name `" larch "`. Override this attribute if that's unsuitable. For example:

```
>>> import re
>>> config = """
... [Section 1]
... option = value
...
... [  Section 2  ]
... another = val
... """
>>> typical = configparser.ConfigParser()
>>> typical.read_string(config)
>>> typical.sections()
['Section 1', '  Section 2  ']
>>> custom = configparser.ConfigParser()
>>> custom.SECTCRE = re.compile(r"\[ *(?P<header>[^]]+?) *\]")
```

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```
>>> custom.read_string(config)
>>> custom.sections()
['Section 1', 'Section 2']
```

Note: While ConfigParser objects also use an `OPTCRE` attribute for recognizing option lines, it's not recommended to override it because that would interfere with constructor options *allow_no_value* and *delimiters*.

14.2.8 Legacy API Examples

Mainly because of backwards compatibility concerns, *configparser* provides also a legacy API with explicit `get`/`set` methods. While there are valid use cases for the methods outlined below, mapping protocol access is preferred for new projects. The legacy API is at times more advanced, low-level and downright counterintuitive.

An example of writing to a configuration file:

```
import configparser

config = configparser.RawConfigParser()

# Please note that using RawConfigParser's set functions, you can assign
# non-string values to keys internally, but will receive an error when
# attempting to write to a file or when you get it in non-raw mode. Setting
# values using the mapping protocol or ConfigParser's set() does not allow
# such assignments to take place.
config.add_section('Section1')
config.set('Section1', 'an_int', '15')
config.set('Section1', 'a_bool', 'true')
config.set('Section1', 'a_float', '3.1415')
config.set('Section1', 'baz', 'fun')
config.set('Section1', 'bar', 'Python')
config.set('Section1', 'foo', '%(bar)s is %(baz)s!')

# Writing our configuration file to 'example.cfg'
with open('example.cfg', 'w') as configfile:
    config.write(configfile)
```

An example of reading the configuration file again:

```
import configparser

config = configparser.RawConfigParser()
config.read('example.cfg')

# getfloat() raises an exception if the value is not a float
# getint() and getboolean() also do this for their respective types
a_float = config.getfloat('Section1', 'a_float')
an_int = config.getint('Section1', 'an_int')
print(a_float + an_int)
```

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```
# Notice that the next output does not interpolate '%(bar)s' or '%(baz)s'.
# This is because we are using a RawConfigParser().
if config.getboolean('Section1', 'a_bool'):
    print(config.get('Section1', 'foo'))
```

To get interpolation, use *ConfigParser*:

```
import configparser

cfg = configparser.ConfigParser()
cfg.read('example.cfg')

# Set the optional *raw* argument of get() to True if you wish to disable
# interpolation in a single get operation.
print(cfg.get('Section1', 'foo', raw=False))  # -> "Python is fun!"
print(cfg.get('Section1', 'foo', raw=True))   # -> "%(bar)s is %(baz)s!"

# The optional *vars* argument is a dict with members that will take
# precedence in interpolation.
print(cfg.get('Section1', 'foo', vars={'bar': 'Documentation',
                                       'baz': 'evil'}))

# The optional *fallback* argument can be used to provide a fallback value
print(cfg.get('Section1', 'foo'))
      # -> "Python is fun!"

print(cfg.get('Section1', 'foo', fallback='Monty is not.'))
      # -> "Python is fun!"

print(cfg.get('Section1', 'monster', fallback='No such things as monsters.'))
      # -> "No such things as monsters."

# A bare print(cfg.get('Section1', 'monster')) would raise NoOptionError
# but we can also use:

print(cfg.get('Section1', 'monster', fallback=None))
      # -> None
```

Default values are available in both types of ConfigParsers. They are used in interpolation if an option used is not defined elsewhere.

```
import configparser

# New instance with 'bar' and 'baz' defaulting to 'Life' and 'hard' each
config = configparser.ConfigParser({'bar': 'Life', 'baz': 'hard'})
config.read('example.cfg')

print(config.get('Section1', 'foo'))     # -> "Python is fun!"
config.remove_option('Section1', 'bar')
config.remove_option('Section1', 'baz')
print(config.get('Section1', 'foo'))     # -> "Life is hard!"
```

14.2.9 ConfigParser Objects

class configparser.ConfigParser(*defaults=None, dict_type=dict, allow_no_value=False, delimiters=('=', ':'), comment_prefixes=('#', ';'), inline_comment_prefixes=None, strict=True, empty_lines_in_values=True, default_section=configparser.DEFAULTSECT, interpolation=BasicInterpolation(), converters={}*)

The main configuration parser. When *defaults* is given, it is initialized into the dictionary of intrinsic defaults. When *dict_type* is given, it will be used to create the dictionary objects for the list of sections, for the options within a section, and for the default values.

When *delimiters* is given, it is used as the set of substrings that divide keys from values. When *comment_prefixes* is given, it will be used as the set of substrings that prefix comments in otherwise empty lines. Comments can be indented. When *inline_comment_prefixes* is given, it will be used as the set of substrings that prefix comments in non-empty lines.

When *strict* is `True` (the default), the parser won't allow for any section or option duplicates while reading from a single source (file, string or dictionary), raising *DuplicateSectionError* or *DuplicateOptionError*. When *empty_lines_in_values* is `False` (default: `True`), each empty line marks the end of an option. Otherwise, internal empty lines of a multiline option are kept as part of the value. When *allow_no_value* is `True` (default: `False`), options without values are accepted; the value held for these is `None` and they are serialized without the trailing delimiter.

When *default_section* is given, it specifies the name for the special section holding default values for other sections and interpolation purposes (normally named `"DEFAULT"`). This value can be retrieved and changed on runtime using the `default_section` instance attribute.

Interpolation behaviour may be customized by providing a custom handler through the *interpolation* argument. `None` can be used to turn off interpolation completely, `ExtendedInterpolation()` provides a more advanced variant inspired by `zc.buildout`. More on the subject in the *dedicated documentation section*.

All option names used in interpolation will be passed through the *optionxform()* method just like any other option name reference. For example, using the default implementation of *optionxform()* (which converts option names to lower case), the values `foo %(bar)s` and `foo %(BAR)s` are equivalent.

When *converters* is given, it should be a dictionary where each key represents the name of a type converter and each value is a callable implementing the conversion from string to the desired datatype. Every converter gets its own corresponding `get*()` method on the parser object and section proxies.

Changed in version 3.1: The default *dict_type* is *collections.OrderedDict*.

Changed in version 3.2: *allow_no_value*, *delimiters*, *comment_prefixes*, *strict*, *empty_lines_in_values*, *default_section* and *interpolation* were added.

Changed in version 3.5: The *converters* argument was added.

Changed in version 3.7: The *defaults* argument is read with *read_dict()*, providing consistent behavior across the parser: non-string keys and values are implicitly converted to strings.

Changed in version 3.7: The default *dict_type* is *dict*, since it now preserves insertion order.

defaults()
Return a dictionary containing the instance-wide defaults.

sections()
Return a list of the sections available; the *default section* is not included in the list.

add_section(*section*)
Add a section named *section* to the instance. If a section by the given name already exists,

DuplicateSectionError is raised. If the *default section* name is passed, *ValueError* is raised. The name of the section must be a string; if not, *TypeError* is raised.

Changed in version 3.2: Non-string section names raise *TypeError*.

has_section(*section*)
Indicates whether the named *section* is present in the configuration. The *default section* is not acknowledged.

options(*section*)
Return a list of options available in the specified *section*.

has_option(*section*, *option*)
If the given *section* exists, and contains the given *option*, return *True*; otherwise return *False*. If the specified *section* is *None* or an empty string, DEFAULT is assumed.

read(*filenames*, *encoding=None*)
Attempt to read and parse an iterable of filenames, returning a list of filenames which were successfully parsed.

If *filenames* is a string, a *bytes* object or a *path-like object*, it is treated as a single filename. If a file named in *filenames* cannot be opened, that file will be ignored. This is designed so that you can specify an iterable of potential configuration file locations (for example, the current directory, the user's home directory, and some system-wide directory), and all existing configuration files in the iterable will be read.

If none of the named files exist, the *ConfigParser* instance will contain an empty dataset. An application which requires initial values to be loaded from a file should load the required file or files using *read_file()* before calling *read()* for any optional files:

```
import configparser, os

config = configparser.ConfigParser()
config.read_file(open('defaults.cfg'))
config.read(['site.cfg', os.path.expanduser('~/.myapp.cfg')],
            encoding='cp1250')
```

New in version 3.2: The *encoding* parameter. Previously, all files were read using the default encoding for *open()*.

New in version 3.6.1: The *filenames* parameter accepts a *path-like object*.

New in version 3.7: The *filenames* parameter accepts a *bytes* object.

read_file(*f*, *source=None*)
Read and parse configuration data from *f* which must be an iterable yielding Unicode strings (for example files opened in text mode).

Optional argument *source* specifies the name of the file being read. If not given and *f* has a `name` attribute, that is used for *source*; the default is `'<???>'`.

New in version 3.2: Replaces *readfp()*.

read_string(*string*, *source='<string>'*)
Parse configuration data from a string.

Optional argument *source* specifies a context-specific name of the string passed. If not given, `'<string>'` is used. This should commonly be a filesystem path or a URL.

New in version 3.2.

read_dict(*dictionary*, *source='<dict>'*)
Load configuration from any object that provides a dict-like `items()` method. Keys are section

names, values are dictionaries with keys and values that should be present in the section. If the used dictionary type preserves order, sections and their keys will be added in order. Values are automatically converted to strings.

Optional argument *source* specifies a context-specific name of the dictionary passed. If not given, `<dict>` is used.

This method can be used to copy state between parsers.

New in version 3.2.

get(*section*, *option*, *, *raw=False*, *vars=None*[, *fallback*])
Get an *option* value for the named *section*. If *vars* is provided, it must be a dictionary. The *option* is looked up in *vars* (if provided), *section*, and in *DEFAULTSECT* in that order. If the key is not found and *fallback* is provided, it is used as a fallback value. `None` can be provided as a *fallback* value.

All the `'%'` interpolations are expanded in the return values, unless the *raw* argument is true. Values for interpolation keys are looked up in the same manner as the option.

Changed in version 3.2: Arguments *raw*, *vars* and *fallback* are keyword only to protect users from trying to use the third argument as the *fallback* fallback (especially when using the mapping protocol).

getint(*section*, *option*, *, *raw=False*, *vars=None*[, *fallback*])
A convenience method which coerces the *option* in the specified *section* to an integer. See *get()* for explanation of *raw*, *vars* and *fallback*.

getfloat(*section*, *option*, *, *raw=False*, *vars=None*[, *fallback*])
A convenience method which coerces the *option* in the specified *section* to a floating point number. See *get()* for explanation of *raw*, *vars* and *fallback*.

getboolean(*section*, *option*, *, *raw=False*, *vars=None*[, *fallback*])
A convenience method which coerces the *option* in the specified *section* to a Boolean value. Note that the accepted values for the option are `'1'`, `'yes'`, `'true'`, and `'on'`, which cause this method to return `True`, and `'0'`, `'no'`, `'false'`, and `'off'`, which cause it to return `False`. These string values are checked in a case-insensitive manner. Any other value will cause it to raise *ValueError*. See *get()* for explanation of *raw*, *vars* and *fallback*.

items(*raw=False*, *vars=None*)
items(*section*, *raw=False*, *vars=None*)
When *section* is not given, return a list of *section_name*, *section_proxy* pairs, including DEFAULTSECT.

Otherwise, return a list of *name*, *value* pairs for the options in the given *section*. Optional arguments have the same meaning as for the *get()* method.

set(*section*, *option*, *value*)
If the given section exists, set the given option to the specified value; otherwise raise *NoSectionError*. *option* and *value* must be strings; if not, *TypeError* is raised.

write(*fileobject*, *space_around_delimiters=True*)
Write a representation of the configuration to the specified *file object*, which must be opened in text mode (accepting strings). This representation can be parsed by a future *read()* call. If *space_around_delimiters* is true, delimiters between keys and values are surrounded by spaces.

remove_option(*section*, *option*)
Remove the specified *option* from the specified *section*. If the section does not exist, raise *NoSectionError*. If the option existed to be removed, return *True*; otherwise return *False*.

remove_section(*section*)
Remove the specified *section* from the configuration. If the section in fact existed, return `True`. Otherwise return `False`.

optionxform(*option*)
Transforms the option name *option* as found in an input file or as passed in by client code to the form that should be used in the internal structures. The default implementation returns a lower-case version of *option*; subclasses may override this or client code can set an attribute of this name on instances to affect this behavior.

You don't need to subclass the parser to use this method, you can also set it on an instance, to a function that takes a string argument and returns a string. Setting it to `str`, for example, would make option names case sensitive:

```
cfgparser = ConfigParser()
cfgparser.optionxform = str
```

Note that when reading configuration files, whitespace around the option names is stripped before *optionxform()* is called.

readfp(*fp*, *filename=None*)
Deprecated since version 3.2: Use *read_file()* instead.

Changed in version 3.2: *readfp()* now iterates on *fp* instead of calling `fp.readline()`.

For existing code calling *readfp()* with arguments which don't support iteration, the following generator may be used as a wrapper around the file-like object:

```
def readline_generator(fp):
    line = fp.readline()
    while line:
        yield line
        line = fp.readline()
```

Instead of `parser.readfp(fp)` use `parser.read_file(readline_generator(fp))`.

configparser.MAX_INTERPOLATION_DEPTH
The maximum depth for recursive interpolation for `get()` when the *raw* parameter is false. This is relevant only when the default *interpolation* is used.

14.2.10 RawConfigParser Objects

class configparser.RawConfigParser(*defaults=None*, *dict_type=dict*, *allow_no_value=False*, ***, *delimiters=('=', ':')*, *comment_prefixes=('#', ';')*, *inline_comment_prefixes=None*, *strict=True*, *empty_lines_in_values=True*, *default_section=configparser.DEFAULTSECT*[, *interpolation*])
Legacy variant of the *ConfigParser*. It has interpolation disabled by default and allows for non-string section names, option names, and values via its unsafe `add_section` and `set` methods, as well as the legacy `defaults=` keyword argument handling.

Changed in version 3.7: The default *dict_type* is *dict*, since it now preserves insertion order.

Note: Consider using *ConfigParser* instead which checks types of the values to be stored internally. If you don't want interpolation, you can use `ConfigParser(interpolation=None)`.

---

add_section(*section*)
Add a section named *section* to the instance. If a section by the given name already exists, *DuplicateSectionError* is raised. If the *default section* name is passed, *ValueError* is raised.

Type of *section* is not checked which lets users create non-string named sections. This behaviour is unsupported and may cause internal errors.

set(*section*, *option*, *value*)
If the given section exists, set the given option to the specified value; otherwise raise *NoSectionError*. While it is possible to use *RawConfigParser* (or *ConfigParser* with *raw* parameters set to true) for *internal* storage of non-string values, full functionality (including interpolation and output to files) can only be achieved using string values.

This method lets users assign non-string values to keys internally. This behaviour is unsupported and will cause errors when attempting to write to a file or get it in non-raw mode. **Use the mapping protocol API** which does not allow such assignments to take place.

14.2.11 Exceptions

exception configparser.Error
Base class for all other *configparser* exceptions.

exception configparser.NoSectionError
Exception raised when a specified section is not found.

exception configparser.DuplicateSectionError
Exception raised if `add_section()` is called with the name of a section that is already present or in strict parsers when a section if found more than once in a single input file, string or dictionary.

New in version 3.2: Optional `source` and `lineno` attributes and arguments to `__init__()` were added.

exception configparser.DuplicateOptionError
Exception raised by strict parsers if a single option appears twice during reading from a single file, string or dictionary. This catches misspellings and case sensitivity-related errors, e.g. a dictionary may have two keys representing the same case-insensitive configuration key.

exception configparser.NoOptionError
Exception raised when a specified option is not found in the specified section.

exception configparser.InterpolationError
Base class for exceptions raised when problems occur performing string interpolation.

exception configparser.InterpolationDepthError
Exception raised when string interpolation cannot be completed because the number of iterations exceeds *MAX_INTERPOLATION_DEPTH*. Subclass of *InterpolationError*.

exception configparser.InterpolationMissingOptionError
Exception raised when an option referenced from a value does not exist. Subclass of *InterpolationError*.

exception configparser.InterpolationSyntaxError
Exception raised when the source text into which substitutions are made does not conform to the required syntax. Subclass of *InterpolationError*.

exception configparser.MissingSectionHeaderError
Exception raised when attempting to parse a file which has no section headers.

exception configparser.ParsingError
Exception raised when errors occur attempting to parse a file.

Changed in version 3.2: The `filename` attribute and `__init__()` argument were renamed to `source` for consistency.

14.3 netrc — netrc file processing

Source code: Lib/netrc.py

The *netrc* class parses and encapsulates the netrc file format used by the Unix **ftp** program and other FTP clients.

class netrc.netrc([*file*]**)**

A *netrc* instance or subclass instance encapsulates data from a netrc file. The initialization argument, if present, specifies the file to parse. If no argument is given, the file `.netrc` in the user's home directory – as determined by *os.path.expanduser()* – will be read. Otherwise, a *FileNotFoundError* exception will be raised. Parse errors will raise *NetrcParseError* with diagnostic information including the file name, line number, and terminating token. If no argument is specified on a POSIX system, the presence of passwords in the `.netrc` file will raise a *NetrcParseError* if the file ownership or permissions are insecure (owned by a user other than the user running the process, or accessible for read or write by any other user). This implements security behavior equivalent to that of ftp and other programs that use `.netrc`.

Changed in version 3.4: Added the POSIX permission check.

Changed in version 3.7: *os.path.expanduser()* is used to find the location of the `.netrc` file when *file* is not passed as argument.

exception netrc.NetrcParseError

Exception raised by the *netrc* class when syntactical errors are encountered in source text. Instances of this exception provide three interesting attributes: `msg` is a textual explanation of the error, `filename` is the name of the source file, and `lineno` gives the line number on which the error was found.

14.3.1 netrc Objects

A *netrc* instance has the following methods:

netrc.authenticators(*host***)**

Return a 3-tuple `(login, account, password)` of authenticators for *host*. If the netrc file did not contain an entry for the given host, return the tuple associated with the 'default' entry. If neither matching host nor default entry is available, return `None`.

netrc.__repr__()

Dump the class data as a string in the format of a netrc file. (This discards comments and may reorder the entries.)

Instances of *netrc* have public instance variables:

netrc.hosts

Dictionary mapping host names to `(login, account, password)` tuples. The 'default' entry, if any, is represented as a pseudo-host by that name.

netrc.macros

Dictionary mapping macro names to string lists.

Note: Passwords are limited to a subset of the ASCII character set. All ASCII punctuation is allowed in passwords, however, note that whitespace and non-printable characters are not allowed in passwords. This is a limitation of the way the .netrc file is parsed and may be removed in the future.

14.4 xdrlib — Encode and decode XDR data

Source code: Lib/xdrlib.py

The *xdrlib* module supports the External Data Representation Standard as described in **RFC 1014**, written by Sun Microsystems, Inc. June 1987. It supports most of the data types described in the RFC.

The *xdrlib* module defines two classes, one for packing variables into XDR representation, and another for unpacking from XDR representation. There are also two exception classes.

class xdrlib.Packer
Packer is the class for packing data into XDR representation. The *Packer* class is instantiated with no arguments.

class xdrlib.Unpacker(*data*)
Unpacker is the complementary class which unpacks XDR data values from a string buffer. The input buffer is given as *data*.

See also:

RFC 1014 - XDR: External Data Representation Standard This RFC defined the encoding of data which was XDR at the time this module was originally written. It has apparently been obsoleted by **RFC 1832**.

RFC 1832 - XDR: External Data Representation Standard Newer RFC that provides a revised definition of XDR.

14.4.1 Packer Objects

Packer instances have the following methods:

Packer.get_buffer()
Returns the current pack buffer as a string.

Packer.reset()
Resets the pack buffer to the empty string.

In general, you can pack any of the most common XDR data types by calling the appropriate pack_type() method. Each method takes a single argument, the value to pack. The following simple data type packing methods are supported: pack_uint(), pack_int(), pack_enum(), pack_bool(), pack_uhyper(), and pack_hyper().

Packer.pack_float(*value*)
Packs the single-precision floating point number *value*.

Packer.pack_double(*value*)
Packs the double-precision floating point number *value*.

The following methods support packing strings, bytes, and opaque data:

Packer.pack_fstring(*n*, *s*)
Packs a fixed length string, *s*. *n* is the length of the string but it is *not* packed into the data buffer. The string is padded with null bytes if necessary to guaranteed 4 byte alignment.

Packer.pack_fopaque(*n*, *data*)
Packs a fixed length opaque data stream, similarly to *pack_fstring()*.

Packer.pack_string(*s*)
Packs a variable length string, *s*. The length of the string is first packed as an unsigned integer, then the string data is packed with *pack_fstring()*.

Packer.**pack_opaque**(*data*)
Packs a variable length opaque data string, similarly to *pack_string()*.

Packer.**pack_bytes**(*bytes*)
Packs a variable length byte stream, similarly to *pack_string()*.

The following methods support packing arrays and lists:

Packer.**pack_list**(*list*, *pack_item*)
Packs a *list* of homogeneous items. This method is useful for lists with an indeterminate size; i.e. the size is not available until the entire list has been walked. For each item in the list, an unsigned integer `1` is packed first, followed by the data value from the list. *pack_item* is the function that is called to pack the individual item. At the end of the list, an unsigned integer `0` is packed.

For example, to pack a list of integers, the code might appear like this:

```
import xdrlib
p = xdrlib.Packer()
p.pack_list([1, 2, 3], p.pack_int)
```

Packer.**pack_farray**(*n*, *array*, *pack_item*)
Packs a fixed length list (*array*) of homogeneous items. *n* is the length of the list; it is *not* packed into the buffer, but a *ValueError* exception is raised if `len(array)` is not equal to *n*. As above, *pack_item* is the function used to pack each element.

Packer.**pack_array**(*list*, *pack_item*)
Packs a variable length *list* of homogeneous items. First, the length of the list is packed as an unsigned integer, then each element is packed as in *pack_farray()* above.

14.4.2 Unpacker Objects

The *Unpacker* class offers the following methods:

Unpacker.**reset**(*data*)
Resets the string buffer with the given *data*.

Unpacker.**get_position**()
Returns the current unpack position in the data buffer.

Unpacker.**set_position**(*position*)
Sets the data buffer unpack position to *position*. You should be careful about using *get_position()* and *set_position()*.

Unpacker.**get_buffer**()
Returns the current unpack data buffer as a string.

Unpacker.**done**()
Indicates unpack completion. Raises an *Error* exception if all of the data has not been unpacked.

In addition, every data type that can be packed with a *Packer*, can be unpacked with an *Unpacker*. Unpacking methods are of the form `unpack_type()`, and take no arguments. They return the unpacked object.

Unpacker.**unpack_float**()
Unpacks a single-precision floating point number.

Unpacker.**unpack_double**()
Unpacks a double-precision floating point number, similarly to *unpack_float()*.

In addition, the following methods unpack strings, bytes, and opaque data:

Unpacker.unpack_fstring(*n*)
Unpacks and returns a fixed length string. *n* is the number of characters expected. Padding with null bytes to guaranteed 4 byte alignment is assumed.

Unpacker.unpack_fopaque(*n*)
Unpacks and returns a fixed length opaque data stream, similarly to *unpack_fstring()*.

Unpacker.unpack_string()
Unpacks and returns a variable length string. The length of the string is first unpacked as an unsigned integer, then the string data is unpacked with *unpack_fstring()*.

Unpacker.unpack_opaque()
Unpacks and returns a variable length opaque data string, similarly to *unpack_string()*.

Unpacker.unpack_bytes()
Unpacks and returns a variable length byte stream, similarly to *unpack_string()*.

The following methods support unpacking arrays and lists:

Unpacker.unpack_list(*unpack_item*)
Unpacks and returns a list of homogeneous items. The list is unpacked one element at a time by first unpacking an unsigned integer flag. If the flag is `1`, then the item is unpacked and appended to the list. A flag of `0` indicates the end of the list. *unpack_item* is the function that is called to unpack the items.

Unpacker.unpack_farray(*n*, *unpack_item*)
Unpacks and returns (as a list) a fixed length array of homogeneous items. *n* is number of list elements to expect in the buffer. As above, *unpack_item* is the function used to unpack each element.

Unpacker.unpack_array(*unpack_item*)
Unpacks and returns a variable length *list* of homogeneous items. First, the length of the list is unpacked as an unsigned integer, then each element is unpacked as in *unpack_farray()* above.

14.4.3 Exceptions

Exceptions in this module are coded as class instances:

exception xdrlib.Error
The base exception class. *Error* has a single public attribute `msg` containing the description of the error.

exception xdrlib.ConversionError
Class derived from *Error*. Contains no additional instance variables.

Here is an example of how you would catch one of these exceptions:

```
import xdrlib
p = xdrlib.Packer()
try:
    p.pack_double(8.01)
except xdrlib.ConversionError as instance:
    print('packing the double failed:', instance.msg)
```

14.5 plistlib — Generate and parse Mac OS X .plist files

Source code: Lib/plistlib.py

This module provides an interface for reading and writing the "property list" files used mainly by Mac OS X and supports both binary and XML plist files.

The property list (`.plist`) file format is a simple serialization supporting basic object types, like dictionaries, lists, numbers and strings. Usually the top level object is a dictionary.

To write out and to parse a plist file, use the *dump()* and *load()* functions.

To work with plist data in bytes objects, use *dumps()* and *loads()*.

Values can be strings, integers, floats, booleans, tuples, lists, dictionaries (but only with string keys), *Data*, *bytes*, `bytesarray` or *datetime.datetime* objects.

Changed in version 3.4: New API, old API deprecated. Support for binary format plists added.

See also:

PList manual page Apple's documentation of the file format.

This module defines the following functions:

`plistlib.load`(*fp*, ***, *fmt=None*, *use_builtin_types=True*, *dict_type=dict*)
Read a plist file. *fp* should be a readable and binary file object. Return the unpacked root object (which usually is a dictionary).

The *fmt* is the format of the file and the following values are valid:

- *None*: Autodetect the file format
- *FMT_XML*: XML file format
- *FMT_BINARY*: Binary plist format

If *use_builtin_types* is true (the default) binary data will be returned as instances of *bytes*, otherwise it is returned as instances of *Data*.

The *dict_type* is the type used for dictionaries that are read from the plist file.

XML data for the *FMT_XML* format is parsed using the Expat parser from *xml.parsers.expat* – see its documentation for possible exceptions on ill-formed XML. Unknown elements will simply be ignored by the plist parser.

The parser for the binary format raises `InvalidFileException` when the file cannot be parsed.

New in version 3.4.

`plistlib.loads`(*data*, ***, *fmt=None*, *use_builtin_types=True*, *dict_type=dict*)
Load a plist from a bytes object. See *load()* for an explanation of the keyword arguments.

New in version 3.4.

`plistlib.dump`(*value*, *fp*, ***, *fmt=FMT_XML*, *sort_keys=True*, *skipkeys=False*)
Write *value* to a plist file. *Fp* should be a writable, binary file object.

The *fmt* argument specifies the format of the plist file and can be one of the following values:

- *FMT_XML*: XML formatted plist file
- *FMT_BINARY*: Binary formatted plist file

When *sort_keys* is true (the default) the keys for dictionaries will be written to the plist in sorted order, otherwise they will be written in the iteration order of the dictionary.

When *skipkeys* is false (the default) the function raises *TypeError* when a key of a dictionary is not a string, otherwise such keys are skipped.

A *TypeError* will be raised if the object is of an unsupported type or a container that contains objects of unsupported types.

An *OverflowError* will be raised for integer values that cannot be represented in (binary) plist files.

New in version 3.4.

plistlib.dumps(*value*, ***, *fmt=FMT_XML*, *sort_keys=True*, *skipkeys=False*)
Return *value* as a plist-formatted bytes object. See the documentation for *dump()* for an explanation of the keyword arguments of this function.

New in version 3.4.

The following functions are deprecated:

plistlib.readPlist(*pathOrFile*)
Read a plist file. *pathOrFile* may be either a file name or a (readable and binary) file object. Returns the unpacked root object (which usually is a dictionary).

This function calls *load()* to do the actual work, see the documentation of *that function* for an explanation of the keyword arguments.

Deprecated since version 3.4: Use *load()* instead.

Changed in version 3.7: Dict values in the result are now normal dicts. You no longer can use attribute access to access items of these dictionaries.

plistlib.writePlist(*rootObject*, *pathOrFile*)
Write *rootObject* to an XML plist file. *pathOrFile* may be either a file name or a (writable and binary) file object

Deprecated since version 3.4: Use *dump()* instead.

plistlib.readPlistFromBytes(*data*)
Read a plist data from a bytes object. Return the root object.

See *load()* for a description of the keyword arguments.

Deprecated since version 3.4: Use *loads()* instead.

Changed in version 3.7: Dict values in the result are now normal dicts. You no longer can use attribute access to access items of these dictionaries.

plistlib.writePlistToBytes(*rootObject*)
Return *rootObject* as an XML plist-formatted bytes object.

Deprecated since version 3.4: Use *dumps()* instead.

The following classes are available:

class plistlib.Data(*data*)
Return a "data" wrapper object around the bytes object *data*. This is used in functions converting from/to plists to represent the `<data>` type available in plists.

It has one attribute, `data`, that can be used to retrieve the Python bytes object stored in it.

Deprecated since version 3.4: Use a *bytes* object instead.

The following constants are available:

plistlib.FMT_XML
The XML format for plist files.

New in version 3.4.

plistlib.FMT_BINARY
The binary format for plist files

New in version 3.4.

14.5.1 Examples

Generating a plist:

```
pl = dict(
    aString = "Doodah",
    aList = ["A", "B", 12, 32.1, [1, 2, 3]],
    aFloat = 0.1,
    anInt = 728,
    aDict = dict(
        anotherString = "<hello & hi there!>",
        aThirdString = "M\xe4ssig, Ma\xdf",
        aTrueValue = True,
        aFalseValue = False,
    ),
    someData = b"<binary gunk>",
    someMoreData = b"<lots of binary gunk>" * 10,
    aDate = datetime.datetime.fromtimestamp(time.mktime(time.gmtime())),
)
with open(fileName, 'wb') as fp:
    dump(pl, fp)
```

Parsing a plist:

```
with open(fileName, 'rb') as fp:
    pl = load(fp)
print(pl["aKey"])
```