xlwings - Make Excel Fly!

Release 0.7.0

Zoomer Analytics LLC

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Contents

CHAPTER 1

What's New

1.1 v0.7.0 (March 4, 2016)

This version marks an important first step on our path towards a stable release. It introduces **converters**, a new and powerful concept that brings a consistent experience for how Excel Ranges and their values are treated both when **reading** and **writing** but also across **xlwings.Range** objects and **User Defined Functions** (UDFs).

As a result, a few highlights of this release include:

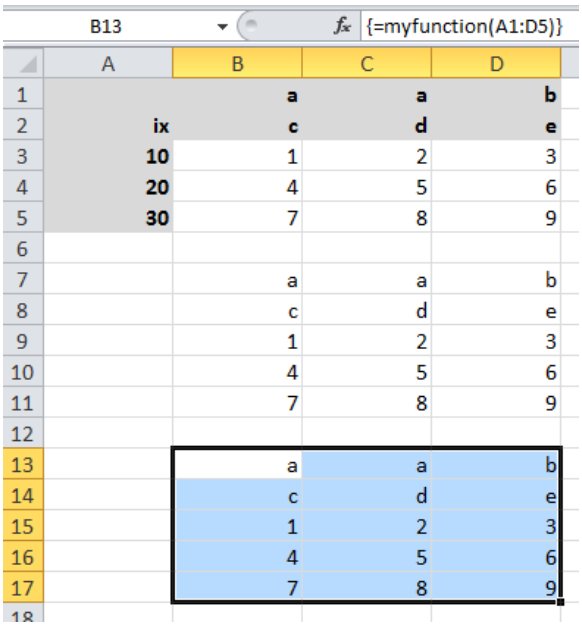
- Pandas DataFrames and Series are now supported for reading and writing, both via Range object and UDFs
- New Range converter options: `transpose`, `dates`, `numbers`, `empty`, `expand`
- New dictionary converter
- New UDF debug server
- No more pyc files when using `RunPython`

Converters are accessed via the new `options` method when dealing with `xlwings.Range` objects or via the `@xw.arg` and `@xw.ret` decorators when using UDFs. As an introductory sample, let's look at how to read and write Pandas DataFrames:

Range object:

```
>>> import xlwings as xw
>>> import pandas as pd
>>> wb = xw.Workbook()
>>> df = xw.Range('A1:D5').options(pd.DataFrame, header=2).value
>>> df
    a     b
    c  d  e
ix
10  1  2  3
20  4  5  6
30  7  8  9

# Writing back using the defaults:
```




```
>>> Range('A1').value = df

# Writing back and changing some of the options, e.g. getting rid of the index:
>>> Range('B7').options(index=False).value = df
```

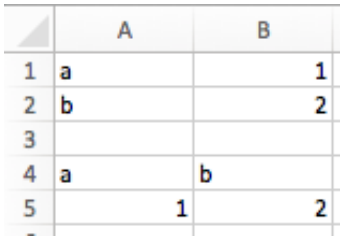
UDFs:

This is the same sample as above (starting in `Range('A13')` on screenshot). If you wanted to return a DataFrame with the defaults, the `@xw.ret` decorator can be left away.

```
@xw.func
@xw.arg('x', pd.DataFrame, header=2)
@xw.ret(index=False)
def myfunction(x):
    # x is a DataFrame, do something with it
    return x
```

1.1.1 Enhancements

- Dictionary (`dict`) converter:



```
>>> Range('A1:B2').options(dict).value
{'a': 1.0, 'b': 2.0}
>>> Range('A4:B5').options(dict, transpose=True).value
{'a': 1.0, 'b': 2.0}
```

- `transpose` option: This works in both directions and finally allows us to e.g. write a list in column orientation to Excel (GH11):

```
Range('A1').options(transpose=True).value = [1, 2, 3]
```

- `dates` option: This allows us to read Excel date-formatted cells in specific formats:

```
>>> import datetime as dt
>>> Range('A1').value
datetime.datetime(2015, 1, 13, 0, 0)
>>> Range('A1').options(dates=dt.date).value
datetime.date(2015, 1, 13)
```

- `empty` option: This allows us to override the default behavior for empty cells:

```
>>> Range('A1:B1').value
[None, None]
>>> Range('A1:B1').options(empty='NA')
['NA', 'NA']
```

- `numbers` option: This transforms all numbers into the indicated type.

```
>>> xw.Range('A1').value = 1
>>> type(xw.Range('A1').value)  # Excel stores all numbers interally as floats
float
>>> type(xw.Range('A1').options(numbers=int).value)
int
```

- `expand` option: This works the same as the Range properties `table`, `vertical` and `horizontal` but is only evaluated when getting the values of a Range:

```
>>> import xlwings as xw
>>> wb = xw.Workbook()
>>> xw.Range('A1').value = [[1,2], [3,4]]
>>> rng1 = xw.Range('A1').table
>>> rng2 = xw.Range('A1').options(expand='table')
>>> rng1.value
[[1.0, 2.0], [3.0, 4.0]]
>>> rng2.value
[[1.0, 2.0], [3.0, 4.0]]
>>> xw.Range('A3').value = [5, 6]
>>> rng1.value
[[1.0, 2.0], [3.0, 4.0]]
>>> rng2.value
[[1.0, 2.0], [3.0, 4.0], [5.0, 6.0]]
```

All these options work the same with decorators for UDFs, e.g. for transpose:

```
@xw.arg('x', transpose=True)
@xw.ret(transpose=True)
def myfunction(x):
    # x will be returned unchanged as transposed both when reading and writing
    return x
```

Note: These options (`dates`, `empty`, `numbers`) currently apply to the whole Range and can't be selectively applied to e.g. only certain columns.

- UDF debug server

  The new UDF debug server allows you to easily debug UDFs: just set `UDF_DEBUG_SERVER = True` in the VBA Settings, at the top of the xlwings VBA module (make sure to update it to the latest version!). Then add the following lines to your Python source file and run it:

```
    if __name__ == '__main__':
        xw.serve()
```

  When you recalculate the Sheet, the code will stop at breakpoints or print any statements that you may have. For details, see: *Debugging*.

- pyc files: The creation of pyc files has been disabled when using `RunPython`, leaving your directory in an uncluttered state when having the Python source file next to the Excel workbook (GH326).

1.1.2 API changes

- UDF decorator changes (it is assumed that xlwings is imported as `xw` and numpy as `np`):

New	Old
`@xw.func`	`@xw.xlfunc`
`@xw.arg`	`@xw.xlarg`
`@xw.ret`	`@xw.xlret`
`@xw.sub`	`@xw.xlsub`

  Pay attention to the following subtle change:

New	Old
`@xw.arg("x", np.array)`	`@xw.xlarg("x", "nparray")`

- Samples of how the new options method replaces the old Range keyword arguments:

New	Old
`Range('A1:A2').options(ndim=2)`	`Range('A1:A2', atleast_2d=True)`
`Range('A1:B2').options(np.array)`	`Range('A1:B2', asarray=True)`
`Range('A1').options(index=False, header=False).value = df`	`Range('A1', index=False, header=False).value = df`

- Upon writing, Pandas Series are now shown by default with their name and index name, if they exist. This can be changed using the same options as for DataFrames (GH276):

```
    import pandas as pd
```

```
# unchanged behaviour
Range('A1').value = pd.Series([1,2,3])

# Changed behaviour: This will print a header row in Excel
s = pd.Series([1,2,3], name='myseries', index=pd.Index([0,1,2], name='myindex'))
Range('A1').value = s

# Control this behaviour like so (as with DataFrames):
Range('A1').options(header=False, index=True).value = s
```

- NumPy scalar values

  Previously, NumPy scalar values were returned as `np.atleast_1d`. To keep the same behaviour, this now has to be set explicitly using `ndim=1`. Otherwise they're returned as numpy scalar values.

New	Old
`Range('A1').options(np.array, ndim=1).value`	`Range('A1', asarray=True).value`

1.1.3 Bug Fixes

A few bugfixes were made: GH352, GH359.

1.2 v0.6.4 (January 6, 2016)

1.2.1 API changes

None

1.2.2 Enhancements

- Quickstart: It's now easier than ever to start a new xlwings project, simply use the commmand line client (GH306):

  `xlwings quickstart myproject` will produce a folder with the following files, ready to be used (see *Command Line Client*):

```
myproject
  |--myproject.xlsm
  |--myproject.py
```

- New documentation about how to use xlwings with other languages like R and Julia, see *xlwings with R and Julia*.

1.2.3 Bug Fixes

- [Win]: Importing UDFs with the add-in was throwing an error if the filename was including characters like spaces or dashes (GH331). To fix this, close Excel completely and run `xlwings addin update`.
- [Win]: `Workbook.caller()` is now also accessible within functions that are decorated with `@xlfunc`. Previously, it was only available with functions that used the `@xlsub` decorator (GH316).
- Writing a Pandas DataFrame failed in case the index was named the same as a column (GH334).

1.3 v0.6.3 (December 18, 2015)

1.3.1 Bug Fixes

- [Mac]: This fixes a bug introduced in v0.6.2: When using `RunPython` from VBA, errors were not shown in a pop-up window (GH330).

1.4 v0.6.2 (December 15, 2015)

1.4.1 API changes

- LOG_FILE: So far, the log file has been placed next to the Excel file per default (VBA settings). This has been changed as it was causing issues for files on SharePoint/OneDrive and Mac Excel 2016: The place where `LOG_FILE = ""` refers to depends on the OS and the Excel version, see *LOG_FILE default locations*.

1.4.2 Enhancements

- [Mac]: This version adds support for the VBA module on Mac Excel 2016 (i.e. the `RunPython` command) and is now feature equivalent with Mac Excel 2011 (GH206).

1.4.3 Bug Fixes

- [Win]: On certain systems, the xlwings dlls weren't found (GH323).

1.5 v0.6.1 (December 4, 2015)

1.5.1 Bug Fixes

- [Python 3]: The command line client has been fixed (GH319).
- [Mac]: It now works correctly with `psutil>=3.0.0` (GH315).

1.6 v0.6.0 (November 30, 2015)

1.6.1 API changes

None

1.6.2 Enhancements

- **User Defined Functions (UDFs) - currently Windows only**

  The ExcelPython project has been fully merged into xlwings. This means that on Windows, UDF's are now supported via decorator syntax. A simple example:

```
from xlwings import xlfunc

@xlfunc
def double_sum(x, y):
    """Returns twice the sum of the two arguments"""
    return 2 * (x + y)
```

  For **array formulas** with or without **NumPy**, see the docs: *UDF Tutorial*

- **Command Line Client**

  The new xlwings command line client makes it easy to work with the xlwings **template** and the developer **add-in** (the add-in is currently Windows-only). E.g. to create a new Excel spreadsheet from the template, run:

```
xlwings template open
```

  For all commands, see the docs: *Command Line Client*

- **Other enhancements**:
  - New method: *xlwings.Sheet.delete()*
  - New method: *xlwings.Range.top()*
  - New method: *xlwings.Range.left()*

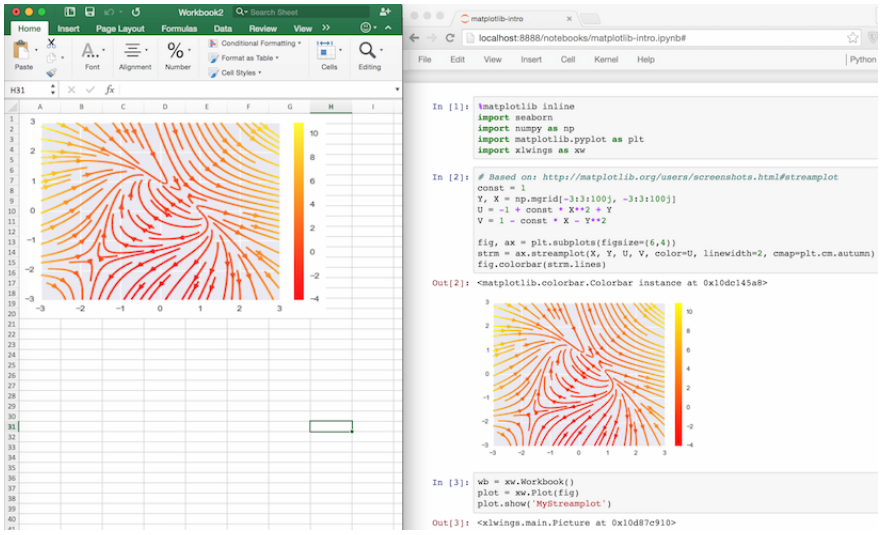
1.7 v0.5.0 (November 10, 2015)

1.7.1 API changes

None

1.7.2 Enhancements

This version adds support for Matplotlib! Matplotlib figures can be shown in Excel as pictures in just 2 lines of code:



1. Get a matplotlib `figure` object:

- via PyPlot interface:

```
import matplotlib.pyplot as plt
fig = plt.figure()
plt.plot([1, 2, 3, 4, 5])
```

- via object oriented interface:

```
from matplotlib.figure import Figure
fig = Figure(figsize=(8, 6))
ax = fig.add_subplot(111)
ax.plot([1, 2, 3, 4, 5])
```

- via Pandas:

```
import pandas as pd
import numpy as np

df = pd.DataFrame(np.random.rand(10, 4), columns=['a', 'b', 'c', 'd'])
ax = df.plot(kind='bar')
fig = ax.get_figure()
```

2. Show it in Excel as picture:

```
plot = Plot(fig)
plot.show('Plot1')
```

See the full API: *xlwings.Plot()*. There's also a new example available both on GitHub and as download on the homepage.

Other enhancements:

- New *xlwings.Shape()* class
- New *xlwings.Picture()* class

- The `PYTHONPATH` in the VBA settings now accepts multiple directories, separated by `;` (GH258)
- An explicit exception is raised when `Range` is called with 0-based indices (GH106)

1.7.3 Bug Fixes

- `Sheet.add` was not always acting on the correct workbook (GH287)
- Iteration over a `Range` only worked the first time (GH272)
- [Win]: Sometimes, an error was raised when Excel was not running (GH269)
- [Win]: Non-default Python interpreters (as specified in the VBA settings under `PYTHON_WIN`) were not found if the path contained a space (GH257)

1.8 v0.4.1 (September 27, 2015)

1.8.1 API changes

None

1.8.2 Enhancements

This release makes it easier than ever to connect to Excel from Python! In addition to the existing ways, you can now connect to the active Workbook (on Windows across all instances) and if the Workbook is already open, it's good enough to refer to it by name (instead of having to use the full path). Accordingly, this is how you make a connection to... (GH30 and GH226):

- a new workbook: `wb = Workbook()`
- the active workbook [New!]: `wb = Workbook.active()`
- an unsaved workbook: `wb = Workbook('Book1')`
- a saved (open) workbook by name (incl. xlsx etc.) [New!]: `wb = Workbook('MyWorkbook.xlsx')`
- a saved (open or closed) workbook by path: `wb = Workbook(r'C:\\path\\to\\file.xlsx')`

Also, there are some new docs:

- *Connect to Workbooks*
- *Missing Features*

1.8.3 Bug Fixes

- The Excel template was updated to the latest VBA code (GH234).
- Connections to files that are saved on OneDrive/SharePoint are now working correctly (GH215).

- Various issues with timezone-aware objects were fixed (GH195).
- [Mac]: A certain range of integers were not written to Excel (GH227).

1.9 v0.4.0 (September 13, 2015)

1.9.1 API changes

None

1.9.2 Enhancements

The most important update with this release was made on Windows: The methodology used to make a connection to Workbooks has been completely replaced. This finally allows xlwings to reliably connect to multiple instances of Excel even if the Workbooks are opened from untrusted locations (network drives or files downloaded from the internet). This gets rid of the dreaded `Filename is already open...` error message that was sometimes shown in this context. It also allows the VBA hooks (`RunPython`) to work correctly if the very same file is opened in various instances of Excel.

Note that you will need to update the VBA module and that apart from `pywin32` there is now a new dependency for the Windows version: `comtypes`. It should be installed automatically though when installing/upgrading xlwings with `pip`.

Other updates:

- Added support to manipulate named Ranges (GH92):

```
>>> wb = Workbook()
>>> Range('A1').name = 'Name1'
>>> Range('A1').name
>>> 'Name1'
>>> del wb.names['Name1']
```

- **New `Range` properties (GH81):**
  - *`xlwings.Range.column_width()`*
  - *`xlwings.Range.row_height()`*
  - *`xlwings.Range.width()`*
  - *`xlwings.Range.height()`*
- `Range` now also accepts `Sheet` objects, the following 3 ways are hence all valid (GH92):

```
r = Range(1, 'A1')
r = Range('Sheet1', 'A1')
sheet1 = Sheet(1)
r = Range(sheet1, 'A1')
```

- [Win]: Error pop-ups show now the full error message that can also be copied with `Ctrl-C` (GH221).

1.9.3 Bug Fixes

- The VBA module was not accepting lower case drive letters (GH205).
- Fixed an error when adding a new Sheet that was already existing (GH211).

1.10 v0.3.6 (July 14, 2015)

1.10.1 API changes

`Application` as attribute of a `Workbook` has been removed (`wb` is a `Workbook` object):

Correct Syntax (as before)	Removed
`Application(wkb=wb)`	`wb.application`

1.10.2 Enhancements

Excel 2016 for Mac Support (GH170)

Excel 2016 for Mac is finally supported (Python side). The VBA hooks (`RunPython`) are currently not yet supported. In more details:

- This release allows Excel 2011 and Excel 2016 to be installed in parallel.
- `Workbook()` will open the default Excel installation (usually Excel 2016).
- The new keyword argument `app_target` allows to connect to a different Excel installation, e.g.:

```
Workbook(app_target='/Applications/Microsoft Office 2011/Microsoft Excel')
```

  Note that `app_target` is only available on Mac. On Windows, if you want to change the version of Excel that xlwings talks to, go to `Control Panel > Programs and Features` and `Repair` the Office version that you want as default.

- The `RunPython` calls in VBA are not yet available through Excel 2016 but Excel 2011 doesn't get confused anymore if Excel 2016 is installed on the same system - make sure to update your VBA module!

Other enhancements

- New method: *`xlwings.Application.calculate()`* (GH207)

1.10.3 Bug Fixes

- [Win]: When using the `OPTIMIZED_CONNECTION` on Windows, Excel left an orphaned process running after closing (GH193).

Various improvements regarding unicode file path handling, including:

- [Mac]: Excel 2011 for Mac now supports unicode characters in the filename when called via VBA's `RunPython` (but not in the path - this is a limitation of Excel 2011 that will be resolved in Excel 2016) (GH154).
- [Win]: Excel on Windows now handles unicode file paths correctly with untrusted documents. (GH154).

1.11 v0.3.5 (April 26, 2015)

1.11.1 API changes

`Sheet.autofit()` and `Range.autofit()`: The integer argument for the axis has been removed (GH186). Use string arguments `rows` or `r` for autofitting rows and `columns` or `c` for autofitting columns (as before).

1.11.2 Enhancements

New methods:

- *`xlwings.Range.row()`* (GH143)
- *`xlwings.Range.column()`* (GH143)
- *`xlwings.Range.last_cell()`* (GH142)

Example:

```
>>> rng = Range('A1').table
>>> rng.row, rng.column
(1, 1)
>>> rng.last_cell.row, rng.last_cell.column
(4, 5)
```

1.11.3 Bug Fixes

- The `unicode` bug on Windows/Python3 has been fixed (GH161)

1.12 v0.3.4 (March 9, 2015)

1.12.1 Bug Fixes

- The installation error on Windows has been fixed (GH160)

1.13 v0.3.3 (March 8, 2015)

1.13.1 API changes

None

1.13.2 Enhancements

- New class `Application` with `quit` method and properties `screen_updating` und `calculation` (GH101, GH158, GH159). It can be conveniently accessed from within a Workbook (on Windows, `Application` is instance dependent). A few examples:

```
>>> from xlwings import Workbook, Calculation
>>> wb = Workbook()
>>> wb.application.screen_updating = False
>>> wb.application.calculation = Calculation.xlCalculationManual
>>> wb.application.quit()
```

- New headless mode: The Excel application can be hidden either during `Workbook` instantiation or through the `application` object:

```
>>> wb = Workbook(app_visible=False)
>>> wb.application.visible
False
>>> wb.application.visible = True
```

- Newly included Excel template which includes the xlwings VBA module and boilerplate code. This is currently accessible from an interactive interpreter session only:

```
>>> from xlwings import Workbook
>>> Workbook.open_template()
```

1.13.3 Bug Fixes

- [Win]: `datetime.date` objects were causing an error (GH44).
- Depending on how it was instantiated, Workbook was sometimes missing the `fullname` attribute (GH76).
- `Range.hyperlink` was failing if the hyperlink had been set as formula (GH132).
- A bug introduced in v0.3.0 caused frozen versions (eg. with `cx_Freeze`) to fail (GH133).
- [Mac]: Sometimes, xlwings was causing an error when quitting the Python interpreter (GH136).

1.14 v0.3.2 (January 17, 2015)

1.14.1 API changes

None

1.14.2 Enhancements

None

1.14.3 Bug Fixes

- The *xlwings.Workbook.save()* method has been fixed to show the expected behavior (GH138): Previously, calling *save()* without a *path* argument would always create a new file in the current working directory. This is now only happening if the file hasn't been previously saved.

1.15 v0.3.1 (January 16, 2015)

1.15.1 API changes

None

1.15.2 Enhancements

- New method *xlwings.Workbook.save()* (GH110).
- New method *xlwings.Workbook.set_mock_caller()* (GH129). This makes calling files from both Excel and Python much easier:

```
import os
from xlwings import Workbook, Range

def my_macro():
    wb = Workbook.caller()
    Range('A1').value = 1

if __name__ == '__main__':
    # To run from Python, not needed when called from Excel.
    # Expects the Excel file next to this source file, adjust accordingly.
    path = os.path.abspath(os.path.join(os.path.dirname(__file__), 'myfile.xlsm'))
    Workbook.set_mock_caller(path)
    my_macro()
```

- The `simulation` example on the homepage works now also on Mac.

1.15.3 Bug Fixes

- [Win]: A long-standing bug that caused the Excel file to close and reopen under certain circumstances has been fixed (GH10): Depending on your security settings (Trust Center) and in connection with files downloaded from the internet or possibly in connection with some add-ins, Excel was either closing the file and reopening it or giving a "file already open" warning. This has now been fixed which means that the examples downloaded from the homepage should work right away after downloading and unzipping.

1.16 v0.3.0 (November 26, 2014)

1.16.1 API changes

- To reference the calling Workbook when running code from VBA, you now have to use `Workbook.caller()`. This means that `wb = Workbook()` is now consistently creating a new Workbook, whether the code is called interactively or from VBA.

New	Old
`Workbook.caller()`	`Workbook()`

1.16.2 Enhancements

This version adds two exciting but still **experimental** features from ExcelPython (**Windows only!**):

- Optimized connection: Set the `OPTIMIZED_CONNECTION = True` in the VBA settings. This will use a COM server that will keep the connection to Python alive between different calls and is therefore much more efficient. However, changes in the Python code are not being picked up until the `pythonw.exe` process is restarted by killing it manually in the Windows Task Manager. The suggested workflow is hence to set `OPTIMIZED_CONNECTION = False` for development and only set it to `True` for production - keep in mind though that this feature is still experimental!
- User Defined Functions (UDFs): Using ExcelPython's wrapper syntax in VBA, you can expose Python functions as UDFs, see *UDF Tutorial* for details.

Note: ExcelPython's developer add-in that autogenerates the VBA wrapper code by simply using Python decorators isn't available through xlwings yet.

Further enhancements include:

- New method *xlwings.Range.resize()* (GH90).
- New method *xlwings.Range.offset()* (GH89).
- New property *xlwings.Range.shape* (GH109).
- New property *xlwings.Range.size* (GH109).
- New property *xlwings.Range.hyperlink* and new method *xlwings.Range.add_hyperlink()* (GH104).
- New property *xlwings.Range.color* (GH97).

- The `len` built-in function can now be used on `Range` (GH109):

```
>>> len(Range('A1:B5'))
5
```

- The `Range` object is now iterable (GH108):

```
for cell in Range('A1:B2'):
    if cell.value < 2:
        cell.color = (255, 0, 0)
```

- [Mac]: The VBA module finds now automatically the default Python installation as per `PATH` variable on `.bash_profile` when `PYTHON_MAC = ""` (the default in the VBA settings) (GH95).
- The VBA error pop-up can now be muted by setting `SHOW_LOG = False` in the VBA settings. To be used with care, but it can be useful on Mac, as the pop-up window is currently showing printed log messages even if no error occurred(GH94).

1.16.3 Bug Fixes

- [Mac]: Environment variables from `.bash_profile` are now available when called from VBA, e.g. by using: `os.environ['USERNAME']` (GH95)

1.17 v0.2.3 (October 17, 2014)

1.17.1 API changes

None

1.17.2 Enhancements

- New method `Sheet.add()` (GH71):

```
>>> Sheet.add()  # Place at end with default name
>>> Sheet.add('NewSheet', before='Sheet1')  # Include name and position
>>> new_sheet = Sheet.add(after=3)
>>> new_sheet.index
4
```

- New method `Sheet.count()`:

```
>>> Sheet.count()
3
```

- `autofit()` works now also on `Sheet` objects, not only on `Range` objects (GH66):

```
>>> Sheet(1).autofit()  # autofit columns and rows
>>> Sheet('Sheet1').autofit('c')  # autofit columns
```

- New property `number_format` for `Range` objects (GH60):

```
>>> Range('A1').number_format
'General'
>>> Range('A1:C3').number_format = '0.00%'
>>> Range('A1:C3').number_format
'0.00%'
```

Works also with the `Range` properties `table`, `vertical`, `horizontal`:

```
>>> Range('A1').value = [1,2,3,4,5]
>>> Range('A1').table.number_format = '0.00%'
```

- New method `get_address` for `Range` objects (GH7):

```
>>> Range((1,1)).get_address()
'$A$1'
>>> Range((1,1)).get_address(False, False)
'A1'
>>> Range('Sheet1', (1,1), (3,3)).get_address(True, False, include_sheetname=True)
'Sheet1!A$1:C$3'
>>> Range('Sheet1', (1,1), (3,3)).get_address(True, False, external=True)
'[Workbook1]Sheet1!A$1:C$3'
```

- New method `Sheet.all()` returning a list with all Sheet objects:

```
>>> Sheet.all()
[<Sheet 'Sheet1' of Workbook 'Book1'>, <Sheet 'Sheet2' of Workbook 'Book1'>]
>>> [i.name.lower() for i in Sheet.all()]
['sheet1', 'sheet2']
>>> [i.autofit() for i in Sheet.all()]
```

1.17.3 Bug Fixes

- xlwings works now also with NumPy < 1.7.0. Before, doing something like `Range('A1').value = 'Foo'` was causing a `NotImplementedError: Not implemented for this type` error when NumPy < 1.7.0 was installed (GH73).
- [Win]: The VBA module caused an error on the 64bit version of Excel (GH72).
- [Mac]: The error pop-up wasn't shown on Python 3 (GH85).
- [Mac]: Autofitting bigger Ranges, e.g. `Range('A:D').autofit()` was causing a time out (GH74).
- [Mac]: Sometimes, calling xlwings from Python was causing Excel to show old errors as pop-up alert (GH70).

1.18 v0.2.2 (September 23, 2014)

1.18.1 API changes

- The `Workbook` qualification changed: It now has to be specified as keyword argument. Assume we have instantiated two Workbooks like so: `wb1 = Workbook()` and `wb2 = Workbook()`. `Sheet`, `Range` and `Chart` classes will default to `wb2` as it was instantiated last. To target `wb1`, use the new `wkb` keyword argument:

New	Old
`Range('A1', wkb=wb1).value`	`wb1.range('A1').value`
`Chart('Chart1', wkb=wb1)`	`wb1.chart('Chart1')`

Alternatively, simply set the current Workbook before using the `Sheet`, `Range` or `Chart` classes:

```
wb1.set_current()
Range('A1').value
```

- Through the introduction of the `Sheet` class (see Enhancements), a few methods moved from the `Workbook` to the `Sheet` class. Assume the current Workbook is: `wb = Workbook()`:

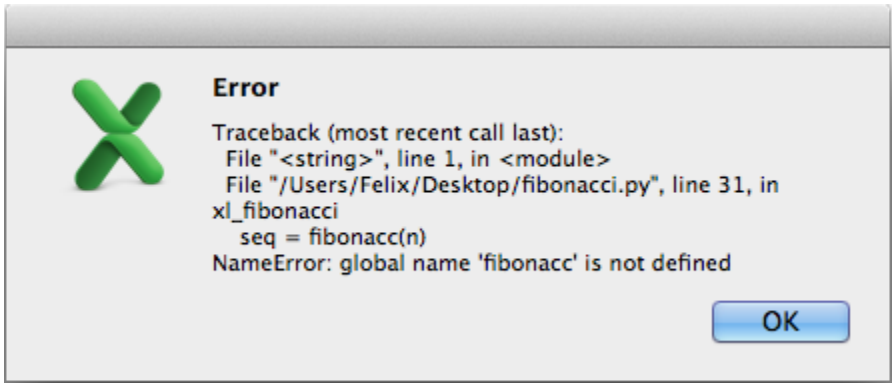
New	Old
`Sheet('Sheet1').activate()`	`wb.activate('Sheet1')`
`Sheet('Sheet1').clear()`	`wb.clear('Sheet1')`
`Sheet('Sheet1').clear_contents()`	`wb.clear_contents('Sheet1')`
`Sheet.active().clear_contents()`	`wb.clear_contents()`

- The syntax to add a new Chart has been slightly changed (it is a class method now):

New	Old
`Chart.add()`	`Chart().add()`

1.18.2 Enhancements

- [Mac]: Python errors are now also shown in a Message Box. This makes the Mac version feature equivalent with the Windows version (GH57):



- New `Sheet` class: The new class handles everything directly related to a Sheet. See the section about *Sheet* for details (GH62). A few examples:

```
>>> Sheet(1).name
'Sheet1'
>>> Sheet('Sheet1').clear_contents()
>>> Sheet.active()
<Sheet 'Sheet1' of Workbook 'Book1'>
```

- The `Range` class has a new method `autofit()` that autofits the width/height of either columns, rows or both (GH33).

  Arguments:

```
axis : string or integer, default None
    - To autofit rows, use one of the following: 'rows' or 'r'
    - To autofit columns, use one of the following: 'columns' or 'c'
    - To autofit rows and columns, provide no arguments
```

  Examples:

```
# Autofit column A
Range('A:A').autofit()
# Autofit row 1
Range('1:1').autofit()
# Autofit columns and rows, taking into account Range('A1:E4')
Range('A1:E4').autofit()
# AutoFit rows, taking into account Range('A1:E4')
Range('A1:E4').autofit('rows')
```

- The `Workbook` class has the following additional methods: `current()` and `set_current()`. They determine the default Workbook for `Sheet`, `Range` or `Chart`. On Windows, in case there are various Excel instances, when creating new or opening existing Workbooks, they are being created in the same instance as the current Workbook.

```
>>> wb1 = Workbook()
>>> wb2 = Workbook()
>>> Workbook.current()
<Workbook 'Book2'>
>>> wb1.set_current()
>>> Workbook.current()
<Workbook 'Book1'>
```

- If a `Sheet`, `Range` or `Chart` object is instantiated without an existing `Workbook` object, a user-friendly error message is raised (GH58).
- New docs about *Debugging* and *Data Structures Tutorial*.

1.18.3 Bug Fixes

- The `atleast_2d` keyword had no effect on Ranges consisting of a single cell and was raising an error when used in combination with the `asarray` keyword. Both have been fixed (GH53):

```
>>> Range('A1').value = 1
>>> Range('A1', atleast_2d=True).value
[[1.0]]
>>> Range('A1', atleast_2d=True, asarray=True).value
array([[1.]])
```

- [Mac]: After creating two new unsaved Workbooks with `Workbook()`, any `Sheet`, `Range` or `Chart` object would always just access the latest one, even if the Workbook had been specified (GH63).
- [Mac]: When xlwings was imported without ever instantiating a `Workbook` object, Excel would start upon quitting the Python interpreter (GH51).
- [Mac]: When installing xlwings, it now requires `psutil` to be at least version `2.0.0` (GH48).

1.19 v0.2.1 (August 7, 2014)

1.19.1 API changes

None

1.19.2 Enhancements

- All VBA user settings have been reorganized into a section at the top of the VBA xlwings module:

```
PYTHON_WIN = ""
PYTHON_MAC = GetMacDir("Home") & "/anaconda/bin"
PYTHON_FROZEN = ThisWorkbook.Path & "\build\exe.win32-2.7"
PYTHONPATH = ThisWorkbook.Path
LOG_FILE = ThisWorkbook.Path & "\xlwings_log.txt"
```

- Calling Python from within Excel VBA is now also supported on Mac, i.e. Python functions can be called like this: `RunPython("import bar; bar.foo()")`. Running frozen executables (`RunFrozenPython`) isn't available yet on Mac though.

Note that there is a slight difference in the way that this functionality behaves on Windows and Mac:

- **Windows**: After calling the Macro (e.g. by pressing a button), Excel waits until Python is done. In case there's an error in the Python code, a pop-up message is being shown with the traceback.
- **Mac**: After calling the Macro, the call returns instantly but Excel's Status Bar turns into "Running..." during the duration of the Python call. Python errors are currently not shown as a pop-up, but need to be checked in the log file. I.e. if the Status Bar returns to its default ("Ready") but nothing has happened, check out the log file for the Python traceback.

1.19.3 Bug Fixes

None

Special thanks go to Georgi Petrov for helping with this release.

1.20 v0.2.0 (July 29, 2014)

1.20.1 API changes

None

1.20.2 Enhancements

- Cross-platform: xlwings is now additionally supporting Microsoft Excel for Mac. The only functionality that is not yet available is the possibility to call the Python code from within Excel via VBA macros.
- The `clear` and `clear_contents` methods of the `Workbook` object now default to the active sheet (GH5):

```
wb = Workbook()
wb.clear_contents()  # Clears contents of the entire active sheet
```

1.20.3 Bug Fixes

- DataFrames with MultiHeaders were sometimes getting truncated (GH41).

1.21 v0.1.1 (June 27, 2014)

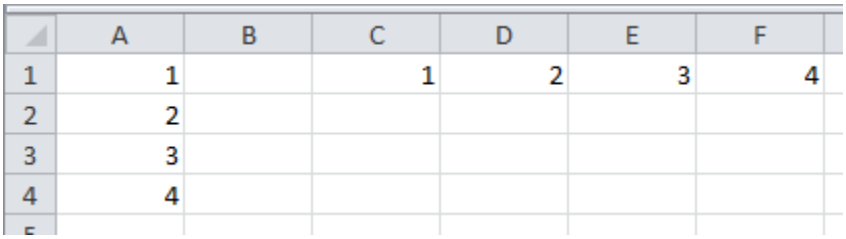
1.21.1 API Changes

- If `asarray=True`, NumPy arrays are now always at least 1d arrays, even in the case of a single cell (GH14):

```
>>> Range('A1', asarray=True).value
array([34.])
```

- Similar to NumPy's logic, 1d Ranges in Excel, i.e. rows or columns, are now being read in as flat lists or 1d arrays. If you want the same behavior as before, you can use the `atleast_2d` keyword (GH13).

> **Note:** The `table` property is also delivering a 1d array/list, if the table Range is really a column or row.



	A	B	C	D	E	F
1	1		1	2	3	4
2	2					
3	3					
4	4					

```
>>> Range('A1').vertical.value
[1.0, 2.0, 3.0, 4.0]
>>> Range('A1', atleast_2d=True).vertical.value
[[1.0], [2.0], [3.0], [4.0]]
>>> Range('C1').horizontal.value
[1.0, 2.0, 3.0, 4.0]
>>> Range('C1', atleast_2d=True).horizontal.value
[[1.0, 2.0, 3.0, 4.0]]
>>> Range('A1', asarray=True).table.value
array([ 1.,  2.,  3.,  4.])
>>> Range('A1', asarray=True, atleast_2d=True).table.value
array([[ 1.],
       [ 2.],
       [ 3.],
       [ 4.]])
```

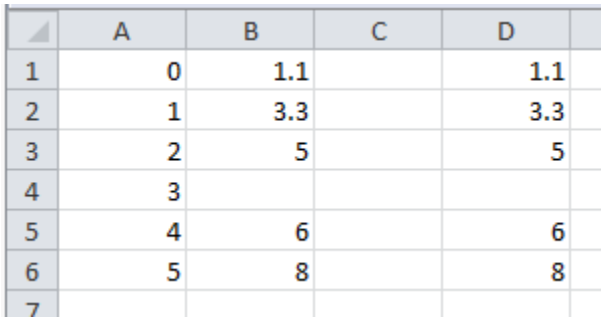
- The single file approach has been dropped. xlwings is now a traditional Python package.

1.21.2 Enhancements

- xlwings is now officially suppported on Python 2.6-2.7 and 3.1-3.4
- Support for Pandas `Series` has been added (GH24):

```
>>> import numpy as np
>>> import pandas as pd
>>> from xlwings import Workbook, Range
>>> wb = Workbook()
>>> s = pd.Series([1.1, 3.3, 5., np.nan, 6., 8.])
>>> s
0    1.1
1    3.3
2    5.0
3    NaN
4    6.0
5    8.0
dtype: float64
>>> Range('A1').value = s
>>> Range('D1', index=False).value = s
```

- Excel constants have been added under their original Excel name, but categorized under their enum (GH18), e.g.:



	A	B	C	D
1	0	1.1		1.1
2	1	3.3		3.3
3	2	5		5
4	3			
5	4	6		6
6	5	8		8
7				

```
# Extra long version
import xlwings as xl
xl.constants.ChartType.xlArea

# Long version
from xlwings import constants
constants.ChartType.xlArea

# Short version
from xlwings import ChartType
ChartType.xlArea
```

- Slightly enhanced Chart support to control the `ChartType` (GH1):

```
>>> from xlwings import Workbook, Range, Chart, ChartType
>>> wb = Workbook()
>>> Range('A1').value = [['one', 'two'],[10, 20]]
>>> my_chart = Chart().add(chart_type=ChartType.xlLine,
                           name='My Chart',
                           source_data=Range('A1').table)
```

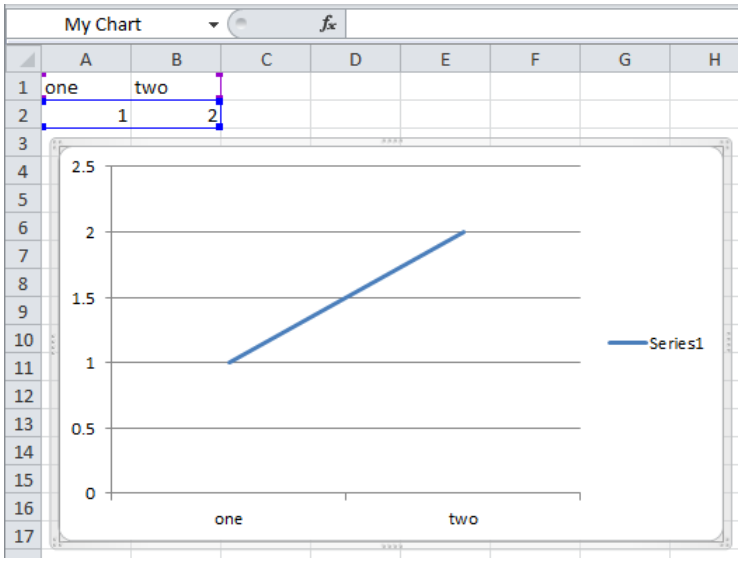
alternatively, the properties can also be set like this:

```
>>> my_chart = Chart().add()  # Existing Charts: my_chart = Chart('My Chart')
>>> my_chart.name = 'My Chart'
>>> my_chart.chart_type = ChartType.xlLine
>>> my_chart.set_source_data(Range('A1').table)
```

- `pytz` is no longer a dependency as `datetime` object are now being read in from Excel as time-zone naive (Excel doesn't know timezones). Before, `datetime` objects got the UTC timezone attached.
- The `Workbook` class has the following additional methods: `close()`
- The `Range` class has the following additional methods: `is_cell()`, `is_column()`, `is_row()`, `is_table()`

1.21.3 Bug Fixes

- Writing `None` or `np.nan` to Excel works now (GH16 & GH15).
- The import error on Python 3 has been fixed (GH26).



- Python 3 now handles Pandas DataFrames with MultiIndex headers correctly (GH39).
- Sometimes, a Pandas DataFrame was not handling `nan` correctly in Excel or numbers were being truncated (GH31) & (GH35).
- Installation is now putting all files in the correct place (GH20).

1.22 v0.1.0 (March 19, 2014)

Initial release of xlwings.

CHAPTER 2

Installation

The easiest way to install xlwings is via pip:

```
pip install xlwings
```

or conda:

```
conda install xlwings
```

Alternatively, it can be installed from source. From within the `xlwings` directory, execute:

```
python setup.py install
```

Note: When you are using Mac Excel 2016 and are installing xlwings with `conda` (or use the version that comes with Anaconda), you'll need to run `$ xlwings runpython install` once to enable the `RunPython` calls from VBA. Alternatively, you can simply install xlwings with `pip`.

2.1 Dependencies

- **Windows**: `pywin32`, `comtypes`

  On Windows, it is recommended to use one of the scientific Python distributions like Anaconda, WinPython or Canopy as they already include pywin32. Otherwise it needs to be installed from here.

- **Mac**: `psutil`, `appscript`

  On Mac, the dependencies are automatically being handled if xlwings is installed with `pip`. However, the Xcode command line tools need to be available. Mac OS X 10.4 (*Tiger*) or later is required. The recommended Python distribution for Mac is Anaconda.

2.2 Optional Dependencies

- NumPy
- Pandas

- Matplotlib
- Pillow/PIL

These packages are not required but highly recommended as they play very nicely with xlwings.

2.3 Python version support

xlwings is tested on Python 2.6-2.7 and 3.3+

CHAPTER 3

Quickstart

This guide assumes you have xlwings already installed. If that's not the case, head over to *Installation*.

3.1 Interact with Excel from Python

Writing/reading values to/from Excel and adding a chart is as easy as:

```
>>> import xlwings as xw
>>> wb = xw.Workbook()  # Creates a connection with a new workbook
>>> xw.Range('A1').value = 'Foo 1'
>>> xw.Range('A1').value
'Foo 1'
>>> xw.Range('A1').value = [['Foo 1', 'Foo 2', 'Foo 3'], [10.0, 20.0, 30.0]]
>>> xw.Range('A1').table.value  # or: Range('A1:C2').value
[['Foo 1', 'Foo 2', 'Foo 3'], [10.0, 20.0, 30.0]]
>>> xw.Sheet(1).name
'Sheet1'
>>> chart = xw.Chart.add(source_data=xw.Range('A1').table)
```

The Range and Chart objects as used above will refer to the active sheet of the current Workbook `wb`. Include the Sheet name like this:

```
xw.Range('Sheet1', 'A1:C3').value
xw.Range(1, (1,1), (3,3)).value  # index notation
xw.Chart.add('Sheet1', source_data=xw.Range('Sheet1', 'A1').table)
```

Qualify the Workbook additionally like this:

```
xw.Range('Sheet1', 'A1', wkb=wb).value
xw.Chart.add('Sheet1', wkb=wb, source_data=xw.Range('Sheet1', 'A1', wkb=wb).table)
xw.Sheet(1, wkb=wb).name
```

or simply set the current workbook first:

```
wb.set_current()
xw.Range('Sheet1', 'A1').value
xw.Chart.add('Sheet1', source_data=xw.Range('Sheet1', 'A1').table)
xw.Sheet(1).name
```

These commands also work seamlessly with **NumPy arrays** and **Pandas DataFrames**, see *Data Structures Tutorial* for details.

Matplotlib figures can be shown as pictures in Excel:

```
import matplotlib.pyplot as plt
fig = plt.figure()
plt.plot([1, 2, 3, 4, 5])

plot = xw.Plot(fig)
plot.show('Plot1')
```

3.2 Call Python from Excel

If, for example, you want to fill your spreadsheet with standard normally distributed random numbers, your VBA code is just one line:

```
Sub RandomNumbers()
    RunPython ("import mymodule; mymodule.rand_numbers()")
End Sub
```

This essentially hands over control to `mymodule.py`:

```
import numpy as np
from xlwings import Workbook, Range

def rand_numbers():
    """ produces standard normally distributed random numbers with shape (n,n)"""
    wb = Workbook.caller()  # Creates a reference to the calling Excel file
    n = int(Range('Sheet1', 'B1').value)  # Write desired dimensions into Cell B1
    rand_num = np.random.randn(n, n)
    Range('Sheet1', 'C3').value = rand_num
```

To make this run, just import the VBA module `xlwings.bas` in the VBA editor (Open the VBA editor with `Alt-F11`, then go to `File > Import File...` and import the `xlwings.bas` file.). It can be found in the directory of your `xlwings` installation.

Note: Always instantiate the `Workbook` within the function that is called from Excel and not outside as global variable.

For further details, see *VBA: Calling Python from Excel*.

3.3 User Defined Functions (UDFs) - Currently Windows only

Writing a UDF in Python is as easy as:

```
import xlwings as xw
```

```
@xw.func
def double_sum(x, y):
    """Returns twice the sum of the two arguments"""
    return 2 * (x + y)
```

This then needs to be imported into Excel: For further details, see *UDF Tutorial*.

3.4 Easy deployment

Deployment is really the part where xlwings shines:

- Just zip-up your Spreadsheet with your Python code and send it around. The receiver only needs to have an installation of Python with xlwings (and obviously all the other packages you're using).
- There is no need to install any Excel add-in.

CHAPTER 4

Connect to Workbooks

First things first: to be able to talk to Excel from Python or call `RunPython` in VBA, you need to establish a connection with an Excel Workbook.

4.1 Python to Excel

There are various ways to connect to an Excel workbook from Python:

- `wb = Workbook()` connects to a a new workbook
- `wb = Workbook.active()` connects to the active workbook (supports multiple Excel instances)
- `wb = Workbook('Book1')` connects to an unsaved workbook
- `wb = Workbook('MyWorkbook.xlsx')` connects to a saved (open) workbook by name (incl. xlsx etc.)
- `wb = Workbook(r'C:\path\to\file.xlsx')` connects to a saved (open or closed) workbook by path

Note: When specifying file paths on Windows, you should either use raw strings by putting an `r` in front of the string or use double back-slashes like so: `C:\\path\\to\\file.xlsx`.

4.2 Excel to Python (RunPython)

To make a connection from Excel, i.e. when calling a Python script with `RunPython`, use `Workbook.caller()`, see *Call Python with "RunPython"*. Check out the section about *Debugging* to see how you can call a script from both sides, Python and Excel, without the need to constantly change between `Workbook.caller()` and one of the methods explained above.

4.3 User Defined Functions (UDFs)

UDFs work differently and don't need the explicit instantiation of a `Workbook`, see *UDF Tutorial*

CHAPTER 5

Data Structures Tutorial

This page gives you a quick introduction to the most common use cases and default behaviour of xlwings when reading and writing values. For an in-depth documentation of how to control things using the `options` method, have a look at *Converters*.

5.1 Single Cells

Single cells are by default returned either as `float`, `unicode`, `None` or `datetime` objects, depending on whether the cell contains a number, a string, is empty or represents a date:

```
>>> from xlwings import Workbook, Range
>>> from datetime import datetime
>>> wb = Workbook()
>>> Range('A1').value = 1
>>> Range('A1').value
1.0
>>> Range('A2').value = 'Hello'
>>> Range('A2').value
'Hello'
>>> Range('A3').value is None
True
>>> Range('A4').value = datetime(2000, 1, 1)
>>> Range('A4').value
datetime.datetime(2000, 1, 1, 0, 0)
```

5.2 Lists

- 1d lists: Ranges that represent rows or columns in Excel are returned as simple lists, which means that once they are in Python, you've lost the information about the orientation. If that is an issue, read under the next point how this information can be preserved:

```
>>> wb = Workbook()
>>> Range('A1').value = [[1],[2],[3],[4],[5]]  # Column orientation (nested list)
>>> Range('A1:A5').value
[1.0, 2.0, 3.0, 4.0, 5.0]
```

```
>>> Range('A1').value = [1, 2, 3, 4, 5]
>>> Range('A1:E1').value
[1.0, 2.0, 3.0, 4.0, 5.0]
```

To force a single cell to arrive as list, use:

```
>>> Range('A1').options(ndim=1).value
[1.0]
```

Note: To write a list in column orientation to Excel, use `transpose`: `Range('A1').options(transpose=True).value = [1,2,3,4]`

- 2d lists: If the row or column orientation has to be preserved, set `ndim` in the Range options. This will return the Ranges as nested lists ("2d lists"):

```
>>> Range('A1:A5').options(ndim=2).value
[[1.0], [2.0], [3.0], [4.0], [5.0]]
>>> Range('A1:E1').options(ndim=2).value
[[1.0, 2.0, 3.0, 4.0, 5.0]]
```

- 2 dimensional Ranges are automatically returned as nested lists. When assigning (nested) lists to a Range in Excel, it's enough to just specify the top left cell as target address. This sample also makes use of index notation to read the values back into Python:

```
>>> Range('A10').value = [['Foo 1', 'Foo 2', 'Foo 3'], [10, 20, 30]]
>>> Range((10,1),(11,3)).value
[['Foo 1', 'Foo 2', 'Foo 3'], [10.0, 20.0, 30.0]]
```

Note: Try to minimize the number of interactions with Excel. It is always more efficient to do `Range('A1').value = [[1,2],[3,4]]` than `Range('A1').value = [1, 2]` and `Range('A2').value = [3, 4]`.

5.3 Range expanding: "table", "vertical" and "horizontal"

You can get the dimensions of Excel Ranges dynamically through either the Range properties `table`, `vertical` and `horizontal` or through `options(expand='table')` (same for `'vertical'` and `'horizontal'`). While properties give back a changed Range object, options are only evaluated when accessing the values of a Range. The difference is best explained with an example:

```
>>> wb = Workbook()
>>> Range('A1').value = [[1,2], [3,4]]
>>> rng1 = Range('A1').table
>>> rng2 = Range('A1').options(expand='table')
>>> rng1.value
[[1.0, 2.0], [3.0, 4.0]]
>>> rng2.value
[[1.0, 2.0], [3.0, 4.0]]
```

```
>>> Range('A3').value = [5, 6]
>>> rng1.value
[[1.0, 2.0], [3.0, 4.0]]
>>> rng2.value
[[1.0, 2.0], [3.0, 4.0], [5.0, 6.0]]
```

Note: Using `table` together with a named Range as top left cell gives you a flexible setup in Excel: You can move around the table and change it's size without having to adjust your code, e.g. by using something like `Range('NamedRange').table.value`.

5.4 NumPy arrays

NumPy arrays work similar to nested lists. However, empty cells are represented by `nan` instead of `None`. If you want to read in a Range as array, set `convert=np.array`:

```
>>> import numpy as np
>>> wb = Workbook()
>>> Range('A1').value = np.eye(3)
>>> Range('A1').options(np.array, expand='table').value
array([[ 1.,  0.,  0.],
       [ 0.,  1.,  0.],
       [ 0.,  0.,  1.]])
```

5.5 Pandas DataFrames

```
>>> wb = Workbook()
>>> df = pd.DataFrame([[1.1, 2.2], [3.3, None]], columns=['one', 'two'])
>>> df
   one  two
0  1.1  2.2
1  3.3  NaN
>>> Range('A1').value = df
>>> Range('A1:C3').options(pd.DataFrame).value
   one  two
0  1.1  2.2
1  3.3  NaN
# options: work for reading and writing
>>> Range('A5').options(index=False).value = df
>>> Range('A9').options(index=False, header=False).value = df
```

5.6 Pandas Series

```
>>> import pandas as pd
>>> import numpy as np
```

```
>>> wb = Workbook()
>>> s = pd.Series([1.1, 3.3, 5., np.nan, 6., 8.], name='myseries')
>>> s
0    1.1
1    3.3
2    5.0
3    NaN
4    6.0
5    8.0
Name: myseries, dtype: float64
>>> Range('A1').value = s
>>> Range('A1:B7').options(pd.Series).value
0    1.1
1    3.3
2    5.0
3    NaN
4    6.0
5    8.0
Name: myseries, dtype: float64
```

Note: You only need to specify the top left cell when writing a list, an NumPy array or a Pandas DataFrame to Excel, e.g.: `Range('A1').value = np.eye(10)`

CHAPTER 6

VBA: Calling Python from Excel

6.1 xlwings VBA module

To get access to the `RunPython` function and/or to be able to run User Defined Functions (UDFs), you need to have the xlwings VBA module available in your Excel workbook.

For new projects, by far the easiest way to get started is by using the command line client with the quickstart option, see *Command Line Client* for details:

```
$ xlwings quickstart myproject
```

This will create a new folder in your current directory with a fully prepared Excel file and an empty Python file.

Alternatively, you can also open a new spreadsheet from a template (`$ xlwings template open`) or manually insert the module in an existing workbook like so:

- Open the VBA editor with `Alt-F11`
- Then go to `File > Import File...` and import the `xlwings.bas` file. It can be found in the directory of your `xlwings` installation.

If you don't know the location of your xlwings installation, you can find it as follows:

```
$ python
>>> import xlwings
>>> xlwings.__path__
```

6.2 Settings

While the defaults will often work out-of-the box, you can change the settings at the top of the xlwings VBA module under `Function Settings`:

```
PYTHON_WIN = ""
PYTHON_MAC = ""
PYTHON_FROZEN = ThisWorkbook.Path & "\build\exe.win32-2.7"
PYTHONPATH = ThisWorkbook.Path
UDF_PATH = ""
```

```
UDF_DEBUG_SERVER = False
LOG_FILE = ThisWorkbook.Path & "\xlwings_log.txt"
SHOW_LOG = True
OPTIMIZED_CONNECTION = False
```

- `PYTHON_WIN`: This is the directory of the Python interpreter on Windows. `""` resolves to your default Python installation on the PATH, i.e. the one you can start by just typing `python` at a command prompt.
- `PYTHON_MAC`: This is the directory of the Python interpreter on Mac OSX. `""` resolves to your default installation as per PATH on .bash_profile. To get special folders on Mac, type `GetMacDir("Name")` where `Name` is one of the following: `Home`, `Desktop`, `Applications`, `Documents`.
- `PYTHON_FROZEN` [Optional]: Currently only on Windows, indicates the directory of the exe file that has been frozen by either using `cx_Freeze` or `py2exe`. Can be set to `""` if unused.
- `PYTHONPATH` [Optional]: If the source file of your code is not found, add the path here. Otherwise set it to `""`.
- `UDF_PATH` [Optional, Windows only]: Full path to a Python file from which the User Defined Functions are being imported. Example: `UDF_PATH = ThisWorkbook.Path & "\functions.py"` Default: `UDF_PATH = ""` defaults to a file in the same directory of the Excel spreadsheet with the same name but ending in `.py`.
- `UDF_DEBUG_SERVER`: Set this to True if you want to run the xlwings COM server manually for debugging, see *Debugging*.
- `LOG_FILE` [Optional]: Leave empty for default location (see below) or provide directory including file name.
- `SHOW_LOG`: If False, no pop-up with the Log messages (usually errors) will be shown. Use with care.
- `OPTIMIZED_CONNECTION`: Currently only on Windows, use a COM Server for an efficient connection (experimental!)

6.2.1 LOG_FILE default locations

- Windows: `%APPDATA%\xlwings_log.txt`
- Mac with Excel 2011: `/tmp/xlwings_log.txt`
- Mac with Excel 2016: `~/Library/Containers/com.microsoft.Excel/Data/xlwings_log.txt`

Note: If the settings (especially `PYTHONPATH` and `LOG_FILE`) need to work on Windows on Mac, use backslashes in relative file path, i.e. `ThisWorkbook.Path & "\mydirectory"`.

6.3 Call Python with "RunPython"

After your workbook contains the xlwings VBA module with potentially adjusted Settings, go to `Insert > Module` (still in the VBA-Editor). This will create a new Excel module where you can write your Python call as follows (note that the `quickstart` or `template` commands already add an empty Module1, so you don't need to insert a new module manually):

```
Sub MyMacro()
    RunPython ("import mymodule; mymodule.rand_numbers()")
End Sub
```

This essentially hands over control to `mymodule.py`:

```
import numpy as np
from xlwings import Workbook, Range

def rand_numbers():
    """ produces std. normally distributed random numbers with shape (n,n)"""
    wb = Workbook.caller()  # Creates a reference to the calling Excel file
    n = int(Range('Sheet1', 'B1').value)  # Write desired dimensions into Cell B1
    rand_num = np.random.randn(n, n)
    Range('Sheet1', 'C3').value = rand_num
```

You can then attach `MyMacro` to a button or run it directly in the VBA Editor by hitting `F5`.

Note: Always place `Workbook.caller()` within the function that is being called from Excel and not outside as global variable. Otherwise it prevents Excel from shutting down properly upon exiting and leaves you with a zombie process when you use `OPTIMIZED_CONNECTION = True`.

6.4 Function Arguments and Return Values

While it's technically possible to include arguments in the function call within `RunPython`, it's not very convenient. To do that easily and to also be able to return values from Python, use UDFs, see *UDF Tutorial* - however, this is currently limited to Windows only.

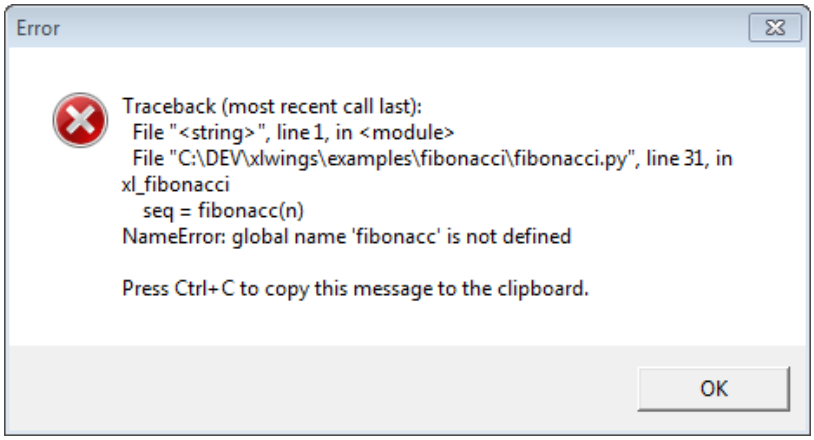
CHAPTER 7

Debugging

Since xlwings runs in every Python environment, you can use your preferred way of debugging.

- **RunPython**: When calling Python through `RunPython`, you can set a `mock_caller` to make it easy to switch back and forth between calling things from Excel and Python.
- **UDFs**: For debugging User Defined Functions, xlwings offers a convenient debugging server

To begin with, Excel will show Python errors in a Message Box:



Note: On Mac, if the `import` of a module/package fails before xlwings is imported, the popup will not be shown and the StatusBar will not be reset. However, the error will still be logged in the log file. For the location of the logfile, see *LOG_FILE default locations*.

RunPython

Consider the following code structure of your Python source code:

```
import os
from xlwings import Workbook, Range

def my_macro():
    wb = Workbook.caller()
    Range('A1').value = 1
```

```
if __name__ == '__main__':
    # Expects the Excel file next to this source file, adjust accordingly.
    path = os.path.abspath(os.path.join(os.path.dirname(__file__), 'myfile.xlsm'))
    Workbook.set_mock_caller(path)
    my_macro()
```

`my_macro()` can now easily be run from Python for debugging and from Excel via `RunPython` without having to change the source code:

```
Sub my_macro()
    RunPython ("import my_module; my_module.my_macro()")
End Sub
```

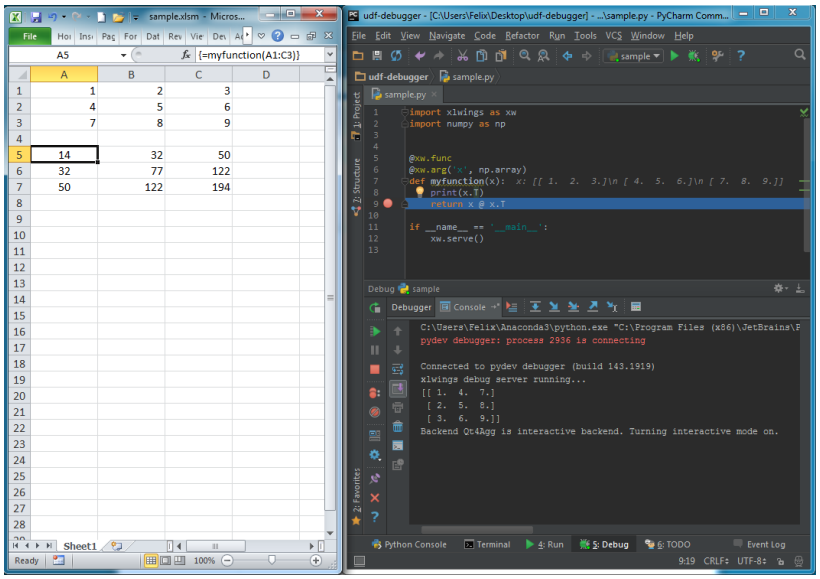
UDF debug server

Windows only: To debug UDFs, just set `UDF_DEBUG_SERVER = True` in the VBA Settings, at the top of the xlwings VBA module. Then add the following lines at the end of your Python source file and run it. Depending on which IDE you use, you might want to run things in "debug" mode (e.g. in case your using PyCharm):

```
if __name__ == '__main__':
    xw.serve()
```

When you recalculate the Sheet (`Ctrl-Alt-F9`), the code will stop at breakpoints or print any statements that you may have.

The following screenshot shows the code stopped at a breakpoint in the community version of PyCharm:



Note: When running the debug server from a command prompt, there is currently no gracious way to terminate it, but closing the command prompt will kill it.

CHAPTER 8

UDF Tutorial

Note: UDFs are currently only available on Windows.

This tutorial gets you quickly started on how to write User Defined Functions. For details of how to control the behaviour of the arguments and return values, have a look at *Converters*.

8.1 One-time Excel preparations

Required: Enable `Trust access to the VBA project object model` under `File > Options > Trust Center > Trust Center Settings > Macro Settings`

Recommended: Install the add-in via command prompt: `xlwings addin install` (see *Command Line Client*) to be able to easily import the functions.

8.2 Workbook preparation

The easiest way to start a new project is to run `xlwings quickstart myproject` on a command prompt (see *Command Line Client*). Alternative ways of getting the xlwings VBA module into your workbook are described under *VBA: Calling Python from Excel*

8.3 A simple UDF

The default settings (see *VBA settings*) expect a Python source file in the way it is created by `quickstart`:

- in the same directory as the Excel file
- with the same name as the Excel file, but with a `.py` ending instead of `.xlsm`.

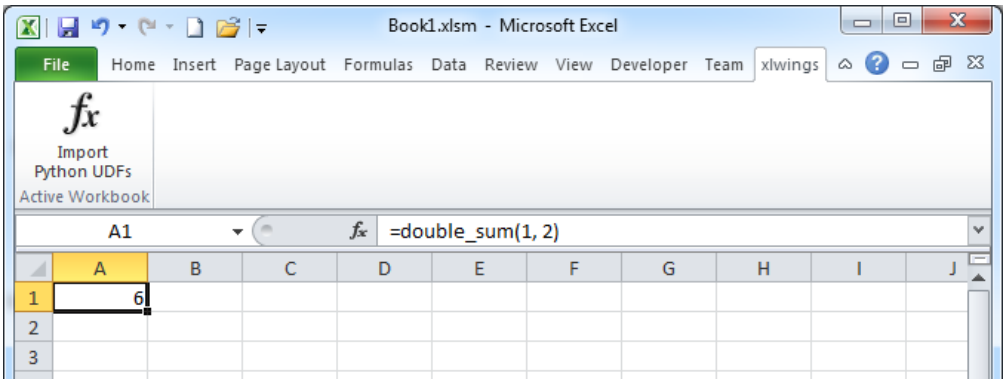
Alternatively, you can point to a specific source file by setting the `UDF_PATH` in the VBA settings.

Let's assume you have a Workbook `myproject.xlsm`, then you would write the following code in `myproject.py`:

```
import xlwings as xw

@xw.func
def double_sum(x, y):
    """Returns twice the sum of the two arguments"""
    return 2 * (x + y)
```

- Now click on `Import Python UDFs` in the xlwings tab to pick up the changes made to `myproject.py`. If you don't want to install/use the add-in, you could also run the `ImportPythonUDFs` macro directly (one possibility to do that is to hit `Alt + F8` and select the macro from the pop-up menu).
- Enter the formula `=double_sum(1, 2)` into a cell and you will see the correct result:



- This formula can be used in VBA, too.
- The docstring (in triple-quotes) will be shown as function description in Excel.

Note:

- You only need to re-import your functions if you change the function arguments or the function name.
- Code changes in the actual functions are picked up automatically (i.e. at the next calculation of the formula, e.g. triggered by `Ctrl-Alt-F9`), but changes in imported modules are not. This is the very behaviour of how Python imports work. The easiest way to come around this is by working with the debug server that can easily be restarted, see: *Debugging*. If you aren't working with the debug server, the `pythonw.exe` process currently has to be killed via Windows Task Manager.
- The `@xw.func` decorator is only used by xlwings when the function is being imported into Excel. It tells xlwings for which functions it should create a VBA wrapper function, otherwise it has no effect on how the functions behave in Python.

8.4 Array formulas: Get efficient

Calling one big array formula in Excel is much more efficient than calling many single-cell formulas, so it's generally a good idea to use them, especially if you hit performance problems.

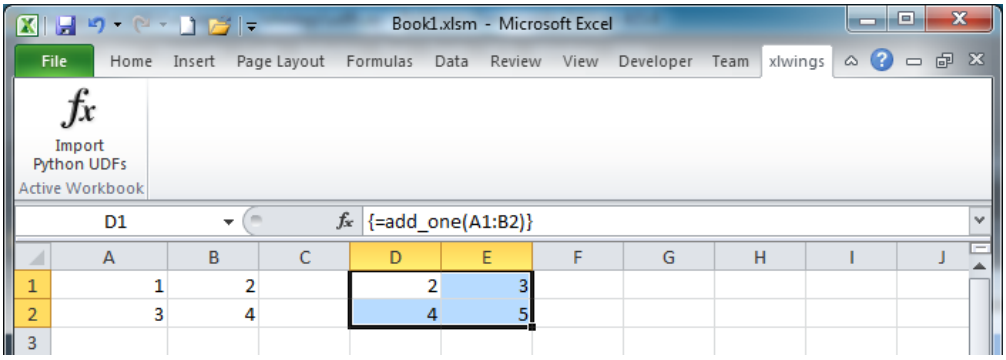
You can pass an Excel Range as a function argument, as opposed to a single cell and it will show up in Python as list of lists.

For example, you can write the following function to add 1 to every cell in a Range:

```
@xw.func
def add_one(data):
    return [[cell + 1 for cell in row] for row in data]
```

To use this formula in Excel,

- Click on `Import Python UDFs` again
- Fill in the values in the range `A1:B2`
- Select the range `D1:E2`
- Type in the formula `=add_one("A1:B2")`
- Press `Ctrl+Shift+Enter` to create an array formula. If you did everything correctly, you'll see the formula surrounded by curly braces as in this screenshot:



8.4.1 Number of array dimensions: ndim

The above formula has the issue that it expects a "two dimensional" input, e.g. a nested list of the form `[[1, 2], [3, 4]]`. Therefore, if you would apply the formula to a single cell, you would get the following error: `TypeError: 'float' object is not iterable`.

To force Excel to always give you a two-dimensional array, no matter whether the argument is a single cell, a column/row or a two-dimensional Range, you can extend the above formula like this:

```
@xw.func
@xw.arg('data', ndim=2)
def add_one(data):
    return [[cell + 1 for cell in row] for row in data]
```

8.5 Array formulas with NumPy and Pandas

Often, you'll want to use NumPy arrays or Pandas DataFrames in your UDF, as this unlocks the full power of Python's ecosystem for scientific computing.

To define a formula for matrix multiplication using numpy arrays, you would define the following function:

```
import xlwings as xw
import numpy as np

@xw.func
@xw.arg('x', np.array, ndim=2)
@xw.arg('y', np.array, ndim=2)
def matrix_mult(x, y):
    return x @ y
```

Note: If you are not on Python >= 3.5 with NumPy >= 1.10, use `x.dot(y)` instead of `x @ y`.

A great example of how you can put Pandas at work is the creation of an array-based `CORREL` formula. Excel's version of `CORREL` only works on 2 datasets and is cumbersome to use if you want to quickly get the correlation matrix of a few time-series, for example. Pandas makes the creation of an array-based `CORREL2` formula basically a one-liner:

```
import xlwings as xw
import pandas as pd

@xw.func
@xw.arg('x', pd.DataFrame, index=False, header=False)
@xw.ret(index=False, header=False)
def CORREL2(x):
    """Like CORREL, but as array formula for more than 2 data sets"""
    return x.corr()
```

8.6 @xw.arg and @xw.ret decorators

These decorators are to UDFs what the `options` method is to `Range` objects: they allow you to apply converters and their options to function arguments (`@xw.arg`) and to the return value (`@xw.ret`). For example, to convert the argument `x` into a pandas DataFrame and suppress the index when returning it, you would do the following:

```
@xw.func
@xw.arg('x', pd.DataFrame)
@xw.ret(index=False)
def myfunction(x):
   # x is a DataFrame, do something with it
   return x
```

For further details see the *Converters* documentation.

8.7 Get the argument as xlwings.Range

If you need access to the `xlwings.Range` object directly, you can do:

```
@xw.func
@xw.arg('x', xw.Range)
def myfunction(x):
    return x.formula
```

8.8 The "vba" keyword

It's often helpful to get the address of the calling cell. Right now, one of the easiest ways to accomplish this is to use the `vba` keyword. `vba`, in fact, allows you to access any available VBA expression e.g. `Application`. Note, however, that currently you're acting directly on the pywin32 COM object:

```
@xw.func
@xw.arg('xl_app', vba='Application')
def get_caller_address(xl_app)
    return xl_app.Caller.Address
```

8.9 Macros

On Windows, as alternative to calling macros via *RunPython*, you can also use the `@xw.sub` decorator:

```
import xlwings as xw

@xw.sub
def my_macro():
    """Writes the name of the Workbook into Range("A1") of Sheet 1"""
    wb = xw.Workbook.caller()
    xw.Range(1, 'A1').value = wb.name
```

After clicking on `Import Python UDFs`, you can then use this macro by executing it via `Alt + F8` or by binding it e.g. to a button. To to the latter, make sure you have the `Developer` tab selected under `File > Options > Customize Ribbon`. Then, under the `Developer` tab, you can insert a button via `Insert > Form Controls`. After drawing the button, you will be prompted to assign a macro to it and you can select `my_macro`.

CHAPTER 9

Converters

Introduced with v0.7.0, converters define how Excel ranges and their values are converted both during **reading** and **writing** operations. They also provide a consistent experience across **xlwings.Range** objects and **User Defined Functions** (UDFs).

Converters are explicitely set in the `options` method when manipulating `xlwings.Range` objects or in the `@xw.arg` and `@xw.ret` decorators when using UDFs. If no converter is specified, the default converter is applied when reading. When writing, xlwings will automatically apply the correct converter (if available) according to the object's type that is being written to Excel. If no converter is found for that type, it falls back to the default converter.

Syntax:

	Range	UDF
reading	`Range.options(convert=None, **kwargs).value`	`@arg('x', convert=None, **kwargs)`
writing	`Range.options(convert=None, **kwargs).value = myvalue`	`@ret(convert=None, **kwargs)`

Note: Keyword arguments (`kwargs`) may refer to the specific converter or the default converter. For example, to set the `numbers` option in the default converter and the `index` option in the DataFrame converter, you would write:

```
Range('A1:C3').options(pd.DataFrame, index=False, numbers=int).value
```

9.1 Default Converter

If no options are set, the following conversions are performed:

- single cells are read in as `floats` in case the Excel cell holds a number, as `unicode` in case it holds text, as `datetime` if it contains a date and as `None` in case it is empty.
- columns/rows are read in as lists, e.g. `[None, 1.0, 'a string']`
- 2d cell ranges are read in as list of lists, e.g. `[[None, 1.0, 'a string'], [None, 2.0, 'another string']]`

The following options can be set:

- **ndim**

  Force the value to have either 1 or 2 dimensions regardless of the shape of the range:

```
>>> import xlwings as xw
>>> wb = Workbook()
>>> xw.Range('A1').value = [[1, 2], [3, 4]]
>>> xw.Range('A1').value
1.0
>>> xw.Range('A1').options(ndim=1).value
[1.0]
>>> xw.Range('A1').options(ndim=2).value
[[1.0]]
>>> xw.Range('A1:A2').value
[1.0 3.0]
>>> xw.Range('A1:A2').options(ndim=2).value
[[1.0], [3.0]]
```

- **numbers**

  By default cells with numbers are read as `float`, but you can change it to `int`:

```
>>> xw.Range('A1').value = 1
>>> xw.Range('A1').value
1.0
>>> xw.Range('A1').options(numbers=int).value
1
```

  Alternatively, you can specify any other function or type which takes a single float argument.

  Using this on UDFs looks like this:

```
@xw.func
@xw.arg('x', numbers=int)
def myfunction(x):
    # all numbers in x arrive as int
    return x
```

  Note: Excel always stores numbers internally as floats.

- **dates**

  By default cells with dates are read as `datetime.datetime`, but you can change it to `datetime.date`:

  – Range:

```
>>> import datetime as dt
>>> xw.Range('A1').options(dates=dt.date).value
```

  – UDFs: `@xw.arg('x', dates=dt.date)`

  Alternatively, you can specify any other function or type which takes the same keyword arguments as `datetime.datetime`, for example:

```
>>> my_date_handler = lambda year, month, day, **kwargs: "%04i-%02i-%02i" % (year, mon
>>> xw.Range('A1').options(dates=my_date_handler).value
'2017-02-20'
```

- **empty**

  Empty cells are converted per default into `None`, you can change this as follows:

  - Range: `>>> xw.Range('A1').options(empty='NA').value`
  - UDFs: `@xw.arg('x', empty='NA')`

- **transpose**

  This works for reading and writing and allows us to e.g. write a list in column orientation to Excel:

  - Range: `Range('A1').options(transpose=True).value = [1, 2, 3]`
  - UDFs:

```
@xw.arg('x', transpose=True)
@xw.ret(transpose=True)
def myfunction(x):
    # x will be returned unchanged as transposed both when reading and writing
    return x
```

- **expand**

  This works the same as the Range properties `table`, `vertical` and `horizontal` but is only evaluated when getting the values of a Range:

```
>>> import xlwings as xw
>>> wb = xw.Workbook()
>>> xw.Range('A1').value = [[1,2], [3,4]]
>>> rng1 = xw.Range('A1').table
>>> rng2 = xw.Range('A1').options(expand='table')
>>> rng1.value
[[1.0, 2.0], [3.0, 4.0]]
>>> rng2.value
[[1.0, 2.0], [3.0, 4.0]]
>>> xw.Range('A3').value = [5, 6]
>>> rng1.value
[[1.0, 2.0], [3.0, 4.0]]
>>> rng2.value
[[1.0, 2.0], [3.0, 4.0], [5.0, 6.0]]
```

Note: The `expand` option is only available on `Range` objects as UDFs only allow to manipulate the calling cells.

9.2 Built-in converters

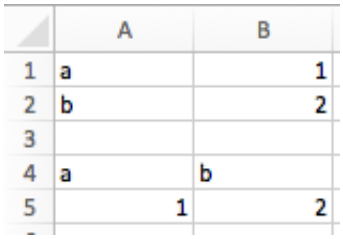
xlwings offers several built-in converters that perform type conversion to **dictionaries**, **NumPy arrays**, **Pandas Series** and **DataFrames**. These build on top of the default converter, so in most case the options described above can be used in this context too (unless they are meaningless, for example the `ndim` in the case of a dictionary).

It is also possible to write and register custom converter for additional types. The documentation for doing this will be provided in the near future.

The samples below may be used with both `xlwings.Range` objects and UDFs, but the samples may only show one version.

9.2.1 Dictionary converter

The dictionary converter turns two Excel columns into a dictionary. If the data is in row orientation, use `transpose`:



	A	B
1	a	1
2	b	2
3		
4	a	b
5	1	2

```
>>> Range('A1:B2').options(dict).value
{'a': 1.0, 'b': 2.0}
>>> Range('A4:B5').options(dict, transpose=True).value
{'a': 1.0, 'b': 2.0}
```

9.2.2 Numpy array converter

options: `dtype=None, copy=True, order=None, ndim=None`

The first 3 options behave the same as when using `np.array()` directly. Also, `ndim` works the same as shown above for lists (under default converter) and hence returns either numpy scalars, 1d arrays or 2d arrays.

Example:

```
>>> import numpy as np
>>> Range('A1').options(transpose=True).value = np.array([1, 2, 3])
>>> xw.Range('A1:A3').options(np.array, ndim=2).value
array([[ 1.],
       [ 2.],
       [ 3.]])
```

9.2.3 Pandas Series converter

options: `dtype=None, copy=False, index=1, header=True`

The first 2 options behave the same as when using `pd.Series()` directly. `ndim` doesn't have an effect on Pandas series as they are always expected and returned in column orientation.

`index`: int or Boolean

When reading, it expects the number of index columns shown in Excel.

When writing, include or exclude the index by setting it to `True` or `False`.

`header`: Boolean

When reading, set it to `False` if Excel doesn't show either index or series names.

When writing, include or exclude the index and series names by setting it to `True` or `False`.

For `index` and `header`, `1` and `True` may be used interchangeably.

Example:

	A	B	C	D	E
1	date	series name		01/01/01	1
2	01/01/01	1		02/01/01	2
3	02/01/01	2		03/01/01	3
4	03/01/01	3		04/01/01	4
5	04/01/01	4		05/01/01	5
6	05/01/01	5		06/01/01	6
7	06/01/01	6			

```
>>> s = xw.Range('A1').options(pd.Series, expand='table').value
>>> s
date
2001-01-01    1
2001-01-02    2
2001-01-03    3
2001-01-04    4
2001-01-05    5
2001-01-06    6
Name: series name, dtype: float64
>>> xw.Range('D1', header=False).value = s
```

9.2.4 Pandas DataFrame converter

options: `dtype=None, copy=False, index=1, header=1`

The first 2 options behave the same as when using `pd.DataFrame()` directly. `ndim` doesn't have an effect on Pandas DataFrames as they are automatically read in with `ndim=2`.

`index`: int or Boolean

When reading, it expects the number of index columns shown in Excel.

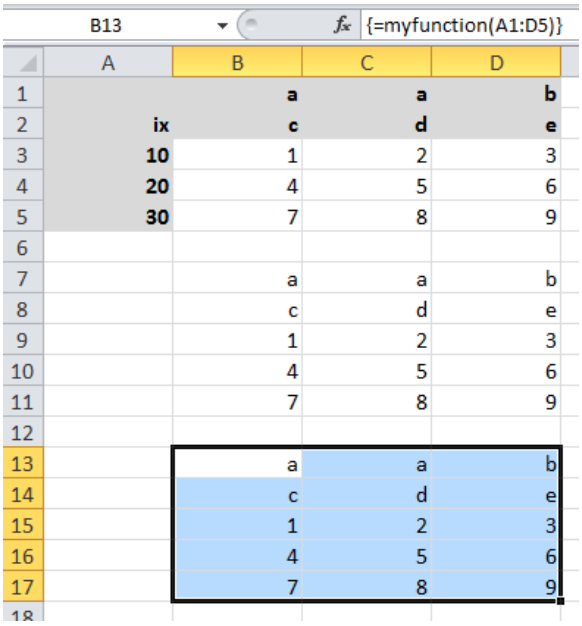
When writing, include or exclude the index by setting it to `True` or `False`.

`header`: int or Boolean

When reading, it expects the number of column headers shown in Excel.
When writing, include or exclude the index and series names by setting it to `True` or `False`.

For `index` and `header`, `1` and `True` may be used interchangeably.

Example:




```
>>> df = xw.Range('A1:D5').options(pd.DataFrame, header=2).value
>>> df
    a     b
    c  d  e
ix
10  1  2  3
20  4  5  6
30  7  8  9

# Writing back using the defaults:
>>> Range('A1').value = df

# Writing back and changing some of the options, e.g. getting rid of the index:
>>> Range('B7').options(index=False).value = df
```

The same sample for **UDF** (starting in `Range('A13')` on screenshot) looks like this:

```
@xw.func
@xw.arg('x', pd.DataFrame, header=2)
@xw.ret(index=False)
def myfunction(x):
    # x is a DataFrame, do something with it
    return x
```

CHAPTER 10

Command Line Client

xlwings comes with a command line client that makes it easy to set up workbooks and install the developer add-in. On Windows, type the commands into a `Command Prompt`, on Mac, type them into a `Terminal`.

10.1 Quickstart

- `xlwings quickstart myproject`

This command is by far the fastest way to get off the ground: It creates a new folder `myproject` with the necessary Excel workbook (including the xlwings VBA module) and a Python file, ready to be used right away:

```
myproject
  |--myproject.xlsm
  |--myproject.py
```

New in version 0.6.4.

10.2 Add-in (Currently Windows-only)

The add-in is currently in an early stage and only provides one button to import User Defined Functions (UDFs). As such, it is only a developer add-in and not necessary to run Workbooks with xlwings.

Note: Excel needs to be closed before installing/updating the add-in. If you're still getting an error, start the Task Manager and make sure there are no `EXCEL.EXE` processes left.

- `xlwings addin install`: Copies the xlwings add-in to the XLSTART folder
- `xlwings addin update`: Replaces the current add-in with the latest one
- `xlwings addin remove`: Removes the add-in from the XLSTART folder
- `xlwings addin status`: Shows if the add-in is installed together with the installation path

After installing the add-in, it will be available as xlwings tab on the Excel Ribbon.

New in version 0.6.0.

10.3 Template

- `xlwings template open`: Opens a new Workbook with the xlwings VBA module
- `xlwings template install`: Copies the xlwings template file to the correct Excel folder, see below
- `xlwings template update`: Replaces the current xlwings template with the latest one
- `xlwings template remove`: Removes the template from Excel's template folder
- `xlwings template status`: Shows if the template is installed together with the installation path

After installing, the templates are accessible via Excel's Menu:

- Win (Excel 2007, 2010): `File > New > My templates`
- Win (Excel 2013, 2016): There's an additional step needed as explained here
- Mac (Excel 2011, 2016): `File > New from template`

New in version 0.6.0.

10.4 RunPython

Only required if you are on Mac, are using Excel 2016 and have xlwings installed via conda or as part of Anaconda. To enable the `RunPython` calls in VBA, run this one time:

```
xlwings runpython install
```

Alternatively, install xlwings with `pip`.

New in version 0.7.0.

CHAPTER 11

Missing Features

If you're missing a feature in xlwings, do the following:

1. Most importantly, open an issue on GitHub. If it's something bigger or if you want support from other users, consider opening a feature request. Adding functionality should be user driven, so only if you tell us about what you're missing, it's eventually going to find its way into the library. By the way, we also appreciate pull requests!

2. Workaround: in essence, xlwings is just a smart wrapper around pywin32 on Windows and appscript on Mac. You can access the underlying objects by doing:

```
>>> wb = Workbook('Book1')
>>> wb.xl_workbook
<COMObject <unknown>>  # Windows/pywin32
app('/Applications/Microsoft Excel.app').workbooks['Book1']  # Mac/appscript
```

   This works accordingly for `Range.xl_range`, `Sheet.xl_sheet`, `Chart.xl_chart` etc.

   The underlying objects will offer you pretty much everything you can do with VBA, using the syntax of pywin32 (which pretty much feels like VBA) and appscript (which doesn't feel like VBA). But apart from looking ugly, keep in mind that **it makes your code platform specific (!)**, i.e. even if you go for option 2), you should still follow option 1) and open an issue so the feature finds it's way into the library (cross-platform and with a Pythonic syntax).

11.1 Example: Workaround to use VBA's `Range.WrapText`

```
# Windows
Range('A1').xl_range.WrapText = True

# Mac
Range('A1').xl_range.wrap_text.set(True)
```

CHAPTER 12

xlwings with R and Julia

While xlwings is a pure Python package, there are cross-language packages that allow for a relative straightforward use from/with other languages. This means, however, that you'll always need to have Python with xlwings installed in addition to R or Julia. We recommend the Anaconda distribution, see also *Installation*.

12.1 R

The R instructions are for Windows, but things work accordingly on Mac except that calling the R functions as User Defined Functions is not supported at the moment (but `RunPython` works, see *Call Python with "RunPython"*).

Setup:

- Install R and Python
- Add `R_HOME` environment variable to base directory of installation, .e.g `C:\Program Files\R\R-x.x.x`
- Add `R_USER` environment variable to user folder, e.g. `C:\Users\<user>`
- Add `C:\Program Files\R\R-x.x.x\bin` to `PATH`
- Restart Windows because of the environment variables (!)

12.1.1 Simple functions with R

Original R function that we want to access from Excel (saved in `r_file.R`):

```
myfunction <- function(x, y){
    return(x * y)
}
```

Python wrapper code:

```
import xlwings as xw
import rpy2.robjects as robjects
# you might want to use some relative path or place the file in R's current working dir
robjects.r.source(r"C:\path\to\r_file.R")
```

```
@xw.func
def myfunction(x, y):
    myfunc = robjects.r['myfunction']
    return tuple(myfunc(x, y))
```

After importing this function (see: *UDF Tutorial*), it will be available as UDF from Excel.

12.1.2 Array functions with R

Original R function that we want to access from Excel (saved in `r_file.R`):

```
array_function <- function(m1, m2){
  # Matrix multiplication
  return(m1 %*% m2)
}
```

Python wrapper code:

```
import xlwings as xw
import numpy as np
import rpy2.robjects as robjects
from rpy2.robjects import numpy2ri

robjects.r.source(r"C:\path\to\r_file.R")
numpy2ri.activate()

@xw.func
@xw.arg("x", np.array, ndim=2)
@xw.arg("y", np.array, ndim=2)
def array_function(x, y):
    array_func = robjects.r['array_function']
    return np.array(array_func(x, y))
```

After importing this function (see: *UDF Tutorial*), it will be available as UDF from Excel.

12.2 Julia

Setup:

- Install Julia and Python
- Run `Pkg.add("PyCall")` from an interactive Julia interpreter

xlwings can then be called from Julia with the following syntax (the colons take care of automatic type conversion):

```
julia> using PyCall
julia> @pyimport xlwings as xw

julia> xw.Workbook()
PyObject <Workbook 'Workbook1'>
```

```
julia> xw.Range("A1")[:value] = "Hello World"
julia> xw.Range("A1")[:value]
"Hello World"


julia> xw.Range("A1")[:value] = [1 2; 3 4]
julia> xw.Range("A1")[:table][:value]
2x2 Array{Int64,2}:
1  2
3  4
```

CHAPTER 13

API Documentation

The xlwings object model is very similar to the one used by Excel VBA but the hierarchy is flattened. An example:

VBA:

```
Workbooks("Book1").Sheets("Sheet1").Range("A1").Value = "Some Text"
```

xlwings:

```
wb = Workbook("Book1")
Range("Sheet1", "A1").value = "Some Text"
```

13.1 Application

class xlwings.**Application**(*wkb*)

Application is dependent on the Workbook since there might be different application instances on Windows.

version

Returns Excel's version string.

New in version 0.5.0.

quit()

Quits the application without saving any workbooks.

New in version 0.3.3.

screen_updating

True if screen updating is turned on. Read/write Boolean.

New in version 0.3.3.

visible
Gets or sets the visibility of Excel to `True` or `False`. This property can also be conveniently set during instantiation of a new Workbook: `Workbook(app_visible=False)`

New in version 0.3.3.

calculation
Returns or sets a Calculation value that represents the calculation mode.

Example

```
>>> from xlwings import Workbook, Application
>>> from xlwings.constants import Calculation
>>> wb = Workbook()
>>> Application(wkb=wb).calculation = Calculation.xlCalculationManual
```

New in version 0.3.3.

calculate()
Calculates all open Workbooks

New in version 0.3.6.

13.2 Workbook

In order to use xlwings, instantiating a workbook object is always the first thing to do:

class `xlwings.`**Workbook**(*fullname=None*, *xl_workbook=None*, *app_visible=True*, *app_target=None*)
`Workbook` connects an Excel Workbook with Python. You can create a new connection from Python with

- a new workbook: `wb = Workbook()`
- the active workbook: `wb = Workbook.active()`
- an unsaved workbook: `wb = Workbook('Book1')`
- a saved (open) workbook by name (incl. xlsx etc): `wb = Workbook('MyWorkbook.xlsx')`
- a saved (open or closed) workbook by path: `wb = Workbook(r'C:\path\to\file.xlsx')`

Keyword Arguments

- **fullname** (*str, default None*) – Full path or name (incl. xlsx, xlsm etc.) of existing workbook or name of an unsaved workbook.
- **xl_workbook** (*pywin32 or appscript Workbook object, default None*) – This enables to turn existing Workbook objects of the underlying libraries into xlwings objects

- **app_visible** (*boolean, default True*) – The resulting Workbook will be visible by default. To open it without showing a window, set `app_visible=False`. Or, to not alter the visibility (e.g., if Excel is already running), set `app_visible=None`. Note that this property acts on the whole Excel instance, not just the specific Workbook.
- **app_target** (*str, default None*) – Mac-only, use the full path to the Excel application, e.g. `/Applications/Microsoft Office 2011/Microsoft Excel` or `/Applications/Microsoft Excel`

  On Windows, if you want to change the version of Excel that xlwings talks to, go to `Control Panel > Programs and Features` and `Repair` the Office version that you want as default.

To create a connection when the Python function is called from Excel, use:

```
wb = Workbook.caller()
```

classmethod active(*app_target=None*)

Returns the Workbook that is currently active or has been active last. On Windows, this works across all instances.

New in version 0.4.1.

classmethod caller()

Creates a connection when the Python function is called from Excel:

```
wb = Workbook.caller()
```

Always pack the `Workbook` call into the function being called from Excel, e.g.:

```
def my_macro():
    wb = Workbook.caller()
    Range('A1').value = 1
```

To be able to easily invoke such code from Python for debugging, use `Workbook.set_mock_caller()`.

New in version 0.3.0.

static set_mock_caller(*fullpath*)

Sets the Excel file which is used to mock `Workbook.caller()` when the code is called from within Python.

Examples

```
# This code runs unchanged from Excel and Python directly
import os
from xlwings import Workbook, Range

def my_macro():
    wb = Workbook.caller()
    Range('A1').value = 'Hello xlwings!'
```

```
if __name__ == '__main__':
    # Mock the calling Excel file
    Workbook.set_mock_caller(r'C:\path\to\file.xlsx')
    my_macro()
```

New in version 0.3.1.

classmethod current()

Returns the current Workbook object, i.e. the default Workbook used by `Sheet`, `Range` and `Chart` if not specified otherwise. On Windows, in case there are various instances of Excel running, opening an existing or creating a new Workbook through `Workbook()` is acting on the same instance of Excel as this Workbook. Use like this: `Workbook.current()`.

New in version 0.2.2.

set_current()

This makes the Workbook the default that `Sheet`, `Range` and `Chart` use if not specified otherwise. On Windows, in case there are various instances of Excel running, opening an existing or creating a new Workbook through `Workbook()` is acting on the same instance of Excel as this Workbook.

New in version 0.2.2.

get_selection()

Returns the currently selected cells from Excel as `Range` object.

Example

```
>>> import xlwings as xw
>>> wb = xw.Workbook.active()
>>> wb.get_selection()
<Range on Sheet 'Sheet1' of Workbook 'Workbook1'>
>>> wb.get_selection.value
[[1.0, 2.0], [3.0, 4.0]]
>>> wb.get_selection().options(transpose=True).value
[[1.0, 3.0], [2.0, 4.0]]
```

Returns

Return type Range object

close()

Closes the Workbook without saving it.

New in version 0.1.1.

save(*path=None*)

Saves the Workbook. If a path is being provided, this works like SaveAs() in Excel. If no path is specified and if the file hasn't been saved previously, it's being saved in the current working directory with the current filename. Existing files are overwritten without prompting.

Parameters **path** (*str, default None*) – Full path to the workbook

Example

```
>>> from xlwings import Workbook
>>> wb = Workbook()
>>> wb.save()
>>> wb.save(r'C:\path\to\new_file_name.xlsx')
```

New in version 0.3.1.

static get_xl_workbook (*wkb*)
Returns the `xl_workbook_current` if `wkb` is `None`, otherwise the `xl_workbook` of `wkb`. On Windows, `xl_workbook` is a pywin32 COM object, on Mac it's an appscript object.

Parameters **wkb** (*Workbook or None*) – Workbook object

static open_template ()
Creates a new Excel file with the xlwings VBA module already included. This method must be called from an interactive Python shell:

```
>>> Workbook.open_template()
```

New in version 0.3.3.

names
A collection of all the (platform-specific) name objects in the application or workbook. Each name object represents a defined name for a range of cells (built-in or custom ones).

New in version 0.4.0.

13.3 Sheet

Sheet objects allow you to interact with anything directly related to a Sheet.

class `xlwings.`**Sheet** (*sheet*, *wkb=None*)
Represents a Sheet of the current Workbook. Either call it with the Sheet name or index:

```
Sheet('Sheet1')
Sheet(1)
```

Parameters **sheet** (*str or int*) – Sheet name or index

Keyword Arguments **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

New in version 0.2.3.

activate ()
Activates the sheet.

autofit (*axis=None*)
Autofits the width of either columns, rows or both on a whole Sheet.

Parameters **axis** (*string, default None*) –

- To autofit rows, use one of the following: `rows` or `r`
- To autofit columns, use one of the following: `columns` or `c`
- To autofit rows and columns, provide no arguments

Examples

```
# Autofit columns
Sheet('Sheet1').autofit('c')
# Autofit rows
Sheet('Sheet1').autofit('r')
# Autofit columns and rows
Range('Sheet1').autofit()
```

New in version 0.2.3.

clear_contents()
Clears the content of the whole sheet but leaves the formatting.

clear()
Clears the content and formatting of the whole sheet.

name
Get or set the name of the Sheet.

index
Returns the index of the Sheet.

classmethod active(*wkb=None*)
Returns the active Sheet. Use like so: `Sheet.active()`

classmethod add(*name=None*, *before=None*, *after=None*, *wkb=None*)
Creates a new worksheet: the new worksheet becomes the active sheet. If neither `before` nor `after` is specified, the new Sheet will be placed at the end.

Parameters

- **name** (*str, default None*) – Sheet name, defaults to Excel standard name
- **before** (*str or int, default None*) – Sheet name or index
- **after** (*str or int, default None*) – Sheet name or index

Returns

Return type Sheet object

Examples

```
>>> Sheet.add()  # Place at end with default name
>>> Sheet.add('NewSheet', before='Sheet1')  # Include name and position
>>> new_sheet = Sheet.add(after=3)
>>> new_sheet.index
4
```

New in version 0.2.3.

static count(*wkb=None*)

Counts the number of Sheets.

Keyword Arguments wkb (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

Examples

```
>>> Sheet.count()
3
```

New in version 0.2.3.

static all(*wkb=None*)

Returns a list with all Sheet objects.

Keyword Arguments wkb (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

Examples

```
>>> Sheet.all()
[<Sheet 'Sheet1' of Workbook 'Book1'>, <Sheet 'Sheet2' of Workbook 'Book1'>]
>>> [i.name.lower() for i in Sheet.all()]
['sheet1', 'sheet2']
>>> [i.autofit() for i in Sheet.all()]
```

New in version 0.2.3.

delete()

Deletes the Sheet.

13.4 Range

The xlwings Range object represents a block of contiguous cells in Excel.

class xlwings.**Range**(**args*, *wkb=None*)

A Range object can be instantiated with the following arguments:

```
Range('A1')           Range('Sheet1', 'A1')           Range(1, 'A1')
Range('A1:C3')        Range('Sheet1', 'A1:C3')        Range(1, 'A1:C3')
Range((1,2))          Range('Sheet1, (1,2))           Range(1, (1,2))
Range((1,1), (3,3))   Range('Sheet1', (1,1), (3,3))   Range(1, (1,1), (3,3))
Range('NamedRange')   Range('Sheet1', 'NamedRange')   Range(1, 'NamedRange')
```

The Sheet can also be provided as Sheet object:

```
sh = Sheet(1)
Range(sh, 'A1')
```

If no worksheet name is provided as first argument, it will take the Range from the active sheet.

You usually want to go for `Range(...).value` to get the values (as list of lists). You can influence the reading/writing behavior by making use of *Converters* and their options: `Range(...).options(...).value`

Parameters ***args** – Definition of sheet (optional) and Range in the above described combinations.

Keyword Arguments **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via *Workbook.set_current()*'.

options(*convert=None*, ***options*)

Allows you to set a converter and their options. Converters define how Excel Ranges and their values are being converted both during reading and writing operations. If no explicit converter is specified, the base converter is being applied, see *Converters*.

Parameters **convert** (*object, default None*) – A converter, e.g. `dict`, `np.array`, `pd.DataFrame`, `pd.Series`, defaults to default converter

Keyword Arguments

- **ndim** (*int, default None*) – number of dimensions
- **numbers** (*type, default None*) – type of numbers, e.g. `int`
- **dates** (*type, default None*) – e.g. `datetime.date` defaults to `datetime.datetime`
- **empty** (*object, default None*) – transformation of empty cells
- **transpose** (*Boolean, default False*) – transpose values
- **expand** (*str, default None*) – One of `'table'`, `'vertical'`, `'horizontal'`, see also `Range.table` etc

  => For converter-specific options, see *Converters*.

Returns

Return type Range object

New in version 0.7.0.

is_cell()
Returns `True` if the Range consists of a single Cell otherwise `False`.

New in version 0.1.1.

is_row()
Returns `True` if the Range consists of a single Row otherwise `False`.

New in version 0.1.1.

is_column()
Returns `True` if the Range consists of a single Column otherwise `False`.

New in version 0.1.1.

is_table()
Returns `True` if the Range consists of a 2d array otherwise `False`.

New in version 0.1.1.

shape
Tuple of Range dimensions.

New in version 0.3.0.

size
Number of elements in the Range.

New in version 0.3.0.

value
Gets and sets the values for the given Range.

Returns Empty cells are set to `None`.

Return type object

formula
Gets or sets the formula for the given Range.

table
Returns a contiguous Range starting with the indicated cell as top-left corner and going down and right as long as no empty cell is hit.

Keyword Arguments **strict** (*boolean, default False*) – `True` stops the table at empty cells even if they contain a formula. Less efficient than if set to `False`.

Returns

Return type Range object

Examples

To get the values of a contiguous range or clear its contents use:

```
Range('A1').table.value
Range('A1').table.clear_contents()
```

vertical

Returns a contiguous Range starting with the indicated cell and going down as long as no empty cell is hit. This corresponds to `Ctrl-Shift-DownArrow` in Excel.

Parameters **strict** (*bool, default False*) – `True` stops the table at empty cells even if they contain a formula. Less efficient than if set to `False`.

Returns

Return type Range object

Examples

To get the values of a contiguous range or clear its contents use:

```
Range('A1').vertical.value
Range('A1').vertical.clear_contents()
```

horizontal

Returns a contiguous Range starting with the indicated cell and going right as long as no empty cell is hit.

Keyword Arguments **strict** (*bool, default False*) – `True` stops the table at empty cells even if they contain a formula. Less efficient than if set to `False`.

Returns

Return type Range object

Examples

To get the values of a contiguous Range or clear its contents use:

```
Range('A1').horizontal.value
Range('A1').horizontal.clear_contents()
```

current_region

This property returns a Range object representing a range bounded by (but not including) any combination of blank rows and blank columns or the edges of the worksheet. It corresponds to `Ctrl-*` on Windows and `Shift-Ctrl-Space` on Mac.

Returns

Return type Range object

number_format

Gets and sets the number_format of a Range.

Examples

```
>>> Range('A1').number_format
'General'
>>> Range('A1:C3').number_format = '0.00%'
>>> Range('A1:C3').number_format
'0.00%'
```

New in version 0.2.3.

clear()
Clears the content and the formatting of a Range.

clear_contents()
Clears the content of a Range but leaves the formatting.

column_width
Gets or sets the width, in characters, of a Range. One unit of column width is equal to the width of one character in the Normal style. For proportional fonts, the width of the character 0 (zero) is used.

If all columns in the Range have the same width, returns the width. If columns in the Range have different widths, returns None.

column_width must be in the range: 0 <= column_width <= 255

Note: If the Range is outside the used range of the Worksheet, and columns in the Range have different widths, returns the width of the first column.

Returns

Return type float

New in version 0.4.0.

row_height
Gets or sets the height, in points, of a Range. If all rows in the Range have the same height, returns the height. If rows in the Range have different heights, returns None.

row_height must be in the range: 0 <= row_height <= 409.5

Note: If the Range is outside the used range of the Worksheet, and rows in the Range have different heights, returns the height of the first row.

Returns

Return type float

New in version 0.4.0.

width
Returns the width, in points, of a Range. Read-only.

Returns

Return type float

New in version 0.4.0.

height
Returns the height, in points, of a Range. Read-only.

Returns

Return type float

New in version 0.4.0.

left
Returns the distance, in points, from the left edge of column A to the left edge of the range. Read-only.

Returns

Return type float

New in version 0.6.0.

top
Returns the distance, in points, from the top edge of row 1 to the top edge of the range. Read-only.

Returns

Return type float

New in version 0.6.0.

autofit(*axis=None*)
Autofits the width of either columns, rows or both.

Parameters **axis** (*string or integer, default None*) –

- To autofit rows, use one of the following: `rows` or `r`
- To autofit columns, use one of the following: `columns` or `c`
- To autofit rows and columns, provide no arguments

Examples

```
# Autofit column A
Range('A:A').autofit('c')
# Autofit row 1
Range('1:1').autofit('r')
# Autofit columns and rows, taking into account Range('A1:E4')
Range('A1:E4').autofit()
# AutoFit rows, taking into account Range('A1:E4')
Range('A1:E4').autofit('rows')
```

New in version 0.2.2.

get_address(*row_absolute=True*, *column_absolute=True*, *include_sheetname=False*, *external=False*)

Returns the address of the range in the specified format.

Parameters

- **row_absolute** (*bool, default True*) – Set to True to return the row part of the reference as an absolute reference.
- **column_absolute** (*bool, default True*) – Set to True to return the column part of the reference as an absolute reference.
- **include_sheetname** (*bool, default False*) – Set to True to include the Sheet name in the address. Ignored if external=True.
- **external** (*bool, default False*) – Set to True to return an external reference with workbook and worksheet name.

Returns

Return type str

Examples

```
>>> Range((1,1)).get_address()
'$A$1'
>>> Range((1,1)).get_address(False, False)
'A1'
>>> Range('Sheet1', (1,1), (3,3)).get_address(True, False, True)
'Sheet1!A$1:C$3'
>>> Range('Sheet1', (1,1), (3,3)).get_address(True, False, external=True)
'[Workbook1]Sheet1!A$1:C$3'
```

New in version 0.2.3.

hyperlink

Returns the hyperlink address of the specified Range (single Cell only)

Examples

```
>>> Range('A1').value
'www.xlwings.org'
>>> Range('A1').hyperlink
'http://www.xlwings.org'
```

New in version 0.3.0.

add_hyperlink(*address*, *text_to_display=None*, *screen_tip=None*)

Adds a hyperlink to the specified Range (single Cell)

Parameters

- **address** (*str*) – The address of the hyperlink.

- **text_to_display** (*str, default None*) – The text to be displayed for the hyperlink. Defaults to the hyperlink address.
- **screen_tip** (*str, default None*) – The screen tip to be displayed when the mouse pointer is paused over the hyperlink. Default is set to '<address> - Click once to follow. Click and hold to select this cell.'

New in version 0.3.0.

color

Gets and sets the background color of the specified Range.

To set the color, either use an RGB tuple `(0, 0, 0)` or a color constant. To remove the background, set the color to `None`, see Examples.

Returns RGB

Return type tuple

Examples

```
>>> Range('A1').color = (255,255,255)
>>> from xlwings import RgbColor
>>> Range('A2').color = RgbColor.rgbAqua
>>> Range('A2').color
(0, 255, 255)
>>> Range('A2').color = None
>>> Range('A2').color is None
True
```

New in version 0.3.0.

resize(*row_size=None*, *column_size=None*)

Resizes the specified Range

Parameters

- **row_size** (*int > 0*) – The number of rows in the new range (if None, the number of rows in the range is unchanged).
- **column_size** (*int > 0*) – The number of columns in the new range (if None, the number of columns in the range is unchanged).

Returns Range

Return type Range object

New in version 0.3.0.

offset(*row_offset=None*, *column_offset=None*)

Returns a Range object that represents a Range that's offset from the specified range.

Returns Range

Return type Range object

New in version 0.3.0.

column
Returns the number of the first column in the in the specified range. Read-only.

Returns

Return type Integer

New in version 0.3.5.

row
Returns the number of the first row in the in the specified range. Read-only.

Returns

Return type Integer

New in version 0.3.5.

last_cell
Returns the bottom right cell of the specified range. Read-only.

Returns

Return type Range object

Example

```
>>> rng = Range('A1').table
>>> rng.last_cell.row, rng.last_cell.column
(4, 5)
```

New in version 0.3.5.

name
Sets or gets the name of a Range.

To delete a named Range, use `del wb.names['NamedRange']` if `wb` is your Workbook object.

New in version 0.4.0.

13.5 Shape

class `xlwings.`**Shape**(**args*, ***kwargs*)
A Shape object represents an existing Excel shape and can be instantiated with the following arguments:

```
Shape(1)              Shape('Sheet1', 1)              Shape(1, 1)
Shape('Shape 1')      Shape('Sheet1', 'Shape 1')      Shape(1, 'Shape 1')
```

The Sheet can also be provided as Sheet object:

```
sh = Sheet(1)
Shape(sh, 'Shape 1')
```

If no Worksheet is provided as first argument, it will take the Shape from the active Sheet.

Parameters ***args** – Definition of Sheet (optional) and shape in the above described combinations.

Keyword Arguments **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

New in version 0.5.0.

name
Returns or sets a String value representing the name of the object.

New in version 0.5.0.

left
Returns or sets a value that represents the distance, in points, from the left edge of the object to the left edge of column A.

New in version 0.5.0.

top
Returns or sets a value that represents the distance, in points, from the top edge of the topmost shape in the shape range to the top edge of the worksheet.

New in version 0.5.0.

width
Returns or sets a value that represents the width, in points, of the object.

New in version 0.5.0.

height
Returns or sets a value that represents the height, in points, of the object.

New in version 0.5.0.

delete()
Deletes the object.

New in version 0.5.0.

activate()
Activates the object.

New in version 0.5.0.

13.6 Chart

Note: The chart object is currently still lacking a lot of important methods/attributes.

class xlwings.**Chart**(**args*, ***kwargs*)

Bases: xlwings.main.Shape

A Chart object represents an existing Excel chart and can be instantiated with the following arguments:

```
Chart(1)              Chart('Sheet1', 1)              Chart(1, 1)
Chart('Chart 1')      Chart('Sheet1', 'Chart 1')      Chart(1, 'Chart 1')
```

The Sheet can also be provided as Sheet object:

```
sh = Sheet(1)
Chart(sh, 'Chart 1')
```

If no Worksheet is provided as first argument, it will take the Chart from the active Sheet.

To insert a new Chart into Excel, create it as follows:

```
Chart.add()
```

Parameters ***args** – Definition of Sheet (optional) and chart in the above described combinations.

Keyword Arguments **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via Workbook.set_current().

Example

```
>>> from xlwings import Workbook, Range, Chart, ChartType
>>> wb = Workbook()
>>> Range('A1').value = [['Foo1', 'Foo2'], [1, 2]]
>>> chart = Chart.add(source_data=Range('A1').table, chart_type=ChartType.xlLine)
>>> chart.name
'Chart1'
>>> chart.chart_type = ChartType.xl3DArea
```

activate()

Activates the object.

New in version 0.5.0.

delete()

Deletes the object.

New in version 0.5.0.

height

Returns or sets a value that represents the height, in points, of the object.

New in version 0.5.0.

left

Returns or sets a value that represents the distance, in points, from the left edge of the object to the left edge of column A.

New in version 0.5.0.

name
Returns or sets a String value representing the name of the object.

New in version 0.5.0.

top
Returns or sets a value that represents the distance, in points, from the top edge of the topmost shape in the shape range to the top edge of the worksheet.

New in version 0.5.0.

width
Returns or sets a value that represents the width, in points, of the object.

New in version 0.5.0.

classmethod add(*sheet=None*, *left=0*, *top=0*, *width=355*, *height=211*, ***kwargs*)
Inserts a new Chart into Excel.

Parameters

- **sheet** (*str or int or xlwings.Sheet, default None*) – Name or index of the Sheet or Sheet object, defaults to the active Sheet
- **left** (*float, default 0*) – left position in points
- **top** (*float, default 0*) – top position in points
- **width** (*float, default 375*) – width in points
- **height** (*float, default 225*) – height in points

Keyword Arguments

- **chart_type** (*xlwings.ChartType member, default xlColumnClustered*) – Excel chart type. E.g. xlwings.ChartType.xlLine
- **name** (*str, default None*) – Excel chart name. Defaults to Excel standard name if not provided, e.g. 'Chart 1'
- **source_data** (*Range*) – e.g. Range('A1').table
- **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

chart_type
Gets and sets the chart type of a chart.

New in version 0.1.1.

set_source_data(*source*)
Sets the source for the chart.

Parameters **source** (Range) – Range object, e.g. `Range('A1')`

13.7 Picture

class xlwings.**Picture**(**args*, ***kwargs*)

Bases: xlwings.main.Shape

A Picture object represents an existing Excel Picture and can be instantiated with the following arguments:

```
Picture(1)                Picture('Sheet1', 1)                  Picture(1, 1)
Picture('Picture 1')      Picture('Sheet1', 'Picture 1')        Picture(1, 'Picture 1')
```

The Sheet can also be provided as Sheet object:

```
sh = Sheet(1)
Shape(sh, 'Picture 1')
```

If no Worksheet is provided as first argument, it will take the Picture from the active Sheet.

Parameters ***args** – Definition of Sheet (optional) and picture in the above described combinations.

Keyword Arguments **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via Workbook.set_current().

New in version 0.5.0.

activate()

Activates the object.

New in version 0.5.0.

delete()

Deletes the object.

New in version 0.5.0.

height

Returns or sets a value that represents the height, in points, of the object.

New in version 0.5.0.

left

Returns or sets a value that represents the distance, in points, from the left edge of the object to the left edge of column A.

New in version 0.5.0.

name

Returns or sets a String value representing the name of the object.

New in version 0.5.0.

top

Returns or sets a value that represents the distance, in points, from the top edge of the topmost shape in the shape range to the top edge of the worksheet.

New in version 0.5.0.

width
Returns or sets a value that represents the width, in points, of the object.

New in version 0.5.0.

classmethod add (*filename*, *sheet=None*, *name=None*, *link_to_file=False*, *save_with_document=True*, *left=0*, *top=0*, *width=None*, *height=None*, *wkb=None*)
Inserts a picture into Excel.

Parameters **filename** (*str*) – The full path to the file.

Keyword Arguments

- **sheet** (*str or int or xlwings.Sheet, default None*) – Name or index of the Sheet or `xlwings.Sheet` object, defaults to the active Sheet
- **name** (*str, default None*) – Excel picture name. Defaults to Excel standard name if not provided, e.g. 'Picture 1'
- **left** (*float, default 0*) – Left position in points.
- **top** (*float, default 0*) – Top position in points.
- **width** (*float, default None*) – Width in points. If PIL/Pillow is installed, it defaults to the width of the picture. Otherwise it defaults to 100 points.
- **height** (*float, default None*) – Height in points. If PIL/Pillow is installed, it defaults to the height of the picture. Otherwise it defaults to 100 points.
- **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

New in version 0.5.0.

update (*filename*)
Replaces an existing picture with a new one, taking over the attributes of the existing picture.

Parameters **filename** (*str*) – Path to the picture.

New in version 0.5.0.

13.8 Plot

class xlwings.**Plot** (*figure*)
Plot allows to easily display Matplotlib figures as pictures in Excel.

Parameters **figure** (*matplotlib.figure.Figure*) – Matplotlib figure

Example

Get a matplotlib `figure` object:

•via PyPlot interface:

```
import matplotlib.pyplot as plt
fig = plt.figure()
plt.plot([1, 2, 3, 4, 5])
```

•via object oriented interface:

```
from matplotlib.figure import Figure
fig = Figure(figsize=(8, 6))
ax = fig.add_subplot(111)
ax.plot([1, 2, 3, 4, 5])
```

•via Pandas:

```
import pandas as pd
import numpy as np

df = pd.DataFrame(np.random.rand(10, 4), columns=['a', 'b', 'c', 'd'])
ax = df.plot(kind='bar')
fig = ax.get_figure()
```

Then show it in Excel as picture:

```
plot = Plot(fig)
plot.show('Plot1')
```

New in version 0.5.0.

show(*name*, *sheet=None*, *left=0*, *top=0*, *width=None*, *height=None*, *wkb=None*)

Inserts the matplotlib figure as picture into Excel if a picture with that name doesn't exist yet. Otherwise it replaces the picture, taking over its position and size.

Parameters **name** (*str*) – Name of the picture in Excel

Keyword Arguments

- **sheet** (*str or int or xlwings.Sheet, default None*) – Name or index of the Sheet or `xlwings.Sheet` object, defaults to the active Sheet
- **left** (*float, default 0*) – Left position in points. Only has an effect if the picture doesn't exist yet in Excel.
- **top** (*float, default 0*) – Top position in points. Only has an effect if the picture doesn't exist yet in Excel.
- **width** (*float, default None*) – Width in points, defaults to the width of the matplotlib figure. Only has an effect if the picture doesn't exist yet in Excel.
- **height** (*float, default None*) – Height in points, defaults to the height of the matplotlib figure. Only has an effect if the picture doesn't exist yet in Excel.
- **wkb** (*Workbook object, default Workbook.current()*) – Defaults to the Workbook that was instantiated last or set via `Workbook.set_current()`.

New in version 0.5.0.

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