xlwings - Make Excel Fly!

Release 0.11.4

Zoomer Analytics LLC

Jul 23, 2017

Contents

CHAPTER 1

Migrate to v0.9

The purpose of this document is to enable you a smooth experience when upgrading to xlwings v0.9.0 and above by laying out the concept and syntax changes in detail. If you want to get an overview of the new features and bug fixes, have a look at the release notes. Note that the syntax for User Defined Functions (UDFs) didn't change.

Full qualification: Using collections

The new object model allows to specify the Excel application instance if needed:

- **old**: `xw.Range('Sheet1', 'A1', wkb=xw.Workbook('Book1'))`
- **new**: `xw.apps[0].books['Book1'].sheets['Sheet1'].range('A1')`

See *Syntax Overview* for the details of the new object model.

Connecting to Books

- **old**: `xw.Workbook()`
- **new**: `xw.Book()` or via `xw.books` if you need to control the app instance.

See *Connect to a Book* for the details.

Active Objects

```
# Active app (i.e. Excel instance)
>>> app = xw.apps.active

# Active book
>>> wb = xw.books.active  # in active app
>>> wb = app.books.active  # in specific app

# Active sheet
>>> sht = xw.sheets.active  # in active book
>>> sht = wb.sheets.active  # in specific book

# Range on active sheet
>>> xw.Range('A1')  # on active sheet of active book of active app
```

Round vs. Square Brackets

Round brackets follow Excel's behavior (i.e. 1-based indexing), while square brackets use Python's 0-based indexing/slicing.

As an example, the following all reference the same range:

```
xw.apps[0].books[0].sheets[0].range('A1')
xw.apps(1).books(1).sheets(1).range('A1')
xw.apps[0].books['Book1'].sheets['Sheet1'].range('A1')
xw.apps(1).books('Book1').sheets('Sheet1').range('A1')
```

Access the underlying Library/Engine

- **old**: `xw.Range('A1').xl_range` and `xl_sheet` etc.
- **new**: `xw.Range('A1').api`, same for all other objects

This returns a `pywin32` COM object on Windows and an `appscript` object on Mac.

Cheat sheet

Note that `sht` stands for a sheet object, like e.g. (in 0.9.0 syntax): `sht = xw.books['Book1'].sheets[0]`

	v0.9.0	v0.7.2
Active Excel instance	`xw.apps.active`	unsupported
New Excel instance	`app = xw.App()`	unsupported
Get app from book	`app = wb.app`	`app = xw.Applicat`

Table 1.1 – continued from previous page

	v0.9.0	v0.7.2
Target installation (Mac)	`app = xw.App(spec=...)`	`wb = xw.Workbook(`
Hide Excel Instance	`app = xw.App(visible=False)`	`wb = xw.Workbook(`
Selected Range	`app.selection`	`wb.get_selection(`
Calculation mode	`app.calculation = 'manual'`	`app.calculation =`
All books in app	`app.books`	unsupported
Fully qualified book	`app.books['Book1']`	unsupported
Active book in active app	`xw.books.active`	`xw.Workbook.activ`
New book in active app	`wb = xw.Book()`	`wb = xw.Workbook(`
New book in specific app	`wb = app.books.add()`	unsupported
All sheets in book	`wb.sheets`	`xw.Sheet.all(wb)`
Call a macro in an addin	`app.macro('MacroName')`	unsupported
First sheet of book wb	`wb.sheets[0]`	`xw.Sheet(1, wkb=w`
Active sheet	`wb.sheets.active`	`xw.Sheet.active(w`
Add sheet	`wb.sheets.add()`	`xw.Sheet.add(wkb=`
Sheet count	`wb.sheets.count` or `len(wb.sheets)`	`xw.Sheet.count(wb`
Add chart to sheet	`chart = wb.sheets[0].charts.add()`	`chart = xw.Chart.`
Existing chart	`wb.sheets['Sheet 1'].charts[0]`	`xw.Chart('Sheet 1`
Chart Type	`chart.chart_type = '3d_area'`	`chart.chart_type`
Add picture to sheet	`wb.sheets[0].pictures.add('path/to/pic')`	`xw.Picture.add('p`
Existing picture	`wb.sheets['Sheet 1'].pictures[0]`	`xw.Picture('Sheet`
Matplotlib	`sht.pictures.add(fig, name='x', update=True)`	`xw.Plot(fig).show`
Table expansion	`sht.range('A1').expand('table')`	`xw.Range(sht, 'A1`
Vertical expansion	`sht.range('A1').expand('down')`	`xw.Range(sht, 'A1`
Horizontal expansion	`sht.range('A1').expand('right')`	`xw.Range(sht, 'A1`
Set name of range	`sht.range('A1').name = 'name'`	`xw.Range(sht, 'A1`
Get name of range	`sht.range('A1').name.name`	`xw.Range(sht, 'A1`
mock caller	`xw.Book('file.xlsm').set_mock_caller()`	`xw.Workbook.set_m`

CHAPTER 2

Installation

The easiest way to install xlwings is via pip:

```
pip install xlwings
```

or conda:

```
conda install xlwings
```

Note that the official `conda` package might be few releases behind. You can, however, use the `conda-forge` channel (see: https://anaconda.org/conda-forge/xlwings) which should be reasonably up to date (but might still be a few days behind the pip release):

```
conda install -c conda-forge 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`.

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 which can be a hassle.

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

  On Mac, the dependencies are automatically being handled if xlwings is installed with `conda` or `pip`. However, with pip, 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.

Optional Dependencies

- NumPy
- Pandas
- Matplotlib
- Pillow/PIL

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

Add-in

Please see xlwings_addin on how to install the xlwings add-in.

Python version support

xlwings is tested on Python 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*.

1. Scripting: Automate/interact with Excel from Python

Establish a connection to a workbook:

```
>>> import xlwings as xw
>>> wb = xw.Book()  # this will create a new workbook
>>> wb = xw.Book('FileName.xlsx')  # connect to an existing file in the␣
↪current working directory
>>> wb = xw.Book(r'C:\path\to\file.xlsx')  # on Windows: use raw strings to␣
↪escape backslashes
```

If you have the same file open in two instances of Excel, you need to fully qualify it and include the app instance:

```
>>> xw.apps[0].books['FileName.xlsx']
```

Instantiate a sheet object:

```
>>> sht = wb.sheets['Sheet1']
```

Reading/writing values to/from ranges is as easy as:

```
>>> sht.range('A1').value = 'Foo 1'
>>> sht.range('A1').value
'Foo 1'
```

There are many **convenience features** available, e.g. Range expanding:

```
>>> sht.range('A1').value = [['Foo 1', 'Foo 2', 'Foo 3'], [10.0, 20.0, 30.0]]
>>> sht.range('A1').expand().value
[['Foo 1', 'Foo 2', 'Foo 3'], [10.0, 20.0, 30.0]]
```

Powerful converters handle most data types of interest, including Numpy arrays and Pandas DataFrames in both directions:

```
>>> import pandas as pd
>>> df = pd.DataFrame([[1,2], [3,4]], columns=['a', 'b'])
>>> sht.range('A1').value = df
>>> sht.range('A1').options(pd.DataFrame, expand='table').value
       a    b
0.0  1.0  2.0
1.0  3.0  4.0
```

Matplotlib figures can be shown as pictures in Excel:

```
>>> import matplotlib.pyplot as plt
>>> fig = plt.figure()
>>> plt.plot([1, 2, 3, 4, 5])
[<matplotlib.lines.Line2D at 0x1071706a0>]
>>> sht.pictures.add(fig, name='MyPlot', update=True)
<Picture 'MyPlot' in <Sheet [Workbook4]Sheet1>>
```

Shortcut for the active sheet: `xw.Range`

If you want to quickly talk to the active sheet in the active workbook, you don't need instantiate a workbook and sheet object, but can simply do:

```
>>> import xlwings xw
>>> xw.Range('A1').value = 'Foo'
>>> xw.Range('A1').value
'Foo'
```

Note: You should only use `xw.Range` when interacting with Excel. In scripts, you should always go via book and sheet objects as shown above.

2. Macros: Call Python from Excel

You can call Python functions from VBA using the `RunPython` function:

```
Sub HelloWorld()
    RunPython ("import hello; hello.world()")
End Sub
```

Per default, `RunPython` expects `hello.py` in the same directory as the Excel file. Refer to the calling Excel book by using `xw.Book.caller`:

```
# hello.py
import numpy as np
```

```
import xlwings as xw

def world():
    wb = xw.Book.caller()
    wb.sheets[0].range('A1').value = 'Hello World!'
```

To make this run, you'll need to have the xlwings add-in installed. The easiest way to get everything set up is to use the xlwings command line client from either a command prompt on Windows or a terminal on Mac: `xlwings quickstart myproject`.

For details about the addin, see xlwings_addin.

3. UDFs: User Defined Functions (Windows only)

Writing a UDF in Python is as easy as:

```
import xlwings as xw

@xw.func
def hello(name):
    return 'Hello {0}'.format(name)
```

Converters can be used with UDFs, too. Again a Pandas DataFrame example:

```
import xlwings as xw
import pandas as pd

@xw.func
@xw.arg('x', pd.DataFrame)
def correl2(x):
    # x arrives as DataFrame
    return x.corr()
```

Import this function into Excel by clicking the import button of the xlwings add-in: For further details, see *VBA: User Defined Functions (UDFs)*.

CHAPTER 4

Connect to a Book

When reading/writing data to the active sheet, you don't need a book object:

```
>>> import xlwings as xw
>>> xw.Range('A1').value = 'something'
```

Python to Excel

The easiest way to connect to a book is offered by `xw.Book`: it looks for the book in all app instances and returns an error, should the same book be open in multiple instances. To connect to a book in the active app instance, use `xw.books` and to refer to a specific app, use:

```
>>> app = xw.App()  # or something like xw.apps[0] for existing apps
>>> app.books['Book1']
```

	xw.Book	xw.books
New book	`xw.Book()`	`xw.books.add()`
Unsaved book	`xw.Book('Book1')`	`xw.books['Book1']`
Book by (full)name	`xw.Book(r'C:/path/to/file.xlsx')`	`xw.books.open(r'C:/path/to/file.xlsx')`

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`.

Excel to Python (RunPython)

To reference the calling book when using `RunPython` in VBA, use `xw.Book.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 `xw.Book.caller()` and one of the methods explained above.

User Defined Functions (UDFs)

Unlike `RunPython`, UDFs don't need a call to `xw.Book.caller()`, see *VBA: User Defined Functions (UDFs)*. However, it's available (restricted to read-only though), which sometimes proofs to be useful.

CHAPTER 5

Syntax Overview

The xlwings object model is very similar to the one used by VBA.

All code samples below depend on the following import:

```
>>> import xlwings as xw
```

Active Objects

```
# Active app (i.e. Excel instance)
>>> app = xw.apps.active

# Active book
>>> wb = xw.books.active  # in active app
>>> wb = app.books.active  # in specific app

# Active sheet
>>> sht = xw.sheets.active  # in active book
>>> sht = wb.sheets.active  # in specific book

# Range on active sheet
>>> xw.Range('A1')  # on active sheet of active book of active app
```

A Range can be instantiated with A1 notation, a tuple of Excel's 1-based indices, a named range or two Range objects:

```
xw.Range('A1')
xw.Range('A1:C3')
xw.Range((1,1))
xw.Range((1,1), (3,3))
```

```
xw.Range('NamedRange')
xw.Range(xw.Range('A1'), xw.Range('B2'))
```

Full qualification

Round brackets follow Excel's behavior (i.e. 1-based indexing), while square brackets use Python's 0-based indexing/slicing. As an example, the following expressions all reference the same range:

```
xw.apps[0].books[0].sheets[0].range('A1')
xw.apps(1).books(1).sheets(1).range('A1')
xw.apps[0].books['Book1'].sheets['Sheet1'].range('A1')
xw.apps(1).books('Book1').sheets('Sheet1').range('A1')
```

Range indexing/slicing

Range objects support indexing and slicing, a few examples:

```
>>> rng = xw.Book().sheets[0].range('A1:D5')
>>> rng[0, 0]
 <Range [Workbook1]Sheet1!$A$1>
>>> rng[1]
 <Range [Workbook1]Sheet1!$B$1>
>>> rng[:, 3:]
<Range [Workbook1]Sheet1!$D$1:$D$5>
>>> rng[1:3, 1:3]
<Range [Workbook1]Sheet1!$B$2:$C$3>
```

Range Shortcuts

Sheet objects offer a shortcut for range objects by using index/slice notation on the sheet object. This evaluates to either `sheet.range` or `sheet.cells` depending on whether you pass a string or indices/slices:

```
>>> sht = xw.Book().sheets['Sheet1']
>>> sht['A1']
<Range [Book1]Sheet1!$A$1>
>>> sht['A1:B5']
<Range [Book1]Sheet1!$A$1:$B$5>
>>> sht[0, 1]
<Range [Book1]Sheet1!$B$1>
>>> sht[:10, :10]
<Range [Book1]Sheet1!$A$1:$J$10>
```

Object Hierarchy

The following shows an example of the object hierarchy, i.e. how to get from an app to a range object and all the way back:

```
>>> rng = xw.apps[0].books[0].sheets[0].range('A1')
>>> rng.sheet.book.app
<Excel App 1644>
```

CHAPTER 6

Data Structures Tutorial

This tutorial 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 the behavior using the `options` method, have a look at *Converters and Options*.

All code samples below depend on the following import:

```
>>> import xlwings as xw
```

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:

```
>>> import datetime as dt
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = 1
>>> sht.range('A1').value
1.0
>>> sht.range('A2').value = 'Hello'
>>> sht.range('A2').value
'Hello'
>>> sht.range('A3').value is None
True
>>> sht.range('A4').value = dt.datetime(2000, 1, 1)
>>> sht.range('A4').value
datetime.datetime(2000, 1, 1, 0, 0)
```

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, the next point shows you how to preserve this info:

```
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = [[1],[2],[3],[4],[5]]  # Column orientation␣
↪(nested list)
>>> sht.range('A1:A5').value
[1.0, 2.0, 3.0, 4.0, 5.0]
>>> sht.range('A1').value = [1, 2, 3, 4, 5]
>>> sht.range('A1:E1').value
[1.0, 2.0, 3.0, 4.0, 5.0]
```

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

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

  Note: To write a list in column orientation to Excel, use `transpose`: `sht.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"):

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

```
>>> sht.range('A10').value = [['Foo 1', 'Foo 2', 'Foo 3'], [10, 20, 30]]
>>> sht.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 `sht.range('A1').value = [[1,2],[3,4]]` than `sht.range('A1').value = [1, 2]` and `sht.range('A2').value = [3, 4]`.

Range expanding

You can get the dimensions of Excel Ranges dynamically through either the method `expand` or through the `expand` keyword in the `options` method. While `expand` gives back an expanded Range object, options are only evaluated when accessing the values of a Range. The difference is best explained with an example:

```
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = [[1,2], [3,4]]
>>> rng1 = sht.range('A1').expand('table')  # or just .expand()
>>> rng2 = sht.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]]
>>> sht.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]]
```

`'table'` expands to `'down'` and `'right'`, the other available options which can be used for column or row only expansion, respectively.

Note: Using `expand()` 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 `sht.range('NamedRange').expand().value`.

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` in the `options` method:

```
>>> import numpy as np
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = np.eye(3)
>>> sht.range('A1').options(np.array, expand='table').value
array([[ 1.,  0.,  0.],
       [ 0.,  1.,  0.],
       [ 0.,  0.,  1.]])
```

Pandas DataFrames

```
>>> sht = xw.Book().sheets[0]
>>> 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
>>> sht.range('A1').value = df
>>> sht.range('A1:C3').options(pd.DataFrame).value
   one  two
0  1.1  2.2
1  3.3  NaN
# options: work for reading and writing
>>> sht.range('A5').options(index=False).value = df
>>> sht.range('A9').options(index=False, header=False).value = df
```

Pandas Series

```
>>> import pandas as pd
>>> import numpy as np
>>> sht = xw.Book().sheets[0]
>>> 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
>>> sht.range('A1').value = s
>>> sht.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, a NumPy array or a Pandas DataFrame to Excel, e.g.: `sht.range('A1').value = np.eye(10)`

CHAPTER 7

VBA: RunPython

xlwings add-in

To get access to the `RunPython` function, you'll need the xlwings addin (or VBA module), see xlwings_addin.

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

```
$ xlwings quickstart myproject
```

Call Python with "RunPython"

In the VBA Editor (`Alt-F11`), write the code below into a VBA module. `xlwings quickstart` automatically adds a new module with a sample call. If you rather want to start from scratch, you can add new module via `Insert > Module`.

```
Sub HelloWorld()
    RunPython ("import hello; hello.world()")
End Sub
```

This calls the following code in `hello.py`:

```
# hello.py
import numpy as np
import xlwings as xw

def world():
```

```
    wb = xw.Book.caller()
    wb.sheets[0].range('A1').value = 'Hello World!'
```

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

Note: Place `xw.Book.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`.

Function Arguments and Return Values

While it's technically possible to include arguments in the function call within `RunPython`, it's not very convenient. Also, `RunPython` does not allow you to return values. To overcome these issue, use UDFs, see *VBA: User Defined Functions (UDFs)* - however, this is currently limited to Windows only.

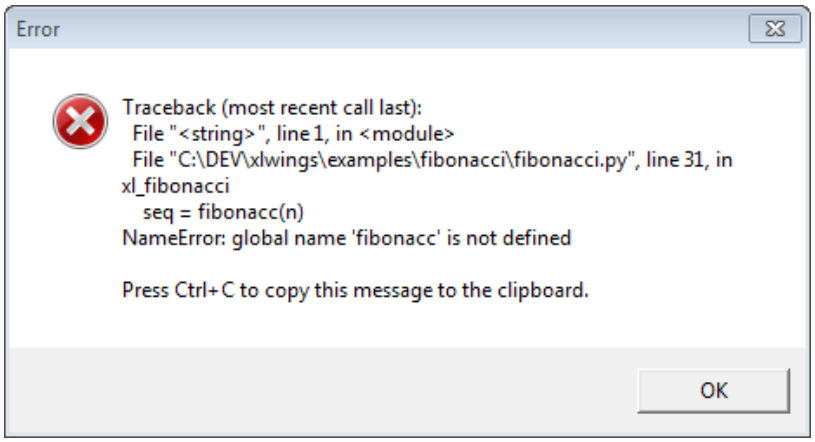
CHAPTER 8

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 the function 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.

RunPython

Consider the following sample code of your Python source code `my_module.py`:

```
# my_module.py
import os
import xlwings as xw

def my_macro():
    wb = xw.Book.caller()
    wb.sheets[0].range('A1').value = 1

if __name__ == '__main__':
    # Expects the Excel file next to this source file, adjust accordingly.
    xw.Book('myfile.xlsm').set_mock_caller()
    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

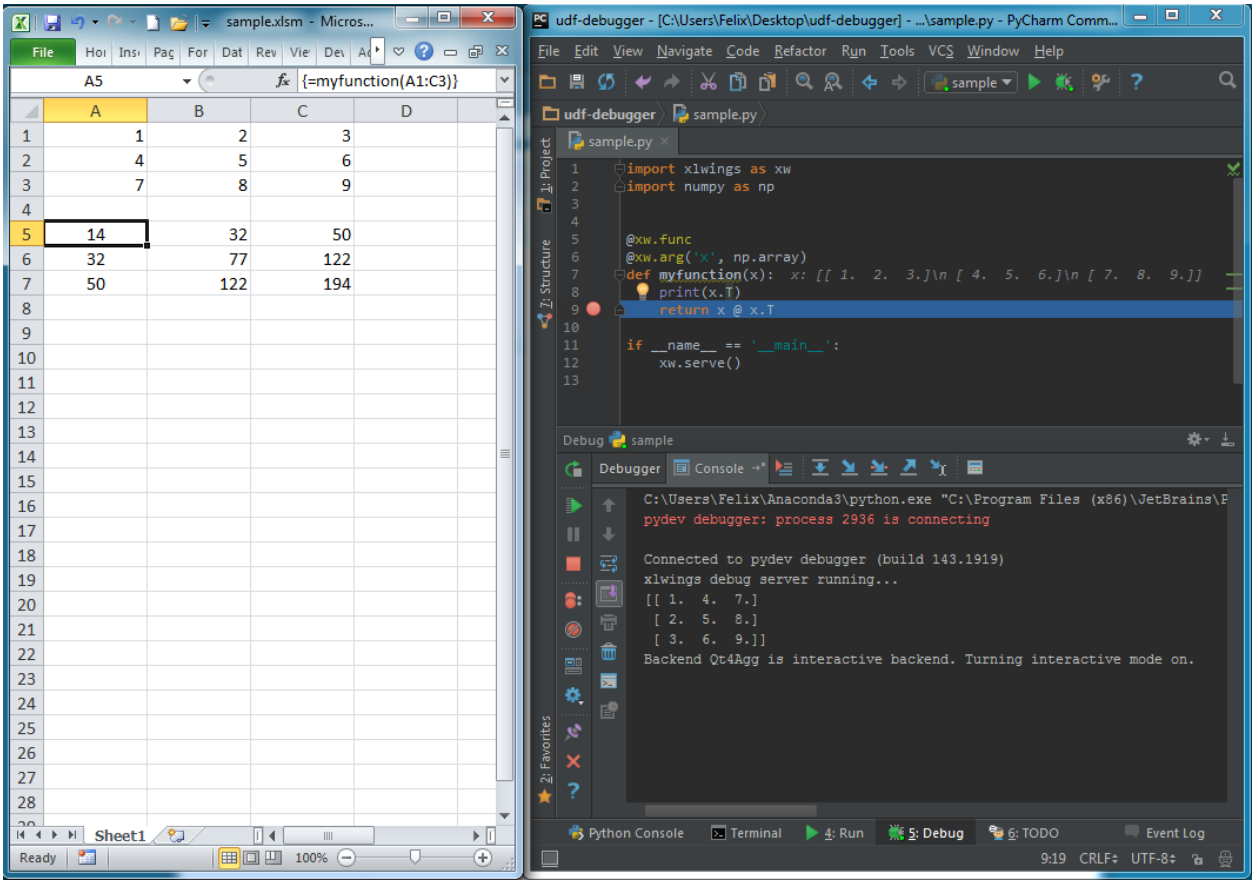
Windows only: To debug UDFs, just check the `Debug UDFs` in the xlwings_addin, at the top of the xlwings VBA module. Then add the following lines at the end of your Python source file and run it. Depending on which IDE you use, you might need to run the code in "debug" mode (e.g. in case you're using PyCharm or PyDev):

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

When you recalculate the Sheet (`Ctrl-Alt-F9`), the code will stop at breakpoints or output any print calls 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.


sample.xlsm - Micros...
File
A5
{=myfunction(A1:C3)}
Sheet1
Ready
100%
udf-debugger - [C:\Users\Felix\Desktop\udf-debugger] - ...\sample.py - PyCharm Comm...
File Edit View Navigate Code Refactor Run Tools VCS Window Help
udf-debugger
sample.py
import xlwings as xw
import numpy as np
@xw.func
@xw.arg('x', np.array)
def myfunction(x):
print(x.T)
return x @ x.T
if __name__ == '__main__':
xw.serve()
Debug sample
Debugger
Console
C:\Users\Felix\Anaconda3\python.exe "C:\Program Files (x86)\JetBrains\P
pydev debugger: process 2936 is connecting
Connected to pydev debugger (build 143.1919)
xlwings debug server running...
[[1. 4. 7.]
[2. 5. 8.]
[3. 6. 9.]]
Backend Qt4Agg is interactive backend. Turning interactive mode on.
Python Console
Terminal
4: Run
5: Debug
6: TODO
Event Log
9:19
CRLF
UTF-8

CHAPTER 9

Matplotlib

Using *pictures.add()*, it is easy to paste a Matplotlib plot as picture in Excel.

Getting started

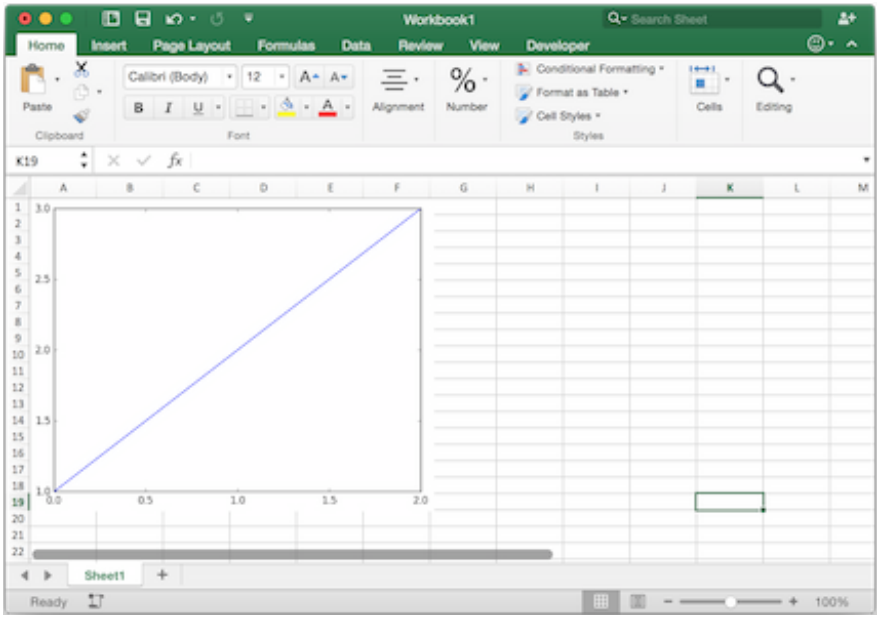
The easiest sample boils down to:

```
>>> import matplotlib.pyplot as plt
>>> import xlwings as xw

>>> fig = plt.figure()
>>> plt.plot([1, 2, 3])

>>> sht = xw.Book().sheets[0]
>>> sht.pictures.add(fig, name='MyPlot', update=True)
```

Note: If you set `update=True`, you can resize and position the plot on Excel: subsequent calls to `pictures.add()` with the same name (`'MyPlot'`) will update the picture without changing its position or size.

Full integration with Excel

Calling the above code with *RunPython* and binding it e.g. to a button is straightforward and works cross-platform.



However, on Windows you can make things feel even more integrated by setting up a *UDF* along the following lines:

```
@xw.func
def myplot(n):
    sht = xw.Book.caller().sheets.active
    fig = plt.figure()
    plt.plot(range(int(n)))
    sht.pictures.add(fig, name='MyPlot', update=True)
    return 'Plotted with n={}'.format(n)
```

If you import this function and call it from cell B2, then the plot gets automatically updated when cell B1 changes:

Properties

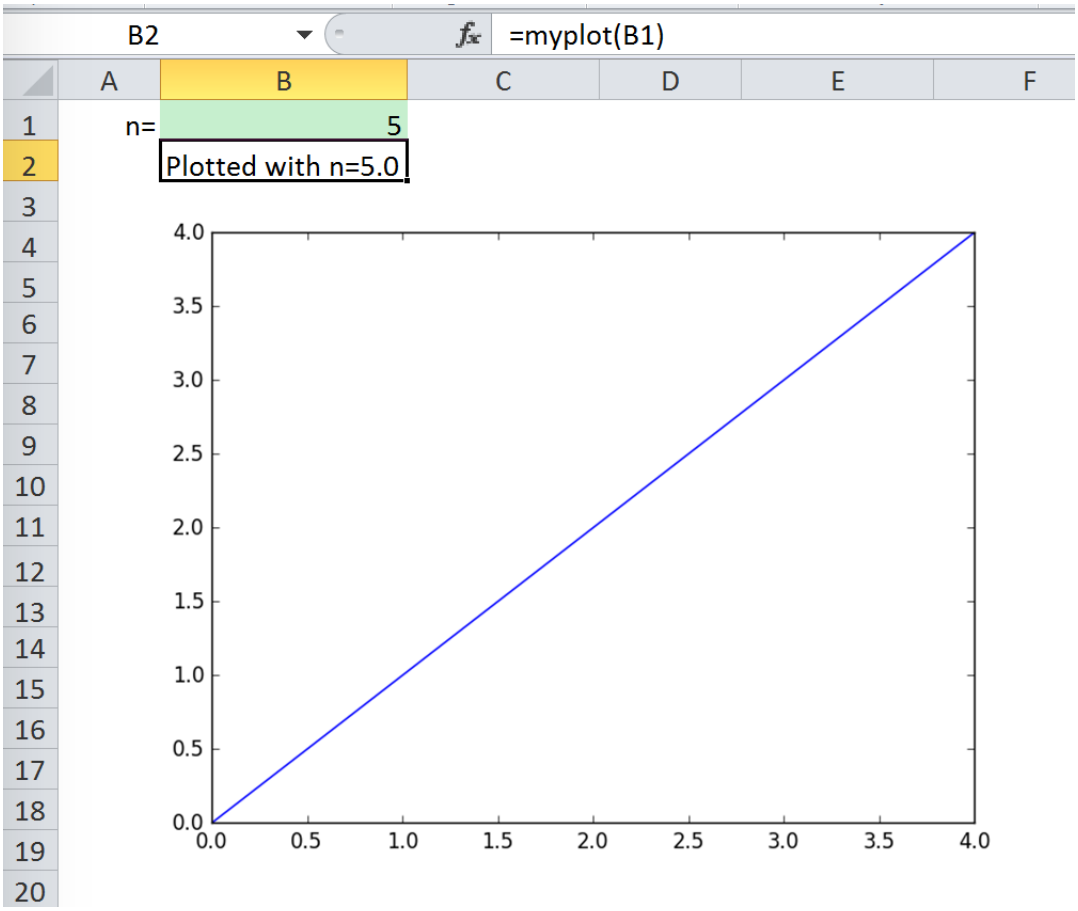
Size, position and other properties can either be set as arguments within *pictures.add()*, or by manipulating the picture object that is returned, see *xlwings.Picture()*.

For example:

```
>>> sht = xw.Book().sheets[0]
>>> sht.pictures.add(fig, name='MyPlot', update=True,
                     left=sht.range('B5').left, top=sht.range('B5').top)
```

or:

```
>>> plot = sht.pictures.add(fig, name='MyPlot', update=True)
>>> plot.height /= 2
>>> plot.width /= 2
```


B2
=myplot(B1)
A
B
C
D
E
F
n=
5
Plotted with n=5.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

Getting a Matplotlib figure

Here are a few examples of how you get a matplotlib `figure` object:

- via PyPlot interface:

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

  or:

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

- 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()
```

CHAPTER 10

VBA: User Defined Functions (UDFs)

This tutorial gets you quickly started on how to write User Defined Functions.

Note:

- UDFs are currently only available on Windows.
- For details of how to control the behaviour of the arguments and return values, have a look at *Converters and Options*.
- For a comprehensive overview of the available decorators and their options, check out the corresponding API docs: *UDF decorators*.

One-time Excel preparations

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

2. Install the add-in via command prompt: `xlwings addin install` (see xlwings_addin).

Workbook preparation

The easiest way to start a new project is to run `xlwings quickstart myproject` on a command prompt (see *Command Line Client*). This automatically adds the xlwings reference to the generated workbook.

A simple UDF

The default addin settings expect a Python source file in the way it is created by `quickstart`:

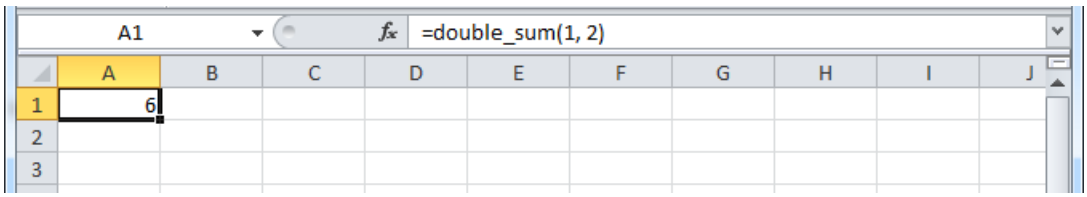
- in the same directory as the Excel file
- with the same name as the Excel file, but with a `.py` ending instead of `.xlsm`.

Alternatively, you can point to a specific module via `UDF Modules` in the xlwings ribbon.

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`.
- Enter the formula `=double_sum(1, 2)` into a cell and you will see the correct result:



- 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. If you want to make sure everything is in a fresh state, click `Restart UDF Server`.
- 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.

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.

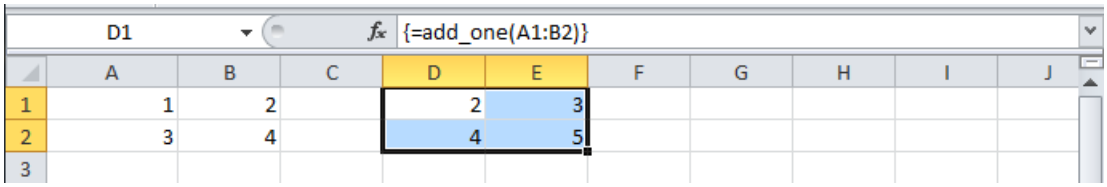
You can pass an Excel Range as a function argument, as opposed to a single cell and it will show up in Python as list of lists.

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:



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]
```

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()
```

@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
```

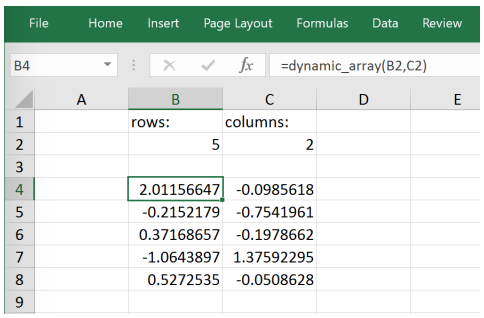
For further details see the *Converters and Options* documentation.

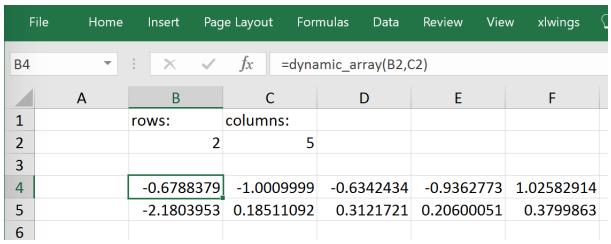
Dynamic Array Formulas

As seen above, to use Excel's array formulas, you need to specify their dimensions up front by selecting the result array first, then entering the formula and finally hitting `Ctrl-Shift-Enter`. While this makes sense from a data integrity point of view, in practice, it often turns out to be a cumbersome limitation, especially when working with dynamic arrays such as time series data. Since v0.10, xlwings offers dynamic UDF expansion:

This is a simple example that demonstrates the syntax and effect of UDF expansion:

```
import numpy as np

@xw.func
@xw.ret(expand='table')
def dynamic_array(r, c):
    return np.random.randn(int(r), int(c))
```





Note:

- Expanding array formulas will overwrite cells without prompting and leave an empty border around them, i.e. they will clear the row to the bottom and the column to the right of the array.
- The way that dynamic array formulas are currently implemented doesn't allow them to have volatile functions as arguments, e.g. you cannot use functions like `=TODAY()` as arguments.

Docstrings

The following sample shows how to include docstrings both for the function and for the arguments x and y that then show up in the function wizard in Excel:

```
import xlwings as xw

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

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
```

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.Book.caller()
    wb.sheets[0].range('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`.

Call UDFs from VBA

Imported functions can also be used from VBA. They return a 2d array:

```
Sub MySub()

Dim arr() As Variant
```

```
Dim i As Long, j As Long

    arr = my_imported_function(...)

    For j = LBound(arr, 2) To UBound(arr, 2)
        For lRow = LBound(arr, 1) To UBound(arr, 1)
            Debug.Print "(" & i & "," & j & ")", arr(i, j)
        Next i
    Next j

End Sub
```

CHAPTER 11

Converters and Options

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 `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.

All code samples below depend on the following import:

```
>>> import xlwings as xw
```

Syntax:

	xw.Range	UDFs
reading	`xw.Range.options(convert=None, **kwargs).value`	`@arg('x', convert=None, **kwargs)`
writing	`xw.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:

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

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
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = [[1, 2], [3, 4]]
>>> sht.range('A1').value
1.0
>>> sht.range('A1').options(ndim=1).value
[1.0]
>>> sht.range('A1').options(ndim=2).value
[[1.0]]
>>> sht.range('A1:A2').value
[1.0 3.0]
>>> sht.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`:

```
>>> sht.range('A1').value = 1
>>> sht.range('A1').value
1.0
>>> sht.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, which is the reason why the *int* converter rounds numbers first before turning them into integers. Otherwise it could happen that e.g. 5 might be

returned as 4 in case it is represented as a floating point number that is slightly smaller than 5. Should you require Python's original *int* in your converter, use *raw int* instead.

- **dates**

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

  - Range:

```
>>> import datetime as dt
>>> sht.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, month, day)
>>> sht.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: `>>> sht.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: `sht.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
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = [[1,2], [3,4]]
>>> rng1 = sht.range('A1').expand()
>>> rng2 = sht.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]]
>>> sht.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` method is only available on `Range` objects as UDFs only allow to manipulate the calling cells.

Built-in Converters

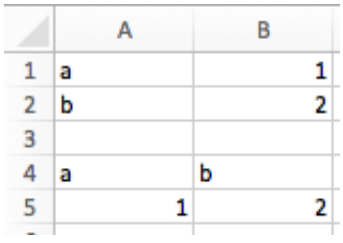
xlwings offers several built-in converters that perform type conversion to **dictionaries**, **NumPy arrays**, **Pandas Series** and **DataFrames**. These build on top of the default converter, so in most cases the options described above can be used in this context, too (unless they are meaningless,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

It is also possible to write and register custom converter for additional types, see below.

The samples below can be used with both `xlwings.Range` objects and UDFs even though only one version may be shown.

Dictionary converter

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




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

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
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').options(transpose=True).value = np.array([1, 2, 3])
>>> sht.range('A1:A3').options(np.array, ndim=2).value
array([[ 1.],
       [ 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			

```
>>> sht = xw.Book().sheets[0]
>>> s = sht.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
>>> sht.range('D1', header=False).value = s
```

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`.

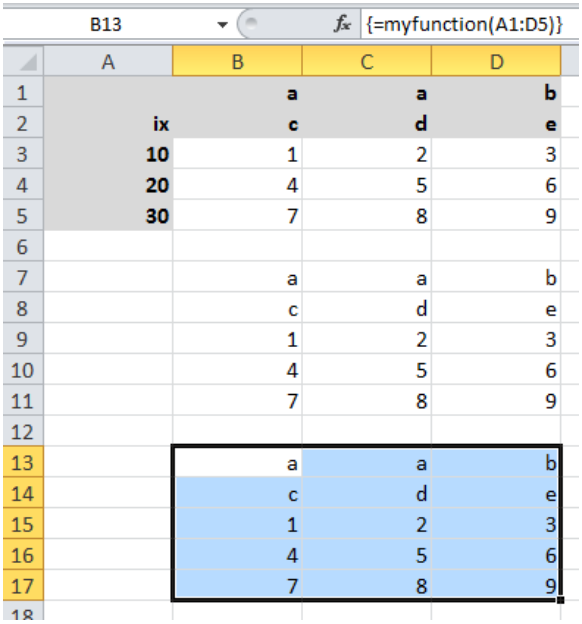
`header`: int or Boolean

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:



```
>>> sht = xw.Book().sheets[0]
>>> df = sht.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:
>>> sht.range('A1').value = df

# Writing back and changing some of the options, e.g. getting rid of the␣
↪index:
>>> sht.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
```

xw.Range and 'raw' converters

Technically speaking, these are "no-converters".

- 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
  ```

  This returns x as `xlwings.Range` object, i.e. without applying any converters or options.

- The `raw` converter delivers the values unchanged from the underlying libraries (`pywin32` on Windows and `appscript` on Mac), i.e. no sanitizing/cross-platform harmonizing of values are being made. This might be useful in a few cases for efficiency reasons. E.g:

  ```
  >>> sht.range('A1:B2').value
  [[1.0, 'text'], [datetime.datetime(2016, 2, 1, 0, 0), None]]

  >>> sht.range('A1:B2').options('raw').value  # or sht.range('A1:B2').raw_
  ↪value
  ((1.0, 'text'), (pywintypes.datetime(2016, 2, 1, 0, 0,␣
  ↪tzinfo=TimeZoneInfo('GMT Standard Time', True)), None))
  ```

Custom Converter

Here are the steps to implement your own converter:

- Inherit from `xlwings.conversion.Converter`
- Implement both a `read_value` and `write_value` method as static- or classmethod:
  - In `read_value`, `value` is what the base converter returns: hence, if no `base` has been specified it arrives in the format of the default converter.
  - In `write_value`, `value` is the original object being written to Excel. It must be returned in the format that the base converter expects. Again, if no `base` has been specified, this is the default converter.

  The `options` dictionary will contain all keyword arguments specified in the `xw.Range.options` method, e.g. when calling `xw.Range('A1').options(myoption='some value')` or as specified in the `@arg` and `@ret` decorator when using UDFs. Here is the basic structure:

```
from xlwings.conversion import Converter

class MyConverter(Converter):

    @staticmethod
    def read_value(value, options):
        myoption = options.get('myoption', default_value)
        return_value = value  # Implement your conversion here
        return return_value

    @staticmethod
    def write_value(value, options):
        myoption = options.get('myoption', default_value)
        return_value = value  # Implement your conversion here
        return return_value
```

- Optional: set a `base` converter (`base` expects a class name) to build on top of an existing converter, e.g. for the built-in ones: `DictCoverter`, `NumpyArrayConverter`, `PandasDataFrameConverter`, `PandasSeriesConverter`
- Optional: register the converter: you can **(a)** register a type so that your converter becomes the default for this type during write operations and/or **(b)** you can register an alias that will allow you to explicitly call your converter by name instead of just by class name

The following examples should make it much easier to follow - it defines a DataFrame converter that extends the built-in DataFrame converter to add support for dropping nan's:

```
from xlwings.conversion import Converter, PandasDataFrameConverter

class DataFrameDropna(Converter):

    base = PandasDataFrameConverter

    @staticmethod
    def read_value(builtin_df, options):
```

```
        dropna = options.get('dropna', False)  # set default to False
        if dropna:
            converted_df = builtin_df.dropna()
        else:
            converted_df = builtin_df
        # This will arrive in Python when using the DataFrameDropna converter␣
↪for reading
        return converted_df

    @staticmethod
    def write_value(df, options):
        dropna = options.get('dropna', False)
        if dropna:
            converted_df = df.dropna()
        else:
            converted_df = df
        # This will be passed to the built-in PandasDataFrameConverter when␣
↪writing
        return converted_df
```

Now let's see how the different converters can be applied:

```
# Fire up a Workbook and create a sample DataFrame
sht = xw.Book().sheets[0]
df = pd.DataFrame([[1.,10.],[2.,np.nan], [3., 30.]])
```

- Default converter for DataFrames:

```
# Write
sht.range('A1').value = df

# Read
sht.range('A1:C4').options(pd.DataFrame).value
```

- DataFrameDropna converter:

```
# Write
sht.range('A7').options(DataFrameDropna, dropna=True).value = df

# Read
sht.range('A1:C4').options(DataFrameDropna, dropna=True).value
```

- Register an alias (optional):

```
DataFrameDropna.register('df_dropna')

# Write
sht.range('A12').options('df_dropna', dropna=True).value = df

# Read
sht.range('A1:C4').options('df_dropna', dropna=True).value
```

- Register DataFrameDropna as default converter for DataFrames (optional):

```
DataFrameDropna.register(pd.DataFrame)

# Write
sht.range('A13').options(dropna=True).value = df

# Read
sht.range('A1:C4').options(pd.DataFrame, dropna=True).value
```

These samples all work the same with UDFs, e.g.:

```
@xw.func
@arg('x', DataFrameDropna, dropna=True)
@ret(DataFrameDropna, dropna=True)
def myfunction(x):
    # ...
    return x
```

Note: Python objects run through multiple stages of a transformation pipeline when they are being written to Excel. The same holds true in the other direction, when Excel/COM objects are being read into Python.

Pipelines are internally defined by `Accessor` classes. A Converter is just a special Accessor which converts to/from a particular type by adding an extra stage to the pipeline of the default Accessor. For example, the `PandasDataFrameConverter` defines how a list of list (as delivered by the default Accessor) should be turned into a Pandas DataFrame.

The `Converter` class provides basic scaffolding to make the task of writing a new Converter easier. If you need more control you can subclass `Accessor` directly, but this part requires more work and is currently undocumented.

CHAPTER 12

Command Line Client

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

Quickstart

- `xlwings quickstart myproject`

This command is by far the fastest way to get off the ground: It creates a new folder `myproject` with an Excel workbook that already has the reference to the xlwings addin and a Python file, ready to be used right away:

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

If you want to use xlwings via VBA module instead of addin, use the `--standalone` or `-s` flag:

```
xlwings quickstart myproject --standalone
```

Add-in

The *addin* command makes it easy on Windows to install/remove the addin. On Mac, you need to install it manually, but `xlwings addin install` will show you how to do it.

Note: Excel needs to be closed before installing/updating the add-in via command line. 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.

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 13

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 calling the `api` property:

   ```
   >>> sht = xw.Book().sheets[0]
   >>> sht.api
   <COMObject <unknown>>  # Windows/pywin32
   app(pid=2319).workbooks['Workbook1'].worksheets[1]  # Mac/appscript
   ```

   This works accordingly for the other objects like `sht.range('A1').api` 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).

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

```
# Windows
sht.range('A1').api.WrapText = True
```

```
# Mac
sht.range('A1').api.wrap_text.set(True)
```

CHAPTER 14

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*.

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 (!)

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: *VBA: User Defined Functions (UDFs)*), it will be available as UDF from Excel.

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: *VBA: User Defined Functions (UDFs)*), it will be available as UDF from Excel.

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.Book()
PyObject <Book [Workbook1]>

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

CHAPTER 15

API Documentation

Top-level functions

xlwings.**view**(*obj*, *sheet=None*)

Opens a new workbook and displays an object on its first sheet by default. If you provide a sheet object, it will clear the sheet before displaying the object on the existing sheet.

Parameters

- **obj** (*any type with built-in converter*) – the object to display, e.g. numbers, strings, lists, numpy arrays, pandas dataframes
- **sheet** (Sheet, *default None*) – Sheet object. If none provided, the first sheet of a new workbook is used.

Examples

```
>>> import xlwings as xw
>>> import pandas as pd
>>> import numpy as np
>>> df = pd.DataFrame(np.random.rand(10, 4), columns=['a', 'b', 'c', 'd
↪'])
>>> xw.view(df)
```

New in version 0.7.1.

Object model

Apps

class xlwings.main.**Apps**(*impl*)

A collection of all *app* objects:

```
>>> import xlwings as xw
>>> xw.apps
Apps([<Excel App 1668>, <Excel App 1644>])
```

active

Returns the active app.

New in version 0.9.0.

add()

Creates a new App. The new App becomes the active one. Returns an App object.

count

Returns the number of apps.

New in version 0.9.0.

App

class xlwings.**App**(*visible=None*, *spec=None*, *add_book=True*, *impl=None*)

An app corresponds to an Excel instance. New Excel instances can be fired up like so:

```
>>> import xlwings as xw
>>> app1 = xw.App()
>>> app2 = xw.App()
```

An app object is a member of the *apps* collection:

```
>>> xw.apps
Apps([<Excel App 1668>, <Excel App 1644>])
>>> xw.apps[0]
<Excel App 1668>
>>> xw.apps.active
<Excel App 1668>
```

Parameters

- **visible** (*bool, default None*) – Returns or sets a boolean value that determines whether the app is visible. The default leaves the state unchanged or sets visible=True if the object doesn't exist yet.
- **spec** (*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.

Note: On Mac, while xlwings allows you to run multiple instances of Excel, it's a feature that is not officially supported by Excel for Mac: Unlike on Windows, Excel will not ask you to open a read-only version of a file if it is already open in another instance. This means that you need to watch out yourself so that the same file is not being overwritten from different instances.

---

activate(*steal_focus=False*)

Activates the Excel app.

Parameters **steal_focus** (*bool, default False*) – If True, make frontmost application and hand over focus from Python to Excel.

New in version 0.9.0.

api

Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

New in version 0.9.0.

books

A collection of all Book objects that are currently open.

New in version 0.9.0.

calculate()

Calculates all open books.

New in version 0.3.6.

calculation

Returns or sets a calculation value that represents the calculation mode. Modes: `'manual'`, `'automatic'`, `'semiautomatic'`

Examples

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> wb.app.calculation = 'manual'
```

Changed in version 0.9.0.

display_alerts

The default value is True. Set this property to False to suppress prompts and alert messages while code is running; when a message requires a response, Excel chooses the default response.

New in version 0.9.0.

hwnd
Returns the Window handle (Windows-only).

New in version 0.9.0.

kill()
Forces the Excel app to quit by killing its process.

New in version 0.9.0.

macro(*name*)
Runs a Sub or Function in Excel VBA that are not part of a specific workbook but e.g. are part of an add-in.

Parameters **name** (Name of Sub or Function with or without module name, e.g. `'Module1.MyMacro'` or `'MyMacro'`) –

Examples

This VBA function:

```
Function MySum(x, y)
    MySum = x + y
End Function
```

can be accessed like this:

```
>>> import xlwings as xw
>>> app = xw.App()
>>> my_sum = app.macro('MySum')
>>> my_sum(1, 2)
3
```

See also: *Book.macro()*

New in version 0.9.0.

pid
Returns the PID of the app.

New in version 0.9.0.

quit()
Quits the application without saving any workbooks.

New in version 0.3.3.

range(*cell1*, *cell2=None*)
Range object from the active sheet of the active book, see *Range()*.

New in version 0.9.0.

screen_updating
Turn screen updating off to speed up your script. You won't be able to see what the script is

doing, but it will run faster. Remember to set the screen_updating property back to True when your script ends.

New in version 0.3.3.

selection
Returns the selected cells as Range.

New in version 0.9.0.

version
Returns the Excel version number object.

Examples

```
>>> import xlwings as xw
>>> xw.App().version
VersionNumber('15.24')
>>> xw.apps[0].version.major
15
```

Changed in version 0.9.0.

visible
Gets or sets the visibility of Excel to `True` or `False`.

New in version 0.3.3.

Books

class `xlwings.main.`**Books**(*impl*)
A collection of all *book* objects:

```
>>> import xlwings as xw
>>> xw.books  # active app
Books([<Book [Book1]>, <Book [Book2]>])
>>> xw.apps[0].books  # specific app
Books([<Book [Book1]>, <Book [Book2]>])
```

New in version 0.9.0.

active
Returns the active Book.

add()
Creates a new Book. The new Book becomes the active Book. Returns a Book object.

open(*fullname*)
Opens a Book if it is not open yet and returns it. If it is already open, it doesn't raise an exception but simply returns the Book object.

Parameters **fullname** (*str*) – filename or fully qualified filename, e.g. `r'C:\path\to\file.xlsx'` or `'file.xlsm'`. Without a full path, it looks for the file in the current working directory.

Returns Book

Return type Book that has been opened.

Book

class `xlwings.`**Book**(*fullname=None*, *impl=None*)

A book object is a member of the *books* collection:

```
>>> import xlwings as xw
>>> xw.books[0]
<Book [Book1]>
```

The easiest way to connect to a book is offered by `xw.Book`: it looks for the book in all app instances and returns an error, should the same book be open in multiple instances. To connect to a book in the active app instance, use `xw.books` and to refer to a specific app, use:

```
>>> app = xw.App()  # or something like xw.apps[0] for existing apps
>>> app.books['Book1']
```

	xw.Book	xw.books
New book	`xw.Book()`	`xw.books.add()`
Unsaved book	`xw.Book('Book1')`	`xw.books['Book1']`
Book by (full)name	`xw.Book(r'C:/path/to/file.xlsx')`	`xw.books.open(r'C:/path/to/file.xlsx')`

Parameters **fullname** (*str, default None*) – Full path or name (incl. xlsx, xlsm etc.) of existing workbook or name of an unsaved workbook. Without a full path, it looks for the file in the current working directory.

activate(*steal_focus=False*)

Activates the book.

Parameters **steal_focus** (*bool, default False*) – If True, make frontmost window and hand over focus from Python to Excel.

api

Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

New in version 0.9.0.

app

Returns an app object that represents the creator of the book.

New in version 0.9.0.

classmethod caller()
References the calling book when the Python function is called from Excel via `RunPython`. Pack it into the function being called from Excel, e.g.:

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

New in version 0.3.0.

close()
Closes the book without saving it.

New in version 0.1.1.

fullname
Returns the name of the object, including its path on disk, as a string. Read-only String.

macro(*name*)
Runs a Sub or Function in Excel VBA.

Parameters **name** (Name of Sub or Function with or without module name, e.g. `'Module1.MyMacro'` or `'MyMacro'`) –

Examples

This VBA function:

```
Function MySum(x, y)
    MySum = x + y
End Function
```

can be accessed like this:

```
>>> import xlwings as xw
>>> wb = xw.books.active
>>> my_sum = wb.macro('MySum')
>>> my_sum(1, 2)
3
```

See also: *App.macro()*

New in version 0.7.1.

name
Returns the name of the book as str.

names
Returns a names collection that represents all the names in the specified book (including all sheet-specific names).

Changed in version 0.9.0.

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:

```
>>> xw.Book.open_template()
```

See also: *Command Line Client*

New in version 0.3.3.

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

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> wb.save()
>>> wb.save(r'C:\path\to\new_file_name.xlsx')
```

New in version 0.3.1.

selection
Returns the selected cells as Range.

New in version 0.9.0.

set_mock_caller()
Sets the Excel file which is used to mock `xw.Book.caller()` when the code is called from Python and not from Excel via `RunPython`.

Examples

```
# This code runs unchanged from Excel via RunPython and from Python␣
↪directly
import os
import xlwings as xw

def my_macro():
    sht = xw.Book.caller().sheets[0]
    sht.range('A1').value = 'Hello xlwings!'

if __name__ == '__main__':
    xw.Book('file.xlsm').set_mock_caller()
    my_macro()
```

New in version 0.3.1.

sheets
Returns a sheets collection that represents all the sheets in the book.

New in version 0.9.0.

Sheets

class xlwings.main.**Sheets**(*impl*)
A collection of all *sheet* objects:

```
>>> import xlwings as xw
>>> xw.sheets  # active book
Sheets([<Sheet [Book1]Sheet1>, <Sheet [Book1]Sheet2>])
>>> xw.apps[0].books['Book1'].sheets  # specific book
Sheets([<Sheet [Book1]Sheet1>, <Sheet [Book1]Sheet2>])
```

New in version 0.9.0.

active
Returns the active Sheet.

add(*name=None*, *before=None*, *after=None*)
Creates a new Sheet and makes it the active sheet.

Parameters

- **name** (*str, default None*) – Name of the new sheet. If None, will default to Excel's default name.
- **before** (Sheet, *default None*) – An object that specifies the sheet before which the new sheet is added.
- **after** (Sheet, *default None*) – An object that specifies the sheet after which the new sheet is added.

Sheet

class xlwings.**Sheet**(*sheet=None*, *impl=None*)
A sheet object is a member of the *sheets* collection:

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> wb.sheets[0]
<Sheet [Book1]Sheet1>
>>> wb.sheets['Sheet1']
<Sheet [Book1]Sheet1>
>>> wb.sheets.add()
<Sheet [Book1]Sheet2>
```

Changed in version 0.9.0.

activate()
Activates the Sheet and returns it.

api
Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

New in version 0.9.0.

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

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> wb.sheets['Sheet1'].autofit('c')
>>> wb.sheets['Sheet1'].autofit('r')
>>> wb.sheets['Sheet1'].autofit()
```

New in version 0.2.3.

book
Returns the Book of the specified Sheet. Read-only.

cells
Returns a Range object that represents all the cells on the Sheet (not just the cells that are currently in use).

New in version 0.9.0.

charts
See *Charts*

New in version 0.9.0.

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

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

delete()
Deletes the Sheet.

index
Returns the index of the Sheet (1-based as in Excel).

name
Gets or sets the name of the Sheet.

names
Returns a names collection that represents all the sheet-specific names (names defined with the "SheetName!" prefix).

New in version 0.9.0.

pictures
See *Pictures*

New in version 0.9.0.

range(*cell1*, *cell2=None*)
Returns a Range object from the active sheet of the active book, see *Range()*.

New in version 0.9.0.

select()
Selects the Sheet. Select only works on the active book.

New in version 0.9.0.

shapes
See *Shapes*

New in version 0.9.0.

Range

class xlwings.**Range**(*cell1=None*, *cell2=None*, ***options*)
Returns a Range object that represents a cell or a range of cells.

Parameters

- **cell1** (*str or tuple or Range*) – Name of the range in the upper-left corner in A1 notation or as index-tuple or as name or as xw.Range object. It can also specify a range using the range operator (a colon), .e.g. 'A1:B2'
- **cell2** (*str or tuple or Range, default None*) – Name of the range in the lower-right corner in A1 notation or as index-tuple or as name or as xw.Range object.

Examples

Active Sheet:

```
import xlwings as xw
xw.Range('A1')
xw.Range('A1:C3')
xw.Range((1,1))
xw.Range((1,1), (3,3))
```

```
xw.Range('NamedRange')
xw.Range(xw.Range('A1'), xw.Range('B2'))
```

Specific Sheet:

```
xw.books['MyBook.xlsx'].sheets[0].range('A1')
```

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.

address
Returns a string value that represents the range reference. Use `get_address()` to be able to provide paramaters.

New in version 0.9.0.

api
Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

New in version 0.9.0.

autofit()
Autofits the width and height of all cells in the range.

- To autofit only the width of the columns use `xw.Range('A1:B2').columns.autofit()`
- To autofit only the height of the rows use `xw.Range('A1:B2').rows.autofit()`

Changed in version 0.9.0.

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

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

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

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> xw.Range('A1').color = (255,255,255)
>>> xw.Range('A2').color
(255, 255, 255)
>>> xw.Range('A2').color = None
>>> xw.Range('A2').color is None
True
```

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.

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.

columns

Returns a *RangeColumns* object that represents the columns in the specified range.

New in version 0.9.0.

count

Returns the number of cells.

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

end(*direction*)

Returns a Range object that represents the cell at the end of the region that contains the source range. Equivalent to pressing Ctrl+Up, Ctrl+down, Ctrl+left, or Ctrl+right.

Parameters **direction** (*One of 'up', 'down', 'right', 'left'*) –

Examples

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> xw.Range('A1:B2').value = 1
>>> xw.Range('A1').end('down')
<Range [Book1]Sheet1!$A$2>
>>> xw.Range('B2').end('right')
<Range [Book1]Sheet1!$B$2>
```

New in version 0.9.0.

expand(*mode='table'*)

Expands the range according to the mode provided. Ignores empty top-left cells (unlike `Range.end()`).

Parameters **mode** (*str, default 'table'*) – One of `'table'` (=down and right), `'down'`, `'right'`.

Returns

Return type *Range*

Examples

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> xw.Range('A1').value = [[None, 1], [2, 3]]
>>> xw.Range('A1').expand().address
$A$1:$B$2
>>> xw.Range('A1').expand('right').address
$A$1:$B$1
```

New in version 0.9.0.

formula

Gets or sets the formula for the given Range.

formula_array

Gets or sets an array formula for the given Range.

New in version 0.7.1.

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

Returns the address of the range in the specified format. `address` can be used instead if none of the defaults need to be changed.

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

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> xw.Range((1,1)).get_address()
'$A$1'
>>> xw.Range((1,1)).get_address(False, False)
'A1'
>>> xw.Range((1,1), (3,3)).get_address(True, False, True)
'Sheet1!A$1:C$3'
>>> xw.Range((1,1), (3,3)).get_address(True, False, external=True)
'[Book1]Sheet1!A$1:C$3'
```

New in version 0.2.3.

height

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

Returns

Return type float

New in version 0.4.0.

hyperlink

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

Examples

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> xw.Range('A1').value
'www.xlwings.org'
>>> xw.Range('A1').hyperlink
'http://www.xlwings.org'
```

New in version 0.3.0.

last_cell

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

Returns

Return type *Range*

Example

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> rng = xw.Range('A1:E4')
>>> rng.last_cell.row, rng.last_cell.column
(4, 5)
```

New in version 0.3.5.

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.

name

Sets or gets the name of a Range.

New in version 0.4.0.

number_format

Gets and sets the number_format of a Range.

Examples

```
>>> import xlwings as xw
>>> wb = xw.Book()
>>> xw.Range('A1').number_format
```

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

New in version 0.2.3.

offset(*row_offset=0*, *column_offset=0*)

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

Returns **Range object**

Return type *Range*

New in version 0.3.0.

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 and Options*.

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'`, `'down'`, `'right'`

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

Returns

Return type Range object

New in version 0.7.0.

raw_value

Gets and sets the values directly as delivered from/accepted by the engine that is being used (`pywin32` or `appscript`) without going through any of xlwings' data cleaning/converting. This can be helpful if speed is an issue but naturally will be engine specific, i.e. might remove the cross-platform compatibility.

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 object

Return type *Range*

New in version 0.3.0.

row

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

Returns

Return type Integer

New in version 0.3.5.

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.

rows

Returns a *RangeRows* object that represents the rows in the specified range.

New in version 0.9.0.

select()

Selects the range. Select only works on the active book.

New in version 0.9.0.

shape

Tuple of Range dimensions.

New in version 0.3.0.

sheet

Returns the Sheet object to which the Range belongs.

New in version 0.9.0.

size

Number of elements in the Range.

New in version 0.3.0.

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.

value
Gets and sets the values for the given Range.

Returns object

Return type returned object depends on the converter being used, see *xlwings.Range.options()*

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

Returns

Return type float

New in version 0.4.0.

RangeRows

class xlwings.**RangeRows**(*rng*)
Represents the rows of a range. Do not construct this class directly, use *Range.rows* instead.

Example

```
import xlwings as xw

rng = xw.Range('A1:C4')

assert len(rng.rows) == 4  # or rng.rows.count

rng.rows[0].value = 'a'

assert rng.rows[2] == xw.Range('A3:C3')
assert rng.rows(2) == xw.Range('A2:C2')

for r in rng.rows:
    print(r.address)
```

autofit()
Autofits the height of the rows.

count
Returns the number of rows.

New in version 0.9.0.

RangeColumns

class xlwings.**RangeColumns**(*rng*)

Represents the columns of a range. Do not construct this class directly, use *Range.columns* instead.

Example

```
import xlwings as xw

rng = xw.Range('A1:C4')

assert len(rng.columns) == 3  # or rng.columns.count

rng.columns[0].value = 'a'

assert rng.columns[2] == xw.Range('C1:C4')
assert rng.columns(2) == xw.Range('B1:B4')

for c in rng.columns:
    print(c.address)
```

autofit()

Autofits the width of the columns.

count

Returns the number of columns.

New in version 0.9.0.

Shapes

class xlwings.main.**Shapes**(*impl*)

A collection of all *shape* objects on the specified sheet:

```
>>> import xlwings as xw
>>> xw.books['Book1'].sheets[0].shapes
Shapes([<Shape 'Oval 1' in <Sheet [Book1]Sheet1>>, <Shape 'Rectangle 1'␣
↪in <Sheet [Book1]Sheet1>>])
```

New in version 0.9.0.

api

Returns the native object (pywin32 or appscript obj) of the engine being used.

count

Returns the number of objects in the collection.

Shape

class xlwings.**Shape**(**args*, ***options*)

The shape object is a member of the *shapes* collection:

```
>>> import xlwings as xw
>>> sht = xw.books['Book1'].sheets[0]
>>> sht.shapes[0]  # or sht.shapes['ShapeName']
<Shape 'Rectangle 1' in <Sheet [Book1]Sheet1>>
```

Changed in version 0.9.0.

activate()

Activates the shape.

New in version 0.5.0.

delete()

Deletes the shape.

New in version 0.5.0.

height

Returns or sets the number of points that represent the height of the shape.

New in version 0.5.0.

left

Returns or sets the number of points that represent the horizontal position of the shape.

New in version 0.5.0.

name

Returns or sets the name of the shape.

New in version 0.5.0.

parent

Returns the parent of the shape.

New in version 0.9.0.

top

Returns or sets the number of points that represent the vertical position of the shape.

New in version 0.5.0.

type

Returns the type of the shape.

New in version 0.9.0.

width

Returns or sets the number of points that represent the width of the shape.

New in version 0.5.0.

Charts

class xlwings.main.**Charts**(*impl*)

A collection of all *chart* objects on the specified sheet:

```
>>> import xlwings as xw
>>> xw.books['Book1'].sheets[0].charts
Charts([<Chart 'Chart 1' in <Sheet [Book1]Sheet1>>, <Chart 'Chart 1' in
↪<Sheet [Book1]Sheet1>>])
```

New in version 0.9.0.

add(*left=0*, *top=0*, *width=355*, *height=211*)

Creates a new chart on the specified sheet.

Parameters

- **left** (*float, default 0*) – left position in points
- **top** (*float, default 0*) – top position in points
- **width** (*float, default 355*) – width in points
- **height** (*float, default 211*) – height in points

Returns

Return type *Chart*

Examples

```
>>> import xlwings as xw
>>> sht = xw.Book().sheets[0]
>>> sht.range('A1').value = [['Foo1', 'Foo2'], [1, 2]]
>>> chart = sht.charts.add()
>>> chart.set_source_data(sht.range('A1').expand())
>>> chart.chart_type = 'line'
>>> chart.name
'Chart1'
```

api

Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

count

Returns the number of objects in the collection.

Chart

class xlwings.**Chart**(*name_or_index=None*, *impl=None*)

The chart object is a member of the *charts* collection:

```
>>> import xlwings as xw
>>> sht = xw.books['Book1'].sheets[0]
>>> sht.charts[0]  # or sht.charts['ChartName']
<Chart 'Chart 1' in <Sheet [Book1]Sheet1>>
```

api
Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

New in version 0.9.0.

chart_type
Returns and sets the chart type of the chart.

New in version 0.1.1.

delete()
Deletes the chart.

height
Returns or sets the number of points that represent the height of the chart.

left
Returns or sets the number of points that represent the horizontal position of the chart.

name
Returns or sets the name of the chart.

parent
Returns the parent of the chart.

New in version 0.9.0.

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

Parameters **source** (Range) – Range object, e.g. `xw.books['Book1'].sheets[0].range('A1')`

top
Returns or sets the number of points that represent the vertical position of the chart.

width
Returns or sets the number of points that represent the width of the chart.

Pictures

class `xlwings.main.`**Pictures**(*impl*)
A collection of all *picture* objects on the specified sheet:

```
>>> import xlwings as xw
>>> xw.books['Book1'].sheets[0].pictures
Pictures([<Picture 'Picture 1' in <Sheet [Book1]Sheet1>>, <Picture
↪'Picture 2' in <Sheet [Book1]Sheet1>>])
```

New in version 0.9.0.

add(*image*, *link_to_file=False*, *save_with_document=True*, *left=0*, *top=0*, *width=None*, *height=None*, *name=None*, *update=False*)
Adds a picture to the specified sheet.

Parameters

- **image** (*str or matplotlib.figure.Figure*) – Either a filepath or a Matplotlib figure object.
- **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.
- **name** (*str, default None*) – Excel picture name. Defaults to Excel standard name if not provided, e.g. 'Picture 1'.
- **update** (*bool, default False*) – Replace an existing picture with the same name. Requires `name` to be set.

Returns

Return type *Picture*

Examples

1.Picture

```
>>> import xlwings as xw
>>> sht = xw.Book().sheets[0]
>>> sht.pictures.add(r'C:\path\to\file.jpg')
<Picture 'Picture 1' in <Sheet [Book1]Sheet1>>
```

2.Matplotlib

```
>>> import matplotlib.pyplot as plt
>>> fig = plt.figure()
>>> plt.plot([1, 2, 3, 4, 5])
>>> sht.pictures.add(fig, name='MyPlot', update=True)
<Picture 'MyPlot' in <Sheet [Book1]Sheet1>>
```

api
Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

count
Returns the number of objects in the collection.

Picture

class xlwings.**Picture**(*impl=None*)
The picture object is a member of the *pictures* collection:

```
>>> import xlwings as xw
>>> sht = xw.books['Book1'].sheets[0]
>>> sht.pictures[0]  # or sht.charts['PictureName']
<Picture 'Picture 1' in <Sheet [Book1]Sheet1>>
```

Changed in version 0.9.0.

api
Returns the native object (pywin32 or appscript obj) of the engine being used.

New in version 0.9.0.

delete()
Deletes the picture.

New in version 0.5.0.

height
Returns or sets the number of points that represent the height of the picture.

New in version 0.5.0.

left
Returns or sets the number of points that represent the horizontal position of the picture.

New in version 0.5.0.

name
Returns or sets the name of the picture.

New in version 0.5.0.

parent
Returns the parent of the picture.

New in version 0.9.0.

top
Returns or sets the number of points that represent the vertical position of the picture.

New in version 0.5.0.

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

Parameters **image** (*str or matplotlib.figure.Figure*) – Either a filepath or a Matplotlib figure object.

New in version 0.5.0.

width
Returns or sets the number of points that represent the width of the picture.

New in version 0.5.0.

Names

class xlwings.main.**Names**(*impl*)
A collection of all *name* objects in the workbook:

```
>>> import xlwings as xw
>>> sht = xw.books['Book1'].sheets[0]
>>> sht.names
[<Name 'MyName': =Sheet1!$A$3>]
```

New in version 0.9.0.

add(*name*, *refers_to*)
Defines a new name for a range of cells.

Parameters

- **name** (*str*) – Specifies the text to use as the name. Names cannot include spaces and cannot be formatted as cell references.
- **refers_to** (*str*) – Describes what the name refers to, in English, using A1-style notation.

Returns

Return type *Name*

New in version 0.9.0.

api
Returns the native object (pywin32 or appscript obj) of the engine being used.

New in version 0.9.0.

count
Returns the number of objects in the collection.

Name

class xlwings.**Name**(*impl*)
The name object is a member of the *names* collection:

```
>>> import xlwings as xw
>>> sht = xw.books['Book1'].sheets[0]
>>> sht.names[0]  # or sht.names['MyName']
<Name 'MyName': =Sheet1!$A$3>
```

New in version 0.9.0.

api
Returns the native object (`pywin32` or `appscript` obj) of the engine being used.

New in version 0.9.0.

delete()
Deletes the name.

New in version 0.9.0.

name
Returns or sets the name of the name object.

New in version 0.9.0.

refers_to
Returns or sets the formula that the name is defined to refer to, in A1-style notation, beginning with an equal sign.

New in version 0.9.0.

refers_to_range
Returns the Range object referred to by a Name object.

New in version 0.9.0.

UDF decorators

xlwings.**func**(*category="xlwings"*, *volatile=False*, *call_in_wizard=True*)
Functions decorated with `xlwings.func` will be imported as `Function` to Excel when running "Import Python UDFs".

category [int or str, default "xlwings"] 1-14 represent built-in categories, for user-defined categories use strings

New in version 0.10.3.

volatile [bool, default False] Marks a user-defined function as volatile. A volatile function must be recalculated whenever calculation occurs in any cells on the worksheet. A nonvolatile function is recalculated only when the input variables change. This method has no effect if it's not inside a user-defined function used to calculate a worksheet cell.

New in version 0.10.3.

call_in_wizard [bool, default True] Set to False to suppress the function call in the function wizard.

New in version 0.10.3.

xlwings.**sub**()
Functions decorated with `xlwings.sub` will be imported as `Sub` (i.e. macro) to Excel when running "Import Python UDFs".

xlwings.**arg**(*arg*, *convert=None*, ***options*)

Apply converters and options to arguments, see also *Range.options()*.

Examples:

Convert x into a 2-dimensional numpy array:

```
import xlwings as xw
import numpy as np

@xw.func
@xw.arg('x', np.array, ndim=2)
def add_one(x):
    return x + 1
```

xlwings.**ret**(*convert=None*, ***options*)

Apply converters and options to return values, see also *Range.options()*.

Examples

1.Suppress the index and header of a returned DataFrame:

```
import pandas as pd

@xw.func
@xw.ret(index=False, header=False)
def get_dataframe(n, m):
    return pd.DataFrame(np.arange(n * m).reshape((n, m)))
```

2.Dynamic array:

expand='table' turns the UDF into a dynamic array. Currently you must not use volatile functions as arguments of a dynamic array, e.g. you cannot use =TODAY() as part of a dynamic array. Also note that a dynamic array needs an empty row and column at the bottom and to the right and will overwrite existing data without warning.

Unlike standard Excel arrays, dynamic arrays are being used from a single cell like a standard function and auto-expand depending on the dimensions of the returned array:

```
import xlwings as xw
import numpy as np

@xw.func
@xw.ret(expand='table')
def dynamic_array(n, m):
    return np.arange(n * m).reshape((n, m))
```

New in version 0.10.0.

Index

T

U

V

W

X