



Creating Excel files with Python and XlsxWriter

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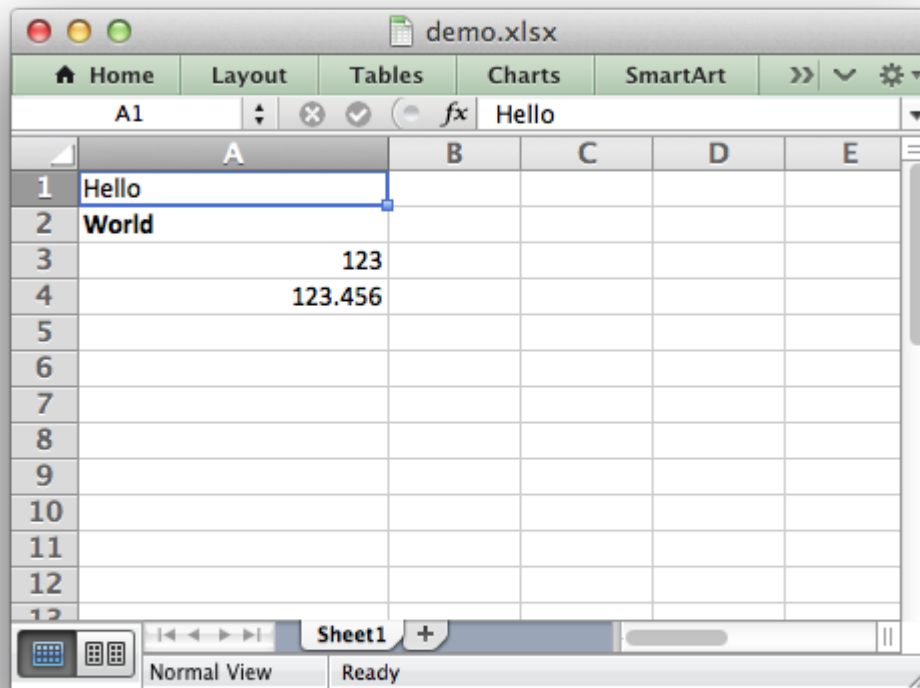
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XlsxWriter is a Python module for creating Excel XLSX files.



XlsxWriter supports the following features in version 0.3.0:

- 100% compatible Excel XLSX files.
- Write text, numbers, formulas, dates to cells.
- Write hyperlinks to cells.
- Full cell formatting.
- Multiple worksheets.
- Page setup methods for printing.
- Merged cells.
- Defined names.
- Autofilters.
- Data validation and drop down lists.
- Conditional formatting.
- Worksheet PNG/JPEG images.
- Rich multi-format strings.

- Cell comments.
- Document properties.
- Worksheet cell protection.
- Freeze and split worksheet panes.
- Worksheet Tables.
- Sparklines.
- Outlines and Grouping.
- Memory optimisation mode for writing large files.
- Standard libraries only.
- Python 2.6, 2.7, 3.1, 3.2 and 3.3 support.

INTRODUCTION

XlsxWriter is a Python module for writing files in the Excel 2007+ XLSX file format.

It can be used to write text, numbers, and formulas to multiple worksheets and it supports features such as formatting, images, page setup, autofilters, conditional formatting and many others.

This module cannot be used to modify or write to an existing Excel XLSX file. There are some *[Alternative modules for handling Excel files](#)* Python modules that do that.

XlsxWriter is intended to have a high degree of compatibility with files produced by Excel. In most cases the files produced are 100% equivalent to files produced by Excel and the [test suite](#) contains a large number of test cases that verify the output of XlsxWriter against actual files created in Excel.

XlsxWriter is licensed under a BSD [License](#) and is available as a `git` repository on [GitHub](#).

GETTING STARTED WITH XLSXWRITER

Here are some easy instructions to get you up and running with the XlsxWriter module.

2.1 Installing XlsxWriter

The first step is to install the XlsxWriter module. There are several ways to do this.

2.1.1 Using PIP

The `pip` installer is the preferred method for installing Python modules from [PyPI](#), the Python Package Index:

```
$ sudo pip install XlsxWriter
```

Note: Windows users can omit `sudo` at the start of the command.

2.1.2 Using Easy_Install

If `pip` doesn't work you can try [easy_install](#):

```
$ sudo easy_install install XlsxWriter
```

2.1.3 Installing from a tarball

If you download a tarball of the latest version of XlsxWriter you can install it as follows (change the version number to suit):

```
$ tar -zxvf XlsxWriter-1.2.3.tar.gz
$ cd XlsxWriter-1.2.3
$ sudo python setup.py install
```

A tarball of the latest code can be downloaded from GitHub as follows:

```
$ curl -O -L http://github.com/jmcnamara/XlsxWriter/archive/master.tar.gz
$ tar zxvf master.tar.gz
$ cd XlsxWriter-master/
$ sudo python setup.py install
```

2.1.4 Cloning from GitHub

The XlsxWriter source code and bug tracker is in the [XlsxWriter repository](https://github.com/jmcnamara/XlsxWriter) on GitHub. You can clone the repository and install from it as follows:

```
$ git clone https://github.com/jmcnamara/XlsxWriter.git
$ cd XlsxWriter
$ sudo python setup.py install
```

2.2 Running a sample program

If the installation went correctly you can create a small sample program like the following to verify that the module works correctly:

```
from xlsxwriter.workbook import Workbook

workbook = Workbook('hello.xlsx')
worksheet = workbook.add_worksheet()

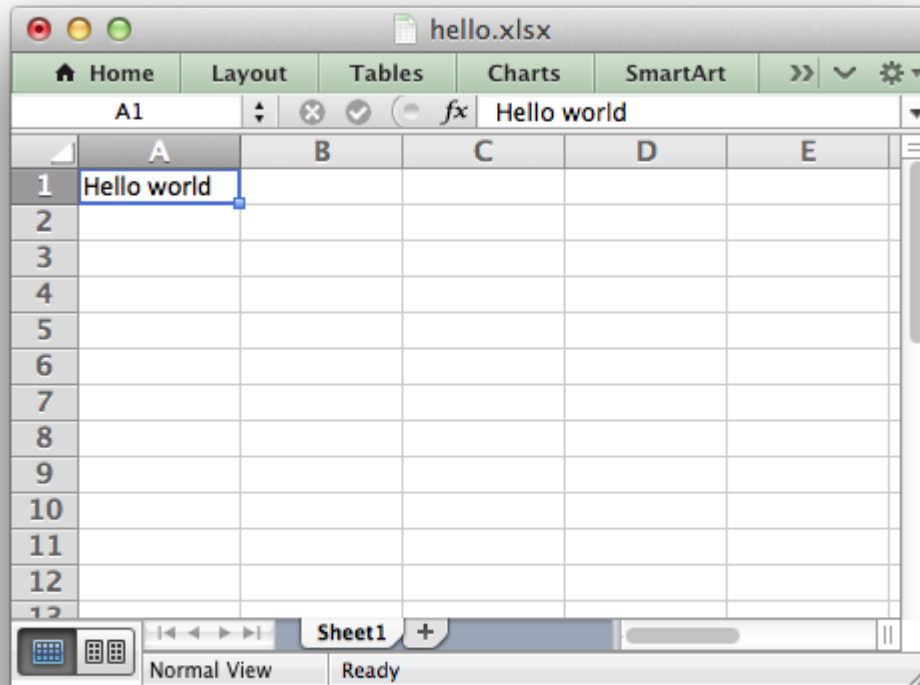
worksheet.write('A1', 'Hello world')

workbook.close()
```

Save this to a file called `hello.py` and run it as follows:

```
$ python hello.py
```

This will output a file called `hello.xlsx` which should look something like the following:



If you downloaded a tarball or cloned the repo, as shown above, you should also have a directory called [examples](#) with some sample applications that demonstrate different features of XlsxWriter.

2.3 Documentation

The latest version of this document is hosted on [Read The Docs](#). It is also available as a [PDF](#).

Once you are happy that the module is installed and operational you can have a look at the rest of the XlsxWriter documentation. [Tutorial 1: Create a simple XLSX file](#) is a good place to start.

TUTORIAL 1: CREATE A SIMPLE XLSX FILE

Let's start by creating a simple spreadsheet using Python and the XlsxWriter module.

Say that we have some data on monthly outgoings that we want to convert into an Excel XLSX file:

```
expenses = (  
    ['Rent', 1000],  
    ['Gas', 100],  
    ['Food', 300],  
    ['Gym', 50],  
)
```

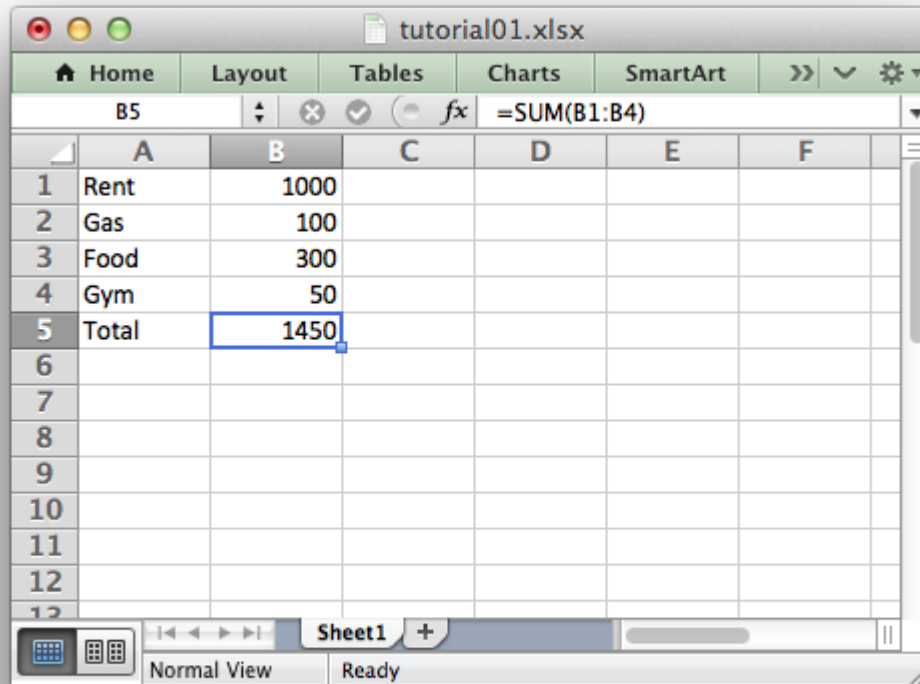
To do that we can start with a small program like the following:

```
from xlsxwriter.workbook import Workbook  
  
# Create a workbook and add a worksheet.  
workbook = Workbook('Expenses01.xlsx')  
worksheet = workbook.add_worksheet()  
  
# Some data we want to write to the worksheet.  
expenses = (  
    ['Rent', 1000],  
    ['Gas', 100],  
    ['Food', 300],  
    ['Gym', 50],  
)  
  
# Start from the first cell. Rows and columns are zero indexed.  
row = 0  
col = 0  
  
# Iterate over the data and write it out row by row.  
for item, cost in expenses:  
    worksheet.write(row, col, item)  
    worksheet.write(row, col + 1, cost)  
    row += 1
```

```
# Write a total using a formula.
worksheet.write(row, 0, 'Total')
worksheet.write(row, 1, '=SUM(B1:B4)')

workbook.close()
```

If we run this program we should get a spreadsheet that looks like this:



This is a simple example but the steps involved are representative of all programs that use XlsxWriter, so let's break it down into separate parts.

The first step is to import the module and the main method that we will call:

```
from xlsxwriter.workbook import Workbook
```

The next step is to create a new workbook object using the `Workbook()` constructor.

`Workbook()` takes one, non-optional, argument which is the filename that we want to create:

```
workbook = Workbook('Expenses01.xlsx')
```

Note: XlsxWriter can only create *new files*. It cannot read or modify existing files.

The workbook object is then used to add a new worksheet via the `add_worksheet()` method:

```
worksheet = workbook.add_worksheet()
```

By default worksheet names in the spreadsheet will be *Sheet1*, *Sheet2* etc., but we can also specify a name:

```
worksheet1 = workbook.add_worksheet()      # Defaults to Sheet1.
worksheet2 = workbook.add_worksheet('Data') # Data.
worksheet3 = workbook.add_worksheet()      # Defaults to Sheet3.
```

We can then use the worksheet object to write data via the `write()` method:

```
worksheet.write(row, col, some_data)
```

Note: Throughout XlsxWriter, *rows* and *columns* are zero indexed. The first cell in a worksheet, A1, is (0, 0).

So in our example we iterate over our data and write it out as follows:

```
# Iterate over the data and write it out row by row.
for item, cost in (expenses):
    worksheet.write(row, col, item)
    worksheet.write(row, col + 1, cost)
    row += 1
```

We then add a formula to calculate the total of the items in the second column:

```
worksheet.write(row, 1, '=SUM(B1:B4)')
```

Finally, we close the Excel file via the `close()` method:

```
workbook.close()
```

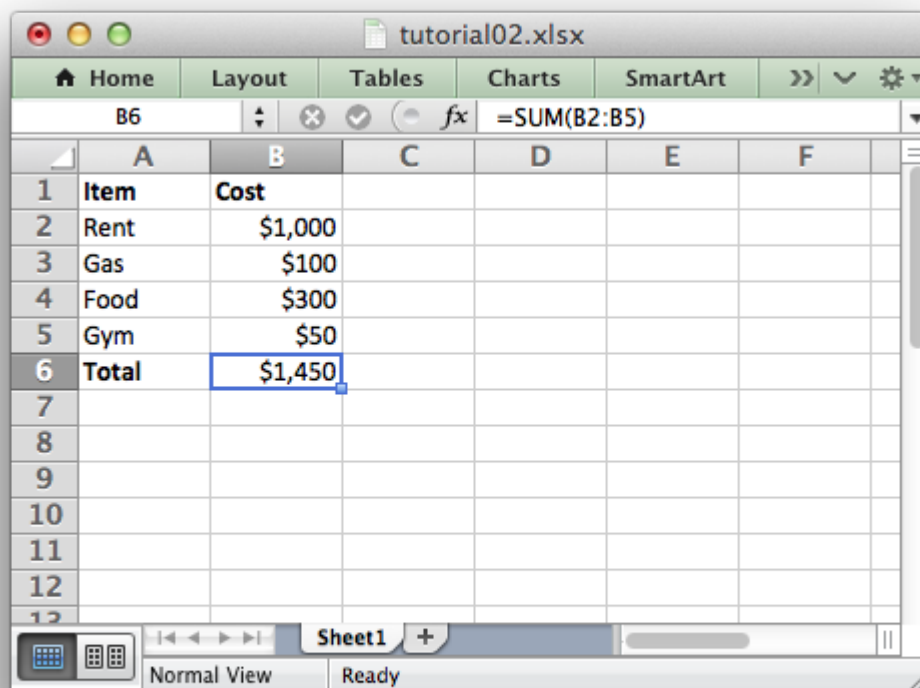
Like most file objects in Python an XlsxWriter file is closed implicitly when it goes out of scope or is no longer referenced in the program. As such this line is generally optional unless you need to close the file explicitly.

And that's it. We now have a file that can be read by Excel and other spreadsheet applications.

In the next sections we will see how we can use the XlsxWriter module to add formatting and other Excel features.

TUTORIAL 2: ADDING FORMATTING TO THE XLSX FILE

In the previous section we created a simple spreadsheet using Python and the XlsxWriter module. This converted the required data into an Excel file but it looked a little bare. In order to make the information clearer we would like to add some simple formatting, like this:



The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F
1	Item	Cost				
2	Rent	\$1,000				
3	Gas	\$100				
4	Food	\$300				
5	Gym	\$50				
6	Total	\$1,450				
7						
8						
9						
10						
11						
12						
13						

The spreadsheet interface includes a ribbon with tabs for Home, Layout, Tables, Charts, and SmartArt. The formula bar shows the formula `=SUM(B2:B5)` for cell B6. The status bar at the bottom indicates 'Normal View' and 'Ready'.

The differences here are that we have added **Item** and **Cost** column headers in a bold font, we have formatted the currency in the second column and we have made the **Total** string bold.

To do this we can extend our program as follows:

```
from xlsxwriter.workbook import Workbook

# Create a workbook and add a worksheet.
workbook = Workbook('Expenses02.xlsx')
worksheet = workbook.add_worksheet()

# Add a bold format to use to highlight cells.
bold = workbook.add_format({'bold': True})

# Add a number format for cells with money.
money = workbook.add_format({'num_format': '$#,##0'})

# Write some data headers.
worksheet.write('A1', 'Item', bold)
worksheet.write('B1', 'Cost', bold)

# Some data we want to write to the worksheet.
expenses = (
    ['Rent', 1000],
    ['Gas', 100],
    ['Food', 300],
    ['Gym', 50],
)

# Start from the first cell below the headers.
row = 1
col = 0

# Iterate over the data and write it out row by row.
for item, cost in expenses:
    worksheet.write(row, col, item)
    worksheet.write(row, col + 1, cost, money)
    row += 1

# Write a total using a formula.
worksheet.write(row, 0, 'Total', bold)
worksheet.write(row, 1, '=SUM(B2:B5)', money)

workbook.close()
```

The main difference between this and the previous program is that we have added two *Format* objects that we can use to format cells in the spreadsheet.

Format objects represent all of the formatting properties that can be applied to a cell in Excel such as fonts, number formatting, colors and borders. This is explained in more detail in *The Format Class* and *Working with Formats*.

For now we will avoid the getting into the details and just use a limited amount of the format functionality to add some simple formatting:

```
# Add a bold format to use to highlight cells.
bold = workbook.add_format({'bold': True})
```



```
# Add a number format for cells with money.  
money = workbook.add_format({'num_format': '$#,##0'})
```

We can then pass these formats as an optional third parameter to the `worksheet.write()` method to format the data in the cell:

```
write(row, column, token, [format])
```

Like this:

```
worksheet.write(row, 0, 'Total', bold)
```

Which leads us to another new feature in this program. To add the headers in the first row of the worksheet we used `write()` like this:

```
worksheet.write('A1', 'Item', bold)  
worksheet.write('B1', 'Cost', bold)
```

So, instead of `(row, col)` we used the Excel 'A1' style notation. See [Working with Cell Notation](#) for more details but don't be too concerned about it for now. It is just a little syntactic sugar to help with laying out worksheets.

In the next section we will look at handling more data types.

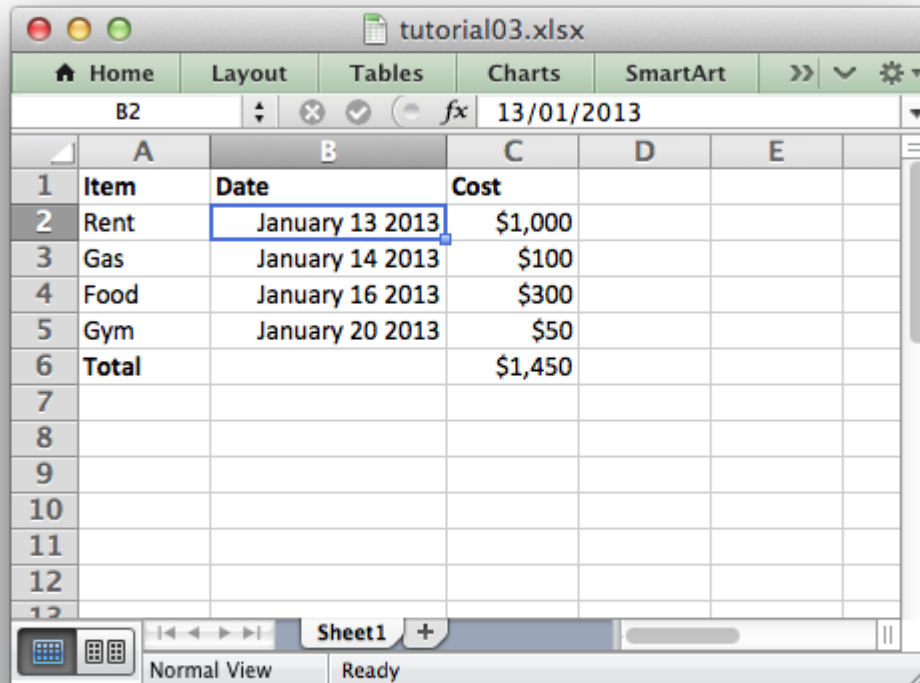
TUTORIAL 3: WRITING DIFFERENT TYPES OF DATA TO THE XLSX FILE

In the previous section we created a simple spreadsheet with formatting using Python and the `XlsxWriter` module.

This time let's extend the data we want to write to include some dates:

```
expenses = (  
    ['Rent', '2013-01-13', 1000],  
    ['Gas', '2013-01-14', 100],  
    ['Food', '2013-01-16', 300],  
    ['Gym', '2013-01-20', 50],  
)
```

The corresponding spreadsheet will look like this:



The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E
1	Item	Date	Cost		
2	Rent	January 13 2013	\$1,000		
3	Gas	January 14 2013	\$100		
4	Food	January 16 2013	\$300		
5	Gym	January 20 2013	\$50		
6	Total		\$1,450		
7					
8					
9					
10					
11					
12					
13					

The differences here are that we have added a **Date** column, formatted the dates and made column 'B' a little wider to accommodate the dates.

To do this we can extend our program as follows:

```
from datetime import datetime
from xlsxwriter.workbook import Workbook

# Create a workbook and add a worksheet.
workbook = Workbook('Expenses03.xlsx')
worksheet = workbook.add_worksheet()

# Add a bold format to use to highlight cells.
bold = workbook.add_format({'bold': 1})

# Add a number format for cells with money.
money_format = workbook.add_format({'num_format': '$#,##0'})

# Add an Excel date format.
date_format = workbook.add_format({'num_format': 'mmm d yyyy'})

# Adjust the column width.
worksheet.set_column(1, 1, 15)

# Write some data headers.
```

```

worksheet.write('A1', 'Item', bold)
worksheet.write('B1', 'Date', bold)
worksheet.write('C1', 'Cost', bold)

# Some data we want to write to the worksheet.
expenses = (
    ['Rent', '2013-01-13', 1000],
    ['Gas', '2013-01-14', 100],
    ['Food', '2013-01-16', 300],
    ['Gym', '2013-01-20', 50],
)

# Start from the first cell below the headers.
row = 1
col = 0

for item, date_str, cost in expenses:
    # Convert the date string into a datetime object.
    date = datetime.strptime(date_str, "%Y-%m-%d")

    worksheet.write_string(row, col, item)
    worksheet.write_datetime(row, col + 1, date, date_format)
    worksheet.write_number(row, col + 2, cost, money_format)
    row += 1

# Write a total using a formula.
worksheet.write(row, 0, 'Total', bold)
worksheet.write(row, 2, '=SUM(C2:C5)', money_format)

workbook.close()

```

The main difference between this and the previous program is that we have added a new *Format* object for dates and we have additional handling for data types.

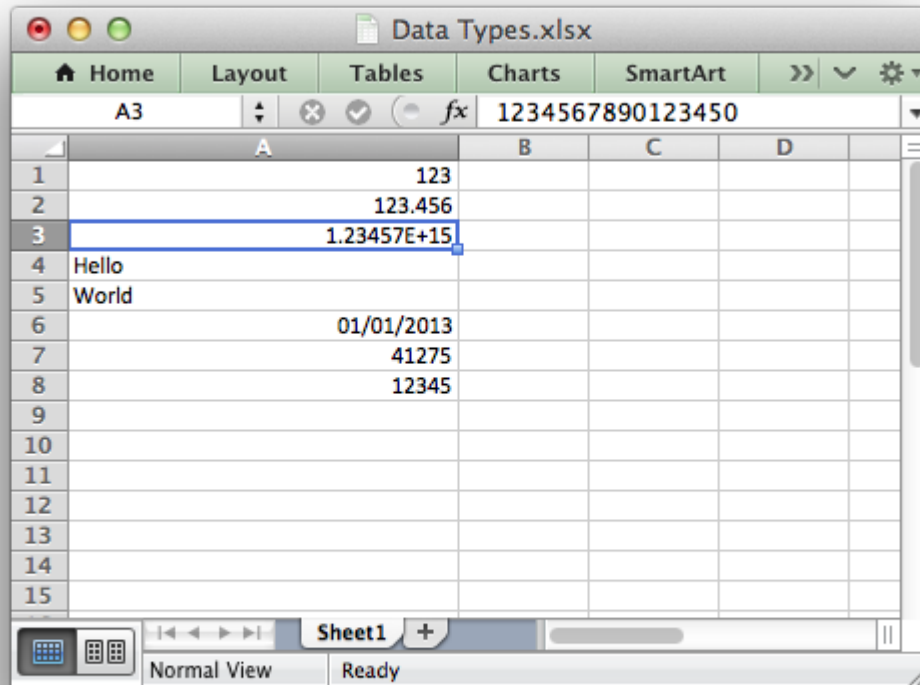
Excel treats different types of input data differently, although it generally does it transparently to the user. To illustrate this, open up a new Excel spreadsheet, make the first column wider and enter the following data:

```

123
123.456
1234567890123456
Hello
World
2013/01/01
2013/01/01          (But change the format from Date to General)
01234

```

You should see something like the following:



There are a few things to notice here. The first is that the numbers in the first three rows are stored as numbers and are aligned to the right of the cell. The second is that the strings in the following rows are stored as strings and are aligned to the left. The third is that the date string format has changed and that it is aligned to the right. The final thing to notice is that Excel has stripped the leading 0 from 012345.

Let's look at each of these in more detail.

Numbers are stored as numbers: In general Excel stores data as either strings or numbers. So it shouldn't be surprising that it stores numbers as numbers. Within a cell a number is right aligned by default. Internally Excel handles numbers as IEEE-754 64-bit double-precision floating point. This means that, in most cases, the maximum number of digits that can be stored in Excel without losing precision is 15. This can be seen in cell 'A3' where the 16 digit number has lost precision in the last digit.

Strings are stored as strings: Again not so surprising. Within a cell a string is left aligned by default. Excel 2007+ stores strings internally as UTF-8.

Dates are stored as numbers: The first clue to this is that the dates are right aligned like numbers. More explicitly, the data in cell 'A7' shows that if you remove the date format the underlying data is a number. When you enter a string that looks like a date Excel converts it to a number and applies the default date format to it so that it is displayed as a date. This is explained in more detail in [Working with Dates and Time](#).

Things that look like numbers are stored as numbers: In cell 'A8' we entered 012345 but Excel converted it to the number 12345. This is something to be aware of if you are writing ID numbers or Zip codes. In order to preserve the leading zero(es) you need to store the data as either a string or a number with a format.

XlsxWriter tries to mimic the way Excel works via the `worksheet.write()` method and separates Python data into types that Excel recognises. The `write()` method acts as a general alias for several more specific methods:

- `write_string()`
- `write_number()`
- `write_datetime()`
- `write_blank()`
- `write_formula()`

So, let's see how all of this affects our program.

The main change in our example program is the addition of date handling. As we saw above Excel stores dates as numbers. XlsxWriter makes the required conversion if the date and time are Python `datetime` objects. To convert the date strings in our example to `datetime.datetime` objects we use the `datetime.strptime` function. We then use the `write_datetime()` function to write it to a file. However, since the date is converted to a number we also need to add a number format to ensure that Excel displays it as a date:

```
from datetime import datetime
...

date_format = workbook.add_format({'num_format': 'mmm d yyyy'})
...

for item, date_str, cost in (expenses):
    # Convert the date string into a datetime object.
    date = datetime.strptime(date_str, "%Y-%m-%d")
    ...
    worksheet.write_datetime(row, col + 1, date, date_format )
    ...
```

The other thing to notice in our program is that we have used explicit write methods for different types of data:

```
worksheet.write_string (row, col, item )
worksheet.write_datetime(row, col + 1, date, date_format )
worksheet.write_number (row, col + 2, cost, money_format)
```

This is mainly to show that if you need more control over the type of data you write to a worksheet you can use the appropriate method. In this simplified example the `write()` method would have worked just as well but it is important to note that in cases where `write()` doesn't do the right thing, such as the number with leading zeroes discussed above, you will need to be explicit.

Finally, the last addition to our program is the `set_column()` method to adjust the width of column 'B' so that the dates are more clearly visible:

```
# Adjust the column width.  
worksheet.set_column('B:B', 15)
```

The `set_column()` and corresponding `set_row()` methods are explained in more detail in *The Worksheet Class*.

Next, let's look at *The Workbook Class* in more detail.

THE WORKBOOK CLASS

The Workbook class is the main class exposed by the XlsxWriter module and it is the only class that you will need to instantiate directly.

The Workbook class represents the entire spreadsheet as you see it in Excel and internally it represents the Excel file as it is written on disk.

6.1 Constructor

Workbook(*filename* [, *options*])

Create a new XlsxWriter Workbook object.

Parameters

- **filename** (*string*) – The name of the new Excel file to create.
- **options** (*dict*) – Optional workbook parameters. See below.

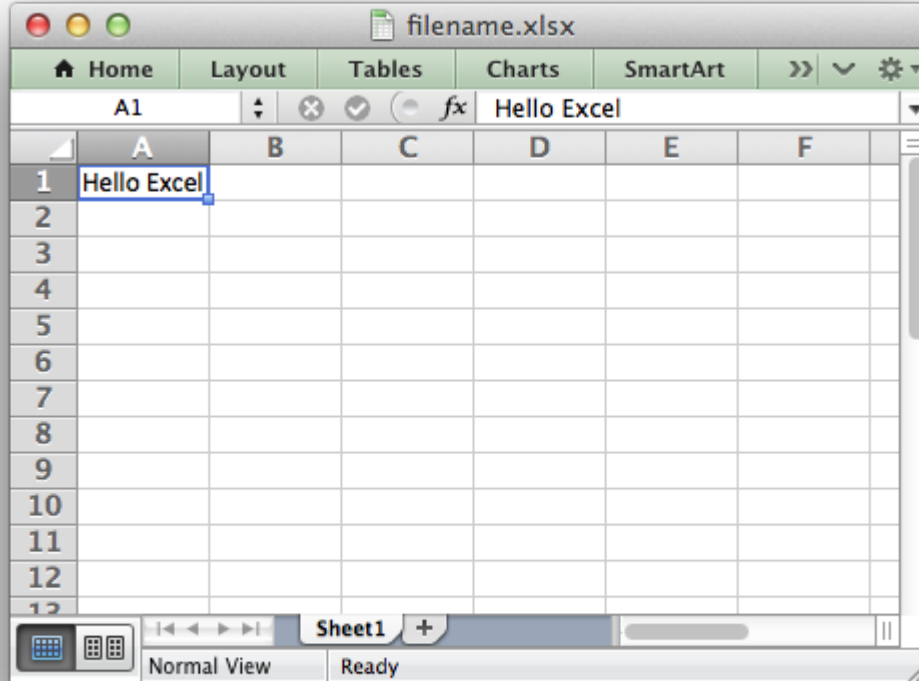
Return type A Workbook object.

The Workbook () constructor is used to create a new Excel workbook with a given filename:

```
from xlsxwriter import Workbook

workbook = Workbook('filename.xlsx')
worksheet = workbook.add_worksheet()

worksheet.write(0, 0, 'Hello Excel')
```



The constructor options are:

- **constant_memory**: Reduces the amount of data stored in memory so that large files can be written efficiently:

```
workbook = Workbook(filename, {'constant_memory': True})
```

Note, in this mode a row of data is written and then discarded when a cell in a new row is added via one of the worksheet `write_()` methods. As such data should be written in sequential row order once this mode is on.

See [Working with Memory and Performance](#) for more details.

- **tmpdir**: XlsxWriter stores worksheet data in a temporary directory prior to assembling the final XLSX file. The temporary directory is generated by the `tempfile.mkdtemp()` function which in general defaults to using your system's temporary directory. If the default temporary directory isn't accessible to your application, or doesn't contain enough space, you can specify an alternative location using the `tmpdir` option:

```
workbook = Workbook(filename, {'tmpdir': '/home/user/tmp'})
```

The temporary directory must exist and will not be created.

- **date_1904**: Excel for Windows uses a default epoch of 1900 and Excel for Mac uses an epoch of 1904. However, Excel on either platform will convert automatically between one

system and the other. XlsxWriter stores dates in the 1900 format by default. If you wish to change this you can use the `date_1904` workbook option. This option is mainly for backward compatibility with `Excel::Writer::XLSX` and in general isn't required very often:

```
workbook = Workbook(filename, {'date_1904': True})
```

When specifying a filename it is recommended that you use an `.xlsx` extension or Excel will generate a warning opening the file.

Note: A later version of the module will support writing to filehandles like `Excel::Writer::XLSX`.

6.2 workbook.add_worksheet()

add_worksheet(*[sheetname]*)

Add a new worksheet to a workbook.

Parameters *sheetname* (*string*) – Optional worksheet name, defaults to Sheet1, etc.

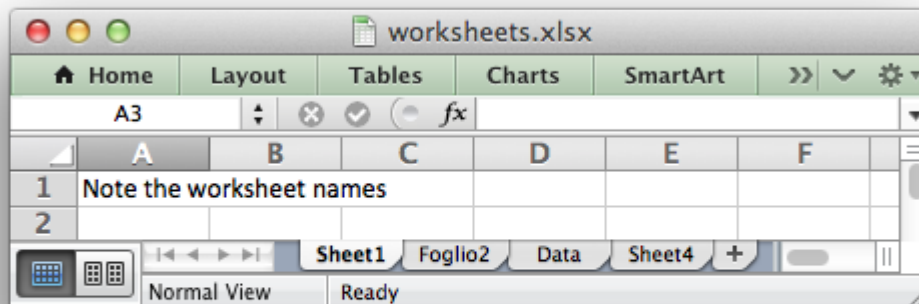
Return type A *worksheet* object.

The `add_worksheet()` method adds a new worksheet to a workbook.

At least one worksheet should be added to a new workbook. The *Worksheet* object is used to write data and configure a worksheet in the workbook.

The *sheetname* parameter is optional. If it is not specified the default Excel convention will be followed, i.e. Sheet1, Sheet2, etc.:

```
worksheet1 = workbook.add_worksheet()           # Sheet1
worksheet2 = workbook.add_worksheet('Foglio2')  # Foglio2
worksheet3 = workbook.add_worksheet('Data')     # Data
worksheet4 = workbook.add_worksheet()           # Sheet4
```



The worksheet name must be a valid Excel worksheet name, i.e. it cannot contain any of the characters ' [] : * ? / \ ' and it must be less than 32 characters. In addition, you cannot use the same, case insensitive, sheetname for more than one worksheet.

6.3 `workbook.add_format()`

`add_format([properties])`

Create a new Format object to format cells in worksheets.

Parameters `properties` (*dictionary*) – An optional dictionary of format properties.

Return type A *format* object.

The `add_format()` method can be used to create new *Format* objects which are used to apply formatting to a cell. You can either define the properties at creation time via a dictionary of property values or later via method calls:

```
format1 = workbook.add_format(props); # Set properties at creation.
format2 = workbook.add_format();     # Set properties later.
```

See the *The Format Class* and *Working with Formats* sections for more details about Format properties and how to set them.

6.4 `workbook.close()`

`close()`

Close the Workbook object and write the XLSX file.

In general your Excel file will be closed automatically when your program ends or when the Workbook object goes out of scope, however the `close()` method can be used to explicitly close an Excel file:

```
workbook.close()
```

An explicit `close()` is required if the file must be closed prior to performing some external action on it such as copying it, reading its size or attaching it to an email.

In addition, `close()` may be occasionally required to prevent Python's garbage collector from disposing of the Workbook, Worksheet and Format objects in the wrong order.

In general, if an XlsxWriter file is created with a size of 0 bytes or fails to be created for some unknown silent reason you should add `close()` to your program.

6.5 `workbook.set_properties()`

`set_properties()`

Set the document properties such as Title, Author etc.

Parameters properties (*dict*) – Dictionary of document properties.

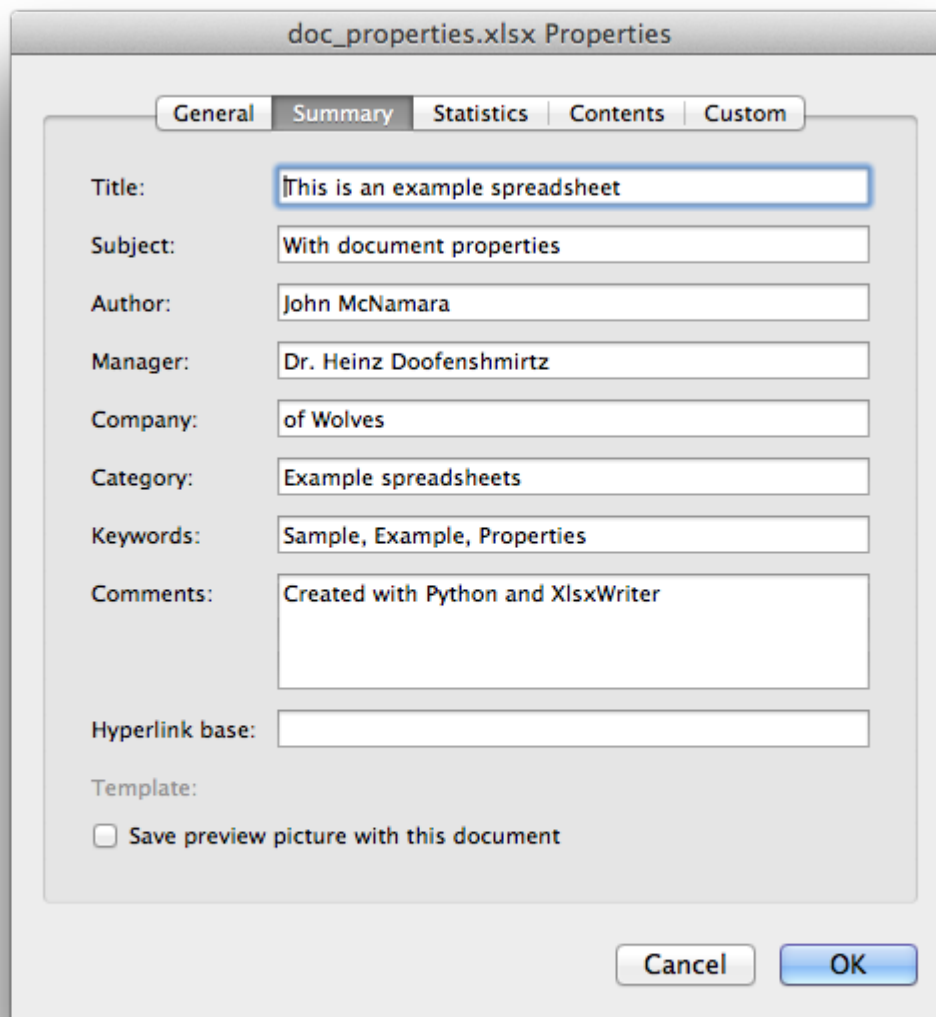
The `set_properties` method can be used to set the document properties of the Excel file created by XlsxWriter. These properties are visible when you use the Office Button -> Prepare -> Properties option in Excel and are also available to external applications that read or index windows files.

The properties that can be set are:

- title
- subject
- author
- manager
- company
- category
- keywords
- comments
- status

The properties should be passed in dictionary format as follows:

```
workbook.set_properties({
    'title': 'This is an example spreadsheet',
    'subject': 'With document properties',
    'author': 'John McNamara',
    'manager': 'Dr. Heinz Doofenshmirtz',
    'company': 'of Wolves',
    'category': 'Example spreadsheets',
    'keywords': 'Sample, Example, Properties',
    'comments': 'Created with Python and XlsxWriter'})
```



See also *Example: Setting Document Properties*.

6.6 workbook.define_name()

define_name()

Create a defined name in the workbook to use as a variable.

Parameters

- **name** (*string*) – The defined name.
- **formula** (*string*) – The cell or range that the defined name refers to.

This method is used to defined a name that can be used to represent a value, a single cell or a range of cells in a workbook.

For example to set a global/workbook name:

```
# Global/workbook names.
workbook.define_name('Exchange_rate', '=0.96')
workbook.define_name('Sales', '=Sheet1!$G$1:$H$10')
```

It is also possible to define a local/worksheet name by prefixing it with the sheet name using the syntax 'sheetname!definedname':

```
# Local/worksheet name.
workbook.define_name('Sheet2!Sales', '=Sheet2!$G$1:$G$10')
```

If the sheet name contains spaces or special characters you must enclose it in single quotes like in Excel:

```
workbook.define_name("'New Data'!Sales", '=Sheet2!$G$1:$G$10')
```

See also the `defined_name.py` program in the examples directory.

6.7 workbook.worksheets()

worksheets()

Return a list of the worksheet objects in the workbook.

Return type A list of *worksheet* objects.

The `worksheets()` method returns a list of the worksheets in a workbook. This is useful if you want to repeat an operation on each worksheet in a workbook:

```
for worksheet in workbook.worksheets():
    worksheet.write('A1', 'Hello')
```


THE WORKSHEET CLASS

The worksheet class represents an Excel worksheet. It handles operations such as writing data to cells or formatting worksheet layout.

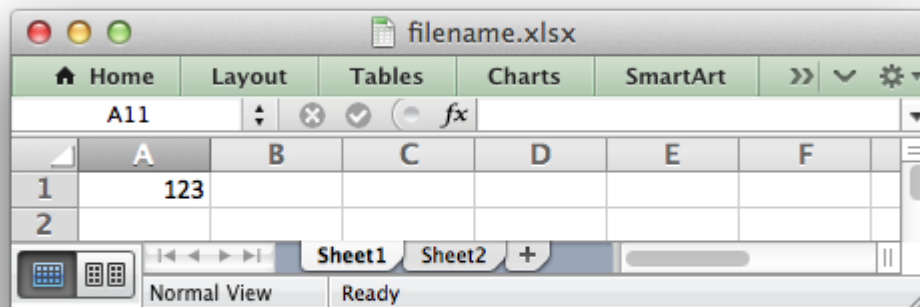
A worksheet object isn't instantiated directly. Instead a new worksheet is created by calling the `add_worksheet()` method from a `Workbook()` object:

```
workbook = Workbook('filename.xlsx')
```

```
worksheet1 = workbook.add_worksheet()
```

```
worksheet2 = workbook.add_worksheet()
```

```
worksheet1.write('A1', 123)
```



7.1 worksheet.write()

write(*row*, *col*, *data*[, *cell_format*])

Write generic data to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **data** – Cell data to write. Variable types.
- **cell_format** (*Format*) – Optional Format object.

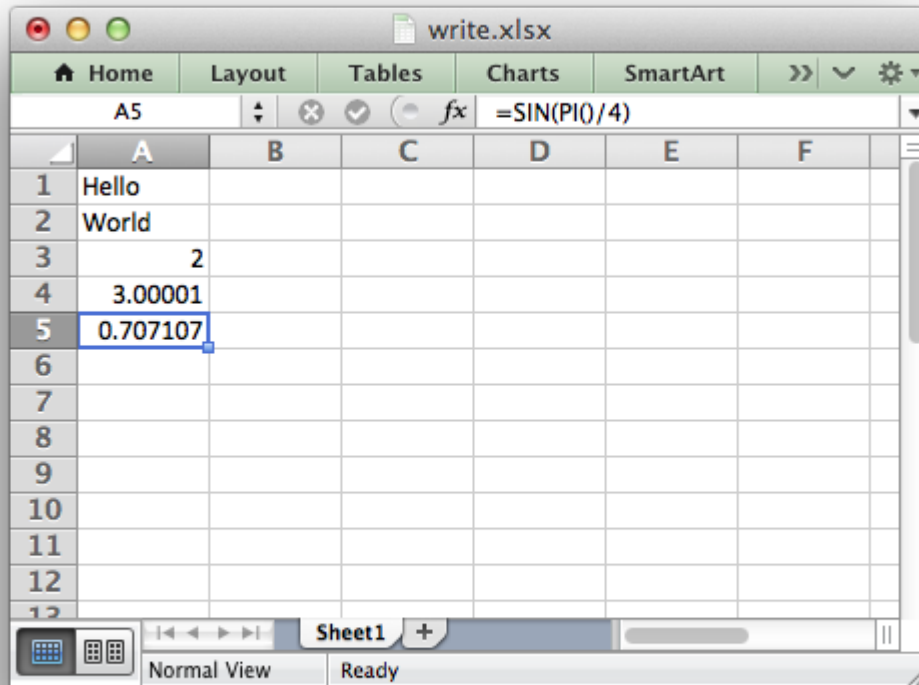
Excel makes a distinction between data types such as strings, numbers, blanks, formulas and hyperlinks. To simplify the process of writing data to an XlsxWriter file the `write()` method acts as a general alias for several more specific methods:

- `write_string()`
- `write_number()`
- `write_blank()`
- `write_formula()`
- `write_url()`

The general rule is that if the data looks like a *something* then a *something* is written. Here are some examples:

```
worksheet.write(0, 0, 'Hello')           # write_string()
worksheet.write(1, 0, 'World')           # write_string()
worksheet.write(2, 0, 2)                  # write_number()
worksheet.write(3, 0, 3.000001)           # write_number()
worksheet.write(4, 0, '=SIN(PI()/4)')     # write_formula()
worksheet.write(5, 0, '')                 # write_blank()
worksheet.write(6, 0, None)               # write_blank()
```

This creates a worksheet like the following:



The `write()` method supports two forms of notation to designate the position of cells: **Row-column** notation and **A1** notation:

```
# These are equivalent.
worksheet.write(0, 0, 'Hello')
worksheet.write('A1', 'Hello')
```

See [Working with Cell Notation](#) for more details.

The `cell_format` parameter is used to apply formatting to the cell. This parameter is optional but when present it should be a valid [Format](#) object:

```
cell_format = workbook.add_format({'bold': True, 'italic': True})

worksheet.write(0, 0, 'Hello', cell_format) # Cell is bold and italic.
```

The `write()` method will ignore empty strings or `None` unless a format is also supplied. As such you needn't worry about special handling for empty or `None` values in your data. See also the [write_blank\(\)](#) method.

One problem with the `write()` method is that occasionally data looks like a number but you don't want it treated as a number. For example, Zip codes or ID numbers or often start with a leading zero. If you write this data as a number then the leading zero(s) will be stripped. In this case you shouldn't use the `write()` method and should use `write_string()` instead.

7.2 worksheet.write_string()

write_string(*row*, *col*, *string*[, *cell_format*])

Write a string to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **string** (*string*) – String to write to cell.
- **cell_format** (*Format*) – Optional Format object.

The `write_string()` method writes a string to the cell specified by row and column:

```
worksheet.write_string(0, 0, 'Your text here')
worksheet.write_string('A2', 'or here')
```

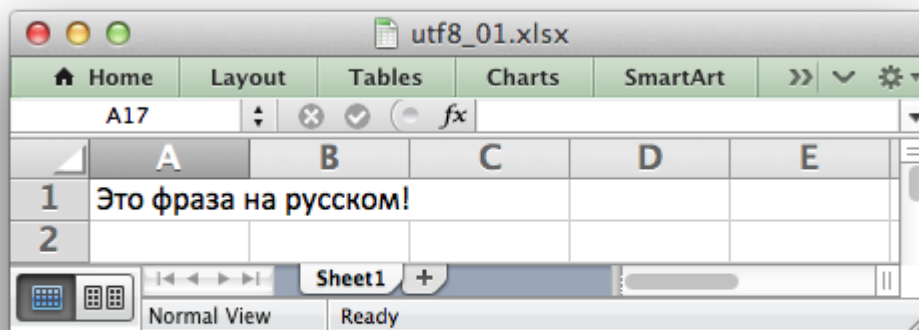
Both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details.

The `cell_format` parameter is used to apply formatting to the cell. This parameter is optional but when present it should be a valid [Format](#) object.

Unicode strings are supported in UTF-8 encoding. This generally requires that your source file is also UTF-8 encoded:

```
# -*- coding: utf-8

worksheet.write('A1', u'Some UTF-8 text')
```



Alternatively, you can read data from an encoded file, convert it to UTF-8 during reading and then write the data to an Excel file. There are several sample `unicode_*.py` programs like this in the `examples` directory of the XlsxWriter source tree.

The maximum string size supported by Excel is 32,767 characters. Strings longer than this will be truncated by `write_string()`.

Note: Even though Excel allows strings of 32,767 characters in a cell, Excel can only **display** 1000. All 32,767 characters are displayed in the formula bar.

In general it is sufficient to use the `write()` method when dealing with string data. However, you may sometimes need to use `write_string()` to write data that looks like a number but that you don't want treated as a number. For example, Zip codes or phone numbers:

```
# Write ID number as a plain string.
worksheet.write_string('A1', '01209')
```

However, if the user edits this string Excel may convert it back to a number. To get around this you can use the Excel text format '@':

```
# Format as a string. Doesn't change to a number when edited
str_format = workbook.add_format({'num_format': '@'})
worksheet.write_string('A1', '01209', str_format)
```

This behaviour, while slightly tedious, is unfortunately consistent with the way Excel handles string data that looks like numbers. See [Tutorial 3: Writing different types of data to the XLSX File](#).

7.3 worksheet.write_number()

write_number(*row*, *col*, *number*[, *cell_format*])

Write a number to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **number** (*int or float*) – Number to write to cell.
- **cell_format** (*Format*) – Optional Format object.

The `write_number()` method writes an integer or a float to the cell specified by `row` and `col` -
umn:

```
worksheet.write_number(0, 0, 123456)
worksheet.write_number('A2', 2.3451)
```

Both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details.

The `cell_format` parameter is used to apply formatting to the cell. This parameter is optional but when present is should be a valid *Format* object.

Excel handles numbers as IEEE-754 64-bit double-precision floating point. This means that, in most cases, the maximum number of digits that can be stored in Excel without losing precision is 15.

7.4 worksheet.write_formula()

write_formula(row, col, formula[, cell_format[, value]])

Write a formula to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **formula** (*string*) – Formula to write to cell.
- **cell_format** (*Format*) – Optional Format object.

The `write_formula()` method writes a formula or function to the cell specified by row and column:

```
worksheet.write_formula(0, 0, '=B3 + B4')
worksheet.write_formula(1, 0, '=SIN(PI()/4)')
worksheet.write_formula(2, 0, '=SUM(B1:B5)')
worksheet.write_formula('A4', '=IF(A3>1,"Yes", "No")')
worksheet.write_formula('A5', '=AVERAGE(1, 2, 3, 4)')
worksheet.write_formula('A6', '=DATEVALUE("1-Jan-2013")')
```

Array formulas are also supported:

```
worksheet.write_formula('A7', '{=SUM(A1:B1*A2:B2)}')
```

See also the `write_array_formula()` method below.

Both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details.

The `cell_format` parameter is used to apply formatting to the cell. This parameter is optional but when present is should be a valid [Format](#) object.

XlsxWriter doesn't calculate the value of a formula and instead stores the value 0 as the formula result. It then sets a global flag in the XLSX file to say that all formulas and functions should be recalculated when the file is opened. This is the method recommended in the Excel documentation and in general it works fine with spreadsheet applications. However, applications that don't have a facility to calculate formulas, such as Excel Viewer, or some mobile applications will only display the 0 results.

If required, it is also possible to specify the calculated result of the formula using the `value` parameter. This is occasionally necessary when working with non-Excel applications that don't calculate the value of the formula. The calculated value is added at the end of the argument list:

```
worksheet.write('A1', '=2+2', num_format, 4)
```

Note: Some early versions of Excel 2007 do not display the calculated values of formulas written by XlsxWriter. Applying all available Office Service Packs should fix this.

7.5 worksheet.write_array_formula()

write_array_formula(*first_row*, *first_col*, *last_row*, *last_col*, *formula*[, *cell_format*[, *value*]])

Write an array formula to a worksheet cell.

Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.
- **last_col** (*int*) – The last col of the range.
- **formula** (*string*) – Array formula to write to cell.
- **cell_format** (*Format*) – Optional Format object.

The `write_array_formula()` method write an array formula to a cell range. In Excel an array formula is a formula that performs a calculation on a set of values. It can return a single value or a range of values.

An array formula is indicated by a pair of braces around the formula: `{=SUM(A1:B1*A2:B2)}`. If the array formula returns a single value then the `first_` and `last_` parameters should be the same:

```
worksheet.write_array_formula('A1:A1', '{=SUM(B1:C1*B2:C2)}')
```

In this case however it is easier to just use the `write_formula()` or `write()` methods:

```
# Same as above but more concise.
worksheet.write('A1', '{=SUM(B1:C1*B2:C2)}')
worksheet.write_formula('A1', '{=SUM(B1:C1*B2:C2)}')
```

For array formulas that return a range of values you must specify the range that the return values will be written to:

```
worksheet.write_array_formula('A1:A3', '{=TREND(C1:C3,B1:B3)}')
worksheet.write_array_formula(0, 0, 2, 0, '{=TREND(C1:C3,B1:B3)}')
```

As shown above, both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details.

The `cell_format` parameter is used to apply formatting to the cell. This parameter is optional but when present it should be a valid *Format* object.

If required, it is also possible to specify the calculated value of the formula. This is occasionally necessary when working with non-Excel applications that don't calculate the value of the formula. The calculated value is added at the end of the argument list:

```
worksheet.write_array_formula('A1:A3', '{=TREND(C1:C3,B1:B3)}', format, 105)
```

In addition, some early versions of Excel 2007 don't calculate the values of array formulas when they aren't supplied. Installing the latest Office Service Pack should fix this issue.

See also *Example: Array formulas*.

7.6 worksheet.write_blank()

write_blank(row, col, blank[, cell_format])

Write a blank worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **blank** – None or empty string. The value is ignored.
- **cell_format** (*Format*) – Optional Format object.

Write a blank cell specified by row and column:

```
worksheet.write_blank(0, 0, None, format)
```

This method is used to add formatting to a cell which doesn't contain a string or number value.

Excel differentiates between an “Empty” cell and a “Blank” cell. An “Empty” cell is a cell which doesn't contain data whilst a “Blank” cell is a cell which doesn't contain data but does contain formatting. Excel stores “Blank” cells but ignores “Empty” cells.

As such, if you write an empty cell without formatting it is ignored:

```
worksheet.write('A1', None, format) # write_blank()
worksheet.write('A2', None)         # Ignored
```

This seemingly uninteresting fact means that you can write arrays of data without special treatment for None or empty string values.

As shown above, both row-column and A1 style notation are supported. See *Working with Cell Notation* for more details.

7.7 worksheet.write_datetime()

write_datetime(*row*, *col*, *datetime*[, *cell_format*])

Write a date or time to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **datetime** (*datetime*) – A `datetime.datetime`, `.date` or `.time` object.
- **cell_format** (*Format*) – Optional `Format` object.

The `write_datetime()` method can be used to write a date or time to the cell specified by row and column:

```
worksheet.write_datetime(0, 0, datetime, date_format)
```

The `datetime` should be a `datetime.datetime`, `datetime.date` or `datetime.time` object. The `datetime` class is part of the standard Python libraries.

There are many way to create `datetime` objects, for example the `datetime.datetime.strptime()` method:

```
date_time = datetime.datetime.strptime('2013-01-23', '%Y-%m-%d')
```

See the `datetime` documentation for other date/time creation methods.

A date/time should always have a `cell_format` of type *Format*, otherwise it will appear as a number:

```
date_format = workbook.add_format({'num_format': 'd mmmm yyyy'})
worksheet.write_datetime('A1', date_time, date_format)
```

See *Working with Dates and Time* for more details.

7.8 worksheet.write_url()

write_url(*row*, *col*, *url*[, *cell_format*[, *string*[, *tip*]]])

Write a hyperlink to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **url** (*string*) – Hyperlink url.
- **cell_format** (*Format*) – Optional `Format` object.

- **string** (*string*) – An optional display string for the hyperlink.
- **tip** (*string*) – An optional tooltip.

The `write_url()` method is used to write a hyperlink in a worksheet cell. The url is comprised of two elements: the displayed string and the non-displayed link. The displayed string is the same as the link unless an alternative string is specified.

Both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details.

The `cell_format` parameter is used to apply formatting to the cell. This parameter is optional, however, without a format the link won't look like a link. The suggested *Format* is:

```
link_format = workbook.add_format({'color': 'blue', 'underline': 1})
```

There are four web style URI's supported: `http://`, `https://`, `ftp://` and `mailto::`

```
worksheet.write_url('A1', 'ftp://www.python.org/', link_format)
worksheet.write_url('A2', 'http://www.python.org/', link_format)
worksheet.write_url('A3', 'https://www.python.org/', link_format)
worksheet.write_url('A4', 'mailto:jmcnamaracpan.org', link_format)
```

All of these URI types are recognised by the `write()` method, so the following are equivalent:

```
worksheet.write_url('A2', 'http://www.python.org/', link_format)
worksheet.write      ('A2', 'http://www.python.org/', link_format)  # Same.
```

You can display an alternative string using the `string` parameter:

```
worksheet.write_url('A1', 'http://www.python.org', link_format, 'Python')
```

If you wish to have some other cell data such as a number or a formula you can overwrite the cell using another call to `write_*`():

```
worksheet.write_url('A1', 'http://www.python.org/', link_format)

# Overwrite the URL string with a formula. The cell is still a link.
worksheet.write_formula('A1', '=1+1', link_format)
```

There are two local URIs supported: `internal:` and `external:`. These are used for hyperlinks to internal worksheet references or external workbook and worksheet references:

```
worksheet.write_url('A1', 'internal:Sheet2!A1', link_format)
worksheet.write_url('A2', 'internal:Sheet2!A1', link_format)
worksheet.write_url('A3', 'internal:Sheet2!A1:B2', link_format)
worksheet.write_url('A4', 'internal:'Sales Data'!A1", link_format)
worksheet.write_url('A5', r'external:c:\temp\foo.xlsx', link_format)
worksheet.write_url('A6', r'external:c:\foo.xlsx#Sheet2!A1', link_format)
worksheet.write_url('A7', r'external:..\foo.xlsx', link_format)
worksheet.write_url('A8', r'external:..\foo.xlsx#Sheet2!A1', link_format)
worksheet.write_url('A9', r'external:\\NET\share\foo.xlsx', link_format)
```

Worksheet references are typically of the form `Sheet1!A1`. You can also link to a worksheet range using the standard Excel notation: `Sheet1!A1:B2`.

In external links the workbook and worksheet name must be separated by the # character: `external:Workbook.xlsx#Sheet1!A1`.

You can also link to a named range in the target worksheet. For example say you have a named range called `my_name` in the workbook `c:\temp\foo.xlsx` you could link to it as follows:

```
worksheet.write_url('A14', r'external:c:\temp\foo.xlsx#my_name')
```

Excel requires that worksheet names containing spaces or non alphanumeric characters are single quoted as follows `'Sales Data'!A1`.

Links to network files are also supported. Network files normally begin with two back slashes as follows `\\NETWORK\etc`. In order to generate this in a single or double quoted string you will have to escape the backslashes, `'\\\\NETWORK\\etc'` or use a raw string `r'\\NETWORK\etc'`.

Alternatively, you can avoid most of these quoting problems by using forward slashes. These are translated internally to backslashes:

```
worksheet.write_url('A14', "external:c:/temp/foo.xlsx")
worksheet.write_url('A15', 'external://NETWORK/share/foo.xlsx')
```

See also [Example: Adding hyperlinks](#).

Note: XlsxWriter will escape the following characters in URLs as required by Excel: `\s " < > \[] ' ^ { }` unless the URL already contains `%xx` style escapes. In which case it is assumed that the URL was escaped correctly by the user and will be passed directly to Excel.

7.9 worksheet.write_rich_string()

write_rich_string(row, col, *string_parts[, cell_format])

Write a “rich” string with multiple formats to a worksheet cell.

Parameters

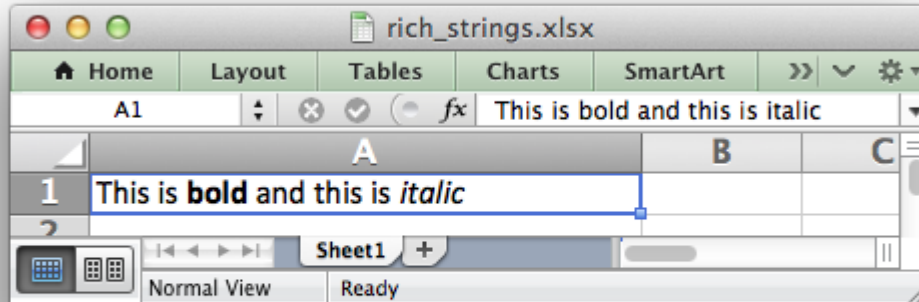
- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **string_parts** – String and format pairs.
- **cell_format** (*Format*) – Optional Format object.

The `write_rich_string()` method is used to write strings with multiple formats. For example to write the string “This is **bold** and this is *italic*” you would use the following:

```
bold = workbook.add_format({'bold': True})
italic = workbook.add_format({'italic': True})

worksheet.write_rich_string('A1',
                             'This is ',
                             bold, 'bold',
```

```
' and this is ',
italic, 'italic')
```



The basic rule is to break the string into fragments and put a `Format` object before the fragment that you want to format. For example:

```
# Unformatted string.
'This is an example string'

# Break it into fragments.
'This is an ', 'example', ' string'

# Add formatting before the fragments you want formatted.
'This is an ', format, 'example', ' string'

# In XlsxWriter.
worksheet.write_rich_string('A1',
                             'This is an ', format, 'example', ' string')
```

String fragments that don't have a format are given a default format. So for example when writing the string "Some **bold** text" you would use the first example below but it would be equivalent to the second:

```
# Some bold format and a default format.
bold    = workbook.add_format({'bold': True})
default = workbook.add_format()

# With default formatting:
worksheet.write_rich_string('A1',
                             'Some ',
                             bold, 'bold',
                             ' text')

# Or more explicitly:
worksheet.write_rich_string('A1',
                             default, 'Some ',
```

```
bold,      'bold',
default,  'text')
```

In Excel only the font properties of the format such as font name, style, size, underline, color and effects are applied to the string fragments in a rich string. Other features such as border, background, text wrap and alignment must be applied to the cell.

The `write_rich_string()` method allows you to do this by using the last argument as a cell format (if it is a format object). The following example centers a rich string in the cell:

```
bold    = workbook.add_format({'bold': True})
center  = workbook.add_format({'align': 'center'})

worksheet.write_rich_string('A5',
                             'Some ',
                             bold, 'bold text',
                             'centered',
                             center)
```

See also [Example: Writing “Rich” strings with multiple formats](#).

7.10 worksheet.write_row()

write_row(row, col, data[, cell_format])

Write a row of data starting from (row, col).

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **data** – Cell data to write. Variable types.
- **cell_format** (*Format*) – Optional Format object.

The `write_row()` method can be used to write a list of data in one go. This is useful for converting the results of a database query into an Excel worksheet. The `write()` method is called for each element of the data. For example:

```
# Some sample data.
data = ('Foo', 'Bar', 'Baz')

# Write the data to a sequence of cells.
worksheet.write_row('A1', data)

# The above example is equivalent to:
worksheet.write('A1', data[0])
worksheet.write('B1', data[1])
worksheet.write('C1', data[2])
```

7.11 worksheet.write_column()

write_column(*row*, *col*, *data*[, *cell_format*])

Write a column of data starting from (*row*, *col*).

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **data** – Cell data to write. Variable types.
- **cell_format** (*Format*) – Optional Format object.

The `write_column()` method can be used to write a list of data in one go. This is useful for converting the results of a database query into an Excel worksheet. The `write()` method is called for each element of the data. For example:

```
# Some sample data.
data = ('Foo', 'Bar', 'Baz')

# Write the data to a sequence of cells.
worksheet.write_row('A1', data)

# The above example is equivalent to:
worksheet.write('A1', data[0])
worksheet.write('A2', data[1])
worksheet.write('A3', data[2])
```

7.12 worksheet.set_row()

set_row(*row*, *height*, *cell_format*, *options*)

Set properties for a row of cells.

Parameters

- **row** (*int*) – The worksheet row (zero indexed).
- **height** (*float*) – The row height.
- **cell_format** (*Format*) – Optional Format object.
- **options** (*dict*) – Optional row parameters: hidden, level, collapsed.

The `set_row()` method is used to change the default properties of a row. The most common use for this method is to change the height of a row:

```
worksheet.set_row(0, 20) # Set the height of Row 1 to 20.
```

The other common use for `set_row()` is to set the *Format* for all cells in the row:

```
cell_format = workbook.add_format({'bold': True})

worksheet.set_row(0, 20, cell_format)
```

If you wish to set the format of a row without changing the height you can pass `None` as the height parameter or use the default row height of 15:

```
worksheet.set_row(1, None, cell_format)
worksheet.set_row(1, 15, cell_format) # Same as this.
```

The `cell_format` parameter will be applied to any cells in the row that don't have a format. As with Excel it is overridden by an explicit cell format. For example:

```
worksheet.set_row(0, None, format1) # Row 1 has format1.

worksheet.write('A1', 'Hello') # Cell A1 defaults to format1.
worksheet.write('B1', 'Hello', format2) # Cell B1 keeps format2.
```

The options parameter is a dictionary with the following possible keys:

- 'hidden'
- 'level'
- 'collapsed'

Options can be set as follows:

```
worksheet.set_row(0, 20, cell_format, {'hidden': True})

# Or use defaults for other properties and set the options only.
worksheet.set_row(0, None, None, {'hidden': True})
```

The 'hidden' option is used to hide a row. This can be used, for example, to hide intermediary steps in a complicated calculation:

```
worksheet.set_row(0, 20, cell_format, {'hidden': True})
```

The 'level' parameter is used to set the outline level of the row. Outlines are described in [Working with Outlines and Grouping](#). Adjacent rows with the same outline level are grouped together into a single outline.

The following example sets an outline level of 1 for some rows:

```
worksheet.set_row(0, None, None, {'level': 1})
worksheet.set_row(1, None, None, {'level': 1})
worksheet.set_row(2, None, None, {'level': 1})
```

Excel allows up to 7 outline levels. The 'level' parameter should be in the range $0 \leq \text{level} \leq 7$.

The 'hidden' parameter can also be used to hide collapsed outlined rows when used in conjunction with the 'level' parameter:

```
worksheet.set_row(1, None, None, {'hidden': 1, 'level': 1})
worksheet.set_row(2, None, None, {'hidden': 1, 'level': 1})
```

The 'collapsed' parameter is used in collapsed outlines to indicate which row has the collapsed '+' symbol:

```
worksheet.set_row(3, None, None, {'collapsed': 1})
```

7.13 worksheet.set_column()

set_column(*first_col*, *last_col*, *width*, *cell_format*, *options*)

Set properties for one or more columns of cells.

Parameters

- **first_col** (*int*) – First column (zero-indexed).
- **last_col** (*int*) – Last column (zero-indexed). Can be same as firstcol.
- **width** (*float*) – The width of the column(s).
- **cell_format** (*Format*) – Optional Format object.
- **options** (*dict*) – Optional parameters: hidden, level, collapsed.

The `set_column()` method can be used to change the default properties of a single column or a range of columns:

```
worksheet.set_column(1, 3, 30) # Width of columns B:D set to 30.
```

If `set_column()` is applied to a single column the value of `first_col` and `last_col` should be the same:

```
worksheet.set_column(1, 1, 30) # Width of column B set to 30.
```

It is also possible, and generally clearer, to specify a column range using the form of A1 notation used for columns. See [Working with Cell Notation](#) for more details.

Examples:

```
worksheet.set_column(0, 0, 20) # Column A width set to 20.
worksheet.set_column(1, 3, 30) # Columns B-D width set to 30.
worksheet.set_column('E:E', 20) # Column E width set to 20.
worksheet.set_column('F:H', 30) # Columns F-H width set to 30.
```

The width corresponds to the column width value that is specified in Excel. It is approximately equal to the length of a string in the default font of Calibri 11. Unfortunately, there is no way to specify “AutoFit” for a column in the Excel file format. This feature is only available at runtime from within Excel. It is possible to simulate “AutoFit” by tracking the width of the data in the column as you write it.

As usual the `cell_format` *Format* parameter is optional. If you wish to set the format without changing the width you can pass `None` as the width parameter:


```
cell_format = workbook.add_format({'bold': True})

worksheet.set_column(0, 0, None, cell_format)
```

The `cell_format` parameter will be applied to any cells in the column that don't have a format. For example:

```
worksheet.set_column('A:A', None, format1) # Col 1 has format1.

worksheet.write('A1', 'Hello')             # Cell A1 defaults to format1.
worksheet.write('A2', 'Hello', format2)    # Cell A2 keeps format2.
```

A row format takes precedence over a default column format:

```
worksheet.set_row(0, None, format1)         # Set format for row 1.
worksheet.set_column('A:A', None, format2)  # Set format for col 1.

worksheet.write('A1', 'Hello')             # Defaults to format1
worksheet.write('A2', 'Hello')             # Defaults to format2
```

The `options` parameter is a dictionary with the following possible keys:

- 'hidden'
- 'level'
- 'collapsed'

Options can be set as follows:

```
worksheet.set_column('D:D', 20, cell_format, {'hidden': 1})

# Or use defaults for other properties and set the options only.
worksheet.set_column('E:E', None, None, {'hidden': 1})
```

The 'hidden' option is used to hide a column. This can be used, for example, to hide intermediary steps in a complicated calculation:

```
worksheet.set_column('D:D', 20, cell_format, {'hidden': 1})
```

The 'level' parameter is used to set the outline level of the column. Outlines are described in [Working with Outlines and Grouping](#). Adjacent columns with the same outline level are grouped together into a single outline.

The following example sets an outline level of 1 for columns B to G:

```
worksheet.set_column('B:G', None, None, {'level': 1})
```

Excel allows up to 7 outline levels. The 'level' parameter should be in the range $0 \leq \text{level} \leq 7$.

The 'hidden' parameter can also be used to hide collapsed outlined columns when used in conjunction with the 'level' parameter:

```
worksheet.set_column('B:G', None, None, {'hidden': 1, 'level': 1})
```

The 'collapsed' parameter is used in collapsed outlines to indicate which column has the collapsed '+' symbol:

```
worksheet.set_column('H:H', None, None, {'collapsed': 1})
```

7.14 worksheet.insert_image()

insert_image(*row*, *col*, *image*[, *options*])

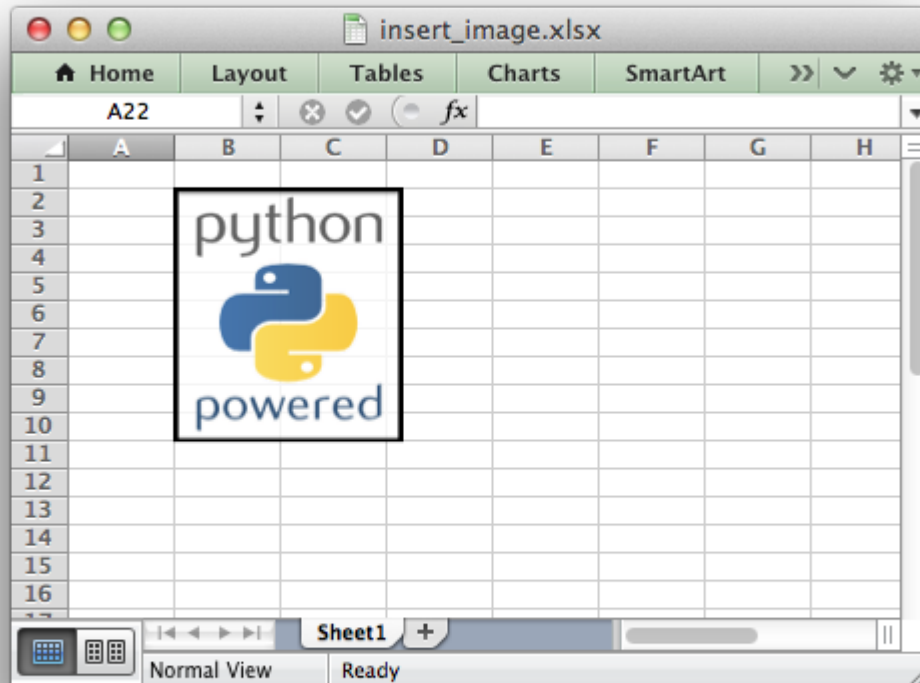
Write a string to a worksheet cell.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **image** (*string*) – Image filename (with path if required).
- **options** (*dict*) – Optional parameters to position and scale the image.

This method can be used to insert a image into a worksheet. The image can be in PNG, JPEG or BMP format:

```
worksheet.insert_image('B2', 'python.png')
```



A file path can be specified with the image name:

```
worksheet1.insert_image('B10', '../images/python.png')
worksheet2.insert_image('B20', r'c:\images\python.png')
```

The `insert_image()` method takes optional parameters in a dictionary to position and scale the image. The available parameters with their default values are:

```
{
    'x_offset': 0,
    'y_offset': 0,
    'x_scale': 1,
    'y_scale': 1,
}
```

The offset values are in pixels:

```
worksheet1.insert_image('B2', 'python.png', {'x_offset': 15, 'y_offset': 10})
```

The offsets can be greater than the width or height of the underlying cell. This can be occasionally useful if you wish to align two or more images relative to the same cell.

The `x_scale` and `y_scale` parameters can be used to scale the image horizontally and vertically:

```
worksheet.insert_image('B3', 'python.png', {'x_scale': 0.5, 'y_scale': 0.5})
```

Currently only 96 dpi images are supported without modification. If you need to insert images with other dpi values you can use the scale parameters.

Note: You must call `set_row()` or `set_column()` before `insert_image()` if you wish to change the default dimensions of any of the rows or columns that the image occupies. The height of a row can also change if you use a font that is larger than the default or have text wrapping turned on. This in turn will affect the scaling of your image. To avoid this you should explicitly set the height of the row using `set_row()` if it contains a font size that will change the row height.

Inserting images into headers or a footers isn't supported.

BMP images are only supported for backward compatibility. In general it is best to avoid BMP images since they aren't compressed. If used, BMP images must be 24 bit, true colour, bitmaps.

See also [Example: Inserting images into a worksheet](#).

7.15 worksheet.data_validation()

data_validation(*first_row*, *first_col*, *last_row*, *last_col*, *options*)

Write a conditional format to range of cells.

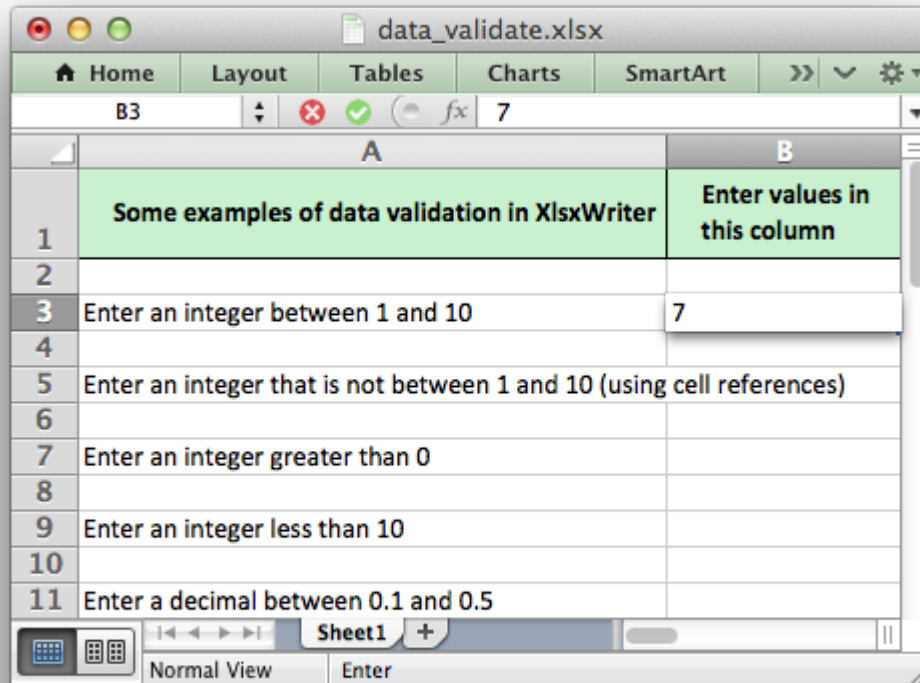
Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.
- **last_col** (*int*) – The last col of the range.
- **options** (*dict*) – Data validation options.

The `data_validation()` method is used to construct an Excel data validation or to limit the user input to a dropdown list of values:

```
worksheet.data_validation('B3', {'validate': 'integer',
                                'criteria': 'between',
                                'minimum': 1,
                                'maximum': 10})

worksheet.data_validation('B13', {'validate': 'list',
                                'source': ['open', 'high', 'close']})
```



The data validation can be applied to a single cell or a range of cells. As usual you can use A1 or Row/Column notation, see [Working with Cell Notation](#).

With Row/Column notation you must specify all four cells in the range: (*first_row*, *first_col*, *last_row*, *last_col*). If you need to refer to a single cell set the *last_* values equal to the *first_* values. With A1 notation you can refer to a single cell or a range of cells:

```
worksheet.data_validation(0, 0, 4, 1, {...})
worksheet.data_validation('B1',    {...})
worksheet.data_validation('C1:E5',  {...})
```

The options parameter in `data_validation()` must be a dictionary containing the parameters that describe the type and style of the data validation. There are a lot of available options which are described in detail in a separate section: [Working with Data Validation](#). See also [Example: Data Validation and Drop Down Lists](#).

7.16 worksheet.conditional_format()

conditional_format(*first_row*, *first_col*, *last_row*, *last_col*, *options*)

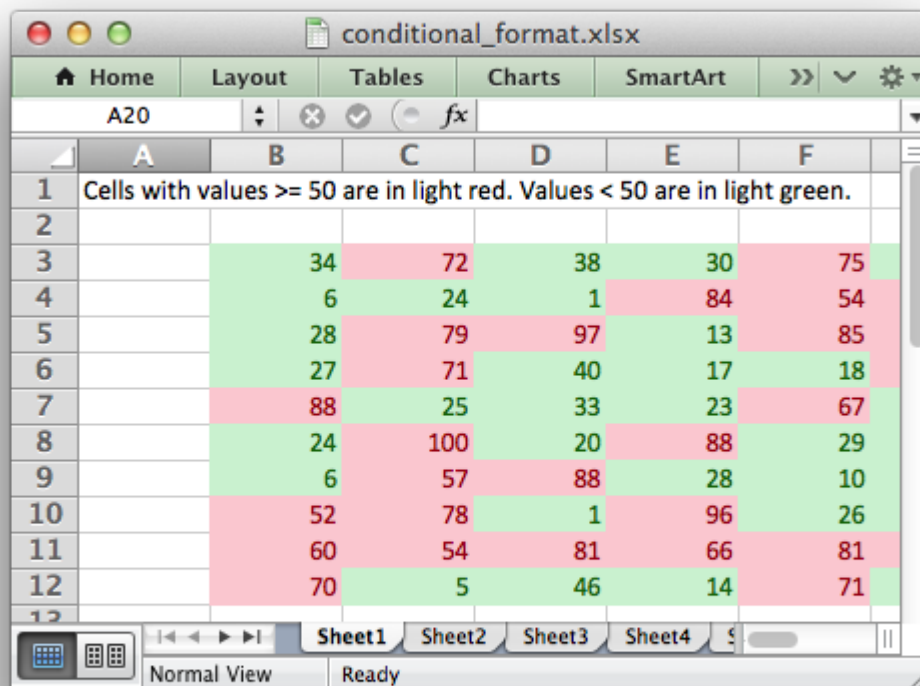
Write a conditional format to range of cells.

Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.
- **last_col** (*int*) – The last col of the range.
- **options** (*dict*) – Conditional formatting options.

The `conditional_format()` method is used to add formatting to a cell or range of cells based on user defined criteria:

```
worksheet.conditional_format('B3:K12', {'type': 'cell',
                                         'criteria': '>= ',
                                         'value': 50,
                                         'format': format1})
```



The conditional format can be applied to a single cell or a range of cells. As usual you can use A1 or Row/Column notation, see [Working with Cell Notation](#).

With Row/Column notation you must specify all four cells in the range: (`first_row`, `first_col`, `last_row`, `last_col`). If you need to refer to a single cell set the `last` values equal to the `first` values. With A1 notation you can refer to a single cell or a range of cells:

```
worksheet.conditional_format(0, 0, 4, 1, {...})
worksheet.conditional_format('B1', {...})
worksheet.conditional_format('C1:E5', {...})
```

The options parameter in `conditional_format()` must be a dictionary containing the parameters that describe the type and style of the conditional format. There are a lot of available options which are described in detail in a separate section: [Working with Conditional Formatting](#). See also [Example: Conditional Formatting](#).

7.17 worksheet.add_table()

add_table(*first_row*, *first_col*, *last_row*, *last_col*, *options*)

Add an Excel table to a worksheet.

Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.
- **last_col** (*int*) – The last col of the range.
- **options** (*dict*) – Table formatting options. (Optional)

The `add_table()` method is used to group a range of cells into an Excel Table:

```
worksheet.add_table('B3:F7', { ... })
```

This method contains a lot of parameters and is described in [Working with Worksheet Tables](#).

See also [Example: Worksheet Tables](#).

7.18 worksheet.add_sparkline()

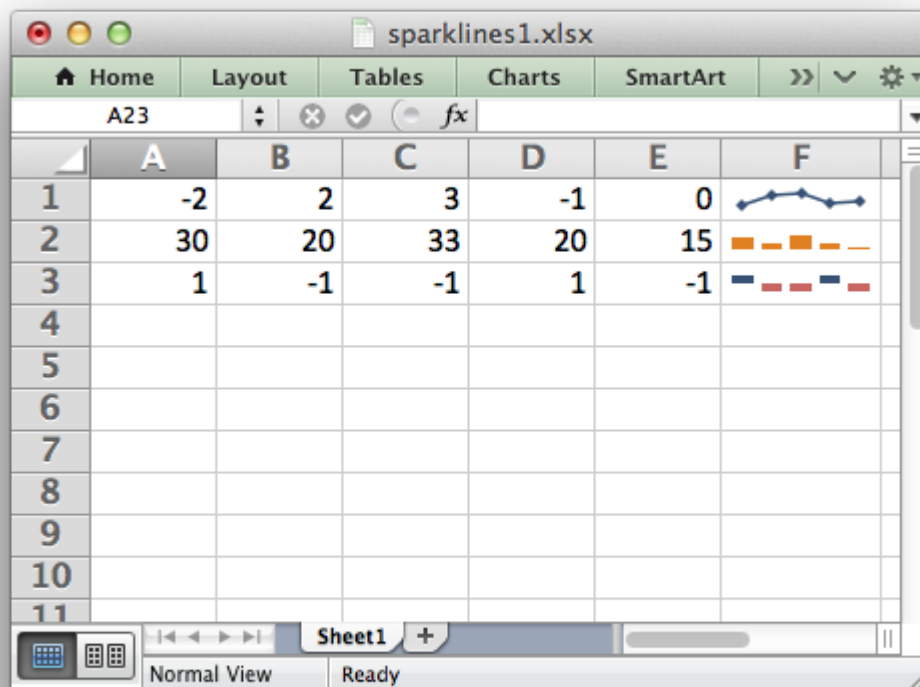
add_sparkline(*row*, *col*, *options*)

Add sparklines to a worksheet.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **options** (*dict*) – Sparkline formatting options.

Sparklines are small charts that fit in a single cell and are used to show trends in data.



The `add_sparkline()` worksheet method is used to add sparklines to a cell or a range of cells:

```
worksheet.add_sparkline('F1', {'range': 'A1:E1'})
```

This method contains a lot of parameters and is described in detail in [Working with Sparklines](#).

See also [Example: Sparklines \(Simple\)](#) and [Example: Sparklines \(Advanced\)](#).

Note: Sparklines are a feature of Excel 2010+ only. You can write them to an XLSX file that can be read by Excel 2007 but they won't be displayed.

7.19 worksheet.write_comment()

write_comment(*row*, *col*, *comment*[, *options*])

Write a comment to a worksheet cell.

Parameters

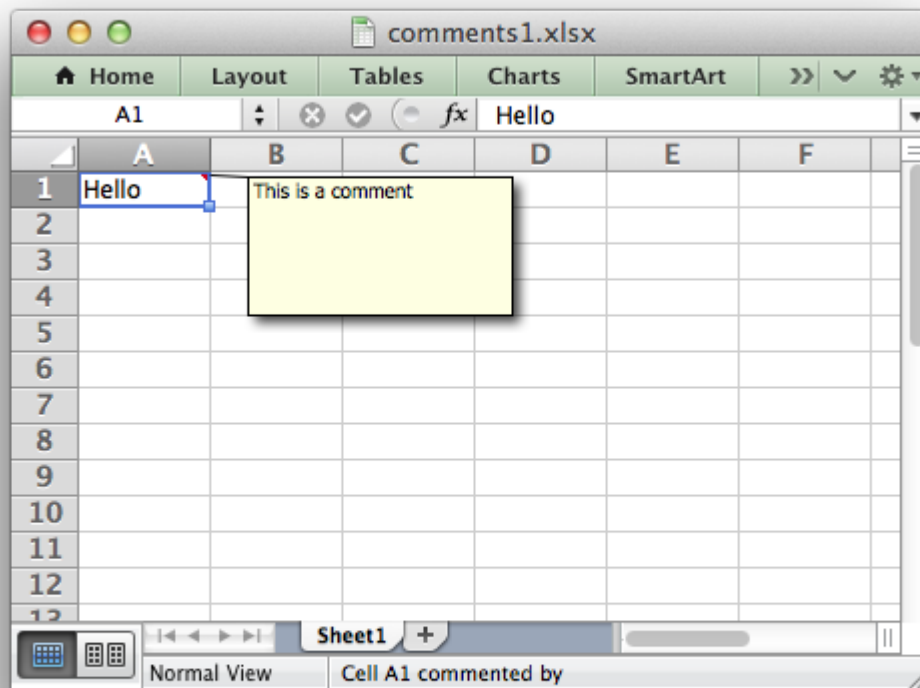
- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).

- **comment** (*string*) – String to write to cell.
- **options** (*dict*) – Comment formatting options..

The `write_comment()` method is used to add a comment to a cell. A comment is indicated in Excel by a small red triangle in the upper right-hand corner of the cell. Moving the cursor over the red triangle will reveal the comment.

The following example shows how to add a comment to a cell:

```
worksheet.write('A1', 'Hello')
worksheet.write_comment('A1', 'This is a comment')
```



As usual you can replace the `row` and `col` parameters with an A1 cell reference. See [Working with Cell Notation](#) for more details.

The properties of the cell comment can be modified by passing an optional dictionary of key/value pairs to control the format of the comment. For example:

```
worksheet.write_comment('C3', 'Hello', {'x_scale': 1.2, 'y_scale': 0.8})
```

Most of these options are quite specific and in general the default comment behaviour will be all that you need. However, should you need greater control over the format of the cell comment the following options are available:

```
author
visible
x_scale
width
y_scale
height
color
start_cell
start_row
start_col
x_offset
y_offset
```

For more details see [Working with Cell Comments](#) and [Example: Adding Cell Comments to Worksheets \(Advanced\)](#).

7.20 worksheet.show_comments()

show_comments()

Make any comments in the worksheet visible.

This method is used to make all cell comments visible when a worksheet is opened:

```
worksheet.show_comments()
```

Individual comments can be made visible using the `visible` parameter of the `write_comment` method (see above):

```
worksheet.write_comment('C3', 'Hello', {'visible': True})
```

If all of the cell comments have been made visible you can hide individual comments as follows:

```
worksheet.show_comments()
worksheet.write_comment('C3', 'Hello', {'visible': False})
```

For more details see [Working with Cell Comments](#) and [Example: Adding Cell Comments to Worksheets \(Advanced\)](#).

7.21 worksheet.set_comments_author()

set_comments_author(author)

Set the default author of the cell comments.

Parameters `author` (*string*) – Comment author.

This method is used to set the default author of all cell comments:

```
worksheet.set_comments_author('John Smith')
```

Individual comment authors can be set using the `author` parameter of the `write_comment` method (see above).

If no author is specified the default comment author name is an empty string.

For more details see [Working with Cell Comments](#) and [Example: Adding Cell Comments to Worksheets \(Advanced\)](#).

7.22 `worksheet.get_name()`

`get_name()`

Retrieve the worksheet name.

The `get_name()` method is used to retrieve the name of a worksheet. This is something useful for debugging or logging:

```
for worksheet in workbook.worksheets():
    print worksheet.get_name()
```

There is no `set_name()` method. The only safe way to set the worksheet name is via the `add_worksheet()` method.

7.23 `worksheet.activate()`

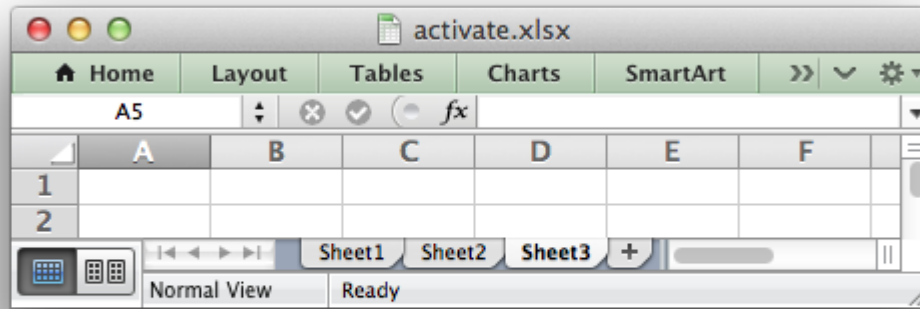
`activate()`

Make a worksheet the active, i.e., visible worksheet.

The `activate()` method is used to specify which worksheet is initially visible in a multi-sheet workbook:

```
worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
worksheet3 = workbook.add_worksheet()

worksheet3.activate()
```



More than one worksheet can be selected via the `select()` method, see below, however only one worksheet can be active.

The default active worksheet is the first worksheet.

7.24 `worksheet.select()`

`select()`

Set a worksheet tab as selected.

The `select()` method is used to indicate that a worksheet is selected in a multi-sheet workbook:

```
worksheet1.activate()  
worksheet2.select()  
worksheet3.select()
```

A selected worksheet has its tab highlighted. Selecting worksheets is a way of grouping them together so that, for example, several worksheets could be printed in one go. A worksheet that has been activated via the `activate()` method will also appear as selected.

7.25 `worksheet.hide()`

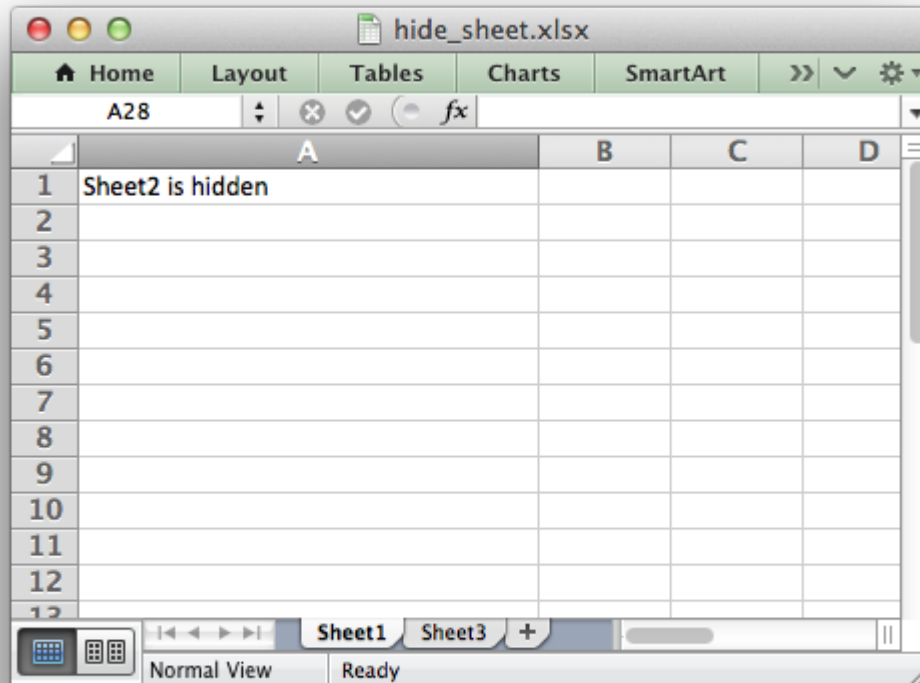
`hide()`

Hide the current worksheet.

The `hide()` method is used to hide a worksheet:

```
worksheet2.hide()
```

You may wish to hide a worksheet in order to avoid confusing a user with intermediate data or calculations.



A hidden worksheet can not be activated or selected so this method is mutually exclusive with the `activate()` and `select()` methods. In addition, since the first worksheet will default to being the active worksheet, you cannot hide the first worksheet without activating another sheet:

```
worksheet2.activate()
worksheet1.hide()
```

See [Example: Hiding Worksheets](#) for more details.

7.26 worksheet.set_first_sheet()

set_first_sheet()

Set current worksheet as the first visible sheet tab.

The `activate()` method determines which worksheet is initially selected. However, if there are a large number of worksheets the selected worksheet may not appear on the screen. To avoid this you can select which is the leftmost visible worksheet tab using `set_first_sheet()`:

```
for in range(1, 21):
    workbook.add_worksheet
```

```
worksheet19.set_first_sheet() # First visible worksheet tab.  
worksheet20.activate()       # First visible worksheet.
```

This method is not required very often. The default value is the first worksheet.

7.27 worksheet.merge_range()

merge_range(*first_row, first_col, last_row, last_col, cell_format*)

Merge a range of cells.

Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.
- **last_col** (*int*) – The last col of the range.
- **data** – Cell data to write. Variable types.
- **cell_format** (*Format*) – Optional Format object.

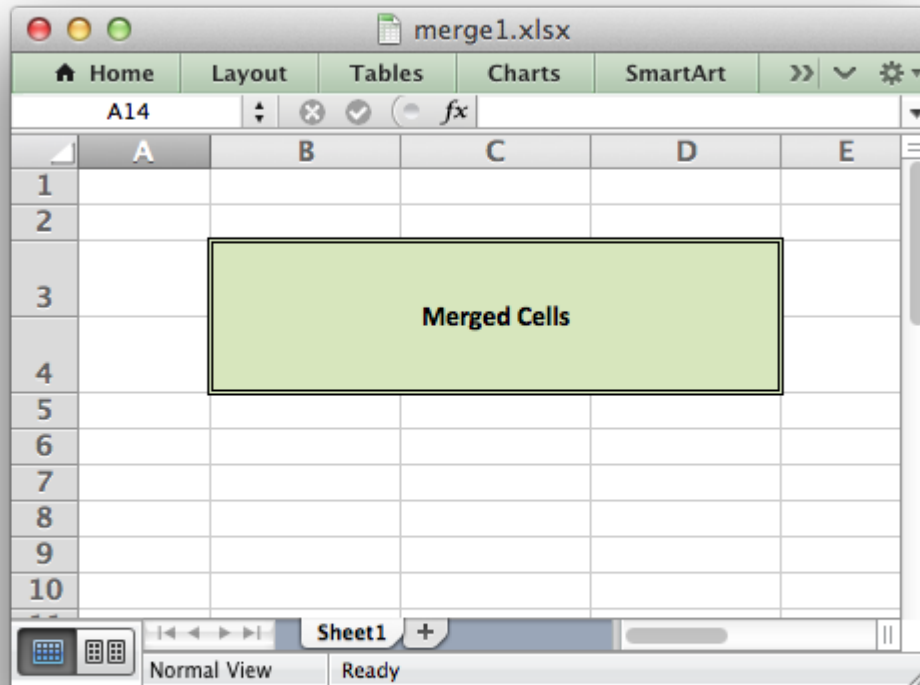
The `merge_range()` method allows cells to be merged together so that they act as a single area.

Excel generally merges and centers cells at same time. To get similar behaviour with XlsxWriter you need to apply a *Format*:

```
merge_format = workbook.add_format({'align': 'center'})  
  
worksheet.merge_range('B3:D4', 'Merged Cells', merge_format)
```

It is possible to apply other formatting to the merged cells as well:

```
merge_format = workbook.add_format({  
    'bold':    True,  
    'border':  6,  
    'align':   'center',  
    'valign':  'vcenter',  
    'fg_color': '#D7E4BC',  
})  
  
worksheet.merge_range('B3:D4', 'Merged Cells', merge_format)
```



The `merge_range()` method writes its data argument using `write()`. Therefore it will handle numbers, strings and formulas as usual. If this doesn't handle your data correctly then you can overwrite the first cell with a call to one of the other `write_*()` methods using the same *Format* as in the merged cells.

See [Example: Merging Cells](#) for more details.

7.28 worksheet.autofilter()

autofilter(*first_row*, *first_col*, *last_row*, *last_col*)

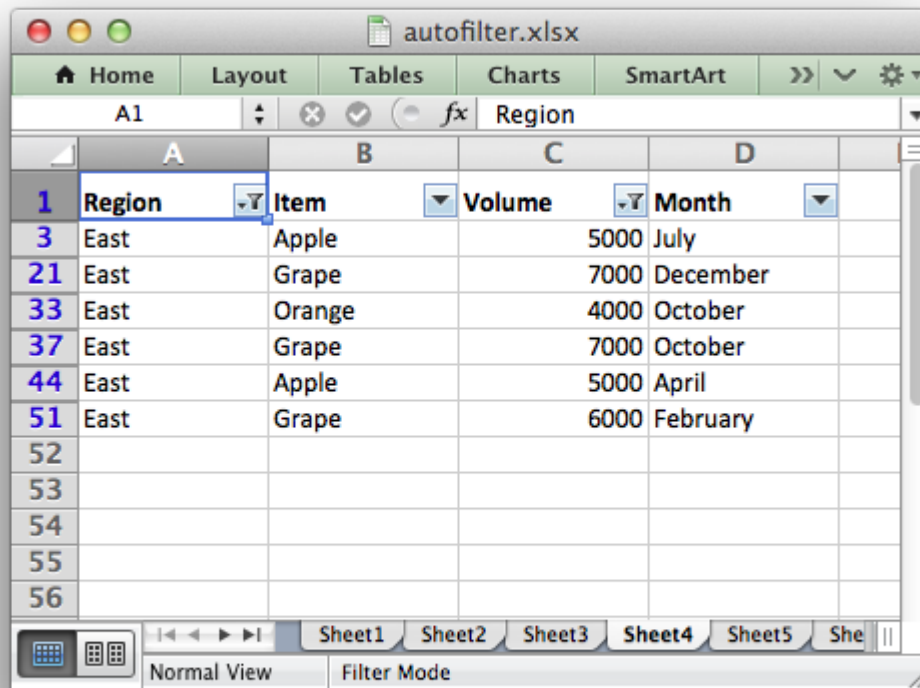
Set the autofilter area in the worksheet.

Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.
- **last_col** (*int*) – The last col of the range.

The `autofilter()` method allows an autofilter to be added to a worksheet. An autofilter is a way of adding drop down lists to the headers of a 2D range of worksheet data. This allows users

to filter the data based on simple criteria so that some data is shown and some is hidden.



To add an autofilter to a worksheet:

```
worksheet.autofilter('A1:D11')
worksheet.autofilter(0, 0, 10, 3) # Same as above.
```

Filter conditions can be applied using the `filter_column()` or `filter_column_list()` methods.

See [Working with Autofilters](#) for more details.

7.29 worksheet.filter_column()

filter_column(col, criteria)
Set the column filter criteria.

Parameters

- **col** (*int*) – Filter column (zero-indexed).
- **criteria** (*string*) – Filter criteria.

The `filter_column` method can be used to filter columns in a autofilter range based on simple conditions.

The conditions for the filter are specified using simple expressions:

```
worksheet.filter_column('A', 'x > 2000')
worksheet.filter_column('B', 'x > 2000 and x < 5000')
```

The `col` parameter can either be a zero indexed column number or a string column name.

It isn't sufficient to just specify the filter condition. You must also hide any rows that don't match the filter condition. See [Working with Autofilters](#) for more details.

7.30 worksheet.filter_column_list()

filter_column_list(*col*, *filters*)

Set the column filter criteria in Excel 2007 list style.

Parameters

- **col** (*int*) – Filter column (zero-indexed).
- **filters** (*list*) – List of filter criteria to match.

The `filter_column_list()` method can be used to represent filters with multiple selected criteria:

```
worksheet.filter_column_list('A', 'March', 'April', 'May')
```

The `col` parameter can either be a zero indexed column number or a string column name.

One or more criteria can be selected:

```
worksheet.filter_column_list('A', 'March')
worksheet.filter_column_list('C', 100, 110, 120, 130)
```

It isn't sufficient to just specify filters. You must also hide any rows that don't match the filter condition. See [Working with Autofilters](#) for more details.

7.31 worksheet.set_selection()

set_selection(*first_row*, *first_col*, *last_row*, *last_col*)

Set the selected cell or cells in a worksheet.

Parameters

- **first_row** (*int*) – The first row of the range. (All zero indexed.)
- **first_col** (*int*) – The first column of the range.
- **last_row** (*int*) – The last row of the range.

- **last_col** (*int*) – The last col of the range.

The `set_selection()` method can be used to specify which cell or range of cells is selected in a worksheet. The most common requirement is to select a single cell, in which case the `first_` and `last_` parameters should be the same.

The active cell within a selected range is determined by the order in which `first_` and `last_` are specified.

Examples:

```
worksheet1.set_selection(3, 3, 3, 3) # 1. Cell D4.
worksheet2.set_selection(3, 3, 6, 6) # 2. Cells D4 to G7.
worksheet3.set_selection(6, 6, 3, 3) # 3. Cells G7 to D4.
worksheet4.set_selection('D4')      # Same as 1.
worksheet5.set_selection('D4:G7')   # Same as 2.
worksheet6.set_selection('G7:D4')   # Same as 3.
```

As shown above, both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details. The default cell selection is (0, 0), 'A1'.

7.32 worksheet.freeze_panes()

freeze_panes (*row*, *col*[, *top_row*, *left_col*])

Create worksheet panes and mark them as frozen.

Parameters

- **row** (*int*) – The cell row (zero indexed).
- **col** (*int*) – The cell column (zero indexed).
- **top_row** (*int*) – Topmost visible row in scrolling region of pane.
- **left_col** (*int*) – Leftmost visible row in scrolling region of pane.

This `freeze_panes` method can be used to divide a worksheet into horizontal or vertical regions known as panes and to “freeze” these panes so that the splitter bars are not visible.

The parameters `row` and `col` are used to specify the location of the split. It should be noted that the split is specified at the top or left of a cell and that the method uses zero based indexing. Therefore to freeze the first row of a worksheet it is necessary to specify the split at row 2 (which is 1 as the zero-based index).

You can set one of the `row` and `col` parameters as zero if you do not want either a vertical or horizontal split.

Examples:

```
worksheet.freeze_panes(1, 0) # Freeze the first row.
worksheet.freeze_panes('A2') # Same using A1 notation.
worksheet.freeze_panes(0, 1) # Freeze the first column.
worksheet.freeze_panes('B1') # Same using A1 notation.
```

```
worksheet.freeze_panes(1, 2) # Freeze first row and first 2 columns.
worksheet.freeze_panes('C2') # Same using A1 notation.
```

The parameters `top_row` and `left_col` are optional. They are used to specify the top-most or left-most visible row or column in the scrolling region of the panes. For example to freeze the first row and to have the scrolling region begin at row twenty:

```
worksheet.freeze_panes(1, 0, 20, 0)
```

You cannot use A1 notation for the `top_row` and `left_col` parameters.

See [Example: Freeze Panes and Split Panes](#) for more details.

7.33 worksheet.split_panes()

split_panes(*x*, *y*[, *top_row*, *left_col*])

Create worksheet panes and mark them as split.

Parameters

- **x** (*float*) – The position for the vertical split.
- **y** (*float*) – The position for the horizontal split.
- **top_row** (*int*) – Topmost visible row in scrolling region of pane.
- **left_col** (*int*) – Leftmost visible row in scrolling region of pane.

The `split_panes` method can be used to divide a worksheet into horizontal or vertical regions known as panes. This method is different from the `freeze_panes()` method in that the splits between the panes will be visible to the user and each pane will have its own scroll bars.

The parameters `y` and `x` are used to specify the vertical and horizontal position of the split. The units for `y` and `x` are the same as those used by Excel to specify row height and column width. However, the vertical and horizontal units are different from each other. Therefore you must specify the `y` and `x` parameters in terms of the row heights and column widths that you have set or the default values which are 15 for a row and 8.43 for a column.

You can set one of the `y` and `x` parameters as zero if you do not want either a vertical or horizontal split. The parameters `top_row` and `left_col` are optional. They are used to specify the top-most or left-most visible row or column in the bottom-right pane.

Example:

```
worksheet.split_panes(15, 0) # First row.
worksheet.split_panes(0, 8.43) # First column.
worksheet.split_panes(15, 8.43) # First row and column.
```

You cannot use A1 notation with this method.

See [Example: Freeze Panes and Split Panes](#) for more details.

7.34 worksheet.set_zoom()

set_zoom(*zoom*)

Set the worksheet zoom factor.

Parameters **zoom** (*int*) – Worksheet zoom factor.

Set the worksheet zoom factor in the range `10 <= zoom <= 400`:

```
worksheet1.set_zoom(50)
worksheet2.set_zoom(75)
worksheet3.set_zoom(300)
worksheet4.set_zoom(400)
```

The default zoom factor is 100. It isn't possible to set the zoom to "Selection" because it is calculated by Excel at run-time.

Note, `set_zoom()` does not affect the scale of the printed page. For that you should use `set_print_scale()`.

7.35 worksheet.right_to_left()

right_to_left()

Display the worksheet cells from right to left for some versions of Excel.

The `right_to_left()` method is used to change the default direction of the worksheet from left-to-right, with the A1 cell in the top left, to right-to-left, with the A1 cell in the top right.

```
worksheet.right_to_left()
```

This is useful when creating Arabic, Hebrew or other near or far eastern worksheets that use right-to-left as the default direction.

7.36 worksheet.hide_zero()

hide_zero()

Hide zero values in worksheet cells.

The `hide_zero()` method is used to hide any zero values that appear in cells:

```
worksheet.hide_zero()
```

7.37 worksheet.set_tab_color()

set_tab_color()

Set the colour of the worksheet tab.

Parameters **color** (*string*) – The tab color.

The `set_tab_color()` method is used to change the colour of the worksheet tab:

```
worksheet1.set_tab_color('red')
worksheet2.set_tab_color('#FF9900') # Orange
```

The colour can be a Html style #RRGGBB string or a limited number named colours, see [Format Colors](#).

See [Example: Setting Worksheet Tab Colours](#) for more details.

7.38 worksheet.protect()

protect()

Set the colour of the worksheet tab.

Parameters

- **password** (*string*) – A worksheet password.
- **options** (*dict*) – A dictionary of worksheet options to protect.

The `protect()` method is used to protect a worksheet from modification:

```
worksheet.protect()
```

The `protect()` method also has the effect of enabling a cell's locked and hidden properties if they have been set. A *locked* cell cannot be edited and this property is on by default for all cells. A *hidden* cell will display the results of a formula but not the formula itself. These properties can be set using the `set_locked()` and `set_hidden()` format methods.

You can optionally add a password to the worksheet protection:

```
worksheet.protect('abc123')
```

Passing the empty string "" is the same as turning on protection without a password.

You can specify which worksheet elements you wish to protect by passing a dictionary in the `options` argument with any or all of the following keys:

```
# Default values shown.
options = {
    'objects': 0,
    'scenarios': 0,
    'format_cells': 0,
    'format_columns': 0,
    'format_rows': 0,
    'insert_columns': 0,
    'insert_rows': 0,
    'insert_hyperlinks': 0,
    'delete_columns': 0,
    'delete_rows': 0,
    'select_locked_cells': 1,
    'sort': 0,
```

```
'autofilter':          0,  
'pivot_tables':       0,  
'select_unlocked_cells': 1,  
}
```

The default boolean values are shown above. Individual elements can be protected as follows:

```
worksheet.protect('acb123', { 'insert_rows': 1 })
```

See also the `set_locked()` and `set_hidden()` format methods and [Example: Enabling Cell protection in Worksheets](#).

Note: Worksheet level passwords in Excel offer very weak protection. They not encrypt your data and are very easy to deactivate. Full workbook encryption is not supported by XlsxWriter since it requires a completely different file format and would take several man months to implement.

7.39 worksheet.set_default_row()

set_default_row(*height*, *hide_unused_rows*)

Set the default row properties.

Parameters

- **height** (*float*) – Default height. Optional, defaults to 15.
- **hide_unused_rows** (*bool*) – Hide unused rows. Optional, defaults to False.

The `set_default_row()` method is used to set the limited number of default row properties allowed by Excel which are the default height and the option to hide unused rows. These parameters are an optimisation used by Excel to set row properties without generating a very large file with an entry for each row.

To set the default row height:

```
worksheet.set_default_row(24)
```

To hide unused rows:

```
worksheet.set_default_row(hide_unused_rows=True)
```

See [Example: Hiding Rows and Columns](#) for more details.

7.40 worksheet.outline_settings()

outline_settings(*visible*, *symbols_below*, *symbols_right*, *auto_style*)

Control outline settings.

Parameters

- **visible** (*bool*) – Outlines are visible. Optional, defaults to True.
- **symbols_below** (*bool*) – Show row outline symbols below the outline bar. Optional, defaults to True.
- **symbols_right** (*bool*) – Show column outline symbols to the right of the outline bar. Optional, defaults to True.
- **auto_style** (*bool*) – Use Automatic style. Optional, defaults to False.

The `outline_settings()` method is used to control the appearance of outlines in Excel. Outlines are described in [Working with Outlines and Grouping](#):

```
worksheet1.outline_settings(False, False, False, True)
```

The 'visible' parameter is used to control whether or not outlines are visible. Setting this parameter to False will cause all outlines on the worksheet to be hidden. They can be un-hidden in Excel by means of the "Show Outline Symbols" command button. The default setting is True for visible outlines.

The 'symbols_below' parameter is used to control whether the row outline symbol will appear above or below the outline level bar. The default setting is True for symbols to appear below the outline level bar.

The 'symbols_right' parameter is used to control whether the column outline symbol will appear to the left or the right of the outline level bar. The default setting is True for symbols to appear to the right of the outline level bar.

The 'auto_style' parameter is used to control whether the automatic outline generator in Excel uses automatic styles when creating an outline. This has no effect on a file generated by XlsxWriter but it does have an effect on how the worksheet behaves after it is created. The default setting is False for "Automatic Styles" to be turned off.

The default settings for all of these parameters correspond to Excel's default parameters.

The worksheet parameters controlled by `outline_settings()` are rarely used.

THE WORKSHEET CLASS (PAGE SETUP)

Page set-up methods affect the way that a worksheet looks when it is printed. They control features such as paper size, orientation, page headers and margins.

These methods are really just standard *worksheet* methods. They are documented separately for the sake of clarity.

8.1 `worksheet.set_landscape()`

`set_landscape()`

Set the page orientation as landscape.

This method is used to set the orientation of a worksheet's printed page to landscape:

```
worksheet.set_landscape()
```

8.2 `worksheet.set_portrait()`

`set_portrait()`

Set the page orientation as portrait.

This method is used to set the orientation of a worksheet's printed page to portrait. The default worksheet orientation is portrait, so you won't generally need to call this method:

```
worksheet.set_portrait()
```

8.3 `worksheet.set_page_view()`

`set_page_view()`

Set the page view mode.

This method is used to display the worksheet in “Page View/Layout” mode:

```
worksheet.set_page_view()
```

8.4 worksheet.set_paper()

set_paper(*index*)

Set the paper type.

Parameters *index* (*int*) – The Excel paper format index.

This method is used to set the paper format for the printed output of a worksheet. The following paper styles are available:

Index	Paper format	Paper size
0	Printer default	
1	Letter	8 1/2 x 11 in
2	Letter Small	8 1/2 x 11 in
3	Tabloid	11 x 17 in
4	Ledger	17 x 11 in
5	Legal	8 1/2 x 14 in
6	Statement	5 1/2 x 8 1/2 in
7	Executive	7 1/4 x 10 1/2 in
8	A3	297 x 420 mm
9	A4	210 x 297 mm
10	A4 Small	210 x 297 mm
11	A5	148 x 210 mm
12	B4	250 x 354 mm
13	B5	182 x 257 mm
14	Folio	8 1/2 x 13 in
15	Quarto	215 x 275 mm
16		10x14 in
17		11x17 in
18	Note	8 1/2 x 11 in
19	Envelope 9	3 7/8 x 8 7/8
20	Envelope 10	4 1/8 x 9 1/2
21	Envelope 11	4 1/2 x 10 3/8
22	Envelope 12	4 3/4 x 11
23	Envelope 14	5 x 11 1/2
24	C size sheet	
25	D size sheet	
26	E size sheet	
27	Envelope DL	110 x 220 mm
28	Envelope C3	324 x 458 mm
29	Envelope C4	229 x 324 mm
Continued on next page		

Table 8.1 – continued from previous page

Index	Paper format	Paper size
30	Envelope C5	162 x 229 mm
31	Envelope C6	114 x 162 mm
32	Envelope C65	114 x 229 mm
33	Envelope B4	250 x 353 mm
34	Envelope B5	176 x 250 mm
35	Envelope B6	176 x 125 mm
36	Envelope	110 x 230 mm
37	Monarch	3.875 x 7.5 in
38	Envelope	3 5/8 x 6 1/2 in
39	Fanfold	14 7/8 x 11 in
40	German Std Fanfold	8 1/2 x 12 in
41	German Legal Fanfold	8 1/2 x 13 in

Note, it is likely that not all of these paper types will be available to the end user since it will depend on the paper formats that the user's printer supports. Therefore, it is best to stick to standard paper types:

```
worksheet.set_paper(1) # US Letter
worksheet.set_paper(9) # A4
```

If you do not specify a paper type the worksheet will print using the printer's default paper style.

8.5 worksheet.center_horizontally()

center_horizontally()

Center the printed page horizontally.

Center the worksheet data horizontally between the margins on the printed page:

```
worksheet.center_horizontally()
```

8.6 worksheet.center_vertically()

center_vertically()

Center the printed page vertically.

Center the worksheet data vertically between the margins on the printed page:

```
worksheet.center_vertically()
```

8.7 worksheet.worksheet.set_margins()

set_margins ([*left=0.7,* *right=0.7,* *top=0.75,* *bottom=0.75*]])

Set the worksheet margins for the printed page.

Parameters

- **left** (*float*) – Left margin in inches. Default 0.7.
- **right** (*float*) – Right margin in inches. Default 0.7.
- **top** (*float*) – Top margin in inches. Default 0.75.
- **bottom** (*float*) – Bottom margin in inches. Default 0.75.

The `set_margins()` method is used to set the margins of the worksheet when it is printed. The units are in inches. All parameters are optional and have default values corresponding to the default Excel values.

8.8 worksheet.set_header()

set_header ([*header=','* *margin=0.3*]])

Set the printed page header caption and optional margin.

Parameters

- **header** (*string*) – Header string with Excel control characters.
- **margin** (*float*) – Header margin in inches. Default 0.3.

Headers and footers are generated using a string which is a combination of plain text and control characters.

The available control character are:

Control	Category	Description
&L	Justification	Left
&C		Center
&R		Right
&P	Information	Page number
&N		Total number of pages
&D		Date
&T		Time
&F		File name
&A		Worksheet name
&Z		Workbook path
&fontsize	Font	Font size
&"font,style"		Font name and style
&U		Single underline
&E		Double underline
&S		Strikethrough
&X		Superscript
&Y		Subscript
&&	Miscellaneous	Literal ampersand &

```
worksheet.set_header('&LHello')
```

```
|-----|
| Hello |
```

```
$worksheet->set_header('&CHello');
```

|
|
| Hello

```
$worksheet->set_header('&RHello');
```

```

|-----|
|                                             Hello
|

```

```
worksheet.set_header('Hello')
```

Hello

You can have text in each of the justification regions:

```
worksheet.set_header('&LCiao&CBello&RCielo')
```

Ciao	Bello	Cielo

The information control characters act as variables that Excel will update as the workbook or worksheet changes. Times and dates are in the users default format:

```
worksheet.set_header('&CPage &P of &N')
```

Page 1 of 6

```
worksheet.set_header('&CUpdated at &T')
```

Updated at 12:30 PM

You can specify the font size of a section of the text by prefixing it with the control character &n where n is the font size:

```
worksheet1.set_header('&C&30Hello Big')  
worksheet2.set_header('&C&10Hello Small')
```

You can specify the font of a section of the text by prefixing it with the control sequence &"font,style" where fontname is a font name such as "Courier New" or "Times New Roman" and style is one of the standard Windows font descriptions: "Regular", "Italic", "Bold" or "Bold Italic":

```
worksheet1.set_header('&C&"Courier New,Italic"Hello')  
worksheet2.set_header('&C&"Courier New,Bold Italic"Hello')  
worksheet3.set_header('&C&"Times New Roman,Regular"Hello')
```

It is possible to combine all of these features together to create sophisticated headers and footers. As an aid to setting up complicated headers and footers you can record a page set-up as a macro in Excel and look at the format strings that VBA produces. Remember however that VBA uses two double quotes "" to indicate a single double quote. For the last example above the equivalent

VBA code looks like this:

```
.LeftHeader = ""
.CenterHeader = "&"Times New Roman,Regular""Hello"
.RightHeader = ""
```

To include a single literal ampersand & in a header or footer you should use a double ampersand &&:

```
worksheet1.set_header('&&Curiouser and Curiouser - Attorneys at Law')
```

As stated above the margin parameter is optional. As with the other margins the value should be in inches. The default header and footer margin is 0.3 inch. The header and footer margin size can be set as follows:

```
worksheet.set_header('&CHello', 0.75)
```

The header and footer margins are independent of the top and bottom margins.

Note, the header or footer string must be less than 255 characters. Strings longer than this will not be written and an exception will be thrown.

See also [Example: Adding Headers and Footers to Worksheets](#).

8.9 worksheet.set_footer()

set_footer ([*footer*="",] *margin*=0.3])

Set the printed page footer caption and optional margin.

Parameters

- **footer** (*string*) – Footer string with Excel control characters.
- **margin** (*float*) – Footer margin in inches. Default 0.3.

The syntax of the `set_footer()` method is the same as `set_header()`.

8.10 worksheet.repeat_rows()

repeat_rows (*first_row*[, *last_row*])

Set the number of rows to repeat at the top of each printed page.

Parameters

- **first_row** (*int*) – First row of repeat range.
- **last_row** (*int*) – Last row of repeat range. Optional.

For large Excel documents it is often desirable to have the first row or rows of the worksheet print out at the top of each page.

This can be achieved by using the `repeat_rows()` method. The parameters `first_row` and `last_row` are zero based. The `last_row` parameter is optional if you only wish to specify one row:

```
worksheet1.repeat_rows(0)      # Repeat the first row.
worksheet2.repeat_rows(0, 1)   # Repeat the first two rows.
```

8.11 worksheet.repeat_columns()

repeat_columns(*first_col*[, *last_col*])

Set the columns to repeat at the left hand side of each printed page.

Parameters

- **first_col** (*int*) – First column of repeat range.
- **last_col** (*int*) – Last column of repeat range. Optional.

For large Excel documents it is often desirable to have the first column or columns of the worksheet print out at the left hand side of each page.

This can be achieved by using the `repeat_columns()` method. The parameters `first_column` and `last_column` are zero based. The `last_column` parameter is optional if you only wish to specify one column. You can also specify the columns using A1 column notation, see [Working with Cell Notation](#) for more details.:

```
worksheet1.repeat_columns(0)      # Repeat the first column.
worksheet2.repeat_columns(0, 1)   # Repeat the first two columns.
worksheet3.repeat_columns('A:A') # Repeat the first column.
worksheet4.repeat_columns('A:B') # Repeat the first two columns.
```

8.12 worksheet.hide_gridlines()

hide_gridlines([*option=1*])

Set the option to hide gridlines on the screen and the printed page.

Parameters *option* (*int*) – Hide gridline options. See below.

This method is used to hide the gridlines on the screen and printed page. Gridlines are the lines that divide the cells on a worksheet. Screen and printed gridlines are turned on by default in an Excel worksheet.

If you have defined your own cell borders you may wish to hide the default gridlines:

```
worksheet.hide_gridlines()
```

The following values of *option* are valid:

- 0. Don't hide gridlines.

1. Hide printed gridlines only.
2. Hide screen and printed gridlines.

If you don't supply an argument the default option is 1, i.e. only the printed gridlines are hidden.

8.13 `worksheet.print_row_col_headers()`

`print_row_col_headers()`

Set the option to print the row and column headers on the printed page.

When you print a worksheet from Excel you get the data selected in the print area. By default the Excel row and column headers (the row numbers on the left and the column letters at the top) aren't printed.

The `print_row_col_headers()` method sets the printer option to print these headers:

```
worksheet.print_row_col_headers()
```

8.14 `worksheet.print_area()`

`print_area(first_row, first_col, last_row, last_col)`

Set the print area in the current worksheet.

Parameters

- **first_row** (*integer*) – The first row of the range. (All zero indexed.)
- **first_col** (*integer*) – The first column of the range.
- **last_row** (*integer*) – The last row of the range.
- **last_col** (*integer*) – The last col of the range.
- **formula** – Array formula to write to cell.

This method is used to specify the area of the worksheet that will be printed.

All four parameters must be specified. You can also use A1 notation, see [Working with Cell Notation](#):

```
worksheet1.print_area('A1:H20')    # Cells A1 to H20.
worksheet2.print_area(0, 0, 19, 7) # The same as above.
worksheet3.print_area('A:H')       # Columns A to H if rows have data.
```

8.15 `worksheet.print_across()`

`print_across()`

Set the order in which pages are printed.

The `print_across` method is used to change the default print direction. This is referred to by Excel as the sheet “page order”:

```
worksheet.print_across()
```

The default page order is shown below for a worksheet that extends over 4 pages. The order is called “down then across”:

```
[1] [3]
[2] [4]
```

However, by using the `print_across` method the print order will be changed to “across then down”:

```
[1] [2]
[3] [4]
```

8.16 worksheet.fit_to_pages()

fit_to_pages (*width*, *height*)

Fit the printed area to a specific number of pages both vertically and horizontally.

Parameters

- **width** (*int*) – Number of pages horizontally.
- **height** (*int*) – Number of pages vertically.

The `fit_to_pages()` method is used to fit the printed area to a specific number of pages both vertically and horizontally. If the printed area exceeds the specified number of pages it will be scaled down to fit. This ensures that the printed area will always appear on the specified number of pages even if the page size or margins change:

```
worksheet1.fit_to_pages(1, 1) # Fit to 1x1 pages.
worksheet2.fit_to_pages(2, 1) # Fit to 2x1 pages.
worksheet3.fit_to_pages(1, 2) # Fit to 1x2 pages.
```

The print area can be defined using the `print_area()` method as described above.

A common requirement is to fit the printed output to *n* pages wide but have the height be as long as necessary. To achieve this set the height to zero:

```
worksheet1.fit_to_pages(1, 0) # 1 page wide and as long as necessary.
```

Note: Although it is valid to use both `fit_to_pages()` and `set_print_scale()` on the same worksheet only one of these options can be active at a time. The last method call made will set the active option.

Note: The `fit_to_pages()` will override any manual page breaks that are defined in the worksheet.

Note: When using `fit_to_pages()` it may also be required to set the printer paper size using `set_paper()` or else Excel will default to “US Letter”.

8.17 worksheet.set_start_page()

`set_start_page()`

Set the start page number when printing.

Parameters `start_page` (*int*) – Starting page number.

The `set_start_page()` method is used to set the number of the starting page when the worksheet is printed out:

```
worksheet.set_start_page(2)
```

8.18 worksheet.set_print_scale()

`set_print_scale()`

Set the scale factor for the printed page.

Parameters `scale` (*int*) – Print scale of worksheet to be printed.

Set the scale factor of the printed page. Scale factors in the range `10 <= $scale <= 400` are valid:

```
worksheet1.set_print_scale(50)
worksheet2.set_print_scale(75)
worksheet3.set_print_scale(300)
worksheet4.set_print_scale(400)
```

The default scale factor is 100. Note, `set_print_scale()` does not affect the scale of the visible page in Excel. For that you should use `set_zoom()`.

Note also that although it is valid to use both `fit_to_pages()` and `set_print_scale()` on the same worksheet only one of these options can be active at a time. The last method call made will set the active option.

8.19 worksheet.set_h_pagebreaks()

`set_h_pagebreaks` (*breaks*)

Set the horizontal page breaks on a worksheet.

Parameters `breaks` (*list*) – List of pagebreak rows.

The `set_h_pagebreaks()` method adds horizontal page breaks to a worksheet. A page break causes all the data that follows it to be printed on the next page. Horizontal page breaks act between rows. To create a page break between rows 20 and 21 you must specify the break at row 21. However in zero index notation this is actually row 20. So you can pretend for a small while that you are using 1 index notation:

```
worksheet1.set_h_pagebreaks([20]) # Break between row 20 and 21.
```

The `set_v_pagebreaks()` method takes a list of page breaks:

```
worksheet2.set_v_pagebreaks([20, 40, 60, 80, 100])
```

Note: Note: If you specify the “fit to page” option via the `fit_to_pages()` method it will override all manual page breaks.

There is a silent limitation of 1023 horizontal page breaks per worksheet in line with an Excel internal limitation.

8.20 worksheet.set_v_pagebreaks()

set_v_pagebreaks (*breaks*)

Set the vertical page breaks on a worksheet.

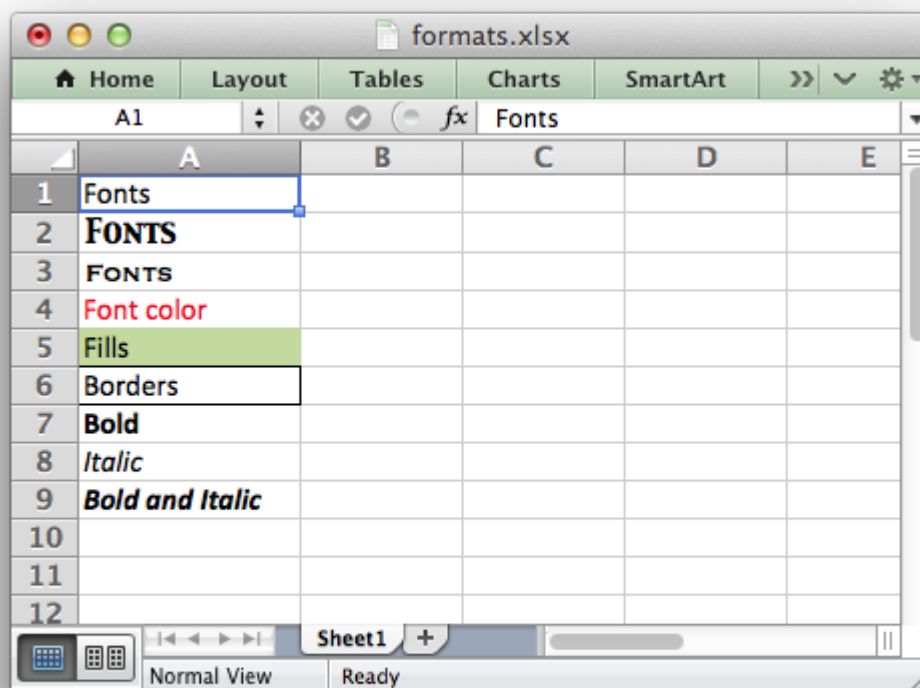
Parameters *breaks* (*list*) – List of pagebreak columns.

The `set_v_pagebreaks()` method is the same as the above `set_h_pagebreaks()` method except it adds page breaks between columns.

THE FORMAT CLASS

This section describes the methods and properties that are available for formatting cells in Excel.

The properties of a cell that can be formatted include: fonts, colours, patterns, borders, alignment and number formatting.



9.1 `format.set_font_name()`

`set_font_name(fontname)`

Set the font used in the cell.

Parameters `fontname` (*string*) – Cell font.

Specify the font used in the cell format:

```
cell_format.set_font_name('Times New Roman')
```

Excel can only display fonts that are installed on the system that it is running on. Therefore it is best to use the fonts that come as standard such as 'Calibri', 'Times New Roman' and 'Courier New'.

The default font for an unformatted cell in Excel 2007+ is 'Calibri'.

9.2 `format.set_font_size()`

`set_font_size(size)`

Set the size of the font used in the cell.

Parameters `size` (*int*) – The cell font size.

Set the font size of the cell format:

```
format = workbook.add_format()
format.set_font_size(30)
```

Excel adjusts the height of a row to accommodate the largest font size in the row. You can also explicitly specify the height of a row using the `set_row()` worksheet method.

9.3 `format.set_font_color()`

`set_font_color(color)`

Set the color of the font used in the cell.

Parameters `color` (*string*) – The cell font color.

Set the font colour:

```
format = workbook.add_format()

format.set_font_color('red')

worksheet.write(0, 0, 'wheelbarrow', format)
```

The color can be a Html style #RRGGBB string or a limited number of named colors, see [Format Colors](#).

Note: The `set_font_color()` method is used to set the colour of the font in a cell. To set the colour of a cell use the `set_bg_color()` and `set_pattern()` methods.

9.4 `format.set_bold()`

`set_bold()`

Turn on bold for the format font.

Set the bold property of the font:

```
format.set_bold()
```

9.5 `format.set_italic()`

`set_italic()`

Turn on italic for the format font.

Set the italic property of the font:

```
format.set_italic()
```

9.6 `format.set_underline()`

`set_underline()`

Turn on underline for the format.

Parameters `style (int)` – Underline style.

Set the underline property of the format:

```
format.set_underline()
```

The available underline styles are:

- 1 = Single underline (the default)
- 2 = Double underline
- 33 = Single accounting underline
- 34 = Double accounting underline

9.7 `format.set_font_strikeout()`

`set_font_strikeout()`

Set the strikeout property of the font.

9.8 format.set_font_script()

set_font_script()

Set the superscript/subscript property of the font.

The available options are:

- 1 = Superscript
- 2 = Subscript

9.9 format.set_num_format()

set_num_format(*format_string*)

Set the number format for a cell.

Parameters *format_string* (*string*) – The cell number format.

This method is used to define the numerical format of a number in Excel. It controls whether a number is displayed as an integer, a floating point number, a date, a currency value or some other user defined format.

The numerical format of a cell can be specified by using a format string or an index to one of Excel's built-in formats:

```
format1 = workbook.add_format()
format2 = workbook.add_format()

format1.set_num_format('d mmm yyyy') # Format string.
format2.set_num_format(0x0F)         # Format index.
```

Format strings can control any aspect of number formatting allowed by Excel:

```
format01.set_num_format('0.000')
worksheet.write(1, 0, 3.1415926, format01)      # -> 3.142

format02.set_num_format('#,##0')
worksheet.write(2, 0, 1234.56, format02)        # -> 1,235

format03.set_num_format('#,##0.00')
worksheet.write(3, 0, 1234.56, format03)        # -> 1,234.56

format04.set_num_format('0.00')
worksheet.write(4, 0, 49.99, format04)          # -> 49.99

format05.set_num_format('mm/dd/yy')
worksheet.write(5, 0, 36892.521, format05)      # -> 01/01/01

format06.set_num_format('mmm d yyyy')
worksheet.write(6, 0, 36892.521, format06)      # -> Jan 1 2001

format07.set_num_format('d mmmm yyyy')
```



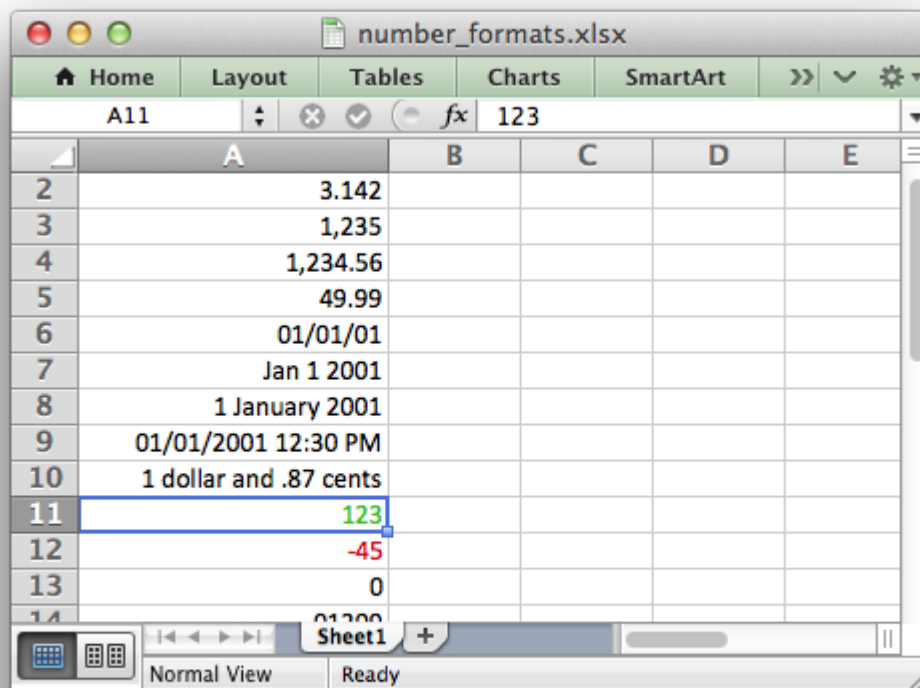
```
worksheet.write(7, 0, 36892.521, format07)           # -> 1 January 2001

format08.set_num_format('dd/mm/yyyy hh:mm AM/PM')
worksheet.write(8, 0, 36892.521, format08)           # -> 01/01/2001 12:30 AM

format09.set_num_format('0 "dollar and" .00 "cents"')
worksheet.write(9, 0, 1.87, format09)                 # -> 1 dollar and .87 cents

# Conditional numerical formatting.
format10.set_num_format('[Green]General;[Red]-General;General')
worksheet.write(10, 0, 123, format10)                 # > 0 Green
worksheet.write(11, 0, -45, format10)                 # < 0 Red
worksheet.write(12, 0, 0, format10)                   # = 0 Default colour

# Zip code.
format11.set_num_format('00000')
worksheet.write(13, 0, 1209, format11)
```



The number system used for dates is described in [Working with Dates and Time](#).

The colour format should have one of the following values:

[Black] [Blue] [Cyan] [Green] [Magenta] [Red] [White] [Yellow]

For more information refer to the [Microsoft documentation on cell formats](#).

Excel's built-in formats are shown in the following table:

Index	Index	Format String
0	0x00	General
1	0x01	0
2	0x02	0.00
3	0x03	#,##0
4	0x04	#,##0.00
5	0x05	(\$#,##0_);(\$#,##0)
6	0x06	(\$#,##0_);[Red](\$#,##0)
7	0x07	(\$#,##0.00_);(\$#,##0.00)
8	0x08	(\$#,##0.00_);[Red](\$#,##0.00)
9	0x09	0%
10	0x0a	0.00%
11	0x0b	0.00E+00
12	0x0c	# ?/?
13	0x0d	# ??/??
14	0x0e	m/d/yy
15	0x0f	d-mmm-yy
16	0x10	d-mmm
17	0x11	mmm-yy
18	0x12	h:mm AM/PM
19	0x13	h:mm:ss AM/PM
20	0x14	h:mm
21	0x15	h:mm:ss
22	0x16	m/d/yy h:mm
...
37	0x25	(#,##0_);(#,##0)
38	0x26	(#,##0_);[Red](#,##0)
39	0x27	(#,##0.00_);(#,##0.00)
40	0x28	(#,##0.00_);[Red](#,##0.00)
41	0x29	_(* #,##0_);_(* (#,##0);_(* " - ");_(@)
42	0x2a	_(\$* #,##0_);_(\$* (#,##0);_(\$* " - ");_(@)
43	0x2b	_(* #,##0.00_);_(* (#,##0.00);_(* " - " ??);_(@)
44	0x2c	_(\$* #,##0.00_);_(\$* (#,##0.00);_(\$* " - " ??);_(@)
45	0x2d	mm:ss
46	0x2e	[h]:mm:ss
47	0x2f	mm:ss.0
48	0x30	##0.0E+0
49	0x31	@

Note: Numeric formats 23 to 36 are not documented by Microsoft and may differ in international versions.

Note: The dollar sign appears as the defined local currency symbol.

9.10 format.set_locked()

set_locked(*state*)

Set the cell locked state.

Parameters *state* (*bool*) – Turn cell locking on or off. Defaults to True.

This property can be used to prevent modification of a cells contents. Following Excel's convention, cell locking is turned on by default. However, it only has an effect if the worksheet has been protected using the worksheet `protect()` method:

```
locked = workbook.add_format()
locked.set_locked(True)

unlocked = workbook.add_format()
locked.set_locked(False)

# Enable worksheet protection
worksheet.protect()

# This cell cannot be edited.
worksheet.write('A1', '=1+2', locked)

# This cell can be edited.
worksheet.write('A2', '=1+2', unlocked)
```

9.11 format.set_hidden()

set_hidden()

Hide formulas in a cell.

This property is used to hide a formula while still displaying its result. This is generally used to hide complex calculations from end users who are only interested in the result. It only has an effect if the worksheet has been protected using the worksheet `protect()` method:

```
hidden = workbook.add_format()
hidden.set_hidden()

# Enable worksheet protection
worksheet.protect()

# The formula in this cell isn't visible
worksheet.write('A1', '=1+2', hidden)
```

9.12 `format.set_align()`

`set_align(alignment)`

Set the alignment for data in the cell.

Parameters `alignment` (*string*) – The vertical and or horizontal alignment direction.

This method is used to set the horizontal and vertical text alignment within a cell. The following are the available horizontal alignments:

Horizontal alignment
center
right
fill
justify
center_across

The following are the available vertical alignments:

Vertical alignment
top
vcenter
bottom
vjustify

As in Excel, vertical and horizontal alignments can be combined:

```
format = workbook.add_format()

format.set_align('center')
format.set_align('vcenter')

worksheet.set_row(0, 30)
worksheet.write(0, 0, 'Some Text', format)
```

Text can be aligned across two or more adjacent cells using the `'center_across'` property. However, for genuine merged cells it is better to use the `merge_range()` worksheet method.

The `'vjustify'` (vertical justify) option can be used to provide automatic text wrapping in a cell. The height of the cell will be adjusted to accommodate the wrapped text. To specify where the text wraps use the `set_text_wrap()` method.

9.13 `format.set_center_across()`

`set_center_across()`

Centre text across adjacent cells.

Text can be aligned across two or more adjacent cells using the `set_center_across()` method. This is an alias for the `set_align('center_across')` method call.

Only one cell should contain the text, the other cells should be blank:

```
format = workbook.add_format()
format.set_center_across()

worksheet.write(1, 1, 'Center across selection', format)
worksheet.write_blank(1, 2, format)
```

For actual merged cells it is better to use the `merge_range()` worksheet method.

9.14 `format.set_text_wrap()`

`set_text_wrap()`

Wrap text in a cell.

Turn text wrapping on for text in a cell:

```
format = workbook.add_format()
format.set_text_wrap()

worksheet.write(0, 0, "Some long text to wrap in a cell", format)
```

If you wish to control where the text is wrapped you can add newline characters to the string:

```
format = workbook.add_format()
format.set_text_wrap()

worksheet.write(0, 0, "It's\na bum\nwrap", format)
```

Excel will adjust the height of the row to accommodate the wrapped text. A similar effect can be obtained without newlines using the `set_align('vjustify')` method.

9.15 `format.set_rotation()`

`set_rotation(angle)`

Set the rotation of the text in a cell.

Parameters *angle* (*int*) – Rotation angle in the range -90 to 90 and 270.

Set the rotation of the text in a cell. The rotation can be any angle in the range -90 to 90 degrees:

```
format = workbook.add_format()
format.set_rotation(30)

worksheet.write(0, 0, 'This text is rotated', format)
```

The angle 270 is also supported. This indicates text where the letters run from top to bottom.

9.16 format.set_indent()

set_indent (*level*)

Set the cell text indentation level.

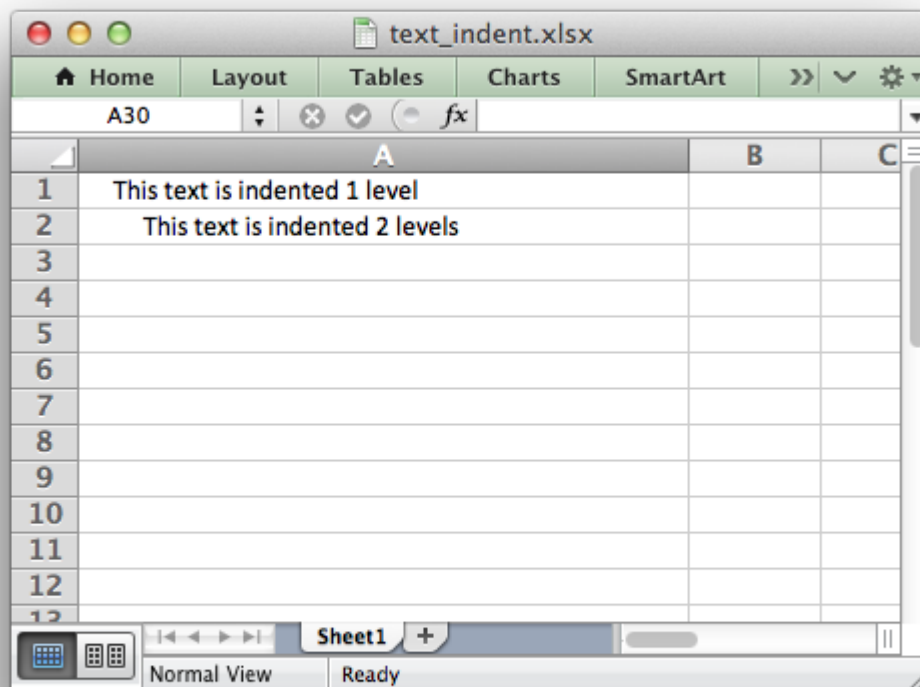
Parameters *level* (*int*) – Indentation level.

This method can be used to indent text in a cell. The argument, which should be an integer, is taken as the level of indentation:

```
format1 = workbook.add_format()
format2 = workbook.add_format()

format1.set_indent(1)
format2.set_indent(2)

worksheet.write('A1', "This text is indented 1 level", format1)
worksheet.write('A2', "This text is indented 2 levels", format2)
```



Indentation is a horizontal alignment property. It will override any other horizontal properties but it can be used in conjunction with vertical properties.

9.17 format.set_shrink()

set_shrink()

Turn on the text “shrink to fit” for a cell.

This method can be used to shrink text so that it fits in a cell:

```
format = workbook.add_format()
format.set_shrink()

worksheet.write(0, 0, 'Honey, I shrunk the text!', format)
```

9.18 format.set_text_justlast()

set_text_justlast()

Turn on the justify last text property.

Only applies to Far Eastern versions of Excel.

9.19 format.set_pattern()

set_pattern(*index*)

Parameters *index* (*int*) – Pattern index. 0 - 18.

Set the background pattern of a cell.

The most common pattern is 1 which is a solid fill of the background color.

9.20 format.set_bg_color()

set_bg_color(*color*)

Set the color of the background pattern in a cell.

Parameters *color* (*string*) – The cell font color.

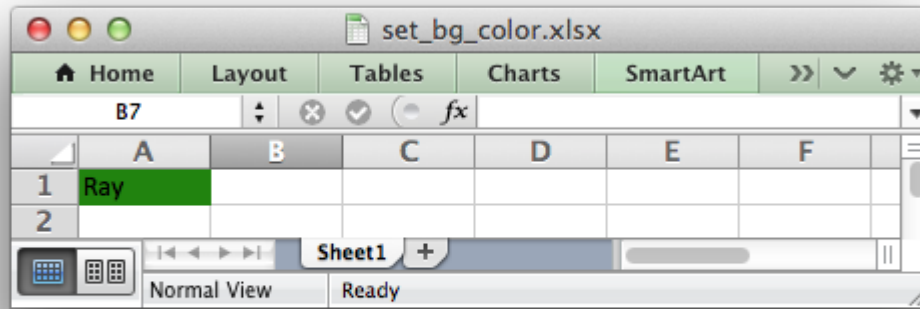
The `set_bg_color()` method can be used to set the background colour of a pattern. Patterns are defined via the `set_pattern()` method. If a pattern hasn't been defined then a solid fill pattern is used as the default.

Here is an example of how to set up a solid fill in a cell:

```
format = workbook.add_format()

format.set_pattern(1) # This is optional when using a solid fill.
format.set_bg_color('green')

worksheet.write('A1', 'Ray', format)
```



The color can be a Html style #RRGGBB string or a limited number of named colors, see [Format Colors](#).

9.21 format.set_fg_color()

set_fg_color(*color*)

Set the color of the foreground pattern in a cell.

Parameters *color* (*string*) – The cell font color.

The `set_fg_color()` method can be used to set the foreground colour of a pattern.

The color can be a Html style #RRGGBB string or a limited number of named colors, see [Format Colors](#).

9.22 format.set_border()

set_border(*style*)

Set the cell border style.

Parameters *style* (*int*) – Border style index. Default is 1.

Individual border elements can be configured using the following methods with the same parameters:

- `set_bottom()`
- `set_top()`
- `set_left()`
- `set_right()`

A cell border is comprised of a border on the bottom, top, left and right. These can be set to the same value using `set_border()` or individually using the relevant method calls shown above.

The following shows the border styles sorted by XlsxWriter index number:

Index	Name	Weight	Style
0	None	0	
1	Continuous	1	-----
2	Continuous	2	-----
3	Dash	1	- - - - -
4	Dot	1
5	Continuous	3	-----
6	Double	3	=====
7	Continuous	0	-----
8	Dash	2	- - - - -
9	Dash Dot	1	- . - . - .
10	Dash Dot	2	- . - . - .
11	Dash Dot Dot	1	- . . - . .
12	Dash Dot Dot	2	- . . - . .
13	SlantDash Dot	2	/ - . / - .

The following shows the borders in the order shown in the Excel Dialog:

Index	Style	Index	Style
0	None	12	- . . - . .
7	-----	13	/ - . / - .
4	10	- . - . - .
11	- . . - . .	8	- - - - -
9	- . - . - .	2	-----
3	- - - - -	5	-----
1	-----	6	=====

9.23 format.set_bottom()

set_bottom(*style*)

Set the cell bottom border style.

Parameters *style* (*int*) – Border style index. Default is 1.

Set the cell bottom border style. See `set_border()` for details on the border styles.

9.24 format.set_top()

set_top(*style*)

Set the cell top border style.

Parameters *style* (*int*) – Border style index. Default is 1.

Set the cell top border style. See `set_border()` for details on the border styles.

9.25 `format.set_left()`

`set_left(style)`

Set the cell left border style.

Parameters `style` (*int*) – Border style index. Default is 1.

Set the cell left border style. See `set_border()` for details on the border styles.

9.26 `format.set_right()`

`set_right(style)`

Set the cell right border style.

Parameters `style` (*int*) – Border style index. Default is 1.

Set the cell right border style. See `set_border()` for details on the border styles.

9.27 `format.set_border_color()`

`set_border_color(color)`

Set the color of the cell border.

Parameters `color` (*string*) – The cell border color.

Individual border elements can be configured using the following methods with the same parameters:

- `set_bottom_color()`
- `set_top_color()`
- `set_left_color()`
- `set_right_color()`

Set the colour of the cell borders. A cell border is comprised of a border on the bottom, top, left and right. These can be set to the same colour using `set_border_color()` or individually using the relevant method calls shown above.

The color can be a Html style `#RRGGBB` string or a limited number of named colors, see [Format Colors](#).

9.28 `format.set_bottom_color()`

`set_bottom_color(color)`

Set the color of the bottom cell border.

Parameters `color` (*string*) – The cell border color.

See `set_border_color()` for details on the border colors.

9.29 `format.set_top_color()`

`set_top_color(color)`

Set the color of the top cell border.

Parameters `color` (*string*) – The cell border color.

See `set_border_color()` for details on the border colors.

9.30 `format.set_left_color()`

`set_left_color(color)`

Set the color of the left cell border.

Parameters `color` (*string*) – The cell border color.

See `set_border_color()` for details on the border colors.

9.31 `format.set_right_color()`

`set_right_color(color)`

Set the color of the right cell border.

Parameters `color` (*string*) – The cell border color.

See `set_border_color()` for details on the border colors.

WORKING WITH CELL NOTATION

XlsxWriter supports two forms of notation to designate the position of cells: **Row-column** notation and **A1** notation.

Row-column notation uses a zero based index for both row and column while A1 notation uses the standard Excel alphanumeric sequence of column letter and 1-based row. For example:

```
(0, 0)      # Row-column notation.  
( 'A1' )    # The same cell in A1 notation.  
  
(6, 2)      # Row-column notation.  
( 'C7' )    # The same cell in A1 notation.
```

Row-column notation is useful if you are referring to cells programmatically:

```
for row in range(0, 5):  
    worksheet.write(row, 0, 'Hello')
```

A1 notation is useful for setting up a worksheet manually and for working with formulas:

```
worksheet.write('H1', 200)  
worksheet.write('H2', '=H1+1')
```

In general when using the XlsxWriter module you can use A1 notation anywhere you can use row-column notation:

```
# These are equivalent.  
worksheet.write(0, 7, 200)  
worksheet.write('H1', 200)
```

The XlsxWriter utility contains several helper functions for dealing with A1 notation, for example:

```
from utility import xl_cell_to_rowcol, xl_rowcol_to_cell  
  
(row, col) = xl_cell_to_rowcol('C2') # -> (1, 2)  
string      = xl_rowcol_to_cell(1, 2) # -> C2
```

Note: In Excel it is also possible to use R1C1 notation. This is not supported by XlsxWriter.

WORKING WITH FORMATS

The methods and properties used to add formatting to a cell are shown in *The Format Class*. This section provides some additional information about working with formats.

11.1 Creating and using a Format object

Cell formatting is defined through a *Format object*. Format objects are created by calling the `workbook.add_format()` method as follows:

```
format1 = workbook.add_format()      # Set properties later.
format2 = workbook.add_format(props) # Set properties at creation.
```

Once a Format object has been constructed and its properties have been set it can be passed as an argument to the worksheet write methods as follows:

```
worksheet.write      (0, 0, 'Foo', format)
worksheet.write_string(1, 0, 'Bar', format)
worksheet.write_number(2, 0, 3,      format)
worksheet.write_blank (3, 0, '',      format)
```

Formats can also be passed to the worksheet `set_row()` and `set_column()` methods to define the default property for a row or column:

```
worksheet.set_row(0, 18, format)
worksheet.set_column('A:D', 20, format)
```

11.2 Format methods and Format properties

The following table shows the Excel format categories, the formatting properties that can be applied and the equivalent object method:

Category	Description	Property	Method Name
Font	Font type	'font_name'	<code>set_font_name()</code>
Continued on next page			

Table 11.1 – continued from previous page

Category	Description	Property	Method Name
	Font size	'font_size'	set_font_size()
	Font color	'font_color'	set_font_color()
	Bold	'bold'	set_bold()
	Italic	'italic'	set_italic()
	Underline	'underline'	set_underline()
	Strikeout	'font_strikeout'	set_font_strikeout()
	Super/Subscript	'font_script'	set_font_script()
Number	Numeric format	'num_format'	set_num_format()
Protection	Lock cells	'locked'	set_locked()
	Hide formulas	'hidden'	set_hidden()
Alignment	Horizontal align	'align'	set_align()
	Vertical align	'valign'	set_align()
	Rotation	'rotation'	set_rotation()
	Text wrap	'text_wrap'	set_text_wrap()
	Justify last	'text_justlast'	set_text_justlast()
	Center across	'center_across'	set_center_across()
	Indentation	'indent'	set_indent()
	Shrink to fit	'shrink'	set_shrink()
Pattern	Cell pattern	'pattern'	set_pattern()
	Background color	'bg_color'	set_bg_color()
	Foreground color	'fg_color'	set_fg_color()
Border	Cell border	'border'	set_border()
	Bottom border	'bottom'	set_bottom()
	Top border	'top'	set_top()
	Left border	'left'	set_left()
	Right border	'right'	set_right()
	Border color	'border_color'	set_border_color()
	Bottom color	'bottom_color'	set_bottom_color()
	Top color	'top_color'	set_top_color()
	Left color	'left_color'	set_left_color()
	Right color	'right_color'	set_right_color()

There are two ways of setting Format properties: by using the object interface or by setting the property as a dictionary of key/value pairs in the constructor. For example, a typical use of the object interface would be as follows:

```
format = workbook.add_format()
format.set_bold()
format.set_font_color('red')
```

By comparison the properties can be set by passing a dictionary of properties to the *add_format()* constructor:

```
format = workbook.add_format({'bold': True, 'font_color': 'red'})
```

The object method interface is mainly provided for backward compatibility with *Ex-*

`cel::Writer::XLSX`. The key/value interface has proved to be more flexible in real world programs and is the recommended method for setting format properties.

11.3 Format Colors

Format property colors are specified using a Html style #RRGGBB index:

```
cell_format.set_font_color('#FF0000')
```

For backward compatibility with `Excel::Writer::XLSX` a limited number of color names are supported:

```
cell_format.set_font_color('red')
```

The color names and corresponding #RRGGBB indices are shown below:

Color name	RGB color code
black	#000000
blue	#0000FF
brown	#800000
cyan	#00FFFF
gray	#808080
green	#008000
lime	#00FF00
magenta	#FF00FF
navy	#000080
orange	#FF6600
pink	#FF00FF
purple	#800080
red	#FF0000
silver	#C0C0C0
white	#FFFFFF
yellow	#FFFF00

11.4 Format Defaults

The default Excel 2007+ cell format is Calibri 11 with all other properties off.

In general a format method call without an argument will turn a property on, for example:

```
format1 = workbook.add_format()

format1.set_bold()    # Turns bold on.
format1.set_bold(1)   # Also turns bold on.
```

Since most properties are already off by default it isn't generally required to turn them off. However, it is possible if required:

```
format1.set_bold(0); # Turns bold off.
```

11.5 Modifying Formats

Each unique cell format in an XlsxWriter spreadsheet must have a corresponding Format object. It isn't possible to use a Format with a `write()` method and then redefine it for use at a later stage. This is because a Format is applied to a cell not in its current state but in its final state. Consider the following example:

```
format = workbook.add_format({'bold': True, 'font_color': 'red'})
worksheet.write('A1', 'Cell A1', format)

# Later...
format.set_font_color('green')
worksheet.write('B1', 'Cell B1', format)
```

Cell A1 is assigned a format which initially has the font set to the colour red. However, the colour is subsequently set to green. When Excel displays Cell A1 it will display the final state of the Format which in this case will be the colour green.

WORKING WITH DATES AND TIME

Dates and times in Excel are represented by real numbers, for example “Jan 1 2013 12:00 PM” is represented by the number 41275.5.

The integer part of the number stores the number of days since the epoch and the fractional part stores the percentage of the day.

A date or time in Excel is just like any other number. To display the number as a date you must apply an Excel number format to it. Here are some examples:

```
from xlswriter.workbook import Workbook

workbook = Workbook('date_examples.xlsx')
worksheet = workbook.add_worksheet()

# Widen column A for extra visibility.
worksheet.set_column('A:A', 30)

# A number to convert to a date.
number = 41333.5

# Write it as a number without formatting.
worksheet.write('A1', number)                # 41333.5

format2 = workbook.add_format({'num_format': 'dd/mm/yy'})
worksheet.write('A2', number, format2)        # 28/02/13

format3 = workbook.add_format({'num_format': 'mm/dd/yy'})
worksheet.write('A3', number, format3)        # 02/28/13

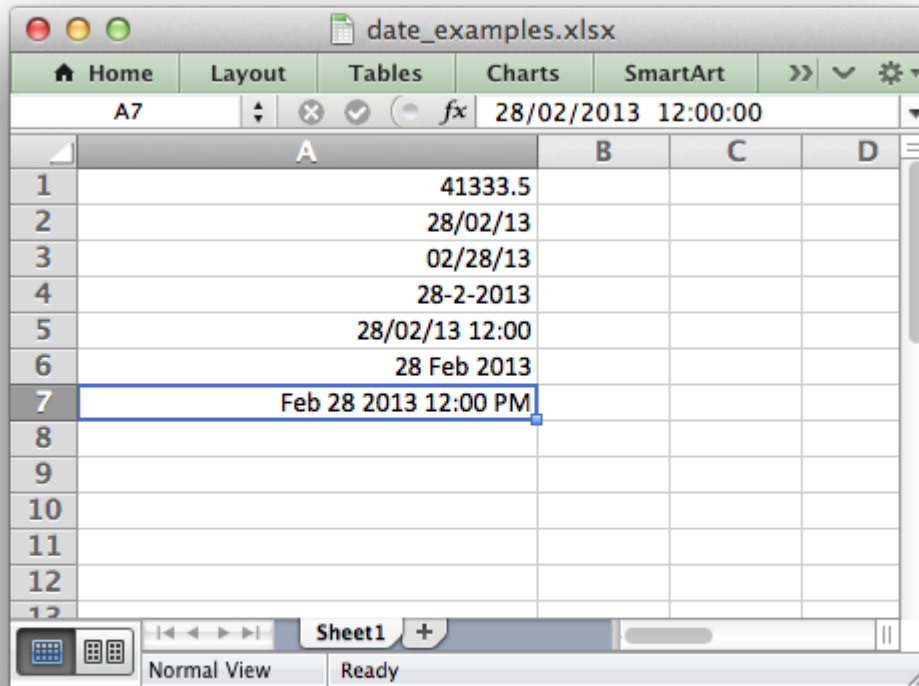
format4 = workbook.add_format({'num_format': 'd-m-yyyy'})
worksheet.write('A4', number, format4)        # 28-2-2013

format5 = workbook.add_format({'num_format': 'dd/mm/yy hh:mm'})
worksheet.write('A5', number, format5)        # 28/02/13 12:00

format6 = workbook.add_format({'num_format': 'd mmm yyyy'})
worksheet.write('A6', number, format6)        # 28 Feb 2013

format7 = workbook.add_format({'num_format': 'mmm d yyyy hh:mm AM/PM'})
```

```
worksheet.write('A7', number, format7)          # Feb 28 2008 12:00 PM
workbook.close()
```



To make working with dates and times a little easier the XlsxWriter module provides a `write_datetime()` method to write dates in standard library `datetime` format.

Specifically it supports datetime objects of type `datetime.datetime`, `datetime.date` and `datetime.time`.

There are many way to create datetime objects, for example the `datetime.datetime.strptime()` method:

```
date_time = datetime.datetime.strptime('2013-01-23', '%Y-%m-%d')
```

See the `datetime` documentation for other date/time creation methods.

As explained above you also need to create and apply a number format to format the date/time:

```
date_format = workbook.add_format({'num_format': 'd mmmm yyyy'})
worksheet.write_datetime('A1', date_time, date_format)
```

```
# Displays "23 January 2013"
```

Here is a longer example that displays the same date in a several different formats:

```

from datetime import datetime
from xlsxwriter.workbook import Workbook

# Create a workbook and add a worksheet.
workbook = Workbook('datetimes.xlsx')
worksheet = workbook.add_worksheet()
bold = workbook.add_format({'bold': True})

# Expand the first columns so that the date is visible.
worksheet.set_column('A:B', 30)

# Write the column headers.
worksheet.write('A1', 'Formatted date', bold)
worksheet.write('B1', 'Format', bold)

# Create a datetime object to use in the examples.
date_time = datetime.strptime('2013-01-23 12:30:05.123',
                              '%Y-%m-%d %H:%M:%S.%f')

# Examples date and time formats.
date_formats = (
    'dd/mm/yy',
    'mm/dd/yy',
    'dd m yy',
    'd mm yy',
    'd mmm yy',
    'd mmmm yy',
    'd mmmm yyy',
    'd mmmm yyyy',
    'dd/mm/yy hh:mm',
    'dd/mm/yy hh:mm:ss',
    'dd/mm/yy hh:mm:ss.000',
    'hh:mm',
    'hh:mm:ss',
    'hh:mm:ss.000',
)

# Start from first row after headers.
row = 1

# Write the same date and time using each of the above formats.
for date_format_str in date_formats:

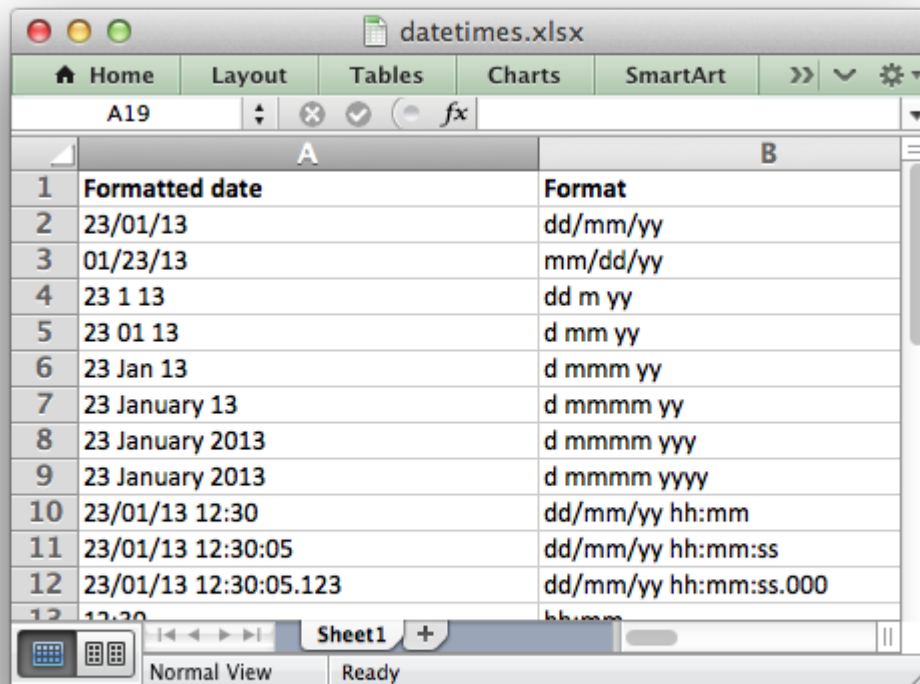
    # Create a format for the date or time.
    date_format = workbook.add_format({'num_format': date_format_str,
                                       'align': 'left'})

    # Write the same date using different formats.
    worksheet.write_datetime(row, 0, date_time, date_format)

    # Also write the format string for comparison.
    worksheet.write_string(row, 1, date_format_str)

```

```
row += 1
```

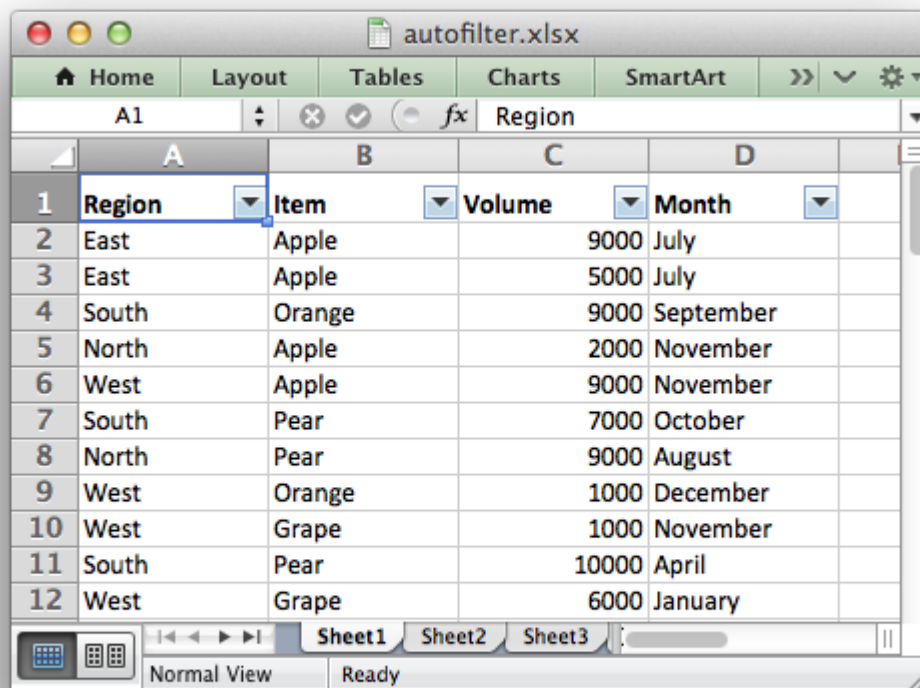


The screenshot shows an Excel spreadsheet with two columns: 'Formatted date' and 'Format'. The data rows show various date and time formats, including full dates, times, and combined date-time strings with varying levels of precision (seconds, milliseconds).

	Formatted date	Format
1	23/01/13	dd/mm/yy
2	01/23/13	mm/dd/yy
3	23 1 13	dd m yy
4	23 01 13	d mm yy
5	23 Jan 13	d mmm yy
6	23 January 13	d mmmm yy
7	23 January 2013	d mmmm yyy
8	23 January 2013	d mmmm yyyy
9	23/01/13 12:30	dd/mm/yy hh:mm
10	23/01/13 12:30:05	dd/mm/yy hh:mm:ss
11	23/01/13 12:30:05.123	dd/mm/yy hh:mm:ss.000
12	12:30	hh:mm

WORKING WITH AUTOFILTERS

An autofilter in Excel is a way of filtering a 2D range of data based on some simple criteria.



13.1 Applying an autofilter

The first step is to apply an autofilter to a cell range in a worksheet using the `autofilter()` method:

```
worksheet.autofilter('A1:D11')
```

As usual you can also use *Row-Column* notation:

```
worksheet.autofilter(0, 0, 10, 3) # Same as above.
```

13.2 Filter data in an autofilter

The `autofilter()` defines the cell range that the filter applies to and creates drop-down selectors in the heading row. In order to filter out data it is necessary to apply some criteria to the columns using either the `filter_column()` or `filter_column_list()` methods.

The `filter_column` method is used to filter columns in a autofilter range based on simple criteria:

```
worksheet.filter_column('A', 'x > 2000')
worksheet.filter_column('B', 'x > 2000 and x < 5000')
```

It isn't sufficient to just specify the filter condition. You must also hide any rows that don't match the filter condition. Rows are hidden using the `set_row()` hidden parameter. XlsxWriter cannot filter rows automatically since it isn't part of the file format.

The following is an example of how you might filter a data range to match an autofilter criteria:

```
# Set the autofilter.
worksheet.autofilter('A1:D51')

# Add the filter criteria. The placeholder "Region" in the filter is
# ignored and can be any string that adds clarity to the expression.
worksheet.filter_column(0, 'Region == East')

# Hide the rows that don't match the filter criteria.
row = 1
for row_data in (data):
    region = row_data[0]

    # Check for rows that match the filter.
    if region == 'East':
        # Row matches the filter, display the row as normal.
        pass
    else:
        # We need to hide rows that don't match the filter.
        worksheet.set_row(row, options={'hidden': True})

    worksheet.write_row(row, 0, row_data)

# Move on to the next worksheet row.
row += 1
```


13.3 Setting a filter criteria for a column

The `filter_column()` method can be used to filter columns in a autofilter range based on simple conditions:

```
worksheet.filter_column('A', 'x > 2000')
```

The `column` parameter can either be a zero indexed column number or a string column name.

The following operators are available for setting the filter criteria:

Operator	Synonyms
<code>==</code>	<code>eq</code> <code>=~ =</code>
<code>!=</code>	<code><></code> <code>ne</code>
<code>></code>	
<code><</code>	
<code>>=</code>	
<code><=</code>	
<code>and</code>	<code>&&</code>
<code>or</code>	<code> </code>

The operator synonyms are just syntactic sugar to make you more comfortable using the expressions. It is important to remember that the expressions will be interpreted by Excel and not by Python.

An expression can comprise a single statement or two statements separated by the `and` and `or` operators. For example:

```
'x < 2000'
'x > 2000'
'x == 2000'
'x > 2000 and x < 5000'
'x == 2000 or x == 5000'
```

Filtering of blank or non-blank data can be achieved by using a value of `Blanks` or `NonBlanks` in the expression:

```
'x == Blanks'
'x == NonBlanks'
```

Excel also allows some simple string matching operations:

```
'x == b*'      # begins with b
'x != b*'      # doesn't begin with b
'x == *b'      # ends with b
'x != *b'      # doesn't end with b
'x == *b*'     # contains b
'x != *b*'     # doesn't contains b
```

You can also use `'*'` to match any character or number and `'?'` to match any single character or number. No other regular expression quantifier is supported by Excel's filters. Excel's regular expression characters can be escaped using `'~'`.

The placeholder variable `x` in the above examples can be replaced by any simple string. The actual placeholder name is ignored internally so the following are all equivalent:

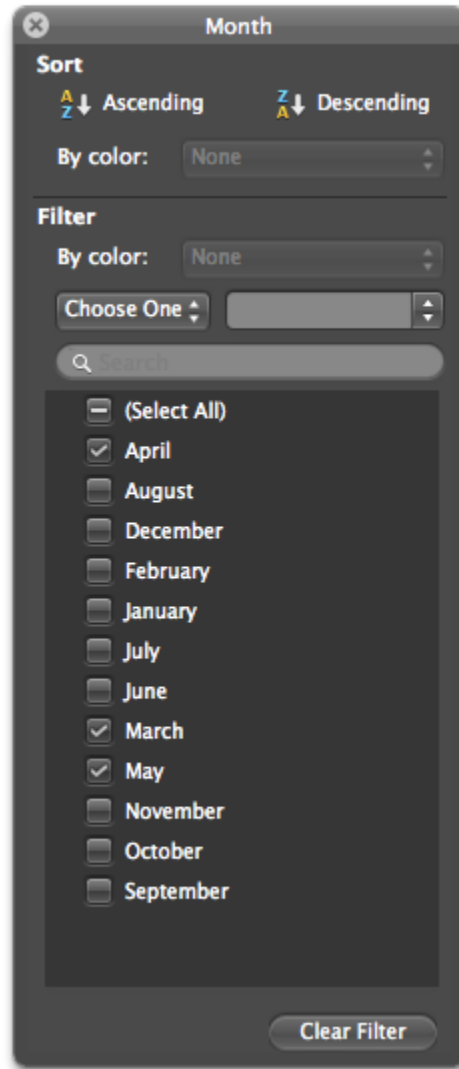
```
'x'      < 2000'  
'col'    < 2000'  
'Price'  < 2000'
```

A filter condition can only be applied to a column in a range specified by the `autofilter()` method.

13.4 Setting a column list filter

Prior to Excel 2007 it was only possible to have either 1 or 2 filter conditions such as the ones shown above in the `filter_column()` method.

Excel 2007 introduced a new list style filter where it is possible to specify 1 or more ‘or’ style criteria. For example if your column contained data for the months of the year you could filter the data based on certain months:



The `filter_column_list()` method can be used to represent these types of filters:

```
worksheet.filter_column_list('A', 'March', 'April', 'May')
```

One or more criteria can be selected:

```
worksheet.filter_column_list('A', 'March')
worksheet.filter_column_list('B', 100, 110, 120, 130)
```

13.5 Example

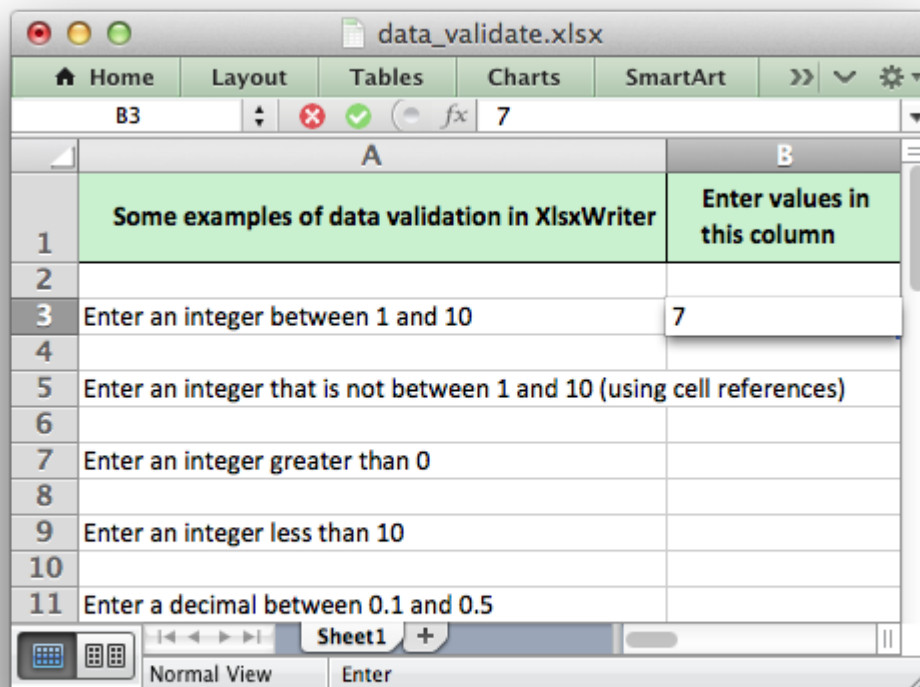
See [Example: Applying Autofilters](#) for a full example of all these features.

WORKING WITH DATA VALIDATION

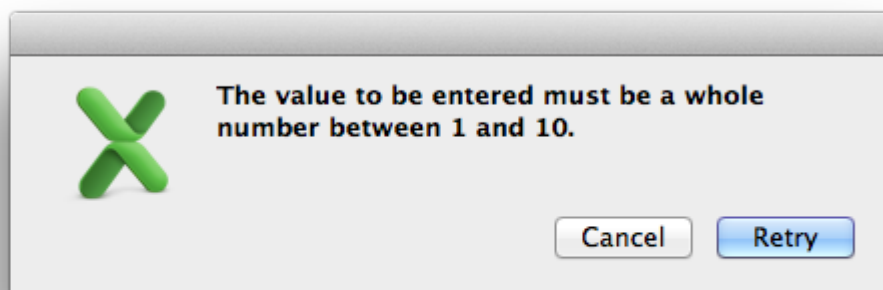
Data validation is a feature of Excel which allows you to restrict the data that a users enters in a cell and to display associated help and warning messages. It also allows you to restrict input to values in a drop down list.

A typical use case might be to restrict data in a cell to integer values in a certain range, to provide a help message to indicate the required value and to issue a warning if the input data doesn't meet the stated criteria. In XlsxWriter we could do that as follows:

```
worksheet.data_validation('B25', {'validate': 'integer',  
                                  'criteria': 'between',  
                                  'minimum': 1,  
                                  'maximum': 100,  
                                  'input_title': 'Enter an integer:',  
                                  'input_message': 'between 1 and 100'})
```



If the user inputs a value that doesn't match the specified criteria an error message is displayed:



For more information on data validation see the Microsoft support article “Description and examples of data validation in Excel”: <http://support.microsoft.com/kb/211485>.

The following sections describe how to use the `data_validation()` method and its various options.

14.1 data_validation()

The `data_validation()` method is used to construct an Excel data validation.

The data validation can be applied to a single cell or a range of cells. As usual you can use A1 or Row/Column notation, see [Working with Cell Notation](#).

With Row/Column notation you must specify all four cells in the range: (`first_row`, `first_col`, `last_row`, `last_col`). If you need to refer to a single cell set the *last_* values equal to the *first_* values. With A1 notation you can refer to a single cell or a range of cells:

```
worksheet.data_validation(0, 0, 4, 1, {...})
worksheet.data_validation('B1',      {...})
worksheet.data_validation('C1:E5',    {...})
```

The options parameter in `data_validation()` must be a dictionary containing the parameters that describe the type and style of the data validation. The main parameters are:

<code>validate</code>		
<code>criteria</code>		
<code>value</code>	<code>minimum</code>	<code>source</code>
<code>maximum</code>		
<code>ignore_blank</code>		
<code>dropdown</code>		
<code>input_title</code>		
<code>input_message</code>		
<code>show_input</code>		
<code>error_title</code>		
<code>error_message</code>		
<code>error_type</code>		
<code>show_error</code>		

These parameters are explained in the following sections. Most of the parameters are optional, however, you will generally require the three main options `validate`, `criteria` and `value`:

```
worksheet.data_validation('A1', {'validate': 'integer',
                                'criteria': '>',
                                'value': 100})
```

14.1.1 validate

The `validate` parameter is used to set the type of data that you wish to validate:

```
worksheet.data_validation('A1', {'validate': 'integer',
                                'criteria': '>',
                                'value': 100})
```

It is always required and it has no default value. Allowable values are:

integer
decimal
list
date
time
length
custom
any

- **integer**: restricts the cell to integer values. Excel refers to this as 'whole number'.
- **decimal**: restricts the cell to decimal values.
- **list**: restricts the cell to a set of user specified values. These can be passed in a Python list or as an Excel cell range. Excel requires that range references are restricted to cells on the same worksheet.
- **date**: restricts the cell to date values specified as a datetime object as shown in [Working with Dates and Time](#).
- **time**: restricts the cell to time values specified as a datetime object as shown in [Working with Dates and Time](#).
- **length**: restricts the cell data based on an integer string length. Excel refers to this as 'Text length'.
- **custom**: restricts the cell based on an external Excel formula that returns a TRUE/FALSE value.
- **any**: is used to specify that the type of data is unrestricted. This is the same as not applying a data validation. It is only provided for completeness and isn't required very often.

14.1.2 criteria

The `criteria` parameter is used to set the criteria by which the data in the cell is validated. It is almost always required except for the `list` and `custom` validate options. It has no default value:

```
worksheet.data_validation('A1', {'validate': 'integer',
                                'criteria': '>',
                                'value': 100})
```

Allowable values are:

between		
not between		
equal to	==	=
not equal to	not =	<>
greater than	>	
less than	<	
greater than or equal to	>=	
less than or equal to	<=	

You can either use Excel's textual description strings, in the first column above, or the more common symbolic alternatives. The following are equivalent:

```
worksheet.data_validation('A1', {'validate': 'integer',
                                'criteria': '>',
                                'value': 100})

worksheet.data_validation('A1', {'validate': 'integer',
                                'criteria': 'greater than',
                                'value': 100})
```

The list and custom validate options don't require a criteria. If you specify one it will be ignored:

```
worksheet.data_validation('B13', {'validate': 'list',
                                'source': ['open', 'high', 'close']})

worksheet.data_validation('B23', {'validate': 'custom',
                                'value': '=AND(F5=50,G5=60)'})
```

14.1.3 value, minimum, source

The value parameter is used to set the limiting value to which the criteria is applied. It is always required and it has no default value. You can also use the synonyms minimum or source to make the validation a little clearer and closer to Excel's description of the parameter:

```
# Use 'value'
worksheet.data_validation('A1', {'validate': 'integer',
                                'criteria': 'greater than',
                                'value': 100})

# Use 'minimum'
worksheet.data_validation('B11', {'validate': 'decimal',
                                'criteria': 'between',
                                'minimum': 0.1,
                                'maximum': 0.5})

# Use 'source'
worksheet.data_validation('B10', {'validate': 'list',
                                'source': '=$E$4:$G$4'})
```

14.1.4 maximum

The maximum parameter is used to set the upper limiting value when the criteria is either 'between' or 'not between':

```
worksheet.data_validation('B11', {'validate': 'decimal',
                                'criteria': 'between',
                                'minimum': 0.1,
                                'maximum': 0.5})
```

14.1.5 ignore_blank

The `ignore_blank` parameter is used to toggle on and off the 'Ignore blank' option in the Excel data validation dialog. When the option is on the data validation is not applied to blank data in the cell. It is on by default:

```
worksheet.data_validation('B5', {'validate': 'integer',
                                  'criteria': 'between',
                                  'minimum': 1,
                                  'maximum': 10,
                                  'ignore_blank': 0,
                                  })
```

14.1.6 dropdown

The `dropdown` parameter is used to toggle on and off the 'In-cell dropdown' option in the Excel data validation dialog. When the option is on a dropdown list will be shown for list validations. It is on by default.

14.1.7 input_title

The `input_title` parameter is used to set the title of the input message that is displayed when a cell is entered. It has no default value and is only displayed if the input message is displayed. See the `input_message` parameter below.

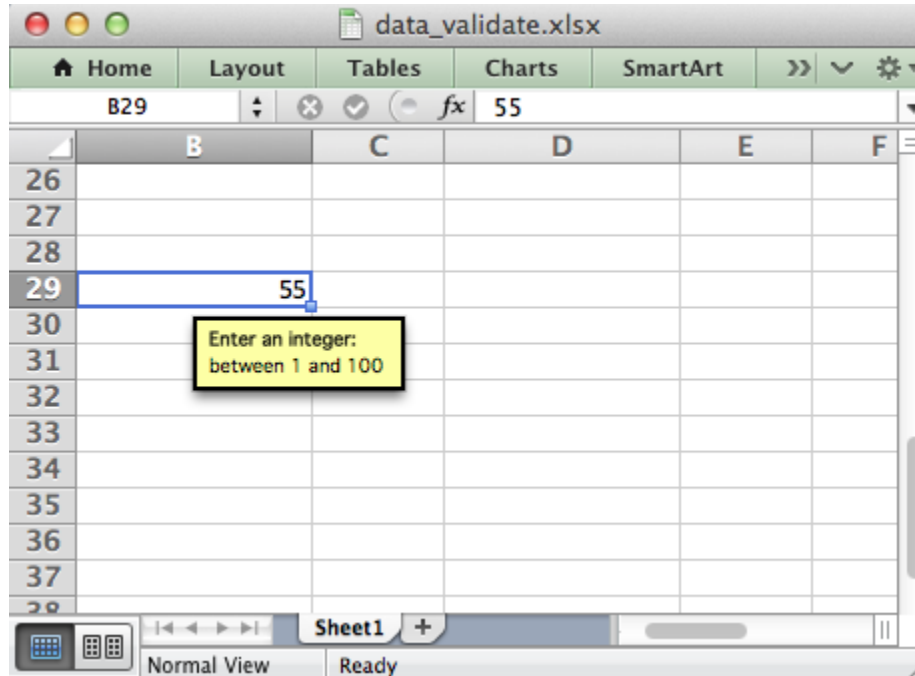
The maximum title length is 32 characters.

14.1.8 input_message

The `input_message` parameter is used to set the input message that is displayed when a cell is entered. It has no default value:

```
worksheet.data_validation('B25', {'validate': 'integer',
                                  'criteria': 'between',
                                  'minimum': 1,
                                  'maximum': 100,
                                  'input_title': 'Enter an integer:',
                                  'input_message': 'between 1 and 100'})
```

The input message generated from the above example is:



The message can be split over several lines using newlines. The maximum message length is 255 characters.

14.1.9 show_input

The `show_input` parameter is used to toggle on and off the ‘Show input message when cell is selected’ option in the Excel data validation dialog. When the option is off an input message is not displayed even if it has been set using `input_message`. It is on by default.

14.1.10 error_title

The `error_title` parameter is used to set the title of the error message that is displayed when the data validation criteria is not met. The default error title is ‘Microsoft Excel’. The maximum title length is 32 characters.

14.1.11 error_message

The `error_message` parameter is used to set the error message that is displayed when a cell is entered. The default error message is “The value you entered is not valid. A user has restricted values that can be entered into the cell.”. A non-default error message can be displayed as follows:

```
worksheet.data_validation('B27', {'validate': 'integer',
                                   'criteria': 'between',
                                   'minimum': 1,
                                   'maximum': 100,
                                   'input_title': 'Enter an integer:',
                                   'input_message': 'between 1 and 100',
```

```
'error_title': 'Input value not valid!',  
'error_message': 'Sorry.')
```

The message can be split over several lines using newlines. The maximum message length is 255 characters.

14.1.12 error_type

The `error_type` parameter is used to specify the type of error dialog that is displayed. There are 3 options:

```
'stop'  
'warning'  
'information'
```

The default is 'stop'.

14.1.13 show_error

The `show_error` parameter is used to toggle on and off the 'Show error alert after invalid data is entered' option in the Excel data validation dialog. When the option is off an error message is not displayed even if it has been set using `error_message`. It is on by default.

14.2 Data Validation Examples

Example 1. Limiting input to an integer greater than a fixed value:

```
worksheet.data_validation('A1', {'validate': 'integer',  
                                'criteria': '>',  
                                'value': 0,  
                                })
```

Example 2. Limiting input to an integer greater than a fixed value where the value is referenced from a cell:

```
worksheet.data_validation('A2', {'validate': 'integer',  
                                'criteria': '>',  
                                'value': '=E3',  
                                })
```

Example 3. Limiting input to a decimal in a fixed range:

```
worksheet.data_validation('A3', {'validate': 'decimal',  
                                'criteria': 'between',  
                                'minimum': 0.1,  
                                'maximum': 0.5,  
                                })
```

Example 4. Limiting input to a value in a dropdown list:

```
worksheet.data_validation('A4', {'validate': 'list',  
                                'source': ['open', 'high', 'close'],  
                                })
```

Example 5. Limiting input to a value in a dropdown list where the list is specified as a cell range:

```
worksheet.data_validation('A5', {'validate': 'list',  
                                'source': '=$E$4:$G$4',  
                                })
```

Example 6. Limiting input to a date in a fixed range:

```
from datetime import date  
  
worksheet.data_validation('A6', {'validate': 'date',  
                                'criteria': 'between',  
                                'minimum': date(2013, 1, 1),  
                                'maximum': date(2013, 12, 12),  
                                })
```

Example 7. Displaying a message when the cell is selected:

```
worksheet.data_validation('A7', {'validate': 'integer',  
                                'criteria': 'between',  
                                'minimum': 1,  
                                'maximum': 100,  
                                'input_title': 'Enter an integer:',  
                                'input_message': 'between 1 and 100',  
                                })
```

See also [Example: Data Validation and Drop Down Lists](#).

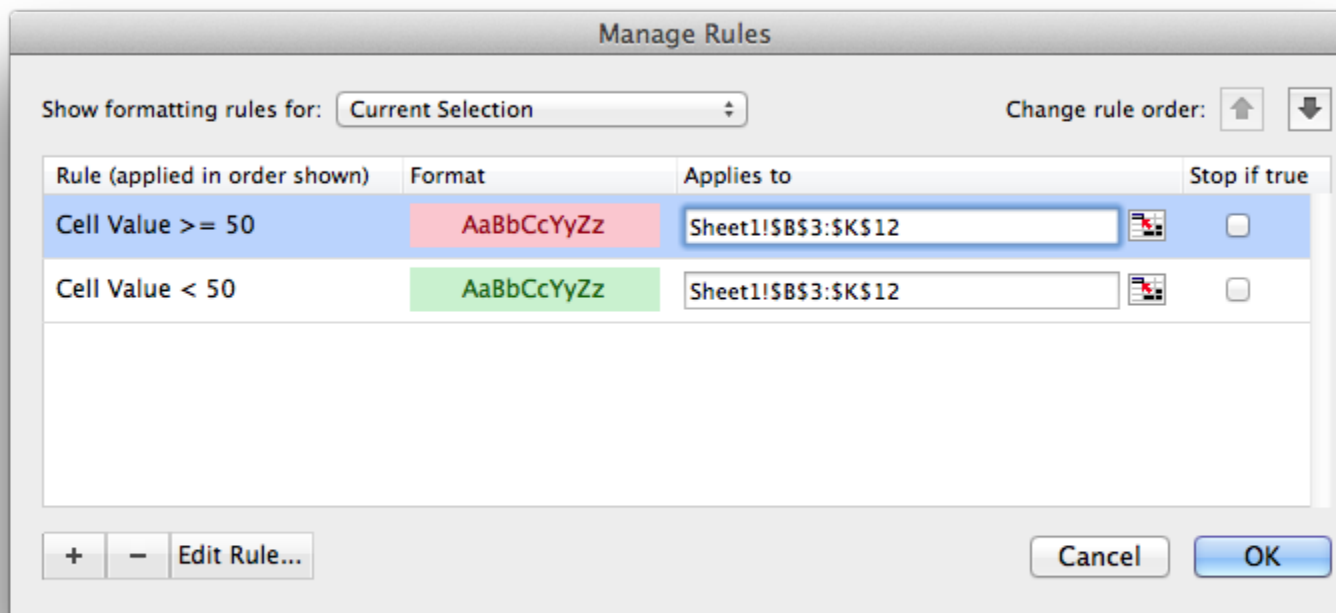
WORKING WITH CONDITIONAL FORMATTING

Conditional formatting is a feature of Excel which allows you to apply a format to a cell or a range of cells based on certain criteria.

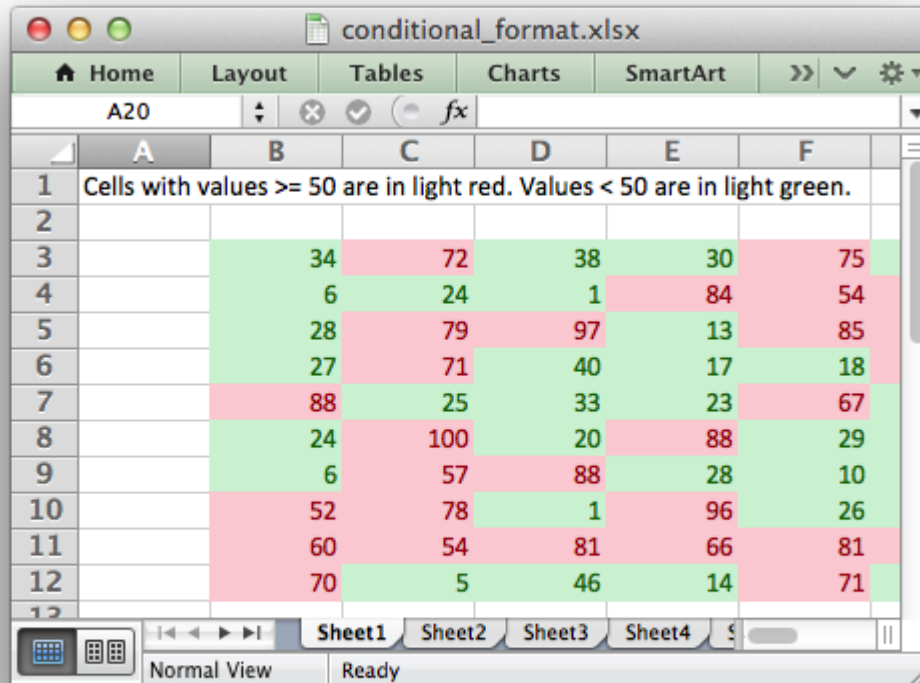
For example the following rules are used to highlight cells in the *conditional_format.py* example:

```
worksheet.conditional_format('B3:K12', {'type':      'cell',  
                                         'criteria': '>=',  
                                         'value':    50,  
                                         'format':   format1})  
  
worksheet.conditional_format('B3:K12', {'type':      'cell',  
                                         'criteria': '<',  
                                         'value':    50,  
                                         'format':   format2})
```

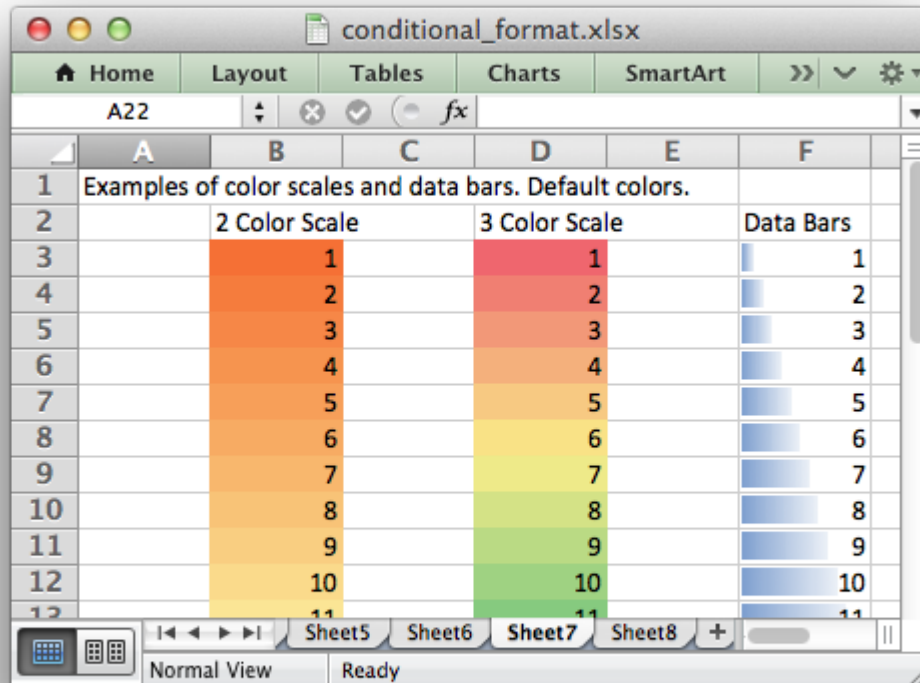
Which gives criteria like this:



And output which looks like this:



It is also possible to create color scales and data bars:



15.1 The conditional_format() method

The `conditional_format()` worksheet method is used to apply formatting based on user defined criteria to an XlsxWriter file.

The conditional format can be applied to a single cell or a range of cells. As usual you can use A1 or Row/Column notation (*Working with Cell Notation*).

With Row/Column notation you must specify all four cells in the range: (`first_row`, `first_col`, `last_row`, `last_col`). If you need to refer to a single cell set the `last_*` values equal to the `first_*` values. With A1 notation you can refer to a single cell or a range of cells:

```
worksheet.conditional_format(0, 0, 4, 1, {...})
worksheet.conditional_format('B1',      {...})
worksheet.conditional_format('C1:E5',    {...})
```

The options parameter in `conditional_format()` must be a dictionary containing the parameters that describe the type and style of the conditional format. The main parameters are:

- `type`
- `format`

- criteria
- value
- minimum
- maximum

Other, less commonly used parameters are:

- min_type
- mid_type
- max_type
- min_value
- mid_value
- max_value
- min_color
- mid_color
- max_color
- bar_color
- multi_range

15.2 Conditional Format Options

The conditional format options that can be used with `conditional_format()` are explained in the following sections.

15.2.1 type

The type option is a required parameter and it has no default value. Allowable type values and their associated parameters are:

Type	Parameters
cell	criteria
	value
	minimum
	maximum
date	criteria
	value
	minimum
	maximum
time_period	criteria
Continued on next page	

Table 15.1 – continued from previous page

Type	Parameters
text	criteria
	value
average	criteria
duplicate	(none)
unique	(none)
top	criteria
	value
bottom	criteria
	value
blanks	(none)
no_blanks	(none)
errors	(none)
no_errors	(none)
2_color_scale	min_type
	max_type
	min_value
	max_value
	min_color
	max_color
3_color_scale	min_type
	mid_type
	max_type
	min_value
	mid_value
	max_value
	min_color
	mid_color
	max_color
data_bar	min_type
	max_type
	min_value
	max_value
	bar_color
formula	criteria

All conditional formatting types have an associated *Format* parameter, see below.

15.2.2 type: cell

This is the most common conditional formatting type. It is used when a format is applied to a cell based on a simple criterion.

For example using a single cell and the greater than criteria:

```
worksheet.conditional_format('A1', {'type': 'cell',
                                     'criteria': 'greater than',
                                     'value': 5,
                                     'format': red_format})
```

Or, using a range and the between criteria:

```
worksheet.conditional_format('C1:C4', {'type': 'cell',
                                     'criteria': 'between',
                                     'minimum': 20,
                                     'maximum': 30,
                                     'format': green_format})
```

Other types are shown below, after the other main options.

15.2.3 criteria:

The `criteria` parameter is used to set the criteria by which the cell data will be evaluated. It has no default value. The most common criteria as applied to `{'type': 'cell'}` are:

between		
not between		
equal to	==	=
not equal to	!=	<>
greater than	>	
less than	<	
greater than or equal to	>=	
less than or equal to	<=	

You can either use Excel's textual description strings, in the first column above, or the more common symbolic alternatives shown in the other columns.

Additional criteria which are specific to other conditional format types are shown in the relevant sections below.

15.2.4 value:

The `value` is generally used along with the `criteria` parameter to set the rule by which the cell data will be evaluated:

```
worksheet.conditional_format('A1', {'type': 'cell',
                                     'criteria': 'greater than',
                                     'value': 5,
                                     'format': red_format})
```

The `value` property can also be an cell reference:

```
worksheet.conditional_format('A1', {'type': 'cell',
                                     'criteria': 'greater than',
```

```
'value':    '$C$1',
'format':   red_format})
```

15.2.5 format:

The format parameter is used to specify the format that will be applied to the cell when the conditional formatting criterion is met. The format is created using the `add_format()` method in the same way as cell formats:

```
format1 = workbook.add_format({'bold': 1, 'italic': 1})

worksheet.conditional_format('A1', {'type':    'cell',
                                     'criteria': '>',
                                     'value':    5,
                                     'format':   format1})
```

Note: In Excel, a conditional format is superimposed over the existing cell format and not all cell format properties can be modified. Properties that cannot be modified are font name, font size, superscript and subscript and diagonal borders.

Excel specifies some default formats to be used with conditional formatting. These can be replicated using the following XlsxWriter formats:

```
# Light red fill with dark red text.
format1 = workbook.add_format({'bg_color':   '#FFC7CE',
                               'font_color': '#9C0006'})

# Light yellow fill with dark yellow text.
format2 = workbook.add_format({'bg_color':   '#FFEB9C',
                               'font_color': '#9C6500'})

# Green fill with dark green text.
format3 = workbook.add_format({'bg_color':   '#C6EFCE',
                               'font_color': '#006100'})
```

See also [Working with Formats](#).

15.2.6 minimum:

The minimum parameter is used to set the lower limiting value when the criteria is either 'between' or 'not between':

```
worksheet.conditional_format('A1', {'type':    'cell',
                                     'criteria': 'between',
                                     'minimum':  2,
                                     'maximum':  6,
                                     'format':   format1,
                                     })
```

15.2.7 maximum:

The maximum parameter is used to set the upper limiting value when the criteria is either 'between' or 'not between'. See the previous example.

15.2.8 type: date

The date type is similar the cell type and uses the same criteria and values. However, the value, minimum and maximum properties are specified as a datetime object as shown in [Working with Dates and Time](#):

```
date = datetime.datetime.strptime('2011-01-01', "%Y-%m-%d")

worksheet.conditional_format('A1:A4', {'type':      'date',
                                       'criteria':  'greater than',
                                       'value':      date,
                                       'format':     format1})
```

15.2.9 type: time_period

The time_period type is used to specify Excel's "Dates Occurring" style conditional format:

```
worksheet.conditional_format('A1:A4', {'type':      'time_period',
                                       'criteria':  'yesterday',
                                       'format':     format1})
```

The period is set in the criteria and can have one of the following values:

```
'criteria': 'yesterday',
'criteria': 'today',
'criteria': 'last 7 days',
'criteria': 'last week',
'criteria': 'this week',
'criteria': 'continue week',
'criteria': 'last month',
'criteria': 'this month',
'criteria': 'continue month'
```

15.2.10 type: text

The text type is used to specify Excel's "Specific Text" style conditional format. It is used to do simple string matching using the criteria and value parameters:

```
worksheet.conditional_format('A1:A4', {'type':      'text',
                                       'criteria':  'containing',
                                       'value':      'foo',
                                       'format':     format1})
```

The criteria can have one of the following values:

```
'criteria': 'containing',  
'criteria': 'not containing',  
'criteria': 'begins with',  
'criteria': 'ends with',
```

The value parameter should be a string or single character.

15.2.11 type: average

The average type is used to specify Excel's "Average" style conditional format:

```
worksheet.conditional_format('A1:A4', {'type': 'average',  
                                       'criteria': 'above',  
                                       'format': format1})
```

The type of average for the conditional format range is specified by the criteria:

```
'criteria': 'above',  
'criteria': 'below',  
'criteria': 'equal or above',  
'criteria': 'equal or below',  
'criteria': '1 std dev above',  
'criteria': '1 std dev below',  
'criteria': '2 std dev above',  
'criteria': '2 std dev below',  
'criteria': '3 std dev above',  
'criteria': '3 std dev below',
```

15.2.12 type: duplicate

The duplicate type is used to highlight duplicate cells in a range:

```
worksheet.conditional_format('A1:A4', {'type': 'duplicate',  
                                       'format': format1})
```

15.2.13 type: unique

The unique type is used to highlight unique cells in a range:

```
worksheet.conditional_format('A1:A4', {'type': 'unique',  
                                       'format': format1})
```

15.2.14 type: top

The top type is used to specify the top n values by number or percentage in a range:


```
worksheet.conditional_format('A1:A4', {'type': 'top',
                                         'value': 10,
                                         'format': format1})
```

The criteria can be used to indicate that a percentage condition is required:

```
worksheet.conditional_format('A1:A4', {'type': 'top',
                                         'value': 10,
                                         'criteria': '%',
                                         'format': format1})
```

15.2.15 type: bottom

The bottom type is used to specify the bottom n values by number or percentage in a range.

It takes the same parameters as top, see above.

15.2.16 type: blanks

The blanks type is used to highlight blank cells in a range:

```
worksheet.conditional_format('A1:A4', {'type': 'blanks',
                                         'format': format1})
```

15.2.17 type: no_blanks

The no_blanks type is used to highlight non blank cells in a range:

```
worksheet.conditional_format('A1:A4', {'type': 'no_blanks',
                                         'format': format1})
```

15.2.18 type: errors

The errors type is used to highlight error cells in a range:

```
worksheet.conditional_format('A1:A4', {'type': 'errors',
                                         'format': format1})
```

15.2.19 type: no_errors

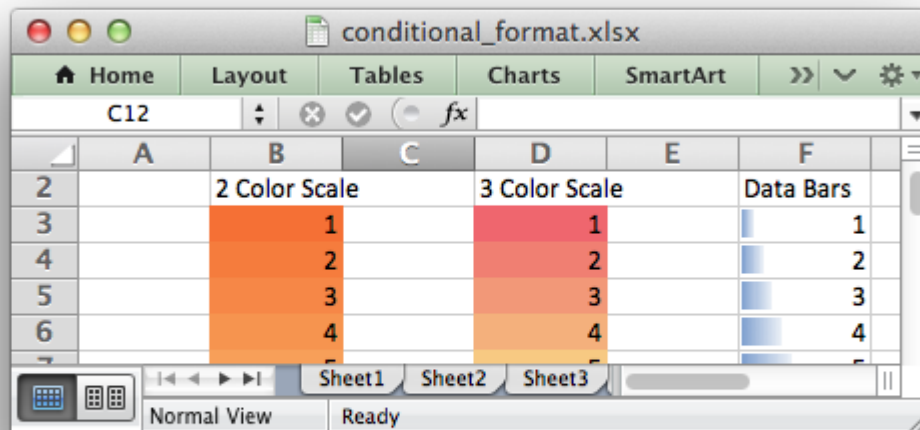
The no_errors type is used to highlight non error cells in a range:

```
worksheet.conditional_format('A1:A4', {'type': 'no_errors',
                                         'format': format1})
```

15.2.20 type: 2_color_scale

The 2_color_scale type is used to specify Excel's "2 Color Scale" style conditional format:

```
worksheet.conditional_format('A1:A12', {'type': '2_color_scale'})
```



This conditional type can be modified with min_type, max_type, min_value, min_value, min_color and max_color, see below.

15.2.21 type: 3_color_scale

The 3_color_scale type is used to specify Excel's "3 Color Scale" style conditional format:

```
worksheet.conditional_format('A1:A12', {'type': '3_color_scale'})
```

This conditional type can be modified with min_type, mid_type, max_type, min_value, mid_value, min_value, min_color, mid_color and max_color, see below.

15.2.22 type: data_bar

The data_bar type is used to specify Excel's "Data Bar" style conditional format:

```
worksheet.conditional_format('A1:A12', {'type': 'data_bar'})
```

This conditional type can be modified with min_type, max_type, min_value, min_value and bar_color, see below.

15.2.23 type: formula

The formula type is used to specify a conditional format based on a user defined formula:

```
worksheet.conditional_format('A1:A4', {'type':      'formula',
                                         'criteria': '=A1>5',
                                         'format':    format1})
```

The formula is specified in the criteria.

15.2.24 min_type:

The min_type and max_type properties are available when the conditional formatting type is 2_color_scale, 3_color_scale or data_bar. The mid_type is available for 3_color_scale. The properties are used as follows:

```
worksheet.conditional_format('A1:A12', {'type':      '2_color_scale',
                                         'min_type':  'percent',
                                         'max_type':  'percent'})
```

The available min/mid/max types are:

```
num
percent
percentile
formula
```

15.2.25 mid_type:

Used for 3_color_scale. Same as min_type, see above.

15.2.26 max_type:

Same as min_type, see above.

15.2.27 min_value:

The min_value and max_value properties are available when the conditional formatting type is 2_color_scale, 3_color_scale or data_bar. The mid_value is available for 3_color_scale. The properties are used as follows:

```
worksheet.conditional_format('A1:A12', {'type':      '2_color_scale',
                                         'min_value': 10,
                                         'max_value': 90})
```

15.2.28 mid_value:

Used for 3_color_scale. Same as min_value, see above.

15.2.29 max_value:

Same as min_value, see above.

15.2.30 min_color:

The min_color and max_color properties are available when the conditional formatting type is 2_color_scale, 3_color_scale or data_bar. The mid_color is available for 3_color_scale. The properties are used as follows:

```
worksheet.conditional_format('A1:A12', {'type': '2_color_scale',
                                         'min_color': '#C5D9F1',
                                         'max_color': '#538ED5'})
```

The colour can be a Html style #RRGGBB string or a limited number named colours, see [Format Colors](#).

15.2.31 mid_color:

Used for 3_color_scale. Same as min_color, see above.

15.2.32 max_color:

Same as min_color, see above.

15.2.33 bar_color:

Used for data_bar. Same as min_color, see above.

15.2.34 multi_range:

The multi_range option is used to extend a conditional format over non-contiguous ranges.

It is possible to apply the conditional format to different cell ranges in a worksheet using multiple calls to conditional_format(). However, as a minor optimisation it is also possible in Excel to apply the same conditional format to different non-contiguous cell ranges.

This is replicated in conditional_format() using the multi_range option. The range must contain the primary range for the conditional format and any others separated by spaces.

For example to apply one conditional format to two ranges, 'B3:K6' and 'B9:K12':

```
worksheet.conditional_format('B3:K6', {'type': 'cell',
                                       'criteria': '>=',
                                       'value': 50,
                                       'format': format1,
                                       'multi_range': 'B3:K6 B9:K12'})
```

15.3 Conditional Formatting Examples

Highlight cells greater than an integer value:

```
worksheet.conditional_format('A1:F10', {'type': 'cell',
                                       'criteria': 'greater than',
                                       'value': 5,
                                       'format': format1})
```

Highlight cells greater than a value in a reference cell:

```
worksheet.conditional_format('A1:F10', {'type': 'cell',
                                       'criteria': 'greater than',
                                       'value': 'H1',
                                       'format': format1})
```

Highlight cells more recent (greater) than a certain date:

```
date = datetime.datetime.strptime('2011-01-01', "%Y-%m-%d")

worksheet.conditional_format('A1:F10', {'type': 'date',
                                       'criteria': 'greater than',
                                       'value': date,
                                       'format': format1})
```

Highlight cells with a date in the last seven days:

```
worksheet.conditional_format('A1:F10', {'type': 'time_period',
                                       'criteria': 'last 7 days',
                                       'format': format1})
```

Highlight cells with strings starting with the letter b:

```
worksheet.conditional_format('A1:F10', {'type': 'text',
                                       'criteria': 'begins with',
                                       'value': 'b',
                                       'format': format1})
```

Highlight cells that are 1 standard deviation above the average for the range:

```
worksheet.conditional_format('A1:F10', {'type': 'average',
                                       'format': format1})
```

Highlight duplicate cells in a range:

```
worksheet.conditional_format('A1:F10', {'type': 'duplicate',  
                                         'format': format1})
```

Highlight unique cells in a range:

```
worksheet.conditional_format('A1:F10', {'type': 'unique',  
                                         'format': format1})
```

Highlight the top 10 cells:

```
worksheet.conditional_format('A1:F10', {'type': 'top',  
                                         'value': 10,  
                                         'format': format1})
```

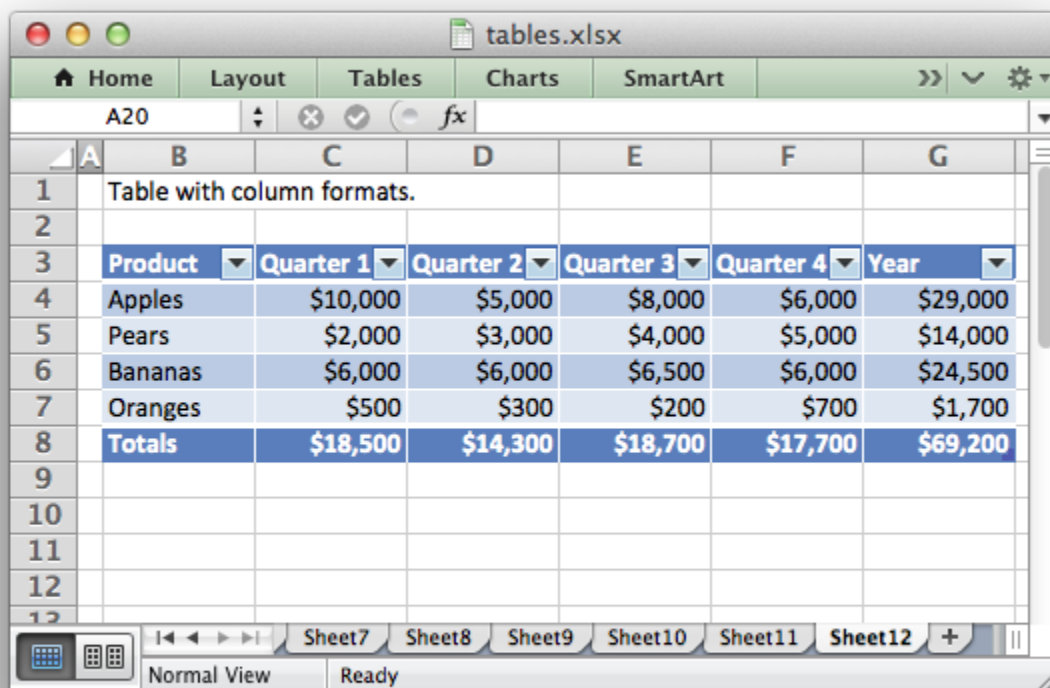
Highlight blank cells:

```
worksheet.conditional_format('A1:F10', {'type': 'blanks',  
                                         'format': format1})
```

See also [Example: Conditional Formatting](#).

WORKING WITH WORKSHEET TABLES

Tables in Excel are a way of grouping a range of cells into a single entity that has common formatting or that can be referenced from formulas. Tables can have column headers, autofilters, total rows, column formulas and default formatting.



The screenshot shows an Excel window titled 'tables.xlsx'. The ribbon includes 'Home', 'Layout', 'Tables', 'Charts', and 'SmartArt'. The active cell is A20. The formula bar shows 'fx'. The spreadsheet contains a table with the following data:

	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
1	Table with column formats.					
2						
3	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
4	Apples	\$10,000	\$5,000	\$8,000	\$6,000	\$29,000
5	Pears	\$2,000	\$3,000	\$4,000	\$5,000	\$14,000
6	Bananas	\$6,000	\$6,000	\$6,500	\$6,000	\$24,500
7	Oranges	\$500	\$300	\$200	\$700	\$1,700
8	Totals	\$18,500	\$14,300	\$18,700	\$17,700	\$69,200
9						
10						
11						
12						
13						

The bottom of the window shows sheet tabs for Sheet7 through Sheet12, and a status bar indicating 'Normal View' and 'Ready'.

For more information see [An Overview of Excel Tables](#) in the Microsoft Office documentation.

Note: Tables aren't available in XlsxWriter when `Workbook()` 'constant_memory' mode is enabled.

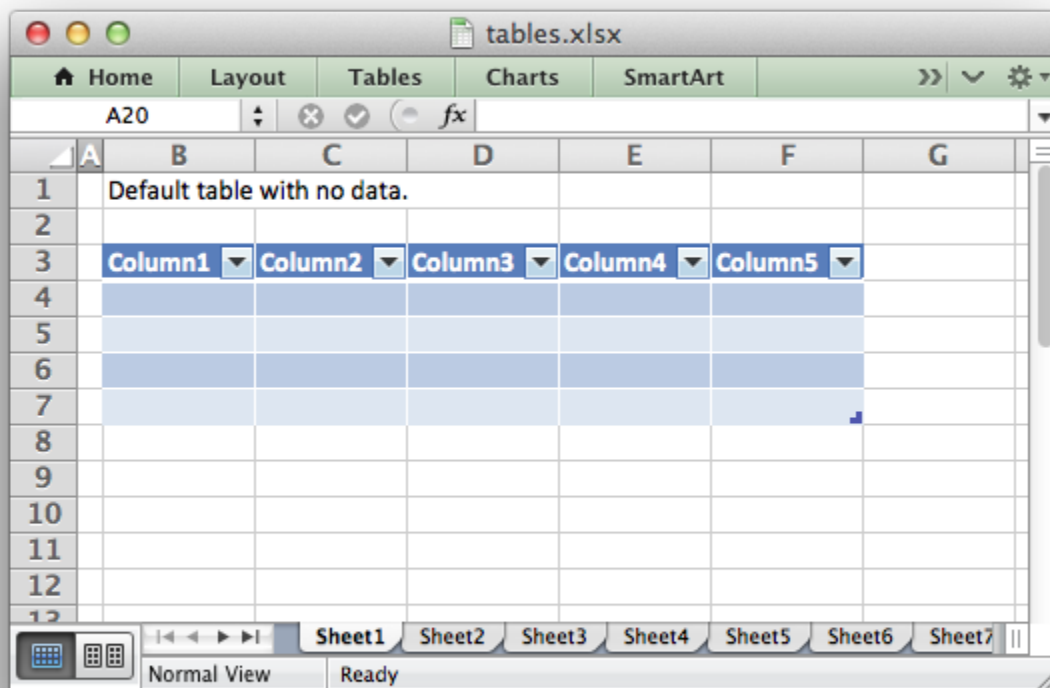
16.1 add_table()

Tables are added to a worksheet using the `add_table()` method:

```
worksheet.add_table('B3:F7', {options})
```

The data range can be specified in 'A1' or 'Row/Column' notation (see [Working with Cell Notation](#)):

```
worksheet.add_table('B3:F7')  
# Same as:  
worksheet.add_table(2, 1, 6, 5)
```



The options parameter should be a dict containing the parameters that describe the table options and data. The available options are:

data
autofilter
header_row
banded_columns
banded_rows
first_column
last_column
style
total_row
columns
name

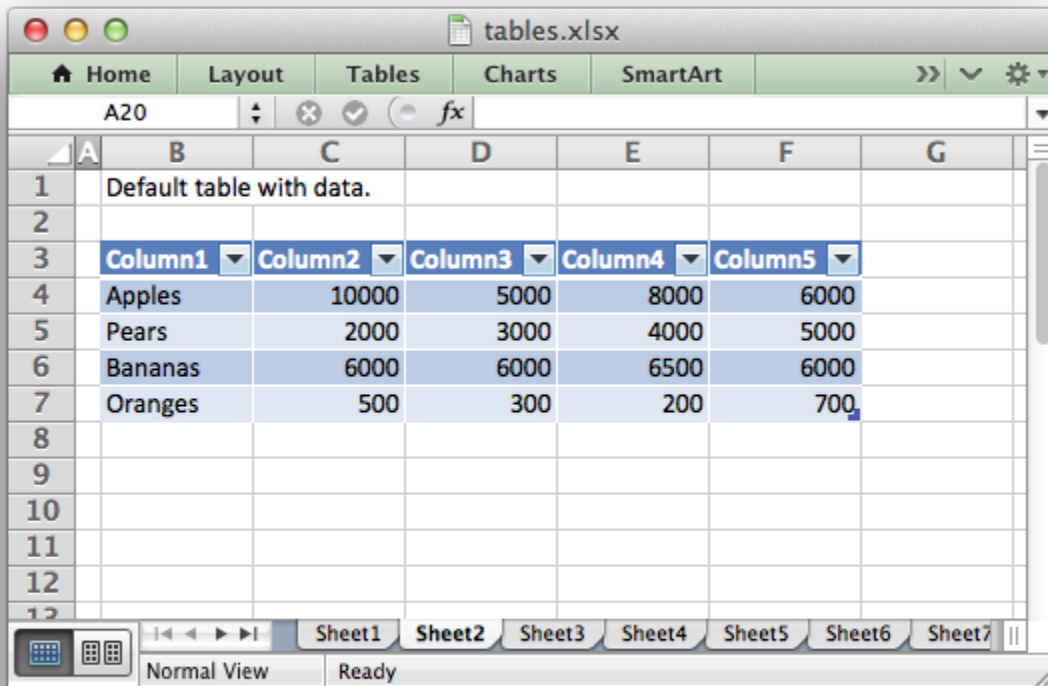
These options are explained below. There are no required parameters and the options parameter is itself optional if no options are specified (as shown above).

16.2 data

The data parameter can be used to specify the data in the cells of the table:

```
data = [
    ['Apples', 10000, 5000, 8000, 6000],
    ['Pears', 2000, 3000, 4000, 5000],
    ['Bananas', 6000, 6000, 6500, 6000],
    ['Oranges', 500, 300, 200, 700],
]

worksheet.add_table('B3:F7', {data, data})
```



	Column1	Column2	Column3	Column4	Column5
Apples	10000	5000	8000	6000	
Pears	2000	3000	4000	5000	
Bananas	6000	6000	6500	6000	
Oranges	500	300	200	700	

Table data can also be written separately, as an array or individual cells:

```
# These statements are the same as the single statement above.
worksheet.add_table('B3:F7')
worksheet.write_row('B4', data[0])
worksheet.write_row('B5', data[1])
worksheet.write_row('B6', data[2])
worksheet.write_row('B7', data[3])
```

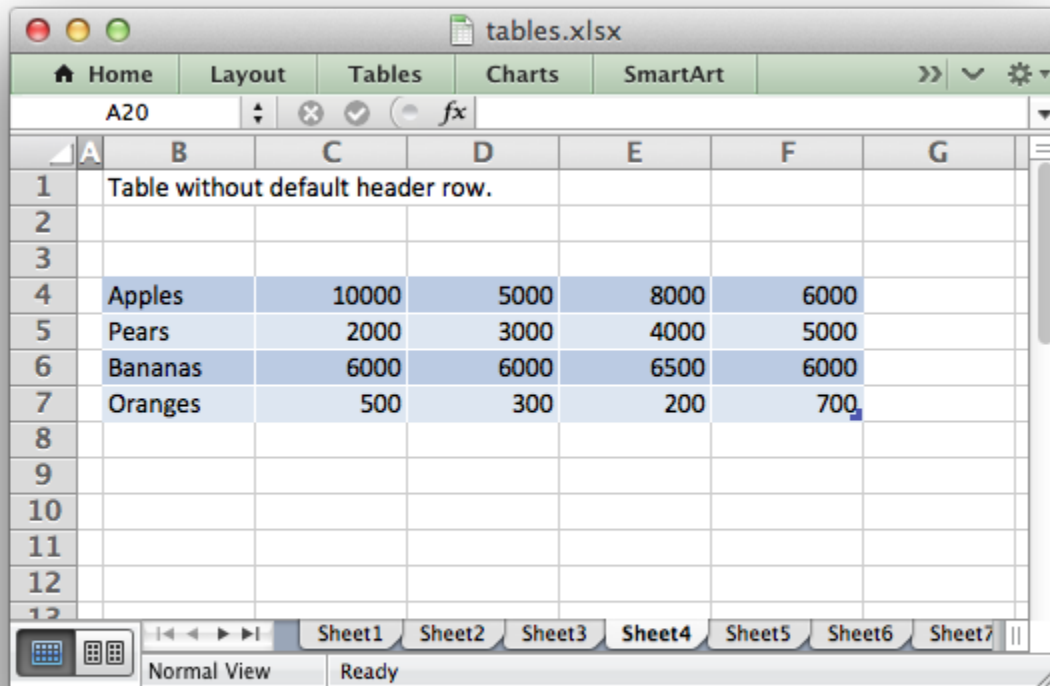
Writing the cell data separately is occasionally required when you need to control the `write_()` methods used to populate the cells or if you wish to modify individual cell formatting.

The data structure should be an list of lists holding row data as shown above.

16.3 header_row

The `header_row` parameter can be used to turn on or off the header row in the table. It is on by default:

```
# Turn off the header row.
worksheet.add_table('B4:F7', {'header_row': False})
```



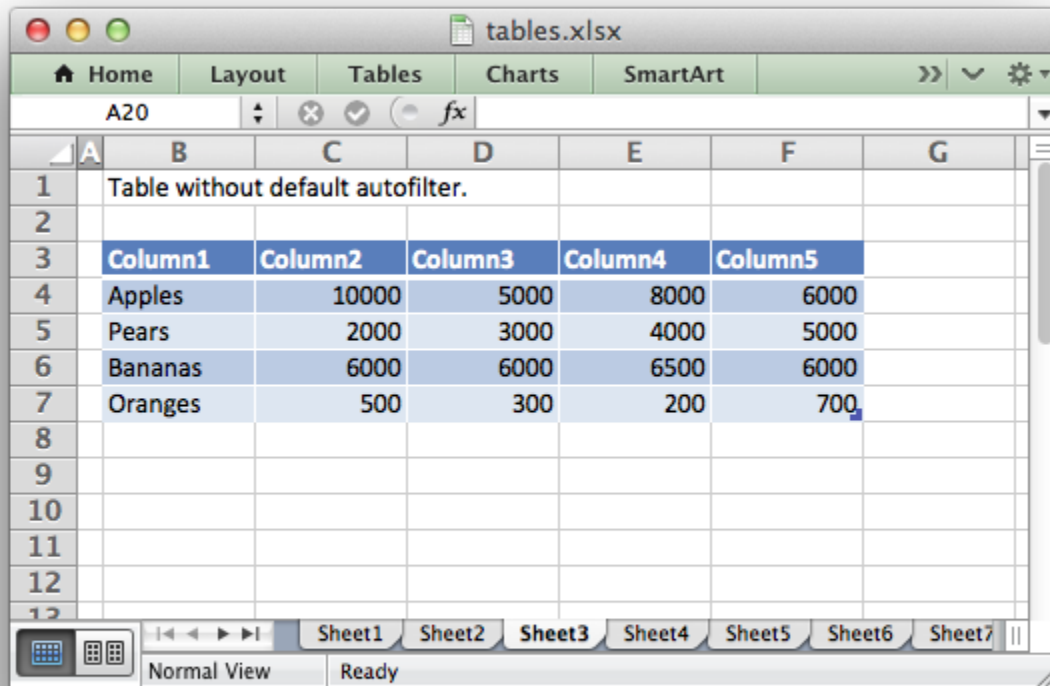
	A	B	C	D	E	F	G
1		Table without default header row.					
2							
3							
4		Apples	10000	5000	8000	6000	
5		Pears	2000	3000	4000	5000	
6		Bananas	6000	6000	6500	6000	
7		Oranges	500	300	200	700	
8							
9							
10							
11							
12							
13							

The header row will contain default captions such as Column 1, Column 2, etc. These captions can be overridden using the `columns` parameter below.

16.4 autofilter

The `autofilter` parameter can be used to turn on or off the autofilter in the header row. It is on by default:

```
# Turn off the default autofilter.  
worksheet.add_table('B3:F7', {'autofilter': False})
```



The autofilter is only shown if the `header_row` is on. Filter conditions within the table are not supported.

16.5 banded_rows

The `banded_rows` parameter can be used to create rows of alternating colour in the table. It is on by default:

```
# Turn off banded rows.
worksheet.add_table('B3:F7', {'banded_rows': False})
```

	Column1	Column2	Column3	Column4	Column5
1	Table with banded columns but without default banded rows.				
2					
3	Apples	10000	5000	8000	6000
4	Pears	2000	3000	4000	5000
5	Bananas	6000	6000	6500	6000
6	Oranges	500	300	200	700
7					
8					
9					
10					
11					
12					
13					

16.6 banded_columns

The `banded_columns` parameter can be used to create columns of alternating colour in the table. It is off by default:

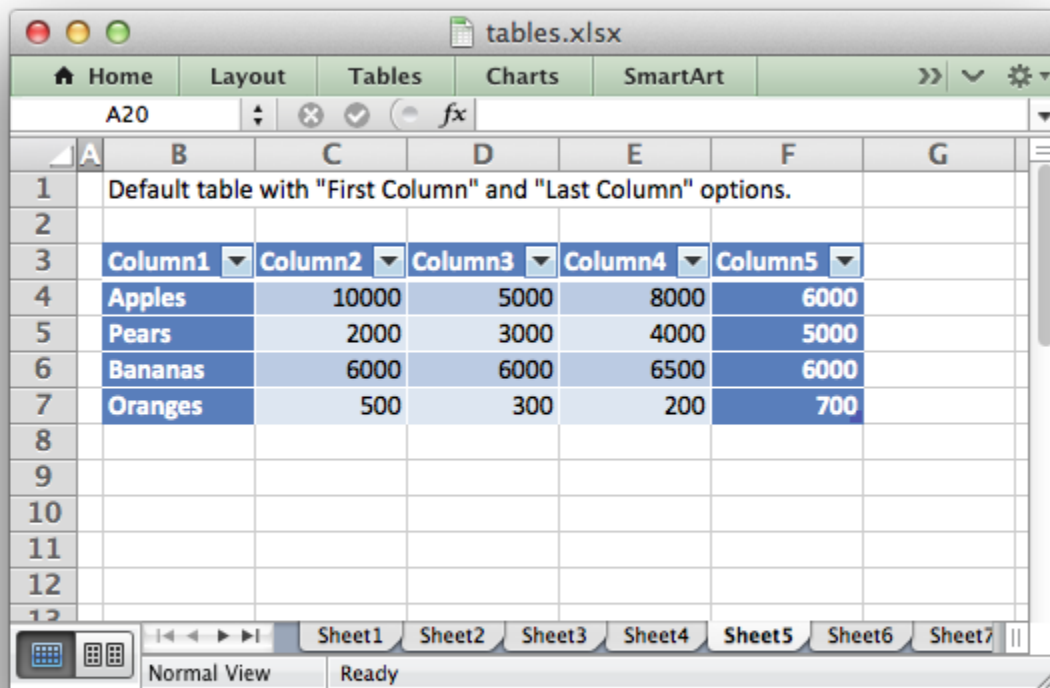
```
# Turn on banded columns.
worksheet.add_table('B3:F7', {'banded_columns': True})
```

See the above image.

16.7 first_column

The `first_column` parameter can be used to highlight the first column of the table. The type of highlighting will depend on the style of the table. It may be bold text or a different colour. It is off by default:

```
# Turn on highlighting for the first column in the table.
worksheet.add_table('B3:F7', {'first_column': True})
```



	Column1	Column2	Column3	Column4	Column5
1	Default table with "First Column" and "Last Column" options.				
2					
3	Apples	10000	5000	8000	6000
4	Pears	2000	3000	4000	5000
5	Bananas	6000	6000	6500	6000
6	Oranges	500	300	200	700
7					
8					
9					
10					
11					
12					

16.8 last_column

The `last_column` parameter can be used to highlight the last column of the table. The type of highlighting will depend on the style of the table. It may be bold text or a different colour. It is off by default:

```
# Turn on highlighting for the last column in the table.
worksheet.add_table('B3:F7', {'last_column': True})
```

See the above image.

16.9 style

The `style` parameter can be used to set the style of the table. Standard Excel table format names should be used (with matching capitalisation):

```
worksheet.add_table('B3:F7', {'data': data,
                              'style': 'Table Style Light 11'})
```

Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
Apples	10000	5000	8000	6000	29000
Pears	2000	3000	4000	5000	14000
Bananas	6000	6000	6500	6000	24500
Oranges	500	300	200	700	1700
Totals	18500	14300	18700	17700	69200

The default table style is 'Table Style Medium 9'.

16.10 name

The name parameter can be used to set the name of the table.

By default tables are named Table1, Table2, etc. If you override the table name you must ensure that it doesn't clash with an existing table name and that it follows Excel's requirements for table names:

```
worksheet.add_table('B3:F7', {'name': 'SalesData'})
```

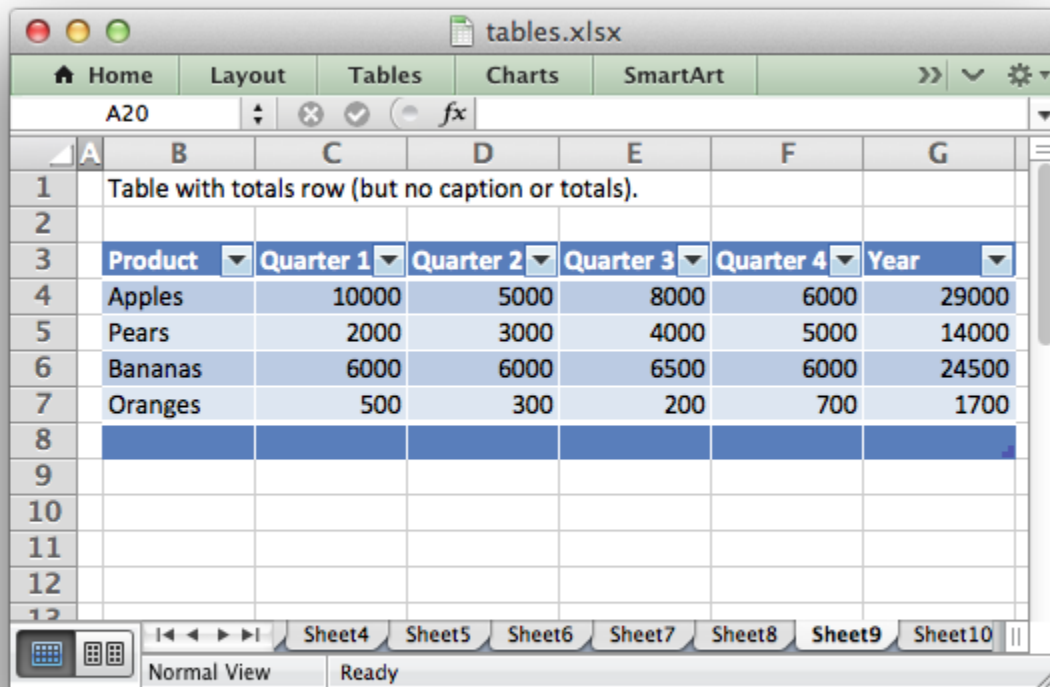
If you need to know the name of the table, for example to use it in a formula, you can get it as follows:

```
table = worksheet.add_table('B3:F7')
table_name = table.name
```

16.11 total_row

The `total_row` parameter can be used to turn on the total row in the last row of a table. It is distinguished from the other rows by a different formatting and also with dropdown SUBTOTAL functions:

```
worksheet.add_table('B3:F7', {'total_row': True})
```



The default total row doesn't have any captions or functions. These must be specified via the `columns` parameter below.

16.12 columns

The `columns` parameter can be used to set properties for columns within the table.

	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4
4	Apples	10000	5000	8000	6000
5	Pears	2000	3000	4000	5000
6	Bananas	6000	6000	6500	6000
7	Oranges	500	300	200	700

The sub-properties that can be set are:

header
formula
total_string
total_function
format

The column data must be specified as a list of dicts. For example to override the default 'Column n' style table headers:

```
worksheet.add_table('B3:F7', {'data': data,
                              'columns': [{ 'header': 'Product'},
                                           { 'header': 'Quarter 1'},
                                           { 'header': 'Quarter 2'},
                                           { 'header': 'Quarter 3'},
                                           { 'header': 'Quarter 4'},
                                           ]})
```

See the resulting image above.

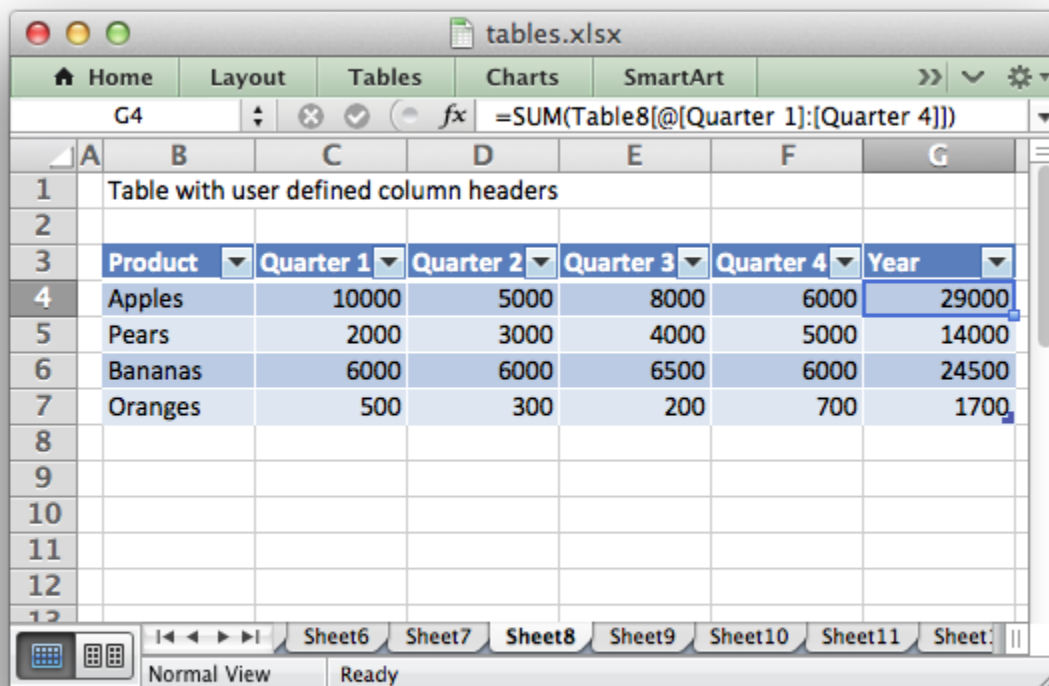
If you don't wish to specify properties for a specific column you pass an empty hash ref and the defaults will be applied:

```
...
columns, [
    {header, 'Product'},
    {header, 'Quarter 1'},
    {}, # Defaults to 'Column 3'.
    {header, 'Quarter 3'},
    {header, 'Quarter 4'},
]
...
```

Column formulas can be applied using the column formula property:

```
formula = '=SUM(Table8[@[Quarter 1]:[Quarter 4]])'

worksheet.add_table('B3:G7', {'data': data,
                                'columns': [{ 'header': 'Product'},
                                             { 'header': 'Quarter 1'},
                                             { 'header': 'Quarter 2'},
                                             { 'header': 'Quarter 3'},
                                             { 'header': 'Quarter 4'},
                                             { 'header': 'Year',
                                               'formula': formula}],
                                'formula': formula})
```



	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
4	Apples	10000	5000	8000	6000	29000
5	Pears	2000	3000	4000	5000	14000
6	Bananas	6000	6000	6500	6000	24500
7	Oranges	500	300	200	700	1700

The Excel 2007 [#This Row] and Excel 2010 @ structural references are supported within the formula.

As stated above the `total_row` table parameter turns on the “Total” row in the table but it doesn’t populate it with any defaults. Total captions and functions must be specified via the `columns` property and the `total_string` and `total_function` sub properties:

```
options = {'data': data,
          'total_row': 1,
          'columns': [{'header': 'Product', 'total_string': 'Totals'},
                     {'header': 'Quarter 1', 'total_function': 'sum'},
                     {'header': 'Quarter 2', 'total_function': 'sum'},
                     {'header': 'Quarter 3', 'total_function': 'sum'},
                     {'header': 'Quarter 4', 'total_function': 'sum'},
                     {'header': 'Year',
                      'formula': '=SUM(Table10[@[Quarter 1]:[Quarter 4]]',
                      'total_function': 'sum'}
                    ],
          ]}

# Add a table to the worksheet.
worksheet.add_table('B3:G8', options)
```

The supported totals row SUBTOTAL functions are:

average
count_nums
count
max
min
std_dev
sum
var

User defined functions or formulas aren’t supported.

Formats can also be applied to columns:

```
currency_format = workbook.add_format(num_format, '$#,##0')

worksheet.add_table('B3:D8', {'data': data,
                              'total_row': 1,
                              'columns': [{'header': 'Product'},
                                         {'header': 'Quarter 1',
                                          'total_function': 'sum',
                                          'format': currency_format},
                                         {'header': 'Quarter 2',
                                          'total_function': 'sum',
                                          'format': currency_format},
                                         ],
                              })
```

	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
1	Table with column formats.					
2						
3	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
4	Apples	\$10,000	\$5,000	\$8,000	\$6,000	\$29,000
5	Pears	\$2,000	\$3,000	\$4,000	\$5,000	\$14,000
6	Bananas	\$6,000	\$6,000	\$6,500	\$6,000	\$24,500
7	Oranges	\$500	\$300	\$200	\$700	\$1,700
8	Totals	\$18,500	\$14,300	\$18,700	\$17,700	\$69,200
9						
10						
11						
12						
13						

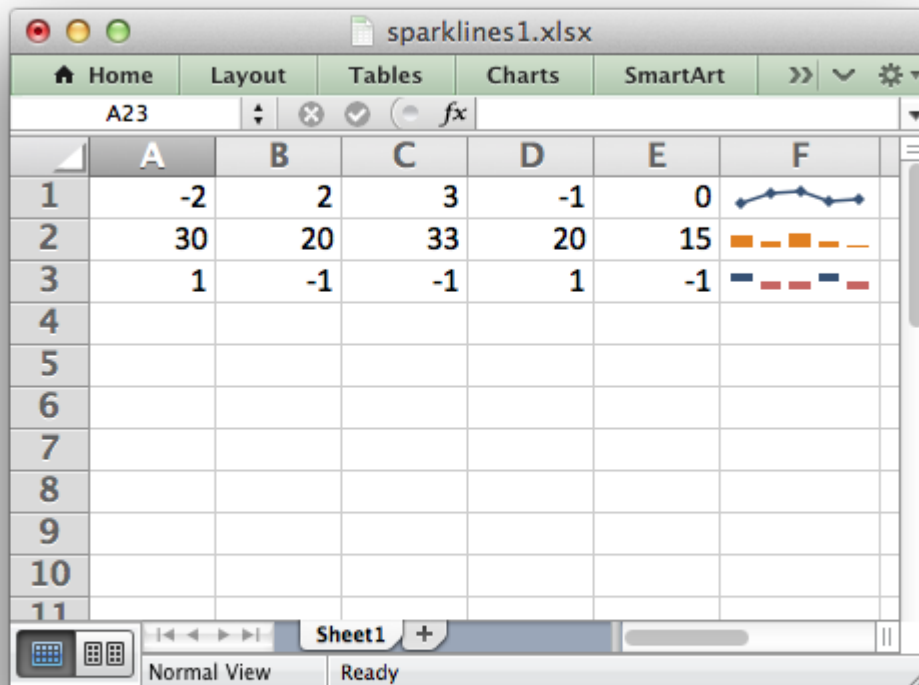
Standard XlsxWriter *Format object* objects are used for this formatting. However, they should be limited to numerical formats. Overriding other table formatting may produce inconsistent results.

16.13 Example

All of the images shown above are taken from *Example: Worksheet Tables*.

WORKING WITH SPARKLINES

Sparklines are a feature of Excel 2010+ which allows you to add small charts to worksheet cells. These are useful for showing visual trends in data in a compact format.



Sparklines were invented by Edward Tufte: <http://en.wikipedia.org/wiki/Sparklines>

17.1 The `add_sparkline()` method

The `add_sparkline()` worksheet method is used to add sparklines to a cell or a range of cells:

```
worksheet.add_sparkline(0, 5, {'range': 'Sheet1!A1:E1'})
```

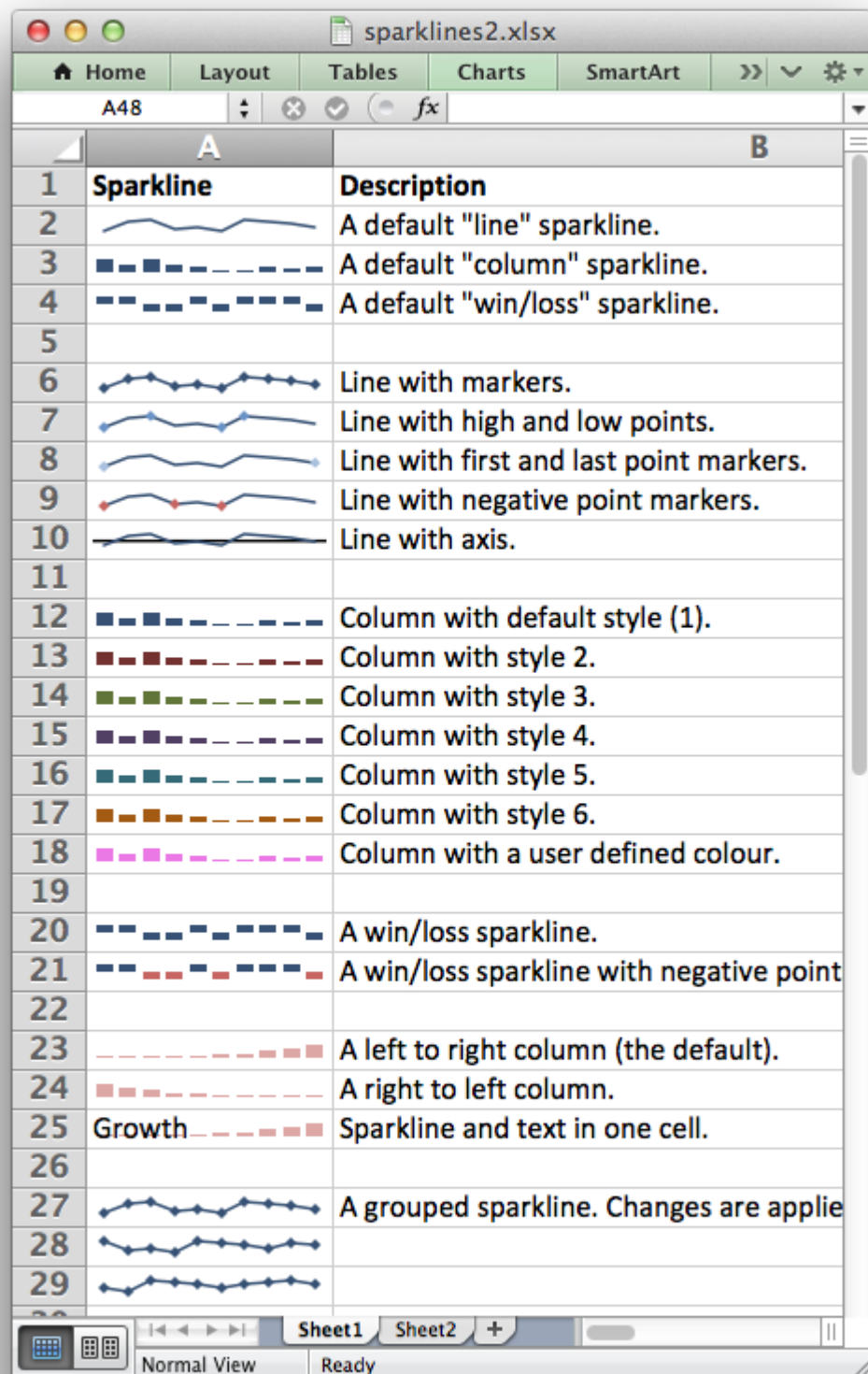
Both row-column and A1 style notation are supported. See [Working with Cell Notation](#) for more details.

The parameters to `add_sparkline()` must be passed in a dictionary. The main sparkline parameters are:

range (required)
type
style
markers
negative_points
axis
reverse

Other, less commonly used parameters are:

location
high_point
low_point
first_point
last_point
max
min
empty_cells
show_hidden
date_axis
weight
series_color
negative_color
markers_color
first_color
last_color
high_color
low_color



These parameters are explained in the sections below.

Note: Sparklines are a feature of Excel 2010+ only. You can write them to an XLSX file that can be read by Excel 2007 but they won't be displayed.

17.2 range

The range specifier is the only non-optional parameter.

It specifies the cell data range that the sparkline will plot:

```
worksheet.add_sparkline('F1', {'range': 'A1:E1'})
```

The range should be a 2D array. (For 3D arrays of cells see “Grouped Sparklines” below).

If range is not on the same worksheet you can specify its location using the usual Excel notation:

```
worksheet.add_sparkline('F1', {'range': 'Sheet2!A1:E1'})
```

If the worksheet contains spaces or special characters you should quote the worksheet name in the same way that Excel does:

```
worksheet.add_sparkline('F1', {'range': "'Monthly Data'!A1:E1'})
```

17.3 type

Specifies the type of sparkline. There are 3 available sparkline types:

```
line (default)
column
win_loss
```

For example:

```
worksheet.add_sparkline('F2', {'range': 'A2:E2',
                                'type': 'column'})
```

17.4 style

Excel provides 36 built-in Sparkline styles in 6 groups of 6. The style parameter can be used to replicate these and should be a corresponding number from 1 .. 36:

```
worksheet.add_sparkline('F2', {'range': 'A2:E2',
                                'type': 'column',
                                'style': 12})
```


The style number starts in the top left of the style grid and runs left to right. The default style is 1. It is possible to override colour elements of the sparklines using the `_color` parameters below.

17.5 markers

Turn on the markers for line style sparklines:

```
worksheet.add_sparkline('A6', {'range': 'Sheet2!A1:J1',
                              'markers': True})
```

Markers aren't shown in Excel for column and win_loss sparklines.

17.6 negative_points

Highlight negative values in a sparkline range. This is usually required with win_loss sparklines:

```
worksheet.add_sparkline('A9', {'range': 'Sheet2!A1:J1',
                              'negative_points': True})
```

17.7 axis

Display a horizontal axis in the sparkline:

```
worksheet.add_sparkline('A10', {'range': 'Sheet2!A1:J1',
                              'axis': True})
```

17.8 reverse

Plot the data from right-to-left instead of the default left-to-right:

```
worksheet.add_sparkline('A24', {'range': 'Sheet2!A4:J4',
                              'type': 'column',
                              'style': 20,
                              'reverse': True})
```

17.9 weight

Adjust the default line weight (thickness) for line style sparklines:

```
worksheet.add_sparkline('F2', {'range': 'A2:E2',
                              'weight': 0.25})
```

The weight value should be one of the following values allowed by Excel:

```
0.25 0.5 0.75
1 1.25
2.25
3
4.25
6
```

17.10 high_point, low_point, first_point, last_point

Highlight points in a sparkline range:

```
worksheet.add_sparkline('A7', {'range': 'Sheet2!A1:J1',
                                'high_point': True,
                                'low_point': True,
                                'first_point': True})
```

17.11 max, min

Specify the maximum and minimum vertical axis values:

```
worksheet.add_sparkline('F1', {'range': 'A1:E1',
                                'max': 0.5,
                                'min': -0.5})
```

As a special case you can set the maximum and minimum to be for a group of sparklines rather than one:

```
'max': 'group'
```

See “Grouped Sparklines” below.

17.12 empty_cells

Define how empty cells are handled in a sparkline:

```
worksheet.add_sparkline('F1', {'range': 'A1:E1',
                                'empty_cells': 'zero'})
```

The available options are:

- gaps: show empty cells as gaps (the default).
- zero: plot empty cells as 0.
- connect: Connect points with a line (“line” type sparklines only).

17.13 show_hidden

Plot data in hidden rows and columns:

```
worksheet.add_sparkline('F3', {'range': 'A3:E3',  
                              'show_hidden': True})
```

Note, this option is off by default.

17.14 date_axis

Specify an alternative date axis for the sparkline. This is useful if the data being plotted isn't at fixed width intervals:

```
worksheet.add_sparkline('F3', {'range': 'A3:E3',  
                              'date_axis': 'A4:E4'})
```

The number of cells in the date range should correspond to the number of cells in the data range.

17.15 series_color

It is possible to override the colour of a sparkline style using the following parameters:

```
series_color  
negative_color  
markers_color  
first_color  
last_color  
high_color  
low_color
```

The color should be specified as a HTML style #rrggbb hex value:

```
worksheet.add_sparkline('A18', {'range': 'Sheet2!A2:J2',  
                                'type': 'column',  
                                'series_color': '#E965E0'})
```

17.16 location

By default the sparkline location is specified by row and col in `add_sparkline()`. However, for grouped sparklines it is necessary to specify more than one cell location. The `location` parameter is used to specify a list of cells. See “Grouped Sparklines” below.

17.17 Grouped Sparklines

The `add_sparkline()` worksheet method can be used multiple times to write as many sparklines as are required in a worksheet.

However, it is sometimes necessary to group contiguous sparklines so that changes that are applied to one are applied to all. In Excel this is achieved by selecting a 3D range of cells for the data range and a 2D range of cells for the location.

In XlsxWriter, you can simulate this by passing an array refs of values to `location` and `range`:

```
worksheet.add_sparkline('A27', {'location': ['A27', 'A28', 'A29'],  
                                'range':    ['A5:J5', 'A6:J6', 'A7:J7']})
```

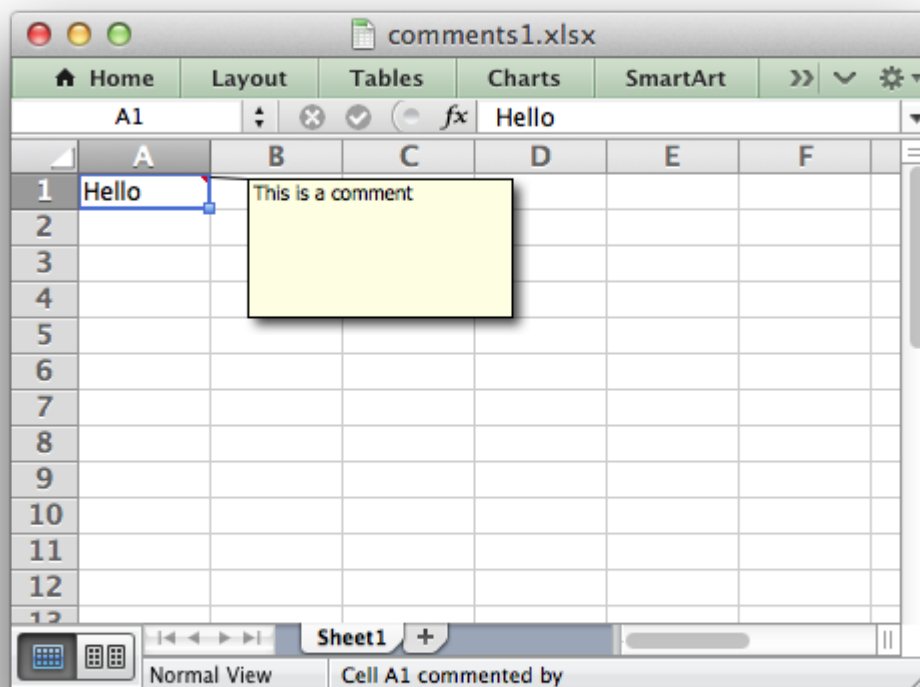
17.18 Sparkline examples

See [Example: Sparklines \(Simple\)](#) and [Example: Sparklines \(Advanced\)](#).

WORKING WITH CELL COMMENTS

Cell comments are a way of adding notation to cells in Excel. For example:

```
worksheet.write('A1', 'Hello')  
worksheet.write_comment('A1', 'This is a comment')
```



18.1 Setting Comment Properties

The properties of the cell comment can be modified by passing an optional dictionary of key/value pairs to control the format of the comment. For example:

```
worksheet.write_comment('C3', 'Hello', {'x_scale': 1.2, 'y_scale': 0.8})
```

The following options are available:

```
author
visible
x_scale
width
y_scale
height
color
start_cell
start_row
start_col
x_offset
y_offset
```

The options are explained in detail below:

- **author:** This option is used to indicate who is the author of the cell comment. Excel displays the author of the comment in the status bar at the bottom of the worksheet. This is usually of interest in corporate environments where several people might review and provide comments to a workbook:

```
worksheet.write_comment('C3', 'Atonement', {'author': 'Ian McEwan'})
```

The default author for all cell comments in a worksheet can be set using the `set_comments_author()` method:

```
worksheet.set_comments_author('John Smith')
```

- **visible:** This option is used to make a cell comment visible when the worksheet is opened. The default behaviour in Excel is that comments are initially hidden. However, it is also possible in Excel to make individual comments or all comments visible. In XlsxWriter individual comments can be made visible as follows:

```
worksheet.write_comment('C3', 'Hello', {'visible': True})
```

It is possible to make all comments in a worksheet visible using the `show_comments()` worksheet method. Alternatively, if all of the cell comments have been made visible you can hide individual comments:

```
worksheet.write_comment('C3', 'Hello', {'visible': False})
```

- **x_scale:** This option is used to set the width of the cell comment box as a factor of the default width:

```
worksheet.write_comment('C3', 'Hello', {'x_scale': 2 })
worksheet.write_comment('C4', 'Hello', {'x_scale': 4.2})
```

- width: This option is used to set the width of the cell comment box explicitly in pixels:

```
worksheet.write_comment('C3', 'Hello', {'width': 200})
```

- y_scale: This option is used to set the height of the cell comment box as a factor of the default height:

```
worksheet.write_comment('C3', 'Hello', {'y_scale': 2 })
worksheet.write_comment('C4', 'Hello', {'y_scale': 4.2})
```

- height: This option is used to set the height of the cell comment box explicitly in pixels:

```
worksheet.write_comment('C3', 'Hello', {'height': 200})
```

- color: This option is used to set the background colour of cell comment box. You can use one of the named colours recognised by XlsxWriter or a Html color. See [Format Colors](#):

```
worksheet.write_comment('C3', 'Hello', {'color': 'green' })
worksheet.write_comment('C4', 'Hello', {'color': '#CCFFCC'})
```

- start_cell: This option is used to set the cell in which the comment will appear. By default Excel displays comments one cell to the right and one cell above the cell to which the comment relates. However, you can change this behaviour if you wish. In the following example the comment which would appear by default in cell D2 is moved to E2:

```
worksheet.write_comment('C3', 'Hello', {'start_cell': 'E2'})
```

- start_row: This option is used to set the row in which the comment will appear. See the start_cell option above. The row is zero indexed:

```
worksheet.write_comment('C3', 'Hello', {'start_row': 0})
```

- start_col: This option is used to set the column in which the comment will appear. See the start_cell option above. The column is zero indexed:

```
worksheet.write_comment('C3', 'Hello', {'start_col': 4})
```

- x_offset: This option is used to change the x offset, in pixels, of a comment within a cell:

```
worksheet.write_comment('C3', comment, {'x_offset': 30})
```

- y_offset: This option is used to change the y offset, in pixels, of a comment within a cell:

```
worksheet.write_comment('C3', comment, {'y_offset': 30})
```

You can apply as many of these options as you require. For a working example of these options in use see [Example: Adding Cell Comments to Worksheets \(Advanced\)](#).

Note: Excel only displays offset cell comments when they are displayed as `visible`. Excel does **not** display hidden cells as displaced when you mouse over them. Please note this when using options that adjust the position of the cell comment such as `start_cell`, `start_row`, `start_col`, `x_offset` and `y_offset`.

Note: Row height and comments. If you specify the height of a row that contains a comment then XlsxWriter will adjust the height of the comment to maintain the default or user specified dimensions. However, the height of a row can also be adjusted automatically by Excel if the text wrap property is set or large fonts are used in the cell. This means that the height of the row is unknown to the module at run time and thus the comment box is stretched with the row. Use the `set_row()` method to specify the row height explicitly and avoid this problem. See example 8 of [Example: Adding Cell Comments to Worksheets \(Advanced\)](#).

WORKING WITH OUTLINES AND GROUPING

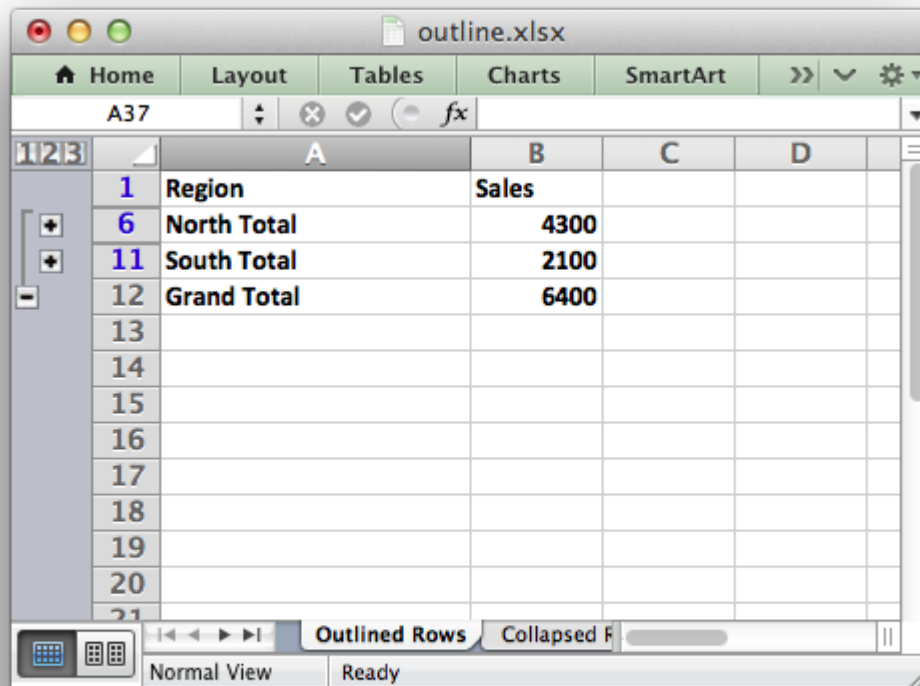
Excel allows you to group rows or columns so that they can be hidden or displayed with a single mouse click. This feature is referred to as outlines and grouping.

Outlines can reduce complex data down to a few salient sub-totals or summaries.

For example the following is a worksheet with three outlines. Rows 2-11 are grouped at level 1 and rows 2-5 and 7-10 are grouped at level 2. The lines at the left hand side are called outline level bars and the level is shown by the small numeral above the outline.

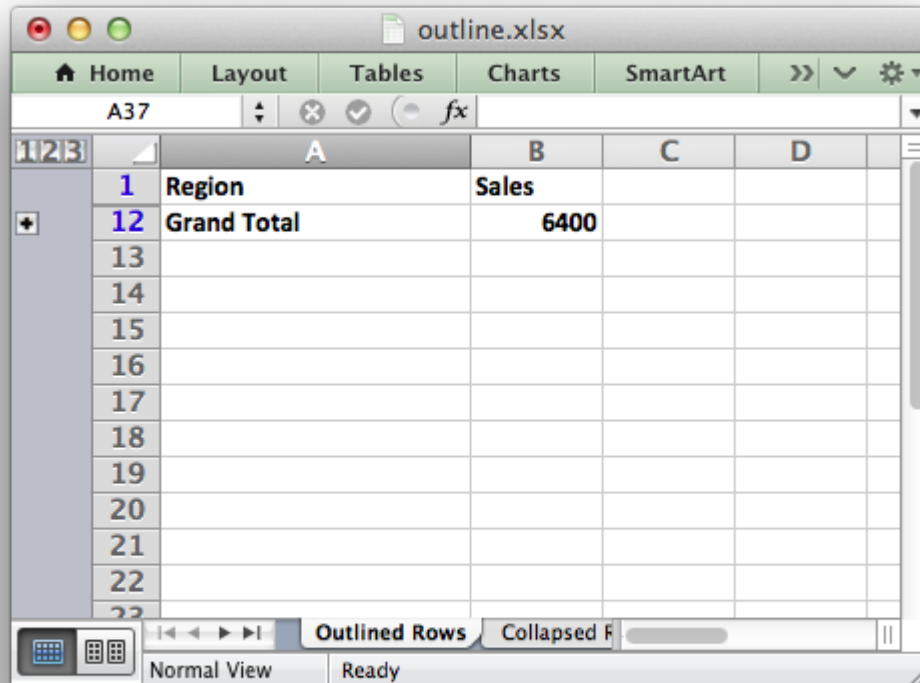
	A	B	C	D
1	Region	Sales		
2	North	1000		
3	North	1200		
4	North	900		
5	North	1200		
6	North Total	4300		
7	South	400		
8	South	600		
9	South	500		
10	South	600		
11	South Total	2100		
12	Grand Total	6400		

Clicking the minus sign on each of the level 2 outlines will collapse and hide the data as shown below. The minus sign changes to a plus sign to indicate that the data in the outline is hidden.



This shows the usefulness of outlines: with 2 mouse clicks we have reduce the amount of visual data down to 2 sub-totals and a master total.

Clicking on the minus sign on the level 1 outline will collapse the remaining rows as follows:



19.1 Outlines and Grouping in XlsxWriter

Grouping in XlsxWriter is achieved by setting the outline level via the `set_row()` and `set_column()` worksheet methods:

```
worksheet.set_row(row, height, format, options)
worksheet.set_column(first_col, last_col, width, format, options)
```

Adjacent row or columns with the same outline level are grouped together into a single outline.

The 'options' parameter is a dictionary with the following possible keys:

- 'hidden'
- 'level'
- 'collapsed'

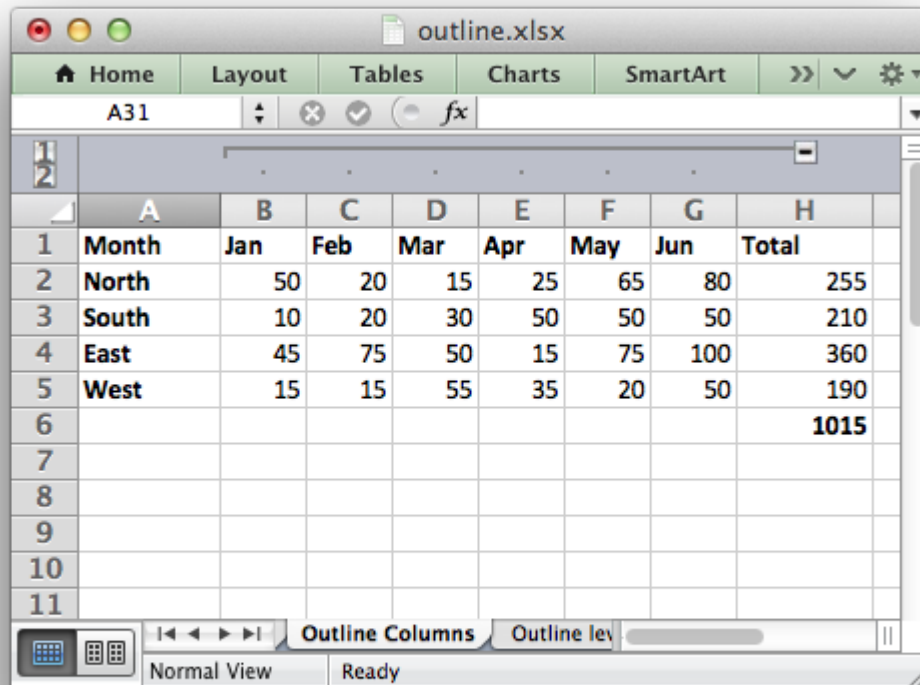
Options can be set as follows:

```
worksheet.set_row(0, 20, cell_format, {'hidden': True})

# Or use defaults for other properties and set the options only.
worksheet.set_row(0, None, None, {'hidden': True})
```

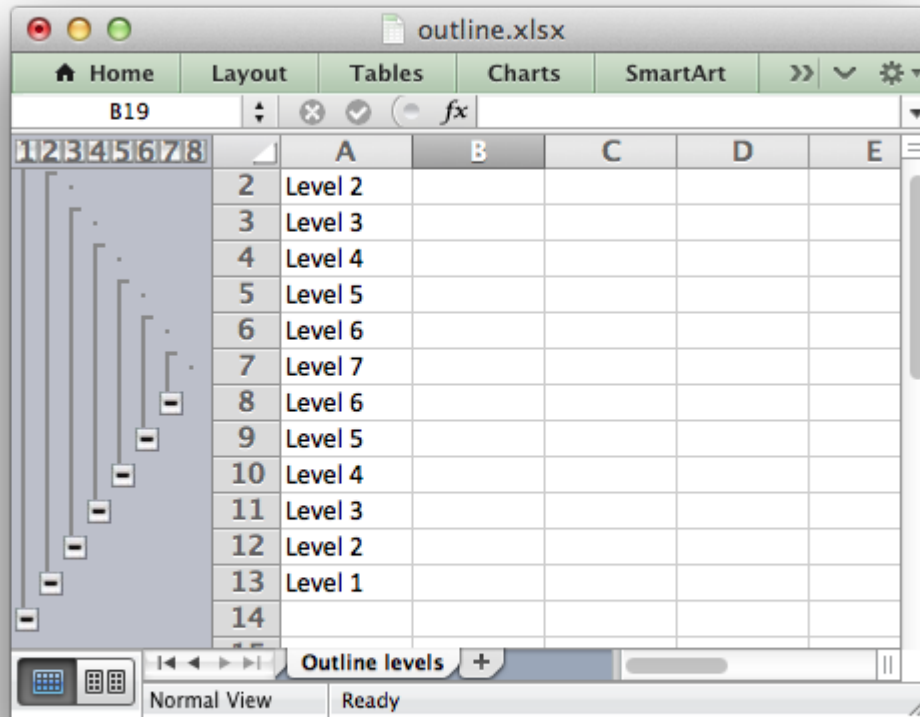
The following example sets an outline level of 1 for rows 1 and 2 (zero-indexed) and columns B to G. The parameters `height` and `cell_format` are assigned default values:

```
worksheet.set_row(1, None, None, {'level': 1})
worksheet.set_row(2, None, None, {'level': 1})
worksheet.set_column('B:G', None, None, {'level': 1})
```



	A	B	C	D	E	F	G	H
1	Month	Jan	Feb	Mar	Apr	May	Jun	Total
2	North	50	20	15	25	65	80	255
3	South	10	20	30	50	50	50	210
4	East	45	75	50	15	75	100	360
5	West	15	15	55	35	20	50	190
6								1015
7								
8								
9								
10								
11								

Excel allows up to 7 outline levels. Therefore the `level` parameter should be in the range $0 \leq \text{level} \leq 7$.



Rows and columns can be collapsed by setting the hidden flag for the hidden rows/columns and setting the collapsed flag for the row/column that has the collapsed '+' symbol:

```
worksheet.set_row(1, None, None, {'level': 1, 'hidden': True})
worksheet.set_row(2, None, None, {'level': 1, 'hidden': True})
worksheet.set_row(3, None, None, {'collapsed': True})

worksheet.set_column('B:G', None, None, {'level': 1, 'hidden': True})
worksheet.set_column('H:H', None, None, {'collapsed': True})
```

Note: Setting the collapsed flag is particularly important for compatibility with non-Excel spreadsheets.

For a more complete examples see [Example: Outline and Grouping](#) and [Example: Collapsed Outline and Grouping](#).

Some additional outline properties can be set via the `outline_settings()` worksheet method.

WORKING WITH MEMORY AND PERFORMANCE

The Python XlsxWriter module is based on the design of the Perl module *Excel::Writer::XLSX* which in turn is based on an older Perl module called *Spreadsheet::WriteExcel*.

Spreadsheet::WriteExcel was written to optimise speed and reduce memory usage. However, these design goals meant that it wasn't easy to implement features that many users requested such as writing formatting and data separately.

As a result XlsxWriter (and *Excel::Writer::XLSX*) takes a different design approach and holds a lot more data in memory so that it is functionally more flexible.

The effect of this is that XlsxWriter can consume a lot of memory. In addition the extended row and column ranges in Excel 2007+ mean that it is possible to run out of memory creating large files.

Fortunately, this memory usage can be reduced almost completely by using the *Workbook()* 'constant_memory' property:

```
workbook = Workbook(filename, {'constant_memory': True})
```

The optimisation works by flushing each row after a subsequent row is written. In this way the largest amount of data held in memory for a worksheet is the amount of data required to hold a single row of data.

Since each new row flushes the previous row, data must be written in sequential row order when 'constant_memory' mode is on:

```
# With 'constant_memory' you must write data in row by column order.
for row in range(0, row_max):
    for col in range(0, col_max):
        worksheet.write(row, col, some_data)

# With 'constant_memory' this would only write the first column of data.
for col in range(0, col_max):
    for row in range(0, row_max):
        worksheet.write(row, col, some_data)
```

Another optimisation that is used to reduce memory usage is that cell strings aren't stored in an Excel structure call "shared strings" and instead are written "in-line". This is a documented Excel feature that is supported by most spreadsheet applications. One known exception is Apple Numbers for Mac where the string data isn't displayed.

The trade-off when using 'constant_memory' mode is that you won't be able to take advantage of any new features that manipulate cell data after it is written. Currently the only such feature is [Worksheet Tables](#).

For larger files 'constant_memory' mode also gives an increase in execution speed, see below.

20.1 Performance Figures

The performance figures below show execution time and memory usage for worksheets of size N rows x 50 columns with a 50/50 mixture of strings and numbers. The figures are taken from an arbitrary, mid-range, machine. Specific figures will vary from machine to machine but the trends should be the same.

XlsxWriter in normal operation mode: the execution time and memory usage increase more or less linearly with the number of rows:

Rows	Columns	Time (s)	Memory (bytes)
200	50	0.72	2050552
400	50	1.45	4478272
800	50	2.90	8083072
1600	50	5.92	17799424
3200	50	11.83	32218624
6400	50	23.72	64792576
12800	50	47.85	128760832

XlsxWriter in constant_memory mode: the execution time still increases linearly with the number of rows but the memory usage remains small and constant:

Rows	Columns	Time (s)	Memory (bytes)
200	50	0.40	54248
400	50	0.80	54248
800	50	1.60	54248
1600	50	3.19	54248
3200	50	6.29	54248
6400	50	12.74	54248
12800	50	25.34	54248

In the constant_memory mode the performance is also increased. There will be further optimisation in both modes in later releases.

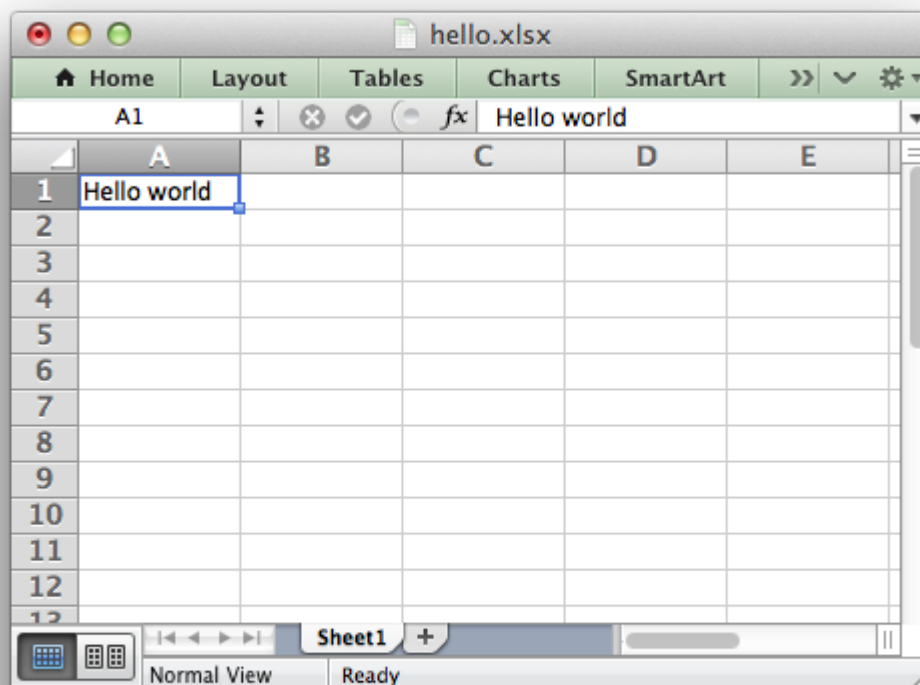
These figures were generated using programs in the dev/performance directory of the XlsxWriter source code.

EXAMPLES

The following are some of the examples included in the [examples](#) directory of the XlsxWriter distribution.

21.1 Example: Hello World

The simplest possible spreadsheet. This is a good place to start to see if the XlsxWriter module is installed correctly.



```
#####
#
# A hello world spreadsheet using the XlsxWriter Python module.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

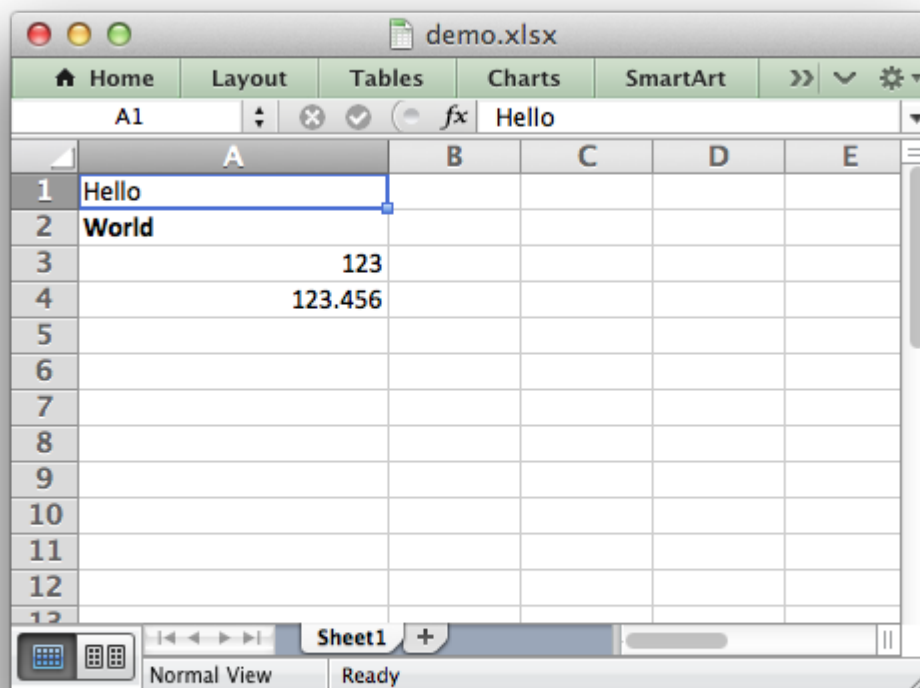
workbook = Workbook('hello_world.xlsx')
worksheet = workbook.add_worksheet()

worksheet.write('A1', 'Hello world')

workbook.close()
```

21.2 Example: Simple Feature Demonstration

This program is an example of writing some of the features of the XlsxWriter module.



```
#####
#
# A simple example of some of the features of the XlsxWriter Python module.
```

```
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

# Create an new Excel file and add a worksheet.
workbook = Workbook('demo.xlsx')
worksheet = workbook.add_worksheet()

# Widen the first column to make the text clearer.
worksheet.set_column('A:A', 20)

# Add a bold format to use to highlight cells.
bold = workbook.add_format({'bold': 1})

# Write some simple text.
worksheet.write('A1', 'Hello')

# Text with formatting.
worksheet.write('A2', 'World', bold)

# Write some numbers, with row/column notation.
worksheet.write(2, 0, 123)
worksheet.write(3, 0, 123.456)

workbook.close()
```

Notes:

- This example includes the use of cell formatting via the *The Format Class*.
- Strings and numbers can be written with the same worksheet `write()` method.
- Data can be written to cells using Row-Column notation or 'A1' style notation, see *Working with Cell Notation*.

21.3 Example: Dates and Times in Excel

This program is an example of writing some of the features of the XlsxWriter module. See the *Working with Dates and Time* section for more details on this example.

The screenshot shows an Excel spreadsheet with two columns: 'Formatted date' and 'Format'. The rows contain various date and time strings and their corresponding Excel format codes. The spreadsheet is titled 'datetimes.xlsx' and has tabs for 'Home', 'Layout', 'Tables', 'Charts', and 'SmartArt'. The active cell is A19.

	A	B
1	Formatted date	Format
2	23/01/13	dd/mm/yy
3	01/23/13	mm/dd/yy
4	23 1 13	dd m yy
5	23 01 13	d mm yy
6	23 Jan 13	d mmm yy
7	23 January 13	d mmmm yy
8	23 January 2013	d mmmm yyyy
9	23 January 2013	d mmmm yyyy
10	23/01/13 12:30	dd/mm/yy hh:mm
11	23/01/13 12:30:05	dd/mm/yy hh:mm:ss
12	23/01/13 12:30:05.123	dd/mm/yy hh:mm:ss.000
13	12:30	hh:mm

```
#####
#
# A simple program to write some dates and times to an Excel file
# using the XlsxWriter Python module.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from datetime import datetime
from xlsxwriter.workbook import Workbook

# Create a workbook and add a worksheet.
workbook = Workbook('datetimes.xlsx')
worksheet = workbook.add_worksheet()
bold = workbook.add_format({'bold': True})

# Expand the first columns so that the date is visible.
worksheet.set_column('A:B', 30)

# Write the column headers.
worksheet.write('A1', 'Formatted date', bold)
worksheet.write('B1', 'Format', bold)

# Create a datetime object to use in the examples.
```

```
date_time = datetime.strptime('2013-01-23 12:30:05.123',
                              '%Y-%m-%d %H:%M:%S.%f')

# Examples date and time formats. In the output file compare how changing
# the format codes change the appearance of the date.
date_formats = (
    'dd/mm/yy',
    'mm/dd/yy',
    'dd m yy',
    'd mm yy',
    'd mmm yy',
    'd mmmm yy',
    'd mmmm yyy',
    'd mmmm yyyy',
    'dd/mm/yy hh:mm',
    'dd/mm/yy hh:mm:ss',
    'dd/mm/yy hh:mm:ss.000',
    'hh:mm',
    'hh:mm:ss',
    'hh:mm:ss.000',
)

# Start from first row after headers.
row = 1

# Write the same date and time using each of the above formats.
for date_format_str in date_formats:

    # Create a format for the date or time.
    date_format = workbook.add_format({'num_format': date_format_str,
                                       'align': 'left'})

    # Write the same date using different formats.
    worksheet.write_datetime(row, 0, date_time, date_format)

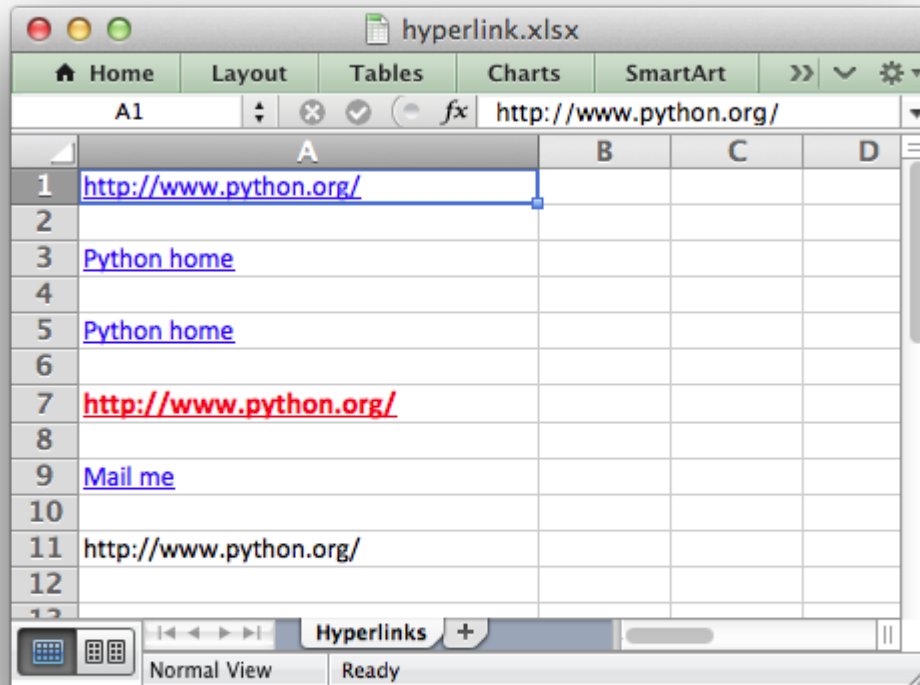
    # Also write the format string for comparison.
    worksheet.write_string(row, 1, date_format_str)

    row += 1

workbook.close()
```

21.4 Example: Adding hyperlinks

This program is an example of writing hyperlinks to a worksheet. See the `write_url()` method for more details.



```
#####
#
# Example of how to use the XlsxWriter module to write hyperlinks
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

# Create a new workbook and add a worksheet
workbook = Workbook('hyperlink.xlsx')
worksheet = workbook.add_worksheet('Hyperlinks')

# Format the first column
worksheet.set_column('A:A', 30)

# Add the standard url link format.
url_format = workbook.add_format({
    'color': 'blue',
    'underline': 1
})

# Add a sample alternative link format.
red_format = workbook.add_format({
    'color': 'red',

```

```
        'bold':      1,
        'underline': 1,
        'size':      12,
    })

    # Add an alternate description string to the URL.
    string = 'Python home'

    # Add a "tool tip" to the URL.
    tip = 'Get the latest Python news here.'

    # Write some hyperlinks
    worksheet.write('A1', 'http://www.python.org/', url_format)
    worksheet.write('A3', 'http://www.python.org/', url_format, string)
    worksheet.write('A5', 'http://www.python.org/', url_format, string, tip)
    worksheet.write('A7', 'http://www.python.org/', red_format)
    worksheet.write('A9', 'mailto:jmcnamaracpan.org', url_format, 'Mail me')

    # Write a URL that isn't a hyperlink
    worksheet.write_string('A11', 'http://www.python.org/')

    workbook.close()
```

21.5 Example: Array formulas

This program is an example of writing array formulas with one or more return values. See the `write_array_formula()` method for more details.

	A	B	C	D	E	F
1	9500	500	300			
2	9500	10	15			
3						
4						
5	22196	1	20234			
6	17079	2	21003			
7	11962	3	10000			
8						
9						
10						
11						
12						
13						

```
#####
#
# Example of how to use Python and the XlsxWriter module to write
# simple array formulas.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

# Create a new workbook and add a worksheet
workbook = Workbook('array_formula.xlsx')
worksheet = workbook.add_worksheet()

# Write some test data.
worksheet.write('B1', 500)
worksheet.write('B2', 10)
worksheet.write('B5', 1)
worksheet.write('B6', 2)
worksheet.write('B7', 3)
worksheet.write('C1', 300)
worksheet.write('C2', 15)
worksheet.write('C5', 20234)
worksheet.write('C6', 21003)
worksheet.write('C7', 10000)
```



```
# Write an array formula that returns a single value
worksheet.write('A1', '{=SUM(B1:C1*B2:C2)}')

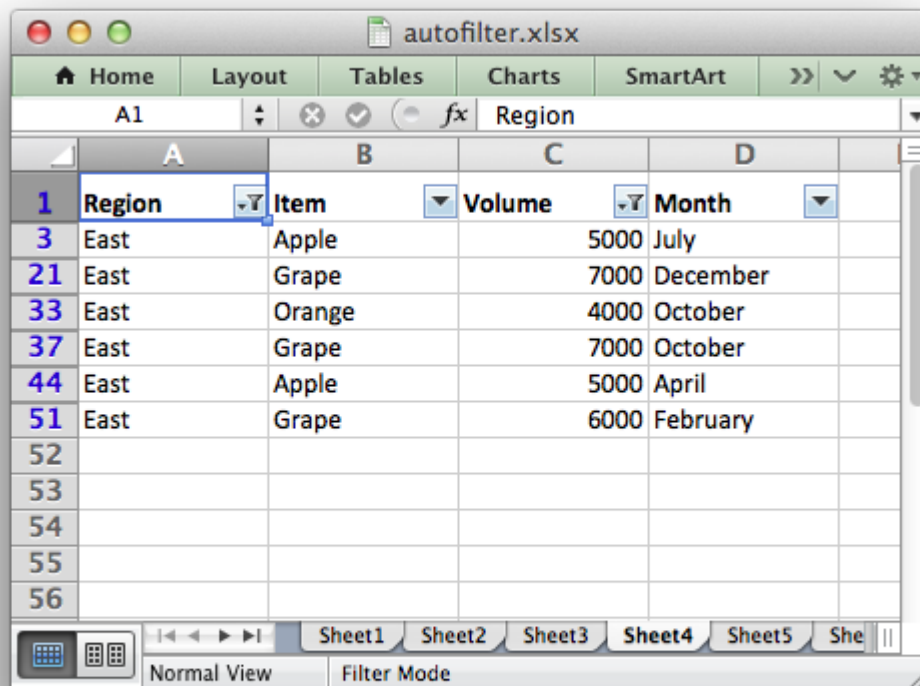
# Same as above but more verbose.
worksheet.write_array_formula('A2:A2', '{=SUM(B1:C1*B2:C2)}')

# Write an array formula that returns a range of values
worksheet.write_array_formula('A5:A7', '{=TREND(C5:C7,B5:B7)}')

workbook.close()
```

21.6 Example: Applying Autofilters

This program is an example of using autofilters in a worksheet. See [Working with Autofilters](#) for more details.



```
#####
#
# An example of how to create autofilters with XlsxWriter.
#
```

```
# An autofilter is a way of adding drop down lists to the headers of a 2D
# range of worksheet data. This allows users to filter the data based on
# simple criteria so that some data is shown and some is hidden.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('autofilter.xlsx')

# Add a worksheet for each autofilter example.
worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
worksheet3 = workbook.add_worksheet()
worksheet4 = workbook.add_worksheet()
worksheet5 = workbook.add_worksheet()
worksheet6 = workbook.add_worksheet()

# Add a bold format for the headers.
bold = workbook.add_format({'bold': 1})

# Open a text file with autofilter example data.
textfile = open('autofilter_data.txt')

# Read the headers from the first line of the input file.
headers = textfile.readline().strip("\n").split()

# Read the text file and store the field data.
data = []
for line in textfile:
    # Split the input data based on whitespace.
    row_data = line.strip("\n").split()
    data.append(row_data)

# Set up several sheets with the same data.
for worksheet in (workbook.worksheets()):
    # Make the columns wider.
    worksheet.set_column('A:D', 12)
    # Make the header row larger.
    worksheet.set_row(0, 20, bold)
    # Make the headers bold.
    worksheet.write_row('A1', headers)

#####
#
# Example 1. Autofilter without conditions.
#

# Set the autofilter.
worksheet1.autofilter('A1:D51')
```

```

row = 1
for row_data in (data):
    worksheet1.write_row(row, 0, row_data)

    # Move on to the next worksheet row.
    row += 1

#####
#
#
# Example 2. Autofilter with a filter condition in the first column.
#

# Autofilter range using Row-Column notation.
worksheet2.autofilter(0, 0, 50, 3)

# Add filter criteria. The placeholder "Region" in the filter is
# ignored and can be any string that adds clarity to the expression.
worksheet2.filter_column(0, 'Region == East')

# Hide the rows that don't match the filter criteria.
row = 1
for row_data in (data):
    region = row_data[0]

    # Check for rows that match the filter.
    if region == 'East':
        # Row matches the filter, no further action required.
        pass
    else:
        # We need to hide rows that don't match the filter.
        worksheet2.set_row(row, options={'hidden': True})

    worksheet2.write_row(row, 0, row_data)

    # Move on to the next worksheet row.
    row += 1

#####
#
#
# Example 3. Autofilter with a dual filter condition in one of the columns.
#

# Set the autofilter.
worksheet3.autofilter('A1:D51')

# Add filter criteria.
worksheet3.filter_column('A', 'x == East or x == South')

# Hide the rows that don't match the filter criteria.

```

```

row = 1
for row_data in (data):
    region = row_data[0]

    # Check for rows that match the filter.
    if region == 'East' or region == 'South':
        # Row matches the filter, no further action required.
        pass
    else:
        # We need to hide rows that don't match the filter.
        worksheet3.set_row(row, options={'hidden': True})

    worksheet3.write_row(row, 0, row_data)

    # Move on to the next worksheet row.
    row += 1

#####
#
#
# Example 4. Autofilter with filter conditions in two columns.
#

# Set the autofilter.
worksheet4.autofilter('A1:D51')

# Add filter criteria.
worksheet4.filter_column('A', 'x == East')
worksheet4.filter_column('C', 'x > 3000 and x < 8000')

# Hide the rows that don't match the filter criteria.
row = 1
for row_data in (data):
    region = row_data[0]
    volume = int(row_data[2])

    # Check for rows that match the filter.
    if region == 'East' and volume > 3000 and volume < 8000:
        # Row matches the filter, no further action required.
        pass
    else:
        # We need to hide rows that don't match the filter.
        worksheet4.set_row(row, options={'hidden': True})

    worksheet4.write_row(row, 0, row_data)

    # Move on to the next worksheet row.
    row += 1

#####
#

```

```

#
# Example 5. Autofilter with filter for blanks.
#
# Create a blank cell in our test data.

# Set the autofilter.
worksheet5.autofilter('A1:D51')

# Add filter criteria.
worksheet5.filter_column('A', 'x == Blanks')

# Simulate a blank cell in the data.
data[5][0] = ''

# Hide the rows that don't match the filter criteria.
row = 1
for row_data in (data):
    region = row_data[0]

    # Check for rows that match the filter.
    if region == '':
        # Row matches the filter, no further action required.
        pass
    else:
        # We need to hide rows that don't match the filter.
        worksheet5.set_row(row, options={'hidden': True})

    worksheet5.write_row(row, 0, row_data)

    # Move on to the next worksheet row.
    row += 1

#####
#
#
# Example 6. Autofilter with filter for non-blanks.
#

# Set the autofilter.
worksheet6.autofilter('A1:D51')

# Add filter criteria.
worksheet6.filter_column('A', 'x == NonBlanks')

# Hide the rows that don't match the filter criteria.
row = 1
for row_data in (data):
    region = row_data[0]

    # Check for rows that match the filter.
    if region != '':
        # Row matches the filter, no further action required.

```

```

        pass
    else:
        # We need to hide rows that don't match the filter.
        worksheet6.set_row(row, options={'hidden': True})

    worksheet6.write_row(row, 0, row_data)

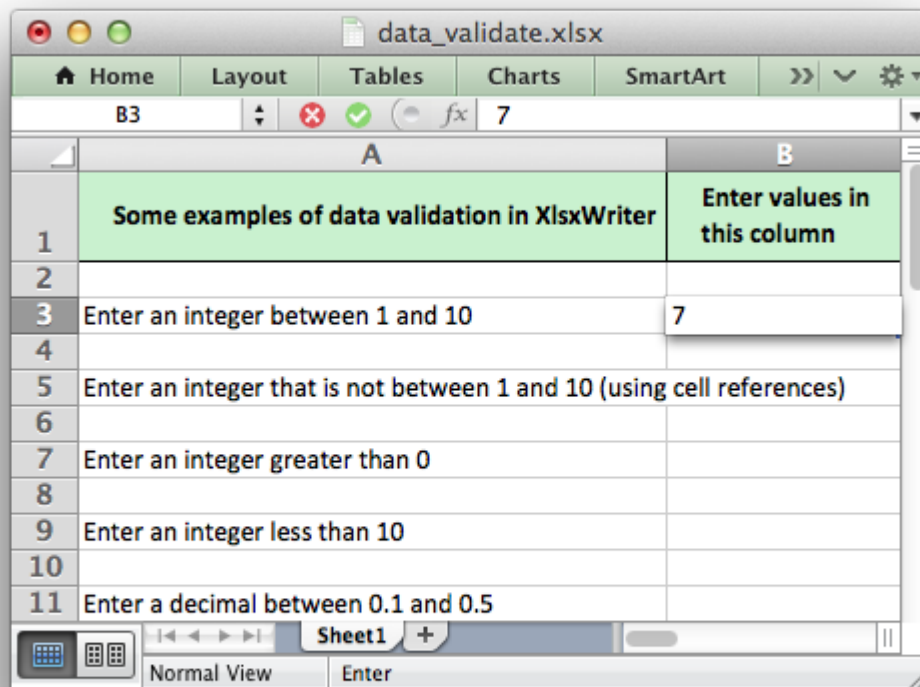
    # Move on to the next worksheet row.
    row += 1

workbook.close()

```

21.7 Example: Data Validation and Drop Down Lists

Example of how to add data validation and drop down lists to an XlsxWriter file. Data validation is a way of limiting user input to certain ranges or to allow a selection from a drop down list.



```

#####
#
# Example of how to add data validation and dropdown lists to an
# XlsxWriter file.

```

```

#
# Data validation is a feature of Excel which allows you to restrict
# the data that a user enters in a cell and to display help and
# warning messages. It also allows you to restrict input to values in
# a drop down list.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from datetime import date, time
from xlsxwriter.workbook import Workbook

workbook = Workbook('data_validate.xlsx')
worksheet = workbook.add_worksheet()

# Add a format for the header cells.
header_format = workbook.add_format({
    'border': 1,
    'bg_color': '#C6EFCE',
    'bold': True,
    'text_wrap': True,
    'valign': 'vcenter',
    'indent': 1,
})

# Set up layout of the worksheet.
worksheet.set_column('A:A', 68)
worksheet.set_column('B:B', 15)
worksheet.set_column('D:D', 15)
worksheet.set_row(0, 36)

# Write the header cells and some data that will be used in the examples.
heading1 = 'Some examples of data validation in XlsxWriter'
heading2 = 'Enter values in this column'
heading3 = 'Sample Data'

worksheet.write('A1', heading1, header_format)
worksheet.write('B1', heading2, header_format)
worksheet.write('D1', heading3, header_format)

worksheet.write_row('D3', ['Integers', 1, 10])
worksheet.write_row('D4', ['List data', 'open', 'high', 'close'])
worksheet.write_row('D5', ['Formula', '=AND(F5=50,G5=60)', 50, 60])

# Example 1. Limiting input to an integer in a fixed range.
#
txt = 'Enter an integer between 1 and 10'

worksheet.write('A3', txt)
worksheet.data_validation('B3', {'validate': 'integer',
                                'criteria': 'between',
                                'minimum': 1,
                                'maximum': 10})

```

```
# Example 2. Limiting input to an integer outside a fixed range.
#
txt = 'Enter an integer that is not between 1 and 10 (using cell references)'

worksheet.write('A5', txt)
worksheet.data_validation('B5', {'validate': 'integer',
                                  'criteria': 'not between',
                                  'minimum': '=E3',
                                  'maximum': '=F3'})

# Example 3. Limiting input to an integer greater than a fixed value.
#
txt = 'Enter an integer greater than 0'

worksheet.write('A7', txt)
worksheet.data_validation('B7', {'validate': 'integer',
                                  'criteria': '>',
                                  'value': 0})

# Example 4. Limiting input to an integer less than a fixed value.
#
txt = 'Enter an integer less than 10'

worksheet.write('A9', txt)
worksheet.data_validation('B9', {'validate': 'integer',
                                  'criteria': '<',
                                  'value': 10})

# Example 5. Limiting input to a decimal in a fixed range.
#
txt = 'Enter a decimal between 0.1 and 0.5'

worksheet.write('A11', txt)
worksheet.data_validation('B11', {'validate': 'decimal',
                                  'criteria': 'between',
                                  'minimum': 0.1,
                                  'maximum': 0.5})

# Example 6. Limiting input to a value in a dropdown list.
#
txt = 'Select a value from a drop down list'

worksheet.write('A13', txt)
worksheet.data_validation('B13', {'validate': 'list',
                                  'source': ['open', 'high', 'close']})
```



```
# Example 7. Limiting input to a value in a dropdown list.
#
txt = 'Select a value from a drop down list (using a cell range)'

worksheet.write('A15', txt)
worksheet.data_validation('B10', {'validate': 'list',
                                   'source': '=$E$4:$G$4'})

# Example 8. Limiting input to a date in a fixed range.
#
txt = 'Enter a date between 1/1/2008 and 12/12/2008'

worksheet.write('A17', txt)
worksheet.data_validation('B17', {'validate': 'date',
                                   'criteria': 'between',
                                   'minimum': date(2013, 1, 1),
                                   'maximum': date(2013, 12, 12)})

# Example 9. Limiting input to a time in a fixed range.
#
txt = 'Enter a time between 6:00 and 12:00'

worksheet.write('A19', txt)
worksheet.data_validation('B19', {'validate': 'time',
                                   'criteria': 'between',
                                   'minimum': time(6, 0),
                                   'maximum': time(12, 0)})

# Example 10. Limiting input to a string greater than a fixed length.
#
txt = 'Enter a string longer than 3 characters'

worksheet.write('A21', txt)
worksheet.data_validation('B21', {'validate': 'length',
                                   'criteria': '>',
                                   'value': 3})

# Example 11. Limiting input based on a formula.
#
txt = 'Enter a value if the following is true "=&AND(F5=50,G5=60)""'

worksheet.write('A23', txt)
worksheet.data_validation('B23', {'validate': 'custom',
                                   'value': '=&AND(F5=50,G5=60)'})

# Example 12. Displaying and modifying data validation messages.
#
txt = 'Displays a message when you select the cell'
```

```

worksheet.write('A25', txt)
worksheet.data_validation('B25', {'validate': 'integer',
                                   'criteria': 'between',
                                   'minimum': 1,
                                   'maximum': 100,
                                   'input_title': 'Enter an integer:',
                                   'input_message': 'between 1 and 100'})

# Example 13. Displaying and modifying data validation messages.
#
txt = "Display a custom error message when integer isn't between 1 and 100"

worksheet.write('A27', txt)
worksheet.data_validation('B27', {'validate': 'integer',
                                   'criteria': 'between',
                                   'minimum': 1,
                                   'maximum': 100,
                                   'input_title': 'Enter an integer:',
                                   'input_message': 'between 1 and 100',
                                   'error_title': 'Input value is not valid!',
                                   'error_message':
                                       'It should be an integer between 1 and 100'})

# Example 14. Displaying and modifying data validation messages.
#
txt = "Display a custom info message when integer isn't between 1 and 100"

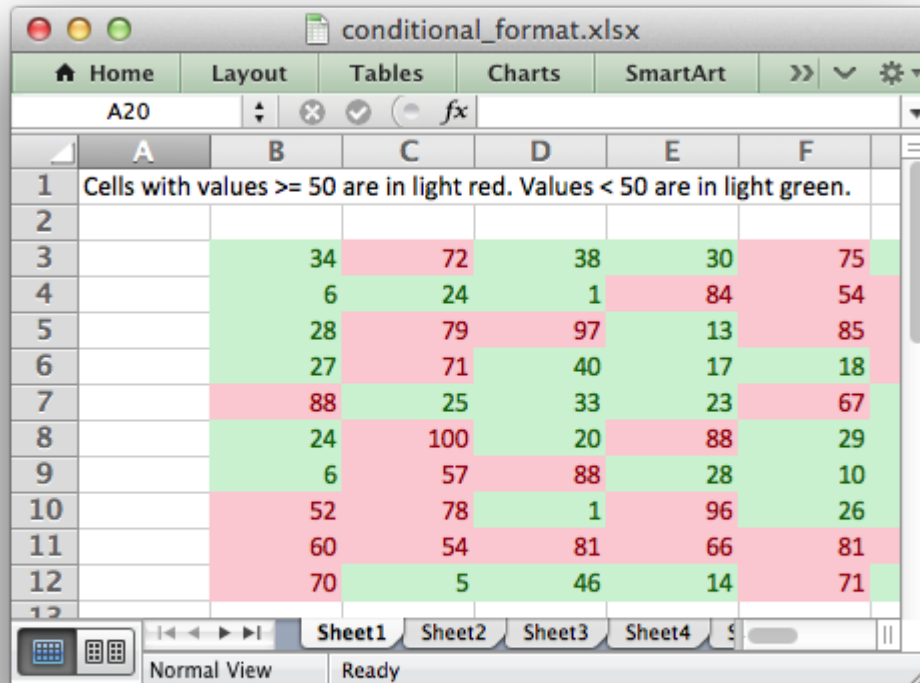
worksheet.write('A29', txt)
worksheet.data_validation('B29', {'validate': 'integer',
                                   'criteria': 'between',
                                   'minimum': 1,
                                   'maximum': 100,
                                   'input_title': 'Enter an integer:',
                                   'input_message': 'between 1 and 100',
                                   'error_title': 'Input value is not valid!',
                                   'error_message':
                                       'It should be an integer between 1 and 100',
                                   'error_type': 'information'})

workbook.close()

```

21.8 Example: Conditional Formatting

Example of how to add conditional formatting to an XlsxWriter file. Conditional formatting allows you to apply a format to a cell or a range of cells based on certain criteria.



```
#####
#
# Example of how to add conditional formatting to an XlsxWriter file.
#
# Conditional formatting allows you to apply a format to a cell or a
# range of cells based on certain criteria.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('conditional_format.xlsx')
worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
worksheet3 = workbook.add_worksheet()
worksheet4 = workbook.add_worksheet()
worksheet5 = workbook.add_worksheet()
worksheet6 = workbook.add_worksheet()
worksheet7 = workbook.add_worksheet()
worksheet8 = workbook.add_worksheet()

# Add a format. Light red fill with dark red text.
format1 = workbook.add_format({'bg_color': '#FFC7CE',
                                'font_color': '#9C0006'})
```

```
# Add a format. Green fill with dark green text.
format2 = workbook.add_format({'bg_color': '#C6EFCE',
                               'font_color': '#006100'})

# Some sample data to run the conditional formatting against.
data = [
    [34, 72, 38, 30, 75, 48, 75, 66, 84, 86],
    [6, 24, 1, 84, 54, 62, 60, 3, 26, 59],
    [28, 79, 97, 13, 85, 93, 93, 22, 5, 14],
    [27, 71, 40, 17, 18, 79, 90, 93, 29, 47],
    [88, 25, 33, 23, 67, 1, 59, 79, 47, 36],
    [24, 100, 20, 88, 29, 33, 38, 54, 54, 88],
    [6, 57, 88, 28, 10, 26, 37, 7, 41, 48],
    [52, 78, 1, 96, 26, 45, 47, 33, 96, 36],
    [60, 54, 81, 66, 81, 90, 80, 93, 12, 55],
    [70, 5, 46, 14, 71, 19, 66, 36, 41, 21],
]

#####
#
# Example 1.
#
caption = ('Cells with values >= 50 are in light red. '
          'Values < 50 are in light green.')

# Write the data.
worksheet1.write('A1', caption)

for row, row_data in enumerate(data):
    worksheet1.write_row(row + 2, 1, row_data)

# Write a conditional format over a range.
worksheet1.conditional_format('B3:K12', {'type': 'cell',
                                          'criteria': '>=',
                                          'value': 50,
                                          'format': format1})

# Write another conditional format over the same range.
worksheet1.conditional_format('B3:K12', {'type': 'cell',
                                          'criteria': '<',
                                          'value': 50,
                                          'format': format2})

#####
#
# Example 2.
#
caption = ('Values between 30 and 70 are in light red. '
          'Values outside that range are in light green.')

worksheet2.write('A1', caption)
```

```

for row, row_data in enumerate(data):
    worksheet2.write_row(row + 2, 1, row_data)

worksheet2.conditional_format('B3:K12', {'type': 'cell',
                                          'criteria': 'between',
                                          'minimum': 30,
                                          'maximum': 70,
                                          'format': format1})

worksheet2.conditional_format('B3:K12', {'type': 'cell',
                                          'criteria': 'not between',
                                          'minimum': 30,
                                          'maximum': 70,
                                          'format': format2})

#####
#
# Example 3.
#
caption = ('Duplicate values are in light red. '
          'Unique values are in light green.')

worksheet3.write('A1', caption)

for row, row_data in enumerate(data):
    worksheet3.write_row(row + 2, 1, row_data)

worksheet3.conditional_format('B3:K12', {'type': 'duplicate',
                                          'format': format1})

worksheet3.conditional_format('B3:K12', {'type': 'unique',
                                          'format': format2})

#####
#
# Example 4.
#
caption = ('Above average values are in light red. '
          'Below average values are in light green.')

worksheet4.write('A1', caption)

for row, row_data in enumerate(data):
    worksheet4.write_row(row + 2, 1, row_data)

worksheet4.conditional_format('B3:K12', {'type': 'average',
                                          'criteria': 'above',
                                          'format': format1})

worksheet4.conditional_format('B3:K12', {'type': 'average',
                                          'criteria': 'below',

```

```

        'format': format2})

#####
#
# Example 5.
#
caption = ('Top 10 values are in light red. '
          'Bottom 10 values are in light green.')

worksheet5.write('A1', caption)

for row, row_data in enumerate(data):
    worksheet5.write_row(row + 2, 1, row_data)

worksheet5.conditional_format('B3:K12', {'type': 'top',
                                          'value': '10',
                                          'format': format1})

worksheet5.conditional_format('B3:K12', {'type': 'bottom',
                                          'value': '10',
                                          'format': format2})

#####
#
# Example 6.
#
caption = ('Cells with values >= 50 are in light red. '
          'Values < 50 are in light green. Non-contiguous ranges.')

# Write the data.
worksheet6.write('A1', caption)

for row, row_data in enumerate(data):
    worksheet6.write_row(row + 2, 1, row_data)

# Write a conditional format over a range.
worksheet6.conditional_format('B3:K6', {'type': 'cell',
                                          'criteria': '>=',
                                          'value': 50,
                                          'format': format1,
                                          'multi_range': 'B3:K6 B9:K12'})

# Write another conditional format over the same range.
worksheet6.conditional_format('B3:K6', {'type': 'cell',
                                          'criteria': '<',
                                          'value': 50,
                                          'format': format2,
                                          'multi_range': 'B3:K6 B9:K12'})

#####

```

```
#
# Example 7.
#
caption = 'Examples of color scales and data bars. Default colours.'

data = range(1, 13)

worksheet7.write('A1', caption)

worksheet7.write('B2', "2 Color Scale")
worksheet7.write('D2', "3 Color Scale")
worksheet7.write('F2', "Data Bars")

for row, row_data in enumerate(data):
    worksheet7.write(row + 2, 1, row_data)
    worksheet7.write(row + 2, 3, row_data)
    worksheet7.write(row + 2, 5, row_data)

worksheet7.conditional_format('B3:B14', {'type': '2_color_scale'})
worksheet7.conditional_format('D3:D14', {'type': '3_color_scale'})
worksheet7.conditional_format('F3:F14', {'type': 'data_bar'})

#####
#
# Example 8.
#
caption = 'Examples of color scales and data bars. Modified colours.'

data = range(1, 13)

worksheet8.write('A1', caption)

worksheet8.write('B2', "2 Color Scale")
worksheet8.write('D2', "3 Color Scale")
worksheet8.write('F2', "Data Bars")

for row, row_data in enumerate(data):
    worksheet8.write(row + 2, 1, row_data)
    worksheet8.write(row + 2, 3, row_data)
    worksheet8.write(row + 2, 5, row_data)

worksheet8.conditional_format('B3:B14', {'type': '2_color_scale',
                                          'min_color': "#FF0000",
                                          'max_color': "#00FF00"})

worksheet8.conditional_format('D3:D14', {'type': '3_color_scale',
                                          'min_color': "#C5D9F1",
                                          'mid_color': "#8DB4E3",
                                          'max_color': "#538ED5"})

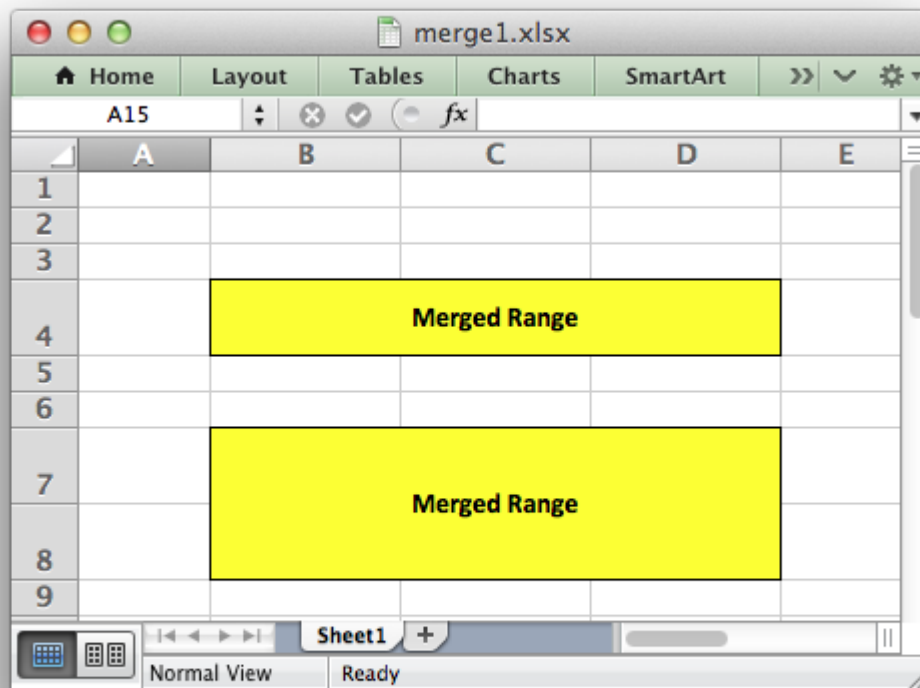
worksheet8.conditional_format('F3:F14', {'type': 'data_bar',
```

```
'bar_color': '#63C384'})
```

```
workbook.close()
```

21.9 Example: Merging Cells

This program is an example of merging cells in a worksheet. See the `merge_range()` method for more details.



```
#####
#
# A simple example of merging cells with the XlsxWriter Python module.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

# Create an new Excel file and add a worksheet.
workbook = Workbook('merge1.xlsx')
worksheet = workbook.add_worksheet()
```



```
# Increase the cell size of the merged cells to highlight the formatting.
worksheet.set_column('B:D', 12)
worksheet.set_row(3, 30)
worksheet.set_row(6, 30)
worksheet.set_row(7, 30)

# Create a format to use in the merged range.
merge_format = workbook.add_format({
    'bold': 1,
    'border': 1,
    'align': 'center',
    'valign': 'vcenter',
    'fg_color': 'yellow'})

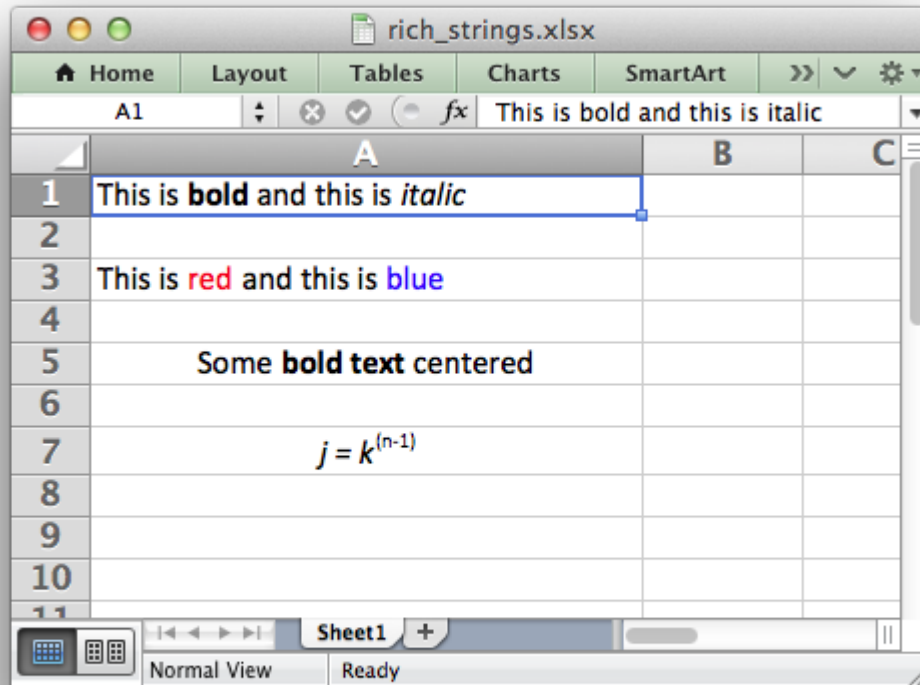
# Merge 3 cells.
worksheet.merge_range('B4:D4', 'Merged Range', merge_format)

# Merge 3 cells over two rows.
worksheet.merge_range('B7:D8', 'Merged Range', merge_format)

workbook.close()
```

21.10 Example: Writing “Rich” strings with multiple formats

This program is an example of writing rich strings with multiple format to a cell in a worksheet. See the [write_rich_string\(\)](#) method for more details.



```
#####
#
# An example of using Python and XlsxWriter to write some "rich strings",
# i.e., strings with multiple formats.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('rich_strings.xlsx')
worksheet = workbook.add_worksheet()

worksheet.set_column('A:A', 30)

# Set up some formats to use.
bold = workbook.add_format({'bold': True})
italic = workbook.add_format({'italic': True})
red = workbook.add_format({'color': 'red'})
blue = workbook.add_format({'color': 'blue'})
center = workbook.add_format({'align': 'center'})
superscript = workbook.add_format({'font_script': 1})

# Write some strings with multiple formats.
worksheet.write_rich_string('A1',
```

```
        'This is ',
        bold, 'bold',
        ' and this is ',
        italic, 'italic')

worksheet.write_rich_string('A3',
        'This is ',
        red, 'red',
        ' and this is ',
        blue, 'blue')

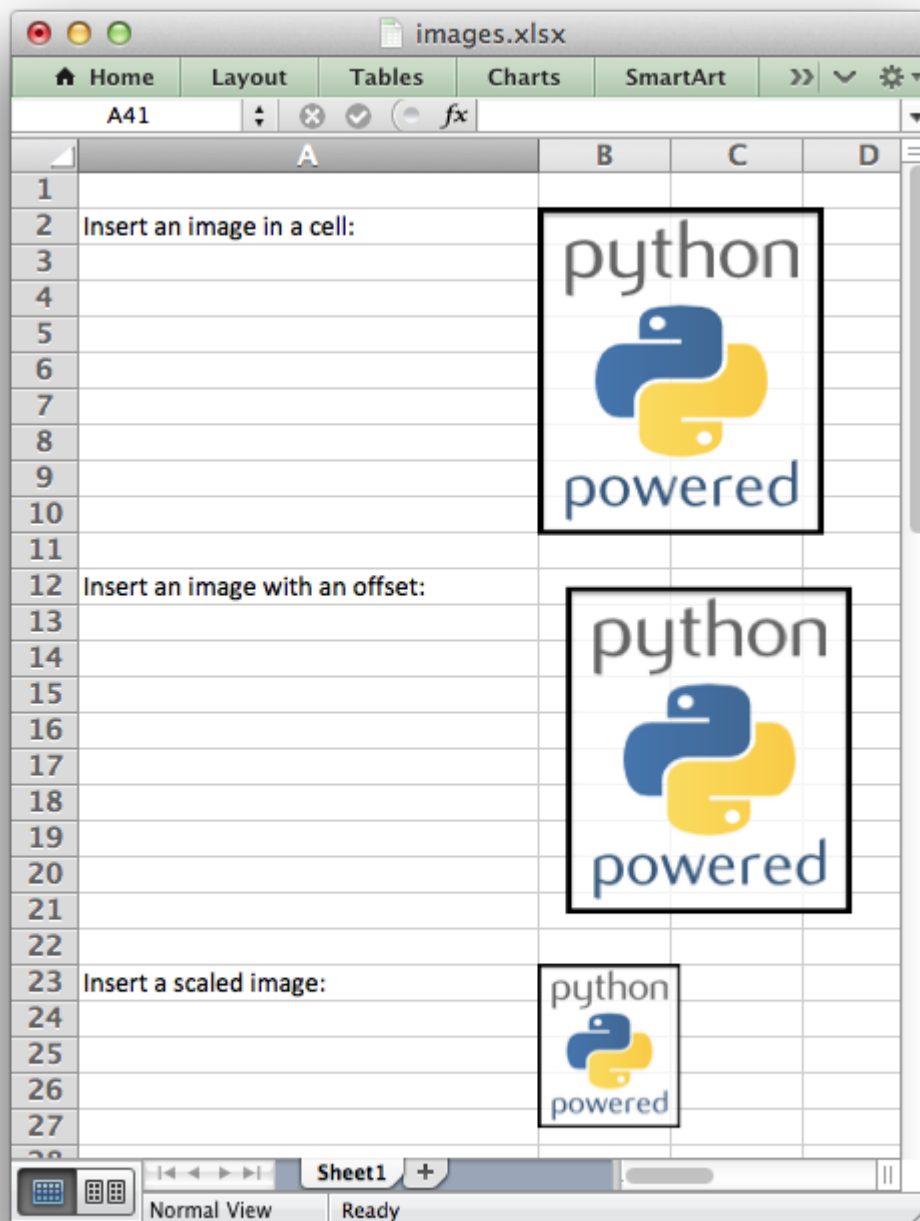
worksheet.write_rich_string('A5',
        'Some ',
        bold, 'bold text',
        ' centered',
        center)

worksheet.write_rich_string('A7',
        italic,
        'j = k',
        superscript, '(n-1)',
        center)

workbook.close()
```

21.11 Example: Inserting images into a worksheet

This program is an example of inserting images into a worksheet. See the `insert_image()` method for more details.



```
#####
#
# An example of inserting images into a worksheet using the XlsxWriter
# Python module.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
```

```
from xlsxwriter.workbook import Workbook

# Create an new Excel file and add a worksheet.
workbook = Workbook('images.xlsx')
worksheet = workbook.add_worksheet()

# Widen the first column to make the text clearer.
worksheet.set_column('A:A', 30)

# Insert an image.
worksheet.write('A2', 'Insert an image in a cell:')
worksheet.insert_image('B2', 'python.png')

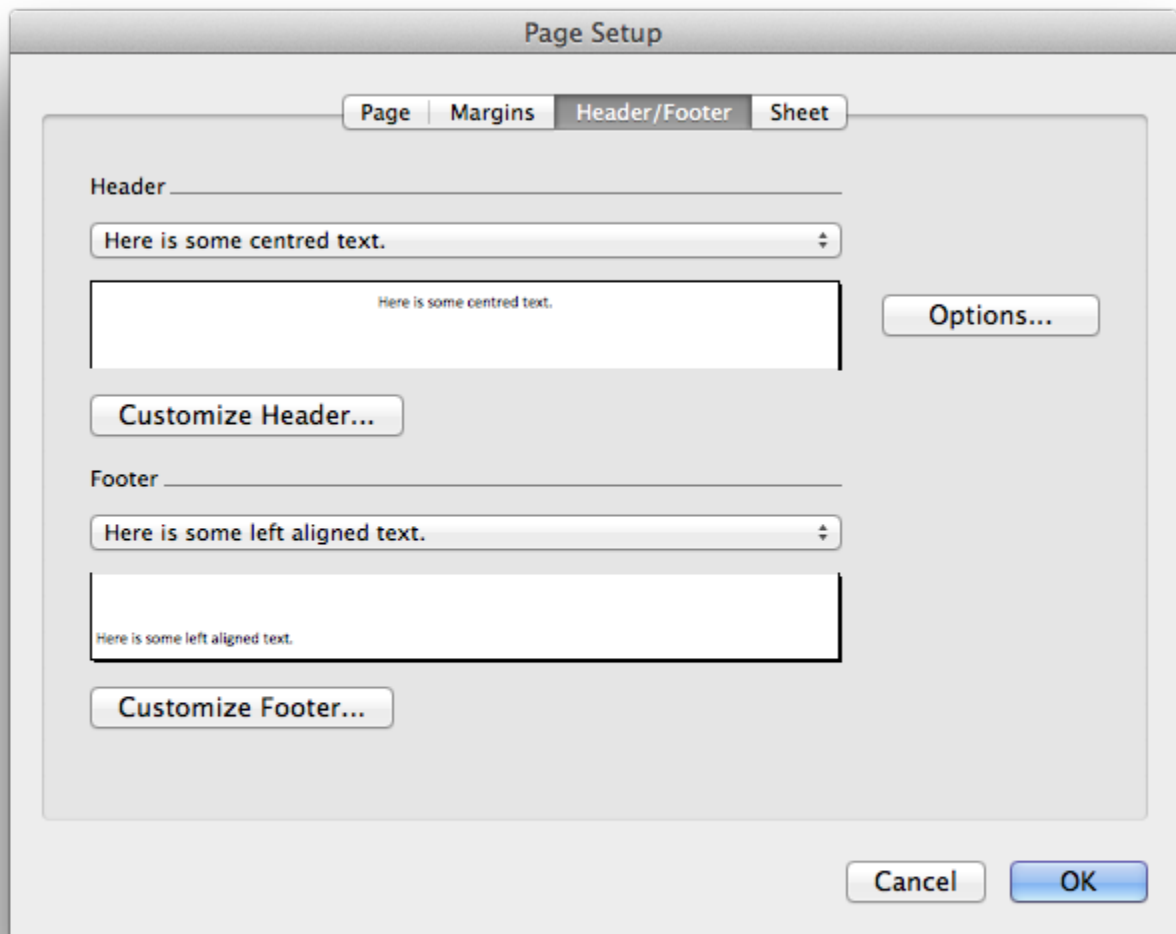
# Insert an image offset in the cell.
worksheet.write('A12', 'Insert an image with an offset:')
worksheet.insert_image('B12', 'python.png', {'x_offset': 15, 'y_offset': 10})

# Insert an image with scaling.
worksheet.write('A23', 'Insert a scaled image:')
worksheet.insert_image('B23', 'python.png', {'x_scale': 0.5, 'y_scale': 0.5})

workbook.close()
```

21.12 Example: Adding Headers and Footers to Worksheets

This program is an example of adding headers and footers to worksheets. See the `set_header()` and `set_footer()` methods for more details.



```
#####
#
# This program shows several examples of how to set up headers and
# footers with XlsxWriter.
#
# The control characters used in the header/footer strings are:
#
# Control          Category          Description
# =====
# &L               Justification    Left
# &C               Justification    Center
# &R               Justification    Right
#
# &P               Information      Page number
# &N               Information      Total number of pages
```

```
#      &D      Date
#      &T      Time
#      &F      File name
#      &A      Worksheet name
#
#      &fontsize      Font      Font size
#      &"font,style"      Font name and style
#      &U      Single underline
#      &E      Double underline
#      &S      Strikethrough
#      &X      Superscript
#      &Y      Subscript
#
#      &&      Miscellaneous      Literal ampersand &
#
# See the main XlsxWriter documentation for more information.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('headers_footers.xlsx')
preview = 'Select Print Preview to see the header and footer'

#####
#
# A simple example to start
#
worksheet1 = workbook.add_worksheet('Simple')
header1 = '&CHere is some centred text.'
footer1 = '&LHere is some left aligned text.'

worksheet1.set_header(header1)
worksheet1.set_footer(footer1)

worksheet1.set_column('A:A', 50)
worksheet1.write('A1', preview)

#####
#
# This is an example of some of the header/footer variables.
#
worksheet2 = workbook.add_worksheet('Variables')
header2 = '&LPage &P of &N' + '&CFilename: &F' + '&RSheetname: &A'
footer2 = '&LCurrent date: &D' + '&RCurrent time: &T'

worksheet2.set_header(header2)
worksheet2.set_footer(footer2)

worksheet2.set_column('A:A', 50)
worksheet2.write('A1', preview)
worksheet2.write('A21', 'Next sheet')
worksheet2.set_h_pagebreaks([20])
```

```
#####
#
# This example shows how to use more than one font
#
worksheet3 = workbook.add_worksheet('Mixed fonts')
header3 = '&C&"Courier New,Bold"Hello &"Arial,Italic"World'
footer3 = '&C&"Symbol"e&"Arial" = mc&X2'

worksheet3.set_header(header3)
worksheet3.set_footer(footer3)

worksheet3.set_column('A:A', 50)
worksheet3.write('A1', preview)

#####
#
# Example of line wrapping
#
worksheet4 = workbook.add_worksheet('Word wrap')
header4 = "&CHeading 1\nHeading 2"

worksheet4.set_header(header4)

worksheet4.set_column('A:A', 50)
worksheet4.write('A1', preview)

#####
#
# Example of inserting a literal ampersand &
#
worksheet5 = workbook.add_worksheet('Ampersand')
header5 = '&CCuriously && Curiously - Attorneys at Law'

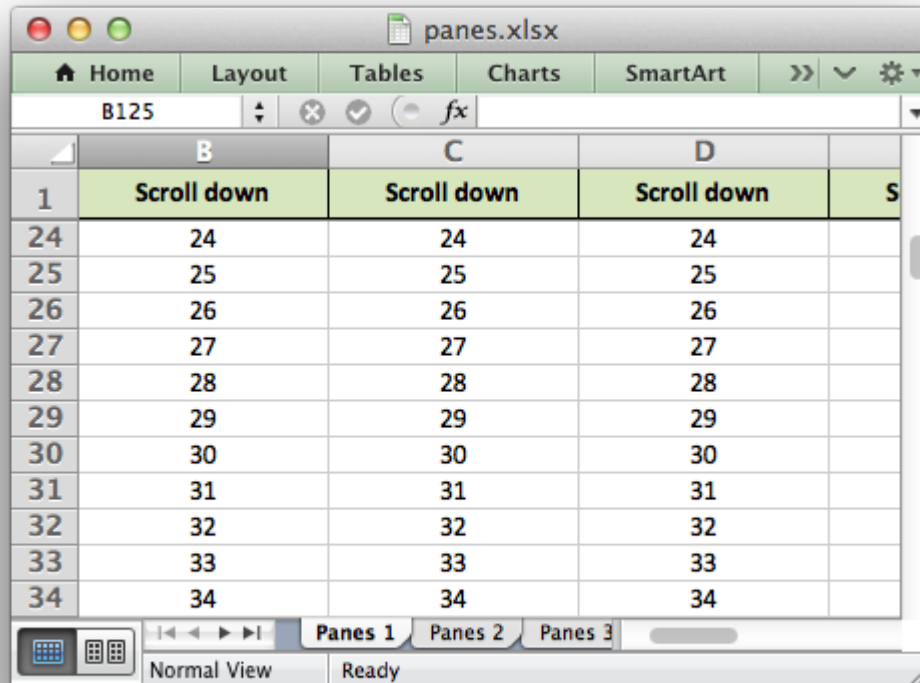
worksheet5.set_header(header5)

worksheet5.set_column('A:A', 50)
worksheet5.write('A1', preview)

workbook.close()
```

21.13 Example: Freeze Panes and Split Panes

An example of how to create panes in a worksheet, both “freeze” panes and “split” panes. See the `freeze_panes()` and `split_panes()` methods for more details.



```
#####
#
# Example of using Python and the XlsxWriter module to create
# worksheet panes.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('panes.xlsx')

worksheet1 = workbook.add_worksheet('Paness 1')
worksheet2 = workbook.add_worksheet('Paness 2')
worksheet3 = workbook.add_worksheet('Paness 3')
worksheet4 = workbook.add_worksheet('Paness 4')

#####
#
# Set up some formatting and text to highlight the panes.
#
header_format = workbook.add_format({'bold': True,
                                     'align': 'center',
                                     'valign': 'vcenter',
                                     'fg_color': '#D7E4BC',
```

```

        'border': 1})

center_format = workbook.add_format({'align': 'center'})

#####
#
# Example 1. Freeze pane on the top row.
#
worksheet1.freeze_panes(1, 0)

# Other sheet formatting.
worksheet1.set_column('A:I', 16)
worksheet1.set_row(0, 20)
worksheet1.set_selection('C3')

# Some text to demonstrate scrolling.
for col in range(0, 9):
    worksheet1.write(0, col, 'Scroll down', header_format)

for row in range(1, 100):
    for col in range(0, 9):
        worksheet1.write(row, col, row + 1, center_format)

#####
#
# Example 2. Freeze pane on the left column.
#
worksheet2.freeze_panes(0, 1)

# Other sheet formatting.
worksheet2.set_column('A:A', 16)
worksheet2.set_selection('C3')

# Some text to demonstrate scrolling.
for row in range(0, 50):
    worksheet2.write(row, 0, 'Scroll right', header_format)
    for col in range(1, 26):
        worksheet2.write(row, col, col, center_format)

#####
#
# Example 3. Freeze pane on the top row and left column.
#
worksheet3.freeze_panes(1, 1)

# Other sheet formatting.
worksheet3.set_column('A:Z', 16)
worksheet3.set_row(0, 20)
worksheet3.set_selection('C3')

```

```

worksheet3.write(0, 0, '', header_format)

# Some text to demonstrate scrolling.
for col in range(1, 26):
    worksheet3.write(0, col, 'Scroll down', header_format)

for row in range(1, 50):
    worksheet3.write(row, 0, 'Scroll right', header_format)
    for col in range(1, 26):
        worksheet3.write(row, col, col, center_format)

#####
#
# Example 4. Split pane on the top row and left column.
#
# The divisions must be specified in terms of row and column dimensions.
# The default row height is 15 and the default column width is 8.43
#
worksheet4.split_panes(15, 8.43)

# Other sheet formatting.
worksheet4.set_selection('C3')

# Some text to demonstrate scrolling.
for col in range(1, 26):
    worksheet4.write(0, col, 'Scroll', center_format)

for row in range(1, 50):
    worksheet4.write(row, 0, 'Scroll', center_format)
    for col in range(1, 26):
        worksheet4.write(row, col, col, center_format)

workbook.close()

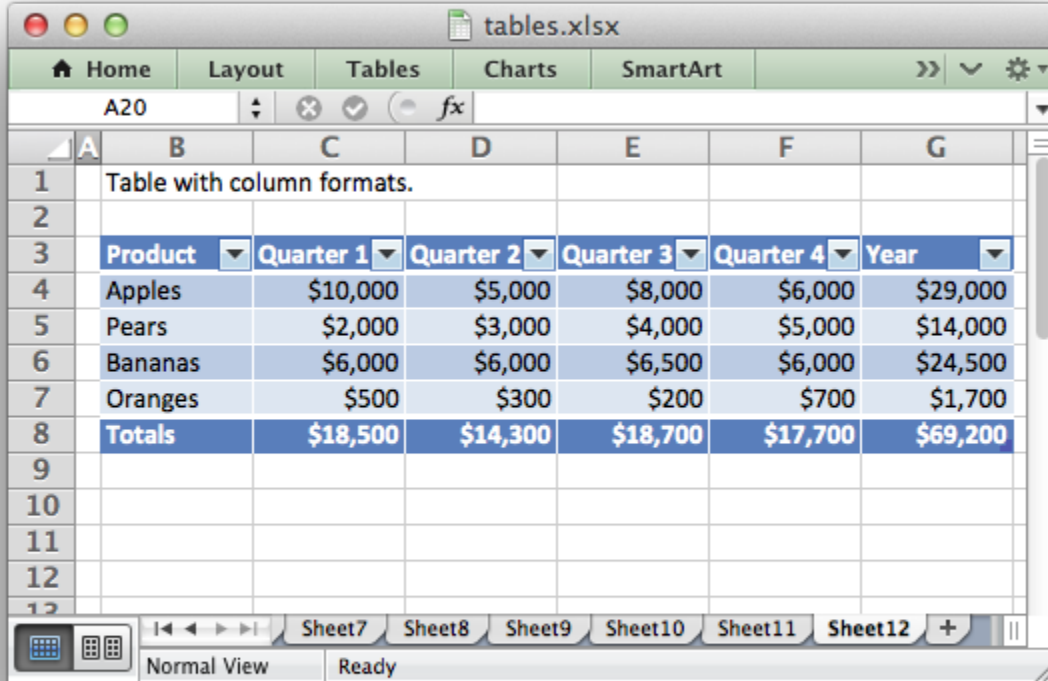
```

21.14 Example: Worksheet Tables

Example of how to add tables to an XlsxWriter worksheet.

Tables in Excel are used to group rows and columns of data into a single structure that can be referenced in a formula or formatted collectively.

See also [Working with Worksheet Tables](#).



	Product	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
1	Table with column formats.					
2						
3	Apples	\$10,000	\$5,000	\$8,000	\$6,000	\$29,000
4	Pears	\$2,000	\$3,000	\$4,000	\$5,000	\$14,000
5	Bananas	\$6,000	\$6,000	\$6,500	\$6,000	\$24,500
6	Oranges	\$500	\$300	\$200	\$700	\$1,700
7	Totals	\$18,500	\$14,300	\$18,700	\$17,700	\$69,200
8						
9						
10						
11						
12						
13						

```
#####
#
# Example of how to add tables to an XlsxWriter worksheet.
#
# Tables in Excel are used to group rows and columns of data into a single
# structure that can be referenced in a formula or formatted collectively.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('tables.xlsx')
worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
worksheet3 = workbook.add_worksheet()
worksheet4 = workbook.add_worksheet()
worksheet5 = workbook.add_worksheet()
worksheet6 = workbook.add_worksheet()
worksheet7 = workbook.add_worksheet()
worksheet8 = workbook.add_worksheet()
worksheet9 = workbook.add_worksheet()
worksheet10 = workbook.add_worksheet()
worksheet11 = workbook.add_worksheet()
worksheet12 = workbook.add_worksheet()
```

```

currency_format = workbook.add_format({'num_format': '$#,##0'})

# Some sample data for the table.
data = [
    ['Apples', 10000, 5000, 8000, 6000],
    ['Pears', 2000, 3000, 4000, 5000],
    ['Bananas', 6000, 6000, 6500, 6000],
    ['Oranges', 500, 300, 200, 700],
]

#####
#
# Example 1.
#
caption = 'Default table with no data.'

# Set the columns widths.
worksheet1.set_column('B:G', 12)

# Write the caption.
worksheet1.write('B1', caption)

# Add a table to the worksheet.
worksheet1.add_table('B3:F7')

#####
#
# Example 2.
#
caption = 'Default table with data.'

# Set the columns widths.
worksheet2.set_column('B:G', 12)

# Write the caption.
worksheet2.write('B1', caption)

# Add a table to the worksheet.
worksheet2.add_table('B3:F7', {'data': data})

#####
#
# Example 3.
#
caption = 'Table without default autofilter.'

# Set the columns widths.
worksheet3.set_column('B:G', 12)

```

```
# Write the caption.
worksheet3.write('B1', caption)

# Add a table to the worksheet.
worksheet3.add_table('B3:F7', {'autofilter': 0})

# Table data can also be written separately, as an array or individual cells.
worksheet3.write_row('B4', data[0])
worksheet3.write_row('B5', data[1])
worksheet3.write_row('B6', data[2])
worksheet3.write_row('B7', data[3])

#####
#
# Example 4.
#
caption = 'Table without default header row.'

# Set the columns widths.
worksheet4.set_column('B:G', 12)

# Write the caption.
worksheet4.write('B1', caption)

# Add a table to the worksheet.
worksheet4.add_table('B4:F7', {'header_row': 0})

# Table data can also be written separately, as an array or individual cells.
worksheet4.write_row('B4', data[0])
worksheet4.write_row('B5', data[1])
worksheet4.write_row('B6', data[2])
worksheet4.write_row('B7', data[3])

#####
#
# Example 5.
#
caption = 'Default table with "First Column" and "Last Column" options.'

# Set the columns widths.
worksheet5.set_column('B:G', 12)

# Write the caption.
worksheet5.write('B1', caption)

# Add a table to the worksheet.
worksheet5.add_table('B3:F7', {'first_column': 1, 'last_column': 1})

# Table data can also be written separately, as an array or individual cells.
worksheet5.write_row('B4', data[0])
worksheet5.write_row('B5', data[1])
```

```

worksheet5.write_row('B6', data[2])
worksheet5.write_row('B7', data[3])

#####
#
# Example 6.
#
caption = 'Table with banded columns but without default banded rows.'

# Set the columns widths.
worksheet6.set_column('B:G', 12)

# Write the caption.
worksheet6.write('B1', caption)

# Add a table to the worksheet.
worksheet6.add_table('B3:F7', {'banded_rows': 0, 'banded_columns': 1})

# Table data can also be written separately, as an array or individual cells.
worksheet6.write_row('B4', data[0])
worksheet6.write_row('B5', data[1])
worksheet6.write_row('B6', data[2])
worksheet6.write_row('B7', data[3])

#####
#
# Example 7.
#
caption = 'Table with user defined column headers'

# Set the columns widths.
worksheet7.set_column('B:G', 12)

# Write the caption.
worksheet7.write('B1', caption)

# Add a table to the worksheet.
worksheet7.add_table('B3:F7', {'data': data,
                                'columns': [{'header': 'Product'},
                                             {'header': 'Quarter 1'},
                                             {'header': 'Quarter 2'},
                                             {'header': 'Quarter 3'},
                                             {'header': 'Quarter 4'},
                                             ]})

#####
#
# Example 8.
#
caption = 'Table with user defined column headers'

```

```

# Set the columns widths.
worksheet8.set_column('B:G', 12)

# Write the caption.
worksheet8.write('B1', caption)

# Formula to use in the table.
formula = '=SUM(Table8[@[Quarter 1]:[Quarter 4]])'

# Add a table to the worksheet.
worksheet8.add_table('B3:G7', {'data': data,
                                'columns': [{'header': 'Product'},
                                             {'header': 'Quarter 1'},
                                             {'header': 'Quarter 2'},
                                             {'header': 'Quarter 3'},
                                             {'header': 'Quarter 4'},
                                             {'header': 'Year',
                                              'formula': formula},
                                             ]})

#####
#
# Example 9.
#
caption = 'Table with totals row (but no caption or totals).'

# Set the columns widths.
worksheet9.set_column('B:G', 12)

# Write the caption.
worksheet9.write('B1', caption)

# Formula to use in the table.
formula = '=SUM(Table9[@[Quarter 1]:[Quarter 4]])'

# Add a table to the worksheet.
worksheet9.add_table('B3:G8', {'data': data,
                                'total_row': 1,
                                'columns': [{'header': 'Product'},
                                             {'header': 'Quarter 1'},
                                             {'header': 'Quarter 2'},
                                             {'header': 'Quarter 3'},
                                             {'header': 'Quarter 4'},
                                             {'header': 'Year',
                                              'formula': formula},
                                             ],
                                ]})

#####
#
# Example 10.

```



```

#
caption = 'Table with totals row with user captions and functions.'

# Set the columns widths.
worksheet10.set_column('B:G', 12)

# Write the caption.
worksheet10.write('B1', caption)

# Options to use in the table.
options = {'data': data,
          'total_row': 1,
          'columns': [{'header': 'Product', 'total_string': 'Totals'},
                      {'header': 'Quarter 1', 'total_function': 'sum'},
                      {'header': 'Quarter 2', 'total_function': 'sum'},
                      {'header': 'Quarter 3', 'total_function': 'sum'},
                      {'header': 'Quarter 4', 'total_function': 'sum'},
                      {'header': 'Year',
                       'formula': '=SUM(Table10[@[Quarter 1]:[Quarter 4]]',
                       'total_function': 'sum'}
                      ],
          1}

# Add a table to the worksheet.
worksheet10.add_table('B3:G8', options)

#####
#
# Example 11.
#
caption = 'Table with alternative Excel style.'

# Set the columns widths.
worksheet11.set_column('B:G', 12)

# Write the caption.
worksheet11.write('B1', caption)

# Options to use in the table.
options = {'data': data,
          'style': 'Table Style Light 11',
          'total_row': 1,
          'columns': [{'header': 'Product', 'total_string': 'Totals'},
                      {'header': 'Quarter 1', 'total_function': 'sum'},
                      {'header': 'Quarter 2', 'total_function': 'sum'},
                      {'header': 'Quarter 3', 'total_function': 'sum'},
                      {'header': 'Quarter 4', 'total_function': 'sum'},
                      {'header': 'Year',
                       'formula': '=SUM(Table11[@[Quarter 1]:[Quarter 4]]',
                       'total_function': 'sum'}
                      ],
          1}

```

```
# Add a table to the worksheet.
worksheet11.add_table('B3:G8', options)

#####
#
# Example 12.
#
caption = 'Table with column formats.'

# Set the columns widths.
worksheet12.set_column('B:G', 12)

# Write the caption.
worksheet12.write('B1', caption)

# Options to use in the table.
options = {'data': data,
          'total_row': 1,
          'columns': [{ 'header': 'Product', 'total_string': 'Totals'},
                      { 'header': 'Quarter 1',
                        'total_function': 'sum',
                        'format': currency_format,
                        },
                      { 'header': 'Quarter 2',
                        'total_function': 'sum',
                        'format': currency_format,
                        },
                      { 'header': 'Quarter 3',
                        'total_function': 'sum',
                        'format': currency_format,
                        },
                      { 'header': 'Quarter 4',
                        'total_function': 'sum',
                        'format': currency_format,
                        },
                      { 'header': 'Year',
                        'formula': '=SUM(Table12[@[Quarter 1]:[Quarter 4]]',
                        'total_function': 'sum',
                        'format': currency_format,
                        },
                      ],
          ]}

# Add a table to the worksheet.
worksheet12.add_table('B3:G8', options)

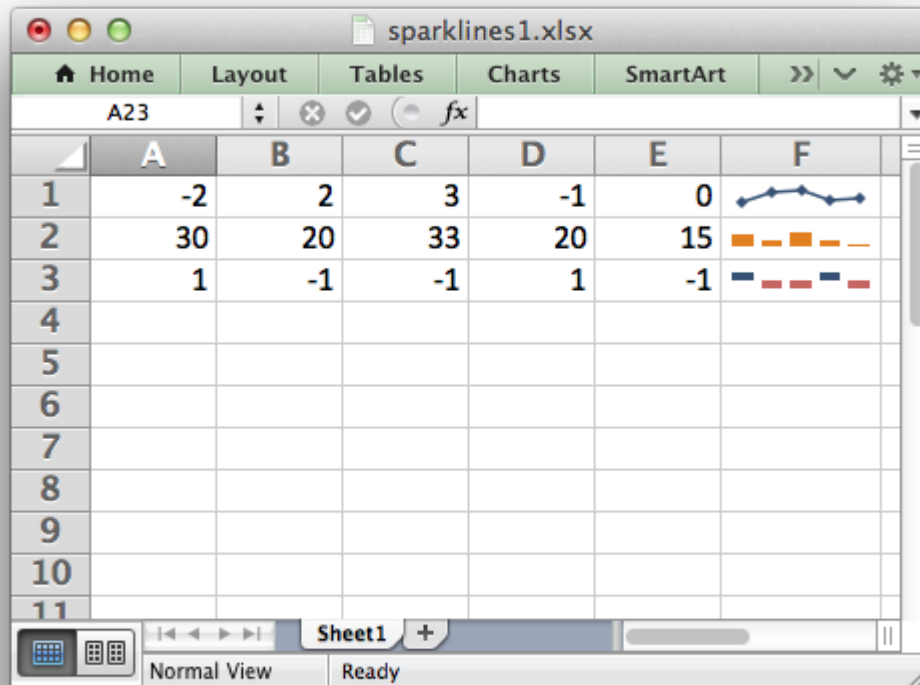
workbook.close()
```

21.15 Example: Sparklines (Simple)

Example of how to add sparklines to a XlsxWriter worksheet.

Sparklines are small charts that fit in a single cell and are used to show trends in data.

See the [Working with Sparklines](#) method for more details.



```
#####
#
# Example of how to add sparklines to a Python XlsxWriter file.
#
# Sparklines are small charts that fit in a single cell and are
# used to show trends in data.
#
# See sparklines2.py for examples of more complex sparkline formatting.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('sparklines1.xlsx')
worksheet = workbook.add_worksheet()
```

```
# Some sample data to plot.
data = [
    [-2, 2, 3, -1, 0],
    [30, 20, 33, 20, 15],
    [1, -1, -1, 1, -1],
]

# Write the sample data to the worksheet.
worksheet.write_row('A1', data[0])
worksheet.write_row('A2', data[1])
worksheet.write_row('A3', data[2])

# Add a line sparkline (the default) with markers.
worksheet.add_sparkline('F1', {'range': 'Sheet1!A1:E1',
                              'markers': True})

# Add a column sparkline with non-default style.
worksheet.add_sparkline('F2', {'range': 'Sheet1!A2:E2',
                              'type': 'column',
                              'style': 12})

# Add a win/loss sparkline with negative values highlighted.
worksheet.add_sparkline('F3', {'range': 'Sheet1!A3:E3',
                              'type': 'win_loss',
                              'negative_points': True})

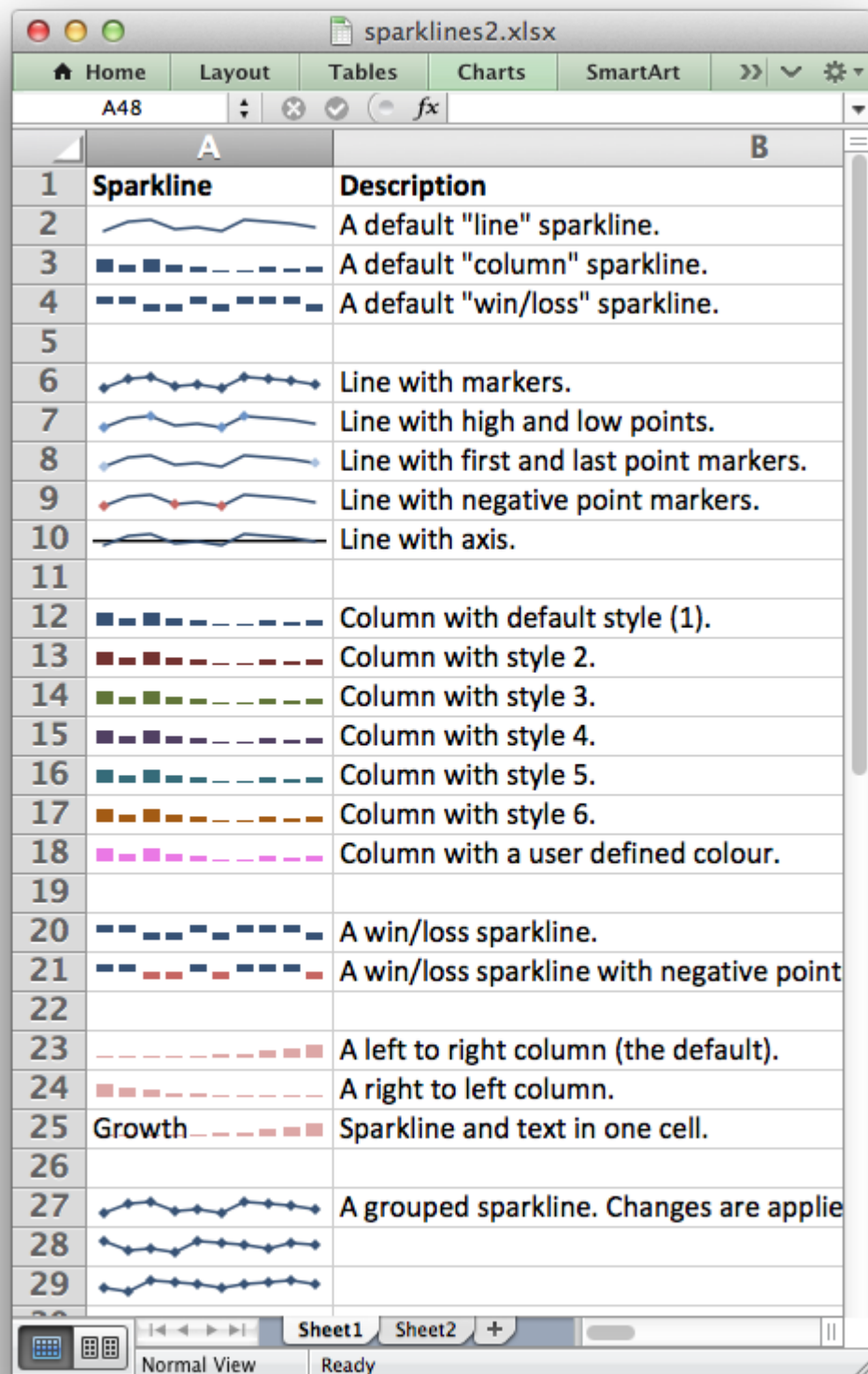
workbook.close()
```

21.16 Example: Sparklines (Advanced)

This example shows the majority of options that can be applied to sparklines.

Sparklines are small charts that fit in a single cell and are used to show trends in data.

See the [Working with Sparklines](#) method for more details.



```
#####
#
# Example of how to add sparklines to an XlsxWriter file with Python.
#
# Sparklines are small charts that fit in a single cell and are
# used to show trends in data. This example shows the majority of
# options that can be applied to sparklines.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('sparklines2.xlsx')
worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
bold = workbook.add_format({'bold': True})
row = 1

# Set the columns widths to make the output clearer.
worksheet1.set_column('A:A', 14)
worksheet1.set_column('B:B', 50)
worksheet1.set_zoom(150)

# Headings.
worksheet1.write('A1', 'Sparkline', bold)
worksheet1.write('B1', 'Description', bold)

#####
#
text = 'A default "line" sparkline.'

worksheet1.add_sparkline('A2', {'range': 'Sheet2!A1:J1'})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'A default "column" sparkline.'

worksheet1.add_sparkline('A3', {'range': 'Sheet2!A2:J2',
                                'type': 'column'})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'A default "win/loss" sparkline.'
```

```

worksheet1.add_sparkline('A4', {'range': 'Sheet2!A3:J3',
                                'type': 'win_loss'})

worksheet1.write(row, 1, text)
row += 2

#####
#
text = 'Line with markers.'

worksheet1.add_sparkline('A6', {'range': 'Sheet2!A1:J1',
                                'markers': True})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Line with high and low points.'

worksheet1.add_sparkline('A7', {'range': 'Sheet2!A1:J1',
                                'high_point': True,
                                'low_point': True})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Line with first and last point markers.'

worksheet1.add_sparkline('A8', {'range': 'Sheet2!A1:J1',
                                'first_point': True,
                                'last_point': True})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Line with negative point markers.'

worksheet1.add_sparkline('A9', {'range': 'Sheet2!A1:J1',
                                'negative_points': True})

worksheet1.write(row, 1, text)
row += 1

```

```
#####
#
text = 'Line with axis.'

worksheet1.add_sparkline('A10', {'range': 'Sheet2!A1:J1',
                                'axis': True})

worksheet1.write(row, 1, text)
row += 2

#####
#
text = 'Column with default style (1).'

worksheet1.add_sparkline('A12', {'range': 'Sheet2!A2:J2',
                                'type': 'column'})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Column with style 2.'

worksheet1.add_sparkline('A13', {'range': 'Sheet2!A2:J2',
                                'type': 'column',
                                'style': 2})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Column with style 3.'

worksheet1.add_sparkline('A14', {'range': 'Sheet2!A2:J2',
                                'type': 'column',
                                'style': 3})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Column with style 4.'

worksheet1.add_sparkline('A15', {'range': 'Sheet2!A2:J2',
                                'type': 'column',
                                'style': 4})
```



```

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Column with style 5.'

worksheet1.add_sparkline('A16', {'range': 'Sheet2!A2:J2',
                                'type': 'column',
                                'style': 5})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Column with style 6.'

worksheet1.add_sparkline('A17', {'range': 'Sheet2!A2:J2',
                                'type': 'column',
                                'style': 6})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Column with a user defined colour.'

worksheet1.add_sparkline('A18', {'range': 'Sheet2!A2:J2',
                                'type': 'column',
                                'series_color': '#E965E0'})

worksheet1.write(row, 1, text)
row += 2

#####
#
text = 'A win/loss sparkline.'

worksheet1.add_sparkline('A20', {'range': 'Sheet2!A3:J3',
                                'type': 'win_loss'})

worksheet1.write(row, 1, text)
row += 1

#####
#

```

```

text = 'A win/loss sparkline with negative points highlighted.'

worksheet1.add_sparkline('A21', {'range': 'Sheet2!A3:J3',
                                'type': 'win_loss',
                                'negative_points': True})

worksheet1.write(row, 1, text)
row += 2

#####
#
text = 'A left to right column (the default).'

worksheet1.add_sparkline('A23', {'range': 'Sheet2!A4:J4',
                                'type': 'column',
                                'style': 20})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'A right to left column.'

worksheet1.add_sparkline('A24', {'range': 'Sheet2!A4:J4',
                                'type': 'column',
                                'style': 20,
                                'reverse': True})

worksheet1.write(row, 1, text)
row += 1

#####
#
text = 'Sparkline and text in one cell.'

worksheet1.add_sparkline('A25', {'range': 'Sheet2!A4:J4',
                                'type': 'column',
                                'style': 20})

worksheet1.write(row, 0, 'Growth')
worksheet1.write(row, 1, text)
row += 2

#####
#
text = 'A grouped sparkline. Changes are applied to all three.'

worksheet1.add_sparkline('A27', {'location': ['A27', 'A28', 'A29'],

```

```

        'range': ['Sheet2!A5:J5',
                  'Sheet2!A6:J6',
                  'Sheet2!A7:J7'],
        'markers': True})

worksheet1.write(row, 1, text)
row += 1

#####
#
# Create a second worksheet with data to plot.
#
worksheet2.set_column('A:J', 11)

data = [

    # Simple line data.
    [-2, 2, 3, -1, 0, -2, 3, 2, 1, 0],

    # Simple column data.
    [30, 20, 33, 20, 15, 5, 5, 15, 10, 15],

    # Simple win/loss data.
    [1, 1, -1, -1, 1, -1, 1, 1, 1, -1],

    # Unbalanced histogram.
    [5, 6, 7, 10, 15, 20, 30, 50, 70, 100],

    # Data for the grouped sparkline example.
    [-2, 2, 3, -1, 0, -2, 3, 2, 1, 0],
    [3, -1, 0, -2, 3, 2, 1, 0, 2, 1],
    [0, -2, 3, 2, 1, 0, 1, 2, 3, 1],

]

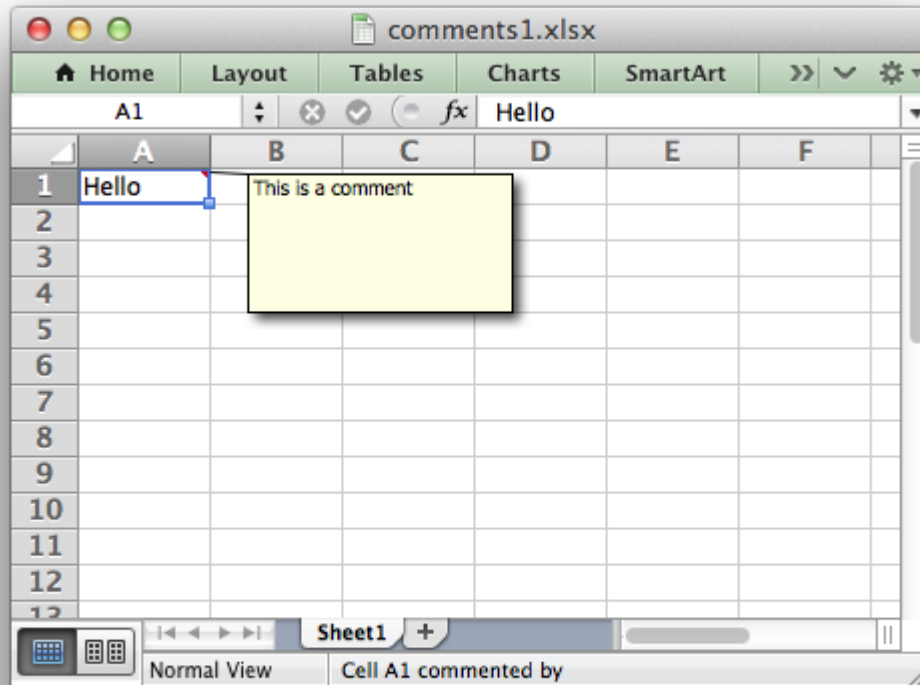
# Write the sample data to the worksheet.
worksheet2.write_row('A1', data[0])
worksheet2.write_row('A2', data[1])
worksheet2.write_row('A3', data[2])
worksheet2.write_row('A4', data[3])
worksheet2.write_row('A5', data[4])
worksheet2.write_row('A6', data[5])
worksheet2.write_row('A7', data[6])

workbook.close()

```

21.17 Example: Adding Cell Comments to Worksheets (Simple)

A simple example of adding cell comments to a worksheet. For more details see [Working with Cell Comments](#).



```
#####
#
# An example of writing cell comments to a worksheet using Python and
# XlsxWriter.
#
# For more advanced comment options see comments2.py.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

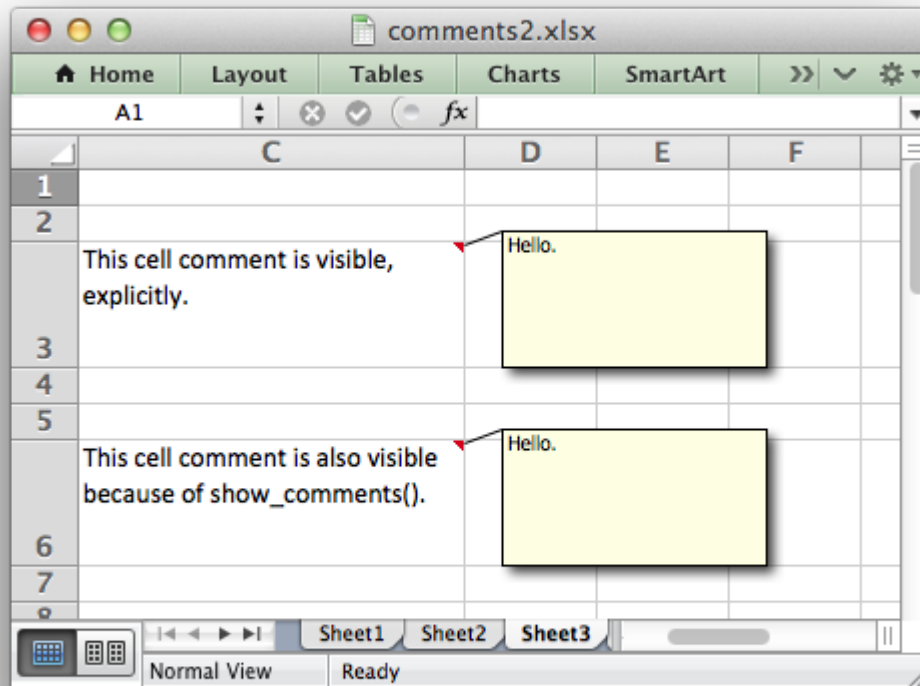
workbook = Workbook('comments1.xlsx')
worksheet = workbook.add_worksheet()

worksheet.write('A1', 'Hello')
worksheet.write_comment('A1', 'This is a comment')

workbook.close()
```

21.18 Example: Adding Cell Comments to Worksheets (Advanced)

Another example of adding cell comments to a worksheet. This example demonstrates most of the available comment formatting options. For more details see [Working with Cell Comments](#).



```
#####
#
# An example of writing cell comments to a worksheet using Python and
# XlsxWriter.
#
# Each of the worksheets demonstrates different features of cell comments.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('comments2.xlsx')

worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
worksheet3 = workbook.add_worksheet()
worksheet4 = workbook.add_worksheet()
worksheet5 = workbook.add_worksheet()
worksheet6 = workbook.add_worksheet()
```

```

worksheet7 = workbook.add_worksheet()
worksheet8 = workbook.add_worksheet()

text_wrap = workbook.add_format({'text_wrap': 1, 'valign': 'top'})

#####
#
# Example 1. Demonstrates a simple cell comments without formatting.
#           comments.
#
# Set up some formatting.
worksheet1.set_column('C:C', 25)
worksheet1.set_row(2, 50)
worksheet1.set_row(5, 50)

# Simple ASCII string.
cell_text = 'Hold the mouse over this cell to see the comment.'

comment = 'This is a comment.'

worksheet1.write('C3', cell_text, text_wrap)
worksheet1.write_comment('C3', comment)

#####
#
# Example 2. Demonstrates visible and hidden comments.
#
# Set up some formatting.
worksheet2.set_column('C:C', 25)
worksheet2.set_row(2, 50)
worksheet2.set_row(5, 50)

cell_text = 'This cell comment is visible.'
comment = 'Hello.'

worksheet2.write('C3', cell_text, text_wrap)
worksheet2.write_comment('C3', comment, {'visible': True})

cell_text = "This cell comment isn't visible (the default)."

worksheet2.write('C6', cell_text, text_wrap)
worksheet2.write_comment('C6', comment)

#####
#
# Example 3. Demonstrates visible and hidden comments set at the worksheet
#           level.
#

```

```
# Set up some formatting.
worksheet3.set_column('C:C', 25)
worksheet3.set_row(2, 50)
worksheet3.set_row(5, 50)
worksheet3.set_row(8, 50)

# Make all comments on the worksheet visible.
worksheet3.show_comments()

cell_text = 'This cell comment is visible, explicitly.'
comment = 'Hello.'

worksheet3.write('C3', cell_text, text_wrap)
worksheet3.write_comment('C3', comment, {'visible': 1})

cell_text = 'This cell comment is also visible because of show_comments().'

worksheet3.write('C6', cell_text, text_wrap)
worksheet3.write_comment('C6', comment)

cell_text = 'However, we can still override it locally.'

worksheet3.write('C9', cell_text, text_wrap)
worksheet3.write_comment('C9', comment, {'visible': False})

#####
#
# Example 4. Demonstrates changes to the comment box dimensions.
#

# Set up some formatting.
worksheet4.set_column('C:C', 25)
worksheet4.set_row(2, 50)
worksheet4.set_row(5, 50)
worksheet4.set_row(8, 50)
worksheet4.set_row(15, 50)

worksheet4.show_comments()

cell_text = 'This cell comment is default size.'
comment = 'Hello.'

worksheet4.write('C3', cell_text, text_wrap)
worksheet4.write_comment('C3', comment)

cell_text = 'This cell comment is twice as wide.'

worksheet4.write('C6', cell_text, text_wrap)
worksheet4.write_comment('C6', comment, {'x_scale': 2})

cell_text = 'This cell comment is twice as high.'
```

```

worksheet4.write('C9', cell_text, text_wrap)
worksheet4.write_comment('C9', comment, {'y_scale': 2})

cell_text = 'This cell comment is scaled in both directions.'

worksheet4.write('C16', cell_text, text_wrap)
worksheet4.write_comment('C16', comment, {'x_scale': 1.2, 'y_scale': 0.8})

cell_text = 'This cell comment has width and height specified in pixels.'

worksheet4.write('C19', cell_text, text_wrap)
worksheet4.write_comment('C19', comment, {'width': 200, 'height': 20})

#####
#
# Example 5. Demonstrates changes to the cell comment position.
#
worksheet5.set_column('C:C', 25)
worksheet5.set_row(2, 50)
worksheet5.set_row(5, 50)
worksheet5.set_row(8, 50)
worksheet5.set_row(11, 50)

worksheet5.show_comments()

cell_text = 'This cell comment is in the default position.'
comment = 'Hello.'

worksheet5.write('C3', cell_text, text_wrap)
worksheet5.write_comment('C3', comment)

cell_text = 'This cell comment has been moved to another cell.'

worksheet5.write('C6', cell_text, text_wrap)
worksheet5.write_comment('C6', comment, {'start_cell': 'E4'})

cell_text = 'This cell comment has been moved to another cell.'

worksheet5.write('C9', cell_text, text_wrap)
worksheet5.write_comment('C9', comment, {'start_row': 8, 'start_col': 4})

cell_text = 'This cell comment has been shifted within its default cell.'

worksheet5.write('C12', cell_text, text_wrap)
worksheet5.write_comment('C12', comment, {'x_offset': 30, 'y_offset': 12})

#####
#
# Example 6. Demonstrates changes to the comment background colour.
#
worksheet6.set_column('C:C', 25)

```



```

worksheet6.set_row(2, 50)
worksheet6.set_row(5, 50)
worksheet6.set_row(8, 50)

worksheet6.show_comments()

cell_text = 'This cell comment has a different colour.'
comment = 'Hello.'

worksheet6.write('C3', cell_text, text_wrap)
worksheet6.write_comment('C3', comment, {'color': 'green'})

cell_text = 'This cell comment has the default colour.'

worksheet6.write('C6', cell_text, text_wrap)
worksheet6.write_comment('C6', comment)

cell_text = 'This cell comment has a different colour.'

worksheet6.write('C9', cell_text, text_wrap)
worksheet6.write_comment('C9', comment, {'color': '#CCFFCC'})

#####
#
# Example 7. Demonstrates how to set the cell comment author.
#
worksheet7.set_column('C:C', 30)
worksheet7.set_row(2, 50)
worksheet7.set_row(5, 50)
worksheet7.set_row(8, 50)

author = ''
cell = 'C3'

cell_text = ("Move the mouse over this cell and you will see 'Cell commented "
             "by (blank)' in the status bar at the bottom")

comment = 'Hello.'

worksheet7.write(cell, cell_text, text_wrap)
worksheet7.write_comment(cell, comment)

author = 'Python'
cell = 'C6'
cell_text = ("Move the mouse over this cell and you will see 'Cell commented "
             "by Python' in the status bar at the bottom")

worksheet7.write(cell, cell_text, text_wrap)
worksheet7.write_comment(cell, comment, {'author': author})

#####

```

```
#
# Example 8. Demonstrates the need to explicitly set the row height.
#
# Set up some formatting.
worksheet8.set_column('C:C', 25)
worksheet8.set_row(2, 80)

worksheet8.show_comments()

cell_text = ('The height of this row has been adjusted explicitly using '
            'set_row(). The size of the comment box is adjusted '
            'accordingly by XlsxWriter.')

comment = 'Hello.'

worksheet8.write('C3', cell_text, text_wrap)
worksheet8.write_comment('C3', comment)

cell_text = ('The height of this row has been adjusted by Excel due to the '
            'text wrap property being set. Unfortunately this means that '
            'the height of the row is unknown to XlsxWriter at run time '
            'and thus the comment box is stretched as well.\n\n'
            'Use set_row() to specify the row height explicitly to avoid '
            'this problem.')

worksheet8.write('C6', cell_text, text_wrap)
worksheet8.write_comment('C6', comment)

workbook.close()
```

21.19 Example: Outline and Grouping

Examples of how use XlsxWriter to generate Excel outlines and grouping. See also *Working with Outlines and Grouping*.

	A	B	C	D
1	Region	Sales		
2	North	1000		
3	North	1200		
4	North	900		
5	North	1200		
6	North Total	4300		
7	South	400		
8	South	600		
9	South	500		
10	South	600		
11	South Total	2100		
12	Grand Total	6400		

```
#####
#
# Example of how use Python and XlsxWriter to generate Excel outlines and
# grouping.
#
# Excel allows you to group rows or columns so that they can be hidden or
# displayed with a single mouse click. This feature is referred to as outlines.
#
# Outlines can reduce complex data down to a few salient sub-totals or
# summaries.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

# Create a new workbook and add some worksheets
workbook = Workbook('outline.xlsx')
worksheet1 = workbook.add_worksheet('Outlined Rows')
worksheet2 = workbook.add_worksheet('Collapsed Rows')
worksheet3 = workbook.add_worksheet('Outline Columns')
worksheet4 = workbook.add_worksheet('Outline Levels')

# Add a general format
bold = workbook.add_format({'bold': 1})
```

```
#####
#
# Example 1: A worksheet with outlined rows. It also includes SUBTOTAL()
# functions so that it looks like the type of automatic outlines that are
# generated when you use the Excel Data->SubTotals menu item.
#
# For outlines the important parameters are 'level' and 'hidden'. Rows with
# the same 'level' are grouped together. The group will be collapsed if
# 'hidden' is enabled. The parameters 'height' and 'cell_format' are assigned
# default values if they are None.
#
worksheet1.set_row(1, None, None, {'level': 2})
worksheet1.set_row(2, None, None, {'level': 2})
worksheet1.set_row(3, None, None, {'level': 2})
worksheet1.set_row(4, None, None, {'level': 2})
worksheet1.set_row(5, None, None, {'level': 1})

worksheet1.set_row(6, None, None, {'level': 2})
worksheet1.set_row(7, None, None, {'level': 2})
worksheet1.set_row(8, None, None, {'level': 2})
worksheet1.set_row(9, None, None, {'level': 2})
worksheet1.set_row(10, None, None, {'level': 1})

# Adjust the column width for clarity
worksheet1.set_column('A:A', 20)

# Add the data, labels and formulas
worksheet1.write('A1', 'Region', bold)
worksheet1.write('A2', 'North')
worksheet1.write('A3', 'North')
worksheet1.write('A4', 'North')
worksheet1.write('A5', 'North')
worksheet1.write('A6', 'North Total', bold)

worksheet1.write('B1', 'Sales', bold)
worksheet1.write('B2', 1000)
worksheet1.write('B3', 1200)
worksheet1.write('B4', 900)
worksheet1.write('B5', 1200)
worksheet1.write('B6', '=SUBTOTAL(9,B2:B5)', bold)

worksheet1.write('A7', 'South')
worksheet1.write('A8', 'South')
worksheet1.write('A9', 'South')
worksheet1.write('A10', 'South')
worksheet1.write('A11', 'South Total', bold)

worksheet1.write('B7', 400)
worksheet1.write('B8', 600)
worksheet1.write('B9', 500)
worksheet1.write('B10', 600)
worksheet1.write('B11', '=SUBTOTAL(9,B7:B10)', bold)
```

```

worksheet1.write('A12', 'Grand Total', bold)
worksheet1.write('B12', '=SUBTOTAL(9,B2:B10)', bold)

#####
#
# Example 2: A worksheet with outlined rows. This is the same as the
# previous example except that the rows are collapsed.
# Note: We need to indicate the rows that contains the collapsed symbol '+'
# with the optional parameter, 'collapsed'. The group will be then be
# collapsed if 'hidden' is True.
#
worksheet2.set_row(1, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(2, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(3, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(4, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(5, None, None, {'level': 1, 'hidden': True})

worksheet2.set_row(6, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(7, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(8, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(9, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(10, None, None, {'level': 1, 'hidden': True})
worksheet2.set_row(11, None, None, {'collapsed': True})

# Adjust the column width for clarity
worksheet2.set_column('A:A', 20)

# Add the data, labels and formulas
worksheet2.write('A1', 'Region', bold)
worksheet2.write('A2', 'North')
worksheet2.write('A3', 'North')
worksheet2.write('A4', 'North')
worksheet2.write('A5', 'North')
worksheet2.write('A6', 'North Total', bold)

worksheet2.write('B1', 'Sales', bold)
worksheet2.write('B2', 1000)
worksheet2.write('B3', 1200)
worksheet2.write('B4', 900)
worksheet2.write('B5', 1200)
worksheet2.write('B6', '=SUBTOTAL(9,B2:B5)', bold)

worksheet2.write('A7', 'South')
worksheet2.write('A8', 'South')
worksheet2.write('A9', 'South')
worksheet2.write('A10', 'South')
worksheet2.write('A11', 'South Total', bold)

worksheet2.write('B7', 400)
worksheet2.write('B8', 600)
worksheet2.write('B9', 500)
worksheet2.write('B10', 600)

```

```

worksheet2.write('B11', '=SUBTOTAL(9,B7:B10)', bold)

worksheet2.write('A12', 'Grand Total', bold)
worksheet2.write('B12', '=SUBTOTAL(9,B2:B10)', bold)

#####
#
# Example 3: Create a worksheet with outlined columns.
#
data = [
    ['Month', 'Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Total'],
    ['North', 50, 20, 15, 25, 65, 80, '=SUM(B2:G2)'],
    ['South', 10, 20, 30, 50, 50, 50, '=SUM(B3:G3)'],
    ['East', 45, 75, 50, 15, 75, 100, '=SUM(B4:G4)'],
    ['West', 15, 15, 55, 35, 20, 50, '=SUM(B5:G5)']]

# Add bold format to the first row.
worksheet3.set_row(0, None, bold)

# Set column formatting and the outline level.
worksheet3.set_column('A:A', 10, bold)
worksheet3.set_column('B:G', 5, None, {'level': 1})
worksheet3.set_column('H:H', 10)

# Write the data and a formula
for row, data_row in enumerate(data):
    worksheet3.write_row(row, 0, data_row)

worksheet3.write('H6', '=SUM(H2:H5)', bold)

#####
#
# Example 4: Show all possible outline levels.
#
levels = [
    'Level 1', 'Level 2', 'Level 3', 'Level 4', 'Level 5', 'Level 6',
    'Level 7', 'Level 6', 'Level 5', 'Level 4', 'Level 3', 'Level 2',
    'Level 1']

worksheet4.write_column('A1', levels)

worksheet4.set_row(0, None, None, {'level': 1})
worksheet4.set_row(1, None, None, {'level': 2})
worksheet4.set_row(2, None, None, {'level': 3})
worksheet4.set_row(3, None, None, {'level': 4})
worksheet4.set_row(4, None, None, {'level': 5})
worksheet4.set_row(5, None, None, {'level': 6})
worksheet4.set_row(6, None, None, {'level': 7})
worksheet4.set_row(7, None, None, {'level': 6})
worksheet4.set_row(8, None, None, {'level': 5})
worksheet4.set_row(9, None, None, {'level': 4})

```

```

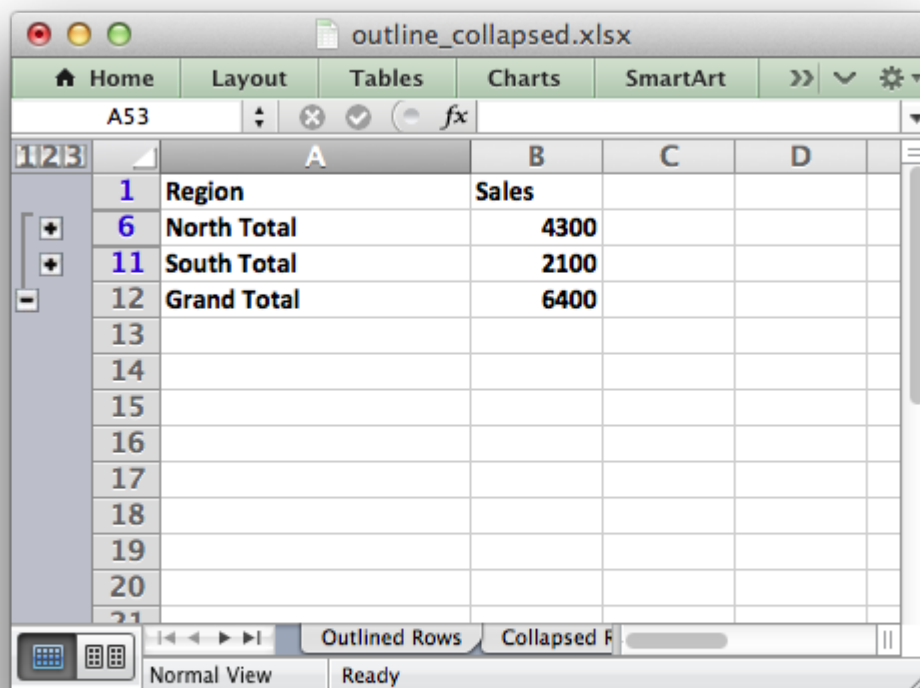
worksheet4.set_row(10, None, None, {'level': 3})
worksheet4.set_row(11, None, None, {'level': 2})
worksheet4.set_row(12, None, None, {'level': 1})

workbook.close()

```

21.20 Example: Collapsed Outline and Grouping

Examples of how use XlsxWriter to generate Excel outlines and grouping. These examples focus mainly on collapsed outlines. See also [Working with Outlines and Grouping](#).



```

#####
#
# Example of how to use Python and XlsxWriter to generate Excel outlines and
# grouping.
#
# These examples focus mainly on collapsed outlines. See also the
# outlines.py example program for more general examples.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

```

```
# Create a new workbook and add some worksheets
workbook = Workbook('outline_collapsed.xlsx')
worksheet1 = workbook.add_worksheet('Outlined Rows')
worksheet2 = workbook.add_worksheet('Collapsed Rows 1')
worksheet3 = workbook.add_worksheet('Collapsed Rows 2')
worksheet4 = workbook.add_worksheet('Collapsed Rows 3')
worksheet5 = workbook.add_worksheet('Outline Columns')
worksheet6 = workbook.add_worksheet('Collapsed Columns')

# Add a general format
bold = workbook.add_format({'bold': 1})

# This function will generate the same data and sub-totals on each worksheet.
# Used in the first 4 examples.
#
def create_sub_totals(worksheet):
    # Adjust the column width for clarity.
    worksheet.set_column('A:A', 20)

    # Add the data, labels and formulas.
    worksheet.write('A1', 'Region', bold)
    worksheet.write('A2', 'North')
    worksheet.write('A3', 'North')
    worksheet.write('A4', 'North')
    worksheet.write('A5', 'North')
    worksheet.write('A6', 'North Total', bold)

    worksheet.write('B1', 'Sales', bold)
    worksheet.write('B2', 1000)
    worksheet.write('B3', 1200)
    worksheet.write('B4', 900)
    worksheet.write('B5', 1200)
    worksheet.write('B6', '=SUBTOTAL(9,B2:B5)', bold)

    worksheet.write('A7', 'South')
    worksheet.write('A8', 'South')
    worksheet.write('A9', 'South')
    worksheet.write('A10', 'South')
    worksheet.write('A11', 'South Total', bold)

    worksheet.write('B7', 400)
    worksheet.write('B8', 600)
    worksheet.write('B9', 500)
    worksheet.write('B10', 600)
    worksheet.write('B11', '=SUBTOTAL(9,B7:B10)', bold)

    worksheet.write('A12', 'Grand Total', bold)
    worksheet.write('B12', '=SUBTOTAL(9,B2:B10)', bold)

#####
#
# Example 1: A worksheet with outlined rows. It also includes SUBTOTAL()
```



```
# functions so that it looks like the type of automatic outlines that are
# generated when you use the Excel Data->SubTotals menu item.
#
worksheet1.set_row(1, None, None, {'level': 2})
worksheet1.set_row(2, None, None, {'level': 2})
worksheet1.set_row(3, None, None, {'level': 2})
worksheet1.set_row(4, None, None, {'level': 2})
worksheet1.set_row(5, None, None, {'level': 1})

worksheet1.set_row(6, None, None, {'level': 2})
worksheet1.set_row(7, None, None, {'level': 2})
worksheet1.set_row(8, None, None, {'level': 2})
worksheet1.set_row(9, None, None, {'level': 2})
worksheet1.set_row(10, None, None, {'level': 1})

# Write the sub-total data that is common to the row examples.
create_sub_totals(worksheet1)

#####
#
# Example 2: Create a worksheet with collapsed outlined rows.
# This is the same as the example 1 except that the all rows are collapsed.
# Note: We need to indicate the rows that contains the collapsed symbol '+'
# with the optional parameter, 'collapsed'.
#
worksheet2.set_row(1, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(2, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(3, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(4, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(5, None, None, {'level': 1, 'hidden': True})

worksheet2.set_row(6, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(7, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(8, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(9, None, None, {'level': 2, 'hidden': True})
worksheet2.set_row(10, None, None, {'level': 1, 'hidden': True})

worksheet2.set_row(11, None, None, {'collapsed': True})

# Write the sub-total data that is common to the row examples.
create_sub_totals(worksheet2)

#####
#
# Example 3: Create a worksheet with collapsed outlined rows.
# Same as the example 1 except that the two sub-totals are collapsed.
#
worksheet3.set_row(1, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(2, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(3, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(4, None, None, {'level': 2, 'hidden': True})
```

```

worksheet3.set_row(5, None, None, {'level': 1, 'collapsed': True})

worksheet3.set_row(6, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(7, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(8, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(9, None, None, {'level': 2, 'hidden': True})
worksheet3.set_row(10, None, None, {'level': 1, 'collapsed': True})

# Write the sub-total data that is common to the row examples.
create_sub_totals(worksheet3)

#####
#
# Example 4: Create a worksheet with outlined rows.
# Same as the example 1 except that the two sub-totals are collapsed.
#
worksheet4.set_row(1, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(2, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(3, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(4, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(5, None, None, {'level': 1, 'hidden': True,
                                   'collapsed': True})

worksheet4.set_row(6, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(7, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(8, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(9, None, None, {'level': 2, 'hidden': True})
worksheet4.set_row(10, None, None, {'level': 1, 'hidden': True,
                                   'collapsed': True})

worksheet4.set_row(11, None, None, {'collapsed': True})

# Write the sub-total data that is common to the row examples.
create_sub_totals(worksheet4)

#####
#
# Example 5: Create a worksheet with outlined columns.
#
data = [
    ['Month', 'Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Total'],
    ['North', 50, 20, 15, 25, 65, 80, '=SUM(B2:G2)'],
    ['South', 10, 20, 30, 50, 50, 50, '=SUM(B3:G3)'],
    ['East', 45, 75, 50, 15, 75, 100, '=SUM(B4:G4)'],
    ['West', 15, 15, 55, 35, 20, 50, '=SUM(B5:G5)']]

# Add bold format to the first row.
worksheet5.set_row(0, None, bold)

# Set column formatting and the outline level.

```

```

worksheet5.set_column('A:A', 10, bold)
worksheet5.set_column('B:G', 5, None, {'level': 1})
worksheet5.set_column('H:H', 10)

# Write the data and a formula.
for row, data_row in enumerate(data):
    worksheet5.write_row(row, 0, data_row)

worksheet5.write('H6', '=SUM(H2:H5)', bold)

#####
#
# Example 6: Create a worksheet with collapsed outlined columns.
# This is the same as the previous example except with collapsed columns.
#

# Reuse the data from the previous example.

# Add bold format to the first row.
worksheet6.set_row(0, None, bold)

# Set column formatting and the outline level.
worksheet6.set_column('A:A', 10, bold)
worksheet6.set_column('B:G', 5, None, {'level': 1, 'hidden': True})
worksheet6.set_column('H:H', 10, None, {'collapsed': True})

# Write the data and a formula.
for row, data_row in enumerate(data):
    worksheet6.write_row(row, 0, data_row)

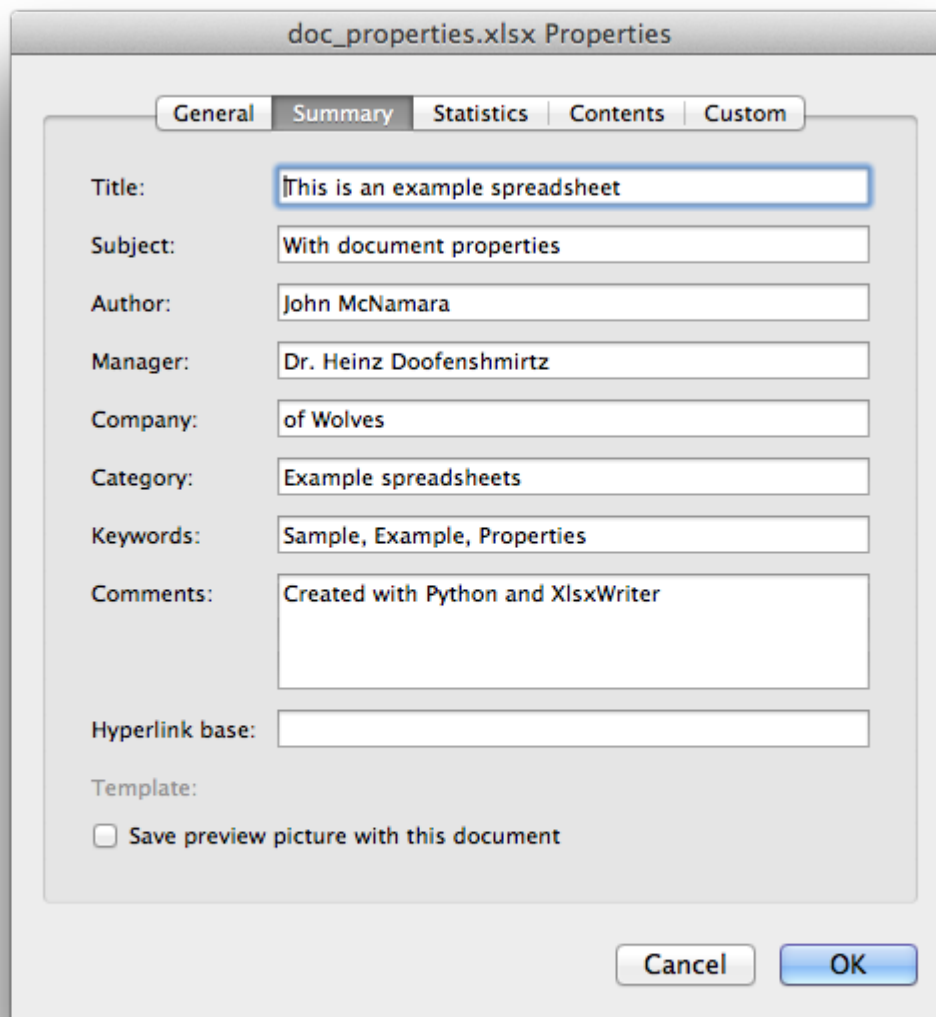
worksheet6.write('H6', '=SUM(H2:H5)', bold)

workbook.close()

```

21.21 Example: Setting Document Properties

This program is an example setting document properties. See the [set_properties\(\)](#) workbook method for more details.



```
#####
#
# An example of adding document properties to a XlsxWriter file.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('doc_properties.xlsx')
worksheet = workbook.add_worksheet()

workbook.set_properties({
    'title': 'This is an example spreadsheet',
    'subject': 'With document properties',
```

```

    'author':    'John McNamara',
    'manager':   'Dr. Heinz Doofenshmirtz',
    'company':   'of Wolves',
    'category':  'Example spreadsheets',
    'keywords':  'Sample, Example, Properties',
    'comments':  'Created with Python and XlsxWriter',
    'status':    'Quo',
})

worksheet.set_column('A:A', 70)
worksheet.write('A1', "Select 'Workbook Properties' to see properties.")

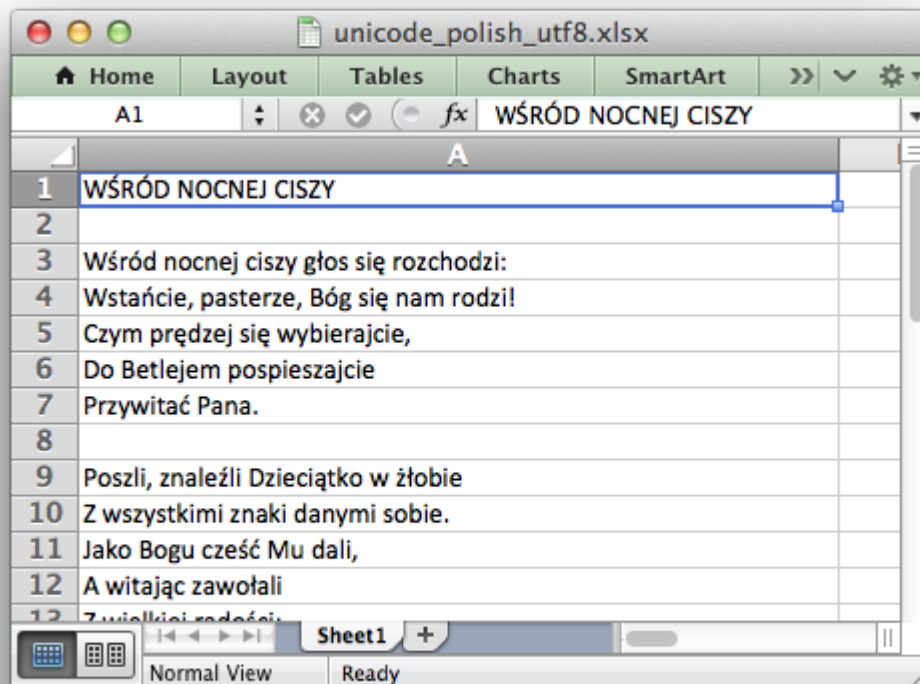
```

21.22 Example: Unicode - Polish in UTF-8

This program is an example of reading in data from a UTF-8 encoded text file and converting it to a worksheet.

The main trick is to ensure that the data read in is converted to UTF-8 within the Python program. The XlsxWriter module will then take care of writing the encoding to the Excel file.

The encoding of the input data shouldn't matter once it can be converted to UTF-8 via the `codecs` module.



```
#####
#
# A simple example of converting some Unicode text to an Excel file using
# the XlsxWriter Python module.
#
# This example generates a spreadsheet with some Polish text from a file
# with UTF8 encoded text.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
import codecs
from xlsxwriter.workbook import Workbook

# Open the input file with the correct encoding.
textfile = codecs.open('unicode_polish_utf8.txt', 'r', 'utf-8')

# Create an new Excel file and convert the text data.
workbook = Workbook('unicode_polish_utf8.xlsx')
worksheet = workbook.add_worksheet()

# Widen the first column to make the text clearer.
worksheet.set_column('A:A', 50)

# Start from the first cell.
row = 0
col = 0

# Read the text file and write it to the worksheet.
for line in textfile:
    # Ignore the comments in the text file.
    if line.startswith('#'):
        continue

    # Write any other lines to the worksheet.
    worksheet.write(row, col, line.rstrip("\n"))
    row += 1

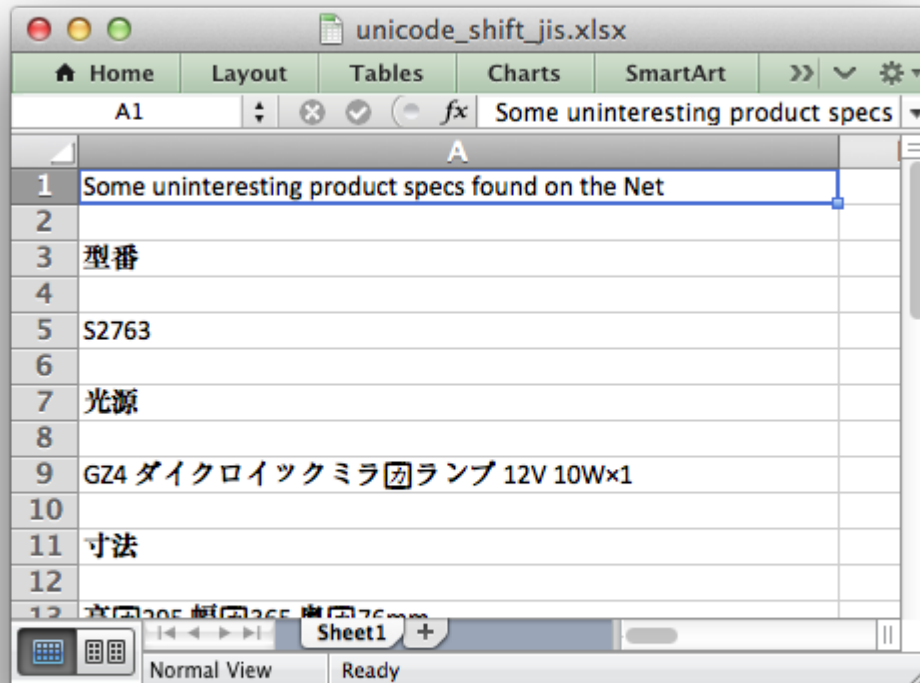
workbook.close()
```

21.23 Example: Unicode - Shift JIS

This program is an example of reading in data from a Shift JIS encoded text file and converting it to a worksheet.

The main trick is to ensure that the data read in is converted to UTF-8 within the Python program. The XlsxWriter module will then take care of writing the encoding to the Excel file.

The encoding of the input data shouldn't matter once it can be converted to UTF-8 via the `codecs` module.



```
#####
#
# A simple example of converting some Unicode text to an Excel file using
# the XlsxWriter Python module.
#
# This example generates a spreadsheet with some Japanese text from a file
# with Shift-JIS encoded text.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
import codecs
from xlsxwriter.workbook import Workbook

# Open the input file with the correct encoding.
textfile = codecs.open('unicode_shift_jis.txt', 'r', 'shift_jis')

# Create an new Excel file and convert the text data.
workbook = Workbook('unicode_shift_jis.xlsx')
worksheet = workbook.add_worksheet()

# Widen the first column to make the text clearer.
worksheet.set_column('A:A', 50)

# Start from the first cell.
```

```
row = 0
col = 0

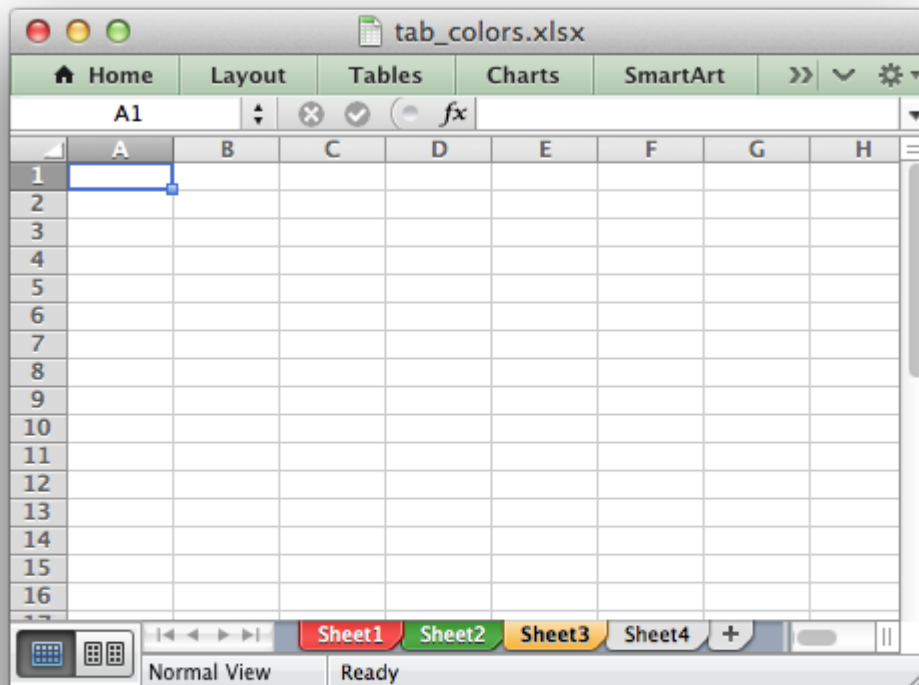
# Read the text file and write it to the worksheet.
for line in textfile:
    # Ignore the comments in the text file.
    if line.startswith('#'):
        continue

    # Write any other lines to the worksheet.
    worksheet.write(row, col, line.rstrip("\n"))
    row += 1

workbook.close()
```

21.24 Example: Setting Worksheet Tab Colours

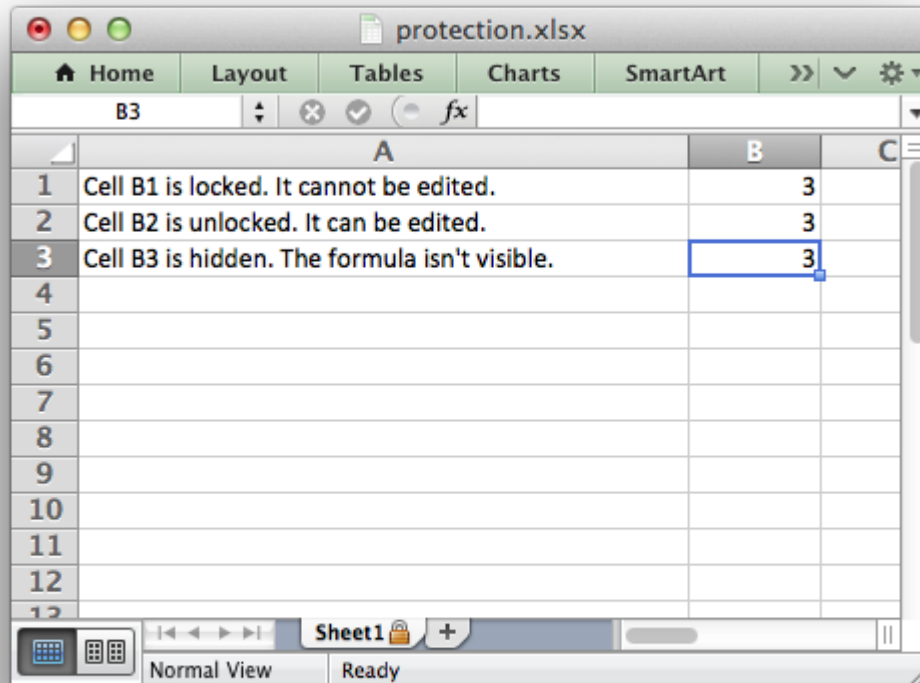
This program is an example of setting worksheet tab colours. See the `set_tab_color()` method for more details.




```
#####  
#  
# Example of how to set Excel worksheet tab colours using Python  
# and the XlsxWriter module..  
#  
# Copyright 2013, John McNamara, jmcnamara@cpan.org  
#  
from xlsxwriter.workbook import Workbook  
  
workbook = Workbook('tab_colors.xlsx')  
  
# Set up some worksheets.  
worksheet1 = workbook.add_worksheet()  
worksheet2 = workbook.add_worksheet()  
worksheet3 = workbook.add_worksheet()  
worksheet4 = workbook.add_worksheet()  
  
# Set tab colours  
worksheet1.set_tab_color('red')  
worksheet2.set_tab_color('green')  
worksheet3.set_tab_color('#FF9900') # Orange  
  
# worksheet4 will have the default colour.  
  
workbook.close()
```

21.25 Example: Enabling Cell protection in Worksheets

This program is an example cell locking and formula hiding in an Excel worksheet using the `protect()` worksheet method.



```
#####
#
# Example of cell locking and formula hiding in an Excel worksheet
# using Python and the XlsxWriter module.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('protection.xlsx')
worksheet = workbook.add_worksheet()

# Create some cell formats with protection properties.
unlocked = workbook.add_format({'locked': 0})
hidden = workbook.add_format({'hidden': 1})

# Format the columns to make the text more visible.
worksheet.set_column('A:A', 40)

# Turn worksheet protection on.
worksheet.protect()

# Write a locked, unlocked and hidden cell.
worksheet.write('A1', 'Cell B1 is locked. It cannot be edited.')
```

```

worksheet.write('A2', 'Cell B2 is unlocked. It can be edited.')
worksheet.write('A3', "Cell B3 is hidden. The formula isn't visible.")

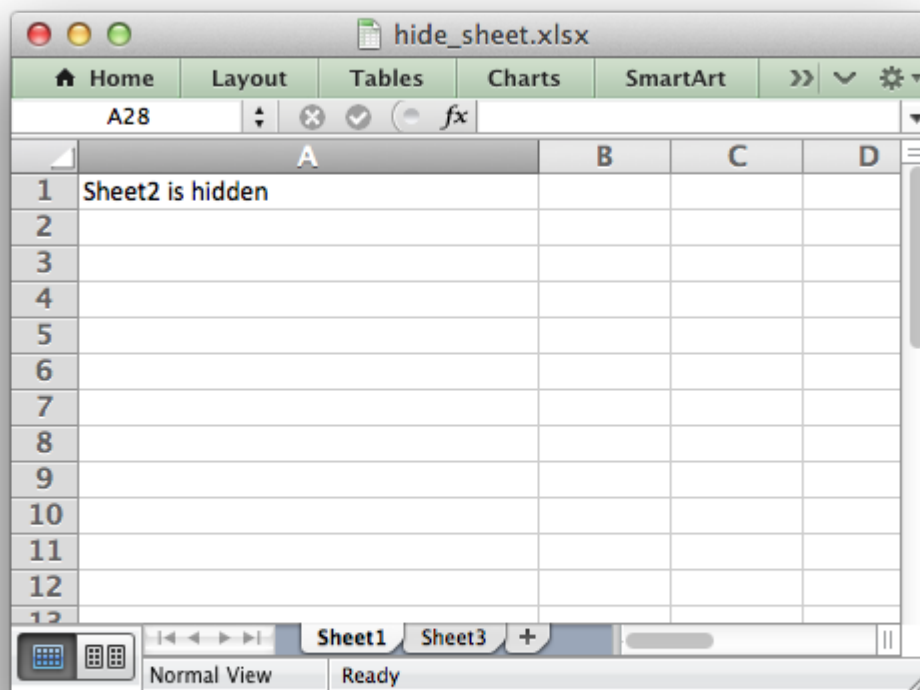
worksheet.write_formula('B1', '=1+2') # Locked by default.
worksheet.write_formula('B2', '=1+2', unlocked)
worksheet.write_formula('B3', '=1+2', hidden)

workbook.close()

```

21.26 Example: Hiding Worksheets

This program is an example of how to hide a worksheet using the `hide()` method.



```

#####
#
# Example of how to hide a worksheet with XlsxWriter.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('hide_sheet.xlsx')

```

```
worksheet1 = workbook.add_worksheet()
worksheet2 = workbook.add_worksheet()
worksheet3 = workbook.add_worksheet()

worksheet1.set_column('A:A', 30)
worksheet2.set_column('A:A', 30)
worksheet3.set_column('A:A', 30)

# Hide Sheet2. It won't be visible until it is unhidden in Excel.
worksheet2.hide()

worksheet1.write('A1', 'Sheet2 is hidden')
worksheet2.write('A1', "Now it's my turn to find you!")
worksheet3.write('A1', 'Sheet2 is hidden')

workbook.close()
```

21.27 Example: Hiding Rows and Columns

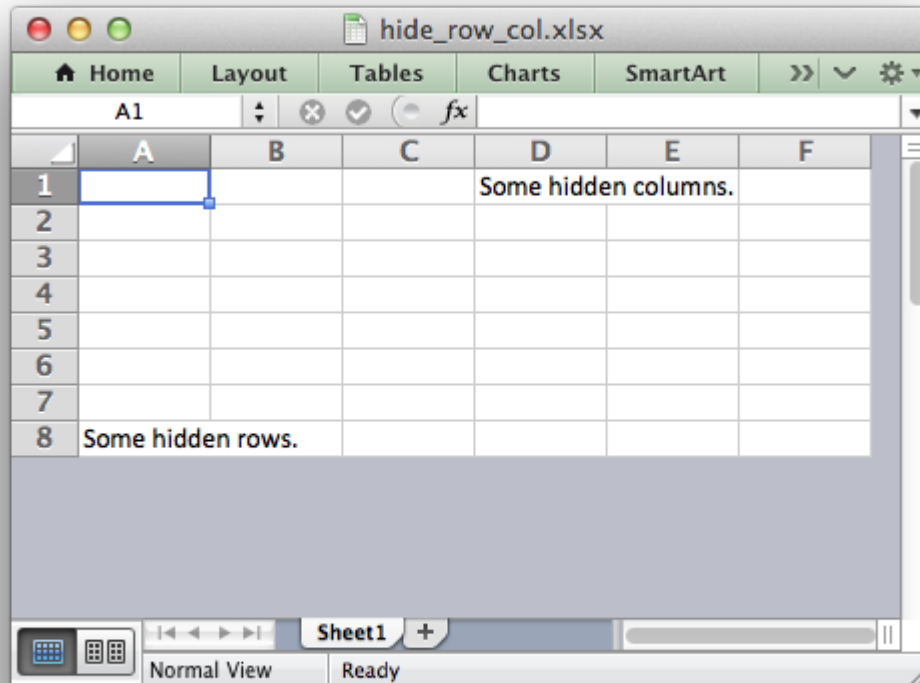
This program is an example of how to hide rows and columns in XlsxWriter.

An individual row can be hidden using the `set_row()` method:

```
worksheet.set_row(0, None, None, {'hidden': True})
```

However, in order to hide a large number of rows, for example all the rows after row 8, we need to use an Excel optimisation to hide rows without setting each one, (of approximately 1 million rows). To do this we use the `set_default_row()` method.

Columns don't require this optimisation and can be hidden using `set_column()`.



```
#####
#
# Example of how to hide rows and columns in XlsxWriter. In order to
# hide rows without setting each one, (of approximately 1 million rows),
# Excel uses an optimisation to hide all rows that don't have data.
#
# Copyright 2013, John McNamara, jmcnamara@cpan.org
#
from xlsxwriter.workbook import Workbook

workbook = Workbook('hide_row_col.xlsx')
worksheet = workbook.add_worksheet()

# Write some data.
worksheet.write('D1', 'Some hidden columns.')
worksheet.write('A8', 'Some hidden rows.')

# Hide all rows without data.
worksheet.set_default_row(hide_unused_rows=True)

# Set the height of empty rows that we do want to display even if it is
# the default height.
for row in range(1, 7):
    worksheet.set_row(row, 15)
```

```
# Columns can be hidden explicitly. This doesn't increase the file size..  
worksheet.set_column('G:XFD', None, None, {'hidden': True})  
  
workbook.close()
```

COMPARISON WITH EXCEL::WRITER::XLSX

The XlsxWriter module is a port of the Perl `Excel::Writer::XLSX` module with more Pythonic interfaces.

XlsxWriter supports almost all of `Excel::Writer::XLSX`'s features apart from those noted in the tables below. Remaining features such as sparklines and charts are in progress.

22.1 Workbook

Status: ongoing.

Workbook Methods	XlsxWriter	Excel::Writer::XLSX
<code>add_worksheet()</code>	Yes	Yes
<code>add_format()</code>	Yes	Yes
<code>add_chart()</code>	No	Yes
<code>close()</code>	Yes	Yes
<code>set_properties()</code>	Yes	Yes
<code>define_name()</code>	Yes	Yes
<code>worksheets()</code>	Yes	Yes
<code>add_shape()</code>	No (1)	Yes
<code>add_vba_project()</code>	No (1)	Yes
<code>set_tmpdir()</code>	Yes (2)	Yes
<code>set_1904()</code>	Yes (2)	Yes
<code>set_optimization()</code>	Yes (2)	Yes
<code>set_custom_color()</code>	Yes (3)	Yes

1. These features are experimental and probably won't be ported.
2. This is a constructor parameter in XlsxWriter.
3. Not required in XlsxWriter. Full RGB colours are supported.

22.2 Worksheet

Status: ongoing.

Worksheet Methods	XlsxWriter	Excel::Writer::XLSX
<code>write()</code>	Yes	Yes
<code>write_number()</code>	Yes	Yes
<code>write_string()</code>	Yes	Yes
<code>write_rich_string()</code>	Yes	Yes
<code>write_blank()</code>	Yes	Yes
<code>write_row()</code>	Yes	Yes
<code>write_column()</code>	Yes	Yes
<code>write_datetime()</code>	Yes	Yes
<code>write_url()</code>	Yes	Yes
<code>write_formula()</code>	Yes	Yes
<code>write_array_formula()</code>	Yes	Yes
<code>write_comment()</code>	Yes	Yes
<code>show_comments()</code>	Yes	Yes
<code>set_comments_author()</code>	Yes	Yes
<code>insert_image()</code>	Yes	Yes
<code>insert_chart()</code>	No	Yes
<code>data_validation()</code>	Yes	Yes
<code>conditional_format()</code>	Yes	Yes
<code>add_sparkline()</code>	No	Yes
<code>add_table()</code>	Yes	Yes
<code>get_name()</code>	Yes	Yes
<code>activate()</code>	Yes	Yes
<code>select()</code>	Yes	Yes
<code>hide()</code>	Yes	Yes
<code>set_first_sheet()</code>	Yes	Yes
<code>protect()</code>	Yes	Yes
<code>set_selection()</code>	Yes	Yes
<code>set_row()</code>	Yes	Yes
<code>set_column()</code>	Yes	Yes
<code>set_default_row()</code>	Yes	Yes
<code>outline_settings()</code>	Yes	Yes
<code>freeze_panes()</code>	Yes	Yes
<code>split_panes()</code>	Yes	Yes
<code>merge_range()</code>	Yes	Yes
<code>set_zoom()</code>	Yes	Yes
<code>right_to_left()</code>	Yes	Yes
<code>hide_zero()</code>	Yes	Yes
<code>set_tab_color()</code>	Yes	Yes
<code>autofilter()</code>	Yes	Yes
<code>filter_column()</code>	Yes	Yes
Continued on next page		

Table 22.1 – continued from previous page

Worksheet Methods	XlsxWriter	Excel::Writer::XLSX
<code>filter_column_list()</code>	Yes	Yes
<code>keep_leading_zeros()</code>	No (1)	Yes
<code>add_write_handler()</code>	No (1)	Yes
<code>merge_range_type()</code>	No (2)	Yes

1. These methods are syntactic sugar and can be handled using the standard API. They probably won't be ported.
2. Not required in XlsxWriter. The same functionality is available via `merge_range()`.

22.3 Page Setup

Status: complete.

Page Set-up Methods	XlsxWriter	Excel::Writer::XLSX
<code>set_landscape()</code>	Yes	Yes
<code>set_portrait()</code>	Yes	Yes
<code>set_page_view()</code>	Yes	Yes
<code>set_paper()</code>	Yes	Yes
<code>center_horizontally()</code>	Yes	Yes
<code>center_vertically()</code>	Yes	Yes
<code>set_margins()</code>	Yes	Yes
<code>set_header()</code>	Yes	Yes
<code>set_footer()</code>	Yes	Yes
<code>repeat_rows()</code>	Yes	Yes
<code>repeat_columns()</code>	Yes	Yes
<code>hide_gridlines()</code>	Yes	Yes
<code>print_row_col_headers()</code>	Yes	Yes
<code>print_area()</code>	Yes	Yes
<code>print_across()</code>	Yes	Yes
<code>fit_to_pages()</code>	Yes	Yes
<code>set_start_page()</code>	Yes	Yes
<code>set_print_scale()</code>	Yes	Yes
<code>set_h_pagebreaks()</code>	Yes	Yes
<code>set_v_pagebreaks()</code>	Yes	Yes

22.4 Format

Status: complete.

Format Methods	XlsxWriter	Excel::Writer::XLSX
<code>set_font_name()</code>	Yes	Yes
Continued on next page		

Table 22.2 – continued from previous page

Format Methods	XlsxWriter	Excel::Writer::XLSX
<code>set_font_size()</code>	Yes	Yes
<code>set_font_color()</code>	Yes	Yes
<code>set_bold()</code>	Yes	Yes
<code>set_italic()</code>	Yes	Yes
<code>set_underline()</code>	Yes	Yes
<code>set_font_strikeout()</code>	Yes	Yes
<code>set_font_script()</code>	Yes	Yes
<code>set_num_format()</code>	Yes	Yes
<code>set_locked()</code>	Yes	Yes
<code>set_hidden()</code>	Yes	Yes
<code>set_align()</code>	Yes	Yes
<code>set_rotation()</code>	Yes	Yes
<code>set_text_wrap()</code>	Yes	Yes
<code>set_text_justlast()</code>	Yes	Yes
<code>set_center_across()</code>	Yes	Yes
<code>set_indent()</code>	Yes	Yes
<code>set_shrink()</code>	Yes	Yes
<code>set_pattern()</code>	Yes	Yes
<code>set_bg_color()</code>	Yes	Yes
<code>set_fg_color()</code>	Yes	Yes
<code>set_border()</code>	Yes	Yes
<code>set_bottom()</code>	Yes	Yes
<code>set_top()</code>	Yes	Yes
<code>set_left()</code>	Yes	Yes
<code>set_right()</code>	Yes	Yes
<code>set_border_color()</code>	Yes	Yes
<code>set_bottom_color()</code>	Yes	Yes
<code>set_top_color()</code>	Yes	Yes
<code>set_left_color()</code>	Yes	Yes
<code>set_right_color()</code>	Yes	Yes

ALTERNATIVE MODULES FOR HANDLING EXCEL FILES

The following are some Python alternatives to XlsxWriter.

23.1 XLWT

From the [xlwt](#) page on PyPI:

Library to create spreadsheet files compatible with MS Excel 97/2000/XP/2003 XLS files, on any platform, with Python 2.3 to 2.7.

xlwt is a library for generating spreadsheet files that are compatible with Excel 97/2000/XP/2003, OpenOffice.org Calc, and Gnumeric. xlwt has full support for Unicode. Excel spreadsheets can be generated on any platform without needing Excel or a COM server. The only requirement is Python 2.3 to 2.7.

23.2 XLRD

From the [xlrd](#) page on PyPI:

Library for developers to extract data from Microsoft Excel (tm) spreadsheet files Extract data from Excel spreadsheets (.xls and .xlsx, versions 2.0 onwards) on any platform. Pure Python (2.6, 2.7, 3.2+). Strong support for Excel dates. Unicode-aware.

23.3 OpenPyXL

From the [openpyxl](#) page on PyPI:

A Python library to read/write Excel 2007 xlsx/xlsm files. Openpyxl is a pure python reader and writer of Excel OpenXML files. It is ported from the PHPExcel project.

KNOWN ISSUES AND BUGS

This section lists known issues and bugs and gives some information on how to submit bug reports.

24.1 ‘unknown encoding: utf-8’ Error

The following error can occur on Windows if the `close()` method isn’t used at the end of the program:

```
Exception LookupError: 'unknown encoding: utf-8' in <bound method
Workbook.__del__ of <xlsxwriter.workbook.Workbook object at 0x022C1450>>
```

This appears to be an issue with the implicit destructor on Windows. It is under investigation. Use `close()` as a workaround.

24.2 Formula results not displaying in Excel

Some early versions of Excel 2007 do not display the calculated values of formulas written by `XlsxWriter`. Applying all available Service Packs to Excel should fix this.

24.3 Formula results displaying as zero in non-Excel applications

Due to wide range of possible formulas and interdependencies between them `XlsxWriter` doesn’t, and realistically cannot, calculate the result of a formula when it is written to an XLSX file. Instead, it stores the value 0 as the formula result. It then sets a global flag in the XLSX file to say that all formulas and functions should be recalculated when the file is opened.

This is the method recommended in the Excel documentation and in general it works fine with spreadsheet applications. However, applications that don’t have a facility to calculate formulas, such as Excel Viewer, or several mobile applications, will only display the 0 results.

If required, it is also possible to specify the calculated result of the formula using the optional `value` parameter in `write_formula()`:

```
worksheet.write_formula('A1', '=2+2', num_format, 4)
```

24.4 Strings aren't displayed in Apple Numbers in 'constant_memory' mode

In `Workbook()` 'constant_memory' mode XlsxWriter uses an optimisation where cell strings aren't stored in an Excel structure call "shared strings" and instead are written "in-line".

This is a documented Excel feature that is supported by most spreadsheet applications. One known exception is Apple Numbers for Mac where the string data isn't displayed.

REPORTING BUGS

Here are some tips on reporting bugs in XlsxWriter.

25.1 Upgrade to the latest version of the module

The bug you are reporting may already be fixed in the latest version of the module. Check the *Changes in XlsxWriter* section as well.

25.2 Read the documentation

The XlsxWriter documentation has been refined in response to user questions. Therefore, if you have a question it is possible that someone else has asked it before you and that it is already addressed in the documentation.

25.3 Look at the example programs

There are several example programs in the distribution. Many of these were created in response to user questions. Try to identify an example program that corresponds to your query and adapt it to your needs.

25.4 Use the official XlsxWriter Issue tracker on GitHub

The official XlsxWriter [Issue tracker](#) is on GitHub.

25.5 Pointers for submitting a bug report

1. Describe the problem as clearly and as concisely as possible.
2. Include a sample program. This is probably the most important step. Also, it is often easier to describe a problem in code than in written prose.

3. The sample program should be as small as possible to demonstrate the problem. Don't copy and past large sections of your program. The program should also be self contained and working.

A sample bug report is shown below. If you use this format then it will help to analyse your question and respond to it more quickly.

XlsxWriter Issue with SOMETHING

I am using XlsxWriter and I have encountered a problem. I want it to do SOMETHING but the module appears to do SOMETHING ELSE.

I am using Python version X.Y.Z and XlsxWriter x.y.z.

Here is some code that demonstrates the problem:

```
from xlsxwriter.workbook import Workbook

workbook = Workbook('hello.xlsx')
worksheet = workbook.add_worksheet()

worksheet.write('A1', 'Hello world')

workbook.close()
```


FREQUENTLY ASKED QUESTIONS

The section outlines some answers to frequently asked questions.

26.1 Q. Can XlsxWriter use an existing Excel file as a template?

No.

XlsxWriter is designed only as a file *writer*. It cannot read or modify an existing Excel file.

26.2 Q. Why do my formulas show a zero result in some, non-Excel applications?

Due to wide range of possible formulas and interdependencies between them XlsxWriter doesn't, and realistically cannot, calculate the result of a formula when it is written to an XLSX file. Instead, it stores the value 0 as the formula result. It then sets a global flag in the XLSX file to say that all formulas and functions should be recalculated when the file is opened.

This is the method recommended in the Excel documentation and in general it works fine with spreadsheet applications. However, applications that don't have a facility to calculate formulas, such as Excel Viewer, or several mobile applications, will only display the 0 results.

If required, it is also possible to specify the calculated result of the formula using the optional `value` parameter in `write_formula()`:

```
worksheet.write_formula('A1', '=2+2', num_format, 4)
```

26.3 Q. Can I apply a format to a range of cells in one go?

Currently no. However, it is a planned features to allow cell formats and data to be written separately.

26.4 Q. Is feature X supported or will it be supported?

All supported features are documented.

Future features will match features that are available in `Excel::Writer::XLSX`. Check the feature matrix in the [Comparison with Excel::Writer::XLSX](#) section.

26.5 Q. Is there an “AutoFit” option for columns?

Unfortunately, there is no way to specify “AutoFit” for a column in the Excel file format. This feature is only available at runtime from within Excel. It is possible to simulate “AutoFit” by tracking the width of the data in the column as you write it.

26.6 Q. Do people actually ask these questions frequently, or at all?

Apart from this question, yes.

CHANGES IN XLSXWRITER

This section shows changes and bug fixes in the XlsxWriter module.

27.1 Release 0.3.0 - April 7 2013

- Added worksheet sparklines. See *Working with Sparklines*, *Example: Sparklines (Simple)* and *Example: Sparklines (Advanced)*

27.2 Release 0.2.9 - April 7 2013

- Added worksheet tables. See *Working with Worksheet Tables* and *Example: Worksheet Tables*.
- Tested with the new Python stable releases 2.7.4 and 3.3.1. All tests now pass in the following versions:
 - Python 2.6
 - Python 2.7.2
 - Python 2.7.3
 - Python 2.7.4
 - Python 3.1
 - Python 3.2
 - Python 3.3.0
 - Python 3.3.1
- There are now over 700 unit tests including more than 170 tests that compare against the output of Excel.

27.3 Release 0.2.8 - April 4 2013

- Added worksheet outlines and grouping. See [Working with Outlines and Grouping](#).

27.4 Release 0.2.7 - April 3 2013

- Added `set_default_row()` method. See [Example: Hiding Rows and Columns](#).
- Added `hide_row_col.py`, `hide_sheet.py` and `text_indent.py` examples.

27.5 Release 0.2.6 - April 1 2013

- Added `freeze_panes()` and `split_panes()` methods. See [Example: Freeze Panes and Split Panes](#).
- Added `set_selection()` method to select worksheet cell or range of cells.

27.6 Release 0.2.5 - April 1 2013

- Added additional `Workbook()` parameters `'tmpdir'` and `'date_1904'`.

27.7 Release 0.2.4 - March 31 2013

- Added `Workbook()` `'constant_memory'` constructor property to minimise memory usage when writing large files. See [Working with Memory and Performance](#) for more details.
- Fixed bug with handling of UTF-8 strings in worksheet names (and probably some other places as well). Reported by Josh English.
- Fixed bug where temporary directory used to create xlsx files wasn't cleaned up after program close.

27.8 Release 0.2.3 - March 27 2013

- Fixed bug that was killing performance for medium sized files. The module is now 10x faster than previous versions. Reported by John Yeung.

27.9 Release 0.2.2 - March 27 2013

- Added worksheet data validation options. See the `data_validation()` method, [Working with Data Validation](#) and [Example: Data Validation and Drop Down Lists](#).

- There are now over 600 unit tests including more than 130 tests that compare against the output of Excel.

27.10 Release 0.2.1 - March 25 2013

- Added support for `datetime.datetime`, `datetime.date` and `datetime.time` to the `write_datetime()` method. GitHub issue #3. Thanks to Eduardo (eazb) and Josh English for the prompt.

27.11 Release 0.2.0 - March 24 2013

- Added conditional formatting. See the `conditional_format()` method, *Working with Conditional Formatting* and *Example: Conditional Formatting*.

27.12 Release 0.1.9 - March 19 2013

- Added Python 2.6 support. All tests now pass in the following versions:
 - Python 2.6
 - Python 2.7.2
 - Python 2.7.3
 - Python 3.1
 - Python 3.2
 - Python 3.3.0

27.13 Release 0.1.8 - March 18 2013

- Fixed Python 3 support.

27.14 Release 0.1.7 - March 18 2013

- Added the option to write cell comments to a worksheet. See `write_comment()` and *Working with Cell Comments*.

27.15 Release 0.1.6 - March 17 2013

- Added `insert_image()` worksheet method to support inserting PNG and JPEG images into a worksheet. See also the example program *Example: Inserting images into a worksheet*.
- There are now over 500 unit tests including more than 100 tests that compare against the output of Excel.

27.16 Release 0.1.5 - March 10 2013

- Added the `write_rich_string()` worksheet method to allow writing of text with multiple formats to a cell. Also added example program: *Example: Writing “Rich” strings with multiple formats*.
- Added the `hide()` worksheet method to hide worksheets.
- Added the `set_first_sheet()` worksheet method.

27.17 Release 0.1.4 - March 8 2013

- Added the `protect()` worksheet method to allow protection of cells from editing. Also added example program: *Example: Enabling Cell protection in Worksheets*.

27.18 Release 0.1.3 - March 7 2013

- Added worksheet methods:
 - `set_zoom()` for setting worksheet zoom levels.
 - `right_to_left()` for middle eastern versions of Excel.
 - `hide_zero()` for hiding zero values in cells.
 - `set_tab_color()` for setting the worksheet tab colour.

27.19 Release 0.1.2 - March 6 2013

- Added autofilters. See *Working with Autofilters* for more details.
- Added the `write_row()` and `write_column()` worksheet methods.

27.20 Release 0.1.1 - March 3 2013

- Added the `write_url()` worksheet method for writing hyperlinks to a worksheet.

27.21 Release 0.1.0 - February 28 2013

- Added the `set_properties()` workbook method for setting document properties.
- Added several new examples programs with documentation. The examples now include:
 - `array_formula.py`
 - `cell_indentation.py`
 - `datetimes.py`
 - `defined_name.py`
 - `demo.py`
 - `doc_properties.py`
 - `headers_footers.py`
 - `hello_world.py`
 - `merge1.py`
 - `tutorial1.py`
 - `tutorial2.py`
 - `tutorial3.py`
 - `unicode_polish_utf8.py`
 - `unicode_shift_jis.py`

27.22 Release 0.0.9 - February 27 2013

- Added the `define_name()` method to create defined names and ranges in a workbook or worksheet.
- Added the `worksheets()` method as an accessor for the worksheets in a workbook.

27.23 Release 0.0.8 - February 26 2013

- Added the `merge_range()` method to merge worksheet cells.

27.24 Release 0.0.7 - February 25 2013

- Added final page setup methods to complete the page setup section.
 - `print_area()`
 - `fit_to_pages()`
 - `set_start_page()`
 - `set_print_scale()`
 - `set_h_pagebreaks()`
 - `set_v_pagebreaks()`

27.25 Release 0.0.6 - February 22 2013

- Added page setup method.
 - `print_row_col_headers`

27.26 Release 0.0.5 - February 21 2013

- Added page setup methods.
 - `repeat_rows()`
 - `repeat_columns()`

27.27 Release 0.0.4 - February 20 2013

- Added Python 3 support with help from John Evans. Tested with:
 - Python-2.7.2
 - Python-2.7.3
 - Python-3.2
 - Python-3.3.0
- Added page setup methods.
 - `center_horizontally()`
 - `center_vertically()`
 - `set_header()`
 - `set_footer()`
 - `hide_gridlines()`

27.28 Release 0.0.3 - February 19 2013

- Added page setup method.
 - `set_margins()`

27.29 Release 0.0.2 - February 18 2013

- Added page setup methods.
 - `set_landscape()`
 - `set_portrait()`
 - `set_page_view()`
 - `set_paper()`
 - `print_across()`

27.30 Release 0.0.1 - February 17 2013

- First public release.

AUTHOR

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- [GitHub repos](#)
- [Perl CPAN modules](#)
- [Twitter @jmcnamara13](#)
- [Coderwall](#)
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