



Creating Excel files with `xlsxwriter.lua`

Release 0.0.1

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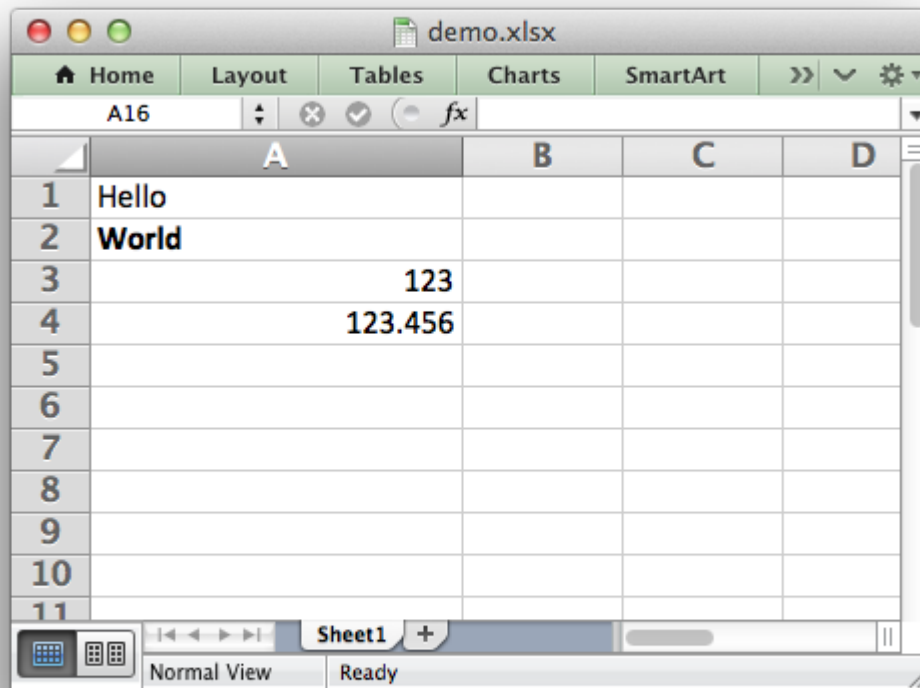
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Xlsxwriter is a Lua module for creating Excel XLSX files.



Xlsxwriter is a Lua module that can be used to write text, numbers and formulas to multiple worksheets in an Excel 2007+ XLSX file. It supports features such as:

- 100% compatible Excel XLSX files.
- Full formatting.
- Memory optimisation mode for writing large files.

It supports Lua 5.1 and Lua 5.2.

INTRODUCTION

Xlsxwriter.lua is a Lua 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.

The main advantages of using Xlsxwriter are:

- It has a high degree of fidelity with files produced by Excel. In most cases the files produced are 100% equivalent to files produced by Excel.
- It has extensive documentation, example files and tests.
- It is fast and can be configured to use very little memory even for very large output files.

However:

- It can only create **new files**. It cannot read or modify existing files.

Xlsxwriter.lua is a port of the Perl [Excel::Writer::XLSX](#) and the Python [XlsxWriter](#) modules and is licensed under an MIT/X11 [License](#).

To try out the module see the next section on [Getting Started with XlsxWriter](#).

GETTING STARTED WITH XLSXWRITER

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

2.1 Installing Xlsxwriter.lua

The first step is to install the `xlsxwriter.lua` module. There are several ways to do this.

Note: `Xlsxwriter.lua` has a dependency on the [ZipWriter](#) module.

2.1.1 Using luarocks

The easiest way to install `xlsxwriter.lua` is with the `luarocks` utility:

```
$ sudo luarocks install xlsxwriter
```

2.1.2 Cloning from GitHub

The `Xlsxwriter.lua` source code and bug tracker is in the [xlsxwriter.lua repository](#) on GitHub. You can clone the repository and install from it as follows:

```
$ git clone https://github.com/jmcnamara/xlsxwriter.lua.git
$ cd xlsxwriter.lua
$ sudo luarocks make
```

2.1.3 Installing from a tarball

If you download a tarball of the latest version of `xlsxwriter.lua` 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 luarocks make
```

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

```
$ curl -O -L http://github.com/jmcnamara/xlsxwriter.lua/archive/master.tar.gz
$ tar zxvf master.tar.gz
$ cd xlsxwriter.lua-master
$ sudo luarocks make
```

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:

```
local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("hello_world.xlsx")
local worksheet = workbook:add_worksheet()

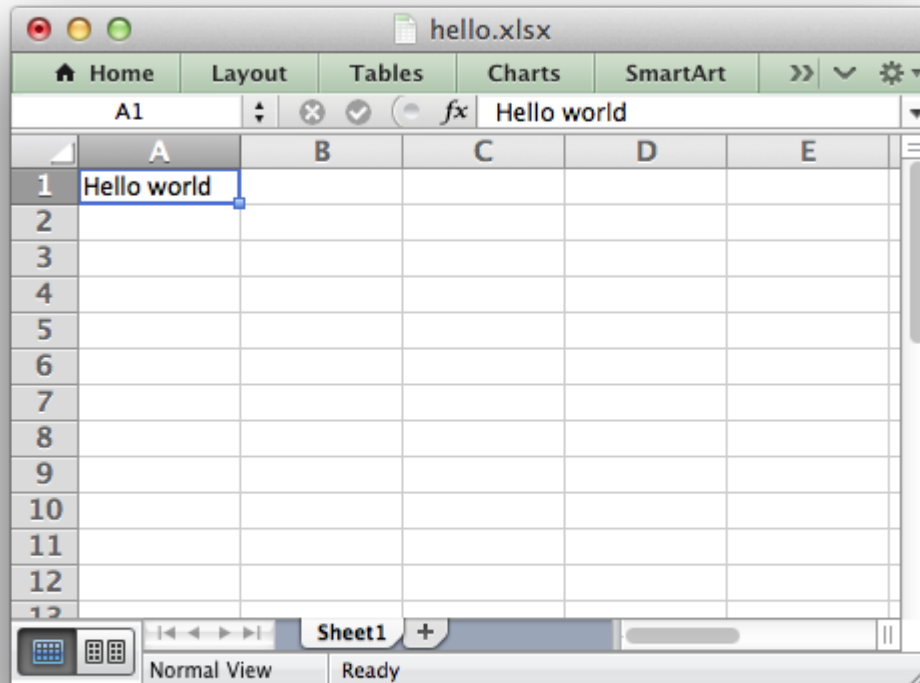
worksheet:write("A1", "Hello world")

workbook:close()
```

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

```
$ lua hello.lua
```

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.lua` 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 Lua and the `xlsxwriter.lua` 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:

```
local Workbook = require "xlsxwriter.workbook"

-- Create a workbook and add a worksheet.
local workbook = Workbook:new("Expenses01.xlsx")
local worksheet = workbook:add_worksheet()

-- Some data we want to write to the worksheet.
local expenses = {
  {"Rent", 1000},
  {"Gas", 100},
  {"Food", 300},
  {"Gym", 50},
}

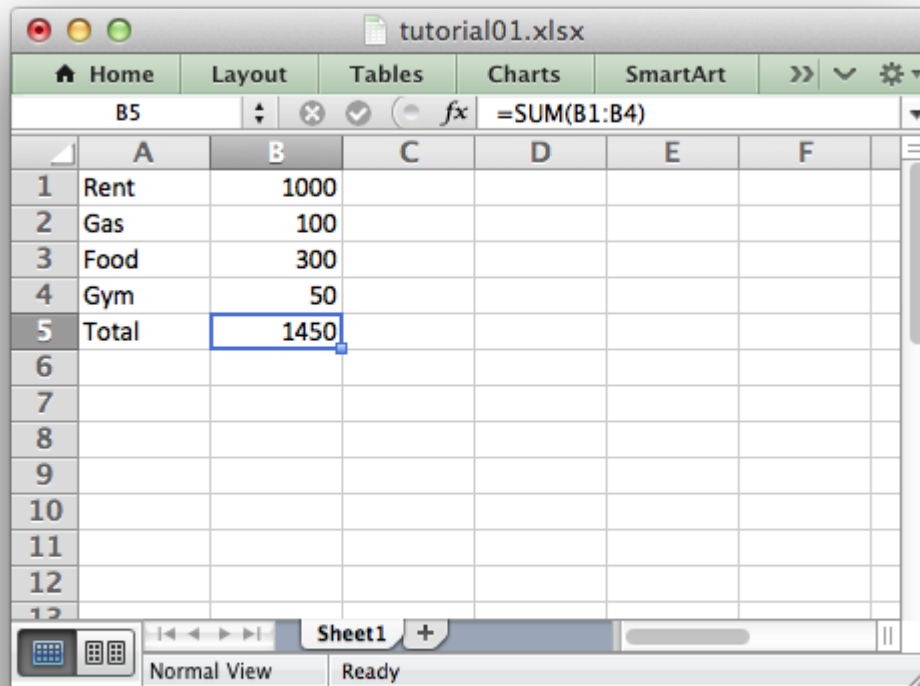
-- Start from the first cell. Rows and columns are zero indexed.
local row = 0
local col = 0

-- Iterate over the data and write it out element by element.
for _, expense in ipairs(expenses) do
  local item, cost = unpack(expense)
  worksheet:write(row, col, item)
  worksheet:write(row, col + 1, cost)
  row = row + 1
end
```

```
-- 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:

```
local Workbook = require "xlsxwriter.workbook"
```

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

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

```
local workbook = Workbook:new("Expenses01.xlsx")
```

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

```
local 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 the `xlsxwriter.lua` API *rows* and *columns* are zero indexed. Thus, 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 element by element.
for _, expense in ipairs(expenses) do
    local item, cost = unpack(expense)
    worksheet:write(row, col, item)
    worksheet:write(row, col + 1, cost)
    row = row + 1
end
```

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:

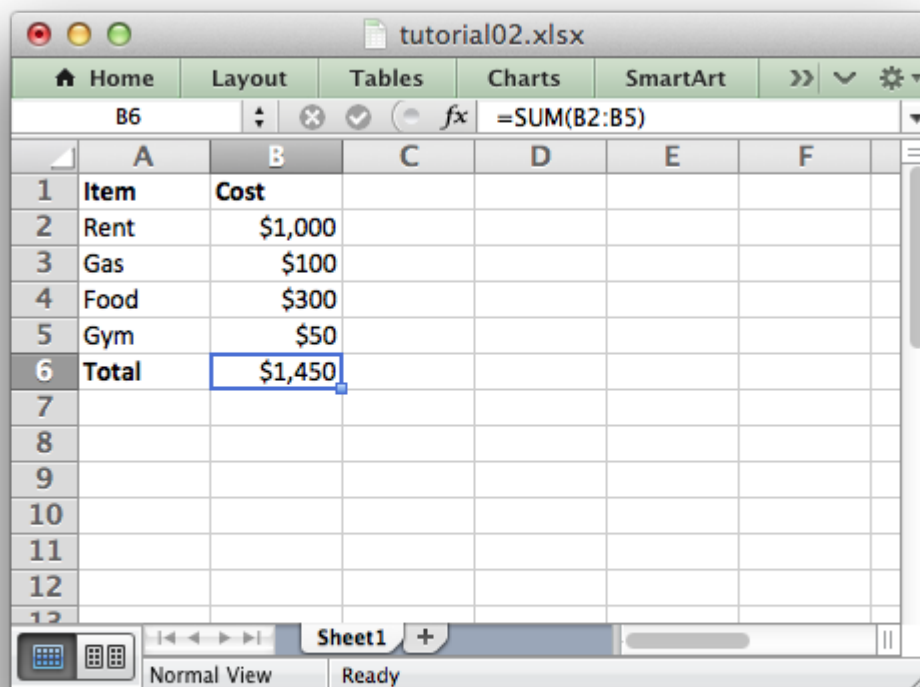
```
workbook:close()
```

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.lua` 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 Lua and the `xlsxwriter.lua` 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:

```
local Workbook = require "xlsxwriter.workbook"

-- Create a workbook and add a worksheet.
local workbook = Workbook:new("Expenses02.xlsx")
local worksheet = workbook:add_worksheet()

-- Add a bold format to use to highlight cells.
local bold = workbook:add_format({bold = true})

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

-- Write some data header.
worksheet:write("A1", "Item", bold)
worksheet:write("B1", "Cost", bold)

-- Some data we want to write to the worksheet.
local expenses = {
    {"Rent", 1000},
    {"Gas", 100},
    {"Food", 300},
    {"Gym", 50},
}

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

-- Iterate over the data and write it out element by element.
for _, expense in ipairs(expenses) do
    local item, cost = unpack(expense)
    worksheet:write(row, col, item)
    worksheet:write(row, col + 1, cost, money)
    row = row + 1
end

-- 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 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.
local bold = workbook:add_format({bold = true})

-- Add a number format for cells with money.
local 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.

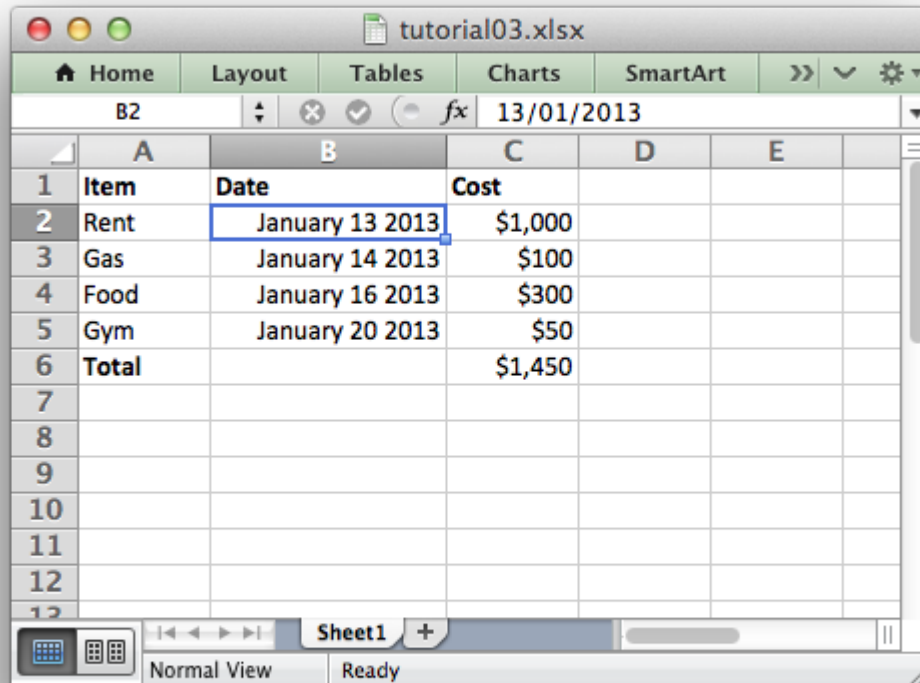
TUTORIAL 3: WRITING DIFFERENT TYPES OF DATA TO THE XLSX FILE

In the previous section we created a simple spreadsheet with formatting using Lua and the `xlswriter.lua` 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 with formatting and made that column a little wider to accommodate the dates.

To do this we can extend our program as follows:

```
local Workbook = require "xlsxwriter.workbook"

-- Create a workbook and add a worksheet.
local workbook = Workbook:new("Expenses03.xlsx")
local worksheet = workbook:add_worksheet()

-- Add a bold format to use to highlight cells.
local bold = workbook:add_format({bold = true})

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

-- Add an Excel date format.
local date_format = workbook:add_format({num_format = "mmm d yyyy"})

-- Adjust the column width.
worksheet:set_column("B:B", 15)

-- Write some data header.
```



```
worksheet:write("A1", "Item", bold)
worksheet:write("B1", "Date", bold)
worksheet:write("C1", "Cost", bold)

-- Some data we want to write to the worksheet.
local 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.
local row = 1
local col = 0

-- Iterate over the data and write it out element by element.
for _, expense in ipairs(expenses) do
    local item, date, cost = unpack(expense)

    worksheet:write_string      (row, col,      item)
    worksheet:write_date_string(row, col + 1, date, date_format)
    worksheet:write_number     (row, col + 2, cost, money)
    row = row + 1
end

-- Write a total using a formula.
worksheet:write(row, 0, "Total",      bold)
worksheet:write(row, 2, "=SUM(C2:C5)", money)

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, such as strings and numbers, differently although it generally does it transparently to the user. `xlsxwriter.lua` tries to emulate this in the `worksheet.write()` method by mapping Lua data types to types that Excel supports.

The `write()` method acts as a general alias for several more specific methods:

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

In this version of our program we have used some of these explicit `write_` methods for different types of data:

```
worksheet:write_string      (row, col,      item)
worksheet:write_date_string(row, col + 1, date, date_format)
worksheet:write_number      (row, col + 2, cost, money)
```

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 actually have worked just as well.

The handling of dates is also new to our program.

Dates and times in Excel are floating point numbers that have a number format applied to display them in the correct format. Since there is no native Lua date or time types `xlsxwriter.lua` provides the `write_date_string()` and `write_date_time()` methods to convert dates and times into Excel date and time numbers.

In the example above we use `write_date_string()` but we also need to add the number format to ensure that Excel displays it as a date:

```
...

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

for _, expense in ipairs(expenses) do
    ...
    worksheet:write_date_string(row, col + 1, date, date_format)
    ...
end
```

Date handling is explained in more detail in [Working with Dates and Time](#).

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)
```

That completes the tutorial section.

In the next sections we will look at the API in more detail starting with [The Workbook Class](#).

THE WORKBOOK CLASS

The Workbook class is the main class exposed by the `xlsxwriter.lua` 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:new(filename[, options])

Create a new `xlsxwriter.lua` Workbook object.

Parameters

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

Return type A Workbook object.

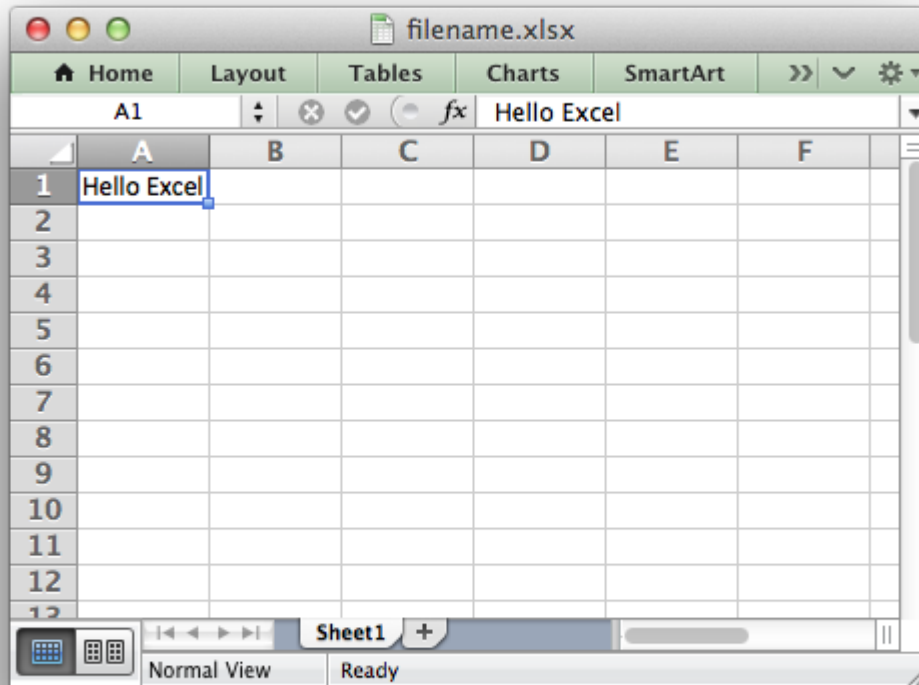
The `Workbook:new()` constructor is used to create a new Excel workbook with a given filename:

```
local Workbook = require "xlsxwriter.workbook"

workbook = Workbook:new("filename.xlsx")
worksheet = workbook:add_worksheet()

worksheet:write(0, 0, "Hello Excel")

workbook:close()
```



The constructor options are:

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

```
workbook = Workbook:new(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. Therefore, once this mode is active, data should be written in sequential row order.

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

- **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.lua` 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 enhanced compatibility with Excel and in general isn't required very often:

```
workbook = Workbook:new(filename, {date_1904 = true})
```

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

6.2 `workbook:add_worksheet()`

`add_worksheet([sheetname])`

Add a new worksheet to a workbook:

Parameters `sheetname` – Optional worksheet name, defaults to Sheet1, etc.

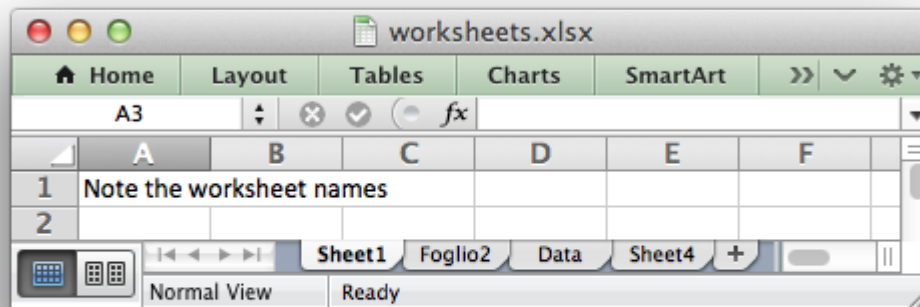
Return type A *Worksheet* object.

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.

Paramionary properties An optional table 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 table 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.

This should be done for every file.

```
workbook:close()
```

Currently, there is no implicit `close()`.

THE WORKSHEET CLASS

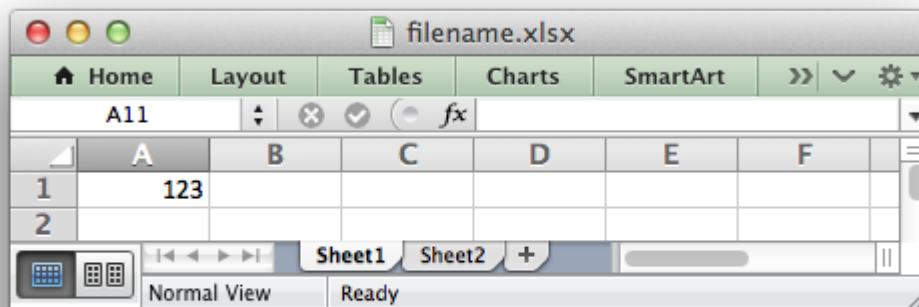
The worksheet class represents an Excel worksheet. It handles operations such as writing data to cells or formatting worksheet layout.

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.new("filename.xlsx")

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

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



7.1 worksheet:write()

write(*row, col, args*)

Write generic data to a worksheet cell.

Parameters

- **row** – The cell row (zero indexed).

- **col** – The cell column (zero indexed).
- **args** – The additional args that are passed to the sub methods such as number, string or format.

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

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

The rules for handling data in `write()` are as follows:

- Variables of Lua type number are written using `write_number()`.
- Empty strings and `nil` are written using `write_blank()`.
- Variables of Lua type boolean are written using `write_boolean()`.

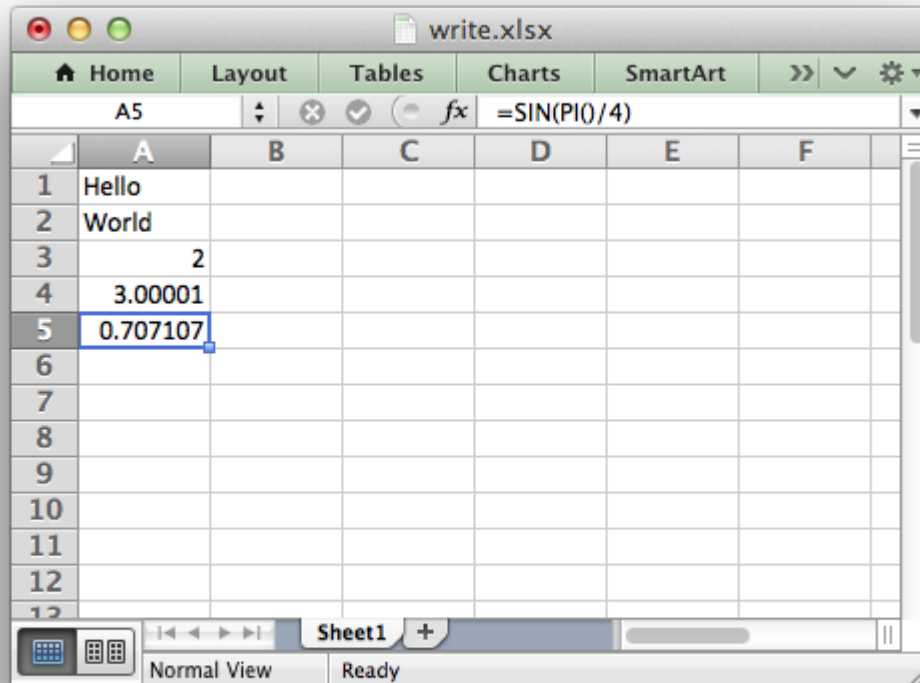
Strings are then handled as follows:

- Strings that start with `"="` are taken to match a formula and are written using `write_formula()`.
- Strings that don't match any of the above criteria are written using `write_string()`.

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, 3.00001)       -- write_number()
worksheet:write(4, 0, "=SIN(PI()/4)") -- write_formula()
worksheet:write(5, 0, "")            -- write_blank()
worksheet:write(6, 0, nil)           -- 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 `format` parameter in the sub `write` methods is used to apply formatting to the cell. This parameter is optional but when present it should be a valid [Format](#) object:

```
format = workbook:add_format({bold = true, italic = true})
worksheet:write(0, 0, "Hello", format) -- Cell is bold and italic.
```

7.2 worksheet:write_string()

write_string(row, col, string[, format])
Write a string to a worksheet cell.

Parameters

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

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

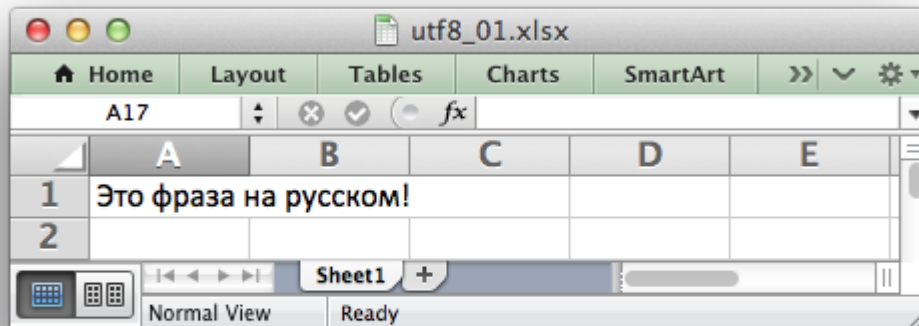
```
worksheet:write_string(0, 0, "Your text here")
worksheet:write_string("A2", "or here")
```

Both row-column and A1 style notation are supported. See *Working with Cell Notation* for more details.

The `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 in Excel must be UTF-8 encoded. With `xlsxwriter.lua` all that is required is that the source file is UTF-8 encoded and Lua will handle the UTF-8 strings like any other strings:

```
worksheet:write("A1", "Some UTF-8 text")
```



There are some sample UTF-8 sample programs in the `examples` directory of the `xlsxwriter.lua` source tree.

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

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

7.3 `worksheet:write_number()`

`write_number`(*row*, *col*, *number*[, *format*])

Write a number to a worksheet cell.

Parameters

- **row** – The cell row (zero indexed).
- **col** – The cell column (zero indexed).
- **number** – Number to write to cell.
- **format** – Optional Format object. [Format](#)

The `write_number()` method writes Lua number type variable to the cell specified by row and column:

```
worksheet:write_number(0, 0, 123456)
worksheet:write_number("A2", 2.3451)
```

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

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

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

7.4 `worksheet:write_formula()`

`write_formula`(*row*, *col*, *formula*[, *format*[, *value*]])

Write a formula to a worksheet cell.

Parameters

- **row** – The cell row (zero indexed).
- **col** – The cell column (zero indexed).
- **formula** – Formula to write to cell.
- **format** – Optional Format object. [Format](#)

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

`Xlsxwriter.lua` 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)
```

Excel stores formulas in US style formatting regardless of the Locale or Language of the Excel version. Therefore all formula names written using `xlsxwriter.lua` must be in English (use the following [formula translator](#) if necessary). Also, formulas must be written with the US style separator/range operator which is a comma (not semi-colon). Therefore a formula with multiple values should be written as follows:

```
worksheet:write_formula("A1", "=SUM(1, 2, 3)") -- OK
worksheet:write_formula("A2", "=SUM(1; 2; 3)") -- NO. Error on load.
```

Excel 2010 and 2013 added functions which weren't defined in the original file specification. These functions are referred to as *future* functions. Examples of these functions are `ACOT`, `CHISQ.DIST.RT`, `CONFIDENCE.NORM`, `STDEV.P`, `STDEV.S` and `WORKDAY.INTL`. The full list is given in the [MS XLSX extensions documentation on future functions](#).

When written using `write_formula()` these functions need to be fully qualified with the `_xlfn.` prefix as they are shown in the MS XLSX documentation link above. For example:

```
worksheet:write_formula("A1", "=_xlfn.STDEV.S(B1:B10)")
```

7.5 `worksheet:write_array_formula()`

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

Write an array formula to a worksheet cell.

Parameters

- **`first_row`** – The first row of the range. (All zero indexed.)
- **`first_col`** – The first column of the range.
- **`last_row`** – The last row of the range.
- **`last_col`** – The last col of the range.
- **`formula`** – Array formula to write to cell.
- **`format`** – Optional Format object. [Format](#)

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)}`.

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)}")
```

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)}")
```

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

The `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)
```

See also [Example: Array formulas](#).

7.6 `worksheet:write_blank()`

`write_blank(row, col, blank[, format])`

Write a blank worksheet cell.

Parameters

- **row** – The cell row (zero indexed).
- **col** – The cell column (zero indexed).
- **blank** – nil or empty string. The value is ignored.
- **format** – Optional Format object. [Format](#)

Write a blank cell specified by row and column:

```
worksheet:write_blank(0, 0, nil, 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 or formatting whilst a “Blank” cell 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", nil, format) -- write_blank()
worksheet:write("A2", nil)         -- Ignored
```

This seemingly uninteresting fact means that you can write tables of data without special treatment for nil 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_boolean()`

`write_boolean(row, col, boolean[, format])`

Write a boolean value to a worksheet cell.

Parameters

- **row** – The cell row (zero indexed).
- **col** – The cell column (zero indexed).
- **boolean** – Boolean value to write to cell.
- **format** – Optional Format object. [Format](#)

The `write_boolean()` method writes a boolean value to the cell specified by row and column:

```
worksheet:write_boolean(0, 0, true)
worksheet:write_boolean("A2", false)
```

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

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

7.8 worksheet:write_date_time()

write_date_time(*row*, *col*, *date_time*[, *format*])

Write a date or time to a worksheet cell.

Parameters

- **row** – The cell row (zero indexed).
- **col** – The cell column (zero indexed).
- **date_time** – A `os.time()` style table of date values.
- **format** – Optional Format object. [Format](#)

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

```
worksheet:write_date_time(0, 0, date_time, date_format)
```

The `date_time` should be a table of values like those used for `os.time()`:

Key	Value
year	4 digit year
month	1 - 12
day	1 - 31
hour	0 - 23
min	0 - 59
sec	0 - 59.999

A date/time should have a format of type [Format](#), otherwise it will appear as a number:

```
date_format = workbook:add_format({num_format = "d mmmm yyyy"})
date_time    = {year = 2014, month = 3, day = 17}

worksheet:write_date_time("A1", date_time, date_format)
```

See [Working with Dates and Time](#) for more details.

7.9 `worksheet:write_date_string()`

`write_date_string(row, col, date_string[, format])`

Write a date or time to a worksheet cell.

Parameters

- **row** – The cell row (zero indexed).
- **col** – The cell column (zero indexed).
- **date_string** – A `os.time()` style table of date values.
- **format** – Optional Format object. [Format](#)

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

```
worksheet:write_date_string(0, 0, date_string, date_format)
```

The `date_string` should be in the following format:

```
yyyy-mm-ddThh:mm:ss.sss
```

This conforms to an ISO8601 date but it should be noted that the full range of ISO8601 formats are not supported.

The following variations on the `$date_string` parameter are permitted:

<code>yyyy-mm-ddThh:mm:ss.sss</code>	-- Standard format.
<code>yyyy-mm-ddThh:mm:ss.sssZ</code>	-- Additional Z (but not time zones).
<code>yyyy-mm-dd</code>	-- Date only, no time.
<code>hh:mm:ss.sss</code>	-- Time only, no date.
<code>hh:mm:ss</code>	-- No fractional seconds.

Note that the T is required for cases with both date and time and seconds are required for all times.

A date/time should have a format of type [Format](#), otherwise it will appear as a number:

```
date_format = workbook:add_format({num_format = "d mmmm yyyy"})  
worksheet:write_date_string("A1", "2014-03-17", date_format)
```

See [Working with Dates and Time](#) for more details.

7.10 `worksheet:set_row()`

`set_row(row, height, format, options)`

Set properties for a row of cells.

Parameters

- **row** – The worksheet row (zero indexed).

- **height** – The row height.
- **format** – Optional Format object. *Format*
- **options** – 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:

```
format = workbook:add_format({bold = true})
worksheet:set_row(0, 20, format)
```

If you wish to set the format of a row without changing the height you can pass `nil` as the height parameter or use the default row height of 15:

```
worksheet:set_row(1, nil, format)
worksheet:set_row(1, 15, format) -- Same as above.
```

The 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, nil, 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 table with the following possible keys:

- "hidden"
- "level"
- "collapsed"

Options can be set as follows:

```
worksheet:set_row(0, 20, format, {hidden = true})

-- Or use defaults for other properties and set the options only.
worksheet:set_row(0, nil, nil, {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, format, {hidden = true})
```

The "level" parameter is used to set the outline level of the row. 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, nil, nil, {level = 1})
worksheet:set_row(1, nil, nil, {level = 1})
worksheet:set_row(2, nil, nil, {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, nil, nil, {hidden = 1, level = 1})
worksheet:set_row(2, nil, nil, {hidden = 1, level = 1})
```

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

```
worksheet:set_row(3, nil, nil, {collapsed = 1})
```

7.11 `worksheet:set_column()`

`set_column()` (*first_col*, *last_col*, *width*, *format*, *options*)
Set properties for one or more columns of cells.

Parameters

- **first_col** – First column (zero-indexed).
- **last_col** – Last column (zero-indexed). Can be same as first_col.
- **width** – The width of the column(s).
- **format** – Optional Format object. *Format*
- **options** – 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 format *Format* parameter is optional. If you wish to set the format without changing the width you can pass `nil` as the width parameter:

```
format = workbook:add_format({bold = true})  
  
worksheet:set_column(0, 0, nil, format)
```

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

```
worksheet:set_column("A:A", nil, 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, nil, format1)        -- Set format for row 1.  
worksheet:set_column("A:A", nil, format2) -- Set format for col 1.  
  
worksheet:write("A1", "Hello")           -- Defaults to format1  
worksheet:write("A2", "Hello")           -- Defaults to format2
```

7.12 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:

```
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.

7.13 `worksheet:activate()`

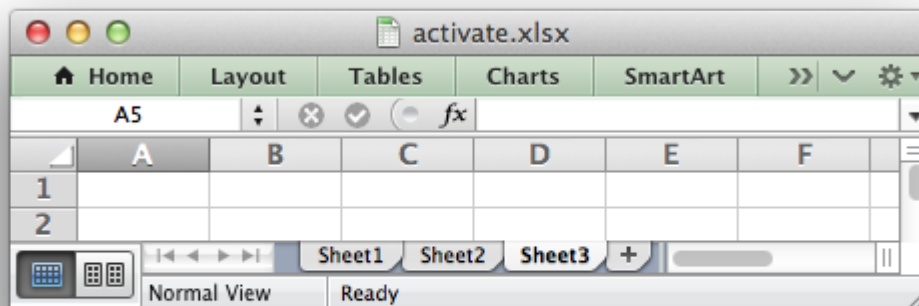
`activate()`

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:

7.14 `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.

7.15 `worksheet:hide()`

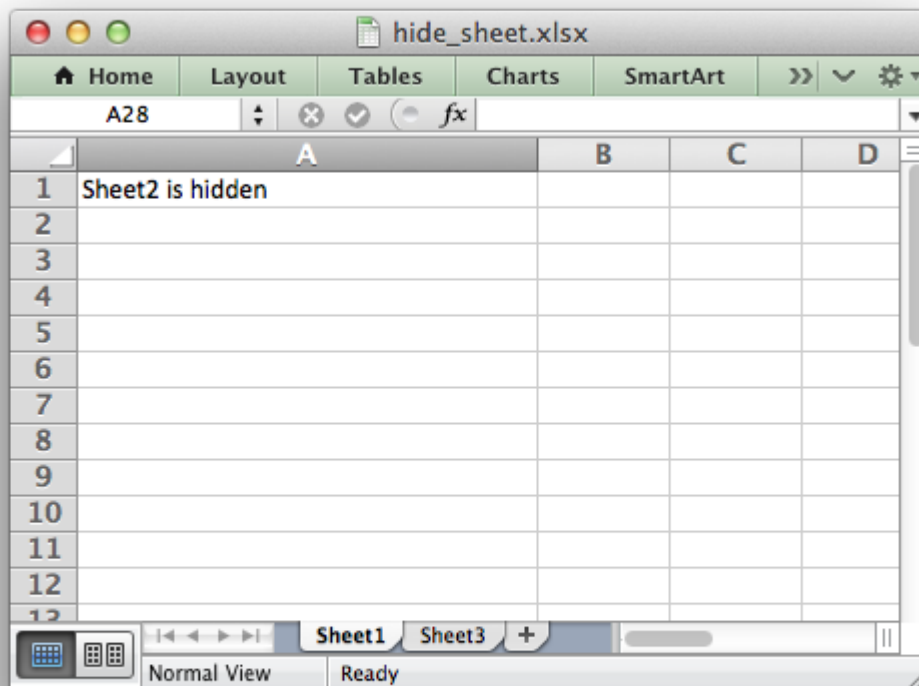
`hide()`

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.

7.16 `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 i = 1, 20 do
    workbook:add_worksheet
end

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:

7.17 `worksheet:set_zoom()`

`set_zoom(zoom)`

Set the worksheet zoom factor.

Parameters `zoom` – 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()`.

7.18 `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.

7.19 `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()
```

7.20 `worksheet:set_tab_color()`

`set_tab_color()`

Set the colour of the worksheet tab.

Parameters `color` – 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 [Working with Colors](#).

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

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.

Format objects are created by calling the workbook `add_format()` method as follows:

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

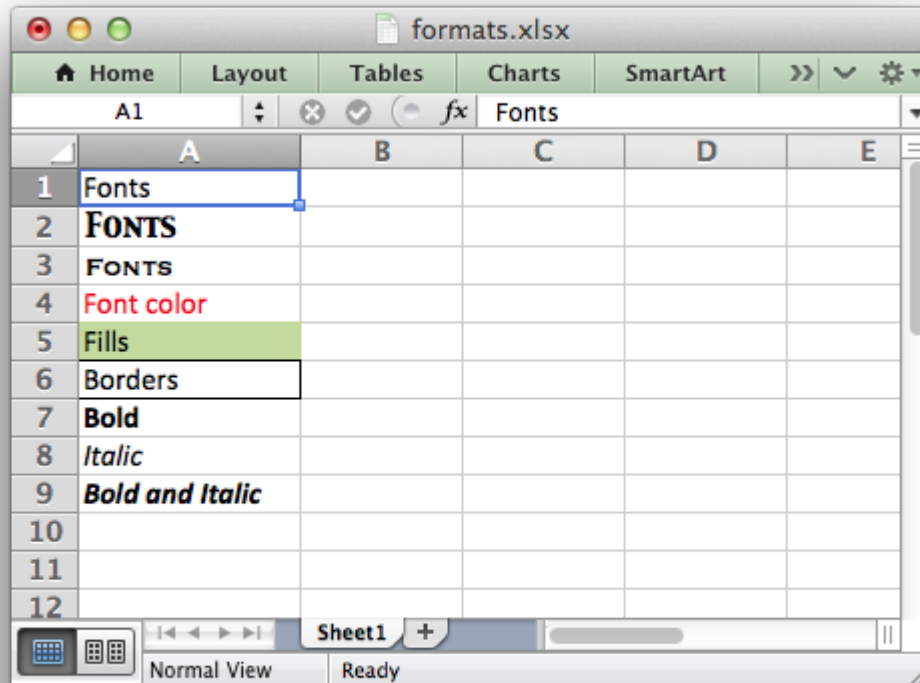
Format properties can be set by calling any of the methods shown in this section:

```
format = workbook.add_format()  
format.set_bold()  
format.set_font_color("red")
```

Alternatively the properties can be set by passing a table of properties to the `add_format()` constructor:

```
format = workbook.add_format({bold = true, font_color = "red"})
```

The documentation below shows the property methods but the information is equally applicable when using them in the `add_format()` constructor.



8.1 `format:set_font_name()`

`set_font_name(fontname)`

Set the font used in the cell.

Parameters `fontname` – 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”.

8.2 `format:set_font_size()`

`set_font_size(size)`

Set the size of the font used in the cell.

Parameters `size` – 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.

8.3 `format:set_font_color()`

`set_font_color()` (*color*)

Set the color of the font used in the cell.

Parameters `color` – 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 [Working with 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.

8.4 `format:set_bold()`

`set_bold()`

Turn on bold for the format font.

Set the bold property of the font:

```
format:set_bold()
```

8.5 `format:set_italic()`

`set_italic()`

Turn on italic for the format font.

Set the italic property of the font:

```
format:set_italic()
```

8.6 `format:set_underline()`

`set_underline()`

Turn on underline for the format:

Parameters `style` – 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

8.7 `format:set_font_strikeout()`

`set_font_strikeout()`

Set the strikeout property of the font.

8.8 `format:set_font_script()`

`set_font_script()`

Set the superscript/subscript property of the font.

The available options are:

- 1 = Superscript
- 2 = Subscript

8.9 `format:set_num_format()`

`set_num_format(format_string)`

Set the number format for a cell.

Parameters `format_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

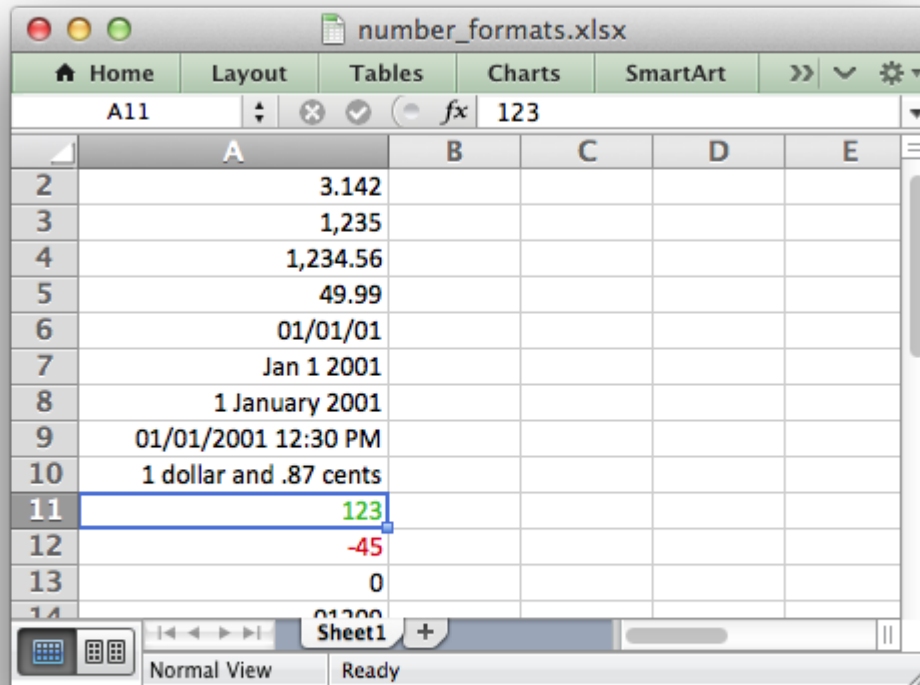
format07:set_num_format("d mmmm yyyy")
worksheet:write(7, 0, 36892.521, format07)     --> 1 January 2001

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

Continued on next page

Table 8.1 – continued from previous page

Index	Index	Format String
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. The listed date and currency formats may also vary depending on system settings.

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

8.10 `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)
```

8.11 `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)
```

8.12 `format:set_align()`

`set_align(alignment)`

Set the alignment for data in the cell.

Parameters `alignment` – 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.

8.13 `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.

8.14 `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.

8.15 `format:set_rotation()`

`set_rotation(angle)`

Set the rotation of the text in a cell.

Parameters `angle` – 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.

8.16 `format:set_indent()`

`set_indent(level)`

Set the cell text indentation level.

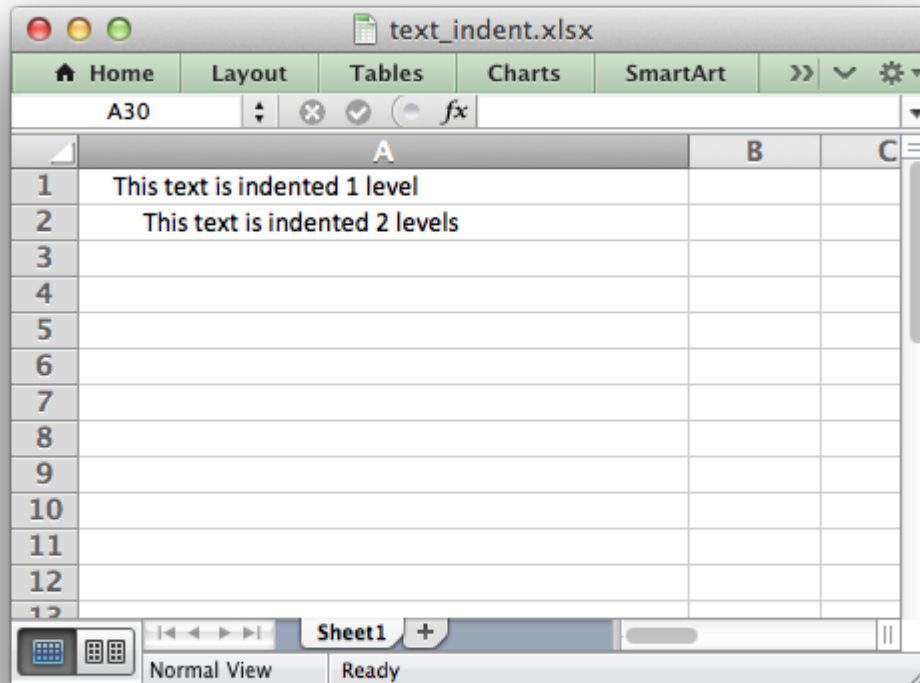
Parameters `level` – Indentation level.

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.

8.17 `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)
```

8.18 `format:set_text_justlast()`

`set_text_justlast()`

Turn on the justify last text property.

Only applies to Far Eastern versions of Excel.

8.19 `format:set_pattern()`

`set_pattern(index)`

Parameters `index` – 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.

8.20 `format:set_bg_color()`

`set_bg_color(color)`

Set the color of the background pattern in a cell.

Parameters `color` – The cell font color.

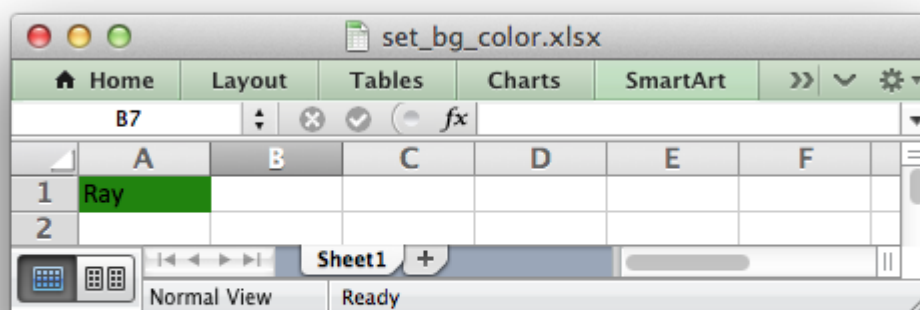
The `set_bg_color()` method can be used to set the background colour of a pattern. Patterns are defined via the `set_pattern()` method. If a pattern hasn't been defined then a solid fill pattern is used as the default.

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 [Working with Colors](#).

8.21 `format:set_fg_color()`

`set_fg_color (color)`

Set the color of the foreground pattern in a cell.

Parameters `color` – 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 [Working with Colors](#).

8.22 `format:set_border()`

`set_border (style)`

Set the cell border style.

Parameters `style` – 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	=====

8.23 `format:set_bottom()`

`set_bottom(style)`

Set the cell bottom border style.

Parameters **style** – Border style index. Default is 1.

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

8.24 `format:set_top()`

`set_top(style)`

Set the cell top border style.

Parameters **style** – Border style index. Default is 1.

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

8.25 `format:set_left()`

`set_left(style)`

Set the cell left border style.

Parameters **style** – Border style index. Default is 1.

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

8.26 `format:set_right()`

`set_right(style)`

Set the cell right border style.

Parameters **style** – Border style index. Default is 1.

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

8.27 `format:set_border_color()`

`set_border_color(color)`

Set the color of the cell border.

Parameters `color` – 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 [Working with Colors](#).

8.28 `format:set_bottom_color()`

`set_bottom_color(color)`

Set the color of the bottom cell border.

Parameters `color` – The cell border color.

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

8.29 `format:set_top_color()`

`set_top_color(color)`

Set the color of the top cell border.

Parameters `color` – The cell border color.

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

8.30 `format:set_left_color()`

`set_left_color(color)`

Set the color of the left cell border.

Parameters `color` – The cell border color.

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

8.31 `format:set_right_color()`

`set_right_color(color)`

Set the color of the right cell border.

Parameters `color` – The cell border color.

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

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.

9.1 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 formatting properties for a row or column:

```
worksheet.set_row(0, 18, format)
worksheet.set_column("A:D", 20, format)
```

9.2 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	set_font_name()
	Font size	font_size	set_font_size()
	Font color	font_color	set_font_color()
Continued on next page			

Table 9.1 – continued from previous page

Category	Description	Property	Method Name
	Bold	<code>bold</code>	<code>set_bold()</code>
	Italic	<code>italic</code>	<code>set_italic()</code>
	Underline	<code>underline</code>	<code>set_underline()</code>
	Strikeout	<code>font_strikeout</code>	<code>set_font_strikeout()</code>
	Super/Subscript	<code>font_script</code>	<code>set_font_script()</code>
Number	Numeric format	<code>num_format</code>	<code>set_num_format()</code>
Protection	Lock cells	<code>locked</code>	<code>set_locked()</code>
	Hide formulas	<code>hidden</code>	<code>set_hidden()</code>
Alignment	Horizontal align	<code>align</code>	<code>set_align()</code>
	Vertical align	<code>valign</code>	<code>set_align()</code>
	Rotation	<code>rotation</code>	<code>set_rotation()</code>
	Text wrap	<code>text_wrap</code>	<code>set_text_wrap()</code>
	Justify last	<code>text_justlast</code>	<code>set_text_justlast()</code>
	Center across	<code>center_across</code>	<code>set_center_across()</code>
	Indentation	<code>indent</code>	<code>set_indent()</code>
Pattern	Shrink to fit	<code>shrink</code>	<code>set_shrink()</code>
	Cell pattern	<code>pattern</code>	<code>set_pattern()</code>
	Background color	<code>bg_color</code>	<code>set_bg_color()</code>
Border	Foreground color	<code>fg_color</code>	<code>set_fg_color()</code>
	Cell border	<code>border</code>	<code>set_border()</code>
	Bottom border	<code>bottom</code>	<code>set_bottom()</code>
	Top border	<code>top</code>	<code>set_top()</code>
	Left border	<code>left</code>	<code>set_left()</code>
	Right border	<code>right</code>	<code>set_right()</code>
	Border color	<code>border_color</code>	<code>set_border_color()</code>
	Bottom color	<code>bottom_color</code>	<code>set_bottom_color()</code>
	Top color	<code>top_color</code>	<code>set_top_color()</code>
	Left color	<code>left_color</code>	<code>set_left_color()</code>
	Right color	<code>right_color</code>	<code>set_right_color()</code>

There are two ways of setting Format properties: by using the object interface or by setting the property as a table 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 table 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. The key/value interface has proved to be more flexible in real world programs and is the recommended method for setting format properties.

9.3 Format Colors

Format property colors are specified using a Html style `#RRGGBB` value or a limited number of named colors:

```
format1:set_font_color("#FF0000")
format2:set_font_color("red")
```

See *Working with Colors* for more details.

9.4 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:

```
format = workbook:add_format()

format:set_bold()  -- Turns bold on.
```

9.5 Modifying Formats

Each unique cell format in an `xlsxwriter.lua` 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 is 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 CELL NOTATION

Xlsxwriter.lua 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 = 0 , 5 do  
    worksheet:write(row, 0, "Hello")  
end
```

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.lua module you can use A1 notation anywhere you can use row-column notation.

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

RELATIVE AND ABSOLUTE CELL REFERENCES

When dealing with Excel cell references it is important to distinguish between relative and absolute cell references in Excel.

Relative cell references change when they are copied while **Absolute** references maintain fixed row and/or column references. In Excel absolute references are prefixed by the dollar symbol as shown below:

- A1 -- Column and row are relative.
- \$A1 -- Column is absolute and row is relative.
- A\$1 -- Column is relative and row is absolute.
- \$A\$1 -- Column and row are absolute.

See the Microsoft Office documentation for [more information on relative and absolute references](#).

CELL UTILITY FUNCTIONS

The Xlsxwriter.lua `utility` module contains several helper functions for dealing with A1 notation as shown below. These functions can be imported and used as follows:

```
local Utility = require "xlsxwriter.utility"

cell = Utility.rowcol_to_cell(1, 2) --> C2
```

12.1 rowcol_to_cell()

rowcol_to_cell(row, col)

Convert a zero indexed row and column cell reference to a A1 style string.

Parameters

- **row** – The cell row.
- **col** – The cell column.

Return type A1 style string.

The `rowcol_to_cell()` function converts a zero indexed row and column cell values to an A1 style string:

```
cell = Utility.rowcol_to_cell(0, 0) --> A1
cell = Utility.rowcol_to_cell(0, 1) --> B1
cell = Utility.rowcol_to_cell(1, 0) --> A2
```

12.2 rowcol_to_cell_abs()

rowcol_to_cell_abs(row, col[, row_abs, col_abs])

Convert a zero indexed row and column cell reference to a A1 style string.

Parameters

- **row** – The cell row.
- **col** – The cell column.

- **row_abs** – Optional flag to make the row absolute.
- **col_abs** – Optional flag to make the column absolute.

Return type A1 style string.

The `rowcol_to_cell_abs()` function is like the `rowcol_to_cell_abs()` function but the optional parameters `row_abs` and `col_abs` can be used to indicate that the row or column is absolute:

```
str = Utility.rowcol_to_cell_abs(0, 0, false, true) --> $A1
str = Utility.rowcol_to_cell_abs(0, 0, true, ) --> A$1
str = Utility.rowcol_to_cell_abs(0, 0, true, true) --> $A$1
```

12.3 cell_to_rowcol()

cell_to_rowcol(*cell_str*)

Convert a cell reference in A1 notation to a zero indexed row and column.

Parameters **cell_str** – A1 style string, absolute or relative.

Return type row, col.

The `cell_to_rowcol()` function converts an Excel cell reference in A1 notation to a zero based row and column. The function will also handle Excel's absolute, \$, cell notation:

```
row, col = Utility.cell_to_rowcol("A1") --> (0, 0)
row, col = Utility.cell_to_rowcol("B1") --> (0, 1)
row, col = Utility.cell_to_rowcol("C2") --> (1, 2)
row, col = Utility.cell_to_rowcol("$C2") --> (1, 2)
row, col = Utility.cell_to_rowcol("C$2") --> (1, 2)
row, col = Utility.cell_to_rowcol("$C$2") --> (1, 2)
```

12.4 col_to_name()

col_to_name(*col* [, *col_abs*])

Convert a zero indexed column cell reference to a string.

Parameters

- **col** – The cell column.
- **col_abs** – Optional flag to make the column absolute.

Return type Column style string.

The `col_to_name()` converts a zero based column reference to a string:

```
column = Utility.col_to_name(0) --> A
column = Utility.col_to_name(1) --> B
column = Utility.col_to_name(702) --> AAA
```

The optional parameter `col_abs` can be used to indicate if the column is absolute:

```
column = Utility.col_to_name(0, false) --> A
column = Utility.col_to_name(0, true)  --> $A
column = Utility.col_to_name(1, true)  --> $B
```

12.5 range()

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

Converts zero indexed row and column cell references to a A1:B1 range string.

Parameters

- **first_row** – The first cell row.
- **first_col** – The first cell column.
- **last_row** – The last cell row.
- **last_col** – The last cell column.

Return type A1:B1 style range string.

The `range()` function converts zero based row and column cell references to an A1:B1 style range string:

```
cell_range = Utility.range(0, 0, 9, 0) --> A1:A10
cell_range = Utility.range(1, 2, 8, 2) --> C2:C9
cell_range = Utility.range(0, 0, 3, 4) --> A1:E4
```

12.6 range_abs()

The `range_abs()` function converts zero based row and column cell references to an absolute \$A\$1:\$B\$1 style range string:

```
cell_range = Utility.range_abs(0, 0, 9, 0) --> $A$1:$A$10
cell_range = Utility.range_abs(1, 2, 8, 2) --> $C$2:$C$9
cell_range = Utility.range_abs(0, 0, 3, 4) --> $A$1:$E$4
```


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:

```
local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("date_examples.xlsx")
local worksheet = workbook:add_worksheet()

-- Widen column A for extra visibility.
worksheet:set_column("A:A", 30)

-- A number to convert to a date.
local number = 41333.5

-- Write it as a number without formatting.
worksheet:write("A1", number)          --> 41333.5

local format2 = workbook:add_format({num_format = "dd/mm/yy"})
worksheet:write("A2", number, format2) --> 28/02/13

local format3 = workbook:add_format({num_format = "mm/dd/yy"})
worksheet:write("A3", number, format3) --> 02/28/13

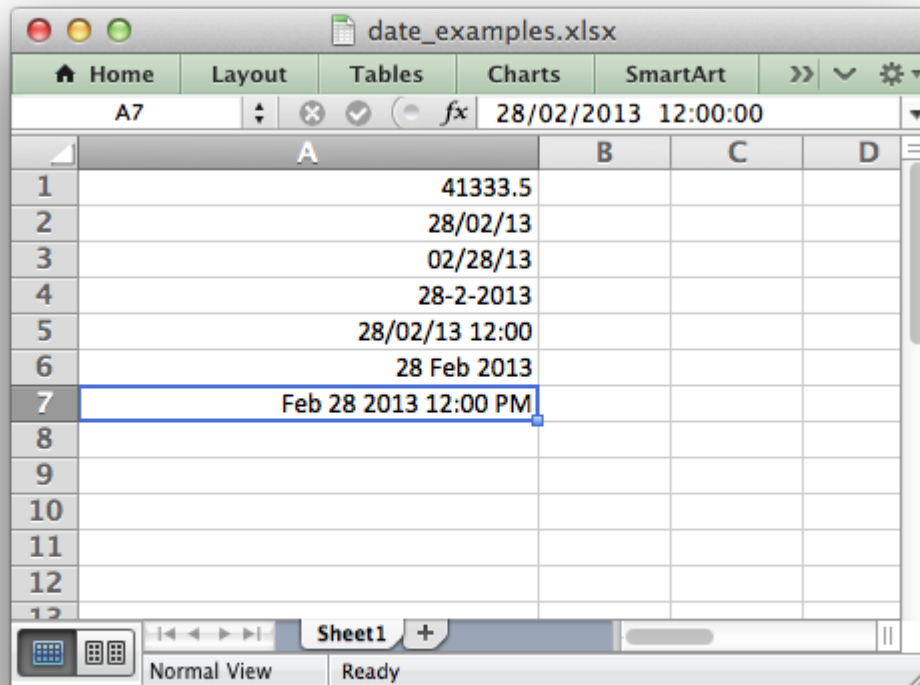
local format4 = workbook:add_format({num_format = "d-m-yyyy"})
worksheet:write("A4", number, format4) --> 28-2-2013

local format5 = workbook:add_format({num_format = "dd/mm/yy hh:mm"})
worksheet:write("A5", number, format5) --> 28/02/13 12:00

local format6 = workbook:add_format({num_format = "d mmm yyyy"})
worksheet:write("A6", number, format6) --> 28 Feb 2013

local 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.lua` module provides two date handling methods: `write_date_time()` and `write_date_string()`.

The `write_date_time()` method takes a table of values like those used for `os.time()`

```
date_format = workbook:add_format({num_format = "d mmmm yyyy"})
```

```
worksheet:write_date_time("A1", {year = 2014, month = 3, day = 17}, date_format)
```

The allowable table keys and values are:

Key	Value
year	4 digit year
month	1 - 12
day	1 - 31
hour	0 - 23
min	0 - 59
sec	0 - 59.999

The `write_date_string()` method takes a string in an ISO8601 format:

`yyyy-mm-ddThh:mm:ss.sss`

This conforms to an ISO8601 date but it should be noted that the full range of ISO8601 formats are not supported. The following variations are permitted:

<code>yyyy-mm-ddThh:mm:ss.sss</code>	-- Standard format.
<code>yyyy-mm-ddThh:mm:ss.sssZ</code>	-- Additional Z (but not time zones).
<code>yyyy-mm-dd</code>	-- Date only, no time.
<code>hh:mm:ss.sss</code>	-- Time only, no date.
<code>hh:mm:ss</code>	-- No fractional seconds.

Note that the T is required for cases with both date, and time and seconds are required for all times.

Here is an example using `write_date_string()`:

```
date_format = workbook:add_format({num_format = "d mmmm yyyy"})
worksheet:write_date_string("A1", "2014-03-17", date_format)
```

Here is a longer example that displays the same date in a several different formats:

```
local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("datetimes.xlsx")
local worksheet = workbook:add_worksheet()
local 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 an ISO8601 style date string to use in the examples.
local date_string = "2013-01-23T12:30:05.123"

-- Examples date and time formats. In the output file compare how changing
-- the format codes change the appearance of the date.
local date_formats = {
  "dd/mm/yy",
  "mm/dd/yy",
  "dd m yy",
  "d mm yy",
  "d mmm yy",
  "d mmmm yy",
  "d mmmm yy",
  "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",
}

-- Write the same date and time using each of the above formats.
for row, date_format_str in ipairs(date_formats) do

    -- Create a format for the date or time.
    local date_format = workbook:add_format({num_format = date_format_str,
                                              align = "left"})

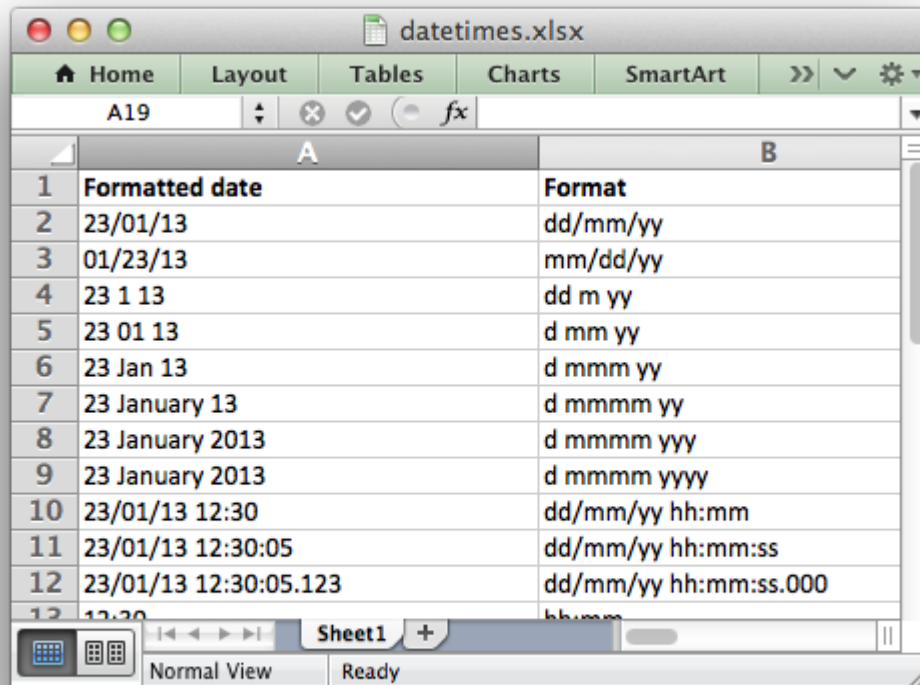
    -- Write the same date using different formats.
    worksheet:write_date_string(row, 0, date_string, date_format)

    -- Also write the format string for comparison.
    worksheet:write_string(row, 1, date_format_str)

end

workbook:close()

```



The screenshot shows an Excel spreadsheet titled "datetimes.xlsx" with two columns: "Formatted date" (Column A) and "Format" (Column B). The data is as follows:

Formatted date	Format
23/01/13	dd/mm/yy
01/23/13	mm/dd/yy
23 1 13	dd m yy
23 01 13	d mm yy
23 Jan 13	d mmm yy
23 January 13	d mmmm yy
23 January 2013	d mmmm yyy
23 January 2013	d mmmm yyyy
23/01/13 12:30	dd/mm/yy hh:mm
23/01/13 12:30:05	dd/mm/yy hh:mm:ss
23/01/13 12:30:05.123	dd/mm/yy hh:mm:ss.000
12:30	hh:mm

WORKING WITH COLORS

Throughout `xlsxwriter.lua` colors are specified using a Html style `#RRGGBB` value. For example with a *Format* object:

```
format:set_font_color('#FF0000')
```

For convenience a limited number of color names are supported:

```
format:set_font_color('red')
```

The color names and corresponding `#RRGGBB` value 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

WORKING WITH MEMORY AND PERFORMANCE

By default `xlsxwriter.lua` holds all cell data in memory. This is to allow future features where formatting is applied separately from the data.

The effect of this is that `xlsxwriter` can consume a lot of memory and it is possible to run out of memory when creating large files.

Fortunately, this memory usage can be reduced almost completely by using the `Workbook:new()` 'constant_memory' property:

```
workbook = Workbook:new(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 memory 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 column order.
for row = 0, row_max do
  for col = 0, col_max do
    worksheet:write(row, col, some_data)
  end
end

-- With 'constant_memory' the following would only write the first column.
for col = 0, col_max do -- !!
  for row = 0, row_max do
    worksheet:write(row, col, some_data)
  end
end
```

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 features that manipulate cell data after it is written. Currently there aren't any such features.

For larger files 'constant_memory' mode also gives an increase in execution speed, see below.

15.1 Performance Figures

The performance figures below show execution time and memory usage for worksheets of size N rows \times 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.lua` 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	0.20	2071819
400	50	0.40	4149803
800	50	0.86	8305771
1600	50	1.87	16617707
3200	50	3.84	33271579
6400	50	8.02	66599323
12800	50	16.54	133254811

`Xlsxwriter.lua` in `constant_memory` mode: the execution time still increases linearly with the number of rows but the memory usage remains small and mainly constant:

Rows	Columns	Time (s)	Memory (bytes)
200	50	0.18	41119
400	50	0.36	24735
800	50	0.69	24735
1600	50	1.41	24735
3200	50	2.83	41119
6400	50	5.83	41119
12800	50	11.29	24735

In the `constant_memory` mode the performance is also a little better. These figures were generated using the `perf_tester.lua` program in the `examples` directory of the `xlsxwriter` repo.

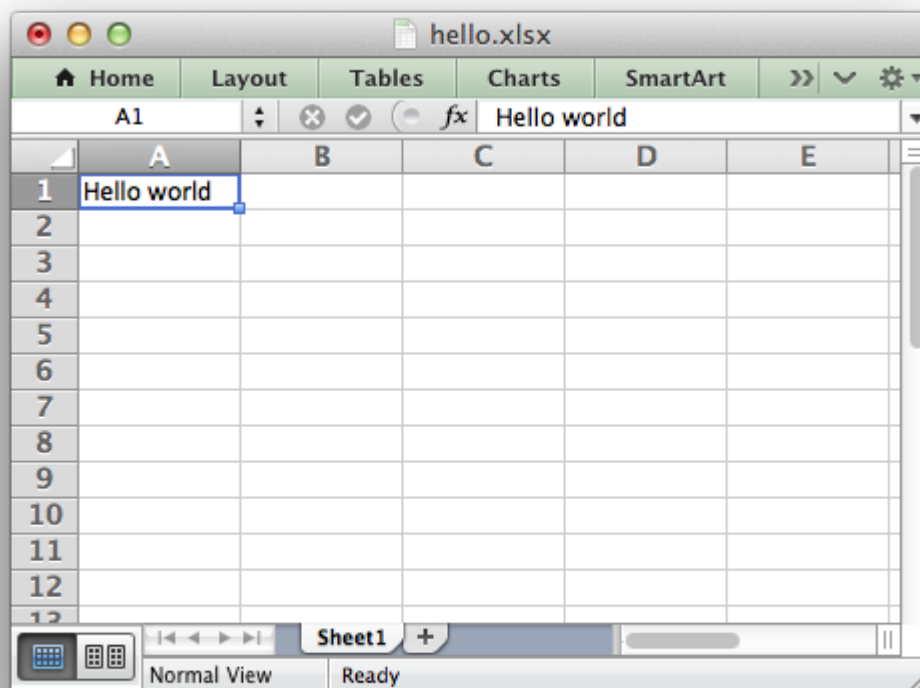
Note, there will be further optimisation in both modes in later releases.

EXAMPLES

The following are some of the examples included in the [examples](#) directory of the `xlsxwriter.lua` distribution.

16.1 Example: Hello World

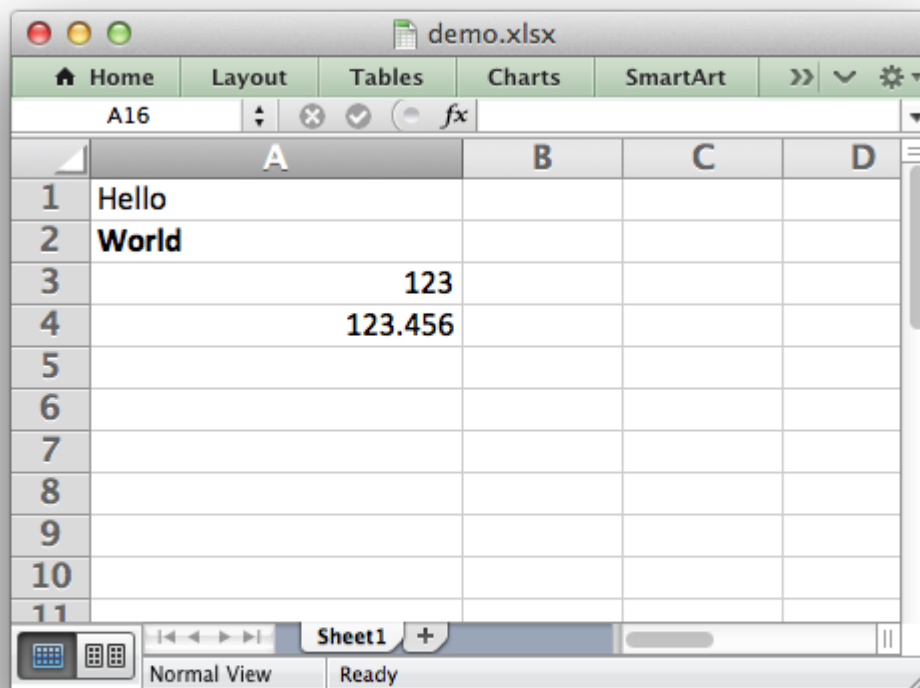
The simplest possible spreadsheet. This is a good place to start to see if the `xlsxwriter.lua` module is installed correctly.



```
-----  
--  
-- A hello world spreadsheet using the xlsxwriter.lua module.  
--  
-- Copyright 2014, John McNamara, jmcnamara@cpan.org  
--  
  
local Workbook = require "xlsxwriter.workbook"  
  
local workbook = Workbook:new("hello_world.xlsx")  
local worksheet = workbook:add_worksheet()  
  
worksheet:write("A1", "Hello world")  
  
workbook:close()
```

16.2 Example: Simple Feature Demonstration

This program is an example of writing some of the features of the `xlsxwriter.lua` module.



```
-----  
--
```

```
-- A simple example of some of the features of the xlsxwriter.lua module.
--
-- Copyright 2014, John McNamara, jmcnamara@cpan.org
--

local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("demo.xlsx")
local 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.
local bold = workbook:add_format({bold = true})

-- 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](#)*.

16.3 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 the xlsxwriter.lua module to write
-- simple array formulas.
--
-- Copyright 2014, John McNamara, jmcnamara@cpan.org
--

```

```

local Workbook = require "xlsxwriter.workbook"

-- Create a new workbook and add a worksheet
local workbook = Workbook:new("array_formula.xlsx")
local 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_formula("A1", "{=SUM(B1:C1*B2:C2)}")

-- Same as above but more explicit.
worksheet:write_array_formula("A2:A2", "{=SUM(B1:C1*B2:C2)}")

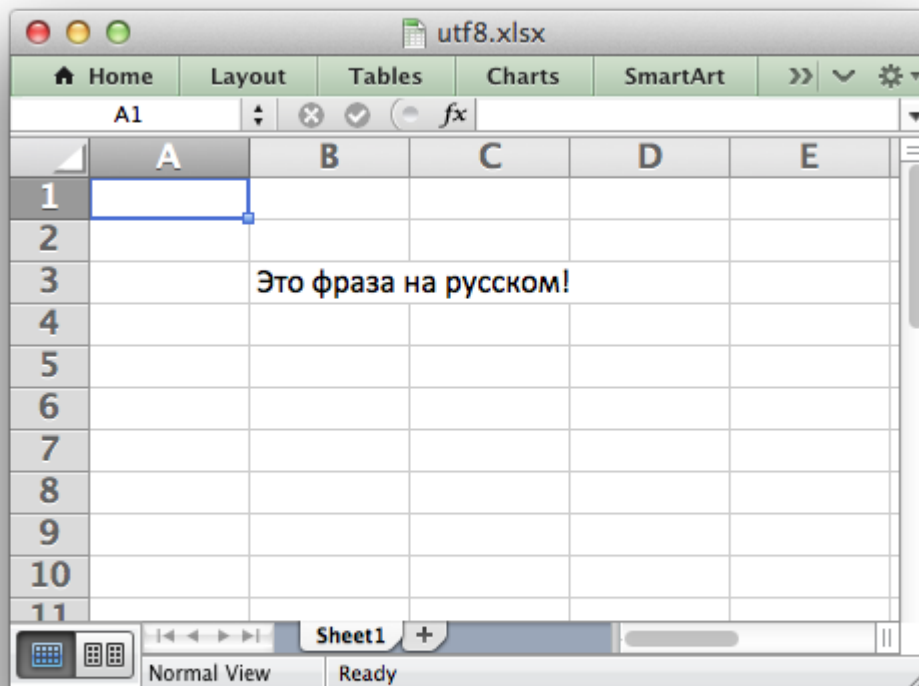
-- Write an array formula that returns a range of values
worksheet:write_array_formula("A5:A7", "{=TREND(C5:C7,B5:B7)}")

workbook:close()
```

16.4 Example: Write UTF-8 Strings

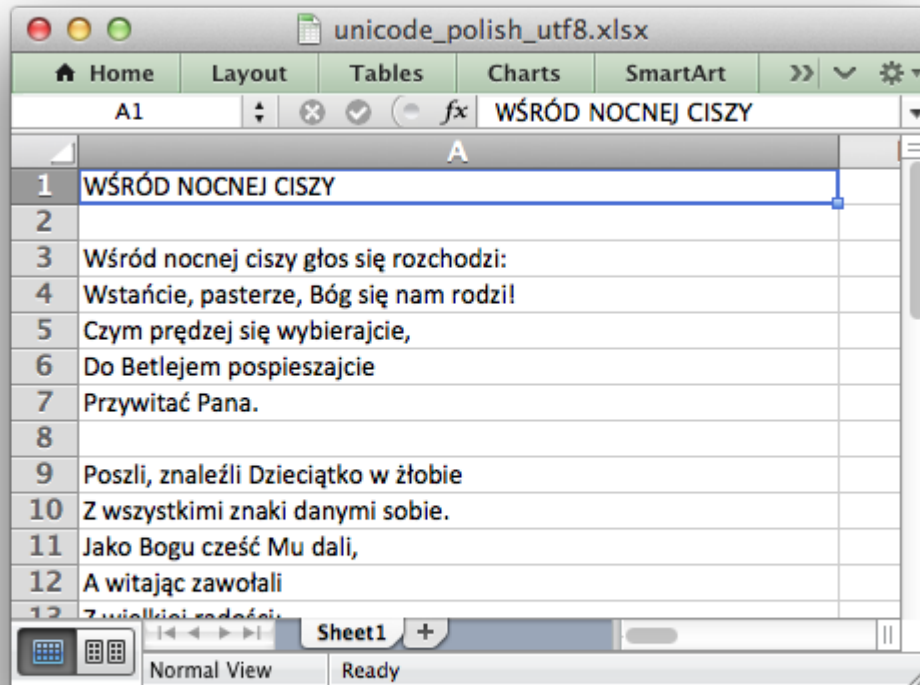
An example of writing simple UTF-8 strings to a worksheet.

Unicode strings in Excel must be UTF-8 encoded. With `xlsxwriter.lua` all that is required is that the source file is UTF-8 encoded and Lua will handle the UTF-8 strings like any other strings:



16.5 Example: Convert a UTF-8 file to a Worksheet

This program is an example of reading in data from a UTF-8 encoded text file and converting it to a worksheet.



```

----
--
-- A simple example of converting some Unicode text to an Excel file using
-- the xlsxwriter.lua module.
--
-- This example generates a spreadsheet with some Polish text from a file
-- with UTF-8 encoded text.
--
-- Copyright 2014, John McNamara, jmcnamara@cpan.org
--

```

```

local Workbook = require "xlsxwriter.workbook"

```

```

local workbook  = Workbook:new("utf8_polish.xlsx")

```

```

local worksheet = workbook:add_worksheet()

```

```

-- Widen the first column to make the text clearer.
worksheet:set_column("A:A", 50)

```

```
-- Open a source of UTF-8 data.
local file = assert(io.open("utf8_polish.txt", "r"))

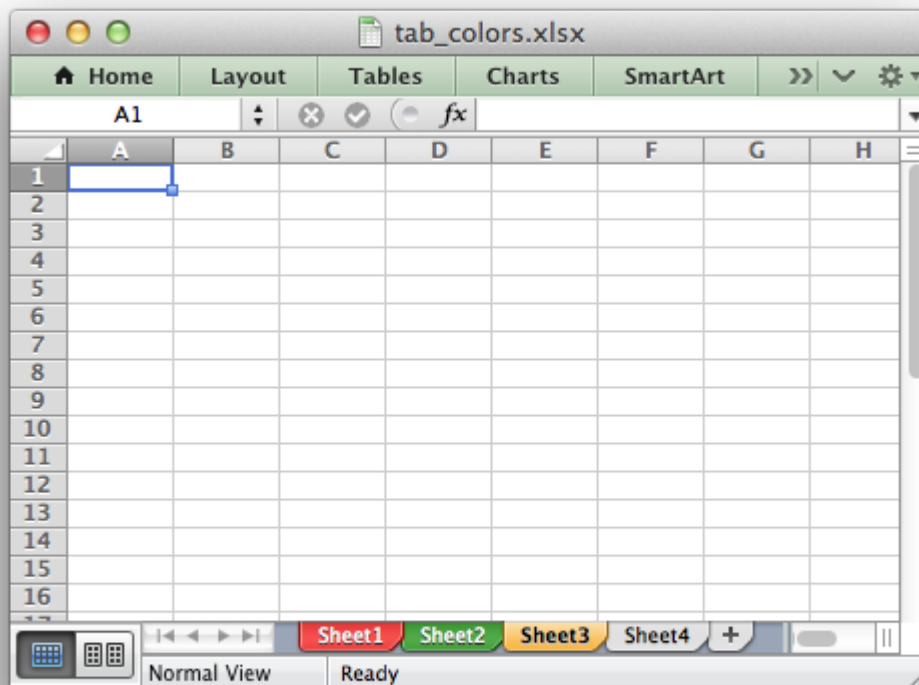
-- Read the text file and write it to the worksheet.
local line = file:read("*l")
local row = 0

while line do
    -- Ignore comments in the text file.
    if not string.match(line, "^#") then
        worksheet:write(row, 0, line)
        row = row + 1
    end
    line = file:read("*l")
end

workbook:close()
```

16.6 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
-- the Xlsxwriter.lua module.
--
-- Copyright 2014, John McNamara, jmcnamara@cpan.org
--

local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("tab_colors.xlsx")

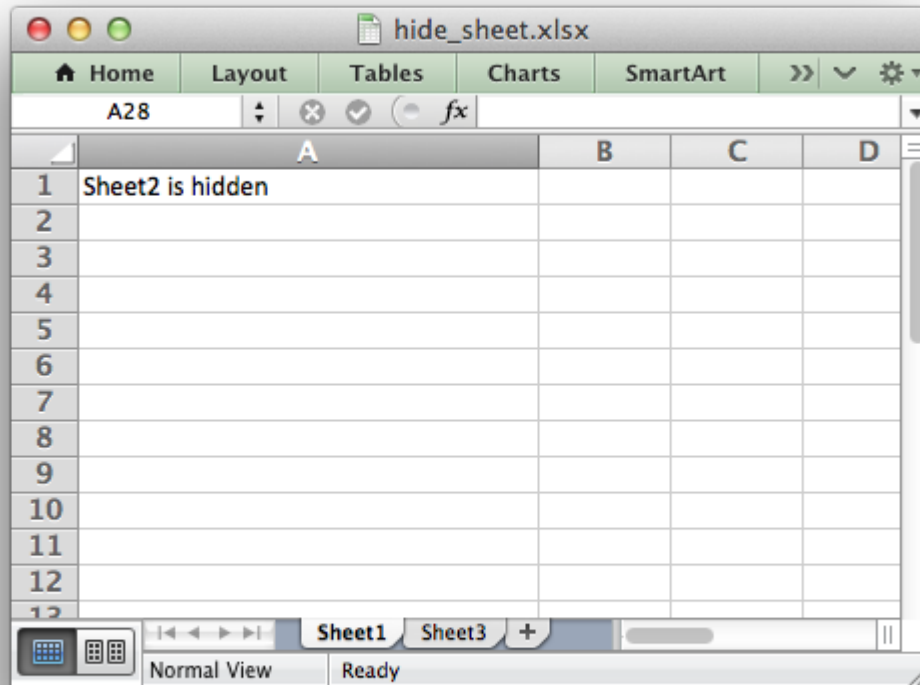
-- Set up some worksheets.
local worksheet1 = workbook:add_worksheet()
local worksheet2 = workbook:add_worksheet()
local worksheet3 = workbook:add_worksheet()
local worksheet4 = workbook:add_worksheet()

-- Set tab colours, worksheet4 will have the default colour.
worksheet1:set_tab_color("red")
worksheet2:set_tab_color("green")
worksheet3:set_tab_color("#FF9900")

workbook:close()
```

16.7 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.lua.
--
-- Copyright 2014, John McNamara, jmcnamara@cpan.org
--

local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("hide_sheet.xlsx")

local worksheet1 = workbook:add_worksheet()
local worksheet2 = workbook:add_worksheet()
local 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()
```

KNOWN ISSUES AND BUGS

This section lists known issues and bugs and gives some information on how to submit bug reports.

17.1 Content is Unreadable. Open and Repair

Very, very occasionally you may see an Excel warning when opening an `xlsxwriter.lua` file like:

Excel could not open file.xlsx because some content is unreadable. Do you want to open and repair this workbook.

This ominous sounding message is Excel's default warning for any validation error in the XML used for the components of the XLSX file.

If you encounter an issue like this you should open an issue on GitHub with a program to replicate the issue (see below) or send one of the failing output files to the [Author](#).

17.2 Formulas displayed as #NAME? until edited

Excel 2010 and 2013 added functions which weren't defined in the original file specification. These functions are referred to as *future* functions. Examples of these functions are `ACOT`, `CHISQ.DIST.RT`, `CONFIDENCE.NORM`, `STDEV.P`, `STDEV.S` and `WORKDAY.INTL`. The full list is given in the [MS XLSX extensions documentation on future functions](#).

When written using `write_formula()` these functions need to be fully qualified with the `_xlfn.` prefix as they are shown in the MS XLSX documentation link above. For example:

```
worksheet.write_formula('A1', '=_xlfn.STDEV.S(B1:B10)')
```

17.3 Formula results displaying as zero in non-Excel applications

Due to wide range of possible formulas and interdependencies between them, `xlsxwriter.lua` 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)
```

17.4 Strings aren't displayed in Apple Numbers in 'constant_memory' mode

In `Workbook()` 'constant_memory' mode `xlsxwriter.lua` 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.

17.5 Images not displayed correctly in Excel 2001 for Mac and non-Excel applications

Images inserted into worksheets via `insert_image()` may not display correctly in Excel 2011 for Mac and non-Excel applications such as OpenOffice and LibreOffice. Specifically the images may look stretched or squashed.

This is not specifically an `xlsxwriter.lua` issue. It also occurs with files created in Excel 2007 and Excel 2010.

REPORTING BUGS

Here are some tips on reporting bugs in `xlsxwriter.lua`.

18.1 Upgrade to the latest version of the module

The bug you are reporting may already be fixed in the latest version of the module. You can check which version of `xlsxwriter.lua` that you are using as follows:

```
lua -e 'W = require "xlsxwriter.workbook"; print(W.version)'
```

Check the [Changes in XlsxWriter](#) section to see what has changed in the latest versions.

18.2 Read the documentation

Read or search the `xlsxwriter.lua` documentation to see if the issue you are encountering is already explained.

18.3 Look at the example programs

There are many [Examples](#) in the distribution. Try to identify an example program that corresponds to your query and adapt it to use as a bug report.

18.4 Use the `xlsxwriter.lua` Issue tracker on GitHub

The `xlsxwriter.lua` [issue tracker](#) is on GitHub.

18.5 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. It is generally 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 paste large non-relevant sections of your program.

A sample bug report is shown below. This format helps to analyse and respond to the bug report more quickly.

Issue with **SOMETHING**

I am using `xlsxwriter` to do **SOMETHING** but it appears to do **SOMETHING ELSE**.

I am using Lua version X.Y and `xlsxwriter` x.y.z.

Here is some code that demonstrates the problem:

```
local Workbook = require "xlsxwriter.workbook"

local workbook = Workbook:new("hello_world.xlsx")
local worksheet = workbook:add_worksheet()

worksheet:write("A1", "Hello world")

workbook:close()
```

FREQUENTLY ASKED QUESTIONS

The section outlines some answers to frequently asked questions.

19.1 Q. Can XlsxWriter use an existing Excel file as a template?

No.

Xlsxwriter.lua is designed only as a file *writer*. It cannot read or modify an existing Excel file.

19.2 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.lua 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)
```

19.3 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.

19.4 Q. Is feature X supported or will it be supported?

All supported features are documented. In time the feature set should expand to be the same as the `Python XlsxWriter` module.

19.5 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.

19.6 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.

20.1 Release 0.0.1 - March XX 2014

- First public release.

XlsxWriter was written by John McNamara.

- [GitHub](#)
- [Twitter @jmcnamara13](#)
- [Coderwall](#)
- [Ohloh](#)

You can contact me at jmcnamara@cpan.org.

21.1 Donations

If you would like to donate to the XlsxWriter project to keep it active you can do so via [PayPal](#).

LICENSE

XlsxWriter is released under a MIT license.

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