XlsxWriter

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About the Tutorial

XlsxWriter is a Python library for creating spreadsheet files in Excel 2007 (XLSX) format. This library has been developed by John McNamara. Its latest version is 3.0.2 which was released in November 2021. The latest version requires Python 3.4 or above.

Audience

This tutorial is meant for Python developers who are interested in programmatically automating the functionality of MS Excel software.

Prerequisites

Before proceeding with this tutorial, you should have an understanding of Python programming and proficiency in handling MS Excel of intermediate level. The knowledge of object oriented programming is desired but not essential.

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1. XlsxWriter – Overview

XlsxWriter is a Python module for creating spreadsheet files in Excel 2007 (XLSX) format that uses open XML standards. XlsxWriter module has been developed by John McNamara. Its earliest version (0.0.1) was released in 2013. The latest version 3.0.2 was released in November 2021. The latest version requires Python 3.4 or above.

XlsxWriter Features

Some of the important features of XlsxWriter include:

- Files created by XlsxWriter are 100% compatible with Excel XLSX files.
- XlsxWriter provides full formatting features such as Merged cells, Defined names, conditional formatting, etc.
- XlsxWriter allows programmatically inserting charts in XLSX files.
- Autofilters can be set using XlsxWriter.
- XlsxWriter supports Data validation and drop-down lists.
- Using XlsxWriter, it is possible to insert PNG/JPEG/GIF/BMP/WMF/EMF images.
- With XlsxWriter, Excel spreadsheet can be integrated with Pandas library.
- XlsxWriter also provides support for adding Macros.
- XlsxWriter has a Memory optimization mode for writing large files.

2. XlsxWriter – Environment Setup

Installing XlsxWriter using PIP

The easiest and recommended method of installing XlsxWriter is to use **PIP** installer. Use the following command to install XlsxWriter (preferably in a virtual environment).

```
pip3 install xlsxwriter
```

Installing from a Tarball

Another option is to install XlsxWriter from its source code, hosted at https://github.com/jmcnamara/XlsxWriter/. Download the latest source tarball and install the library using the following commands:

```
$ curl -O -L
http://github.com/jmcnamara/XlsxWriter/archive/main.tar.gz


$ tar zxvf main.tar.gz
$ cd XlsxWriter-main/
$ python setup.py install
```

Cloning from GitHub

You may also clone the GitHub repository and install from it.

```
$ git clone https://github.com/jmcnamara/XlsxWriter.git


$ cd XlsxWriter
$ python setup.py install
```

To confirm that XlsxWriter is installed properly, check its version from the Python prompt:

```
>>> import xlsxwriter
>>> xlsxwriter.__version__
'3.0.2'
```

3. XlsxWriter – Hello World

Getting Started

The first program to test if the module/library works correctly is often to write Hello world message. The following program creates a file with .XLSX extension. An object of the Workbook class in the xlsxwriter module corresponds to the spreadsheet file in the current working directory.

```
wb = xlsxwriter.Workbook('hello.xlsx')
```

Next, call the **add_worksheet()** method of the Workbook object to insert a new worksheet in it.

```
ws = wb.add_worksheet()
```

We can now add the Hello World string at A1 cell by invoking the **write()** method of the worksheet object. It needs two parameters: the cell address and the string.

```
ws.write('A1', 'Hello world')
```

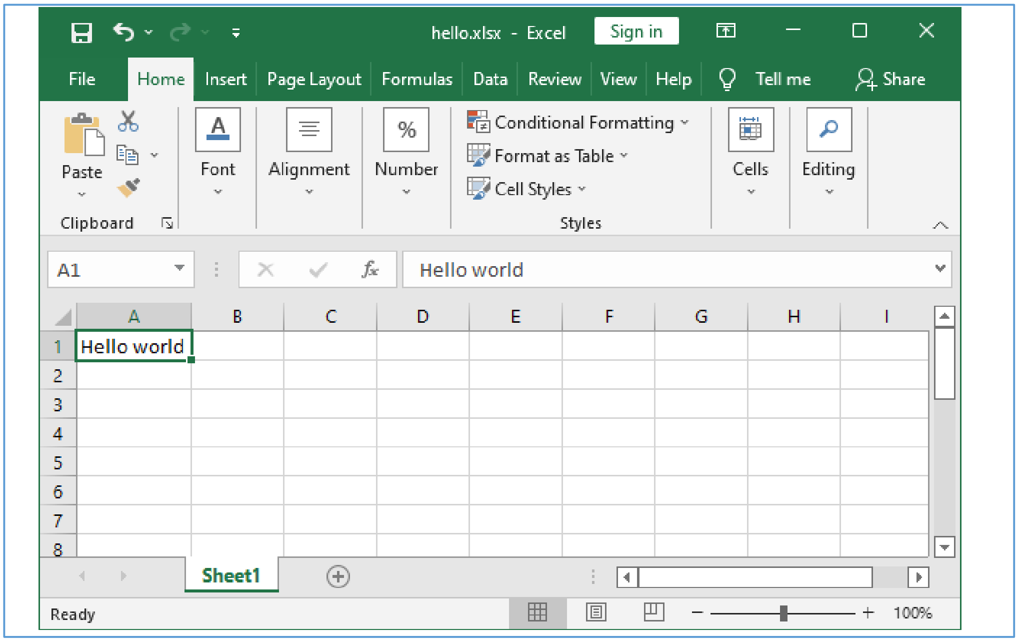
Example

The complete code of **hello.py** is as follows:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')

ws = wb.add_worksheet()

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

wb.close()
```

Output

After the above code is executed, **hello.xlsx** file will be created in the current working directory. You can now open it using Excel software.


hello.xlsx - Excel
Sign in
File
Home
Insert
Page Layout
Formulas
Data
Review
View
Help
Tell me
Share
Paste
Clipboard
Font
Alignment
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Cells
Editing
A1
Hello world
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
7
8
Hello world
Sheet1
Ready
100%

4. XlsxWriter – Important classes

The XlsxWriter library comprises of following classes. All the methods defined in these classes allow different operations to be done programmatically on the XLSX file. The classes are:

- Workbook class
- Worksheet class
- Format class
- Chart class
- Chartsheet class
- Exception class

Workbook Class

This is the main class exposed by the XlsxWriter module and it is the only class that you will need to instantiate directly. It represents the Excel file as it is written on a disk.

```
wb=xlsxwriter.Workbook('filename.xlsx')
```

The Workbook class defines the following methods:

add_worksheet()	Adds a new worksheet to a workbook.
add_format()	Used to create new Format objects which are used to apply formatting to a cell.
add_chart()	Creates a new chart object that can be inserted into a worksheet via the insert_chart() Worksheet method
add_chartsheet()	Adds a new chartsheet to a workbook.
close()	Closes the Workbook object and write the XLSX file.
define_name()	Creates a defined name in the workbook to use as a variable.
add_vba_project()	Used to add macros or functions to a workbook using a binary VBA project file

worksheets()	Returns a list of the worksheets in a workbook.

Worksheet Class

The worksheet class represents an Excel worksheet. An object of this class handles operations such as writing data to cells or formatting worksheet layout. It is created by calling the **`add_worksheet()`** method from a **`Workbook()`** object.

The Worksheet object has access to the following methods:

write()	Writes generic data to a worksheet cell. **Parameters:** • **row** – The cell row (zero indexed). • **col** – The cell column (zero indexed). • ***args** – The additional **args** passed to the sub methods such as number, string and cell_format. **Returns:** • **0:** Success • **-1:** Row or column is out of worksheet bounds.
write_string()	Writes a string to the cell specified by row and column. **Parameters:** • **row (int)** – The cell row (zero indexed). • **col (int)** – The cell column (zero indexed). • **string (string)** – String to write to cell. • **cell_format (Format)** – Optional Format object. **Returns:**

	• **0:** Success • **-1:** Row or column is out of worksheet bounds. • **-2**: String truncated to 32k characters.
write_number()	Writes numeric types to the cell specified by row and column. **Parameters:** • **row (int)** – The cell row (zero indexed). • **col (int)** – The cell column (zero indexed). • **string (string)** – String to write to cell. • **cell_format (Format)** – Optional Format object. **Returns:** • **0:** Success • **-1:** Row or column is out of worksheet bounds.

write_formula()	Writes a formula or function to the cell specified by row and column. **Parameters:** • **row (int)** – The cell row (zero indexed). • **col (int)** – The cell column (zero indexed). • **formula (string)** – Formula to write to cell. • **cell_format (Format)** – Optional Format object. • **value** – Optional result. The value if the formula was calculated. **Returns:** • **0:** Success • **-1:** Row or column is out of worksheet bounds.
insert_image()	Used to insert an image into a worksheet. The image can be in PNG, JPEG, GIF, BMP, WMF or EMF format. **Parameters:** • **row (int)** – The cell row (zero indexed). • **col (int)** – The cell column (zero indexed). • **filename** – Image filename (with path if required). **Returns:** • **0:** Success • **-1:** Row or column is out of worksheet bounds.

insert_chart()	Used to insert a chart into a worksheet. A chart object is created via the Workbook `add_chart()` method. **Parameters:** • **row (int)** – The cell row (zero indexed). • **col (int)** – The cell column (zero indexed). • **chart** – A chart object.
conditional_format()	Used to add formatting to a cell or range of cells based on user-defined criteria. **Parameters:** • **first_row (int)** – The first row of the range. (All zero indexed) • **first_col (int)** – The first column of the range. • **last_row (int)** – The last row of the range. • **last_col (int)** – The last col of the range. • **options (dict)** – Conditional formatting options. must be a dictionary containing the parameters that describe the type and style of the conditional format. **Returns:** • **0:** Success • **-1:** Row or column is out of worksheet bounds. • **-2:** Incorrect parameter or option.

add_table()	Used to group a range of cells into an Excel Table. **Parameters:** • **first_row (int)** – The first row of the range. (All zero indexed) • **first_col (int)** – The first column of the range. • **last_row (int)** – The last row of the range. • **last_col (int)** – The last col of the range. • **options (dict)** – Table formatting options.
autofilter()	Set the auto-filter area in the worksheet. It adds drop down lists to the headers of a 2D range of worksheet data. User can filter the data based on simple criteria **Parameters:** • **first_row (int)** – The first row of the range. (All zero indexed) • **first_col (int)** – The first column of the range. • **last_row (int)** – The last row of the range. • **last_col (int)** – The last col of the range.

Format Class

Format objects are created by calling the workbook `add_format()` method. Methods and properties available to this object are related to fonts, colors, patterns, borders, alignment and number formatting.

Font formatting methods and properties:

Method Name	Description	Property
set_font_name()	Font type	'font_name'
set_font_size()	Font size	'font_size'
set_font_color()	Font color	'font_color'
set_bold()	Bold	'bold'
set_italic()	Italic	'italic'
set_underline()	Underline	'underline'
set_font_strikeout()	Strikeout	'font_strikeout'
set_font_script()	Super/Subscript	'font_script'

Alignment formatting methods and properties:

Method Name	Description	Property
set_align()	Horizontal align	'align'
set_align()	Vertical align	'valign'
set_rotation()	Rotation	'rotation'
set_text_wrap()	Text wrap	'text_wrap'
set_reading_order()	Reading order	'reading_order'
set_text_justlast()	Justify last	'text_justlast'
set_center_across()	Center across	'center_across'
set_indent()	Indentation	'indent'
set_shrink()	Shrink to fit	'shrink'

Chart Class

A chart object is created via the **add_chart()** method of the Workbook object where the chart type is specified.

```
chart = workbook.add_chart({'type': 'column'})
```

The **chart** object is inserted in the worksheet by calling **insert_chart()** method.

```
worksheet.insert_chart('A7', chart)
```

XlxsWriter supports the following chart types:

- **area:** Creates an Area (filled line) style chart.
- **bar:** Creates a Bar style (transposed histogram) chart.
- **column:** Creates a column style (histogram) chart.
- **line:** Creates a Line style chart.
- **pie:** Creates a Pie style chart.
- **doughnut:** Creates a Doughnut style chart.
- **scatter:** Creates a Scatter style chart.
- **stock:** Creates a Stock style chart.
- **radar:** Creates a Radar style chart.

The Chart class defines the following methods:

add_series(options)	Add a data series to a chart. Following properties can be given: • Values, categories • name • line, border • fill , pattern , gradient • data_labels, points
set_x_axis(options)	Set the chart X-axis options including • name, name_font • num_font, num_format • line, fill, pattern, gradient • min, max • position_axis • label_position, label_align • date_axis, text_axis • minor_unit_type, major_unit_type

set_y_axis(options)	Set the chart Y-axis options including: • name, name_font • num_font, num_format • line, fill, pattern, gradient • min, max • position_axis • label_position, label_align • date_axis, text_axis • minor_unit_type, major_unit_type
set_size()	This method is used to set the dimensions of the chart. The size of the chart can be modified by setting the width and height or by setting the `x_scale` and `y_scale`.
set_title(options)	Set the chart title options. **Parameters:** • **options (dict)** – A dictionary of chart size options. • **name:** Set the name (title) for the chart. The name is displayed above the chart. • **name_font:** Set the font properties for the chart title. • **overlay:** Allow the title to be overlaid on the chart. • **layout:** Set the (x, y) position of the title in chart relative units.
set_legend()	This method formats the chart legends with the following properties: • none • position, font, border • fill, pattern, gradient

Chartsheet Class

A chartsheet in a XLSX file is a worksheet that only contains a chart and no other data. a new **chartsheet** object is created by calling the **add_chartsheet()** method from a Workbook object:

```
chartsheet = workbook.add_chartsheet()
```

Some functionalities of the **Chartsheet** class are similar to that of data Worksheets such as tab selection, headers, footers, margins, and print properties. However, its primary purpose is to display a single chart, whereas an ordinary data worksheet can have one or more embedded charts.

The data for the **chartsheet** chart must be present on a separate worksheet. Hence it is always created along with at least one data worksheet, using **set_chart()** method.

```
chartsheet = workbook.add_chartsheet()
chart = workbook.add_chart({'type': 'column'})
chartsheet.set_chart(chart)
```

Remember that a Chartsheet can contain only one chart.

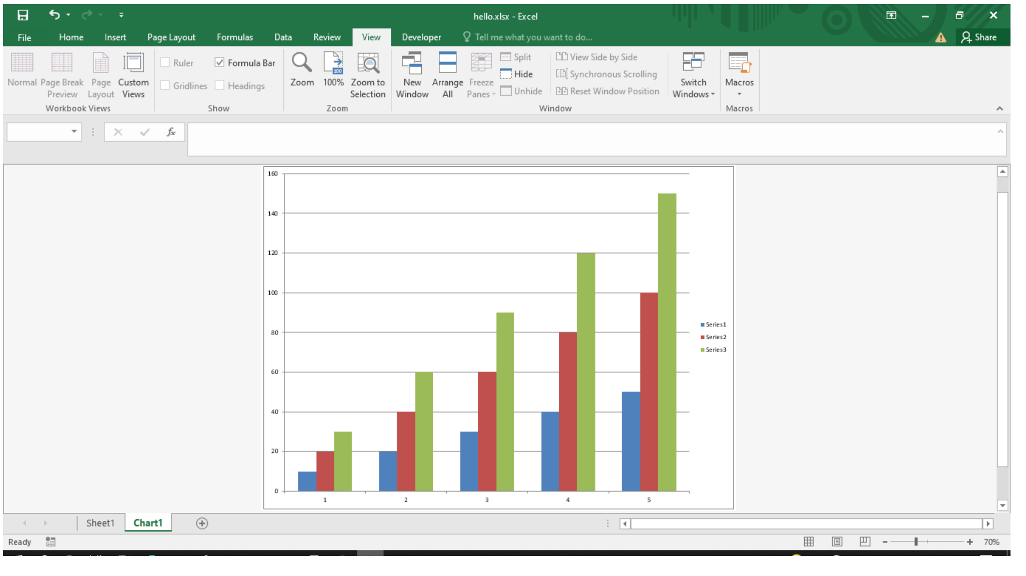
Example

The following code writes the data series in the worksheet names sheet1 but opens a new chartsheet to add a column chart based on the data in sheet1.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()


cs = wb.add_chartsheet()
chart = wb.add_chart({'type': 'column'})


data = [
    [10, 20, 30, 40, 50],
```

```
    [20, 40, 60, 80, 100],
    [30, 60, 90, 120, 150],
]

worksheet.write_column('A1', data[0])
worksheet.write_column('B1', data[1])
worksheet.write_column('C1', data[2])

chart.add_series({'values': '=Sheet1!$A$1:$A$5'})
chart.add_series({'values': '=Sheet1!$B$1:$B$5'})
chart.add_series({'values': '=Sheet1!$C$1:$C$5'})

cs.set_chart(chart)
cs.activate()

wb.close()
```

The following workbook shows a chartsheet with default caption as **chart1**.



Exception Class

XlsxWriter identifies various run-time errors or exceptions which can be trapped using Python's error handling technique so as to avoid corruption of Excel files. The Exception classes in XlsxWriter are as follows:

XlsxWriterException	Base exception for XlsxWriter.
XlsxFileError	Base exception for all file related errors.
XlsxInputError	Base exception for all input data related errors.
FileCreateError	Occurs if there is a file permission error, or IO error, when writing the xlsx file to disk or if the file is already open in Excel.
UndefinedImageSize	Raised with **insert_image()** method if the image doesn't contain height or width information. The exception is raised during Workbook **close()**.
UnsupportedImageFormat	Raised if the image isn't one of the supported file formats: PNG, JPEG, GIF, BMP, WMF or EMF.
EmptyChartSeries	This exception occurs when a chart is added to a worksheet without a data series.
InvalidWorksheetName	if a worksheet name is too long or contains invalid characters.
DuplicateWorksheetName	This exception is raised when a worksheet name is already present.

Exception FileCreateError

Assuming that a workbook named **hello.xlsx** is already opened using Excel app, then the following code will raise a **FileCreateError**:

```
import xlsxwriter

workbook = xlsxwriter.Workbook('hello.xlsx')
```

```
worksheet = workbook.add_worksheet()

workbook.close()
```

When this program is run, the error message is displayed as below:

```
PermissionError: [Errno 13] Permission denied: 'hello.xlsx'

During handling of the above exception, another exception
occurred:

Traceback (most recent call last):

  File "hello.py", line 4, in <module>

    workbook.close()

  File "e:\xlsxenv\lib\site-packages\xlsxwriter\workbook.py",
line 326, in close

    raise FileCreateError(e)

xlsxwriter.exceptions.FileCreateError: [Errno 13] Permission
denied: 'hello.xlsx'
```

Handling the Exception

We can use Python's exception handling mechanism for this purpose.

```
import xlsxwriter

try:

    workbook = xlsxwriter.Workbook('hello.xlsx')

    worksheet = workbook.add_worksheet()

    workbook.close()

except:

    print ("The file is already open")
```

Now the custom error message will be displayed.

```
(xlsxenv) E:\xlsxenv>python ex34.py

The file is already open
```

Exception EmptyChartSeries

Another situation of an exception being raised when a chart is added with a data series.

```
import xlsxwriter

workbook = xlsxwriter.Workbook('hello.xlsx')

worksheet = workbook.add_worksheet()

chart = workbook.add_chart({'type': 'column'})

worksheet.insert_chart('A7', chart)

workbook.close()
```

This leads to **`EmptyChartSeries`** exception:

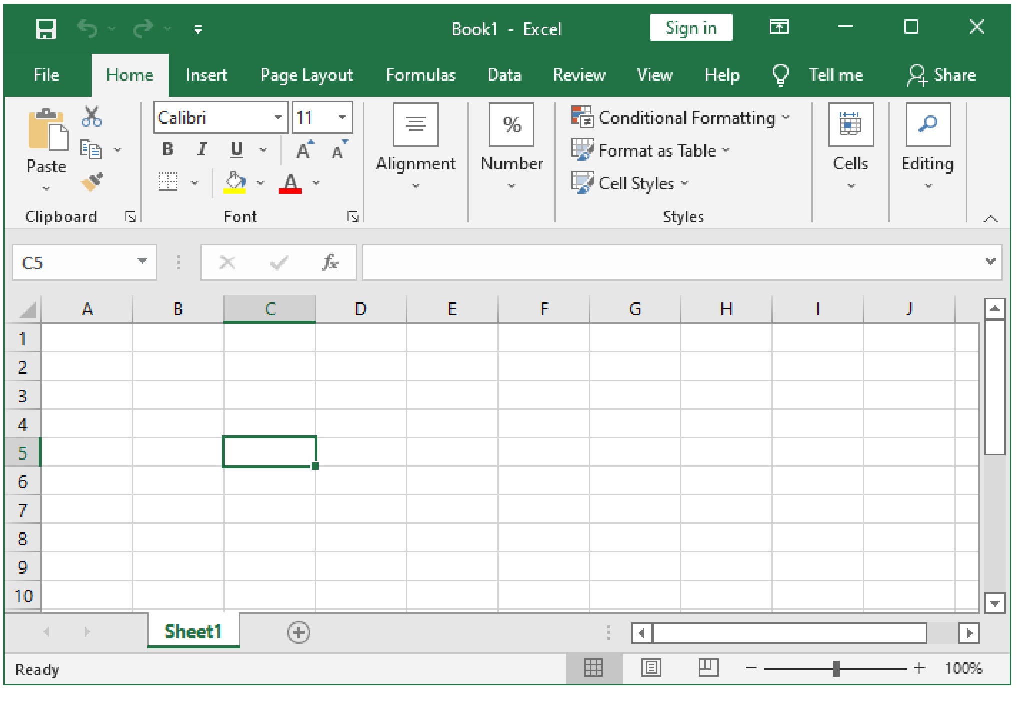
```
xlsxwriter.exceptions.EmptyChartSeries: Chart1 must contain at
least one data series.
```

5. XlsxWriter – Cell Notation and Ranges

Each worksheet in a workbook is a grid of a large number of cells, each of which can store one piece of data - either value or formula. Each Cell in the grid is identified by its row and column number.

In Excel's standard cell addressing, columns are identified by alphabets, A, B, C, …., Z, AA, AB etc., and rows are numbered starting from 1.

The address of each cell is alphanumeric, where the alphabetic part corresponds to the column and number corresponding to the row. For example, the address "C5" points to the cell in column "C" and row number "5".



Cell Notations

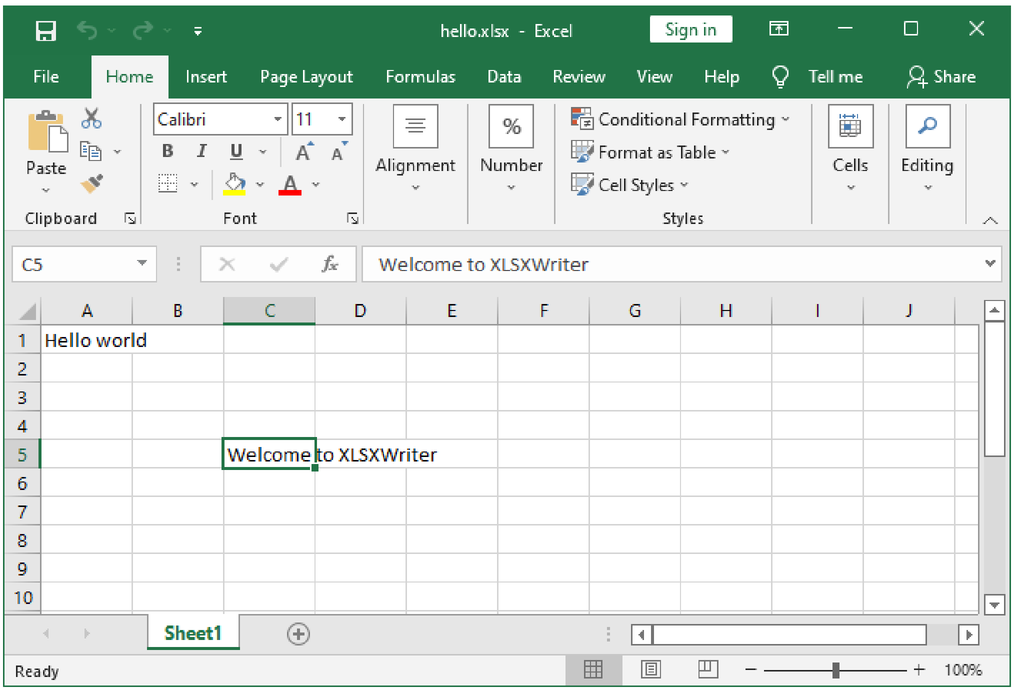
The standard Excel uses alphanumeric sequence of column letter and 1-based row. XlsxWriter supports the standard Excel notation (**A1** notation) as well as **Row-column** notation which uses a zero based index for both row and column.

Example

In the following example, a string 'Hello world' is written into A1 cell using Excel's standard cell address, while 'Welcome to XLSXWriter' is written into cell C5 using row-column notation.

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()
ws.write('A1', 'Hello world')              # A1 notation
ws.write(4,2,"Welcome to XLSXWriter")      # Row-column notation
wb.close()
```

Open the **`hello.xlsx`** file using Excel software.



The numbered **row-column** notation is especially useful when referring to the cells programmatically. In the following code data in a list of lists has to be written to a range of cells in a worksheet. This is achieved by two nested loops, the outer representing the row numbers and the inner loop for column numbers.

```
data = [
    ['Name', 'Physics', 'Chemistry', 'Maths', 'Total'],
    ['Ravi', 60, 70, 80],
    ['Kiran', 65, 75, 85],
    ['Karishma', 55, 65, 75],
]
for row in range(len(data)):
    for col in range(len(data[row])):
        ws.write(row, col, data[row][col])
```

The same result can be achieved by using **write_row()** method of the worksheet object used in the code below:

```
for row in range(len(data)):
    ws.write_row(6+row,0, data[row])
```

The worksheet object has **add_table()** method that writes the data to a range and converts into Excel range, displaying autofilter dropdown arrows in the top row.

```
ws.add_table('G6:J9', {'data': data, 'header_row':True})
```

Example

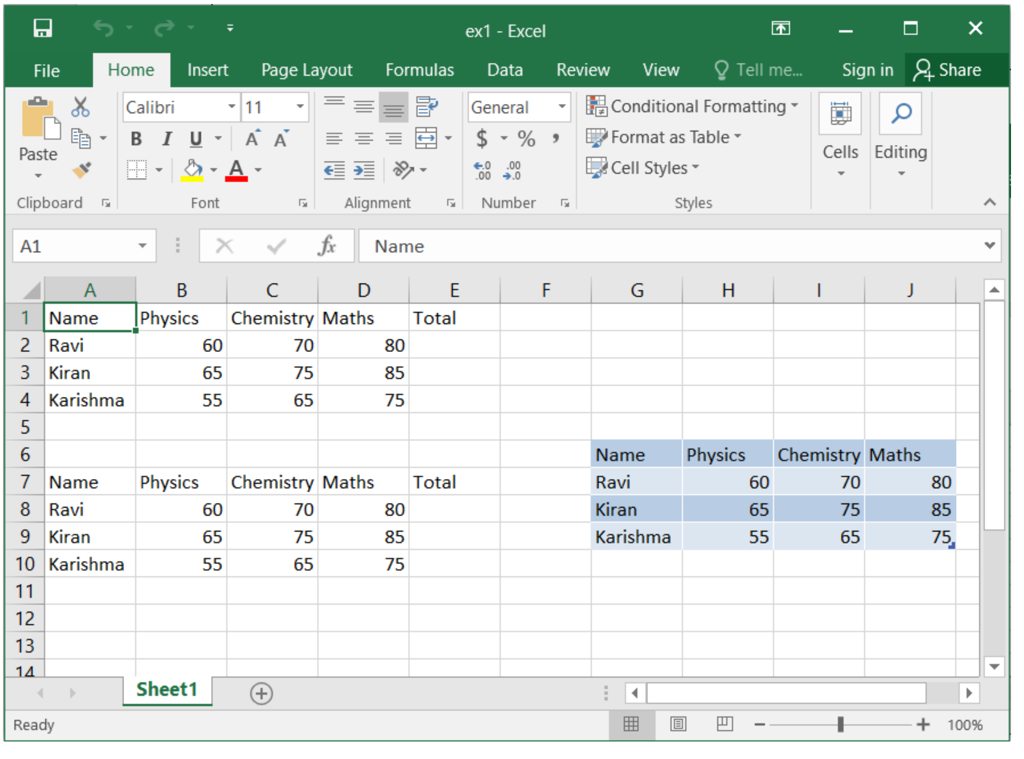
The output of all the three codes above can be verified by the following code and displayed in the following figure:

```
import xlsxwriter

wb = xlsxwriter.Workbook('ex1.xlsx')
ws = wb.add_worksheet()

data = [
    ['Name', 'Physics', 'Chemistry', 'Maths', 'Total'],
    ['Ravi', 60, 70, 80],
    ['Kiran', 65, 75, 85],
    ['Karishma', 55, 65, 75],
```

```
]

for row in range(len(data)):
    for col in range(len(data[row])):
        ws.write(row, col, data[row][col])

for row in range(len(data)):
    ws.write_row(6+row,0, data[row])

ws.add_table('G6:J9', {'data': data, 'header_row':False})

wb.close()
```

Output:

Execute the above program and open the **ex1.xlsx** using Excel software.



6. XlsxWriter – Defined Names

In Excel, it is possible to identify a cell, a formula, or a range of cells by user-defined name, which can be used as a variable used to make the definition of formula easy to understand. This can be achieved using the **define_name()** method of the Workbook class.

In the following code snippet, we have a range of cells consisting of numbers. This range has been given a name as marks.

```
data=['marks',50,60,70, 'Total']
ws.write_row('A1', data)
wb.define_name('marks', '=Sheet1!$A$1:$E$1')
```

If the name is assigned to a range of cells, the second argument of **define_name()** method is a **string** with the name of the sheet followed by "**!**" symbol and then the range of cells using the absolute addressing scheme. In this case, the range **A1:E1** in sheet1 is named as **marks**.

This name can be used in any formula. For example, we calculate the sum of numbers in the range identified by the name **marks**.

```
ws.write('F1', '=sum(marks)')
```

We can also use the named cell in the **write_formula()** method. In the following code, this method is used to calculate interest on the amount where the **rate** is a **defined_name**.

```
ws.write('B5', 10)
wb.define_name('rate', '=sheet1!$B$5')


ws.write_row('A5', ['Rate', 10])


data=['Amount',1000, 2000, 3000]
ws.write_column('A6', data)
ws.write('B6', 'Interest')
```

```
for row in range(6,9):
    ws.write_formula(row, 1, '= rate*$A{}/100'.format(row+1))
```

We can also use **write_array_formula()** method instead of the loop in the above code:

```
ws.write_array_formula('D7:D9' , '{=rate/100*(A7:A9)}')
```

Example

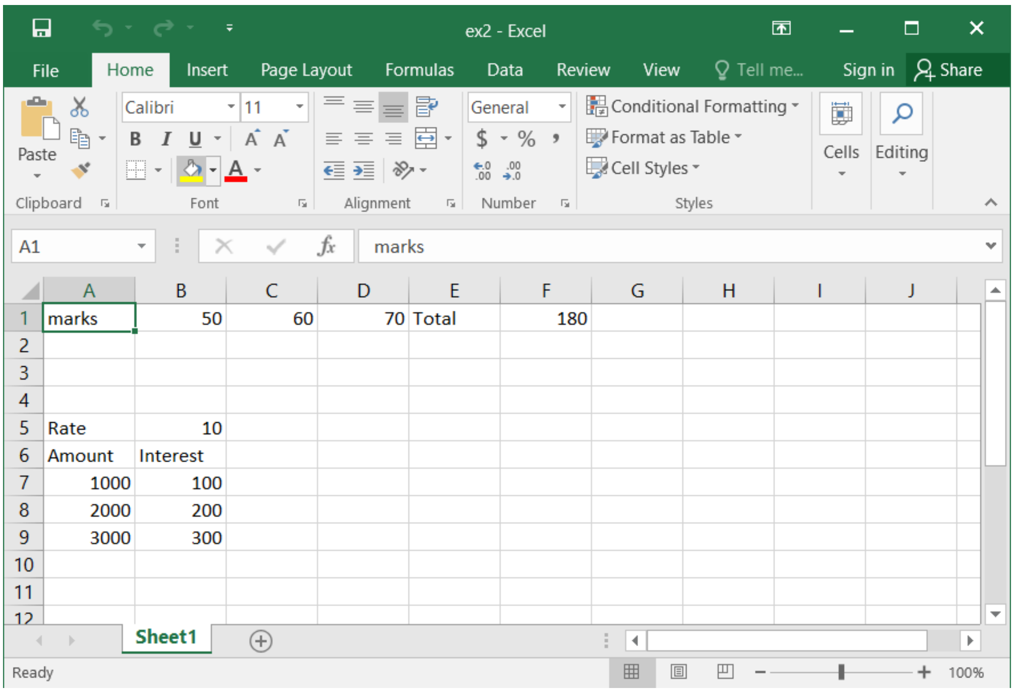
The complete code using **define_name()** method is given below:

```
import xlsxwriter


wb = xlsxwriter.Workbook('ex2.xlsx')
ws = wb.add_worksheet()


data = ['marks',50,60,70, 'Total']
ws.write_row('A1', data)
wb.define_name('marks', '=Sheet1!$A$1:$E$1')
ws.write('F1', '=sum(marks)')


ws.write('B5', 10)
wb.define_name('rate', '=sheet1!$B$5')


ws.write_row('A5', ['Rate', 10])


data=['Amount',1000, 2000, 3000]
ws.write_column('A6', data)
ws.write('B6', 'Interest')


for row in range(6,9):
```

```
    ws.write_formula(row, 1, '= rate*$A{}/100'.format(row+1))


wb.close()
```

Output:

Run the above program and open **ex2.xlsx** with Excel.



7. XlsxWriter – Formula and Function

The Worksheet class offers three methods for using formulas.

- write_formula()
- write_array_formula()
- write_dynamic_array_formula()

All these methods are used to assign formula as well as function to a cell.

The write_formula() Method

The **write_formula()** method requires the address of the cell, and a string containing a valid Excel formula. Inside the formula string, only the A1 style address notation is accepted. However, the cell address argument can be either standard Excel type or zero based row and column number notation.

Example

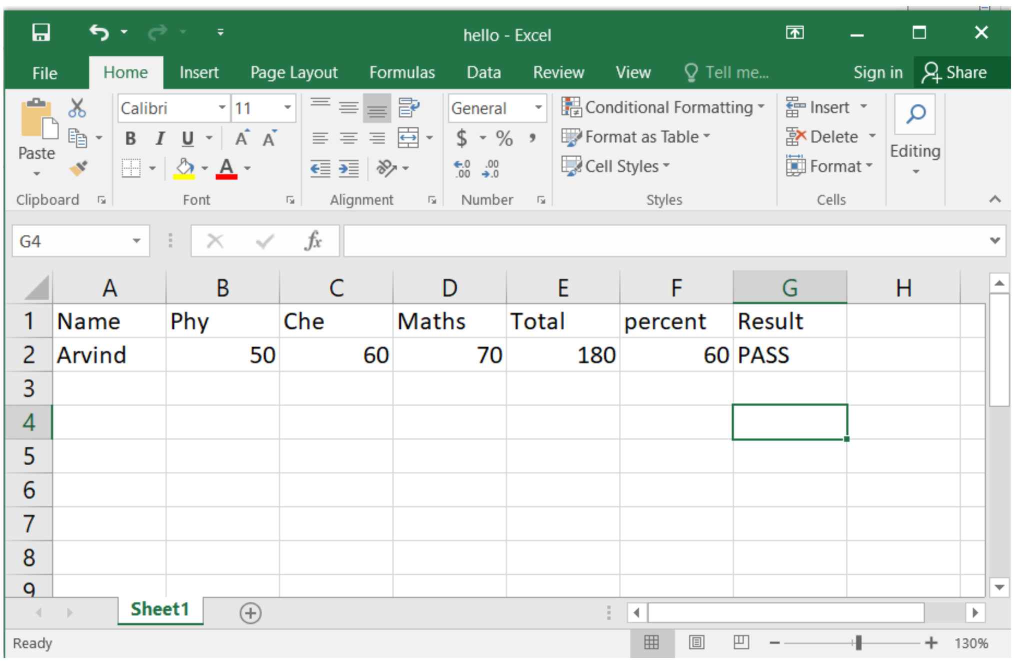
In the example below, various statements use **write_formula()** method. The first uses a standard Excel notation to assign a formula. The second statement uses row and column number to specify the address of the target cell in which the formula is set. In the third example, the **IF()** function is assigned to G2 cell.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


data=[
    ['Name', 'Phy', 'Che', 'Maths', 'Total', 'percent', 'Result' ],
    ['Arvind', 50,60,70]
]
```

```
ws.write_row('A1', data[0])
ws.write_row('A2', data[1])

ws.write_formula('E2', '=B2+C2+D2')
ws.write_formula(1,5, '=E2*100/300')
ws.write_formula('G2', '=IF(F2>=50, "PASS","FAIL")')

wb.close()
```

Output:

The Excel file shows the following result:



The write_array_formula() Method

The **`write_array_formula()`** method is used to extend the formula over a range. In Excel, an array formula performs a calculation on a set of values. It may return a single value or a range of values.

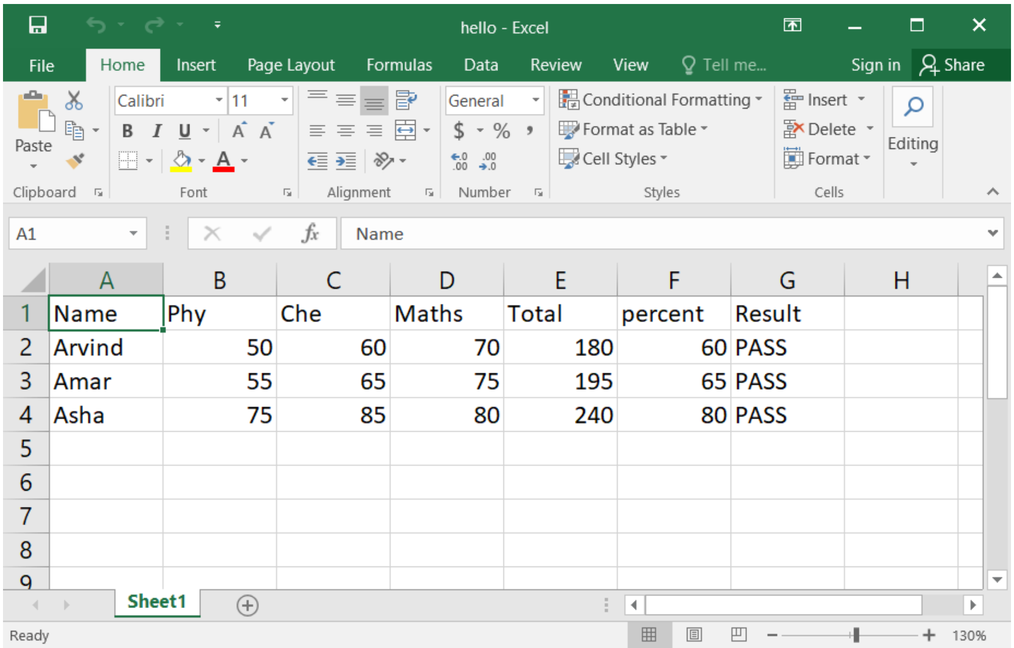
An array formula is indicated by a pair of braces around the formula: **`{=SUM(A1:B1*A2:B2)}`**. The range can be either specified by row and column numbers of first and last cell in the range (such as 0,0, 2,2) or by the string representation 'A1:C2'.

Example

In the following example, array formulas are used for columns E, F and G to calculate total, percent and result from marks in the range B2:D4

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data=[
    ['Name', 'Phy', 'Che', 'Maths', 'Total', 'percent', 'Result'],
    ['Arvind', 50,60,70],
    ['Amar', 55,65,75],
    ['Asha', 75,85,80]
]

for row in range(len(data)):
    ws.write_row(row,0, data[row])

ws.write_array_formula('E2:E4', '{=B2:B4+C2:C4+D2:D4}')
ws.write_array_formula(1,5,3,5, '{=(E2:E4)*100/300}')
ws.write_array_formula('G2:G4', '{=IF((F2:F4)>=50, "PASS","FAIL")}')

wb.close()
```

Here is how the worksheet appears when opened using MS Excel:



The write_dynamic_array_data() Method

The **`write_dynamic_array_data()`** method writes an dynamic array formula to a cell range. The concept of dynamic arrays has been introduced in EXCEL's 365 version, and some new functions that leverage the advantage of dynamic arrays have been introduced. These functions are:

FILTER	Filter data and return matching records
RANDARRAY	Generate array of random numbers
SEQUENCE	Generate array of sequential numbers
SORT	Sort range by column
SORTBY	Sort range by another range or array
UNIQUE	Extract unique values from a list or range
XLOOKUP	replacement for VLOOKUP
XMATCH	replacement for the MATCH function

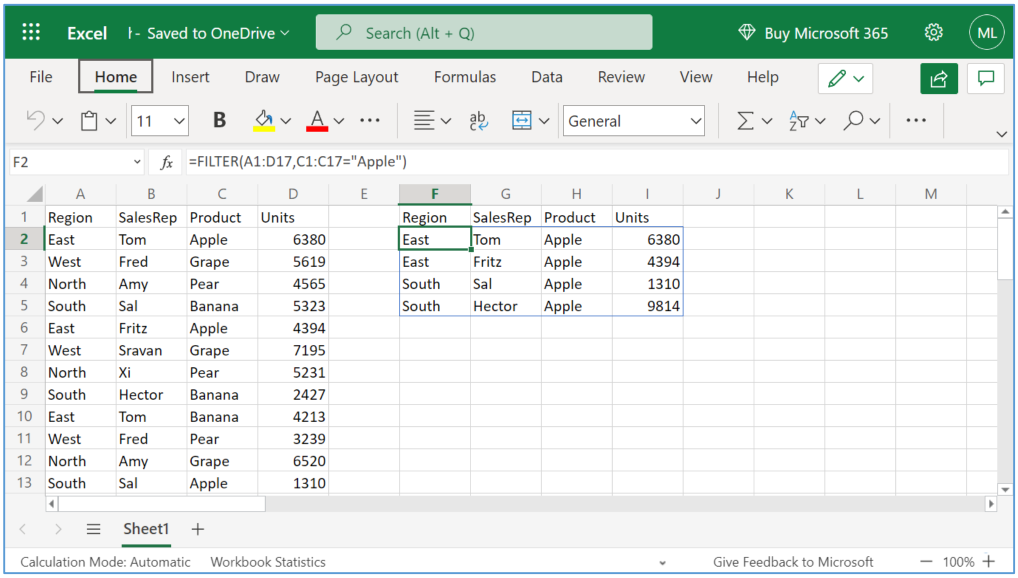
Dynamic arrays are ranges of return values whose size can change based on the results. For example, a function such as **`FILTER()`** returns an array of values that can vary in size depending on the filter results.

Example

In the example below, the data range is A1:D17. The filter function uses this range and the criteria range is C1:C17, in which the product names are given. The **FILTER()** function results in a dynamic array as the number of rows satisfying the criteria may change.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data = (['Region', 'SalesRep', 'Product', 'Units'],
        ['East',  'Tom',    'Apple',  6380],
        ['West',  'Fred',   'Grape',  5619],
        ['North', 'Amy',    'Pear',   4565],
        ['South', 'Sal',    'Banana', 5323],
        ['East',  'Fritz',  'Apple',  4394],
        ['West',  'Sravan', 'Grape',  7195],
        ['North', 'Xi',     'Pear',   5231],
        ['South', 'Hector', 'Banana', 2427],
        ['East',  'Tom',    'Banana', 4213],
        ['West',  'Fred',   'Pear',   3239],
        ['North', 'Amy',    'Grape',  6520],
        ['South', 'Sal',    'Apple',  1310],
        ['East',  'Fritz',  'Banana', 6274],
        ['West',  'Sravan', 'Pear',   4894],
        ['North', 'Xi',     'Grape',  7580],
        ['South', 'Hector', 'Apple',  9814])
for row in range(len(data)):
    ws.write_row(row,0, data[row])

ws.write_dynamic_array_formula('F1', '=FILTER(A1:D17,C1:C17="Apple")')
wb.close()
```

Note that the formula string to write_dynamic_array_formula() need not contain curly brackets. **The resultant hello.xlsx must be opened with Excel 365 app.**

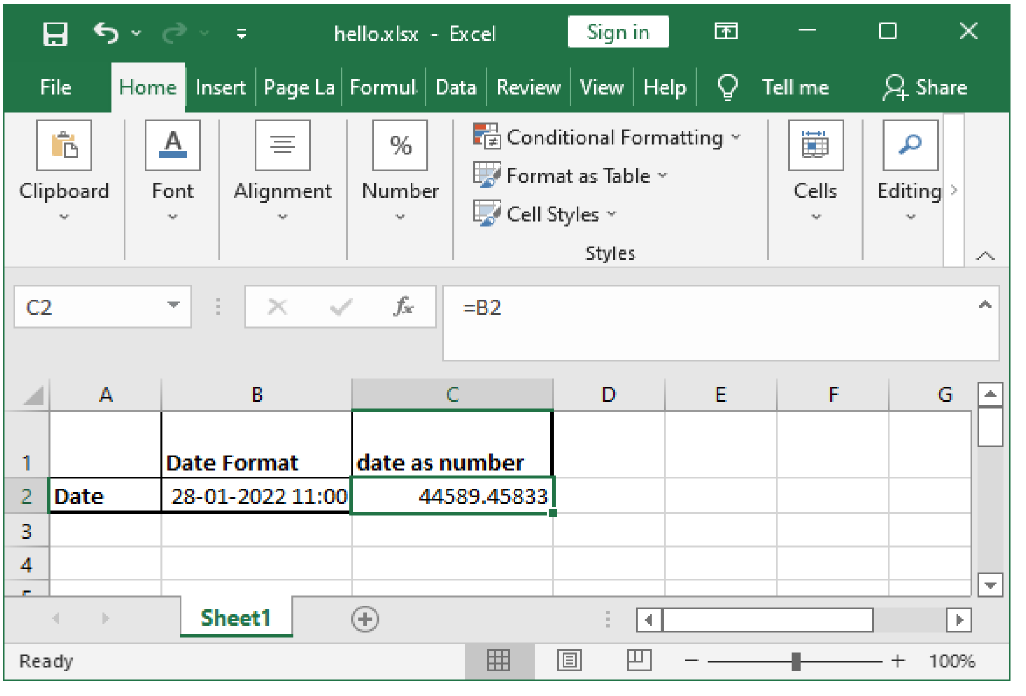


F2 =FILTER(A1:D17,C1:C17="Apple")

	A	B	C	D	E	F	G	H	I
1	Region	SalesRep	Product	Units		Region	SalesRep	Product	Units
2	East	Tom	Apple	6380		East	Tom	Apple	6380
3	West	Fred	Grape	5619		East	Fritz	Apple	4394
4	North	Amy	Pear	4565		South	Sal	Apple	1310
5	South	Sal	Banana	5323		South	Hector	Apple	9814
6	East	Fritz	Apple	4394					
7	West	Sravan	Grape	7195					
8	North	Xi	Pear	5231					
9	South	Hector	Banana	2427					
10	East	Tom	Banana	4213					
11	West	Fred	Pear	3239					
12	North	Amy	Grape	6520					
13	South	Sal	Apple	1310					

8. XlsxWriter – Date and Time

In Excel, dates are stored as real numbers so that they can be used in calculations. By default, January 1, 1900 (called as epoch) is treated 1, and hence January 28, 2022 corresponds to 44589. Similarly, the time is represented as the fractional part of the number, as the percentage of day. Hence, January 28, 2022 11.00 corresponds to 44589.45833.



The set_num_format() Method

Since 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. Use **set_num_format()** method of the Format object using appropriate formatting.

The following code snippet displays a number in "dd/mm/yy" format.

```
num = 44589
format1 = wb.add_format()
format1.set_num_format('dd/mm/yy')
ws.write('B2', num, format1)
```

The num_format Parameter

Alternatively, the **num_format** parameter of **add_format()** method can be set to the desired format.

```
format1 = wb.add_format({'num_format':'dd/mm/yy'})
ws.write('B2', num, format1)
```

Example

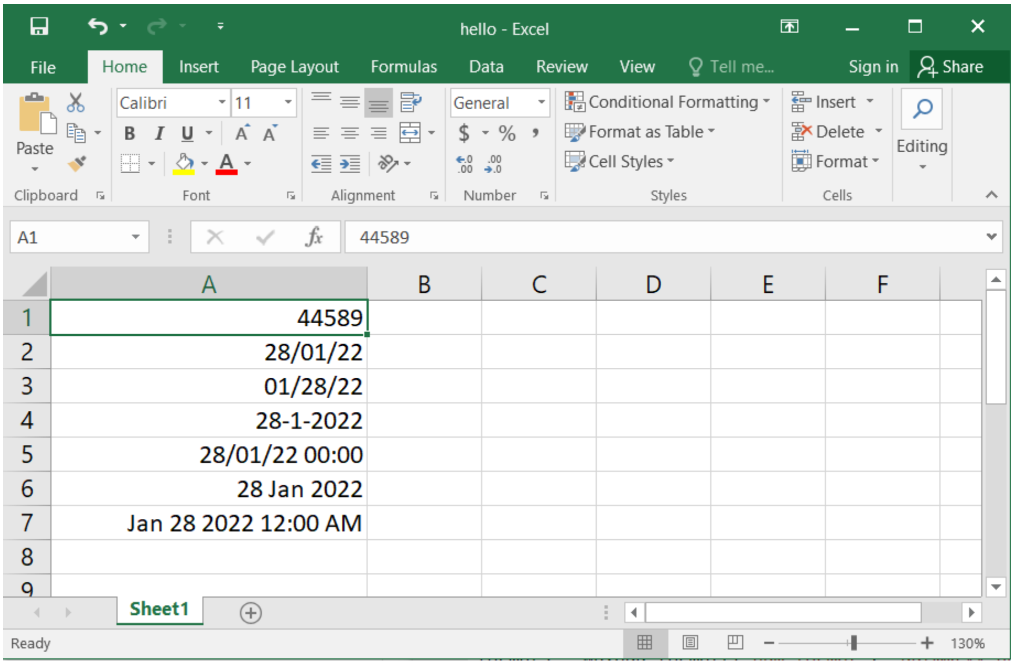
The following code shows the number in various date formats.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

num=44589
ws.write('A1', num)

format2 = wb.add_format({'num_format': 'dd/mm/yy'})
ws.write('A2', num, format2)

format3 = wb.add_format({'num_format': 'mm/dd/yy'})
ws.write('A3', num, format3)

format4 = wb.add_format({'num_format': 'd-m-yyyy'})
ws.write('A4', num, format4)

format5 = wb.add_format({'num_format': 'dd/mm/yy hh:mm'})
ws.write('A5', num, format5)

format6 = wb.add_format({'num_format': 'd mmm yyyy'})
```

```
ws.write('A6', num, format6)


format7 = wb.add_format({'num_format': 'mmm d yyyy hh:mm AM/PM'})
ws.write('A7', num, format7)


wb.close()
```

Output:

The worksheet looks like the following in Excel software:



write_datetime() and strptime()

The XlsxWriter's Worksheet object also has **`write_datetime()`** method that is useful when handling date and time objects obtained with datetime module of Python's standard library.

The **`strptime()`** method returns **`datetime`** object from a string parsed according to the given format. Some of the codes used to format the string are given below:

%a	Abbreviated weekday name	Sun, Mon

%A	Full weekday name	Sunday, Monday
%d	Day of the month as a zero-padded decimal	01, 02
%-d	day of the month as decimal number	1, 2..
%b	Abbreviated month name	Jan, Feb
%m	Month as a zero padded decimal number	01, 02
%-m	Month as a decimal number	1, 2
%B	Full month name	January, February
%y	Year without century as a zero padded decimal number	99, 00
%-y	Year without century as a decimal number	0, 99
%Y	Year with century as a decimal number	2022, 1999
%H	Hour (24 hour clock) as a zero padded decimal number	01, 23
%-H	Hour (24 hour clock) as a decimal number	1, 23
%I	Hour (12 hour clock) as a zero padded decimal number	01, 12
%-I	Hour (12 hour clock) as a decimal number	1, 12
%p	locale's AM or PM	AM, PM
%M	Minute as a zero padded decimal number	01, 59
%-M	Minute as a decimal number	1, 59
%S	Second as a zero padded decimal number	01, 59
%-S	Second as a decimal number	1, 59
%c	locale's appropriate date and time representation	Mon Sep 30 07:06:05 2022

The **strptime()** method is used as follows:

```
>>> from datetime import datetime
>>> dt="Thu February 3 2022 11:35:5"
>>> code="%a %B %d %Y %H:%M:%S"
>>> datetime.strptime(dt, code)
datetime.datetime(2022, 2, 3, 11, 35, 5)
```

This **datetime** object can now be written into the worksheet with **write_datetime()** method.

Example

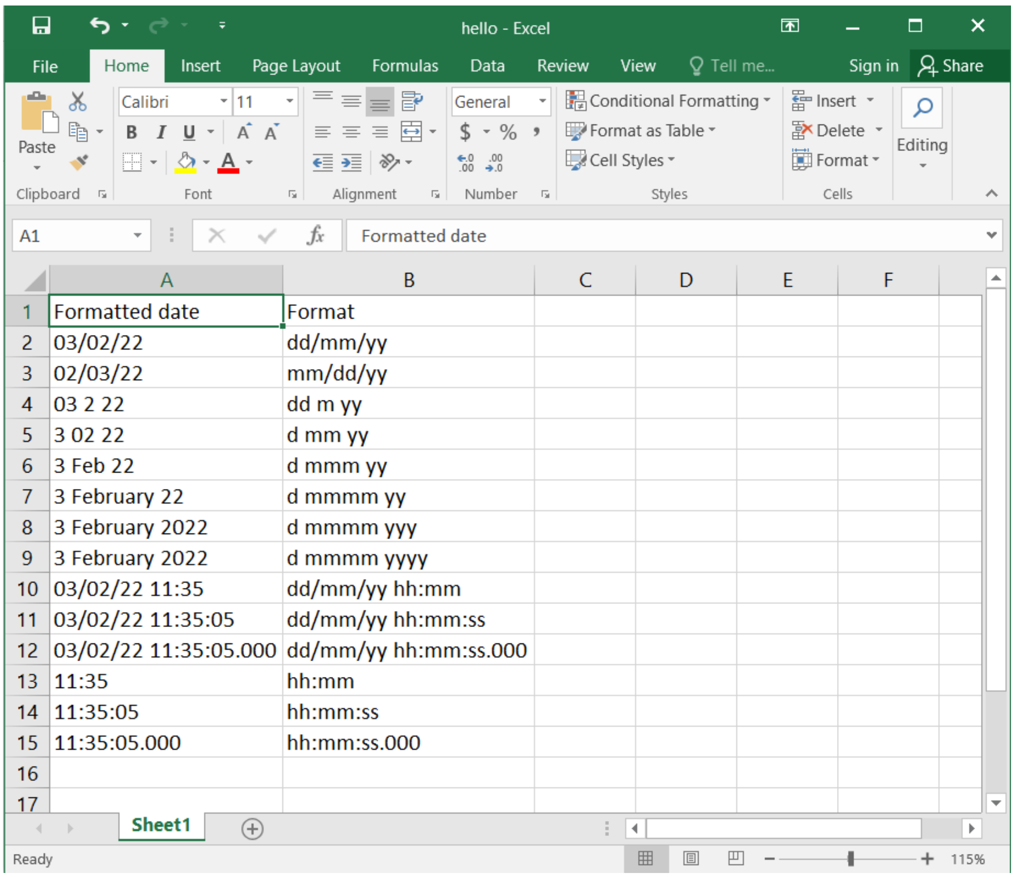
In the following example, the **datetime** object is written with different formats.

```
import xlsxwriter
from datetime import datetime
wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()

dt="Thu February 3 2022 11:35:5"
code="%a %B %d %Y %H:%M:%S"
obj=datetime.strptime(dt, code)
date_formats = (
    'dd/mm/yy',
    'mm/dd/yy',
    'dd m yy',
    'd mm yy',
    'd mmm yy',
    'd mmmm yy',
    'd mmmm yyy',
    'd mmmm yyyy',
    'dd/mm/yy hh:mm',
    'dd/mm/yy hh:mm:ss',
    'dd/mm/yy hh:mm:ss.000',
    'hh:mm',
    'hh:mm:ss',
    'hh:mm:ss.000',
)
worksheet.write('A1', 'Formatted date')
worksheet.write('B1', 'Format')
row = 1

for fmt in date_formats:
    date_format = wb.add_format({'num_format': fmt, 'align': 'left'})
```

```
    worksheet.write_datetime(row, 0, obj, date_format)
    worksheet.write_string(row, 1, fmt)
    row += 1

wb.close()
```

Output:

The worksheet appears as follows when opened with Excel.



Formatted date	Format
03/02/22	dd/mm/yy
02/03/22	mm/dd/yy
03 2 22	dd m yy
3 02 22	d mm yy
3 Feb 22	d mmm yy
3 February 22	d mmmm yy
3 February 2022	d mmmm yyy
3 February 2022	d mmmm yyyy
03/02/22 11:35	dd/mm/yy hh:mm
03/02/22 11:35:05	dd/mm/yy hh:mm:ss
03/02/22 11:35:05.000	dd/mm/yy hh:mm:ss.000
11:35	hh:mm
11:35:05	hh:mm:ss
11:35:05.000	hh:mm:ss.000

9. XlsxWriter – Tables

In MS Excel, a Table is a range of cells that has been grouped as a single entity. It can be referenced from formulas and has common formatting attributes. Several features such as column headers, autofilters, total rows, column formulas can be defined in a worksheet table.

The add_table() Method

The worksheet method **add_table()** is used to add a cell range as a table.

```
worksheet.add_table(first_row, first_col, last_row, last_col, options)
```

Both the methods, the standard '**A1**' or '**Row/Column**' notation are allowed for specifying the range. The **add_table()** method can take one or more of the following optional parameters. Note that except the range parameter, others are optional. If not given, an empty table is created.

data

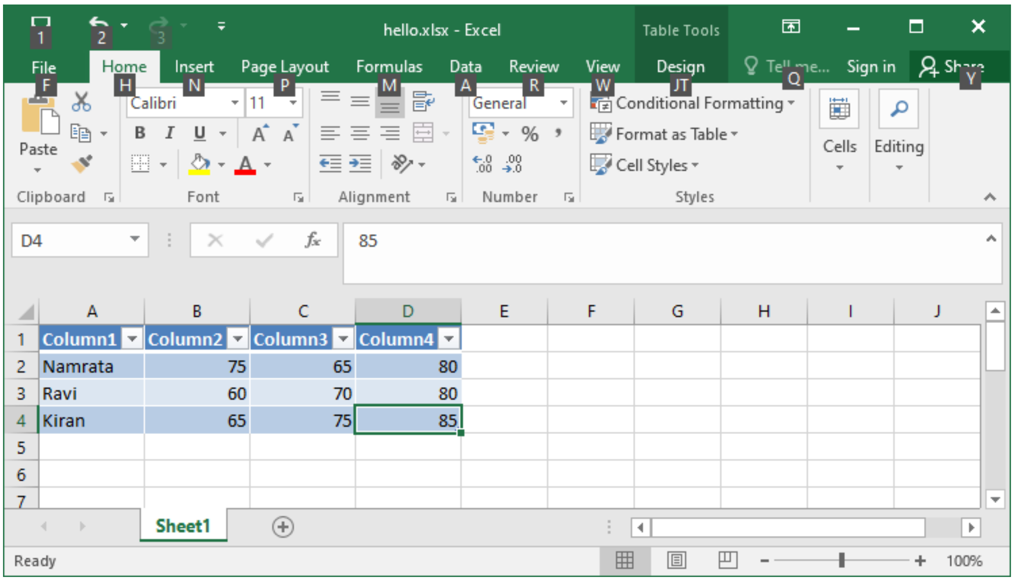
This parameter can be used to specify the data in the cells of the table. Look at the following example:

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data = [
    ['Namrata', 75, 65, 80],
    ['Ravi', 60, 70, 80],
    ['Kiran', 65, 75, 85],
    ['Karishma', 55, 65, 75],
]
```

```
ws.add_table("A1:D4", {'data':data})

wb.close()
```

Output:

Here's the result:



header_row

This parameter can be used to turn on or off the header row in the table. It is on by default. The header row will contain default captions such as Column 1, Column 2, etc. You can set required captions by using the columns parameter.

columns

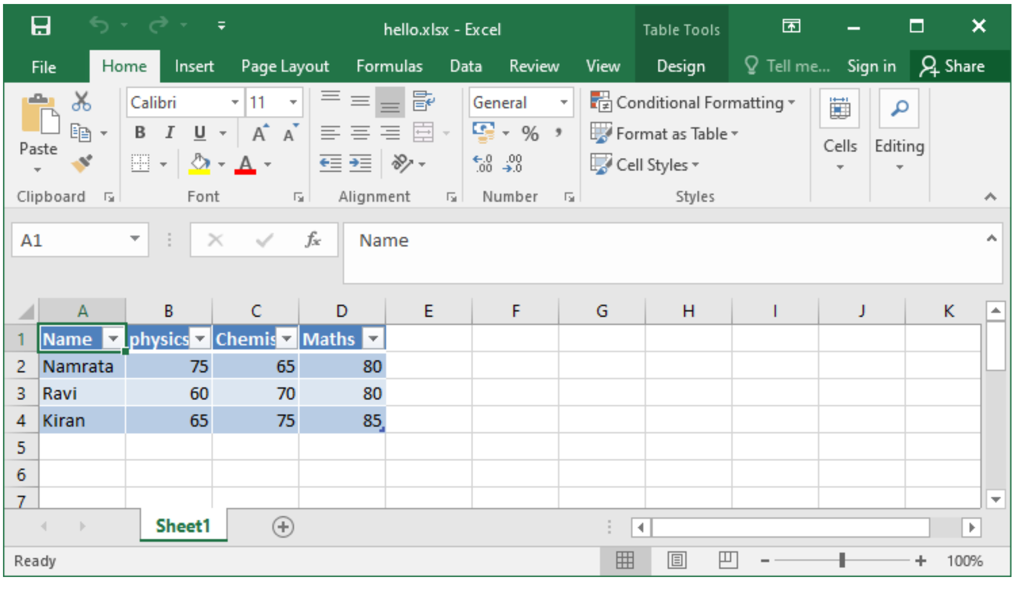
This property is used to set column captions.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()
```

```
data = [
    ['Namrata', 75, 65, 80],
    ['Ravi', 60, 70, 80],
    ['Kiran', 65, 75, 85],
    ['Karishma', 55, 65, 75],
]

ws.add_table("A1:D4",
             {'data':data,
              'columns': [
                  {'header': 'Name'},
                  {'header': 'physics'},
                  {'header': 'Chemistry'},
                  {'header': 'Maths'}]
              })
wb.close()
```

Output:

The header row is now set as shown:



autofilter

This parameter is ON, by default. When set to OFF, the header row doesn't show the dropdown arrows to set the filter criteria.

name

In Excel worksheet, the tables are named as Table1, Table2, etc. The *name* parameter can be used to set the name of the table as required.

```
ws.add_table("A1:E4", {'data':data, 'name':'marklist'})
```

formula

Column with a formula can be created by specifying formula sub-property in columns options.

Example

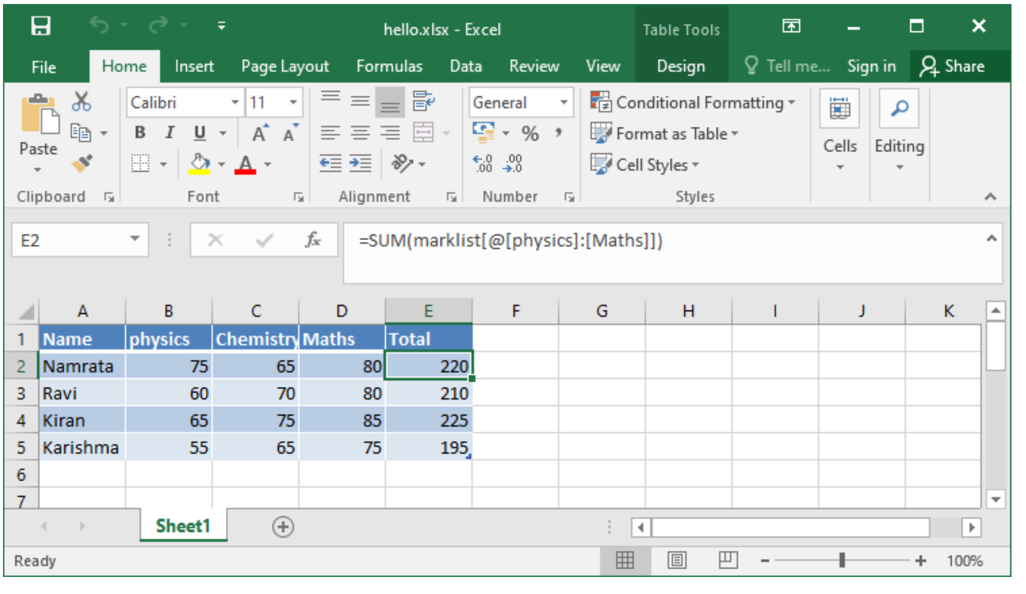
In the following example, the table's name property is set to 'marklist'. The formula for 'Total' column E performs sum of marks, and is assigned the value of formula sub-property.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


data = [
    ['Namrata', 75, 65, 80],
    ['Ravi', 60, 70, 80],
    ['Kiran', 65, 75, 85],
    ['Karishma', 55, 65, 75],


]
formula = '=SUM(marklist[@[physics]:[Maths]])'
tbl = ws.add_table("A1:E5",
```

```
                        {'data': data,
                         'autofilter': False,
                         'name': 'marklist',
                         'columns': [
                             {'header': 'Name'},
                             {'header': 'physics'},
                             {'header': 'Chemistry'},
                             {'header': 'Maths'},
                             {'header': 'Total', 'formula': formula}]
                         })
wb.close()
```

Output:

When the above code is executed, the worksheet shows the **Total** column with the sum of marks.



10. XlsxWriter – Applying Filter

In Excel, you can set filter on a tabular data based upon criteria using logical expressions. In XlsxWriter's worksheet class, we have **autofilter()** method or the purpose. The mandatory argument to this method is the cell range. This creates drop-down selectors in the heading row. To apply some criteria, we have two methods available: **filter_column()** or **filter_column_list()**.

Applying Filter Criteria for a Column

In the following example, the data in the range A1:D51 (i.e. cells 0,0 to 50,3) is used as the range argument for **autofilter()** method. The filter criteria **'Region == East'** is set on 0th column (with Region heading) with **filter_column()** method.

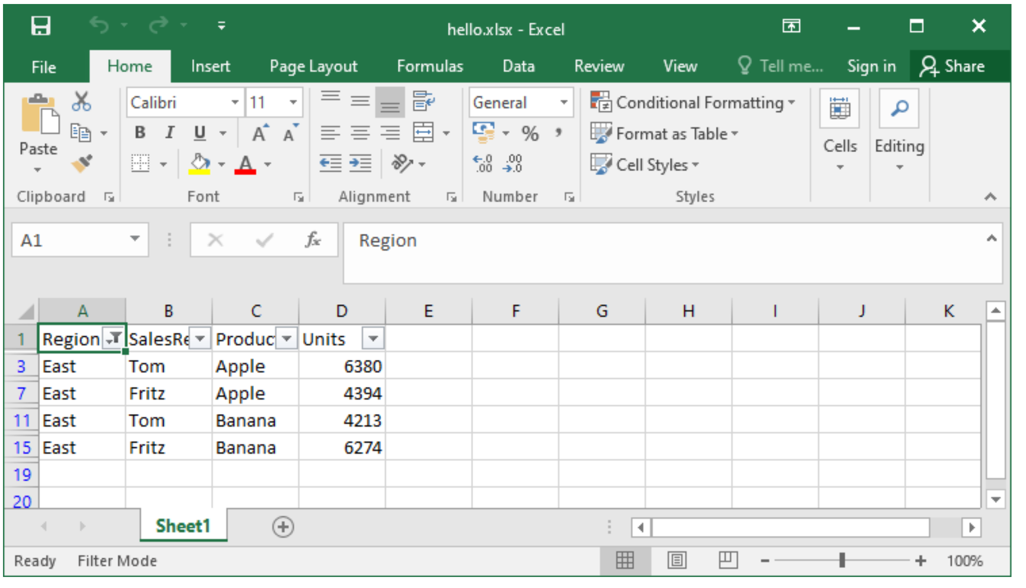
All the rows in the data range not meeting the filter criteria are hidden by setting hidden option to true for the **set_row()** method of the worksheet object.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


data = (['Region', 'SalesRep', 'Product', 'Units'],
        ['East',  'Tom',    'Apple',  6380],
        ['West',  'Fred',   'Grape',  5619],
        ['North', 'Amy',    'Pear',   4565],
        ['South', 'Sal',    'Banana', 5323],
        ['East',  'Fritz',  'Apple',  4394],
        ['West',  'Sravan', 'Grape',  7195],
        ['North', 'Xi',     'Pear',   5231],
        ['South', 'Hector', 'Banana', 2427],
```

```
        ['East',  'Tom',    'Banana', 4213],
        ['West',  'Fred',   'Pear',   3239],
        ['North', 'Amy',    'Grape',  6520],
        ['South', 'Sal',    'Apple',  1310],
        ['East',  'Fritz',  'Banana', 6274],
        ['West',  'Sravan', 'Pear',   4894],
        ['North', 'Xi',     'Grape',  7580],
        ['South', 'Hector', 'Apple',  9814])

for row in range(len(data)):
    ws.write_row(row,0, data[row])

ws.autofilter(0, 0, 50, 3)

ws.filter_column(0, 'Region == East')

row = 1
for row_data in (data):
    region = row_data[0]

    if region != 'East':
        ws.set_row(row, options={'hidden': True})

    ws.write_row(row, 0, row_data)

    row += 1

wb.close()
```

Output:

When we open the worksheet with the help of Excel, we will find that only the rows with Region='East' are visible and others are hidden (which you can display again by clearing the filter).



The column parameter can either be a zero indexed column number or a string column name. All the logical operators allowed in Python can be used in criteria (==, !=, <, >, <=, >=). Filter criteria can be defined on more than one columns and they can be combined by **and** or **or** operators. An example of criteria with logical operator can be as follows:

```
ws.filter_column('A', 'x > 2000')
ws.filter_column('A', 'x != 2000')
ws.filter_column('A', 'x > 2000 and x<5000')
```

Note that "**x**" in the criteria argument is just a formal place holder and can be any suitable string as it is ignored anyway internally.

```
ws.filter_column('A', 'price > 2000')
ws.filter_column('A', 'x != 2000')
ws.filter_column('A', 'marks > 60 and x<75')
```

XlsxWriter also allows the use of wild cards "*" and "?" in the filter criteria on columns containing string data.

```
ws.filter_column('A', name=K*') #starts with K

ws.filter_column('A', name=*K*') #contains K

ws.filter_column('A', name=?K*') # second character as K

ws.filter_column('A', name=*K??') #any two characters after K
```

Example:

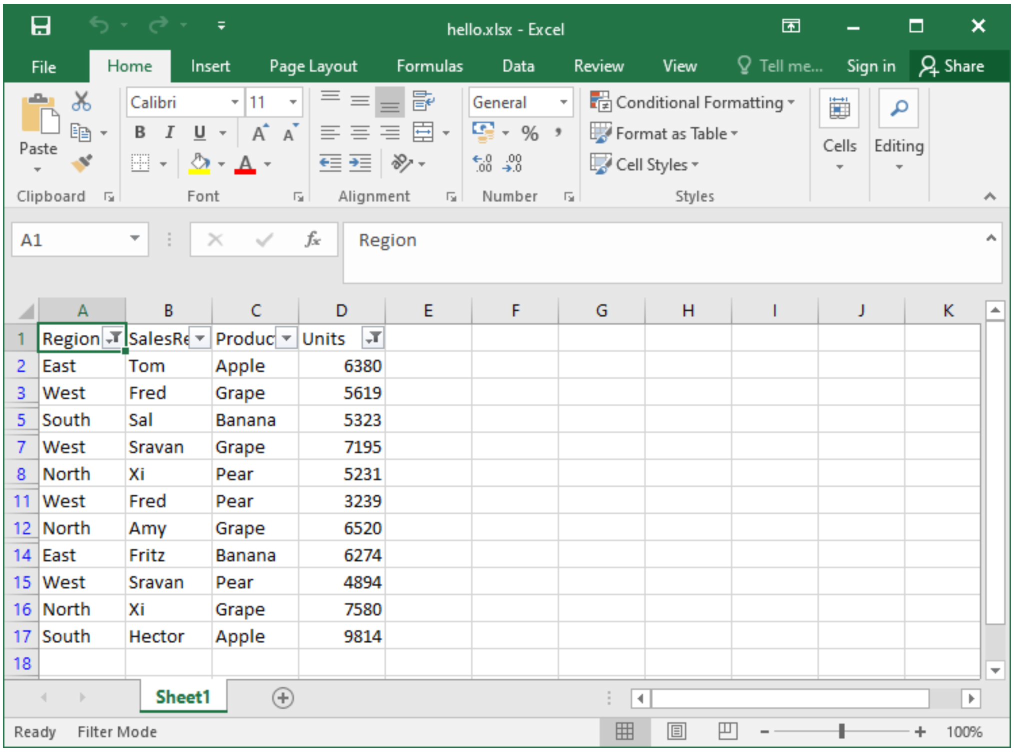
In the following example, first filter on column A requires region to be West and second filter's criteria on column D is "**`units > 5000`**". Rows not satisfying the condition "**`region = West`**" or "**`units > 5000`**" are hidden.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


data = (['Region', 'SalesRep', 'Product', 'Units'],
        ['East',  'Tom',    'Apple',  6380],
        ['West',  'Fred',   'Grape',  5619],
        ['North', 'Amy',    'Pear',   4565],
        ['South', 'Sal',    'Banana', 5323],
        ['East',  'Fritz',  'Apple',  4394],
        ['West',  'Sravan', 'Grape',  7195],
        ['North', 'Xi',     'Pear',   5231],
        ['South', 'Hector', 'Banana', 2427],
        ['East',  'Tom',    'Banana', 4213],
        ['West',  'Fred',   'Pear',   3239],
        ['North', 'Amy',    'Grape',  6520],
        ['South', 'Sal',    'Apple',  1310],
        ['East',  'Fritz',  'Banana', 6274],
        ['West',  'Sravan', 'Pear',   4894],
```

```
        ['North', 'Xi',     'Grape',  7580],
        ['South', 'Hector', 'Apple',  9814])

for row in range(len(data)):
    ws.write_row(row,0, data[row])

ws.autofilter(0, 0, 50, 3)

ws.filter_column('A', 'x == West')
ws.filter_column('D', 'x > 5000')

row = 1
for row_data in (data[1:]):
    region = row_data[0]
    volume = int(row_data[3])

    if region == 'West' or volume > 5000:
        pass
    else:
        ws.set_row(row, options={'hidden': True})

    ws.write_row(row, 0, row_data)
    row += 1

wb.close()
```

Output:

In Excel, the filter icon can be seen on columns A and D headings. The filtered data is seen as below:



Applying a Column List Filter

The **filter_column_list()** method can be used to represent filters with multiple selected criteria in Excel 2007 style.

```
ws.filter_column_list(col,list)
```

The second argument is a list of values against which the data in a given column is matched. For example:

```
ws.filter_column_list('C', ['March', 'April', 'May'])
```

It results in filtering the data so that value in column C matches with any item in the list.

Example

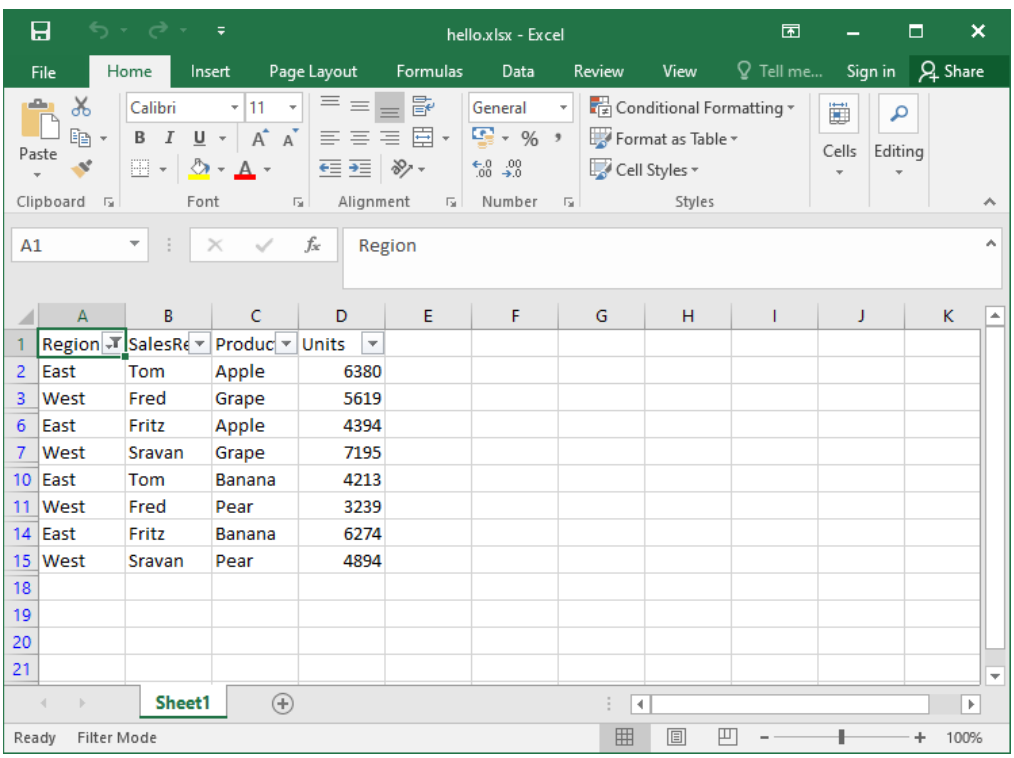
In the following example, the **filter_column_list()** method is used to filter the **rows** with region equaling either East or West.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data = (['Region', 'SalesRep', 'Product', 'Units'],
        ['East',  'Tom',    'Apple',  6380],
        ['West',  'Fred',   'Grape',  5619],
        ['North', 'Amy',    'Pear',   4565],
        ['South', 'Sal',    'Banana', 5323],
        ['East',  'Fritz',  'Apple',  4394],
        ['West',  'Sravan', 'Grape',  7195],
        ['North', 'Xi',     'Pear',   5231],
        ['South', 'Hector', 'Banana', 2427],
        ['East',  'Tom',    'Banana', 4213],
        ['West',  'Fred',   'Pear',   3239],
        ['North', 'Amy',    'Grape',  6520],
        ['South', 'Sal',    'Apple',  1310],
        ['East',  'Fritz',  'Banana', 6274],
        ['West',  'Sravan', 'Pear',   4894],
        ['North', 'Xi',     'Grape',  7580],
        ['South', 'Hector', 'Apple',  9814])

for row in range(len(data)):
    ws.write_row(row,0, data[row])

ws.autofilter(0, 0, 50, 3)

l1= ['East', 'West']
ws.filter_column_list('A', l1)

row = 1
for row_data in (data[1:]):
```

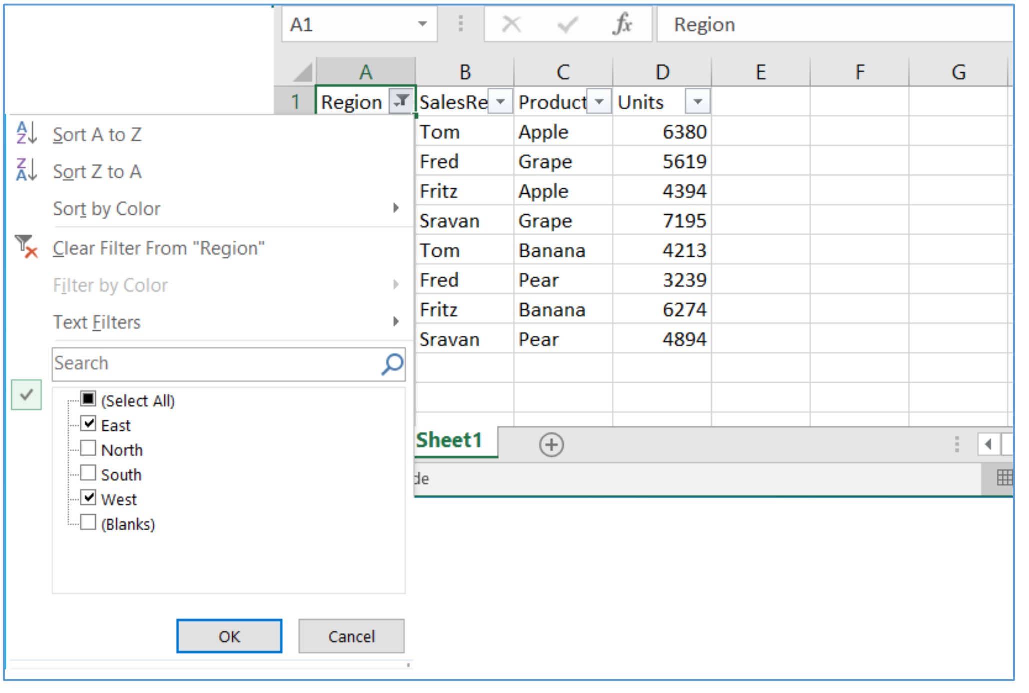
```
    region = row_data[0]

    if region not in l1:
        ws.set_row(row, options={'hidden': True})

    ws.write_row(row, 0, row_data)
    row += 1

wb.close()
```

Output:

The Column A shows that the autofilter is applied. All the rows with Region as East or West are displayed and rest are hidden.



From the Excel software, click on the **filter** selector arrow in the **Region** heading and we should see that the filter on region equal to East or West is applied.



11. XlsxWriter – Fonts and Colors

Working with Fonts

To perform formatting of worksheet cell, we need to use Format object with the help of **add_format()** method and configure it with its properties or formatting methods.

```
f1 = workbook.add_format()
f1 = set_bold(True)
# or
f2 = wb.add_format({'bold':True})
```

This format object is then used as an argument to worksheet's `write()` method.

```
ws.write('B1', 'Hello World', f1)
```

Example

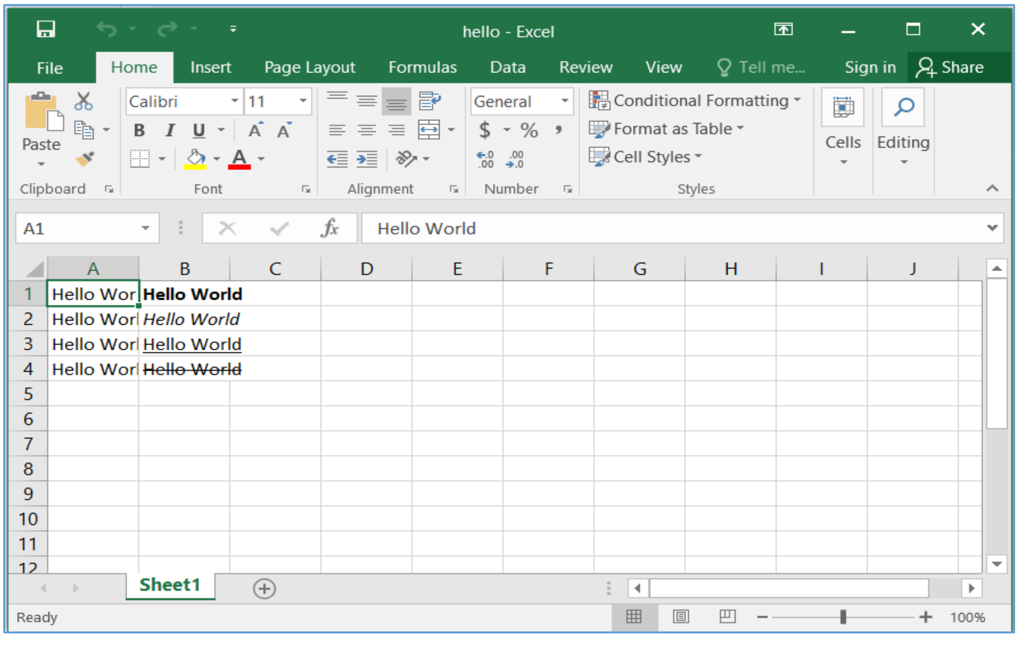
To make the text in a cell **bold**, **underline**, **italic** or **strike through**, we can either use these properties or corresponding methods. In the following example, the text Hello World is written with set methods.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


for row in range(4):
    ws.write(row,0, "Hello World")


f1=wb.add_format()
f2=wb.add_format()
f3=wb.add_format()
```

```
f4=wb.add_format()

f1.set_bold(True)
ws.write('B1', '=A1', f1)

f2.set_italic(True)
ws.write('B2', '=A2', f2)

f3.set_underline(True)
ws.write('B3', '=A3', f3)

f4.set_font_strikeout(True)
ws.write('B4', '=A4', f4)

wb.close()
```

Output:

Here is the result:



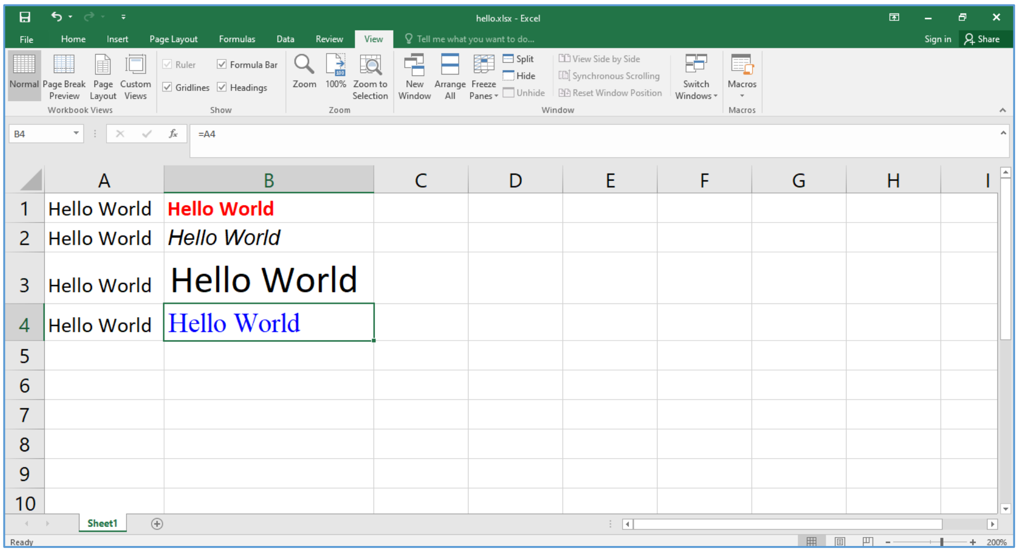
Example

On the other hand, we can use **font_color**, **font_name** and **font_size** properties to format the text as in the following example:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

for row in range(4):
    ws.write(row,0, "Hello World")

f1=wb.add_format({'bold':True, 'font_color':'red'})
f2=wb.add_format({'italic':True,'font_name':'Arial'})
f3=wb.add_format({'font_size':20})
f4=wb.add_format({'font_color':'blue','font_size':14,'font_nam
e':'Times New Roman'})

ws.write('B1', '=A1', f1)
ws.write('B2', '=A2', f2)
ws.write('B3', '=A3', f3)
ws.write('B4', '=A4', f4)

wb.close()
```

Output:

The output of the above code can be verified by opening the worksheet with Excel:



Text Alignment

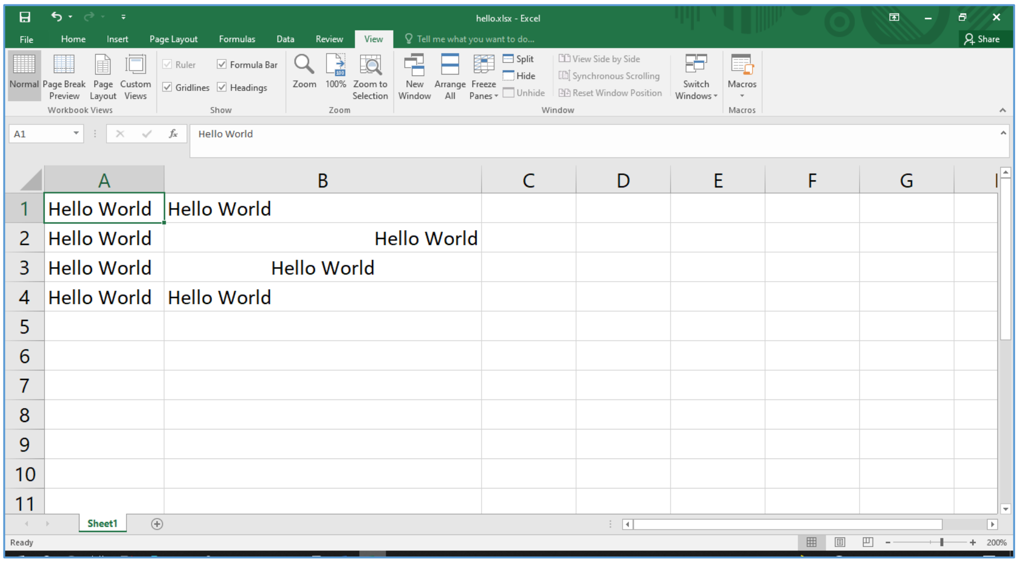
XlsxWriter's Format object can also be created with alignment methods/properties. The align property can have **left**, **right**, **center** and **justify** values.

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()
for row in range(4):
    ws.write(row,0, "Hello World")
ws.set_column('B:B', 30)


f1=wb.add_format({'align':'left'})
f2=wb.add_format({'align':'right'})
f3=wb.add_format({'align':'center'})
f4=wb.add_format({'align':'justify'})
ws.write('B1', '=A1', f1)
ws.write('B2', '=A2', f2)
ws.write('B3', '=A3', f3)
```

```
ws.write('B4', 'Hello World', f4)

wb.close()
```

Output:

The following output shows the text "Hello World" with different alignments. Note that the width of B column is set to 30 by **set_column()** method of the worksheet object.



Example:

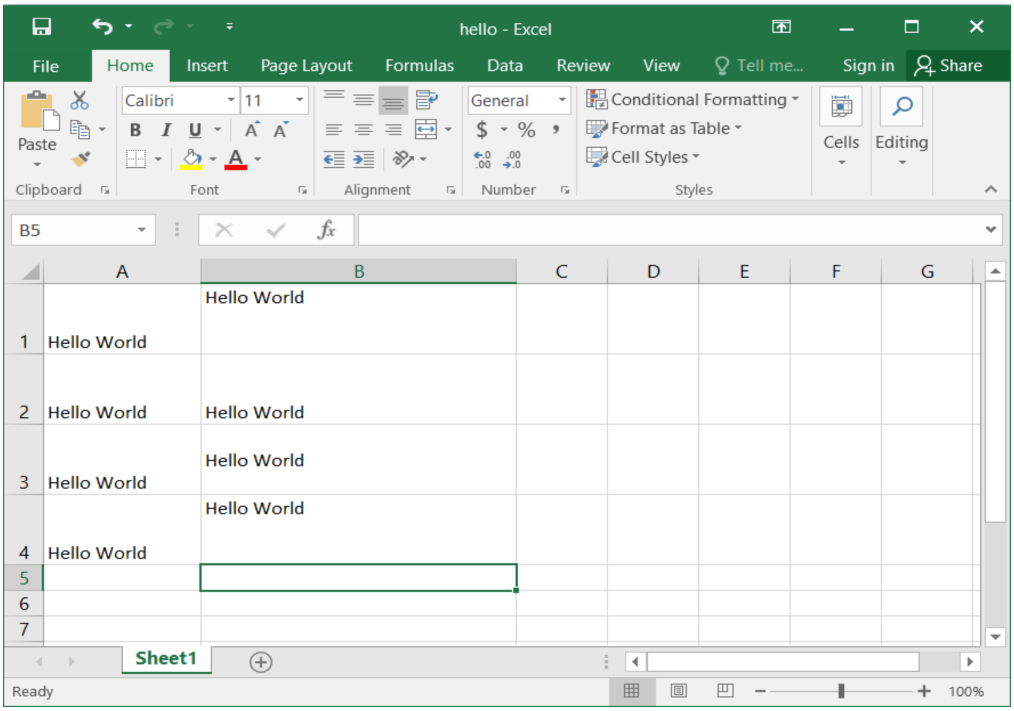
Format object also has **valign** properties to control vertical placement of the cell.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

for row in range(4):
    ws.write(row,0, "Hello World")
```

```
ws.set_column('B:B', 30)


for row in range(4):
    ws.set_row(row, 40)
f1=wb.add_format({'valign':'top'})
f2=wb.add_format({'valign':'bottom'})
f3=wb.add_format({'align':'vcenter'})
f4=wb.add_format({'align':'vjustify'})


ws.write('B1', '=A1', f1)
ws.write('B2', '=A2', f2)
ws.write('B3', '=A3', f3)
ws.write('B4', '=A4', f4)


wb.close()
```

Output:

In the above code, the height of rows 1 to 4 is set to 40 with set_row() method.



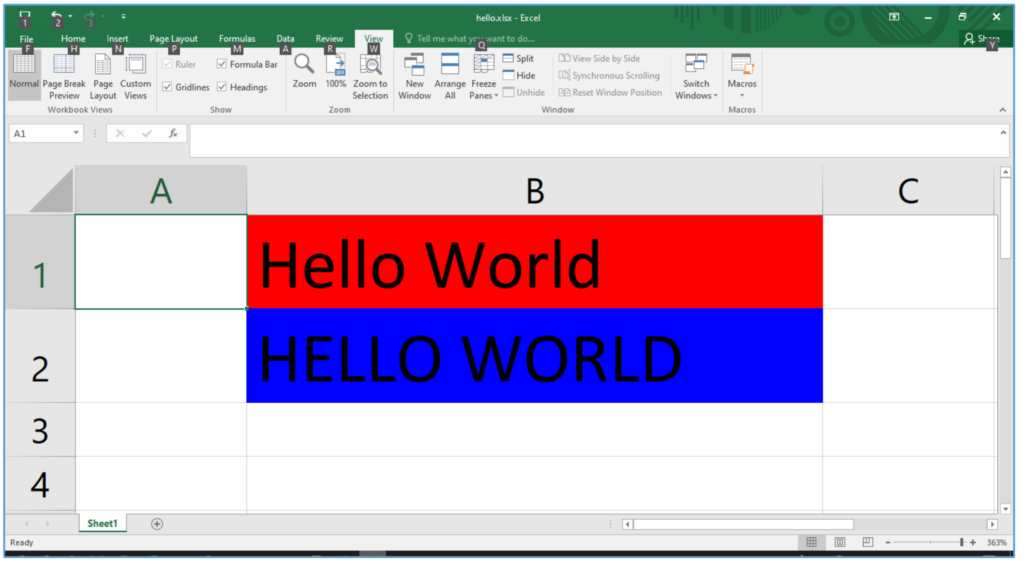
Cell Background and Foreground Colors

Two important properties of Format object are **bg_color** and **fg_color** to set the background and foreground color of a cell.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()
ws.set_column('B:B', 30)

f1=wb.add_format({'bg_color':'red',  'font_size':20})
f2=wb.add_format({'bg_color':'#0000FF',  'font_size':20})

ws.write('B1', 'Hello World', f1)
ws.write('B2', 'HELLO WORLD', f2)
wb.close()
```

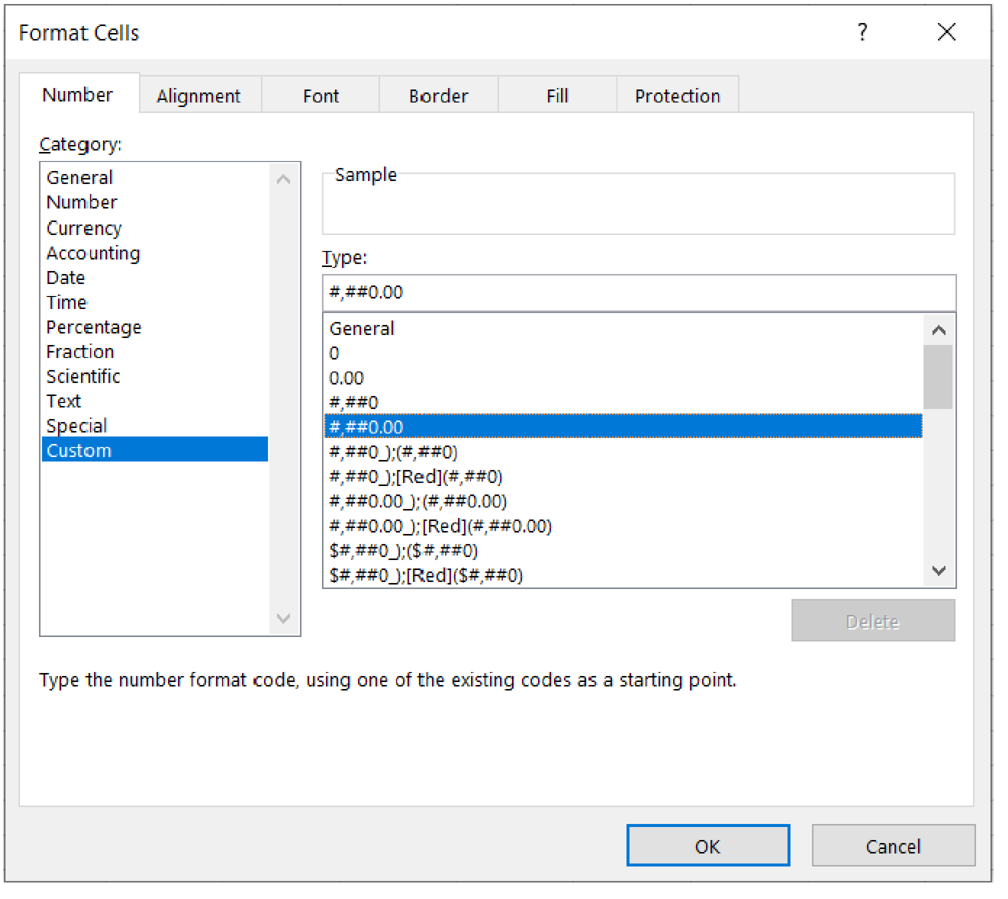
Output:

The result of above code looks like this:



12. XlsxWriter – Number Formats

In Excel, different formatting options of numeric data are provided in the **Number** tab of **Format Cells** menu.



To control the formatting of numbers with XlsxWriter, we can use the **set_num_format()** method or define **num_format** property of **add_format()** method.

```
f1 = wb.add_format()
f1.set_num_format(FormatCode)
#or
f1 = wb.add_format('num_format': FormatCode)
```

Excel has a number of predefined number formats. They can be found under the custom category of Number tab as shown in the above figure. For example, the format code for number with two decimal points and comma separator is #,##0.00.

Example

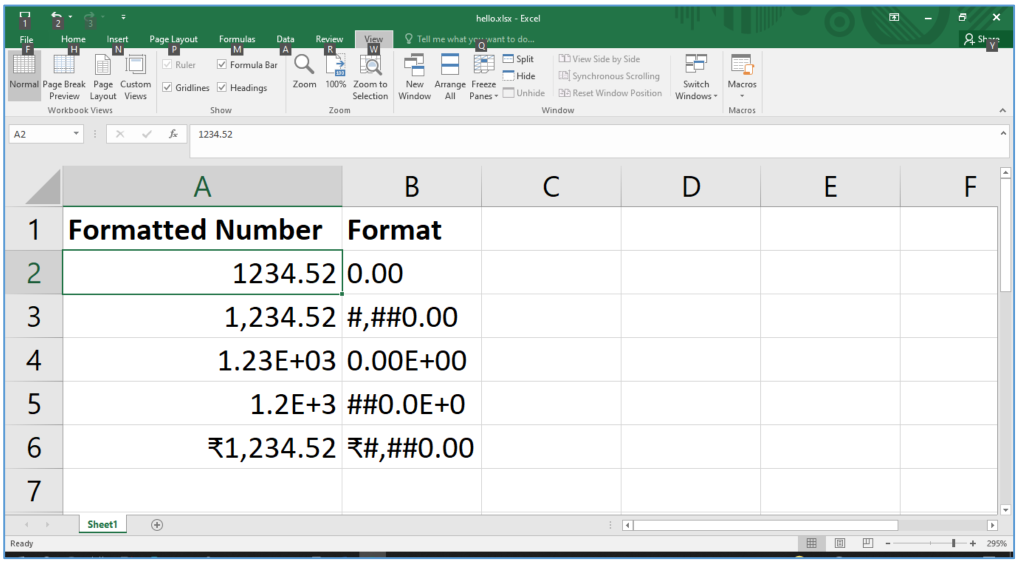
In the following example, a number 1234.52 is formatted with different format codes.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()
ws.set_column('B:B', 30)

num=1234.52

num_formats = (
    '0.00',
    '#,##0.00',
    '0.00E+00',
    '##0.0E+0',
    '₹#,##0.00',
    )

ws.write('A1', 'Formatted Number')
ws.write('B1', 'Format')

row = 1
for fmt in num_formats:
    format = wb.add_format({'num_format': fmt})
    ws.write_number(row, 0, num, format)
    ws.write_string(row, 1, fmt)
    row += 1
```

```
wb.close()
```

Output:

The formatted number along with the format code used is shown in the following figure:



13. XlsxWriter – Border

This section describes how to apply and format the appearance of cell border as well as a border around text box.

Working with Cell Border

The properties in the **add_format()** method that control the appearance of cell border are as shown in the following table:

Description	Property	method
Cell border	'border'	set_border()
Bottom border	'bottom'	set_bottom()
Top border	'top'	set_top()
Left border	'left'	set_left()
Right border	'right'	set_right()
Border color	'border_color'	set_border_color()
Bottom color	'bottom_color'	set_bottom_color()
Top color	'top_color'	set_top_color()
Left color	'left_color'	set_left_color()
Right color	'right_color'	set_right_color()

Note that for each property of **add_format()** method, there is a corresponding format class method starting with the **set_propertyname()** method.

For example, to set a border around a cell, we can use border property in **add_format()** method as follows:

```
f1= wb.add_format({ 'border':2})
```

The same action can also be done by calling the **set_border()** method:

```
f1 = workbook.add_format()

f1.set_border(2)
```

Individual border elements can be configured by the properties or format methods as follows:

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

These border methods/properties have an integer value corresponding to the predefined styles as in the following table:

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	/ - . / - .

Example

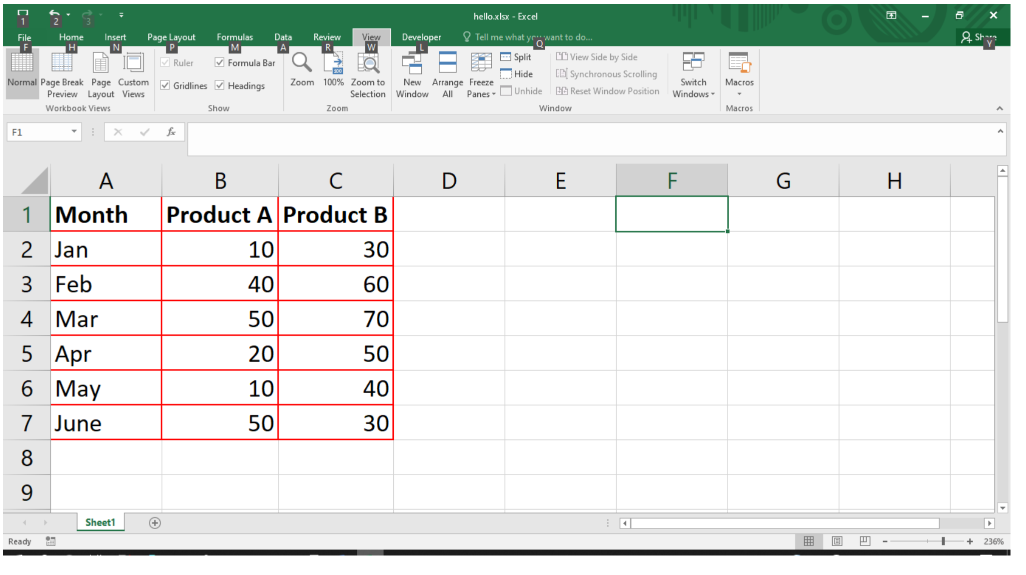
Following code shows how the border property is used. Here, each row is having a border style 2 corresponding to continuous bold.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


f1=wb.add_format({'bold':True, 'border':2, 'border_color':'red'})
f2=wb.add_format({'border':2, 'border_color':'red'})


headings = ['Month', 'Product A', 'Product B']
```

```
data = [
    ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'June'],
    [10, 40, 50, 20, 10, 50],
    [30, 60, 70, 50, 40, 30],
]

ws.write_row('A1', headings, f1)
ws.write_column('A2', data[0], f2)
ws.write_column('B2', data[1],f2)
ws.write_column('C2', data[2],f2)

wb.close()
```

Output:

The worksheet shows a bold border around the cells.



Working with Textbox Border

The border property is also available for the text box object. The text box also has a line property which is similar to border, so that they can be used interchangeably. The border itself can further be formatted by none, color, width and **dash_type** parameters.

Line or border set to none means that the text box will not have any border. The **dash_type** parameter can be any of the following values:

- solid
- round_dot
- square_dot
- dash
- dash_dot
- long_dash
- long_dash_dot
- long_dash_dot_dot

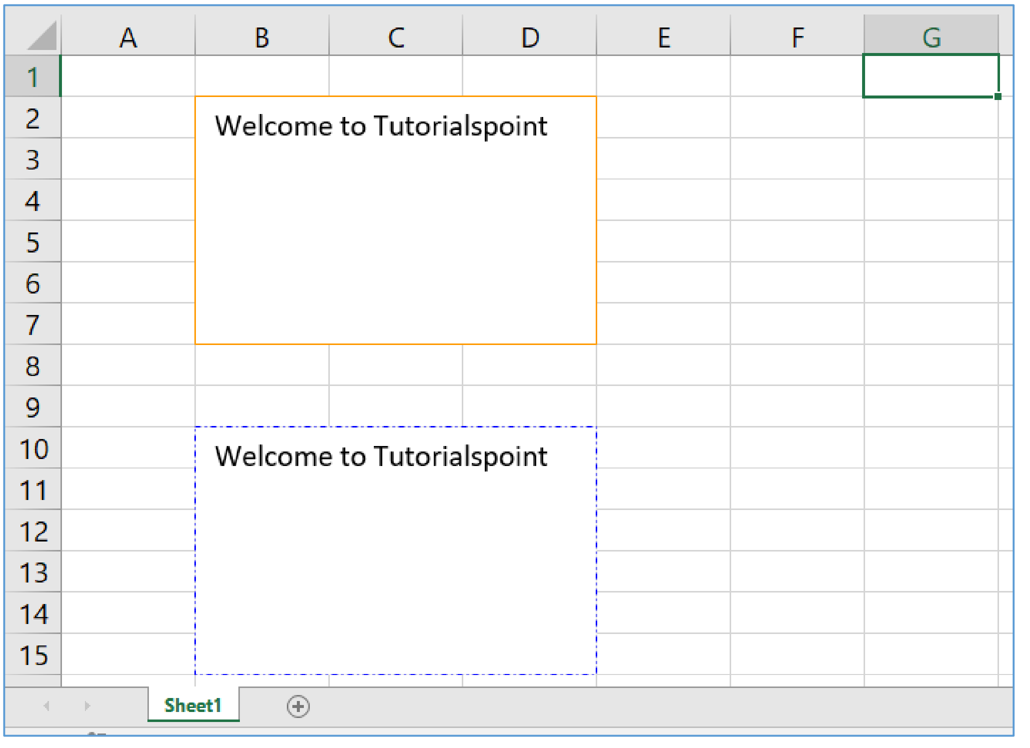
Example

Here is a program that displays two text boxes, one with a solid border, red in color; and the second box has **dash_dot** type border in blue color.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


ws.insert_textbox('B2', 'Welcome to Tutorialspoint',
                  {'border': {'color': '#FF9900'}})


ws.insert_textbox('B10', 'Welcome to Tutorialspoint',
                         {'line':
                              {'color': 'blue',
                               'dash_type': 'dash_dot'}
                         })
wb.close()
```

Output:

The output worksheet shows the textbox borders.


A
B
C
D
E
F
G
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Welcome to Tutorialspoint
Welcome to Tutorialspoint
Sheet1

14. XlsxWriter – Hyperlinks

A **hyperlink** is a string, which when clicked, takes the user to some other location, such as a URL, another worksheet in the same workbook or another workbook on the computer. Worksheet class provides **write_url()** method for the purpose. Hyperlinks can also be placed inside a textbox with the use of url property.

First, let us learn about **write_url()** method. In addition to the Cell location, it needs the URL string to be directed to.

```
import xlsxwriter


workbook = xlsxwriter.Workbook('hello.xlsx')
worksheet = workbook.add_worksheet()
worksheet.write_url('A1', 'https://www.tutorialspoint.com/index.htm')


workbook.close()
```

This method has a few optional parameters. One is a Format object to configure the font, color properties of the URL to be displayed. We can also specify a tool tip string and a display text foe the URL. When the text is not given, the URL itself appears in the cell.

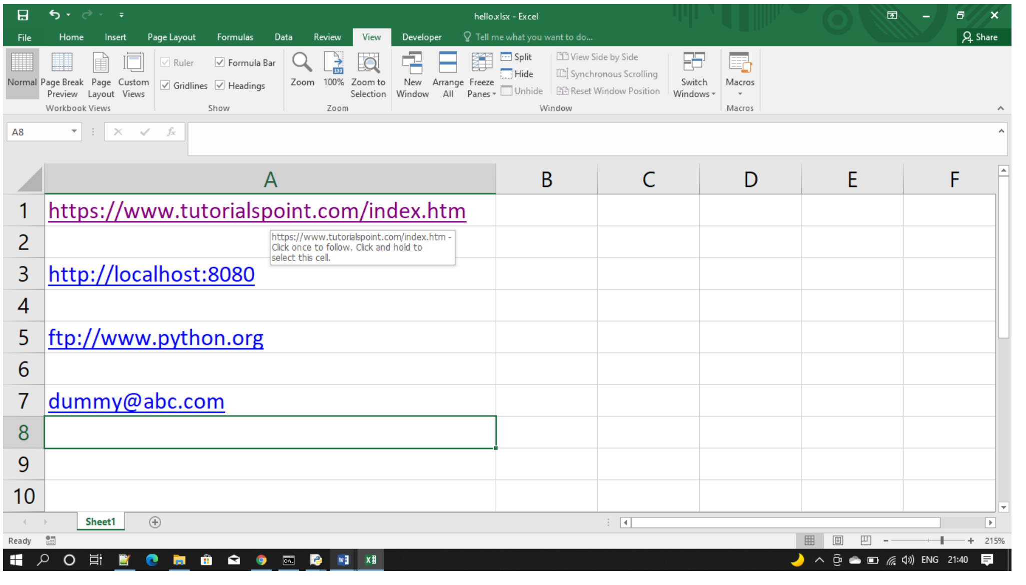
Different types of URLs supported are **http://**, **https://**, **ftp://** and **mailto:**. In the example below, we use these URLs.

```
import xlsxwriter


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


worksheet.write_url('A1', 'https://www.tutorialspoint.com/index.htm')
worksheet.write_url('A3', 'http://localhost:8080')
worksheet.write_url('A5', 'ftp://www.python.org')
```

```
worksheet.write_url('A7', 'mailto:dummy@abc.com')

workbook.close()
```

Output:

Run the above code and open the **`hello.xlsx`** file using Excel.



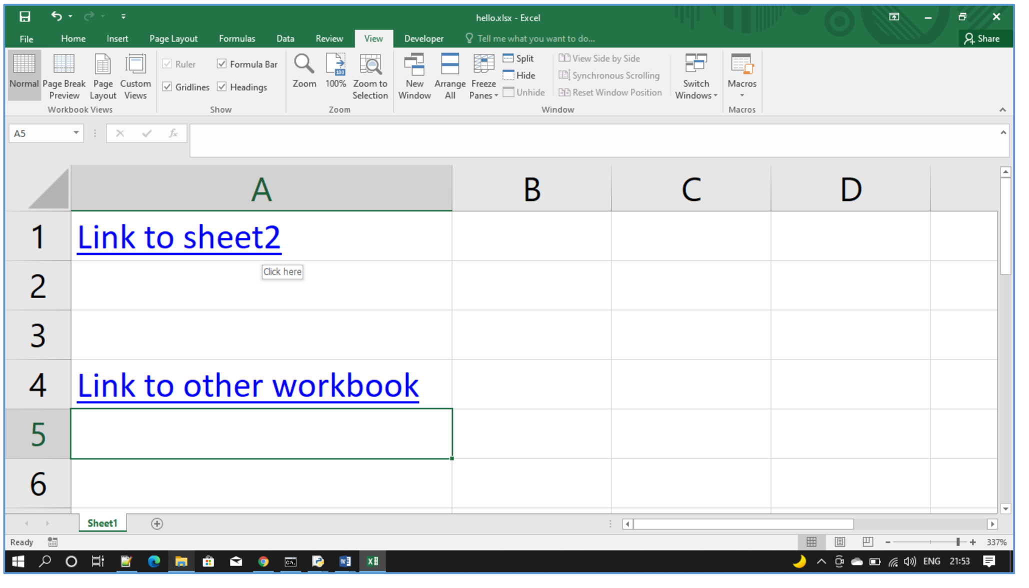
We can also insert hyperlink to either another workskeet in the same workbook, or another workbook. This is done by prefixing with **internal:** or **external:** the local URIs.

```
import xlsxwriter

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

worksheet.write_url('A1',
                    'internal:Sheet2!A1',
                    string="Link to sheet2",
                    tip="Click here")
```

```
worksheet.write_url('A4',
                    "external:c:/test/testlink.xlsx",
                    string="Link to other workbook" )

workbook.close()
```

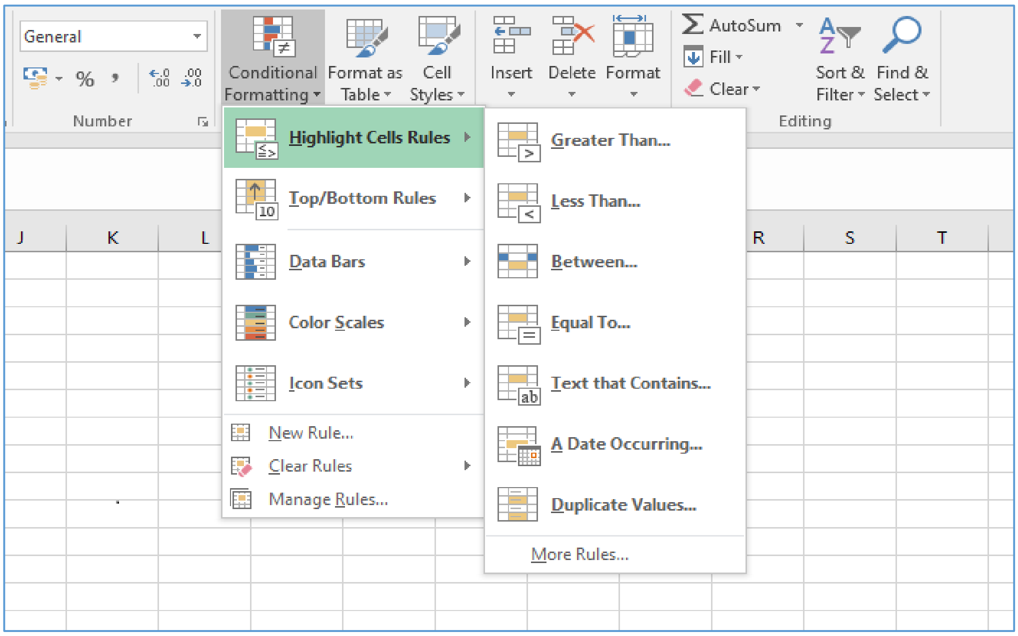
Output:

Note that the **string** and **tip** parameters are given as an alternative text to the **link** and **tool tip**. The output of the above program is as given below:

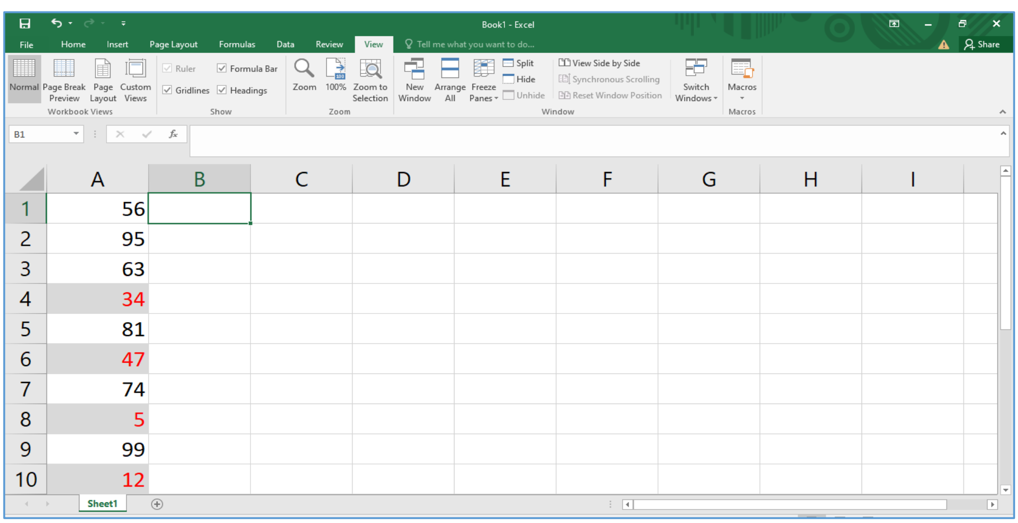


15. XlsxWriter – Conditional Formatting

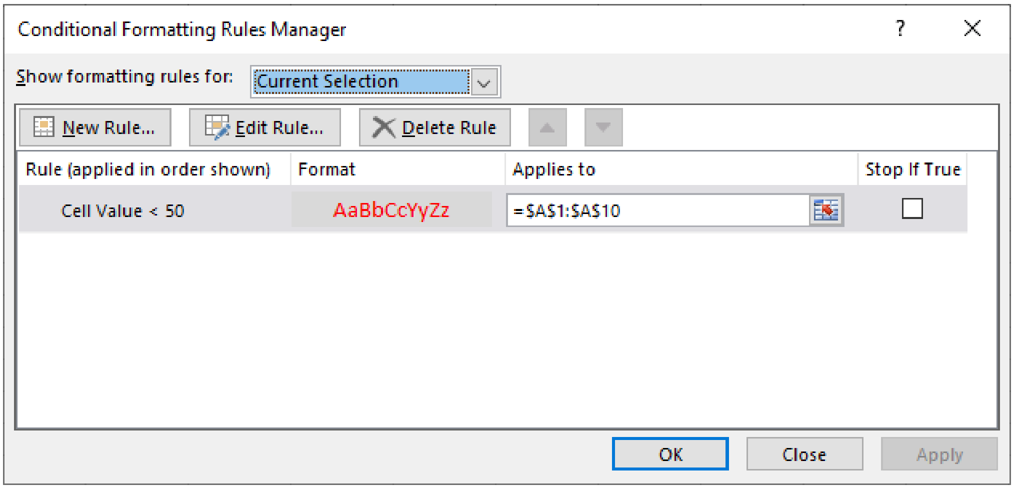
Excel uses **conditional formatting** to change the appearance of cells in a range based on user defined criteria. From the conditional formatting menu, it is possible to define criteria involving various types of values.



In the worksheet shown below, the column A has different numbers. Numbers less than 50 are shown in red font color and grey background color.



This is achieved by defining a conditional formatting rule below:



The conditional_format() method

In XlsxWriter, there as a **conditional_format()** method defined in the Worksheet class. To achieve the above shown result, the **conditional_format()** method is called as in the following code:

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')

ws = wb.add_worksheet()


data=[56,95,63,34,81,47,74,5,99,12]

row=0


for num in data:

    ws.write(row,0,num)

    row+=1

f1 = wb.add_format({'bg_color': '#D9D9D9',

                    'font_color': 'red'})

ws.conditional_format('A1:A10', {'type':'cell',
```

```
                                    'criteria':'<',
                                    'value':50,
                                    'format':f1
                                    }
                        )
wb.close()
```

Parameters:

The **conditional_format()** method's first argument is the cell range, and the second argument is a dictionary of conditional formatting options.

The options dictionary configures the conditional formatting rules with the following parameters:

The `type` option is a required parameter. Its value is either cell, date, text, formula, etc. Each parameter has sub-parameters such as criteria, value, format, etc.

- **type** is the most common conditional formatting type. It is used when a format is applied to a cell based on a simple criterion.
- **criteria** parameter sets the condition by which the cell data will be evaluated. All the logical operator in addition to between and not between operators are the possible values of criteria parameter.
- **value** parameter is the operand of the criteria that forms the rule.
- **format** parameter is the Format object (returned by the `add_format()` method). This defines the formatting features such as font, color, etc. to be applied to cells satisfying the criteria.

The **date** type is similar the cell type and uses the same criteria and values. However, the value parameter should be given as a `datetime` object.

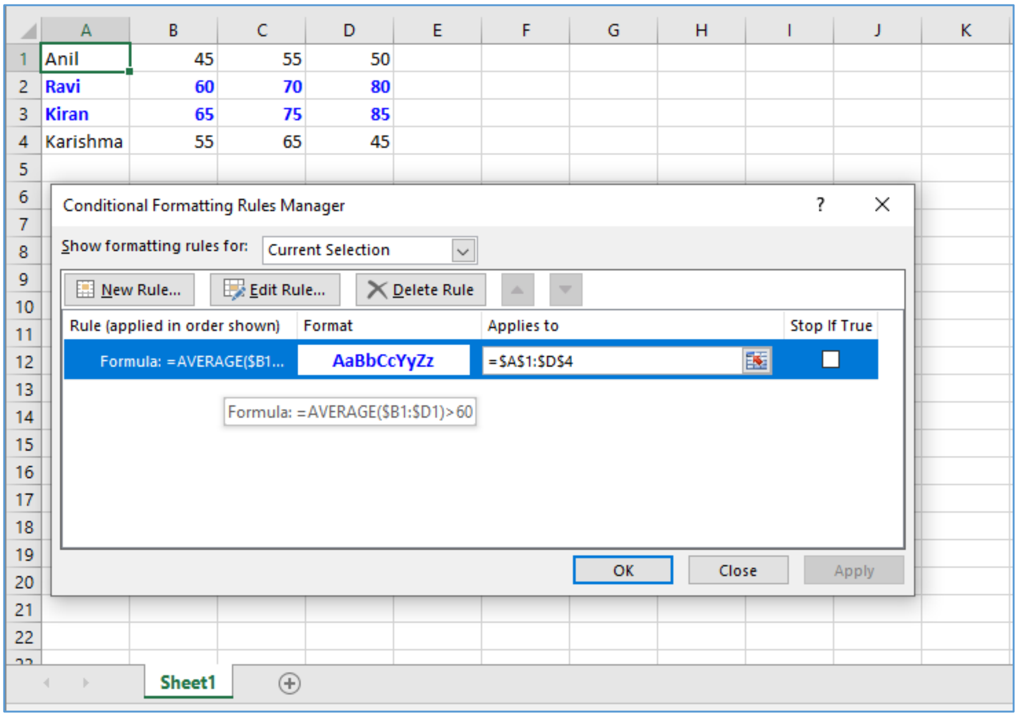
The **text** type specifies Excel's "Specific Text" style conditional format. It is used to do simple string matching using the criteria and value parameters.

When **formula** type is used, the conditional formatting depends on a user defined formula.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data = [['Anil', 45, 55, 50], ['Ravi', 60, 70, 80],
        ['Kiran', 65, 75, 85], ['Karishma', 55, 65, 45]]

for row in range(len(data)):
    ws.write_row(row,0, data[row])

f1 = wb.add_format({'font_color': 'blue', 'bold':True})

ws.conditional_format('A1:D4',
                      {'type':'formula',
                       'criteria':'=AVERAGE($B1:$D1)>60',
                       'value':50,
                       'format':f1
                       })
wb.close()
```

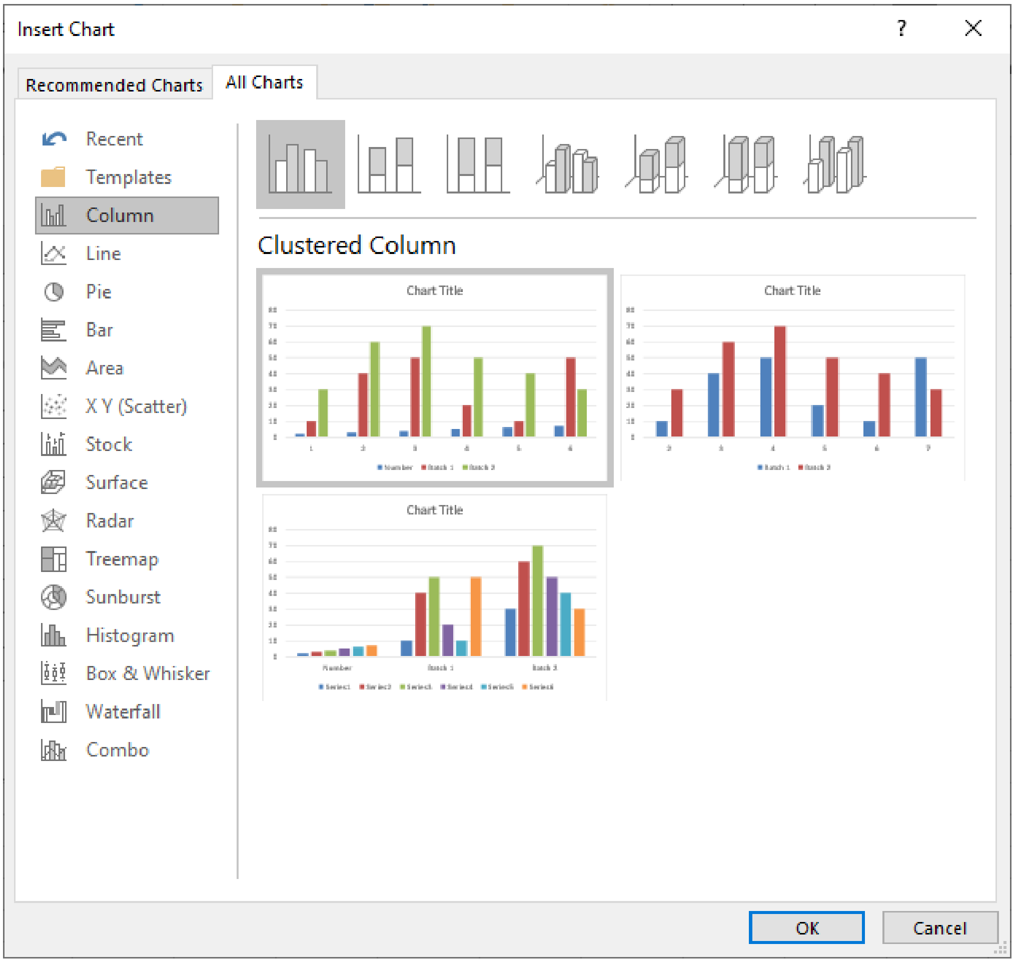
Output:

Open the resultant workbook using MS Excel. We can see the rows satisfying the above condition displayed in blue color according to the format object. The conditional format rule manager also shows the criteria that we have set in the above code.


Anil 45 55 50
Ravi 60 70 80
Kiran 65 75 85
Karishma 55 65 45
Conditional Formatting Rules Manager
Show formatting rules for: Current Selection
New Rule...
Edit Rule...
Delete Rule
Rule (applied in order shown)
Format
Applies to
Stop If True
Formula: =AVERAGE($B1...
AaBbCcYyZz
=$A$1:$D$4
Formula: =AVERAGE($B1:$D1)>60
OK
Close
Apply
Sheet1

16. XlsxWriter – Adding Charts

One of the most important features of Excel is its ability to convert data into chart. A chart is a visual representation of data. Different types of charts can be generated from the `Chart` menu.



To generate charts programmatically, XlsxWriter library has a Chart class. Its object is obtained by calling **add_chart()** method of the Workbook class. It is then associated with the data ranges in the worksheet with the help of **add_series()** method. The chart object is then inserted in the worksheet using its **insert_chart()** method.

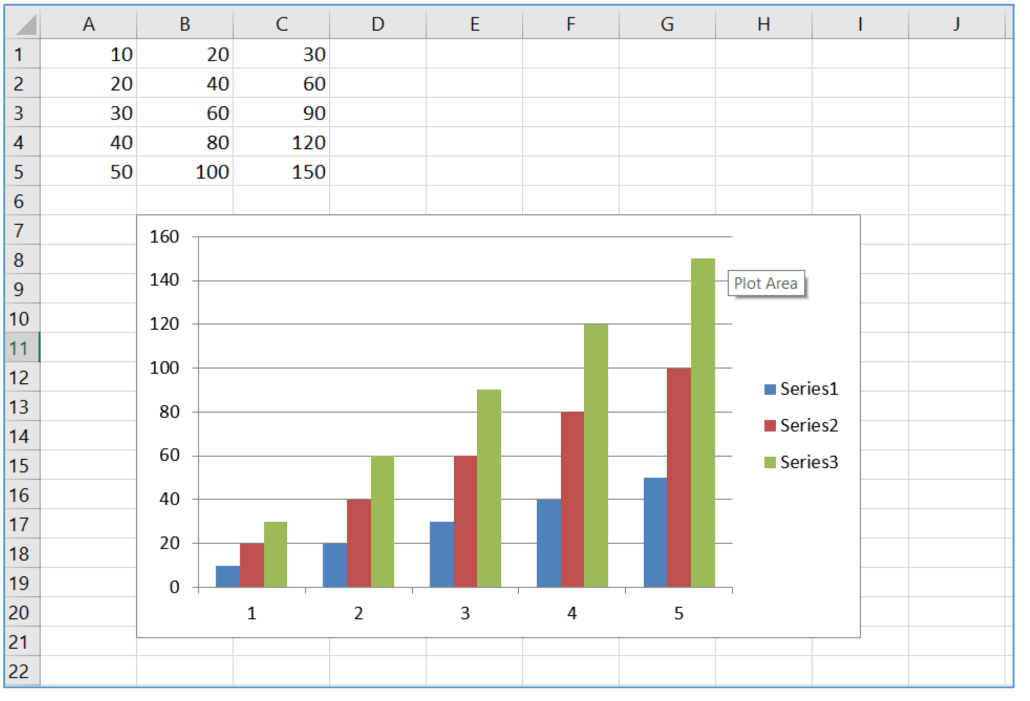
Example

Given below is the code for displaying a simple column chart.

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
chart = wb.add_chart({'type': 'column'})

data = [
    [10, 20, 30, 40, 50],
    [20, 40, 60, 80, 100],
    [30, 60, 90, 120, 150],
]

worksheet.write_column('A1', data[0])
worksheet.write_column('B1', data[1])
worksheet.write_column('C1', data[2])

chart.add_series({'values': '=Sheet1!$A$1:$A$5'})
chart.add_series({'values': '=Sheet1!$B$1:$B$5'})
chart.add_series({'values': '=Sheet1!$C$1:$C$5'})

worksheet.insert_chart('B7', chart)

wb.close()
```

Output:

The generated chart is embedded in the worksheet and appears as follows:



The **add_series()** method has following additional parameters:

- **values**: This is the most important property mandatory option. It links the chart with the worksheet data that it displays.
- **categories**: This sets the chart category labels. If not given, the chart will just assume a sequential series from 1…n.
- **name**: Set the name for the series. The name is displayed in the formula bar.
- **line**: Set the properties of the series line type such as color and width.
- **border**: Set the border properties of the series such as color and style.
- **fill**: Set the solid fill properties of the series such as color.
- **pattern**: Set the pattern fill properties of the series.
- **gradient**: Set the gradient fill properties of the series.

- **data_labels**: Set data labels for the series.
- **points**: Set properties for individual points in a series.

In the following examples, while adding the data series, the value and categories properties are defined. The data for the example is:

```
# Add the worksheet data that the charts will refer to.
headings = ['Name', 'Phy', 'Maths']
data = [
    ["Jay", 30, 60],
    ["Mohan", 40, 50],
    ["Veeru", 60, 70],
]
```

After creating the chart object, the first data series corresponds to the column with phy as the value of name property. Names of the students in the first column are used as categories

```
chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$4',
    'values':     '=Sheet1!$B$2:$B$4',
})
```

The second data series too refers to names in column A as categories and column C with heading as Maths as the values property.

```
chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 3, 0],
    'values':     ['Sheet1', 1, 2, 3, 2],
})
```

Example

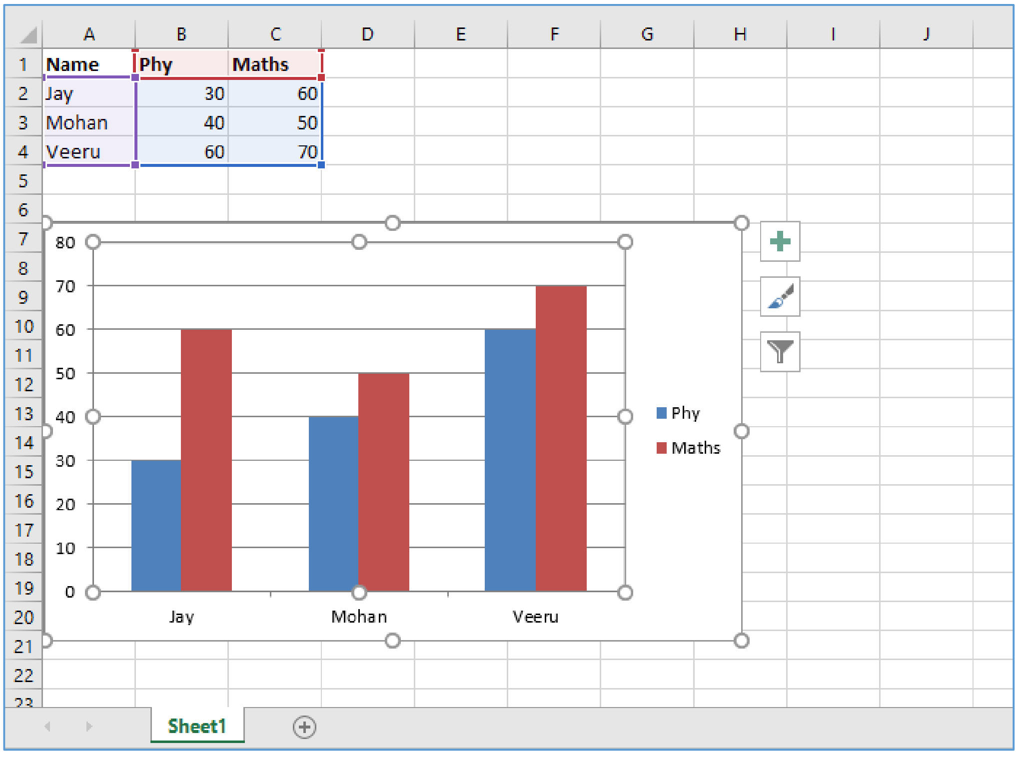
Here is the complete example code:

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
chart1 = wb.add_chart({'type': 'column'})

# Add the worksheet data that the charts will refer to.
headings = ['Name', 'Phy', 'Maths']
data = [
    ["Jay", 30, 60],
    ["Mohan", 40, 50],
    ["Veeru", 60, 70],
]

worksheet.write_row(0,0, headings)
worksheet.write_row(1,0, data[0])
worksheet.write_row(2,0, data[1])
worksheet.write_row(3,0, data[2])

chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$4',
    'values':     '=Sheet1!$B$2:$B$4',
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 3, 0],
    'values':     ['Sheet1', 1, 2, 3, 2],
})
```

```
worksheet.insert_chart('B7', chart1)

wb.close()
```

Output:

The worksheet and the chart based on it appears as follows:



The **add_series()** method also has **`data_labels`** property. If set to True, values of the plotted data points are displayed on top of each column.

Example:

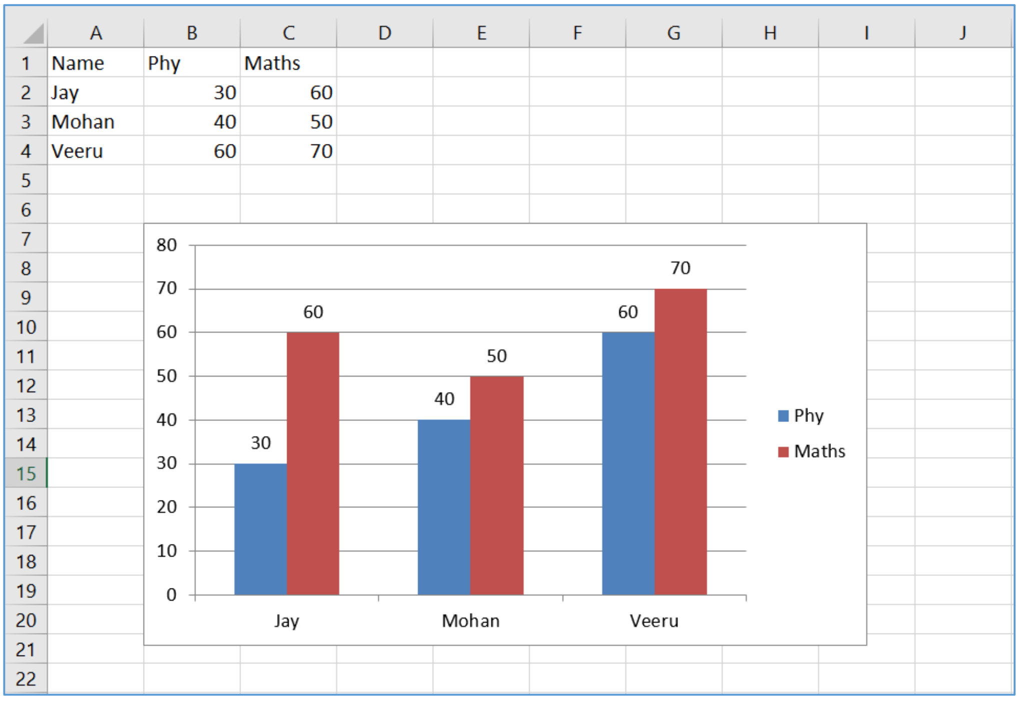
Here is the complete code example for **`add_series()`** method:

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
chart1 = wb.add_chart({'type': 'column'})
```

```
# Add the worksheet data that the charts will refer to.
headings = ['Name', 'Phy', 'Maths']
data = [
    ["Jay", 30, 60],
    ["Mohan", 40, 50],
    ["Veeru", 60, 70],
]

worksheet.write_row(0,0, headings)
worksheet.write_row(1,0, data[0])
worksheet.write_row(2,0, data[1])
worksheet.write_row(3,0, data[2])

chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$4',
    'values':     '=Sheet1!$B$2:$B$4',
    'data_labels': {'value':True},
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 3, 0],
    'values':     ['Sheet1', 1, 2, 3, 2],
    'data_labels': {'value':True},
})

worksheet.insert_chart('B7', chart1)

wb.close()
```

Output:

Execute the code and open **`Hello.xlsx`**. The **`column`** chart now shows the **`data`** labels.



The data labels can be displayed for all types of charts. Position parameter of data label can be set to top, bottom, left or right.

XlsxWriter supports the following types of charts:

- **area**: Creates an Area (filled line) style chart.
- **bar**: Creates a Bar style (transposed histogram) chart.
- **column**: Creates a column style (histogram) chart.
- **line**: Creates a Line style chart.
- **pie**: Creates a Pie style chart.
- **doughnut**: Creates a Doughnut style chart.
- **scatter**: Creates a Scatter style chart.
- **stock**: Creates a Stock style chart.
- **radar**: Creates a Radar style chart.

Many of the chart types also have subtypes. For example, column, bar, area and line charts have sub types as stacked and **`percent_stacked`**. The type and subtype parameters can be given in the **`add_chart()`** method.

```
workbook.add_chart({'type': column, 'subtype': 'stacked'})
```

The chart is embedded in the worksheet with its **insert_chart()** method that takes following parameters:

```
worksheet.insert_chart(location, chartObj, options)
```

The **options** parameter is a dictionary that configures the position and scale of chart. The option properties and their default values are:

```
{
    'x_offset':        0,
    'y_offset':        0,
    'x_scale':         1,
    'y_scale':         1,
    'object_position': 1,
    'description':     None,
    'decorative':      False,
}
```

The **x_offset** and **y_offset** values are in pixels, whereas **x_scale** and **y_scale** values are used to scale the chart horizontally / vertically. The description field can be used to specify a description or "alt text" string for the chart.

The **decorative** parameter is used to mark the chart as decorative, and thus uninformative, for automated screen readers. It has to be set to True/False. Finally, the **object_position** parameter controls the object positioning of the chart. It allows the following values:

- **1**: Move and size with cells (the default).
- **2**: Move but don't size with cells.
- **3**: Don't move or size with cells.

17. XlsxWriter – Chart Formatting

The default appearance of chart can be customized to make it more appealing, explanatory and user friendly. With **XlsxWriter**, we can do following enhancements to a Chart object:

- Set and format chart title
- Set the X and Y axis titles and other parameters
- Configure the chart legends
- Chat layout options
- Setting borders and patterns

Title

You can set and configure the main title of a chart object by calling its **`set_title()`** method. Various parameters that can be are as follows:

- **name**: Set the name (title) for the chart to be displayed above the chart. The name property is optional. The default is to have no chart title.

- **name_font**: Set the font properties for the chart title.

- **overlay**: Allow the title to be overlaid on the chart.

- **layout**: Set the (x, y) position of the title in chart relative units.

- **none**: Excel adds an automatic chart title. The none option turns this default title off. It also turns off all other **`set_title()`** options.

X and Y axis

The two methods **`set_x_axis()`** and **`set_y_axis()`** are used to axis titles, the **`name_font`** to be used for the title text, the **`num_font`** to be used for numbers displayed on the X and Y axis.

- **name**: Set the title or caption for the axis.

- **name_font**: Set the font properties for the axis title.

- **num_font**: Set the font properties for the axis numbers.
- **num_format**: Set the number format for the axis.
- **major_gridlines**: Configure the major gridlines for the axis.
- **display_units**: Set the display units for the axis.

In the previous example, where the data of marklist has been shown in the form of a column chart, we set up the chart formatting options such as the chart title and X as well as Y axis captions and their other display properties as follows:

```
chart1.set_x_axis(
    {'name': 'Students',
     'name_font':{'name':'Arial', 'size':16, 'bold':True},
    })

chart1.set_y_axis(
    {'name': 'Marks',
     'name_font':{'name':'Arial', 'size':16, 'bold':True},
     'num_font':{'name':'Arial', 'italic':True}
    })
```

Example

Add the above snippet in the complete code. It now looks as given below:

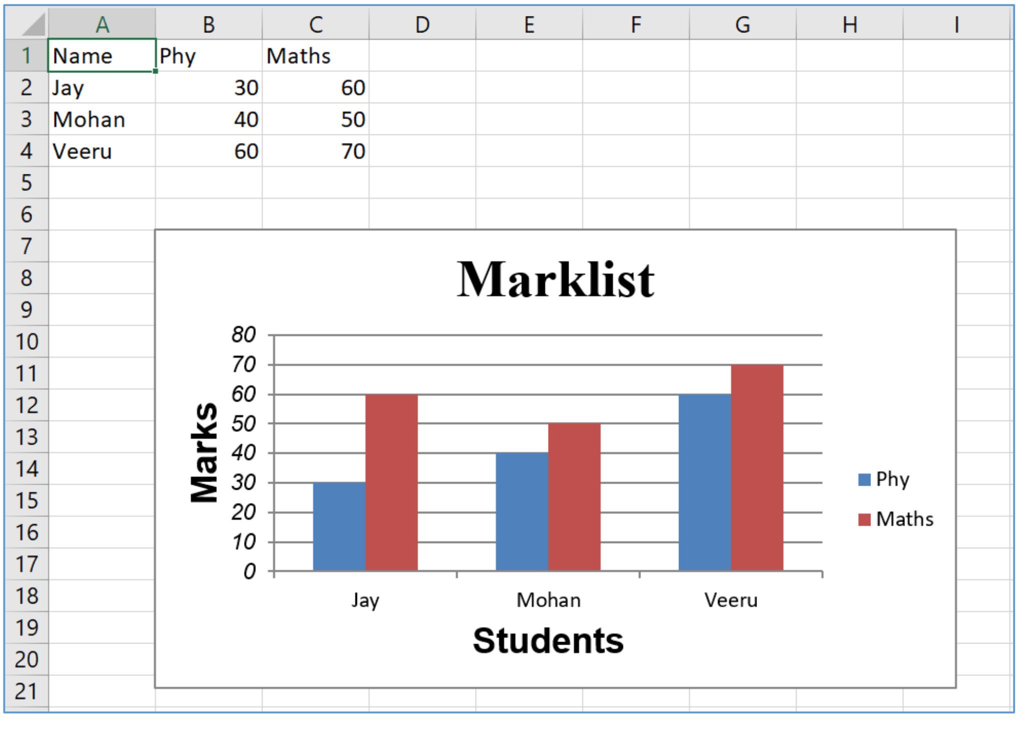
```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
chart1 = wb.add_chart({'type': 'column'})

# Add the worksheet data that the charts will refer to.
headings = ['Name', 'Phy', 'Maths']
```

```
data = [
    ["Jay", 30, 60],
    ["Mohan", 40, 50],
    ["Veeru", 60, 70],
]

worksheet.write_row(0,0, headings)
worksheet.write_row(1,0, data[0])
worksheet.write_row(2,0, data[1])
worksheet.write_row(3,0, data[2])

chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$4',
    'values':     '=Sheet1!$B$2:$B$4',
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 3, 0],
    'values':     ['Sheet1', 1, 2, 3, 2],
})

chart1.set_title ({'name': 'Marklist',
                   'name_font': {'name':'Times New Roman', 'size':24}
                 })

chart1.set_x_axis({'name': 'Students',
                   'name_font': {'name':'Arial', 'size':16, 'bold':True},
                   })
```

```
chart1.set_y_axis({'name': 'Marks',
                   'name_font':{'name':'Arial', 'size':16, 'bold':True},
                   'num_font':{'name':'Arial', 'italic':True}
                   })

worksheet.insert_chart('B7', chart1)

wb.close()
```

Output:

The chart shows the **`title`** and **`axes`** captions as follows:



18. XlsxWriter – Chart Legends

Depending upon the type of chart, the data is visually represented in the form of columns, bars, lines, arcs, etc. in different colors or patterns. The chart legend makes it easy to quickly understand which color/pattern corresponds to which data series.

Working with Chart Legends

To set the legend and configure its properties such as position and font, XlsxWriter has **`set_legend()`** method. The properties are:

- **none**: In Excel chart legends are on by default. The none=True option turns off the chart legend
- **position**: Set the position of the chart legend. It can be set to top, bottom, left, right, none
- **font**: Set the font properties (like name, size, bold, italic etc.) of the chart legend.
- **border**: Set the border properties of the legend such as color and style.
- **fill**: Set the solid fill properties of the legend such as color.
- **pattern**: Set the pattern fill properties of the legend.
- **gradient**: Set the gradient fill properties of the legend.

Some of the legend properties are set for the chart as below:

```
chart1.set_legend(
    {'position':'bottom',
     'font': {'name':'calibri','size': 9, 'bold': True}})
```

Example

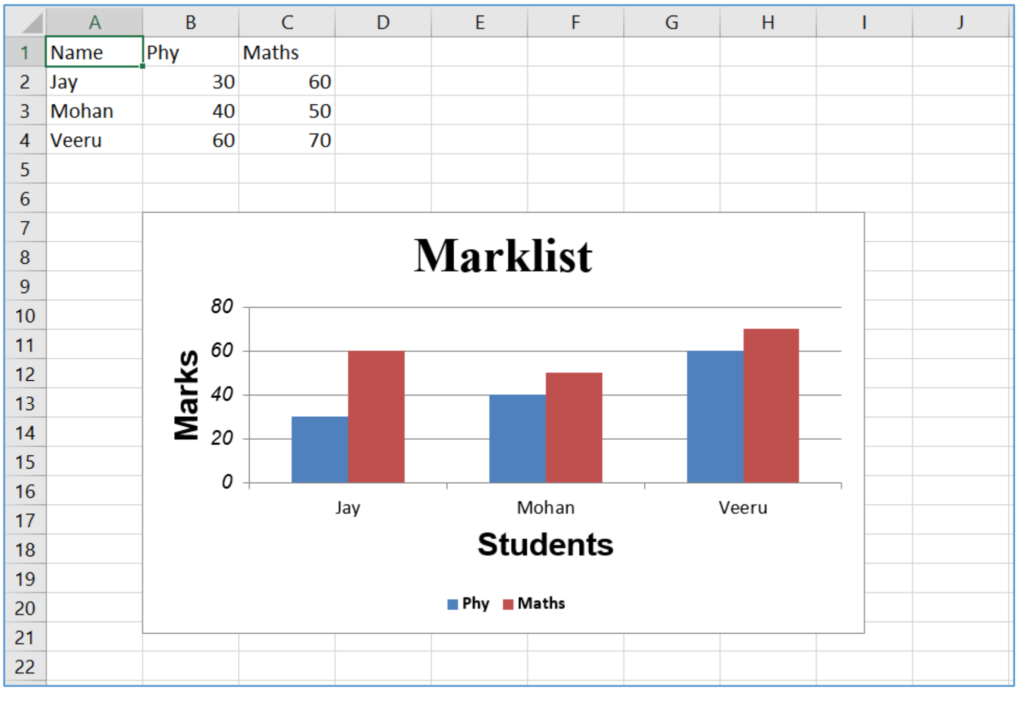
Here is the complete code to display legends as per the above characteristics:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
chart1 = wb.add_chart({'type': 'column'})

# Add the worksheet data that the charts will refer to.
headings = ['Name', 'Phy', 'Maths']
data = [
    ["Jay", 30, 60],
    ["Mohan", 40, 50],
    ["Veeru", 60, 70],
]

worksheet.write_row(0,0, headings)
worksheet.write_row(1,0, data[0])
worksheet.write_row(2,0, data[1])
worksheet.write_row(3,0, data[2])
chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$4',
    'values':     '=Sheet1!$B$2:$B$4',
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 3, 0],
    'values':     ['Sheet1', 1, 2, 3, 2],
})

chart1.set_title ({'name': 'Marklist', 'name_font':
                  {'name':'Times New Roman', 'size':24}})
```

```
chart1.set_x_axis({'name': 'Students', 'name_font':
                  {'name':'Arial', 'size':16, 'bold':True},})

chart1.set_y_axis({'name': 'Marks','name_font':
                  {'name':'Arial', 'size':16, 'bold':True},
                   'num_font':{'name':'Arial', 'italic':True}})

chart1.set_legend({'position':'bottom', 'font':
                  {'name':'calibri','size': 9, 'bold': True}})

worksheet.insert_chart('B7', chart1)

wb.close()
```

Output:

The chart shows the legend below the caption of the X axis.



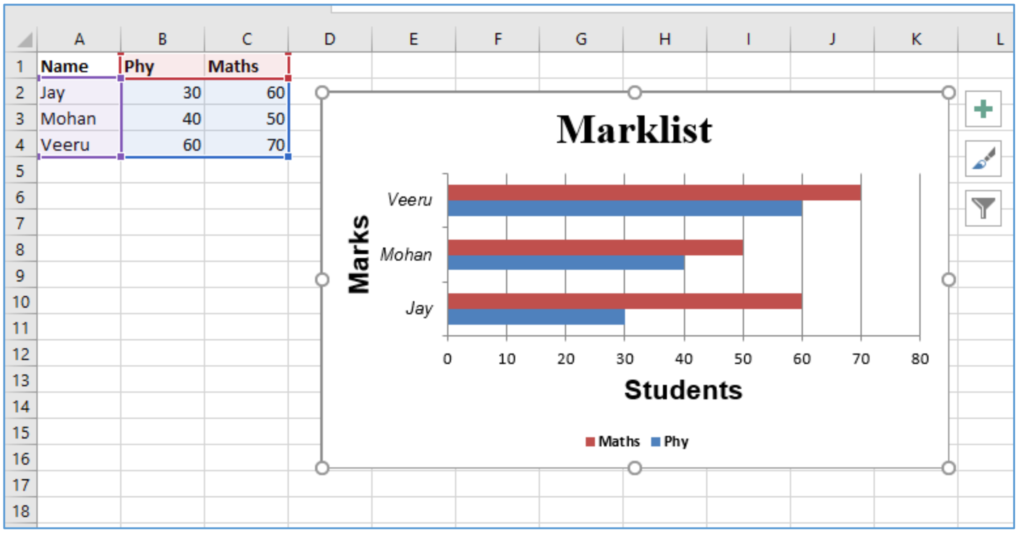
In the chart, the columns corresponding to `physics` and `maths` are shown in different colors. The small colored box symbols to the right of the chart are the legends that show which color corresponds to `physics` or `maths`.

19. XlsxWriter – Bar Chart

The bar chart is similar to a column chart, except for the fact that the data is represented in proportionate horizontal bars instead of vertical columns. To produce a bar chart, the type argument of **add_chart()** method must be set to 'bar'

```
chart1 = workbook.add_chart({'type': 'bar'})
```

The bar chart appears as follows:



There are two subtypes of bar chart, namely stacked and **percent_stacked**. In the stacked chart, the bars of different colors for a certain category are placed one after the other. In a **percent_stacked** chart, the length of each bar shows its percentage in the total value in each category.

```
chart1 = workbook.add_chart({
     'type': 'bar',
     'subtype': 'percent_stacked'
})
```

Example

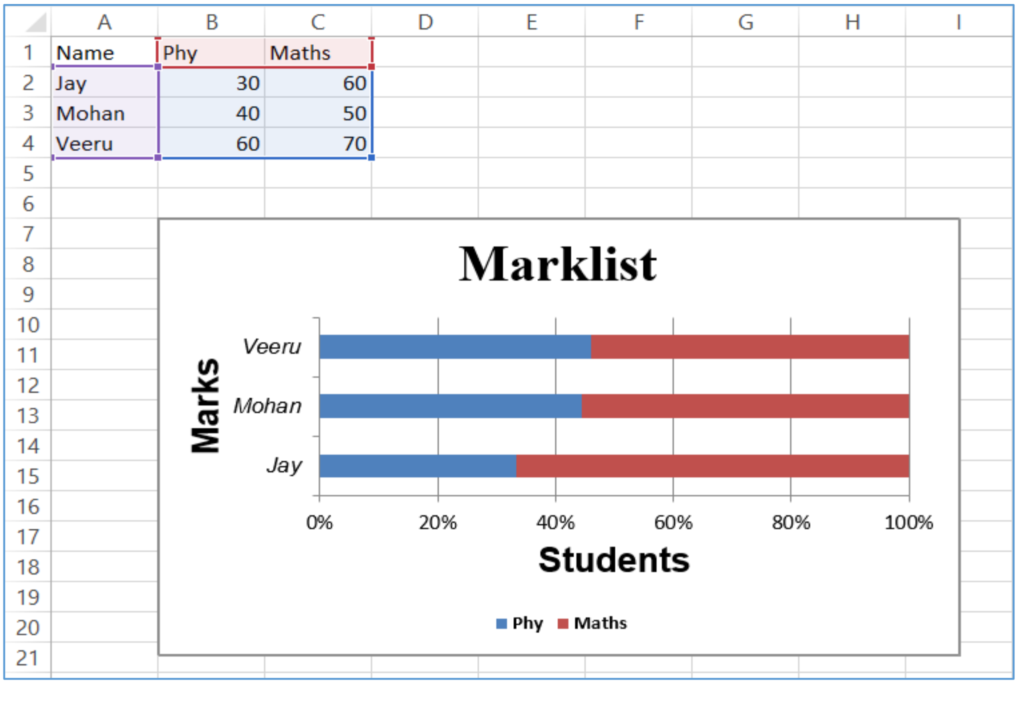
Program to generate percent stacked bar chart is given below:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
chart1 = wb.add_chart({'type': 'bar', 'subtype': 'percent_stacked'})

# Add the worksheet data that the charts will refer to.
headings = ['Name', 'Phy', 'Maths']
data = [
    ["Jay", 30, 60],
    ["Mohan", 40, 50],
    ["Veeru", 60, 70],
]

worksheet.write_row(0,0, headings)
worksheet.write_row(1,0, data[0])
worksheet.write_row(2,0, data[1])
worksheet.write_row(3,0, data[2])

chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$4',
    'values':     '=Sheet1!$B$2:$B$4',
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 3, 0],
    'values':     ['Sheet1', 1, 2, 3, 2],
})

chart1.set_title ({'name': 'Marklist', 'name_font':
```

```
                     {'name':'Times New Roman', 'size':24}})

chart1.set_x_axis({'name': 'Students', 'name_font':
                     {'name':'Arial', 'size':16, 'bold':True}, })

chart1.set_y_axis({'name': 'Marks','name_font':
                     {'name':'Arial', 'size':16, 'bold':True},
                      'num_font':{'name':'Arial', 'italic':True}})

chart1.set_legend({'position':'bottom', 'font':
                     {'name':'calibri','size': 9, 'bold': True}})

worksheet.insert_chart('B7', chart1)

wb.close()
```

Output:

The output file will look like the one given below:



20. XlsxWriter – Line Chart

A line shows a series of data points connected with a line along the X-axis. It is an independent axis because the values on the X-axis do not depend on the vertical Y-axis.

The Y-axis is a dependent axis because its values depend on the X-axis and the result is the line that progress horizontally.

Working with XlsxWriter Line Chart

To generate the **line chart** programmatically using XlsxWriter, we use **add_series()**.The type of chart object is defined as '**line**'.

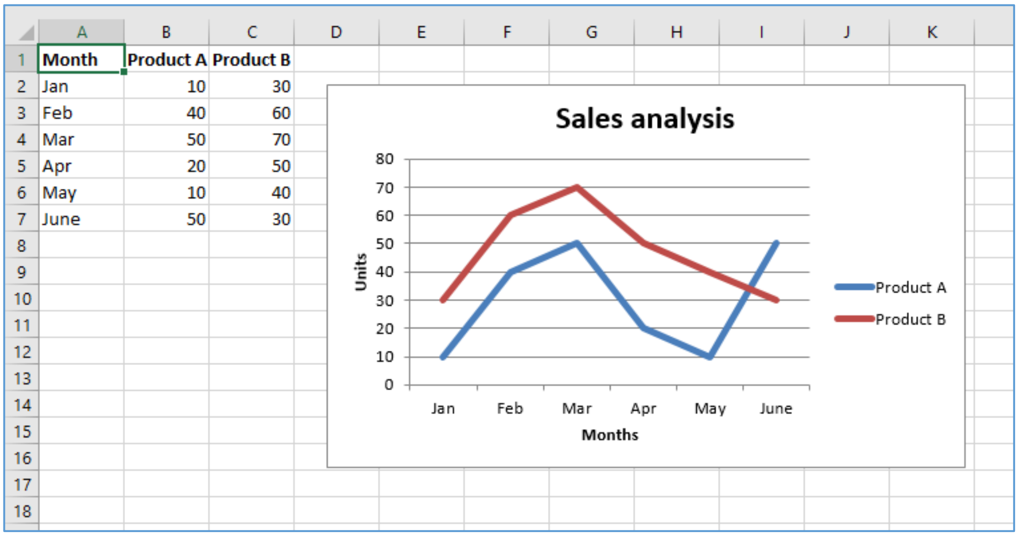
In the following example, we shall plot **line chart** showing the sales figures of two products over six months. Two data series corresponding to sales figures of Product A and Product B are added to the chart with **`add_series()`** method.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
headings = ['Month', 'Product A', 'Product B']

data = [
    ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'June'],
    [10, 40, 50, 20, 10, 50],
    [30, 60, 70, 50, 40, 30],
]

bold=wb.add_format({'bold':True})
worksheet.write_row('A1', headings, bold)
worksheet.write_column('A2', data[0])
worksheet.write_column('B2', data[1])
```

```
worksheet.write_column('C2', data[2])

chart1 = wb.add_chart({'type': 'line'})

chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$7',
    'values':     '=Sheet1!$B$2:$B$7',
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 6, 0],
    'values':     ['Sheet1', 1, 2, 6, 2],
})

chart1.set_title ({'name': 'Sales analysis'})
chart1.set_x_axis({'name': 'Months'})
chart1.set_y_axis({'name': 'Units'})

worksheet.insert_chart('D2', chart1)

wb.close()
```

Output:

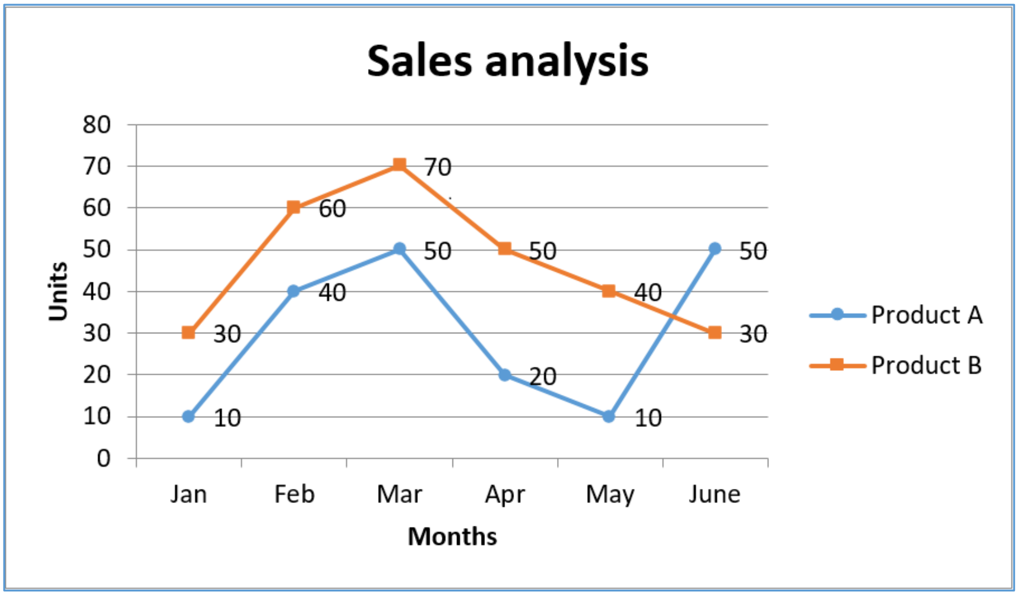
After executing the above program, here is how XlsxWriter generates the Line chart:



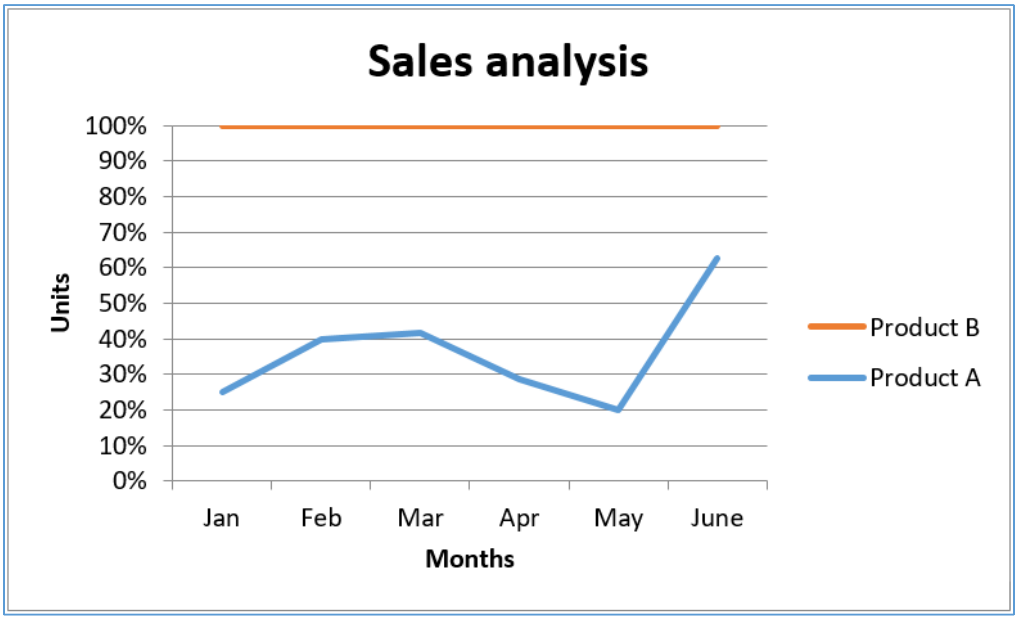
Along with **data_labels**, the **add_series()** method also has a **marker** property. This is especially useful in a line chart. The data points are indicated by marker symbols such as a circle, triangle, square, diamond etc. Let us assign **circle** and **square** symbols to the two data series in this chart.

```
chart1.add_series({
    'name':       '=Sheet1!$B$1',
    'categories': '=Sheet1!$A$2:$A$7',
    'values':     '=Sheet1!$B$2:$B$7',
    'data_labels': {'value': True},
    'marker': {'type': 'circle'},
})

chart1.add_series({
    'name':       ['Sheet1', 0, 2],
    'categories': ['Sheet1', 1, 0, 6, 0],
    'values':     ['Sheet1', 1, 2, 6, 2],
    'data_labels': {'value': True},
    'marker': {'type': 'square'},})
```

The data labels and markers are added to the line chart.

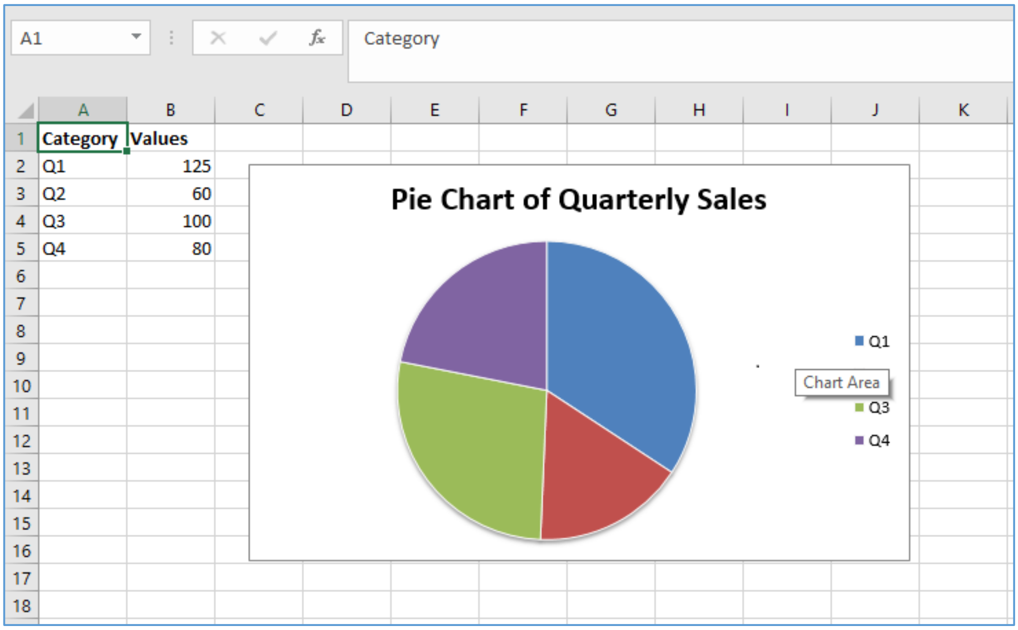


Line chart also supports `stacked` and `percent_stacked` subtypes.



21. XlsxWriter – Pie Chart

A **pie chart** is a representation of a single data series into a circle, which is divided into slices corresponding to each data item in the series. In a pie chart, the arc length of each slice is proportional to the quantity it represents. In the following worksheet, quarterly sales figures of a product are displayed in the form of a pie chart.



Working with XlsxWriter Pie Chart

To generate the above chart programmatically using XlsxWriter, we first write the following data in the worksheet.

```
headings = ['Category', 'Values']
data = [
    ['Q1', 'Q2', 'Q3', 'Q4'],
    [125, 60, 100, 80],
]
worksheet.write_row('A1', headings, bold)
worksheet.write_column('A2', data[0])
```

```
worksheet.write_column('B2', data[1])
```

A Chart object with **type=pie** is declared and the cell range B1:D1 is used as value parameter for **add_series()** method and the quarters (Q1, Q2, Q3 and Q4) in column A are the categories.

```
chart1.add_series({
    'name':       'Quarterly sales data',
    'categories': ['Sheet1', 1, 0, 4, 0],
    'values':     ['Sheet1', 1, 1, 4, 1],
})
chart1.set_title({'name': 'Pie Chart of Quarterly Sales'})
```

In the **pie chart**, we can use **data_labels** property to represent the percent value of each pie by setting **percentage=True**.

Example

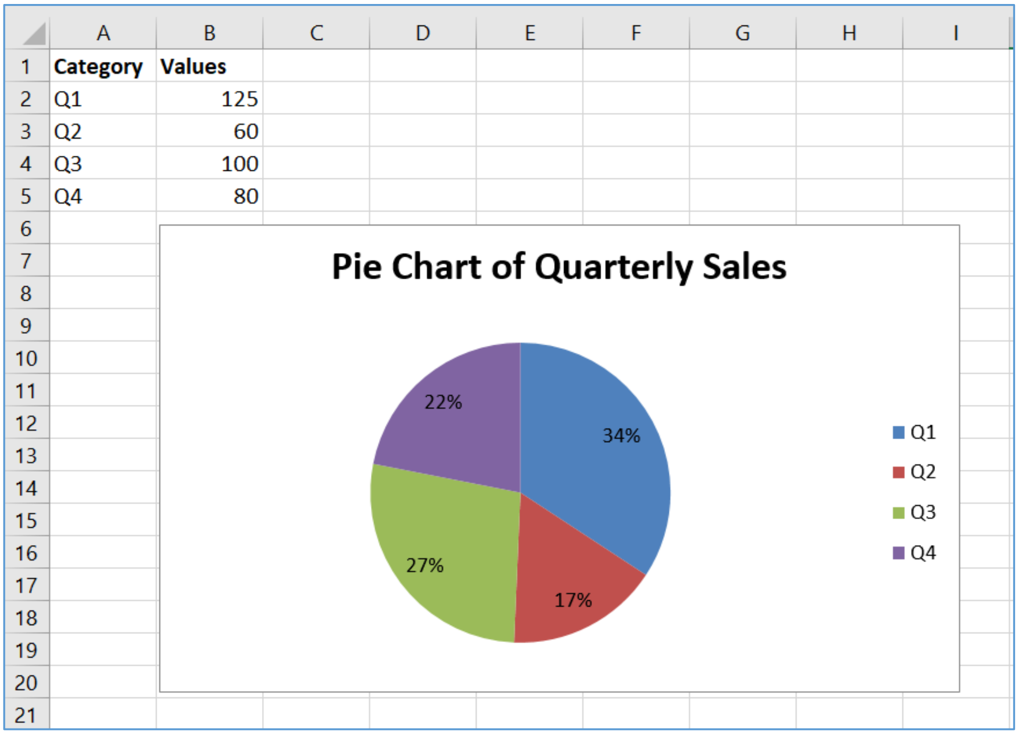
The complete program for pie chart generation is as follows:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()

headings = ['Category', 'Values']
data = [
    ['Q1', 'Q2', 'Q3', 'Q4'],
    [125, 60, 100, 80],
]
bold=wb.add_format({'bold':True})
worksheet.write_row('A1', headings, bold)
worksheet.write_column('A2', data[0])
worksheet.write_column('B2', data[1])

chart1 = wb.add_chart({'type': 'pie'})
```

```
chart1.add_series({
    'name':       'Quarterly sales data',
    'categories': ['Sheet1', 1, 0, 4, 0],
    'values':     ['Sheet1', 1, 1, 4, 1],
    'data_labels': {'percentage':True},
})

chart1.set_title({'name': 'Pie Chart of Quarterly Sales'})

worksheet.insert_chart('D2', chart1)

wb.close()
```

Output:

Have a look at the pie chart that the above program produces.

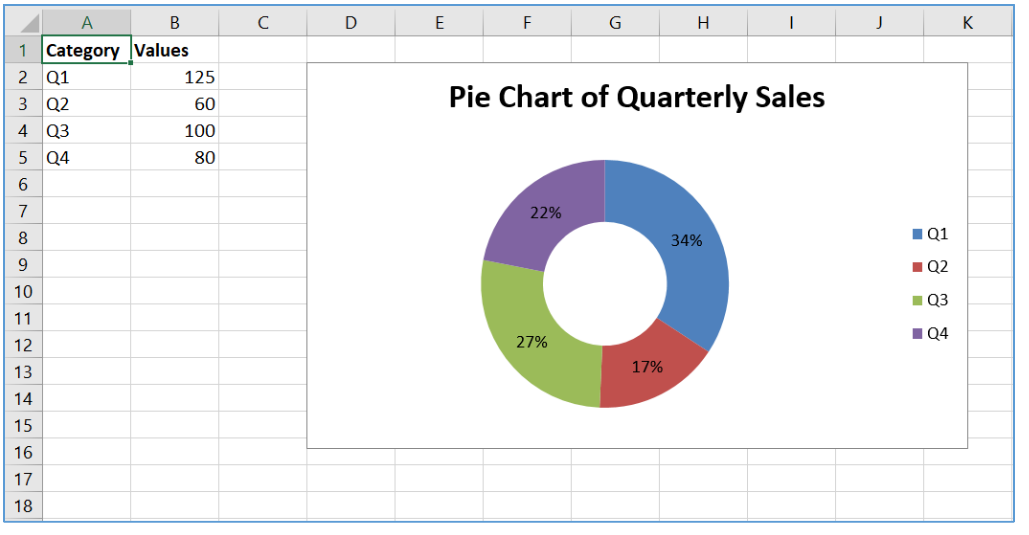


Doughnut Chart

The **doughnut chart** is a variant of the pie chart, with a hole in its center, and it displays categories as arcs rather than slices. Both make part-to-whole relationships easy to grasp at a glance. Just change the chart type to **`doughnut`**.

```
chart1 = workbook.add_chart({'type': 'doughnut'})
```

The doughnut chart of the data in above example appears as below:



22. XlsxWriter – Sparklines

A **sparkline** is a small chart, that doesn't have axes or coordinates. It gives a representation of variation of a certain parameter. Normal charts are bigger in size, with a lot of explanatory features such as title, legend, data labels etc. and are set off from the accompanying text. Sparkline on the other hand is small in size and can be embedded inside the text, or a worksheet cell that has its context.

Feature of Sparkline was introduced by Edward Tufte in 1983. Microsoft introduced sparklines in Excel 2010. We can find sparkline option in the insert ribbon of Excel software.

Sparklines are of three types:

- **line**: Similar to line chart
- **column**: Similar to column chart
- **win_loss**: Whether each value is positive (win) or negative (loss).

Working with XlsxWriter Sparklines

XlsxWriter module has **add_sparkline()** method. It basically needs the cell location of the sparkline and the data range to be represented as a sparkline. Optionally, other parameters such as type, style, etc. are provided in the form of dictionary object. By default, the type is line.

Example

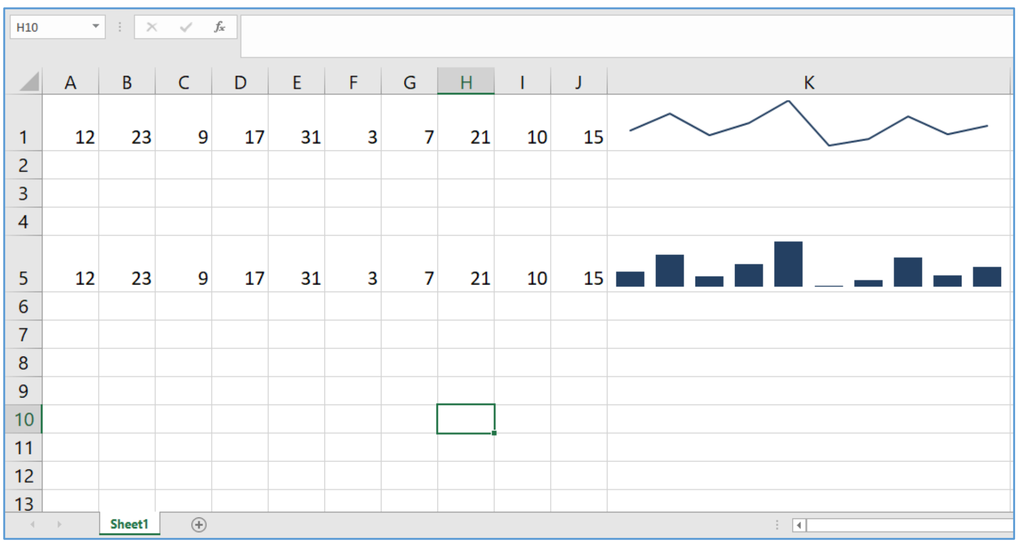
Following program represents same list of numbers in line and column sparklines.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


data=[12,23,9,17,31,3,7,21,10,15]
```

```
ws.write_row('A1', data)
ws.set_column('K:K', 40)
ws.set_row(0, 30)
ws.add_sparkline('K1', {'range':'Sheet1!A1:J1'})

ws.write_row('A5', data)
ws.set_column('K:K', 40)
ws.set_row(4, 30)
ws.add_sparkline('K5', {'range':'Sheet1!A5:J5', 'type':'column'})

wb.close()
```

Output:

In cell K, the sparklines are added.



The properties are:

- **range**: is the mandatory parameter. It specifies the cell data range that the sparkline will plot.
- **type**: specifies the type of sparkline. There are 3 available sparkline types are line, column and win_loss.

- **markers**: Turn on the markers for line style sparklines
- **style**: The sparkline styles defined in MS Excel. There are 36 style types.
- **negative_points**: If set to True, the negative points in a sparkline are highlighted.

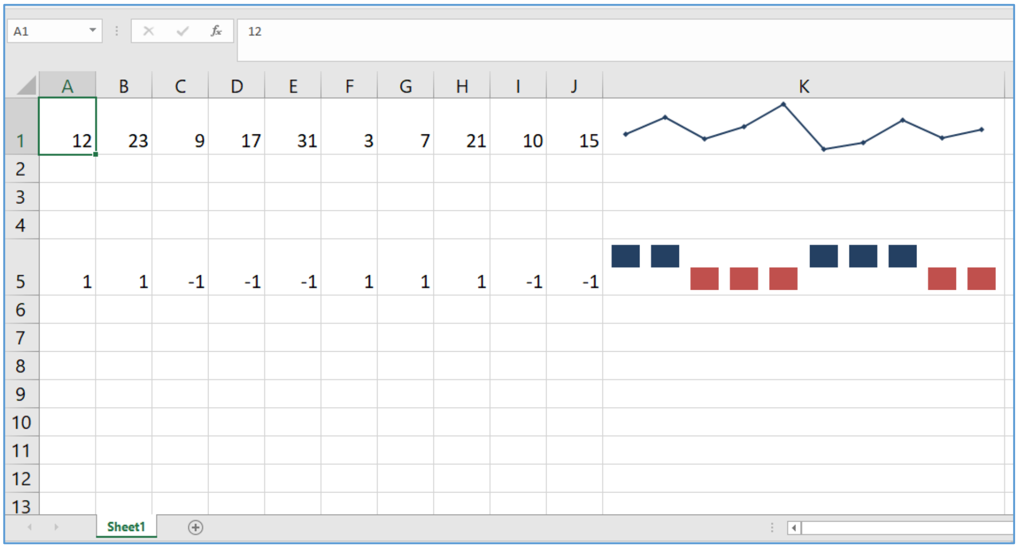
Example

The following program produces a **`line sparkline`** with **markers** and a **`win_loss sparkline`** having negative points highlighted.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()


data=[12,23,9,17,31,3,7,21,10,15]
ws.write_row('A1', data)
ws.set_column('K:K', 40)
ws.set_row(0, 30)


data=[1,1,-1,-1,-1,1,1,1,-1,-1]
ws.write_row('A5', data)
ws.set_column('K:K', 40)
ws.set_row(4, 30)
ws.add_sparkline('K1', {'range':'Sheet1!A1:J1', 'markers':True})
ws.add_sparkline('K5', {'range':'Sheet1!A5:J5', 'type':'win_loss',
                        'negative_points':True})


wb.close()
```

Output:

Line Sparkline in K1 has markers. The sparkline in K5 shows negative points highlighting.



Example – Style Types

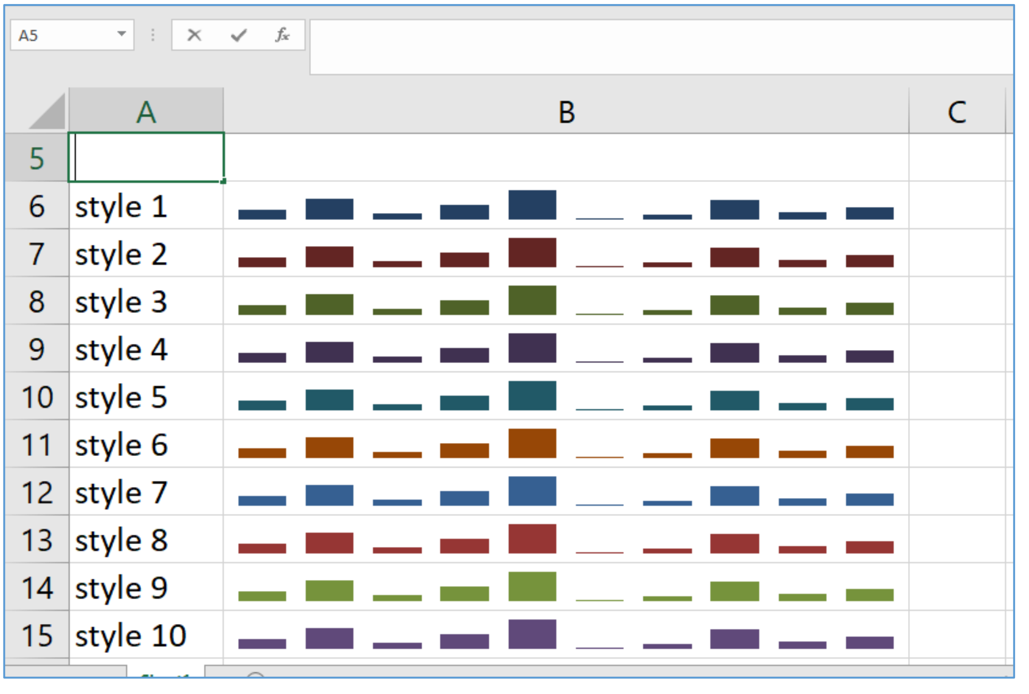
Following code displays a series of numbers in column sparkline. Ten different style types are used here.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data=[12,23,9,17,31,3,7,21,10,15]
ws.write_row('C3', data)
ws.set_column('B:B',40)

for i in range(1,11):
    ws.write(i+4,0, 'style {}'.format(i))
    ws.add_sparkline(i+4,1,
                     {'range':'Sheet1!$C$3:$L$3',
```

```
                                'type':'column',
                                'style':i})

wb.close()
```

Output:

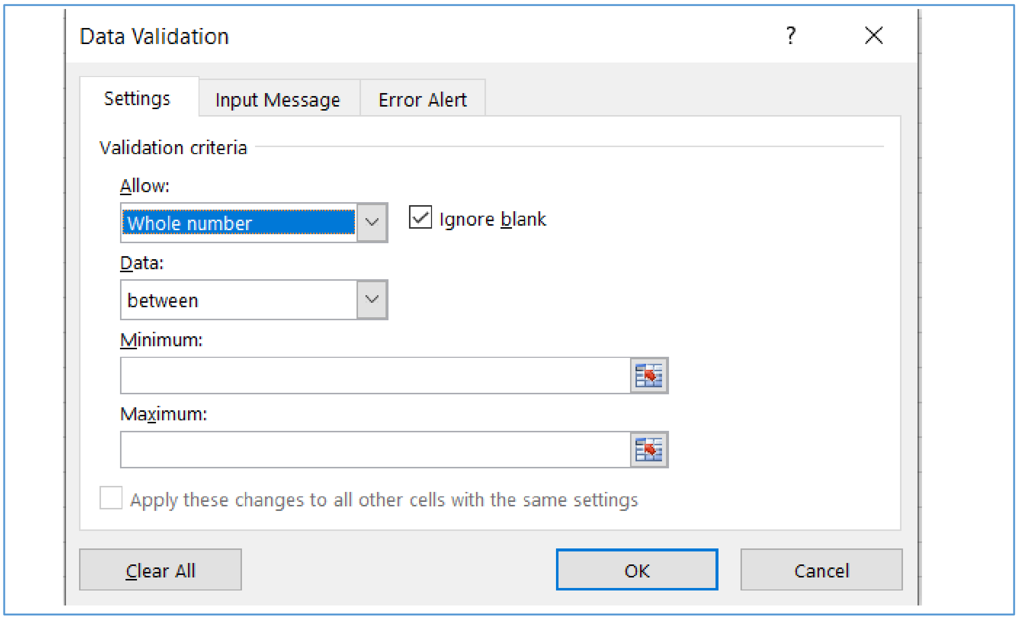
It will produce the following output:



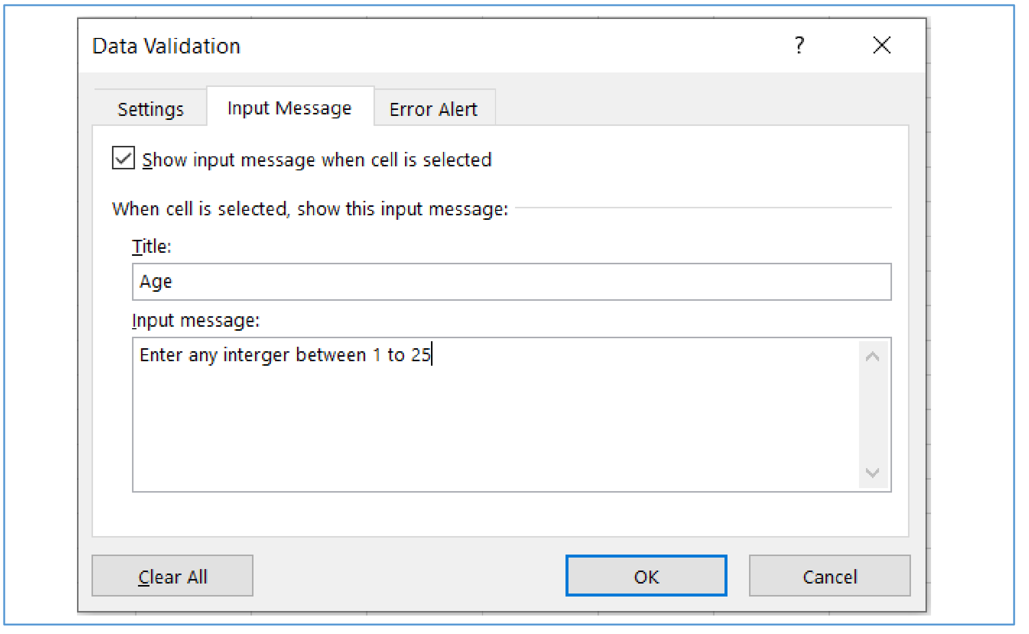
23. XlsxWriter – Data Validation

Data validation feature in Excel allows you to control what a user can enter into a cell. You can use it to ensure that the value in a cell is a number/date within a specified range, text with required length, or to present a dropdown menu to choose the value from.

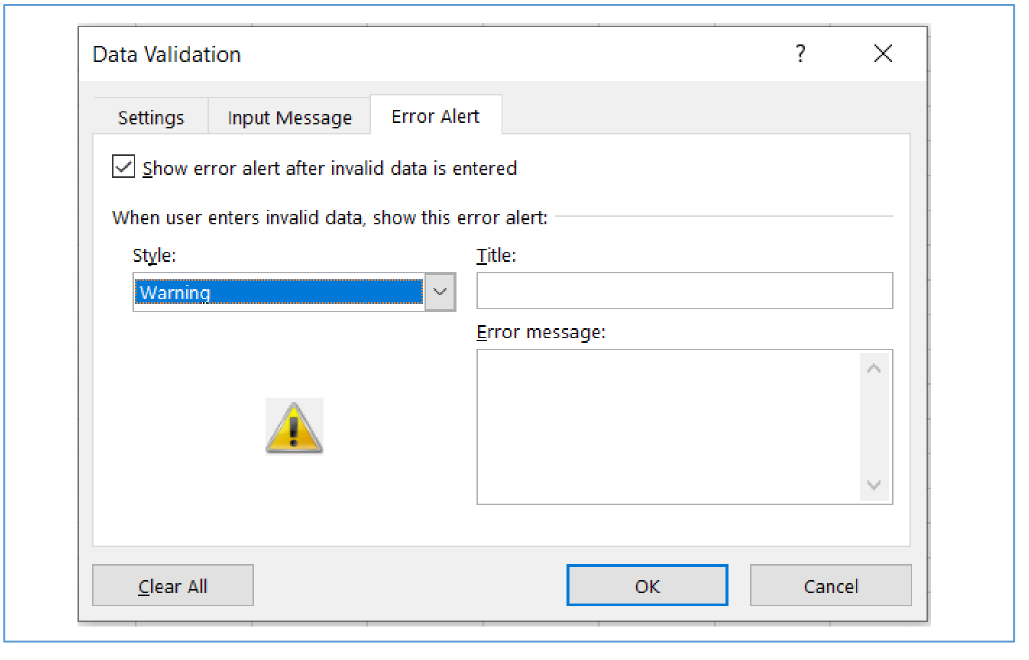
The data validation tools are available in the Data menu. The first tab allows you to set a validation criterion. Following figure shows that criteria requires the cell should contain an integer between 1 to 25:



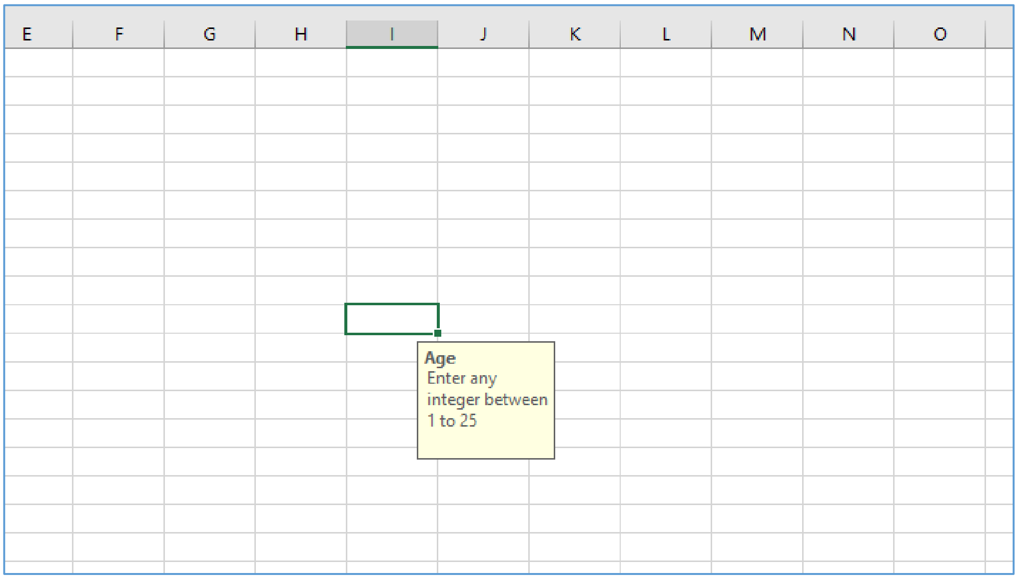
In the second tab, set the message to be flashed when user's cursor is on the desired cell, which in this case is 'Enter any integer between 1 to 25'. You can also set the message title; in this case it is Age.



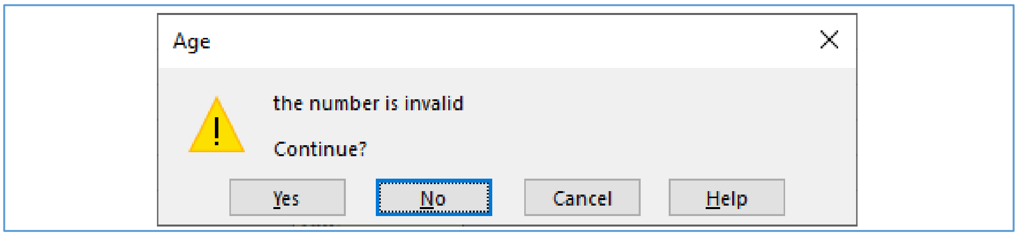
The third tab allows asks you to define any error message you would like to flash if the validation criteria fails.



When the user places the cursor in I10 (for which the validation is set), you can see the input message.



When the entered number is not in the range, the error message will flash.



Working with XlsxWriter Data Validation

You can set the validation criteria, input and error message programmatically with **data_validation()** method.

```
worksheet.data_validation('I10',
                          {'validate': 'integer','criteria': 'between',
                           'minimum': 1,'maximum': 25,
                           'input_title': 'Enter an integer:',
                           'input_message': 'between 1 and 25',
                           'error_title': 'Input value is not valid!',
                           'error_message': 'It should be an integer
between 1 and 25'
                          })
```

The **data_validation()** method accepts options parameter as a dictionary with following parameters:

- **validate**: It is used to set the type of data that you wish to validate. Allowed values are integer, decimal, list, date, time, length etc.

- **criteria**: It is used to set the criteria for validation. It can be set to any logical operator including **between**/ **not between**, **==**, **!=**, **<**, **>**, **<=**, **>=**, etc.

- **value**: Sets the limiting value to which the criteria is applied. It is always required. When using the list validation, it is given as a Comma Separated Variable string.

- **input_title**: Used to set the title of the input message when the cursor is placed in the target cell.

- **input_message**: The message to be displayed when a cell is entered.

- **error_title**: The title of the error message to be displayed when validation criteria is not met.

- **error_message**: Sets the error message. The default error message is "The value you entered is not valid. A user has restricted values that can be entered into the cell."

Example

Following usage of **data_validation()** method results in the behavior of data validation feature as shown in the above figures.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()


worksheet.data_validation('I10',
           {'validate': 'integer','criteria': 'between',
            'minimum': 1,'maximum': 25,
```

```
            'input_title': 'Enter an integer:',
            'input_message': 'between 1 and 25',
            'error_title': 'Input value is not valid!',
            'error_message':'It should be an integer between 1
and 25'})

wb.close()
```

As another example, the cell I10 is set a validation criterion so as to force the user choose its value from a list of strings in a drop down.

```
worksheet.data_validation('I10',
           {'validate': 'list',
            'source': ['Mumbai', 'Delhi', 'Chennai', 'Kolkata'],
            'input_title': 'Choose one:',
            'input_message': 'Select a value from th list',})
```

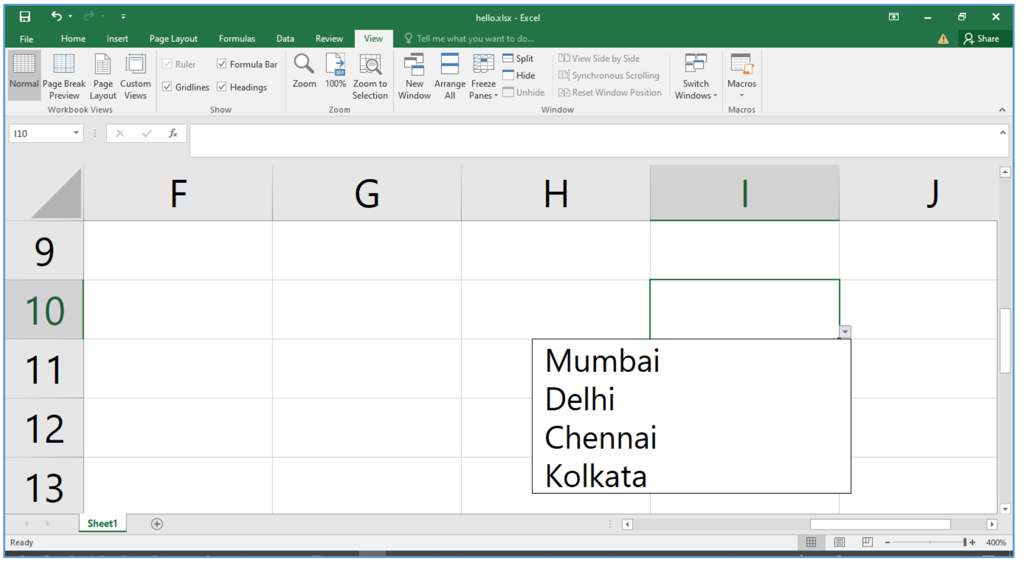
Example:

The modified program for validation with the drop down list is as follows:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()

worksheet.data_validation('I10',
     {'validate': 'list',
      'source': ['Mumbai', 'Delhi', 'Chennai', 'Kolkata'],
      'input_title': 'Choose one:',
      'input_message': 'Select a value from th list',})

wb.close()
```

Output:

The dropdown list appears when the cursor is placed in I10 cell:



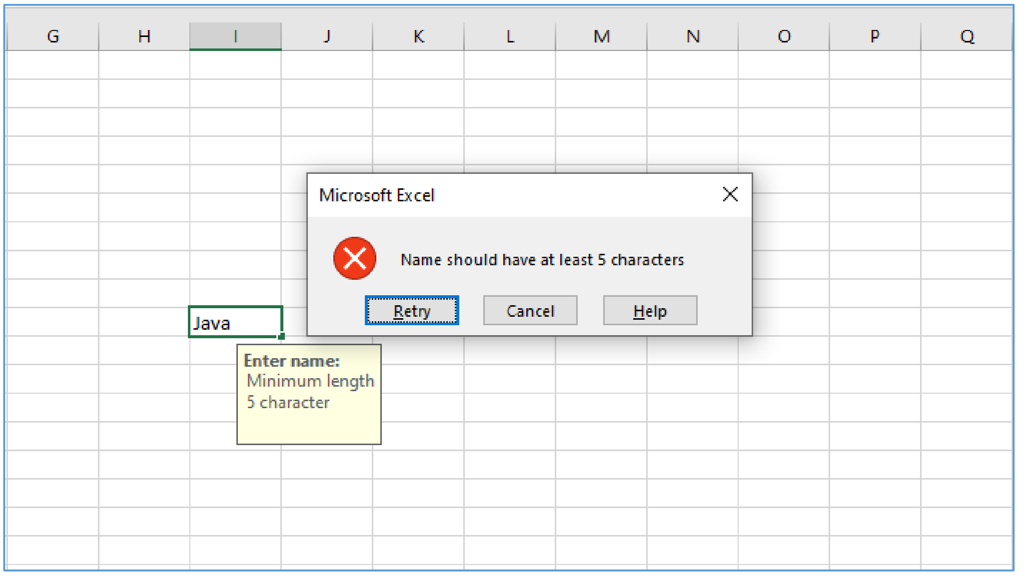
Example:

If you want to make the user enter a string of length greater than 5, use **>=** as criteria and value set to 5

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()


worksheet.data_validation('I10',{'validate': 'length',
            'criteria': '>=','value': 5,'input_title': 'Enter name:',
            'input_message': 'Minimum length 5 character',
            'error_message':'Name should have at least 5
characters'})


wb.close()
```

Output:

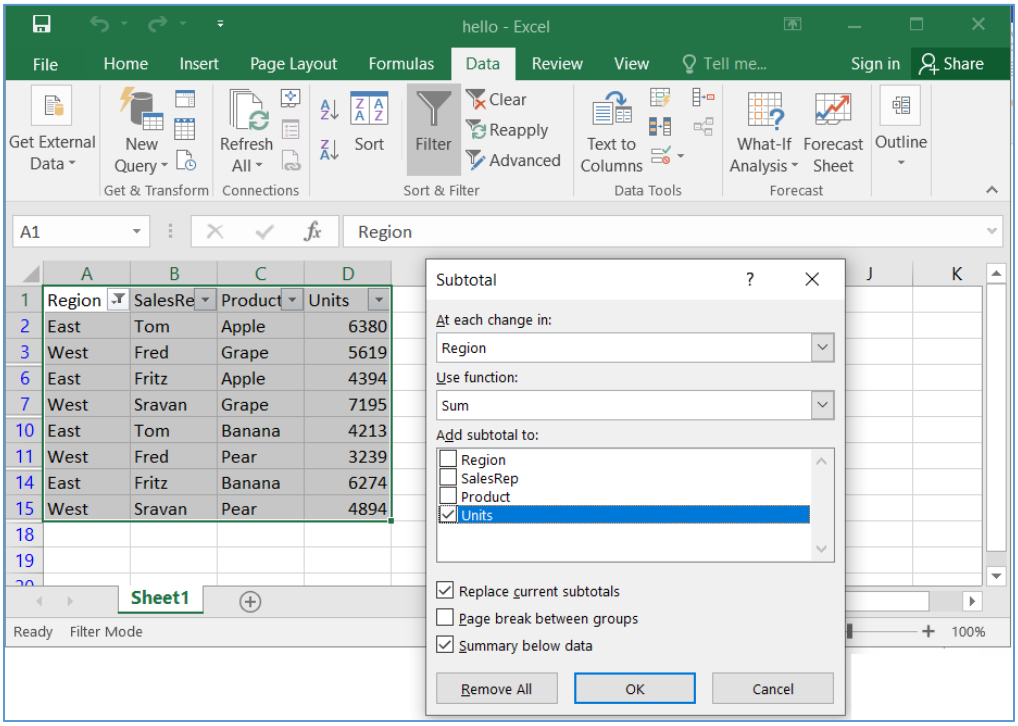
If the string is having less than 5 characters, the error message pops up as follows:



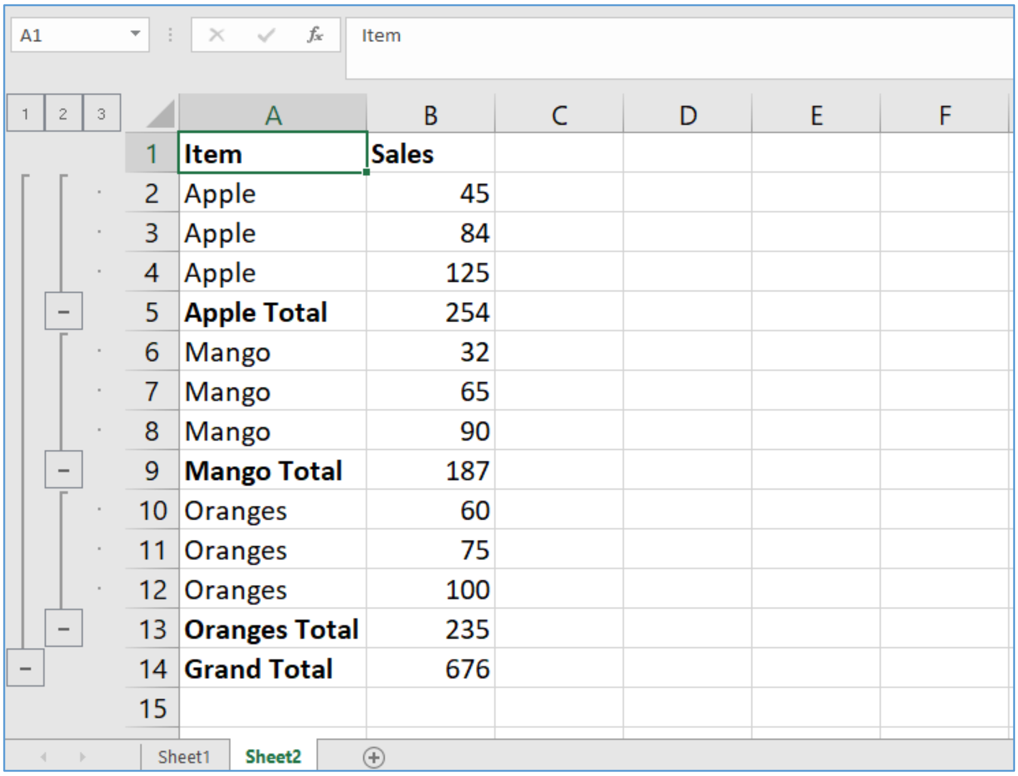
24. XlsxWriter – Outlines and Grouping

In Excel, you can group rows or columns having same value of a particular column (or row)) so that they can be hidden or displayed with a single mouse click. This feature is called to as **outlines and grouping**. It helps in displaying sub-totals or summaries. This feature can be found in MS excel software's **`Data->Outline`** group.

To use this feature, the data range must have all rows should be in the sorted order of values in one column. Suppose we have sales figures of different items. After sorting the range on name of item, click on the Subtotal option in the Outline group. Following dialog box pops up.



The worksheet shows item-wise subtotal of sales and at the end the grand total. On the left of the worksheet, the outline levels are shown. The original data is at level 3, the subtotals at level 2 and grand total at level 1.



	A	B	C	D	E	F
1	**Item**	**Sales**				
2	Apple	45				
3	Apple	84				
4	Apple	125				
5	**Apple Total**	254				
6	Mango	32				
7	Mango	65				
8	Mango	90				
9	**Mango Total**	187				
10	Oranges	60				
11	Oranges	75				
12	Oranges	100				
13	**Oranges Total**	235				
14	**Grand Total**	676				
15						

Working with Outlines and Grouping

To do this using XlsxWriter, we need to use the level property of the **set_row()** method. The data rows are set at level 2.

```
ws.set_row(row, None, None, {'level': 2})
```

The rows for subtotal are having level 1.

```
ws.set_row(row, None, None, {'level': 1})
```

We use **SUBTOTAL()** function to calculate and display the sum of sales figures in one group.

Example

The complete code is given below:

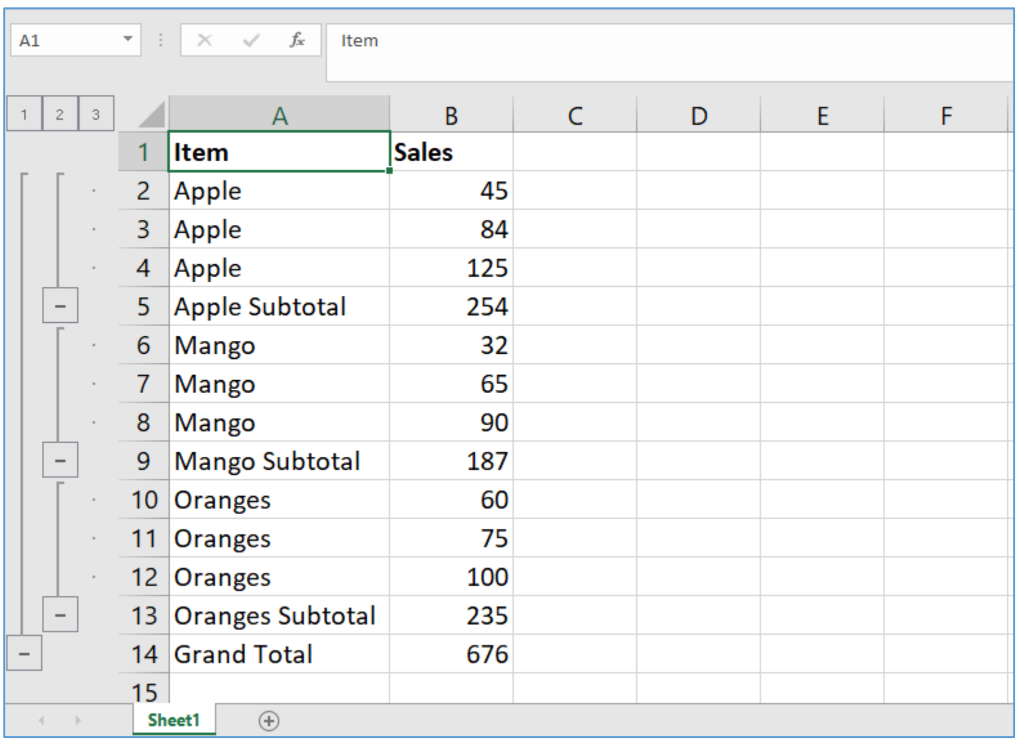
```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()
```

```
headings=['Item', 'Sales']
data=[
    ['Apple', 45], ['Apple', 84], ['Apple', 125],
    ['Mango', 32], ['Mango', 65], ['Mango', 90],
    ['Oranges', 60], ['Oranges', 75], ['Oranges',100],
    ]
ws.write_row('A1', headings)
item='Apple'
rownum=1
startrow=1
for row in data:
    if row[0]==item:
        ws.set_row(rownum, None, None, {'level': 2})
        ws.write_row(rownum,0, row)
        rownum+=1
    else:
        ws.set_row(rownum, None, None, {'level': 1})
        ws.write(rownum, 0, item+' Subtotal')
        cellno='B{}:B{}'.format(startrow,rownum)
        print (cellno)
        ws.write(rownum,1,'=SUBTOTAL(9,'+cellno+')')
        # rownum+=1
        item=data[rownum][0]
        rownum+=1
        ws.set_row(rownum, None, None, {'level': 2})
        ws.write_row(rownum,0, row)
        rownum+=1
        startrow=rownum
else:
    ws.set_row(rownum, None, None, {'level': 1})
    ws.write(rownum, 0, item+' Subtotal')
```

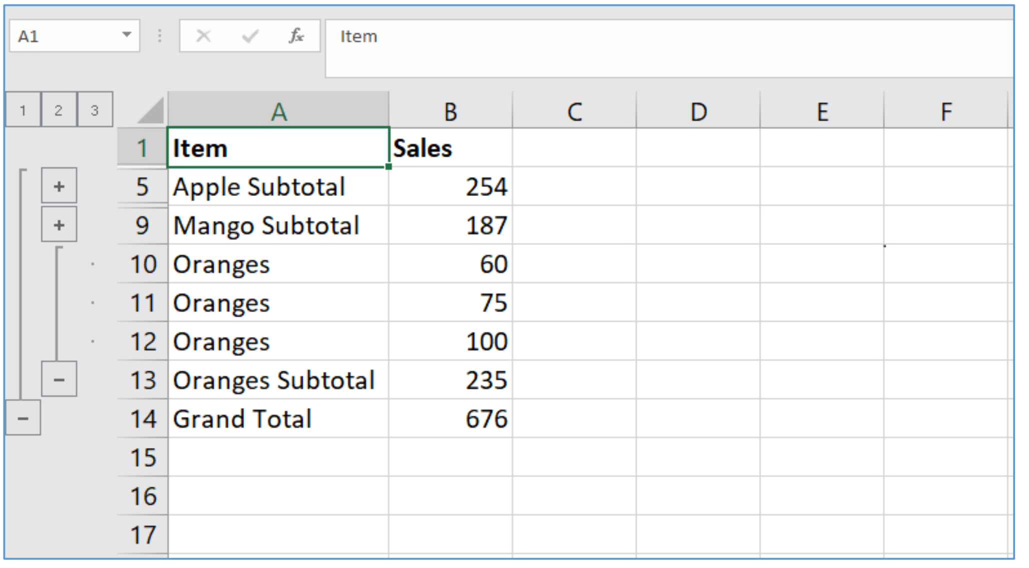
```
    cellno='B{}:B{}'.format(startrow,rownum)
    ws.write(rownum,1,'=SUBTOTAL(9,'+cellno+')')
rownum+=1
ws.write(rownum, 0, 'Grand Total')
cellno='B{}:B{}'.format(1,rownum)
ws.write(rownum,1,'=SUBTOTAL(9,'+cellno+')')

wb.close()
```

Output:

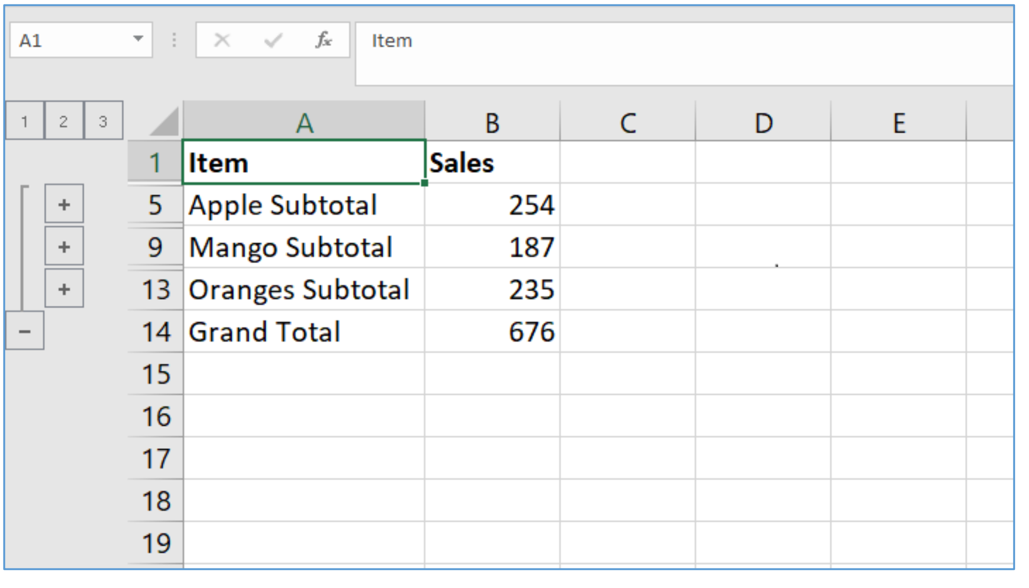
Run the code and open **`hello.xlsx`** using Excel. As we can see, the outlines are displayed on the left.



At each level, the minus sign indicates that the rows can be collapsed and only the subtotal row will be displayed.



This figure shows all rows at **level 2** have been collapsed. It now shows plus symbol in the outline which means that the data rows can be expanded. If you click the minus symbol at **level 1**, only the grand total will remain on the worksheet.



25. XlsxWriter – Freeze and Split Panes

The freeze_panes() method

The **freeze_panes()** method of Worksheet object in XlsxWriter library divides or splits the worksheet into horizontal or vertical regions known as panes, and "freezes" either or both of these panes so that if we scroll down or scroll down or scroll towards right, the panes (top or left respectively) remains stationary.

The method requires the parameters **row** and **col** to specify the location of the split. It should be noted that the split is specified at the top or left of a cell and that the method uses zero based indexing. You can set one of the row and col parameters as zero if you do not want either a vertical or horizontal split.

Example

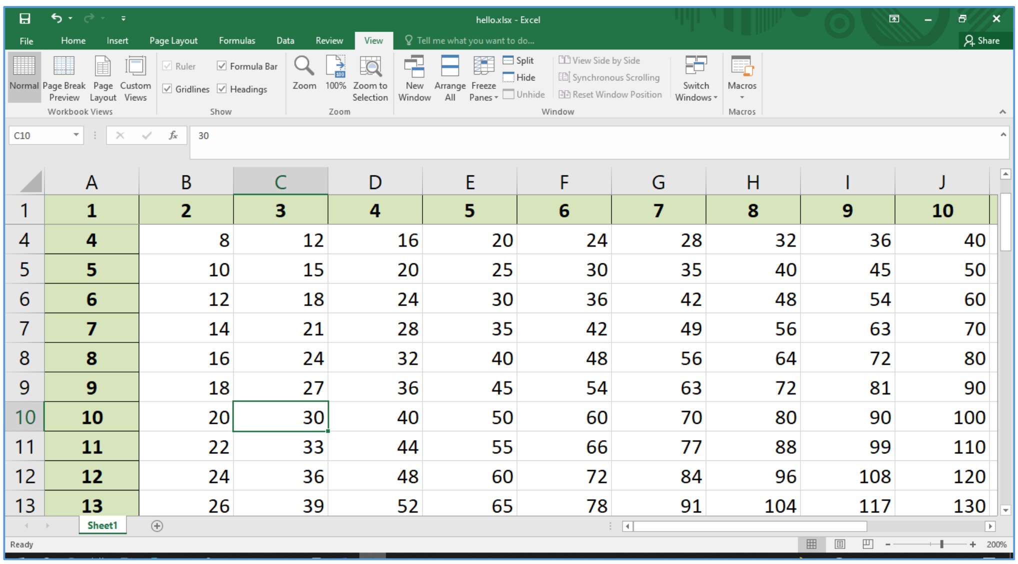
The worksheet in the following example displays incrementing multiples of the column number in each row, so that each cell displays product of row number and column number.

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
format1=wb.add_format({'bg_color':'#D9D9D9',  'bold':True})


for col in range(0, 15):
    worksheet.write(0, col, col+1, format1)


for row in range(1, 51):
    for col in range(0,15):
        if col==0:
```

```
            worksheet.write(row,col,(col+1)*(row + 1), format1)
        else:
            worksheet.write(row,col,(col+1)*(row + 1))
# Freeze pane on the top row.
worksheet.freeze_panes(1, 0)

wb.close()
```

Output:

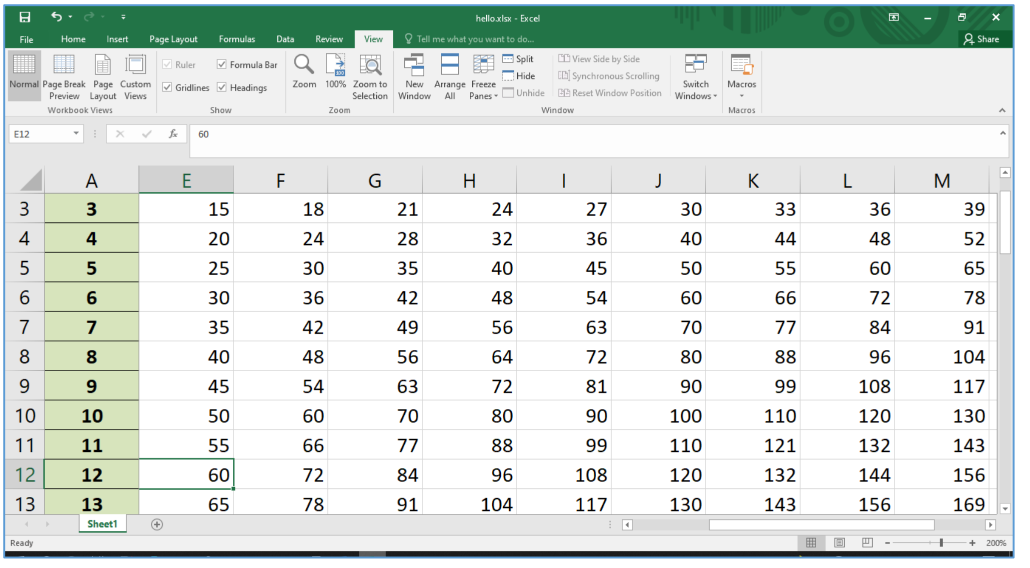
We then freeze the **top row pane**. As a result, after opening the worksheet, if the cell pointer is scrolled down, the top row always remains on the worksheet.



Similarly, we can make the **first column** stationery.

```
# Freeze pane on the first column.
worksheet.freeze_panes(0, 1)
```

The following screenshot shows that **column A** remains visible even if we scroll towards the right.

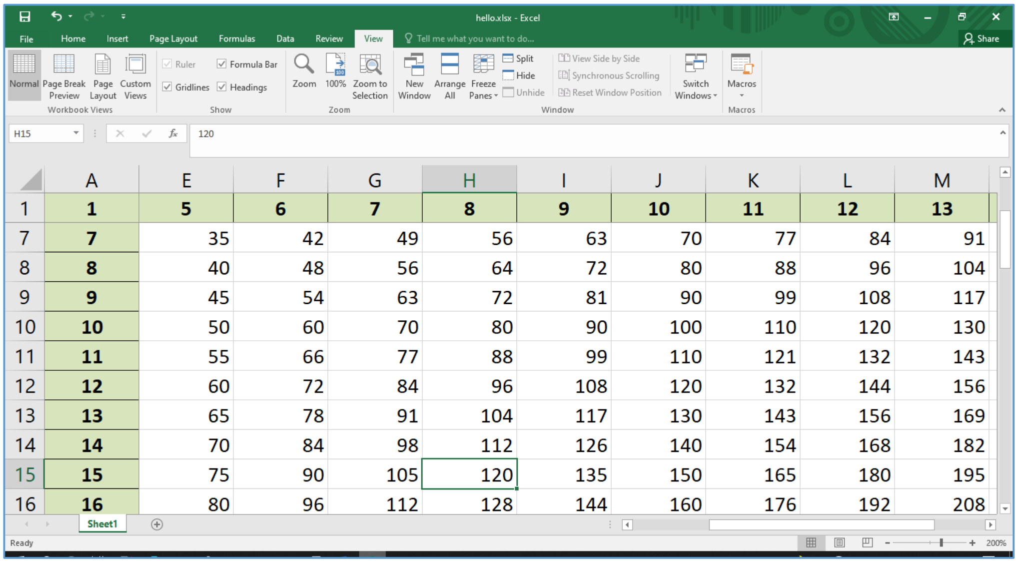


	A	E	F	G	H	I	J	K	L	M
3	3	15	18	21	24	27	30	33	36	39
4	4	20	24	28	32	36	40	44	48	52
5	5	25	30	35	40	45	50	55	60	65
6	6	30	36	42	48	54	60	66	72	78
7	7	35	42	49	56	63	70	77	84	91
8	8	40	48	56	64	72	80	88	96	104
9	9	45	54	63	72	81	90	99	108	117
10	10	50	60	70	80	90	100	110	120	130
11	11	55	66	77	88	99	110	121	132	143
12	12	60	72	84	96	108	120	132	144	156
13	13	65	78	91	104	117	130	143	156	169

By setting row and column parameter in `freeze_panes()` method to 1, both the top row and leftmost column will freeze.

```
# Freeze pane on the first row, first column.
worksheet.freeze_panes(1, 1)
```

Open the resulting worksheet and scroll the cell cursor around. You will find that row and column numbers in top row and leftmost column, which have been formatted in bold and with a background color, are visible always.



	A	E	F	G	H	I	J	K	L	M
1	1	5	6	7	8	9	10	11	12	13
7	7	35	42	49	56	63	70	77	84	91
8	8	40	48	56	64	72	80	88	96	104
9	9	45	54	63	72	81	90	99	108	117
10	10	50	60	70	80	90	100	110	120	130
11	11	55	66	77	88	99	110	121	132	143
12	12	60	72	84	96	108	120	132	144	156
13	13	65	78	91	104	117	130	143	156	169
14	14	70	84	98	112	126	140	154	168	182
15	15	75	90	105	120	135	150	165	180	195
16	16	80	96	112	128	144	160	176	192	208

The split_panes() method

The **split_panes()** method also divides the worksheet into horizontal or vertical regions known as panes, but unlike **freeze_panes()** method, the splits between the panes will be visible to the user and each pane will have its own scroll bars.

The method has the parameters "y" and "x" that are used to specify the vertical and horizontal position of the split. These parameters are in terms of row height and column width used by Excel. The row heights and column widths have default values as 15 for a row and 8.43 for a column.

You can set one of the "y" and "x" parameters as zero if you do not want either a vertical or horizontal split.

To create a split at the 10th row and 7th column, the **split_panes()** method is used as follows:

```
worksheet.split_panes(15*10, 8.43*7)
```

You will find the splitters at 10th row and 7th column of the worksheet. You can scroll the panes to the left and right of vertical splitter and to the top and bottom of horizontal splitter. Note that the other panes will remain constant.

Example

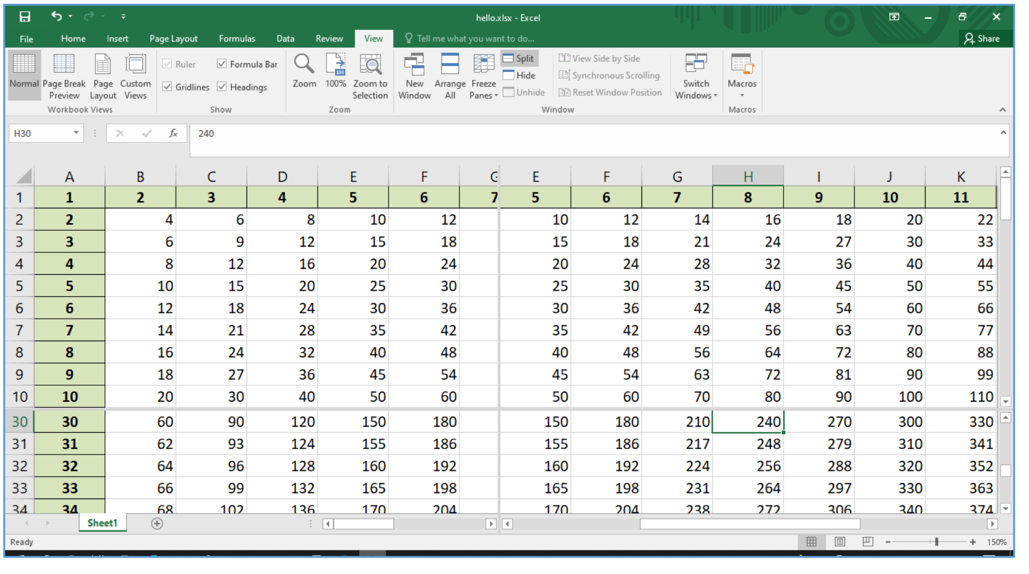
Here's the complete code that creates the splitter, and below that the output is shown:

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
format1=wb.add_format({'bg_color':'#D9D9D9', 'bold':True})


for col in range(0, 15):
    worksheet.write(0, col, col+1, format1)


for row in range(1, 51):
    for col in range(0,15):
        if col==0:
```

```
            worksheet.write(row,col,(col+1)*(row + 1), format1)
        else:
            worksheet.write(row,col,(col+1)*(row + 1))

worksheet.split_panes(15*10, 8.43*7)

wb.close()
```

Output:

Run the code and open **`hello.xlsx`** using Excel. As we can see, the worksheet is split into different panes at 10th row and 7th column.



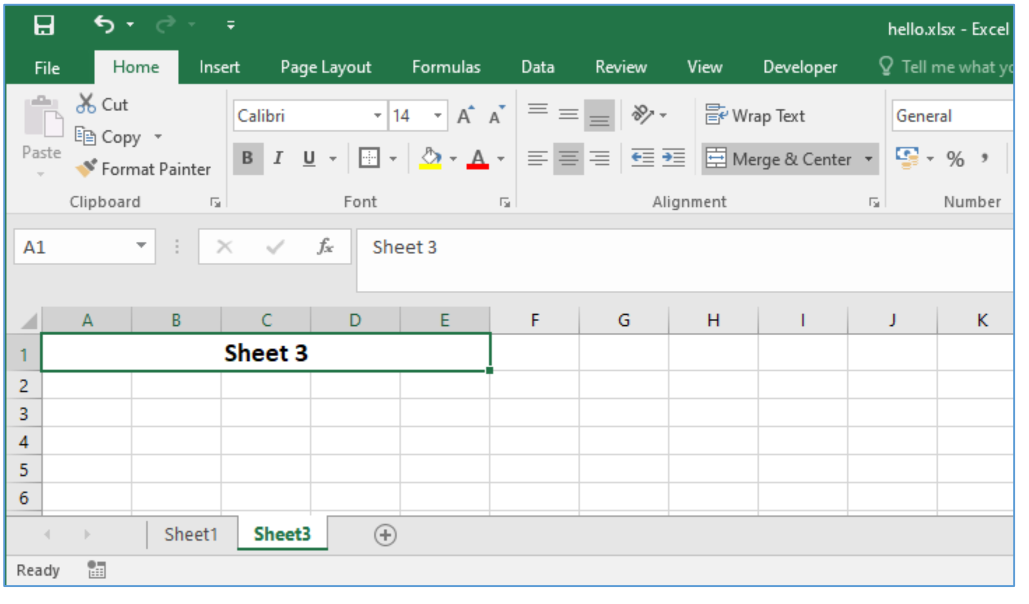
26. XlsxWriter – Hide/Protect Worksheet

The worksheet object's **`hide()`** method makes the worksheet disappear till it is unhidden through Excel menu.

In the following worksheet, there are three sheets, of which **`sheet2`** is hidden.

```
sheet1 = workbook.add_worksheet()
sheet2 = workbook.add_worksheet()
sheet3 = workbook.add_worksheet()


# Hide Sheet2. It won't be visible until it is unhidden in Excel.
worksheet2.hide()
```

It will create the following worksheet:



You can't hide the "**active**" worksheet, which generally is the first worksheet, since this would cause an **Excel error**. So, in order to hide the first sheet, you will need to activate another worksheet.

```
sheet2.activate()
sheet1.hide()
```

Hide Specific Rows or Columns

To hide specific rows or columns in a worksheet, set hidden parameter to 1 in **set_row()** or **set_column()** method. The following statement hides the columns C, D and E in the active worksheet.

```
worksheet.set_column('C:E', None, None, {'hidden': 1})
```

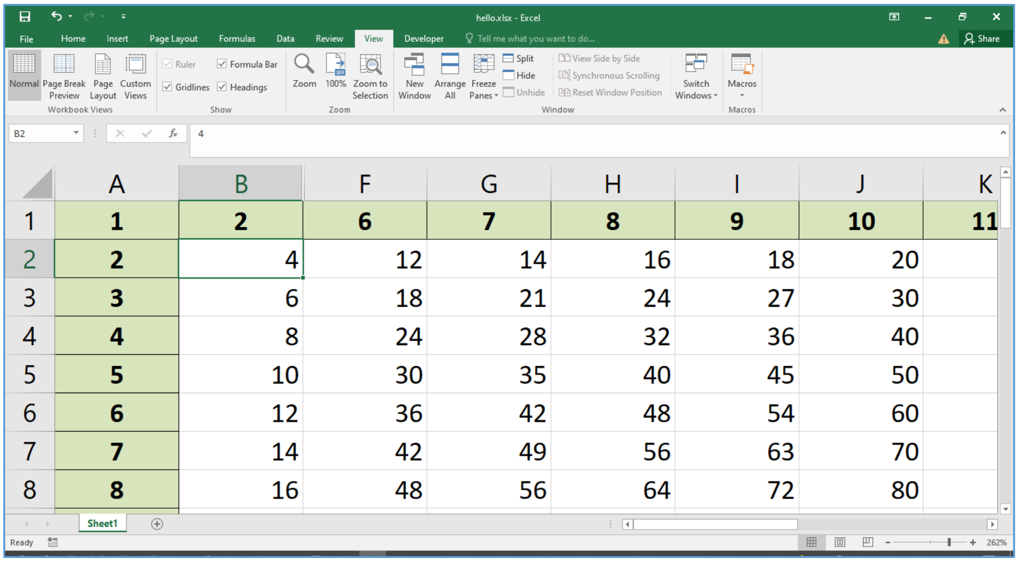
Example

Consider the following program:

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
format1=wb.add_format({'bg_color':'#D9D9D9',  'bold':True})


for col in range(0, 15):
    worksheet.write(0, col, col+1, format1)


for row in range(1, 51):
    for col in range(0,15):
        if col==0:
            worksheet.write(row,col,(col+1)*(row + 1), format1)
        else:
            worksheet.write(row,col,(col+1)*(row + 1))
worksheet.set_column('C:E', None, None, {'hidden': 1})


wb.close()
```

Output:

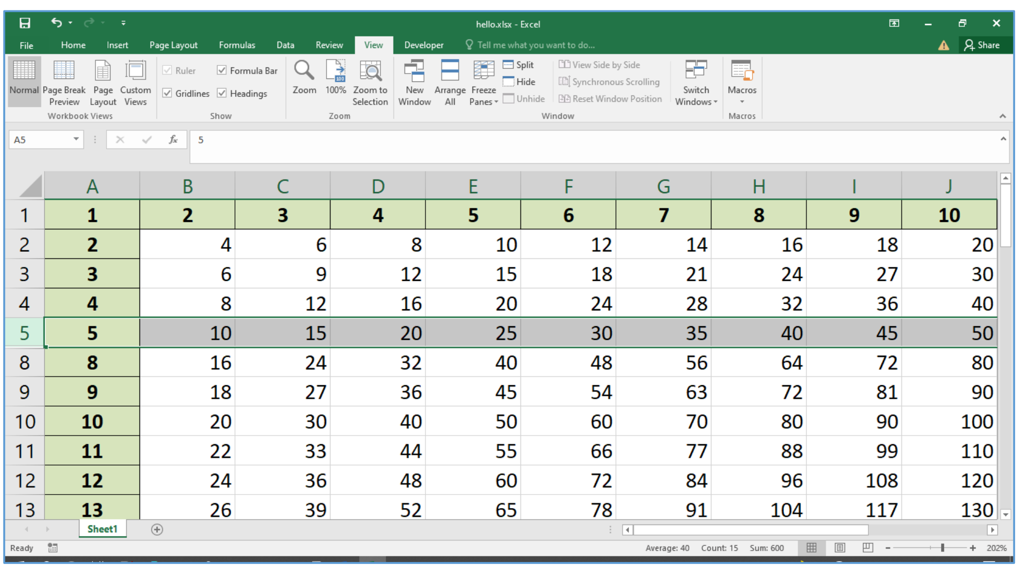
As a result of executing the above code, the columns C, D and E are not visible in the worksheet below:



Similarly, we can hide rows with **set_row()** method with the help of hidden parameter.

```
for row in range(5, 7):
    worksheet.set_row(row, None, None, {'hidden':1})
```

Here is the result:



27. XlsxWriter – Textbox

In Excel, a **text box** is a graphic object that can be placed anywhere on the worksheet, and can be moved around if needed. Desired formatting features such as font (color, size, name etc.), alignment, fill effects, orientation etc. can be applied on the text contained in the text box.

Working with XlsxWriter – Textbox

In XlsxWriter, there is **`insert_textbox()`** method to place text box on the worksheet. The cell location of the text box and the text to be written in it must be given. Additionally, different formatting options are given in the form of a dictionary object.

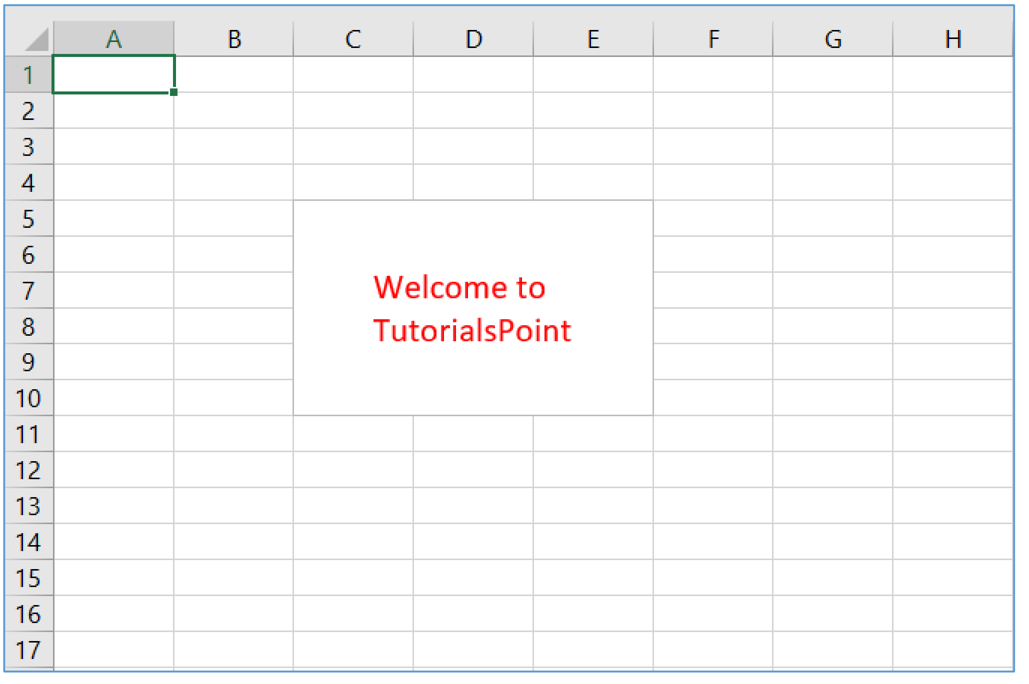
Example

The following code displays a text box at cell C5, the given string is displayed with font and alignment properties as shown below:

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
text = 'Welcome to TutorialsPoint'


options = {'font': {'color': 'red','size': 14},
            'align': {'vertical': 'middle','horizontal': 'center'}
           }
worksheet.insert_textbox('C5', text, options)


wb.close()
```

Output:

Open the worksheet '**hello.xlsx**' with Excel app. The text box appears as below:



Textbox Options – fill

The text box is by default 192X120 pixels in size (corresponds to 3 columns and 6 rows). This size can be changed with width and height parameters, both given in pixels. One of the parameters acceptable to **inset_textbox()** method is the **fill** parameter. It takes a predefined color name or color representation in hexadecimal as value.

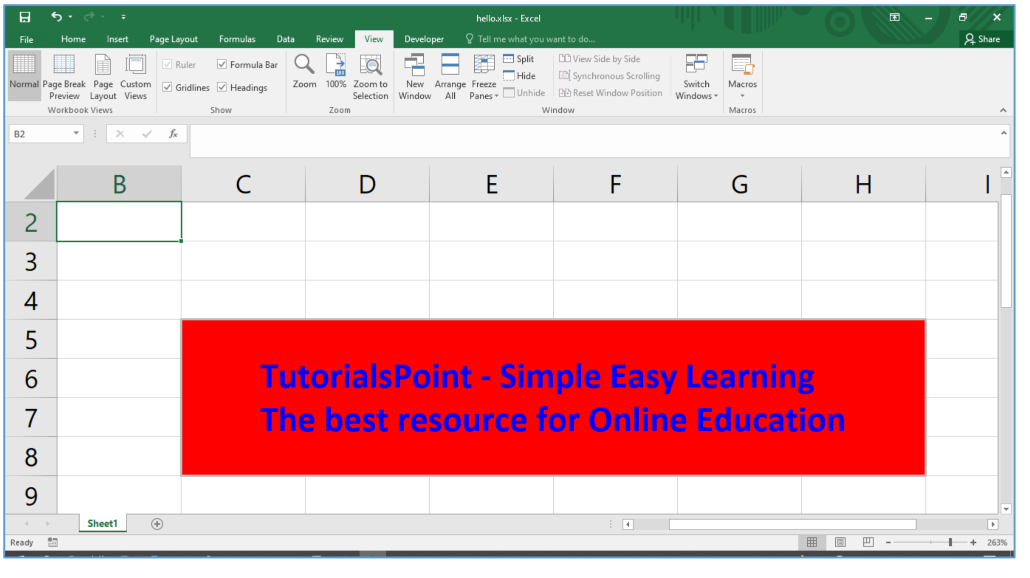
Example

The following code displays a multi-line string in the custom sized text box having background filled with red color.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')

worksheet = wb.add_worksheet()

text = 'TutorialsPoint - Simple Easy Learning\nThe best
resource for Online Education'
```

```
options = {
    'width': 384,
    'height':80,
    'font': {'color': 'blue',
             'bold':True,
             'size': 14},
    'align': {'vertical': 'middle',
              'horizontal': 'center'
              },
    'fill':{'color':'red'},
    }
worksheet.insert_textbox('C5', text, options)
wb.close()
```

As we can see in the figure below, a text box with multiple lines is rendered at cell C5.

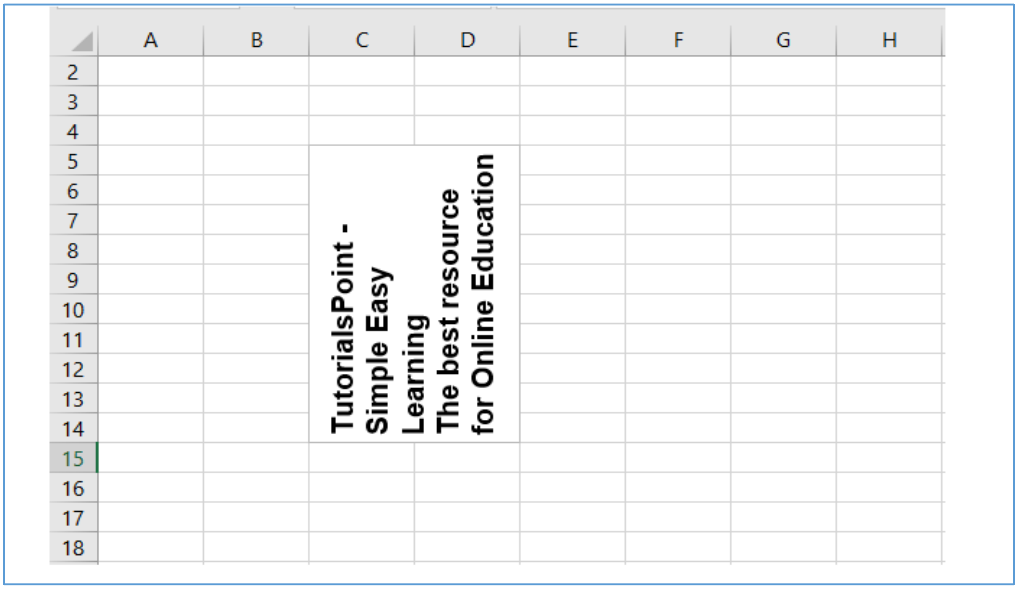


Textbox Options – text_rotation

Another important property is the **text_rotation**. By default, the text appears horizontally. If required, you may change its orientation by giving an angle as its value. Look as the following options.

```
import xlsxwriter
wb = xlsxwriter.Workbook('hello.xlsx')
worksheet = wb.add_worksheet()
text = 'TutorialsPoint - Simple Easy Learning\nThe best resour
ce for Online Education'


options = {
    'width': 128,
    'height':200,
    'font': {'bold':True, 'name':'Arial', 'size': 14},
    'text_rotation':90,
    }


worksheet.insert_textbox('C5', text, options)
wb.close()
```

The text now appears in the text box with its vertical orientation.



The `object_position` parameter controls the **behaviour** of the text box. It can have the following possible values and their effect:

- **"1"**: Move and size with cells (the default).
- **"2"**: Move but don't size with cells.
- **"3"**: Don't move or size with cells.

28. XlsxWriter – Insert Image

It is possible to insert an image object at a certain cell location of the worksheet, with the help of **insert_image()** method. Basically, you have to specify the location of cell using any type of notation and the image to be inserted.

```
worksheet.insert_image('C5', 'logo.png')
```

The **insert_image()** method takes following optional parameters in a dictionary.

Parameter	Default
'x_offset'	0,
'y_offset'	0,
'x_scale'	1,
'y_scale'	1,
'object_position'	2,
'image_data'	None
'url'	None
'description'	None
'decorative'	False

The offset values are in pixels. The **x_scale** and **y_scale** parameters are used to scale the image horizontally and vertically.

The **image_data** parameter is used to add an in-memory byte stream in **io.BytesIO** format.

Example

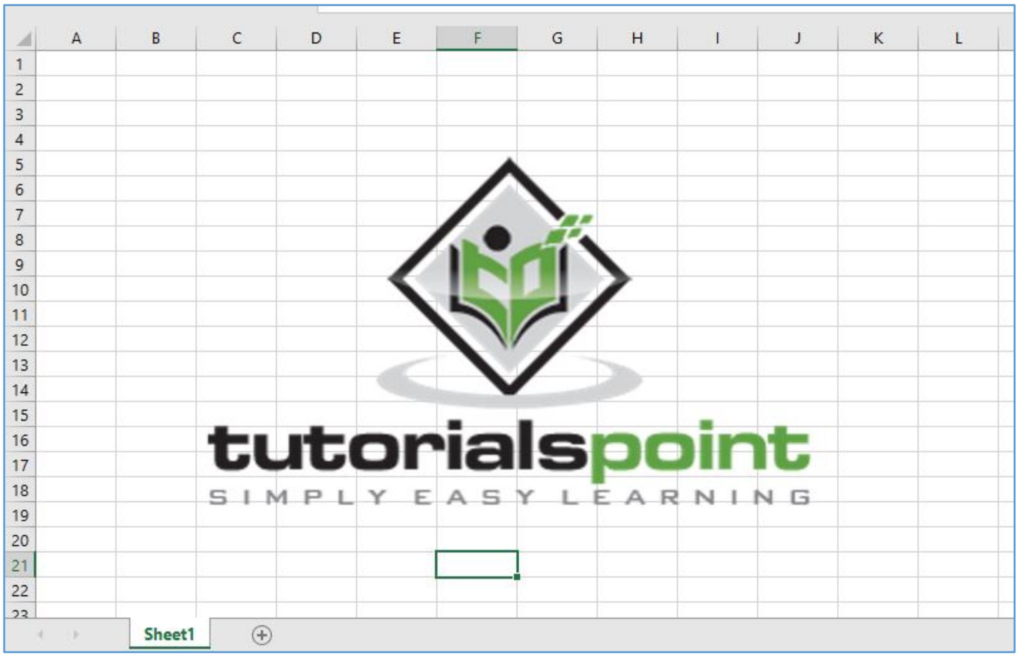
The following program extracts the image data from a file in the current folder and uses is as value for `image_data` parameter.

```
from io import BytesIO
import xlsxwriter
```

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

filename   = 'logo.png'

file = open(filename, 'rb')
data = BytesIO(file.read())
file.close()

worksheet.insert_image('C5', filename, {'image_data': data})

workbook.close()
```

Output:

Here is the view of the resultant worksheet:



29. XlsxWriter – Page Setup

The worksheet **page setup** methods are related to appearance of the worksheet when it is printed. These worksheet methods control the orientation, paper size, margins, etc.

set_landscape()

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

set_portrait()

This method is used to set the orientation of a worksheet's printed page to portrait. This is the default orientation.

set_page_view()

This method is used to display the worksheet in "Page View/Layout" mode.

set_paper()

This method is used to set the paper format for the printed output of a worksheet. It takes index as an integer argument. It is the Excel paper format index.

Following are some of the paper styles and index values:

Index	Paper format	Paper size
0	Printer default	Printer default
1	Letter	8 1/2 x 11 in
2	Letter Small	8 1/2 x 11 in
3	Tabloid	11 x 17 in
4	Ledger	17 x 11 in
5	Legal	8 1/2 x 14 in
6	Statement	5 1/2 x 8 1/2 in
7	Executive	7 1/4 x 10 1/2 in
8	A3	297 x 420 mm
9	A4	210 x 297 mm

set_margin()

This method is used to set the margins of the worksheet when it is printed. It accepts left, right, top and bottom parameters whose values are in inches. All parameters are optional The left and right parameters are 0.7 by default, and top and bottom are 0.75 by default.

30. XlsxWriter – Header and Footer

When the worksheet is printed using the above methods, the **header** and **footer** are generated on the paper. The print preview also displays the header and footer. Both are configured with **set_header()** and **set_footer()** methods. Header and footer string is configured by following control characters:

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

Example

The following code uses **set_header()** and **set_footer()** methods:

```
import xlsxwriter


wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data = [ ['Anil', 45, 55, 50], ['Ravi', 60, 70, 80],
         ['Kiran', 65, 75, 85],['Karishma', 55, 65, 45]]

for row in range(len(data)):
    ws.write_row(row,0, data[row])

header1 = '&CTutorialspoint'
footer1 = '&LSimply Easy Learning'

ws.set_landscape()
ws.set_paper(9) #A4 paper
ws.set_header(header1)
ws.set_footer(footer1)

ws.set_column('A:A', 50)

wb.close()
```

Output:

Run the above Python code and open the worksheet. From File menu, choose Print option. On the right pane, the preview is shown. You should be able to see the header and footer.

Tutorialspoint

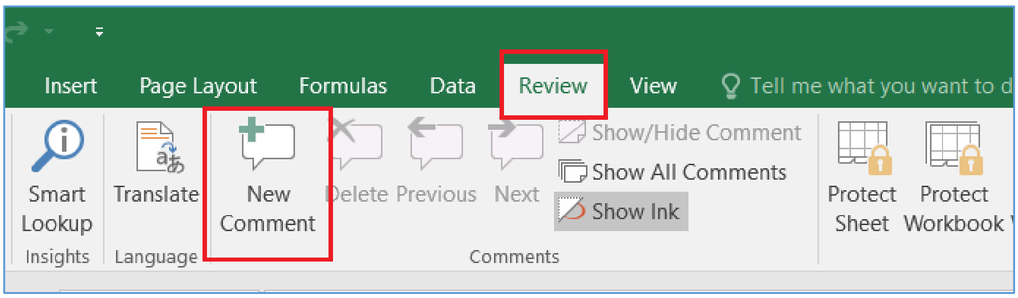
Anil	45	55	50
Ravi	60	70	80
Kiran	65	75	85
Karishma	55	65	45

Simply Easy Learning

31. XlsxWriter – Cell Comments

In an Excel worksheet, **comments** can be inserted for various reasons. One of the uses is to explain a formula in a cell. Also, Excel comments also serve as reminders or notes for other users. They are useful for cross-referencing with other Excel workbooks.

From Excel's menu system, comment feature is available on Review menu in the ribbon.



To add and format comments, XlsxWriter has **add_comment()** method. Two mandatory parameters for this method are **cell location** (either in A1 type or row and column number), and the **comment text**.

Example

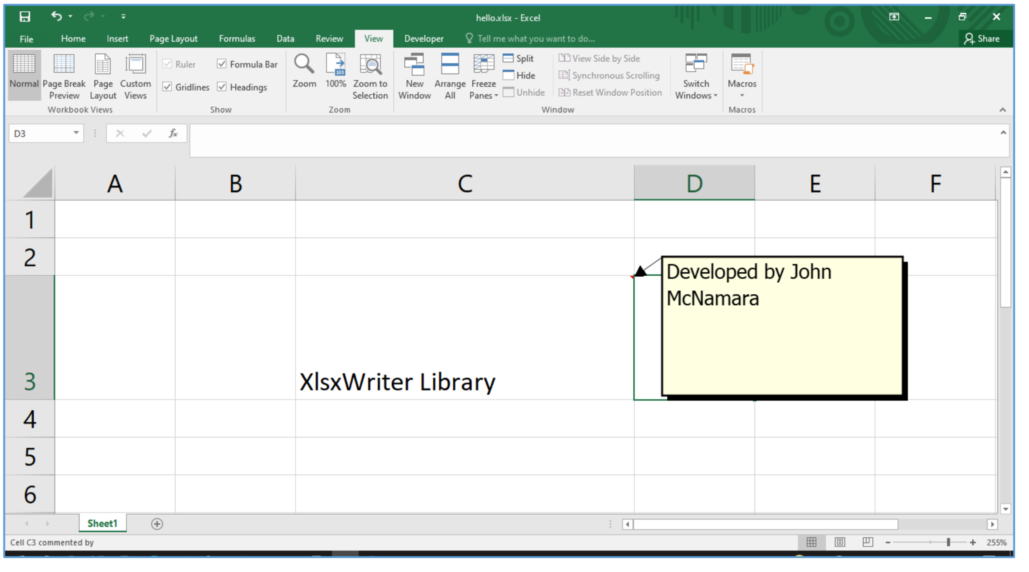
Here is a simple example:

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

data='XlsxWriter Library'

ws.set_column('C:C', 25)
ws.set_row(2, 50)
ws.write('C3', data)
```

```
text = 'Developed by John McNamara'
ws.write_comment('C3', text)

wb.close()
```

Output:

When we open the workbook, a comment will be seen with a marker on top right corner of C3 cell when the cursor is placed in it.



By default, the comments are not visible until the cursor hovers on the cell in which the comment is written. You can either show all the comments in a worksheet by invoking **show_comment()** method of worksheet object, or setting visible property of individual comment to True.

```
ws.write_comment('C3', text, {'visible': True})
```

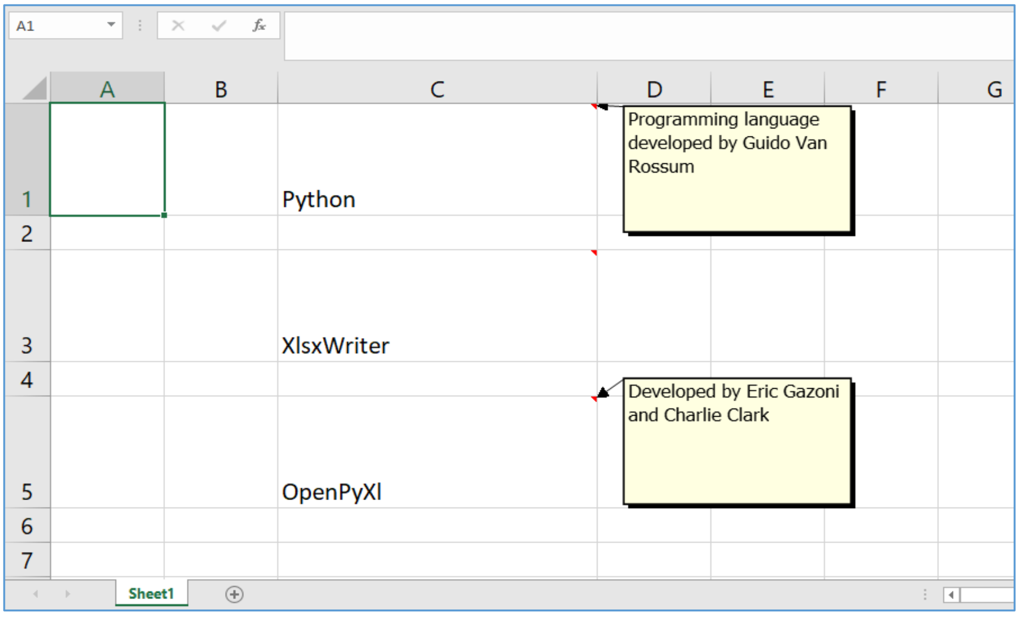
Example:

In the following code, there are three comments placed. However, the one in cell C3 is has been configured with visible property set to False. Hence, it cannot be seen until the cursor is placed in the cell.

```
import xlsxwriter

wb = xlsxwriter.Workbook('hello.xlsx')
ws = wb.add_worksheet()

ws.show_comments()

data='Python'
ws.set_column('C:C', 25)
ws.set_row(0, 50)
ws.write('C1', data)
text = 'Programming language developed by Guido Van Rossum'
ws.write_comment('C1', text)
data= 'XlsxWriter'
ws.set_row(2, 50)
ws.write('C3', data)
text = 'Developed by John McNamara'
ws.write_comment('C3', text, {'visible':False})
data= 'OpenPyXl'
ws.set_row(4, 50)
ws.write('C5', data)
text = 'Developed by Eric Gazoni and Charlie Clark'
ws.write_comment('C5', text, {'visible':True})

wb.close()
```

Output:

It will produce the following output:



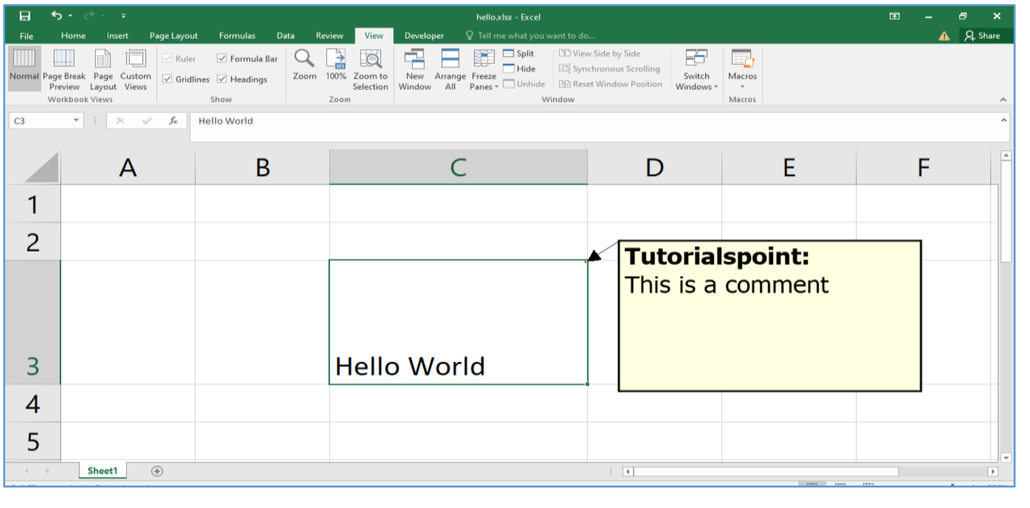
You can set author option to indicate who is the author of the cell comment. The author of the comment is also displayed in the status bar at the bottom of the worksheet.

```
worksheet.write_comment('C3', 'Atonement', {'author': 'Tutorialspoint'})
```

The default author for all cell comments can be set using the **set_comments_author()** method:

```
worksheet.set_comments_author('Tutorialspoint')
```

It will produce the following output:



32. XlsxWriter – Working with Pandas

Pandas is a popular Python library for data manipulation and analysis. We can use XlsWriter for writing **Pandas dataframes** into an Excel worksheet.

To learn the features described in this section, we need to install **Pandas** library in the same environment in which **XlsxWriter** has been installed.

```
pip3 install pandas
```

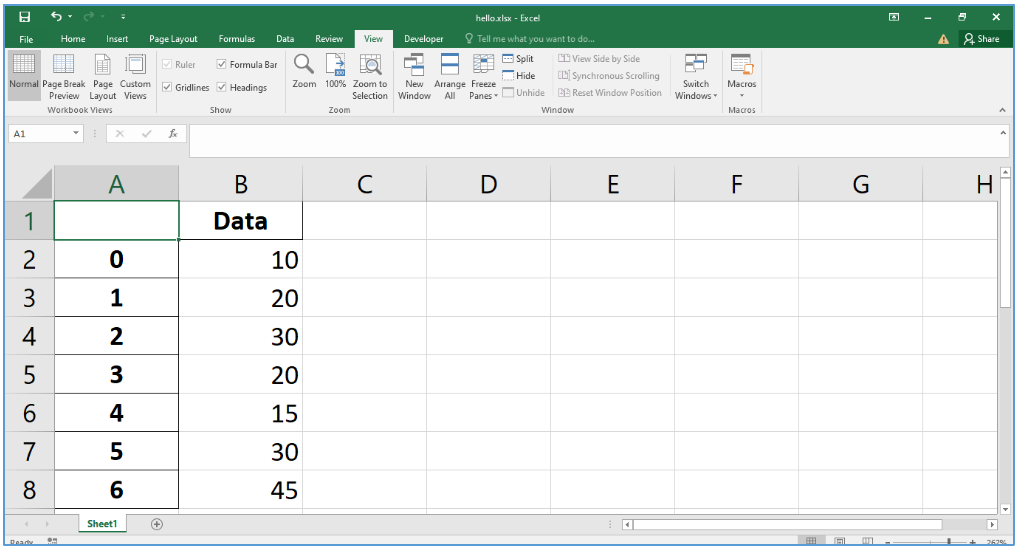
Using XlsxWriter with Pandas

Let us start with a simple example. First, create a Pandas dataframe from the data from a list of integers. Then use XlsxWriter as the engine to create a Pandas Excel writer. With the help of this engine object, we can write the dataframe object to Excel worksheet.

```
import pandas as pd


df = pd.DataFrame({'Data': [10, 20, 30, 20, 15, 30, 45]})
writer = pd.ExcelWriter('hello.xlsx', engine='xlsxwriter')
df.to_excel(writer, sheet_name='Sheet1')


writer.save()
```

Output:

The worksheet so created shows up as follows:



Adding Charts to Padas Dataframe

Just as we obtain an object of Workbook class, and then a Worksheet object by calling its **add_worksheet()** method, the writer object can also be used to fetch these objects. Once we get them, the XlsxWriter methods to add chart, data table etc. can be employed.

In this example, we set up a Pandas dataframe and obtain its dimension (or shape).

```
import pandas as pd

df = pd.DataFrame({'Data': [105, 60, 35, 90, 15, 30, 75]})

writer = pd.ExcelWriter('hello.xlsx', engine='xlsxwriter')

df.to_excel(writer, sheet_name='Sheet1')

(max_row, max_col) = df.shape
```

The workbook and worksheet objects are created from the writer.

```
workbook  = writer.book

worksheet = writer.sheets['Sheet1']
```

Rest of things are easy. The chart object is added as we have done earlier.

```
chart = workbook.add_chart({'type': 'column'})
chart.add_series({'values': ['Sheet1', 1, 1, max_row, 1]})
worksheet.insert_chart(1, 3, chart)
writer.save()
```

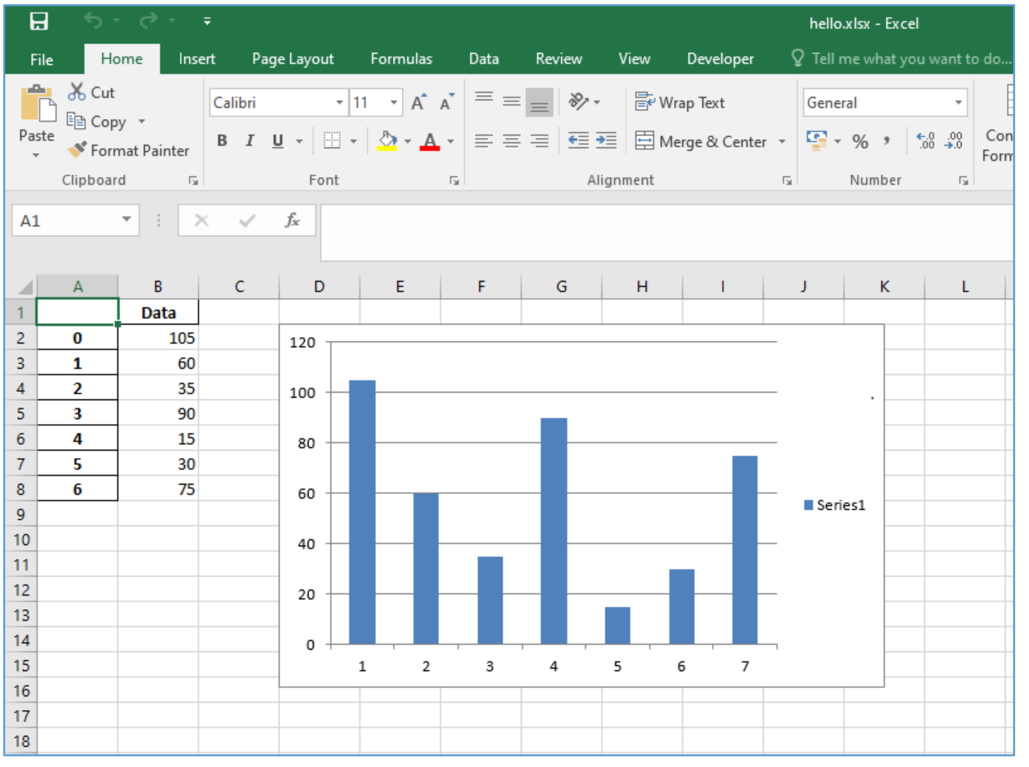
Example

The following code uses Pandas dataframe to write an Excel workbook and a column chart is prepared by XlsxWriter.

```
import pandas as pd


df = pd.DataFrame({'Data': [105, 60, 35, 90, 15, 30, 75]})
writer = pd.ExcelWriter('hello.xlsx', engine='xlsxwriter')
df.to_excel(writer, sheet_name='Sheet1')
(max_row, max_col) = df.shape


workbook  = writer.book
worksheet = writer.sheets['Sheet1']
chart = workbook.add_chart({'type': 'column'})
chart.add_series({'values': ['Sheet1', 1, 1, max_row, 1]})
worksheet.insert_chart(1, 3, chart)


writer.save()
```

Output:

The column chart along with the data is shown below:



Writing Dataframe to Excel Table

Similarly, the dataframe can be written to Excel table object. The dataframe here is derived from a Python dictionary, where the keys are dataframe column headers. Each key has list as a value which in turn becomes values of each column.

```
import pandas as pd


df = pd.DataFrame({
    'Name':    ['Namrata','Ravi','Kiran','Karishma'],
    'Percent': [73.33, 70, 75, 65.5],
    'RollNo':  [1, 2,3,4]})


df = df[['RollNo', 'Name', 'Percent']]
(max_row, max_col) = df.shape
```

Use xlsxwriter engine to write the dataframe to a worksheet (sheet1)

```
writer = pd.ExcelWriter('hello.xlsx', engine='xlsxwriter')
df.to_excel(writer, sheet_name='Sheet1', startrow=1,
header=False, index=False)
```

Following lines give Workbook and Worksheet objects.

```
workbook = writer.book
worksheet = writer.sheets['Sheet1']
```

Data in the worksheet is converted to Table with the help of add_table() method.

```
column_settings = [{'header': column} for column in df.columns]


worksheet.add_table(0, 0, max_row, max_col - 1, {'columns':
column_settings})


writer.save()
```

Example

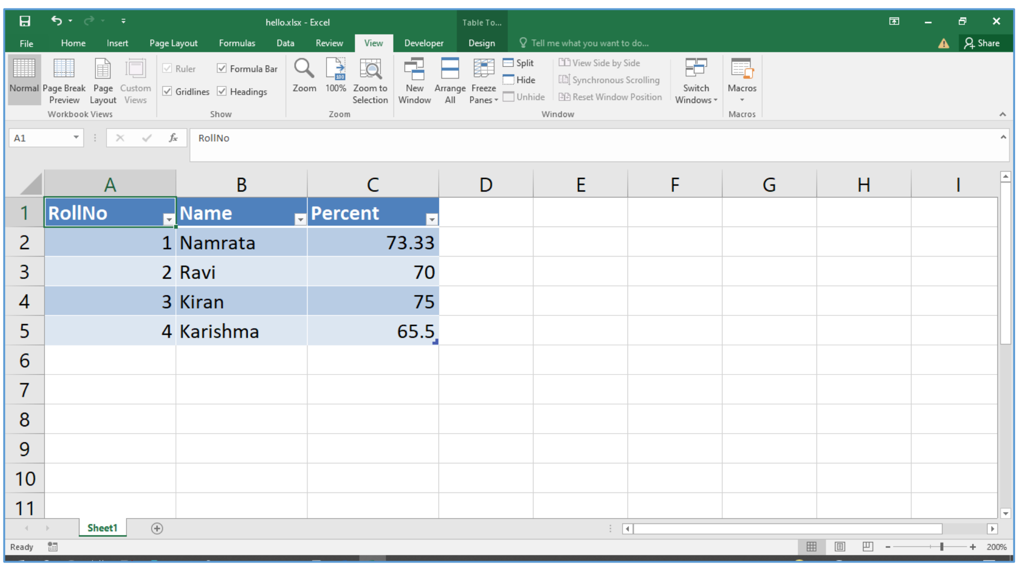
Below is the complete code to write pandas dataframe to Excel table.

```
import pandas as pd
df = pd.DataFrame({
    'Name':    ['Namrata','Ravi','Kiran','Karishma'],
    'Percent': [73.33, 70, 75, 65.5],
    'RollNo':  [1, 2,3,4]})

df = df[['RollNo', 'Name', 'Percent']]
(max_row, max_col) = df.shape

writer = pd.ExcelWriter('hello.xlsx', engine='xlsxwriter')
```

```
df.to_excel(writer, sheet_name='Sheet1', startrow=1, header=Fa
lse, index=False)


workbook = writer.book
worksheet = writer.sheets['Sheet1']


column_settings = [{'header': column} for column in df.columns]


worksheet.add_table(0, 0, max_row, max_col - 1, {'columns': co
lumn_settings})


writer.save()
```

Output:

The Table using default autofilter settings appears at A1 cell onwards.



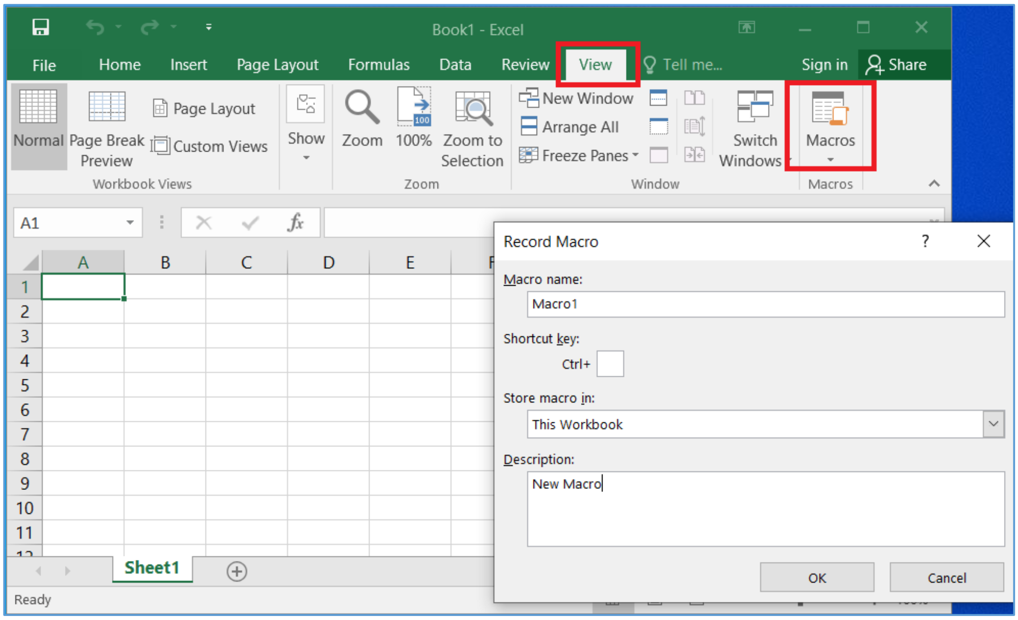
RollNo	Name	Percent
1	Namrata	73.33
2	Ravi	70
3	Kiran	75
4	Karishma	65.5

33. XlsxWriter – VBA Macro

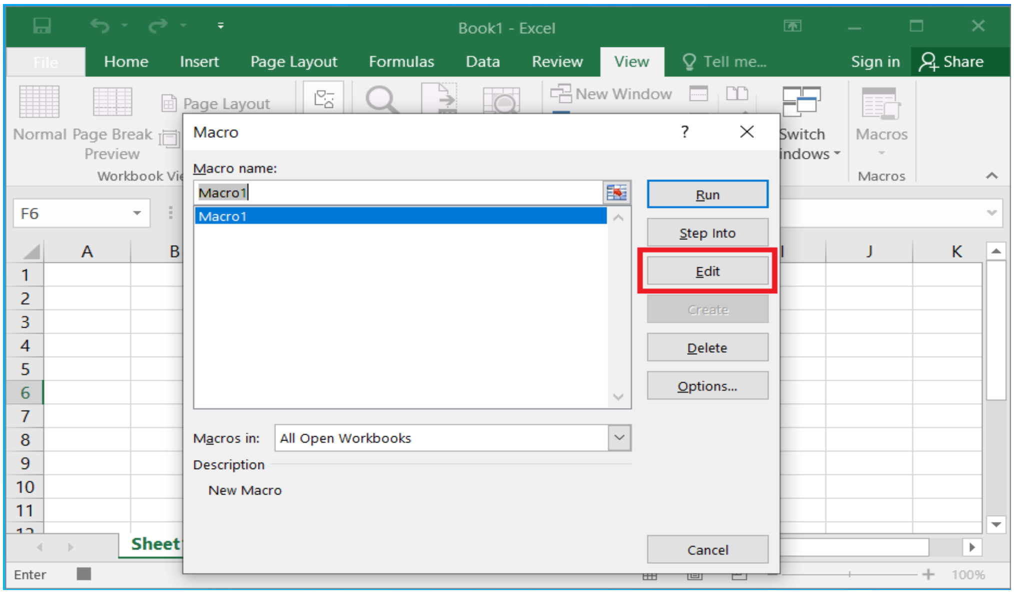
In Excel, a **macro** is a recorded series of steps that can be repeated any number of times with a shortcut key. The steps performed while recording the macro are translated into programming instructions VBA which stands for Visual Basic for Applications. VBA is a subset of Visual basic language, especially written to automate the tasks in MS Office apps such as Word, Excel, PowerPoint etc.

The option to record a macro is available in the Developer menu of MS Excel. If this menu is not seen, it has to be activated by going to the "File→Options→Customize" ribbon screen.

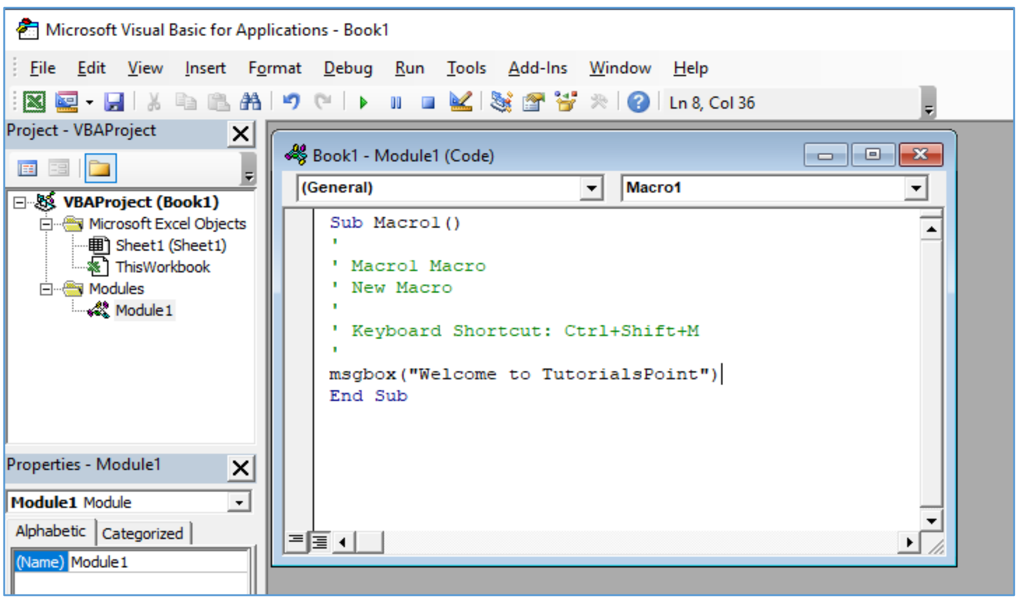
As shown in the following figure, click the Record Macro button by going to "View→Macros→Record Macro", and give a suitable name to the macro and perform desired actions to be recorded. After the steps are over stop the recording. Assign a desired shortcut so that the recorded action can be repeated as and it is pressed.



To view the VBA code, edit the macro by going View->Macros->View Macros. Select the Macro from Macro name and click on Edit.



The VBA editor will be shown. Delete all the steps generated by Excel and add the statement to popup a message box.



Confirm that the macro works perfectly. Press **CTL+Shift+M** and the message box pops up. Save this file with the **.xlsm** extension. It internally contains **vbaproject.bin**, a binary OLE COM container. To extract it from the Excel macro file, use the **`vba_extract.py`** utility.

```
(xlsxenv) E:\xlsxenv>vba_extract.py test.xlsm

Extracted: vbaProject.bin
```

This vbaProject.bin file can now be added to the XlsxWriter workbook using the **add_vba_project()** method. On this worksheet, place a button object at B3 cell, and link it to the macro that we had already created (i.e., **macro1**)

```
import xlsxwriter

workbook = xlsxwriter.Workbook('testvba.xlsm')
worksheet = workbook.add_worksheet()

worksheet.set_column('A:A', 30)
workbook.add_vba_project('./vbaProject.bin')
worksheet.write('A3', 'Press the button to say Welcome.')
worksheet.insert_button('B3',
                        {'macro': 'macro1',
                         'caption': 'Press Me',
                         'width': 80, 'height': 30})
workbook.close()
```

When the above code is executed, the macro enabled workbook named testvba.xlsm will be created. Open it and click on the button. It will cause the message box to pop up as shown.