University of Reading

Microsoft Excel 2013™ Macros (Level 3)

Contents

Introduction

A macro is a series of instructions which can be issued using a single command. The macro can be invoked in various different ways - from the keyboard (using a *Control* key combination), from a special icon on a toolbar or through the menu system. Ideally, you need to know a programming language (*Microsoft Visual Basic*) to create really useful macros; the examples below give you an introduction to macro writing.

Absolute and Relative References

Whenever you write a macro you have the option of using absolute or relative cell referencing. If you want to perform instructions on specific cells (e.g. move to cell A14, calculate the sum of the values above and format the result to appear as a currency in bold), then you use an *absolute reference*. If you want to move to a cell a certain number of rows/columns away from your present position (wherever that may be) then you use a *relative reference*. Hopefully the examples below will make this clear. First, open up the example file and set it up ready for use - users off campus can download the file by clicking on the filename in Step 1, below:

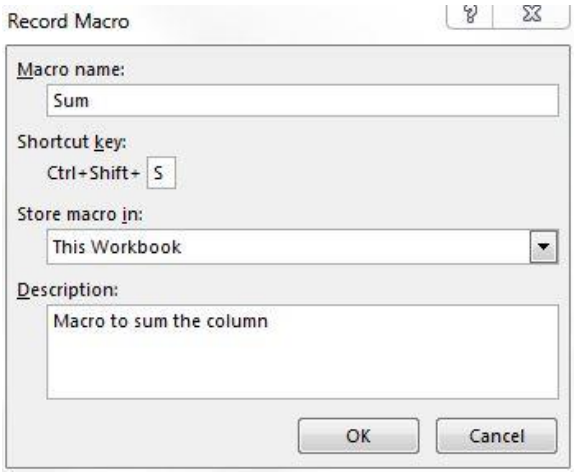
Microsoft Excel 2013 Macros

1. Load up Excel, click on Open Other Workbooks then computer and [Browse] to the file called phoenix.xlsx in the D:\Training folder
2. Next, move to the FILE tab then click on Options
3. Click on Customize Ribbon and tick the box next to Developer in the *Main Tabs* box on the right. Click on [OK] to show the DEVELOPER tab at the top of your Excel window. You'll need the buttons on this tab later (though you can also use a [Macros] button on the far right of the VIEW tab)

Using Absolute References

In this first example you are going to write a macro that adds up the values in columns A to E and applies a bold format to the totals.

1. Move to the DEVELOPER tab and click on the [Record Macro] button – a dialog box appears:



2. Set the *Macro name:* as *Sum* and the *Shortcut key:* to *Ctrl+ S* (i.e. press <Shift> + s to give an uppercase S)

Note that case matters - avoid existing key combinations: *<Ctrl s>* is currently set to the *Save* command.

3. *Store macro in:* This Workbook - the alternative is to store it in your *Personal Macro Workbook*, which would make the macro available every time you used Excel
4. Amend the *Description:* if you like (use this to say what the macro does & who recorded it)
5. Press <Enter> or click on [OK] to start recording

You now need to carry out the keystrokes required:

6. Press <Ctrl Home> (or click on *A1*) to make sure the macro starts in cell *A1*
7. Hold down <Ctrl> and press *<down arrow>* to move the active cell to the end of column A
8. Release <Ctrl> then press *<down arrow>* once more to move to cell *A52*
9. Press <Alt => (or click on the [AutoSum] button on the HOME tab) then press <Ctrl Enter> to confirm the formula =SUM(A2:A51) and stay in cell *A52*
10. Next, press <Ctrl b> (or click on the [Bold] button) to embolden the result
11. Click on the *green square* in the bottom right-hand corner of cell *A52* and drag the formula in *A52* across to *E52* to *automatically fill* the totals for all the columns (these may be rounded up)
12. Click on the DEVELOPER tab then on [Stop Recording] to end the macro

You should now have a macro which sums up the values in column *A*. Test out the macro as follows:

13. First, press <Delete> to empty the cells *A52* to *E52*
14. Hold down the <Ctrl> and <Shift> keys together and type the letter *s* - the sums appear again in bold characters in cells *A52* to *E52*

To demonstrate what is meant by *Absolute Referencing*:

15. Select rows **51** and **52** then press **<Ctrl c>** for **[Copy]**
16. *Right click* on cell *A54* and under **Paste Options...** choose **Values** (the *second* icon shown as **123**)
17. Select rows **51** and **52** again and **<Delete>** the contents – click on any cell to release the selection
18. Run the macro again (**<Ctrl Shift s>**) - you'll find that the totals appear in the same cells based on the same data range (including the empty row 51), with the new total differing from that in row 55
19. Press **<Delete>** to remove the incorrect values
20. Select row **54** and drag the border of the selection to row **51** to reset the data for sample 50. If a message saying that *We couldn't free up space on the Clipboard* appears, just click **[OK]**
21. Select row **55** and **<Delete>** the contents (these were the values from the sums pasted earlier)

This is a clear example of absolute references - the macro only works on the cells for which it was recorded. Even though a control key combination was used to move to the foot of the column, the next move (to cell *A52* in step *8*) was recorded as a move to a fixed cell.

In this second example, absolute references are left turned on but this does not affect the result. The object of this macro is to search for Blue-Green eggs and highlight the cells in an appropriate colour.

1. Press **<Ctrl Home>** to move to cell *A1*
2. On the **DEVELOPER** tab click on the **[Record Macro]** button
3. Set the *Macro name:* as ***Colour*** and the *Shortcut key:* to *Ctrl+* ***C*** (i.e. press **<Shift>** + **c** - *<Ctrl c>* is for copy)
4. *Store Macro in:* **This Workbook** and amend the *Description:* if you want
5. Press **<Enter>** or click on **[OK]** to start recording
6. Press **<Ctrl f>** (or move to the **HOME** tab and click on **[Find & Select]** then choose **Find...**)
7. In the *Find what:* box type ***Blue-Green***
8. Press **<Enter>** or click on **[Find Next]**
9. Press **<Esc>** or click on the **[Close]** button to close the *Find* window
10. *Right click* on the cell found then use the *list arrow* attached to the **[Fill Colour]** button (it looks like paint coming out of a bucket)
11. Choose a suitable colour from the palette - e.g. **Green**
12. Click on the **[Stop Recording]** button on the **DEVELOPER** tab to end the macro

You should now have a macro which colours Blue-Green cells a suitable colour. Test out the macro by pressing the appropriate key combination:

13. Hold down the **<Ctrl>** and **<Shift>** keys and type the letter ***c*** - repeat this a couple of times

The macro works from the active cell downwards, moving to the next blue-green cell rather than to a fixed cell. To demonstrate this further:

14. Move the active cell down several rows, *missing out* some Blue-Green cells
15. Hold down **<Ctrl>** and **<Shift>** and type the letter ***c***

You will see later how to edit the macro to colour all the Blue-Green cells, including those which were skipped.

Using Relative References

You saw earlier how the Sum macro failed to work properly because it was using absolute references. Let's repeat that here, to correct it:

1. Press <Ctrl Home> to move to cell *A1* and make it the active cell, then click on [Record Macro] on the DEVELOPER tab
2. Set the *Macro name:* as ***NewSum*** and the *Shortcut key:* to *Ctrl+* ***t*** (this isn't currently used)
3. *Store Macro in:* This Workbook and amend the *Description:* if you want
4. Press <Enter> or click on [OK] to start recording
5. Click on the [Use Relative References] button below *[Stop Recording]* on the DEVELOPER tab
6. Hold down <Ctrl> and press *<up arrow>* to make sure the active cell is at the top of the column
7. Next, hold down <Ctrl> and press *<down arrow>* to move the active cell to the end of the column
8. Release <Ctrl> then press *<down arrow>* once more to move to cell *A52*
9. Press <Alt => (or click on the [AutoSum] button on the HOME tab) then press <Ctrl Enter> to confirm the formula =SUM(A2:A51) and stay in cell *A52*
10. Click on the [Stop Recording] button on the DEVELOPER tab to end the macro
11. Now, press <Ctrl Home> then move to cell *D1* and press <Ctrl t> to run the macro again – it should work for column *D* (or, indeed, any column)
12. Press <Ctrl t> again for a second total (including the first)

You'll find the new total isn't what you might expect (it isn't quite double the original total). If you look at the formula on the *Formula Bar*, you'll see it says SUM(D3:D52) – it's still summing 50 values, not the 51 you now have. You'll see how to correct this later (but it needs a little programming).

13. <Delete> the value in cell *D53*
14. Click on the [Use Relative References] button again to turn it off

This next example is designed to copy every fifth row of data to a new sheet (*Sheet1*). Here, both absolute and relative references are used. Relative references are required because each successive source and target area is a known distance apart (5 rows down and 1 row down, respectively):

1. Click on the [New sheet] button (the *+* in a *circle*) to the right of the *PHOENIX* tab, at the bottom of the *Excel* window, to create a new ***Sheet1***
2. Click on [Record Macro] on the DEVELOPER tab
3. Set the *Macro name:* as ***Every5*** and the *Shortcut key:* to *Ctrl+* ***e*** (this isn't currently used)
4. *Store Macro in:* This Workbook and amend the *Description:* if you want
5. Press <Enter> or click on [OK] to start recording

Take great care to get the following instructions correct - if you make a mistake it's probably best to abandon the recording and start again (you may have to use a different shortcut key).

6. First, check relative references are off (the [Use Relative References] button should **not** be highlighted)
7. Click on the PHOENIX tab then press <Ctrl Home> to make *A1* the active cell
8. Now click on [Use Relative References] to turn relative references on
9. Hold down <Ctrl> and <Shift> and press the *<right arrow>* key to select row *1* (up to the end of the data)
10. Press <Ctrl c> (or *right click* and choose Copy)
11. Press <Ctrl Page Down> (or click on the *Sheet1* tab) to move to the empty sheet
12. Press <Ctrl Home> to make sure you start in cell *A1* then press <Enter> for Paste
13. Press the *<down arrow>* key to move the active cell on *Sheet1* to *A2*
14. Press <Ctrl Page Up> (or click on the *PHOENIX* tab) to move back to the original data
15. Press the *<down arrow>* key FIVE times to move the active cell to *A6* (or just click on it)
16. Hold down <Ctrl> and <Shift> and press the *<right arrow>* key to select the row

17. Press <Ctrl c> (or *right click* and choose Copy)
18. Press <Ctrl Page Down> (or click on the *Sheet1* tab) then press <Enter> for Paste
19. Click on [Stop Recording] to end the macro and turn off [Use Relative References]

Test out the macro, if you like (clear the data in the cells on *Sheet1* then press <Ctrl e>). All that happens is that the same data is pasted into the same cells on *Sheet1*. To complete the macro you now need to edit it.

Editing a Macro

Though recording macros is relatively simple, changing them is by no means easy. When you edit a macro you are taken into the *Visual Basic Editor*, and you need to understand exactly what the programming code is doing. Even if you can't program you can make minor changes and, if you add the lines of programming detailed below, turn simple recorded macros into very useful ones.

1. On the DEVELOPER tab, click on [Macros] in the *Code* group on the left
2. Select Every5 then click on [Edit]

You are now placed in the *Visual Basic Editor*, (if it flashes up and then disappears, just switch to it via the *Excel icon* on the *taskbar* at the bottom of your window or press <Alt F11>) with the following code displayed:

```
Sub Every5()
'
' Every5 Macro
' Every 5th row of data from the Phoenix sheet is copied to Sheet1.
'
' Keyboard Shortcut: Ctrl+e
'
    Sheets("PHOENIX").Select
    Range("A1").Select
    Range(Selection, Selection.End(xlToRight)).Select
    Selection.Copy
    ActiveSheet.Next.Select
    Range("A1").Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
    ActiveCell.Offset(1, 0).Range("A1").Select
    ActiveSheet.Previous.Select
    ActiveCell.Offset(5, 0).Range("A1").Select
    Range(Selection, Selection.End(xlToRight)).Select
    Selection.Copy
    ActiveSheet.Next.Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
End Sub
```

Don't worry if you don't understand what appears on the screen. If you compare it carefully with the original instructions then you might get some idea of what is happening. Note the line in the middle which says:

ActiveCell.Offset(1,0).Range("A1").Select

This is a relative reference - i.e. move the active cell down 1 row and across 0 columns from the active cell.

If you had been using absolute references this line would have just read:

Range("A2").Select

i.e. move to and select cell *A2*. You might like to scroll up to see the code recorded in the other macros.

Tip: You can use <Alt F11> to open up the *Editor* direct from Excel (or switch between it and Excel). Once you have finished making your changes, <Alt q> can be used to close down the *Editor*.

Repeating an Action

Now try making some changes to the macro. The original objective of the macro was to select *EVERY fifth row* - the instructions which have been recorded need to be repeated *10* times (as there are 50 rows in the data set). To do this, you need to add extra lines to the middle and end of the program:

1. Move the typing position to the *start* of the code to be repeated - *ActiveCell.Offset(1,0)...*
2. Add the following line of code ***for k=1 to 10*** then press <Enter> (the *Editor* may slightly change the format)
3. Click at the *end* of the last-but-one line - *Application.CutCopyMode = False*
4. Press <Enter> and type the following line of code: ***next k***

These extra two lines of code create a *loop* that is repeated 10 times. The loop *counter*, k, starts at 1 and increases by 1 each time the code is run. When it gets to 10, the loop ends.

5. Close the *Editor* window by clicking on the [Close] button of the bigger window in the top right-hand corner (or press <Alt q>) - the changes to the code are saved automatically
6. Select and <Delete> the values stored on *Sheet1* then press <Ctrl e> to run the macro

You should find that 10 rows (every 5th one) are copied across to Sheet1. Note that the macro may take some time to complete.

As an exercise, see if you can perform a similar edit on the Colour macro to colour *all the Blue-Green* eggs. Note that you will need to increase the final value of the loop to at least 21 (as there are 21 blue-green eggs).

Using Variables

The counter, k, in the example above is known as a *variable* in programming. It varies between a starting value of 1 up to an ending value of 10. You can use this variable in your module code, if you want:

1. On the DEVELOPER tab, click on [Macros] then select Every5 and [Edit] it
2. Change the line reading *ActiveCell.Offset(5, 0).Range("A1").Select* to ***ActiveCell.Offset(k,0).Range("A1").Select*** - i.e. change *5* to k
3. Close the MS Visual Basic window by clicking on the *close window* button - or press <Alt q>
4. Select and <Delete> the values stored on *Sheet1* then press <Ctrl e> to run the macro

You will find records 1, 3, 6, 10, 15, 21, 28, 36 and 45 are copied across - the offset (k) increases by 1 each time. When k=10, an empty record - sample number 55 in row 56 - is copied across.

For this final example, you need to understand a little more about programming. The instruction *ActiveCell.Offset* has *numeric* parameters - real numbers like 1, 5 or 0 or numeric variables like k. On the other hand, the instruction *Range("A1")* has a string parameter, A1 (here enclosed in quotation marks). If you want to use the numeric variable *k* within the Range instruction, you must first convert it to a *string* of characters.

5. On the DEVELOPER tab, click on [Macros]
6. Select Every5 then click on [Edit]

7. Click at the *end* of the line for *k=1 to 10* and press <Enter>
8. Type in an extra line reading ***m$ = "A" & CStr(k)***

The CStr function converts the *number* stored in k into a *string*. CInt converts a string to a whole number.

9. Change the next line (reading *ActiveCell.Offset(1, 0).Range("A1").Select*) to ***ActiveCell.Offset(1,0).Range(m$).Select*** - i.e. change *"A1"* to m$
10. Close the *Editor* window by clicking on the [Close] window button - or press <Alt q>
11. Select and <Delete> the values stored on *Sheet1* then press <Ctrl e> to run the macro

Be patient as this macro may take some time to complete! This time, the macro copies the same rows from the *PHOENIX* sheet as before, but pastes them into the *corresponding* rows on *Sheet1*. This is because the paste is carried out not 1 cell down from the active cell (in column *A*) but m$ (i.e. k) cells down.

Tip: You can easily supply the value for a parameter either by picking it up from a cell in the spreadsheet or via a dialog box. The Visual Basic you need for these are:

From a selected cell: k = Selection

From a dialog box: k = InputBox("*Message giving instructions*")

Obviously there's a lot more to macro writing than this simple introduction, but at least you should have some idea of how macros work and how you can change them. If you want to explore further, then please look at our Visual Basic Guide (2010).

To correct the *NewSum* macro that was created earlier (it didn't get the second summation total right), you would need to make the following changes:

Add: ***Row = ActiveCell.Row – 1*** *after ActiveCell.Offset(1, 0).Range("A1").Select*

To work out how many rows there are, then edit the *next* line to:

Selection.FormulaR1C1 = "=SUM(R[-" & CStr(Row) & "]C:R[-1]C)"

i.e. change *50* to " & CStr(Row) & "

With the above, be careful to write it out correctly! To test the macro, make sure you are in the *PHOENIX* sheet and either in cell *A1* or *D1* to start with, and then press <Ctrl t>. It should now be summing from the top of the column every time.

Tip: From the *Macros* dialog box, if you click on the [Step Into] button instead of [Edit], you can use the function key <F8> to step through the code one instruction at a time. You can even flip between the workbook and editor to see the effect of each line of code. This is invaluable in spotting where a macro is going wrong.

Running a Macro from a Toolbar Button or Control

An alternative to running a macro using a control key combination would be to run it from a toolbar button.

1. Click on the *down arrow* to the right of the *Quick Access Toolbar* (the icons at the very top left of your Excel window) and choose More Commands...
2. Set *Choose commands from:* to Macros
3. Select any of your macros (e.g. *NewSum*) then click on [Add>>] to move them onto the toolbar
4. Next, click on [Modify...] and select a symbol for your button
5. Click on [OK] *twice* to close the dialog boxes

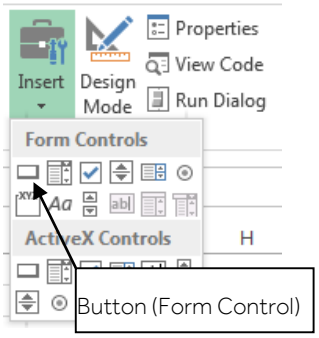
6. Finally, test out your new toolbar button – it should run the macro

To remove a button from the toolbar:

7. Repeat step 1 then select the button and **[<<Remove]** it – click on **[OK]** to close the dialog box

Controls

You can also run a macro from a *control* on a spreadsheet:

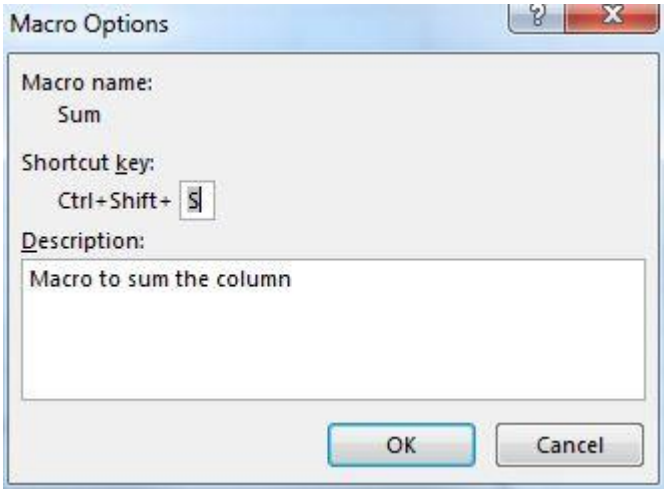


1. Click on the DEVELOPER tab and then the **[Insert]** button in the *Controls* group
2. Choose **[Button (Form Control)]** – the first in this group
3. Click on the spreadsheet (e.g. cell *J10* on the *PHOENIX* sheet) where you would like the control to appear – the *Assign Macro* dialog box appears
4. Select the required macro then press **<Enter>** for **[OK]**
5. Next, *right click* on the button and choose **Edit Text**
6. **<Delete>** the existing words then type in the name of the macro
7. Finally, click on the **[*Button*]** – the macro should run

Changing a Shortcut Key

If you want to change the shortcut key which runs a particular macro:

1. On the DEVELOPER tab, click on **[Macros]**
2. Select the macro whose shortcut key you wish to change (e.g. *Sum*, as shown below) then click on the **[Options...]** button



3. Set the new Shortcut key: then press **<Enter>** for **[OK]**, and **[Cancel]** to close the *Macro* dialog box

Deleting a Macro

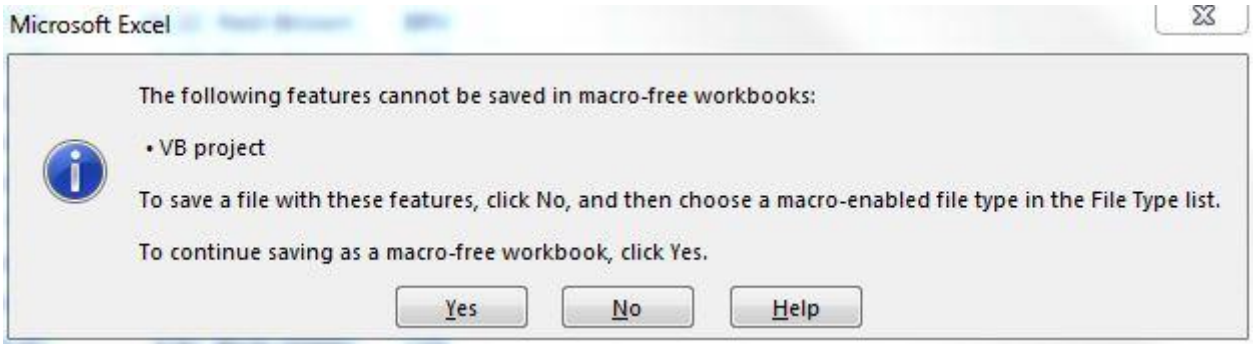
To delete a macro you no longer want:

1. On the DEVELOPER tab, click on **[Macros]** then select the macro to be deleted and click on **[Delete]**
2. You are asked to confirm the deletion - here press **<Esc>** or click on **[No]** (if you did want to delete it, just press **<Enter>** for **[Yes]**)

Saving an Excel Workbook with Macros

When you want to save a file with a macro in the new Excel format, you'll find you have to save it with a special file extension (*.xlsm*) otherwise the macros won't work:

1. Press **<Ctrl s>** or click on the **[Save]** button to save the file – the following warning message appears:



2. Click **[No]** so that you can then save the workbook with macros
3. Change *Save as type:* to **Excel Macro-Enabled Workbook (*.xlsm)**
4. Press **<Enter>** for **[Save]**

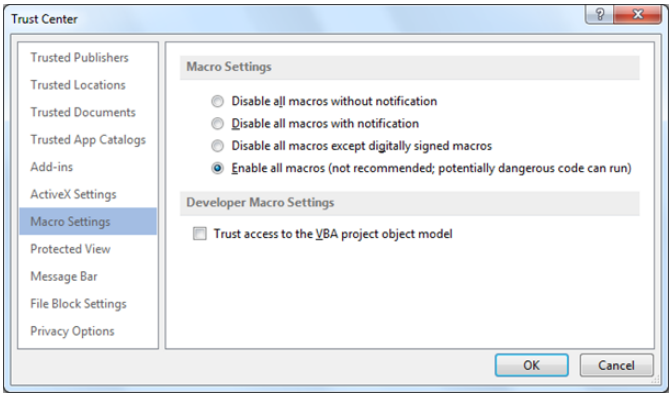
Setting Macro Security Levels

Because macros have been used to spread viruses between computers, Microsoft introduced extra security settings into Office. On the PCs in the IT labs, this is set at the lowest level, as the University already has comprehensive anti-virus software. On your own PC, it's advisable to set this to the *medium level*, giving you the opportunity to enable macros if you so choose.

To see the security settings:

1. Click on the **[Macro Security]** button on the **DEVELOPER** tab

Note: when this tab isn't displayed, click on the **FILE** tab, then **Options** (on the left) followed by **Trust Center** (again on the left) and finally the **[Trust Center Settings...]** button (on the right).

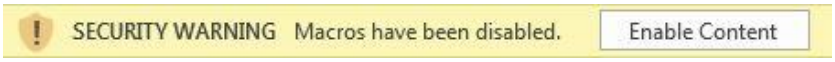


2. Choose the level of security required - here set it to **Disable all macros with notification** then press **<Enter>** for **[OK]**

Note: If you set security to **Enable all macros** then no macro checking is performed (files are opened automatically). If the anti-virus software on your computer is kept up-to-date (as is the case on the PCs in the IT labs) then there is no problem setting this level; if it isn't then you are asking for trouble if you choose this option (it's **not** recommended).

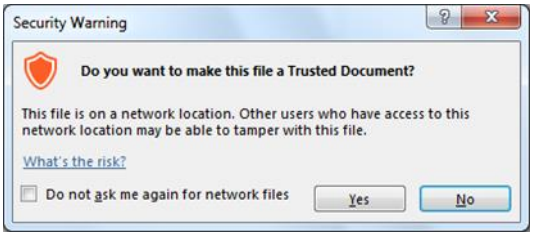
3. Press <Ctrl F4> (or move to the FILE tab and choose Close) to close the file, leaving Excel running
4. Move to the FILE tab and select phoenix.xlsm from the list of *Recent Workbooks*

With this security setting, whenever you open a file with a macro, it is automatically disabled and you have to take positive action to enable it. You should find a warning message appears immediately below the *Ribbon*:



5. Try running one of your macros – nothing happens
6. Click on [Enable Content] to enable the macros

You are now asked, *Do you want to make this file a Trusted Document?*



7. Click [Yes] so that the content will be enabled when you next open this file, and the *Security Warning* will not appear

Note also that Windows allows you to nominate *Trusted Sources* for macros. You can set up a special folder on your own PC in which to store macro files and then declare this to be a Trusted Source. Opening files from the folder will then bypass the macro security.

8. Now try the macro again – it should work
9. Finally, close the file again – there's no need to save the changes (unless you want to)

Last Revised: January 2016