Introduction to MS-Excel for historians
Adapted by Mark Freeman from material used in the School of Historical Studies,
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This exercise uses the Excel 2003 programme. Excel is widely used in business and the public sector as the standard Windows spreadsheet package. A spreadsheet is just like a table and Excel is very useful for carrying out arithmetical calculations and creating graphs.

Excel allows you to enter data, to perform various mathematical functions on it, and to present it in a range of tabular and graphical formats.

Excel is mainly used in history for two purposes:

   a) to consider and analyse trends over time
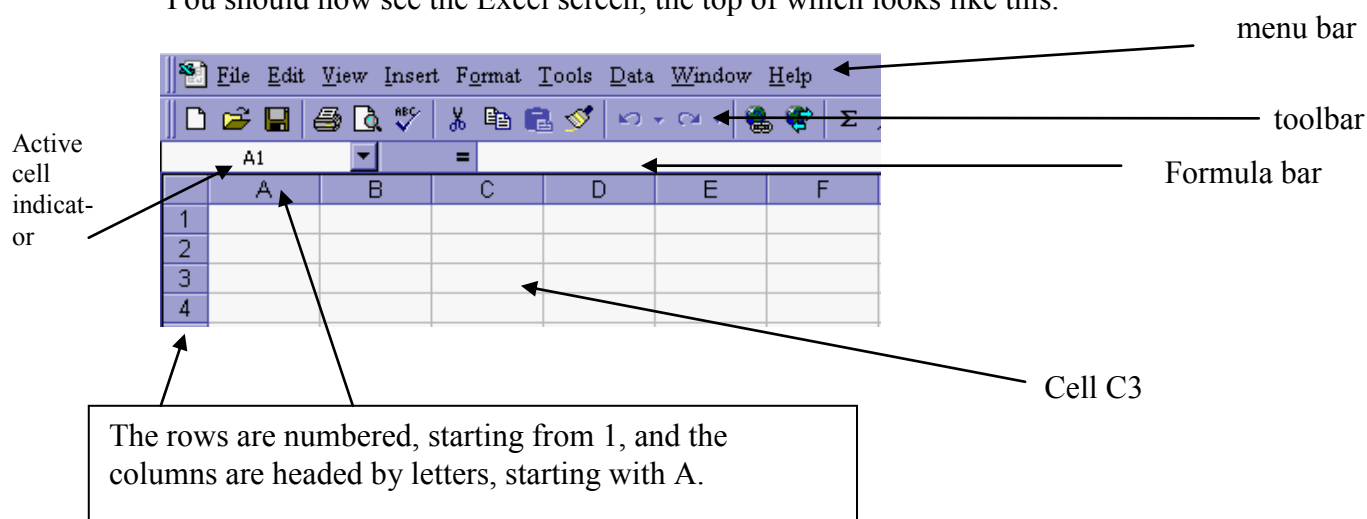   b) to test historical propositions or hypotheses

The purposes of this computing project are fourfold. The worksheet asks you:

   1. to carry out basic calculations and create graphs
   2. to consider different ways of presenting data
   3. to interpret the results obtained
   4. to use your judgement as a historian to relate the results' meaning to historical
      issues and debates

When dealing with data, a common temptation is to graph excessive amounts of material, resulting in graphs which may win a prize for abstract art but which are not particularly useful. You need to learn to select only the material whose graphic presentation will be most effective for the purpose or purposes you have in mind. Some practice on this is provided. Save only those graphs which seem useful for your particular piece of work.

To begin, open MS-Excel. From the Start menu, choose Microsoft Office, and then Microsoft Excel.

You should now see the Excel screen, the top of which looks like this.

menu bar

toolbar

Formula bar

Active cell indicat- or

Cell C3

The rows are numbered, starting from 1, and the columns are headed by letters, starting with A.

Let's go over some of terms that will be used when working with Excel.

Worksheet. The entire Excel *page* is called a worksheet.

Workbook. The *file* you are working in is called a workbook. A workbook contains a number of worksheets. Look at the bottom left-hand corner of the screen: you will see three tabs:
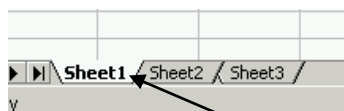
You are currently on **Sheet1**. If you click on **Sheet2**, you will move to the next worksheet. At the moment, as this is a new workbook, all the worksheets are blank. If you right-click on the sheet name, you will be given a menu that includes the option of changing the name of the sheet.

Change the name of Sheet1 to **POPULATION**. Now save the workbook: from the *menu bar*, choose **File** and then **Save As**. Call the workbook **population data** and save it to your H-drive.

Menu Bar. When you click on one of the words in the menu bar you will be presented with a drop down menu with different options. The menus contain all the commands that you will need to work with Excel.

Toolbar. The toolbar contains a series of pictures which provide shortcuts to the most common menu options. You simply click on the button once to carry out a particular operation. Many of these will be familiar to you from MS-Word, for example, the Bold, Italic and Underline buttons.

Cells. Each one of the small divisions on your worksheet is called a cell. They are referenced horizontally by letter and vertically by number, you can see that cell C3 is labeled in the diagram on the last page.

Active Cell Indicator. This will always show you the cell you are currently working in or with, know as the active cell.

Formula Bar. When you enter text, numbers or formulas into a cell, your typing will appear in the *formula bar*. You also use the formula bar to edit text.

Click on one of the words on the menu bar and see what options appear in the drop down menus.

The Excel screen is much bigger than it looks. Use the right arrow key → on the keyboard to move right and see how far you get. To return to column A, press the HOME key. Try the same thing with the down arrow key ↓.

You can also navigate around the page using the *scrollbars* at the right-hand side, and at the bottom, of the worksheet.

In a moment you will enter some data, but first, here are some hints on entering data in Excel:

Typing. The information you enter can be longer than a cell. When you are typing, watch the *formula bar* and not the cell you are typing into. The formula bar will show you *all* your text. When the text is correct on the formula bar, press ENTER to transfer the text to the worksheet.

Correcting. Mistakes can be corrected in the *formula bar* by using either the BACKSPACE key to delete to the l*eft*, or the DELETE key, to delete to the *right*. You can also *double click* in the cell to make the changes there.

Graphing. Always keep a blank cell immediately above your initial year date – in the example below, 1871. This is important for subsequent graphing.

Highlighting cells. If you click on a cell once, it will be highlighted: this is indicated by a black border and a small black square in the bottom right-hand corner of the cell. Try clicking on cell **C3**, and you will that it is highlighted.

You can also highlight a range of cells by dragging the mouse over it, just as you would drag it over text in MS-Word. Try highlighing cells **C3** to **C13**. Now highlight cells **C3** to **E13**.

*You can also highlight non-contiguous cells, by dragging the mouse over them *while holding down the **Ctrl** key*. Try highlighting cells **C3** to **C13** *and* **E3** to **E13**.

We will begin with a very simple exercise, using a very modest amount of data. We will then move on to the data you will be using for the exercise.

Click into cell **B2** and type this: **Scottish City Population (Source: B R Mitchell British Historical Statistics, 1988)**

Notice that this text takes up much more than a single cell, but it all appears in the *formula bar*.

Now enter the following:

	A	B	C	D	E	F	G
1							
2		Scottish City Population (Source: B R Mitchell, British Historical Statistics					
3							
4			Glasgow	Edinburgh	Dundee	Aberdeen	
5		1871	568	242	119	88	
6		1881	673	295	140	105	
7		1891	766	332	154	125	
8		1901	904	394	161	154	
9		1911	953	401	165	164	
10							
11							
12							

Note that it is possible to widen the columns in the worksheet by moving the mouse to the right-hand side of the heading of the column you wish to widen.

We are now going to perform some basic calculations on this data.

In cell **G4**, type '**Glasgow plus Edinburgh**'.

In cell **G5**, type the following:

=C5+D5

The = sign indicates to the Excel programme that you want it to perform a ***function***.

Press **enter**. You will see that Excel has added the populations of Glasgow and Edinburgh in 1871 and come up with the total – i.e. 810. Now highlight cell **G5**.

ourgh	Dundee	Aberdeen	Glasgow	
242	119	88	810	
295	140	105		
332	154	125		

From the *menu bar,* choose **Edit** and then **Copy**. Then highlight cells **G6** to **G9**, and choose **Edit** and then **Paste**.

You can also do the same thing using the *fill handle*, which is the black square in the bottom left-hand corner of the highlighted cell.

You will see that Excel has performed the same calculation for each of the years 1881-1911.

Now click on cell **G9** and look in the *formula bar*. You will see that Excel has copied the formula: *not* as you entered it (**=C5+D5**), but in the form **=C9+D9**. It has adjusted the formula, so it performs the same function.

This feature is called *relative cell referencing* – it allows you to apply the same formula to a large number of rows or columns without having to type it in every time.

Now, in cell **B11**, type **Growth**.

In cell **C11**, type the following:

=C9-C5

This tells Excel to subtract the population of Glasgow in 1871 from the population in 1911. Press **enter**.

Now highlight cell **C11**, and from the *menu bar*, choose **Edit** and then **Copy**.

Then highlight cells **D11** to **G11**, and choose **Edit** and then **Paste**.

In exactly the same way as before, the formula you entered has been copied into the selected cells, using *relative cell referencing*. Your grid should now look like this:

Scottish City Population (Source: B R Mitchell, British Historical Statistics,					
	Glasgow	Edinburgh	Dundee	Aberdeen	Glasgow
1871	568	242	119	88	810
1881	673	295	140	105	968
1891	766	332	154	125	1098
1901	904	394	161	154	1298
1911	953	401	165	164	1354
Growth	385	159	46	76	544

We have now covered *adding* the contents of two cells, and *subtracting* the contents of one cell from another.

You have also learned how to copy and paste formulas using *relative cell referencing*.

We are now going to try a more complex mathematical operation. We are going to calculate the growth of each of the four cities between 1871 and 1911.

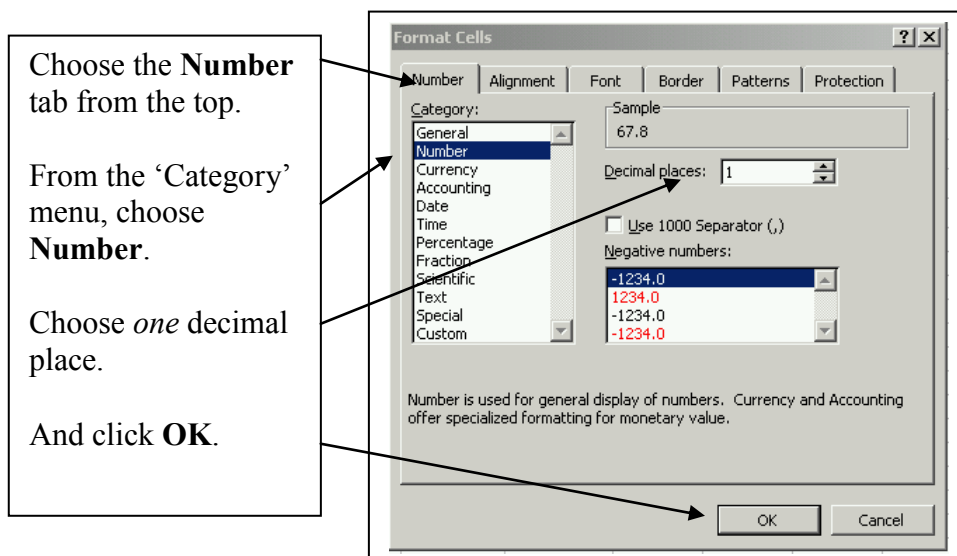In cell **B12**, type **Percentage growth**.

In cell **C12**, type the following formula:

=C11/C5*100

and press **enter**. Excel gives you the answer to several decimal places.

Just like before, copy and paste the formula you have just entered into cells **D12** to **G12**.

There are too many decimal places in the answers. To change the presentation of the data, highlight the range of cells **C12** to **G12**. Using the *menu bar*, choose **Format** and then **Cells**. You will see the following dialogue box:

Choose the **Number** tab from the top.

From the 'Category' menu, choose **Number**.

Choose *one* decimal place.

And click **OK**.

Your grid should now look like this:

Scottish City Population (Source: B R Mitchell, British Historical Statistics,						
	Glasgow	Edinburgh	Dundee	Aberdeen	Glasgow	
1871	568	242	119	88	810	
1881	673	295	140	105	968	
1891	766	332	154	125	1098	
1901	904	394	161	154	1298	
1911	953	401	165	164	1354	
Growth	385	159	46	76	544	
Percentage	67.8	65.7	38.7	86.4	67.2	

Which city had the fastest, and which had the slowest, population growth in the period 1871-1911?

In the calculation above you did two things: you *divided* the contents one cell by another; and you *multiplied* by 100 to work out a percentage.

So you have now learned how to do the following:

1.   Add the contents of two cells
2.   Subtract the contents of one cell from another
3.   Divide the contents of one cell by another (using the / symbol)
4.   Multiply (using the * symbol)
5.   Copy and paste formulas from one cell to another cell, or to a range of cells, using *relative cell referencing*
6.   Change the number format as presented in a cell or range of cells

We are going to try one more calculation – we want to work out the growth rates of each city's population in each 10-year period.

To do this, first highlight the range of cells **C4** to **F4** (those containing the names of the four cities). Then from the *menu bar* choose **E**dit and then **C**opy. Then highlight cells **J4** to **M4**, and choose **E**dit and then **P**aste. Now repeat this operation for cells **B5** to **B9**: copy these cells (containing the dates) into cells **I5** to **I9**.

We will start in cell **J6** – to calculate the growth of Glasgow's population between 1871 and 1881. (We cannot work out the growth rate at 1871, because we have no figures for 1861.) Our formula needs to do *three* things: to calculate the growth between 1871 and 1881, to divide this by the population in 1871, and to multiply by 100 to give us a percentage. In **J6**, type the following:

=(C6-C5)/C5*100

and press **enter**.

Now, using the *fill handle* (the black square in the bottom left-hand corner of cell **J6**, copy this formula to the whole range of cells **J6** to **M9**.

Change the number format of these cells to *one* decimal place (as you have done before).

Your grid should look like this:

	A	B	C	D	E	F	G	H	I	J	K	L	M	
1														
2		Scottish City Population (Source: B R Mitchell, British Historical Statistics, 1988)												
3														
4			Glasgow	Edinburgh	Dundee	Aberdeen	Glasgow			Glasgow	Edinburgh	Dundee	Aberdeen	
5		1871	568	242	119	88	810		1871					
6		1881	673	295	140	105	968		1881	18.5	21.9	17.6	19.3	
7		1891	766	332	154	125	1098		1891	13.8	12.5	10.0	19.0	
8		1901	904	394	161	154	1298		1901	18.0	18.7	4.5	23.2	
9		1911	953	401	165	164	1354		1911	5.4	1.8	2.5	6.5	
10														
11		Growth	385	159	46	76	544							
12		Percentag	67.8	65.7	38.7	86.4	67.2							
13														
14														
15														

This shows you that the growth rates of the four cities changed considerably over time: Aberdeen grew fastest in every decade, and Dundee slowest in every decade except the last, but the rates of growth for all four cities were very different in 1881 and 1911.

You have now learned how to do all the calculations you will need for the computing exercise.

We will now move on to graphs.

It is very easy to create graphs in Excel. However, it is important to bear in mind that graphs must be properly presented. You need to choose the appropriate *type* of graph: for some data, a line graph may be appropriate, for others a pie chart might be best.

When representing change over time, line graphs are often suitable: they can show movement upwards and downwards over time. When presenting other kinds of data, a pie chart could be better.

We will start with a very simple graph, showing the population of Glasgow in the period 1871-1911.

Highlight the cells **B4** to **C9**. Notice that you have highlighted the years, the title of column C ('Glasgow'), and the blank cell in the top left-hand corner of the range.

From the *menu bar*, choose **Insert** and then **Chart**. You will see the following dialogue box:

Choose a **Column** chart, and the first sub-type, as shown.

You can see a sample of the chart you have chosen by pressing and holding this button.

Click **Next**.

The next step – 'step 2 of 4' – gives you a preview of what your chart will look like. It allows you to change the original data range, but ignore this for now and click **Next**.

'Step 3 of 4' gives you considerable scope for annotating your chart. In the **Chart title** box, write **Population of Glasgow, in '000s, 1871-1911 (Source: Mitchell, British Historical Statistics, 1988)**. For the X axis, write **Date**, and for the Y axis, **Population**, as shown.

Your chart has a legend. As only one series of data is graphed here, you *don't* need this. Click on the **Legend** tab. Ensure that the **Show legend** box in the top left-hand corner is un-checked.
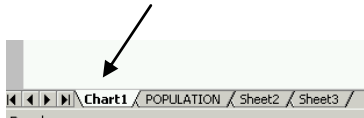
When you have done this, click **Next**.
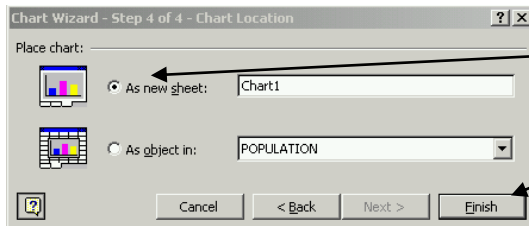
In 'Step 4 of 4', you have a choice of where your graph will go. Choose **As new sheet**.

Click **Finish**.

A new worksheet has been created, displaying your column chart. Notice that there is now an extra tab in the bottom left-hand corner:

You will able to return to the data at any time by clicking on the **POPULATION** tab. Do this now.

We are going to create a more interesting graph. Highlight the range of cells **B4** to **F9** – in other words, the years 1871-1911 (*including* the blank cell in the top left-hand corner), and the four cities (*including* their names). Ensure that column **G** is *not* included in your selection.
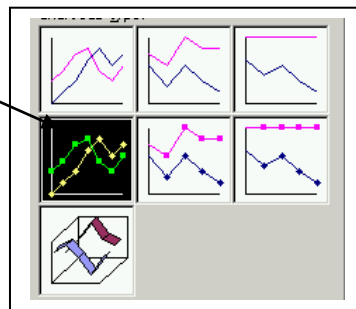
From the *menu bar*, choose **Insert** and then **Chart**, just like you did before.

This time choose a **Line** chart:

Press and hold to view a selection.

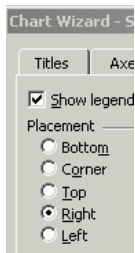If you are happy with it, press **Next**.

In 'Step 3 of 4', enter a chart title:

Population of four Scottish cities,
in '000s, 1871-1911 (Source: Mitchell, British Historical Statistics, 1988)

Also label the X and Y axes.

In this case, you *do* need a legend, so ensure that the **Show legend** box is checked:

As before, make sure that you place the chart as a new sheet.

Population of four Scottish cities, in '000s, 1871-1911 (Source: Mitchell, British Historical Statistics, 1988)
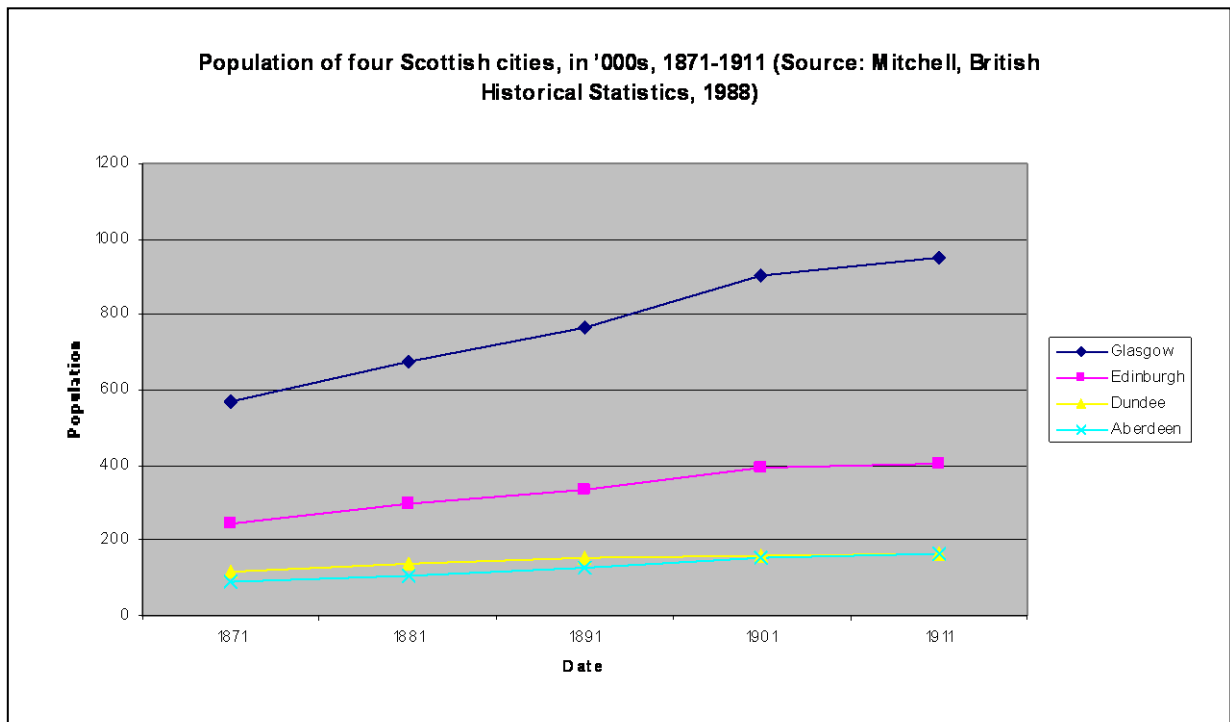
Your chart should look like the one above.

You can move the legend around the graph by clicking on it once to highlight it, and using the mouse to drag it to where you want it to go.

You can change the appearance of the lines on the graph. Click once on the Glasgow line to highlight it (you will see small squares appear on it), and from the *menu bar* choose **Format** and then **Selected data series**.

Ensure that the **Patterns** tab is selected.
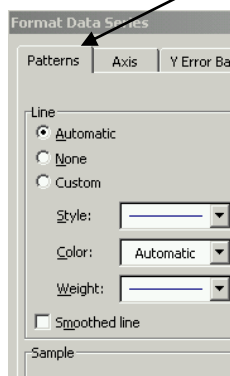
You can change the style, weight and colour of the line. Try doing this, and experiment with changing the other data series as well.

You can also change the appearance of the axes. Click on an axis to highlight it (a small black square will appear at each end of the axis). Then from the *menu bar* choose **Format** and then **Selected axis**. Experiment with this.

If you want to change the title of your chart, its location or other aspects of its presentation, you can use the **Chart** menu on the *menu bar*.

Now return to the **POPULATION** worksheet.

You can copy and paste your findings into MS-Word.

Return to the **POPULATION** worksheet.

Highlight cells **B2** to **G9**. From the *menu bar*, choose **Edit** and then **Copy**.

Start MS-Word, using the **Start** menu.

In Word, from the *menu bar*, choose **Edit** and then **Paste**.

Just as within Word itself, you are able to copy and paste from Excel to Word. You will see that your data has been pasted in the form of a table. You may need to resize columns and change the font size to improve the presentation.

You can also copy and paste graphs. Return to Excel, and go to **Chart2**.

In **Chart2** – your line chart – click once, somewhere on the white area of the chart – i.e. *not* on the plot area itself or on the data labels.

Your chart should now be highlighted – if it is, there will be three small black squares across the top, three across the bottom and one in the middle on each side.

From the *menu bar*, choose **Edit** and then **Copy**. Switch to Word, and from the *menu bar*, choose **Edit** and then **Paste**.

You will probably need to resize the chart using the black squares at the corners.

When you are happy with the appearance of your chart in Word, *double-click* on it.

You will now be able to edit the appearance of the chart *within* Word. Look at the *menu bar*: there is now an option called **Chart**, which allows you to do the things you could do in Excel. Experiment with altering the layout of the chart in Word.

Let us recap on what you have learned to do in this document:

ENTERING DATA

USING FORMULAS
- **ADDING TWO CELLS TOGETHER**
- **SUBTRACTING ONE CELL FROM ANOTHER**
- **DIVIDING ONE CELL BY ANOTHER**
- **MULTIPLYING**
- **CALCULATING PERCENTAGES**

CHANGING THE NUMBER FORMAT (e.g. number of decimal places)

GRAPHING DATA (CHARTS)
- **SELECTING CELLS FOR GRAPHING (INCLUDING NON-CONTIGUOUS CELLS – *ENSURE* THAT YOU KNOW HOW TO DO THIS)**
- **CREATING COLUMN AND LINE CHARTS**
- **ALTERING THE APPEARANCE OF CHARTS**

COPYING AND PASTING FROM EXCEL TO WORD