

Data analysis: Good practice in spreadsheet design



The small print

Prerequisites

Time in the workshop is precious – it is an opportunity for you to interact with the workshop leader and other participants through questions and discussions and to share your experiences and concerns. To make the most of this time we sometimes ask you to carry out learning activities ahead of the workshop so that everyone comes into the class with the same basic knowledge. We keep this prior learning to a minimum and often make use of online videos. Online videos provided through LinkedIn Learning can be accessed free of charge by University members anytime, anywhere, through a browser or app.

Your course booking will tell you if any prior learning activity is required. If you don't have an environment where you can do this learning, you can come along to one of our LinkedIn Learning sessions. These are a quiet space where you can work through videos or other workshop resources.

If you arrive for a workshop without having done the prior learning, the workshop leader may suggest that you come back on another session.

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About the workshop designer

Tanya Prescott first started IT teaching in 2009 and has taught in many different FE settings. Tanya has extensive experience teaching Excel courses, in particular, and is always enthusiastic to help others discover the potential of Excel spreadsheets and how they really can make life easier.

Revision history

Version	Date	Author	Comments
3.2	January 2024	Graham Addis	Update presenter to Tanya Prescott
3.1	November 2022	Graham Addis	Update templates
3.0	April 2020	Graham Addis	Convert to online format.
2.2	November 2019	Graham Addis	Minor edits and small print updates
2.1	August 2019	Duncan Young	Minor edits and small print updates
2.0	November 2016	Pamela Stanworth	Re-ordered
1.0	September 2016	Pamela Stanworth	Created

About this workshop

This workshop will take you through the process of setting out a workbook so that it is well structured and efficient to work with, especially if you are collaborating or sharing with colleagues. We will provide you with key skills to master Excel (or similar software) beyond the everyday level. A range of time-saving techniques are covered, for creating a well-structured workbook that is easy to revise and manage.

We will include pointers to other workshops and further resources that will help you go on later to analyse and organise your data.

What you will learn

We will start with the heart of spreadsheet use: creating formulae to do calculations. We will explore timesaving methods of copying formulae across your worksheet, and some pitfalls to avoid. Then we will discuss the important concept of naming ranges - good practice with naming your cells and ranges will make your workbooks easy to understand and efficient to edit.

We will investigate how to make use of some useful functions that are provided ready-made, and discuss scenarios when you would use various logic functions.

A large workbook can be awkward to work with, leading to errors and confusion. So we will look at ways of keeping them well-behaved, both when editing and reviewing data on a screen and when printing paper copies. Many people are puzzled by workbooks containing multiple worksheets, so we explain how to save time and efficiency by editing multiple sheets as a group, and how to set up calculations that draw data across multiple sheets.

What you need to know

The ideas and techniques covered in this workshop will apply to a range of tools. We will demonstrate using *Excel for Windows*, which is widely available. However, the concepts will be the same, whatever spreadsheet software you decide to use.

I will assume that you are reasonably confident in using the tool you have chosen to use to create your spreadsheets. With your chosen tool, you will need to be able to:

- open and navigate around a workbook using the mouse and scrollbars, save a workbook
- add data to cells, and select and amend such data
- create a formula that calculates using values found in other cells
- Navigate the commands and menus, using Help as necessary

If you need to review these activities, Molly is a great place to get guidance. There is an activity with relevant videos in the IT Learning Portfolio: visit skills.it.ox.ac.uk/it-learning-portfolio and search for “Good Practice in Spreadsheet Design activity”.

The resources you need

Sample documents that you can use to experiment with will be made available, but you may like to bring along your own.

Unless you have been told otherwise, in classroom workshops there will be a computer available for you to use with *Excel for Windows* installed.

You can use your own computer with your preferred app installed if you want to – just bear in mind that I am not an expert in every app (although I am sure that between us we will be able to sort out most problems!).

Learning Objectives

This workshop has the following learning objectives:

Learning Objective One : Formats for laying out information

Learning Objective Two : Formats for displaying numbers

Learning Objective Three : Creating formulae

Learning Objective Four : Copying formulae with absolute and relative references

Learning Objective Five : Setting up patterned data using Flash Fill

Learning Objective Six : Using functions in a formula

Learning Objective Seven : Using logical functions

Learning Objective Eight : Working with dates

Learning Objective Nine : Names for cells or ranges

Learning Objective Ten : Managing and printing large worksheets

Learning Objective Eleven : Organising multiple sheets in a workbook

Learning Objective Twelve : Editing grouped worksheets

Learning Objective Thirteen : Calculations across multiple worksheets

Learning Objective One : Formats for laying out information

You will choose suitable formats for a worksheet, to make the layout easier for readers to understand. Changing the appearance helps the reader to find their way around your information.

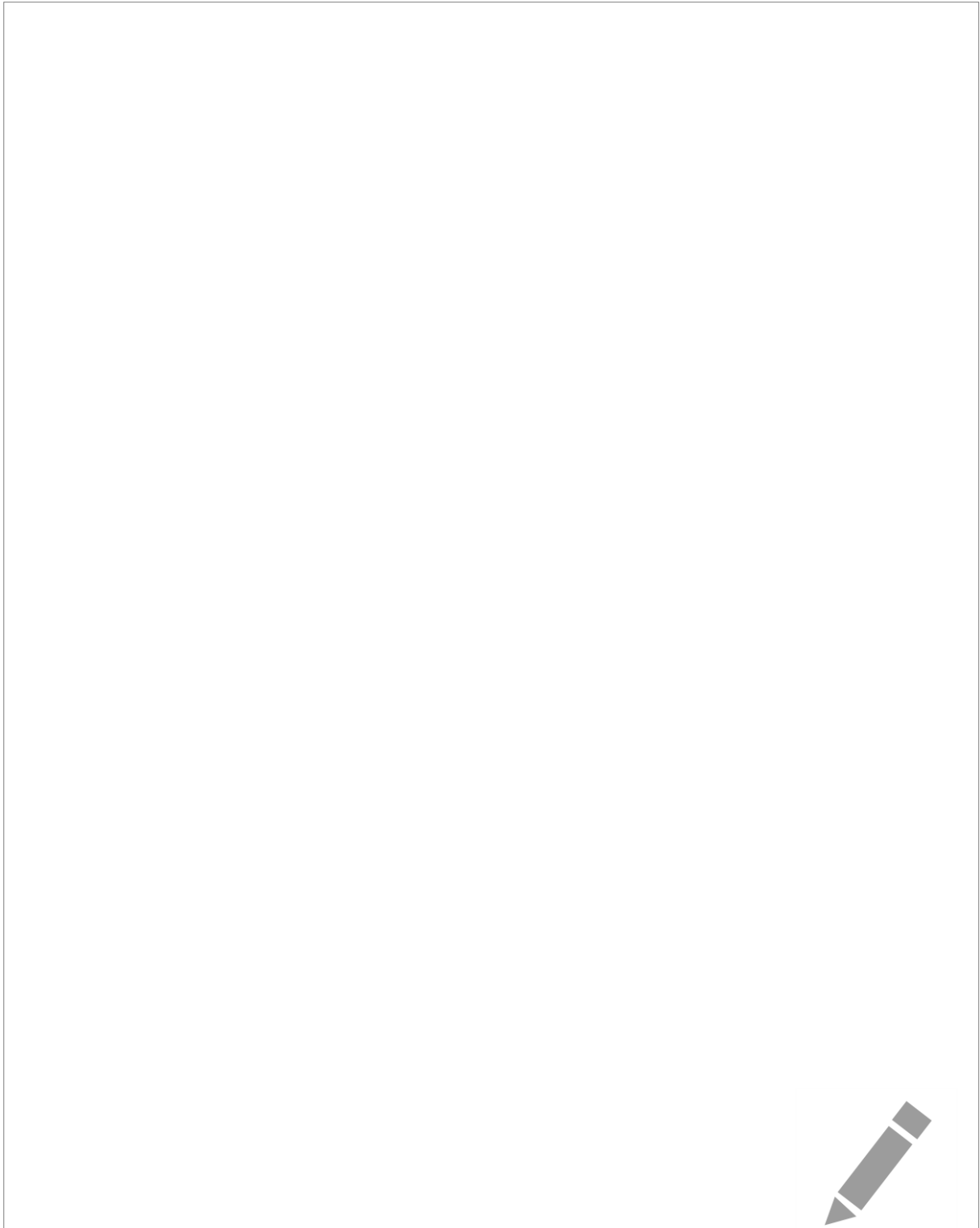
Open the **resitting2.xlsx** workbook and show the scores worksheet. Use a subtle amount of colour and formatting to improve the appearance – colours, font formatting, alignment etc. Try out formats such as Wrap Text to make the column headings more readable.



Learning Objective Two : Formats for displaying numbers

You will choose suitable formats for the numbers in a worksheet, to make them easier for readers to understand. Changing the number format changes the way numbers are displayed in the worksheet: the value itself is stored in full and there is no loss of precision.

Working on the scores worksheet in **resitting2.xlsx** workbook, try out ways to increase then decrease the decimal places displayed. Explore some other number formats available in the Format Cells dialog, such as percent or currency. See if you can format the costs of resits (row 19) in whole pounds or dollars.



Learning Objective Three : Creating formulae

It is good to get plenty of practice at setting up formulae confidently. A formula is used to calculate results. Each one needs to be thought through, depending on the calculation that is needed in each case. Everyday formulae use the well-known operators + - * /.

In **resitting2.xlsx**, on scores, look at the formula in column D, that finds each student's Maths score as a percentage of the total (row 17). Create formulae in column E that do the same for History.

In the **EXAM** worksheet in **StudentResults.xlsx** some other students have each taken 4 exams. Create a formula alongside the first student's results (in cell F4), to calculate his average mark (by adding up his separate scores using + then dividing by 4 using /).



Learning Objective Four : Copying formulae with absolute and relative references

When a formula is copied across, down or up on a spreadsheet, watch out for the parts of the formula that adjust.

In worksheet **EXAM** in **StudentResults.xlsx**, try a variety of methods for copying formulae down from one student to another (drag & drop, copy & paste, Fill button, Fill Handle).

Inspect at least 2 of the copied formulae, to check how the references have adjusted, and that the formulae calculate as desired.

Create a formula in column G which subtracts the pass mark from the student's average score (specify the pass mark in a separate cell in the top row). Think what would happen if you copied this formula down the rows? Would that be a good outcome?

Make some parts of the formula absolute, then copy the corrected formula down, and see how the references are adjusted. Use Ctrl + ` to reveal all the formulae; press Ctrl+` repeatedly to toggle between showing formulae and showing results in the cells.



Learning Objective Five : Setting up patterned data using Flash Fill

Experiment with flash-filling as a way of producing data that follows a regular pattern.

In **FlashFill.xlsx**, on **Sheet1**, the first email address has been set up; type or start typing the next one or two following the same pattern. Let the Flash Fill complete the rest.

Examine the way the Flash Fill tool has assembled the new data. Notice that the email address has been entered as plain text, no formulae have been used. There are more patterns to fill on the other sheets.



Learning Objective Six : Using functions in a formula

Because equations for well-known quantities such as Average and Standard Deviation have already been created as functions in Excel, you do not need to construct the equations, merely include the name of the function in your formula.

You will set up some formulae, making use of some well-known functions.

SUM() In the **functions.xlsx** workbook, at the **EXAM** sheet, create a formula which totals everyone's scores for Exam1, placing it immediately below the Exam1 column (in row 16). This time, use a function to do the adding up. Repeat for Exams 2, 3, and 4.

AVERAGE() Set up a series of average (i.e. mean) formulae below each Exam column (row 20).

COUNT() Create formulae with other functions such as COUNT, this time using the Insert Function dialog – have a look at the variety of other functions available in the dialog.

INT() and **ROUND()** Create more formulae in the rows below, to present the average values from row 20 with various amounts of rounding. Explore the difference between INT() and ROUND().



Learning Objective Seven : Using logical functions

Logic functions are all about statements being true or false.

In **functions.xlsx** at the **EXAM** worksheet, set up a formula in column F that calculates each student's average score. Use IF() to set up another formula in column G that displays suitable messages, whether the student has passed or failed (compare their own average score with a passmark number given in another cell).

Suppose you want to buy a car and you have a list of the cars available, in **Cars2.xlsx**. You have £6500 to spend; on the other hand, you might be interested in a more expensive car if it has a low mileage, say under 8000 miles. So in column H set up formulae that use IF to indicate which cars are too expensive or affordable. In column I, set up formulae that indicate cars with low mileage or too-high mileage.



Learning Objective Eight : Working with dates

A date in an Excel worksheet is an ordinary number which has been formatted with a special date format.

In the **resitting2.xlsx** workbook, **Resit Dates** worksheet, you will help the students who did not pass an exam to organise their studies, ready for resitting the exam. Apply a variety of date formats to the date in cell E1 – this is the day when the classes for resitting begin.

Students who want to re-sit an exam must register 30 days before the revision classes begin, so set up a formula in H1, to calculate the deadline for registering for the revision classes.

Students would like to know how long they have for their revision, before the date of each exam, so in column C create formulae to calculate how many days between the start date and each resit exam. The admin office would like to know how many working days there are, so in column D, create formulae that use the NETWORKDAYS function.

In the Students worksheet of the same workbook, try some of the date functions available. In column D create formulae that use the TODAY function to calculate a student's age today (in days). In column E create others that find the month (as a number) when each student was born.

Experiment with the way that Flash Fill deals with dates and parts of dates, without any formulae or functions: use data in **FlashFill.xlsx** and **Sheet4**.



Learning Objective Nine : Names for cells or ranges

Once a cell or range of cells has been given a name, you can easily use that name for navigation or in formulae. This makes your formulae easier to understand and read: rather than use cell references in your formulae, you can refer to names instead.

Assign names to some individual cells and to some ranges in the worksheet **BUDGET** in **Budget.xlsx**, using the Name Box or using labels that are already in place beside/above the data cells. Use the Name Box to move around the worksheet, from one named range to another.

Enter a rate for inflation such as 5%, in an empty cell such as D1, and assign a name to the cell. Create a formula in C4 that uses this name, to calculate the increase in rent due to inflation. Create a formula in D4 which calculates next year's rent (it will be this year's rent plus the increase). Try out what happens to a name reference, if you copy the formula to nearby cells/s.

Some formulae have previously been set up, without using names. Use Apply Names to write your new names into existing formulae, to make them more readable.



Learning Objective Ten : Managing and printing large worksheets

Use the **printing.xlsx** workbook and the **West** worksheet to try the use of splitting the screen and freezing panes, to help when reviewing a large worksheet on the screen.

Experiment with printing (or at least print-previewing) small parts of the data: print a selected part, set a print area. If you need to print a large amount of data, arrange for appropriate column and row headings to be printed on each page. After each experiment, remember to remove any previous settings for print area, print titles etc. to avoid confusion.



Learning Objective Eleven : Organising multiple sheets in a workbook

Examine the sheets of the **overview.xlsx** workbook, and name each sheet. The overview workbook reports a snapshot of test results achieved by students in various locations and regions, over a few months. Try out re-naming, adding, deleting and re-ordering sheets.

Create a **Summary** sheet at the front, with the same layout as the other sheets, but no data as yet.



Learning Objective Twelve : Editing grouped worksheets

A workbook may be made up of a number of separate sheets, all with the same layout – you can save time and improve accuracy by editing them together as a group.

In overview.xlsx workbook, experiment with selecting several worksheets to form a group, and get the hang of grouping and ungrouping. This means that editing tasks can be performed on all of the selected worksheets while they are a group:

- Enter text or numbers for all the worksheets at once
- Create formulae on all the worksheets at once
- Format cells on all the worksheets at once

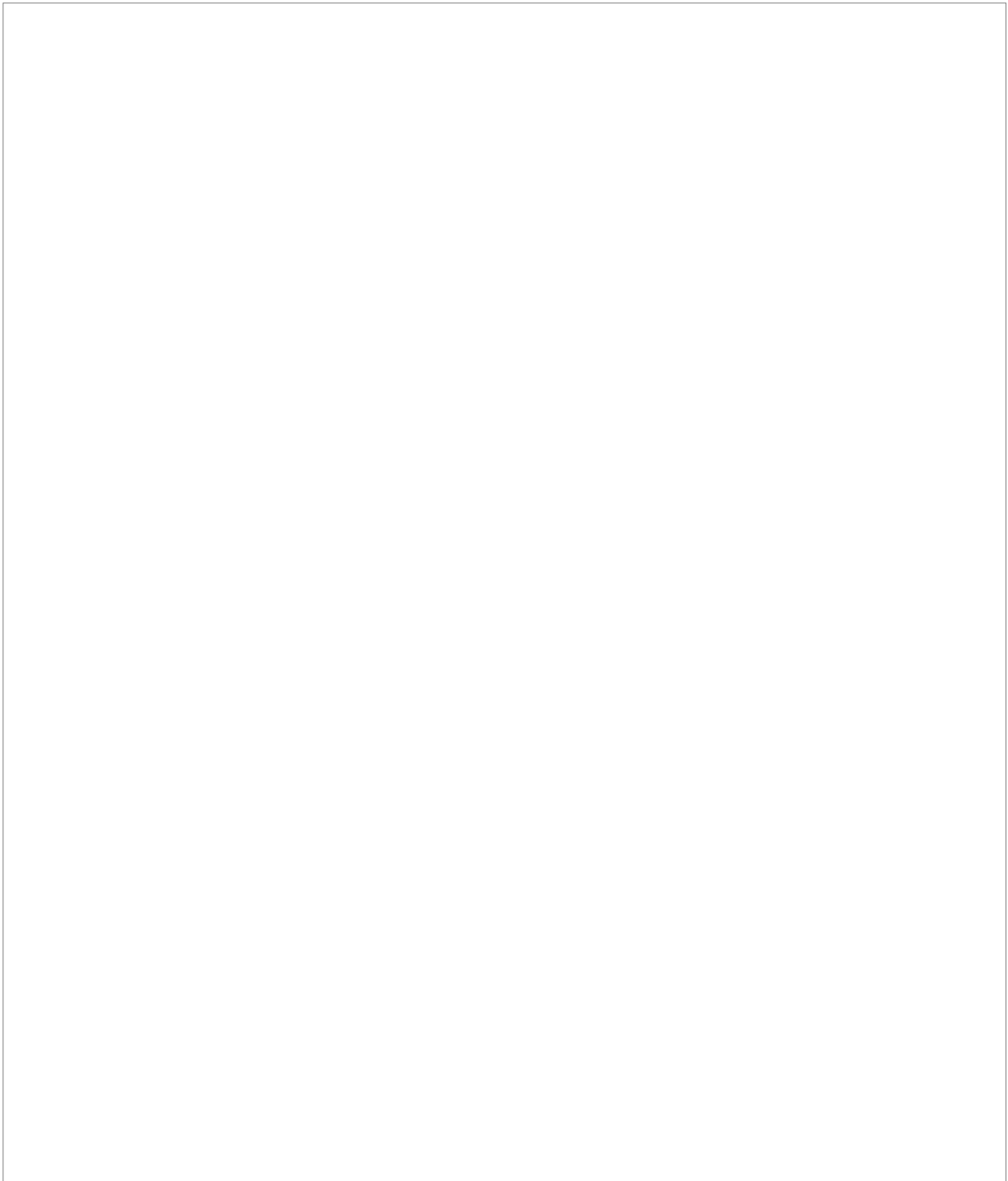


Learning Objective Thirteen : Calculations across multiple worksheets

A formula on one worksheet may use data values from cells on other sheets. You will set up formulae that collect the raw data from the region sheets and calculate totals and averages, on the Summary worksheet.

In **overview.xlsx** on the summary worksheet, create a SUM formula with 3-D references, then copy the 3-D formula across the summary. Create an AVERAGE formula with 3-D references, then copy the AVERAGE formula.

Optional: When names are assigned to 3-D ranges, this makes formulae very much easier to read and understand. Create multi-sheet named ranges for each month's total, including all the four geographical regions. Then create formulae on the Summary sheet, using the new names. These formulae are very much easier to read and understand.



Further information

Getting extra help

The IT Learning Centre offers bookable clinics where you can get pre- or post-course advice. Contact us using courses@it.ox.ac.uk.

Study Videos from LinkedIn Learning

On our website, you will find our collection of self-service courses and resources. This includes providing LinkedIn Learning video-based courses free to all members of the University. Visit skills.it.ox.ac.uk/linkedin-learning and sign in with your Single Sign-On (SSO) credentials.

Some courses recommend pre- and/or post-course activities to support your learning. You can watch the online videos anywhere, anytime, and even download them onto a tablet or smartphone for off-line viewing.

About the IT Learning Portfolio online

Many of the resources used in the IT Learning Centre courses and workshops are made available as Open Educational Resources (OER) via our Portfolio website at skills.it.ox.ac.uk/it-learning-portfolio.

Find the pre-course activity for this course in the IT Learning Portfolio: visit skills.it.ox.ac.uk/it-learning-portfolio and search for “Good Practice in Spreadsheet Design (Activity)”.

About the IT Learning Centre

The IT Learning Centre delivers over 100 IT-related teacher-led courses, which are provided in our teaching rooms and online, and we give you access to thousands of on-line self-service courses through LinkedIn Learning.

Our team of teachers have backgrounds in academia, research, business and education and are supported by other experts from around the University and beyond.

Our courses are open to all members of the University at a small charge. Where resources allow, we can deliver private courses to departments and colleges, which can be more cost-effective than signing up individually. We can also customize courses to suit your needs.

Our fully equipped suite of seven teaching and training rooms are usually available for hire for your own events and courses.

For more information, contact us at courses@it.ox.ac.uk.

About IT Customer Services

The IT Learning Centre is part of the Customer Services Group. The group provides the main user support services for the department, assisting all staff and students within the University as well as retired staff and other users of University IT services. It supports all the services offered by IT Services plus general IT support queries from any user, working in collaboration with local IT support units.

The Customer Services Group also offers a data back-up service; an online shop; and a computer maintenance scheme. Customer Services is further responsible for desktop computing services – for staff and in public/shared areas – throughout UAS and the Bodleian Libraries.

Good practice in spreadsheet design

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Resources for your learning

Activities for you to practice today

In the coursebook

Work at your own pace!

Be selective



Videos with today's topics

[LinkedIn Learning](#)

Follow-up work

Continue with exercises after the session

Bookable Course Clinics later

Course topics

Data, number formatting

Formulae for calculations

Copying cells

Relative & absolute references

Some useful functions

Named cells and ranges

Working with dates

Viewing and printing large workbooks

Editing multiple worksheets

Calculations across multiple sheets

Formatting cells & numbers

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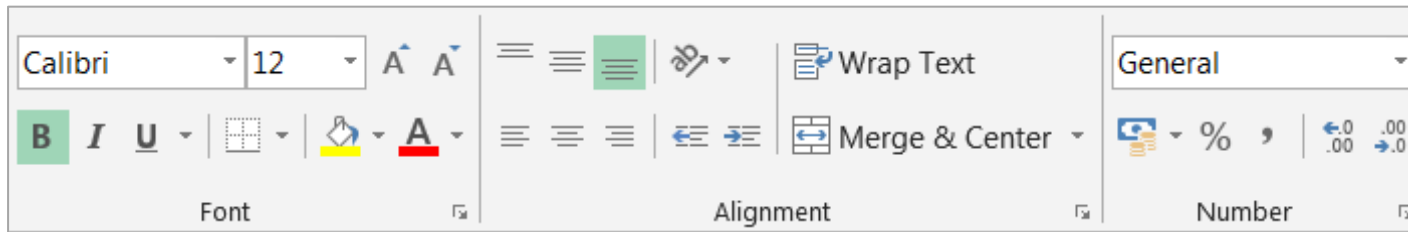
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Formatting

Buttons on the Home tab for popular formats

Align, Wrap text, Merge

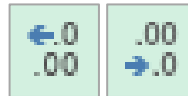


Format Cells dialog for more



Formatting numbers

Adjust decimal places



Percentages



Currency



	A
1	Type a long number:
2	566.867
3	
4	567
5	566.9
6	566.87
7	566.867
8	
9	600
10	570

General

ABC 123 General
No specific format

12 Number

Currency

Accounting

Short Date

Long Date

Time

Percentage

Fraction

Scientific

Text

[More Number Formats...](#)

Formulae

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A formula in a cell (revision)

Typing a formula

Formula begins with =

Type or click cell references

Use arithmetic symbols + - * / ^

Cell contents vs. Result

3 tips when creating formulae

Copying

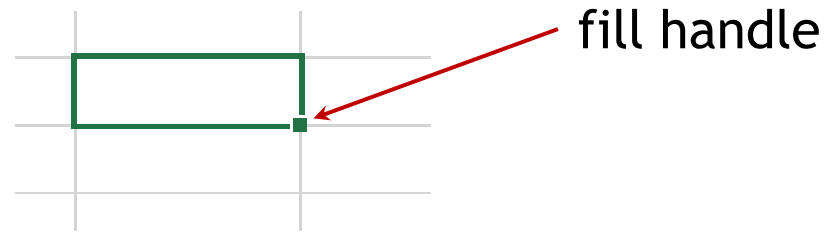
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Copying - options

Use the fill handle




Or fill dialogue



Or Copy & Paste

Effect of copying a formula

Cell references in the formula adjust



Check: Is this
what you wanted?

	A	B	C	D	E	F	G
1	Rainfall Figures (Fictitious)						
2							
3	England	Jan	Feb	Mar	Apr	Total	Average
4	Point 1	95.03	83.13	23.75	50.80		
5	Point 2	36.36	70.20	99.37	26.92		
6	Point 3	60.02	86.25	24.14	61.27		
7	Point 4	92.87	22.85	86.48	47.86		
8	Total						
9	Average						

Using an absolute cell reference (instead of a relative reference)

\$ symbol before part of a cell reference means:
“that part will not be adjusted
when the formula is copied”

A4	relative reference
\$A\$4	absolute reference
A\$4 \$A4	mixed references

Edit the formula *before* copying:
type \$ symbol or use <F4>

Flash Fill



Inserts data

Takes data from adjacent columns

Follows your pattern and formatting

Not a formula – *no updating*

	A	B	C
1	Surname	FirstName	Address Name
2	HERNANDEZ	ROY	R. Hernandez
3	DYER	HAYLEY	H. Dyer
4	HARTHOUSE	PHOEBE	P. Harthouse
5	ROKESMITH	ABBY	A. Rokesmith
6	CROSSDALE	MIKE	M. Crossdale
7	BOWMAN	TOM	T. Bowman
8	QUINTON	BRIAN	B. Quinton
9	WARBECK	JENNIFER	J. Warbeck

Practical Session 1

Learning Objective	Workbook	Worksheet
One	resitting2.xlsx	scores
Two	resitting2.xlsx	scores
Three	resitting2.xlsx	scores
Three	StudentResults.xlsx	EXAM
Four	StudentResults.xlsx	EXAM
Five	FlashFill.xlsx	Sheet1

Functions

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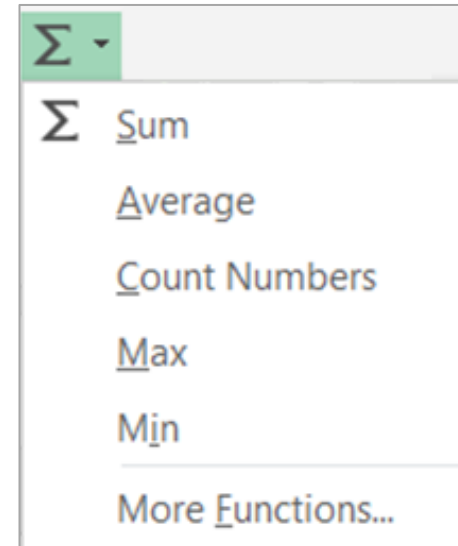
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Some useful functions



Formula is like =SUM(list of info)

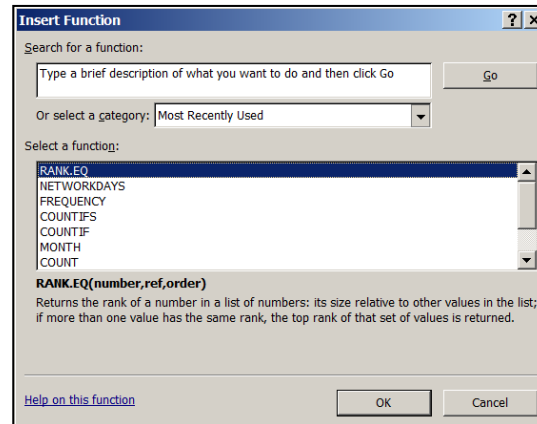


... and more functions



Browse through the Insert Function dialog

CONVERT()
Converts between
measurement units



INT()
The whole-number part

ROUND(,n)
Rounds up/down
to n decimal places

Can combine or nest functions in a formula

IF() function

=IF(Do a Test , outcome if True , outcome if False)

=IF(D6=20 , “That’s 20” , “That’s not 20”)

For more complicated outcomes, nesting IF functions:

=IF(Test, First-True Text, IF(Other Test, True Text, Both-False Text))

Named ranges

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Why name a cell or range?

	A	B	C	D
1	BUDGET PLANNER			5%
2				
3	Household	This Year	Increase	Next Year
4	Mortgage/Rent	£697.89	£34.89	£732.78
5	Council Tax	£177.00	£8.85	£185.85
6	Broadband	£57.00	£2.85	£59.85
7	Electricity	£35.00	£1.75	£36.75
8	Gas	£45.00	£2.25	£47.25
9	Telephone	£41.00	£2.05	£43.05
10	Water	£41.00	£2.05	£43.05
11	Food	£145.00	£7.25	£152.25
12				
13	Monthly Totals	This Year	Increase	Next Year
14	Income	£1,956.56	£97.83	£2,054.39
15	Outgoings	£1,238.89	£61.94	£1,300.83
16	Surplus	£717.67	-	£753.55

D1 or
"InflationRate"

B6:D6 or
"Broadband"

B14:D16 or
"Summary"

Using names in formulae

Using a name in a formula

Easier to understand

Avoid mistakes

Document your work

servicing	234.00	
petrol	1,000.00	
mot	170.00	
insurance	1,100.00	
	=SUM(expenses)	

Apply Names to pre-existing formulae

More about using names

A named range is *absolute* not *relative*

Intersect named ranges

=Gas NextYear

=47.25

Household	This Year	Increase	Next Year
Mortgage/Rent	£697.89	£34.89	£732.78
Council Tax	£177.00	£8.85	£185.85
Broadband	£57.00	£2.85	£59.85
Electricity	£35.00	£1.75	£36.75
Gas	£45.00	£2.25	£47.25
Telephone	£41.00	£2.05	£43.05
Water	£41.00	£2.05	£43.05
Food	£145.00	£7.25	£152.25

Dates

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Working with dates

Numbers can be formatted as Dates

A time is a fraction of a day

Date calculations: + -



Functions with dates

Find current date:

TODAY(), NOW()

Get part of a date:

YEAR(), MONTH(), HOUR()

Date calculations:

DAYS(), NETWORKDAYS(), DATEDIF()

Practical Session 2

Learning Objective	Workbook	Worksheet
Six	functions.xlsx	EXAM
Seven	functions.xlsx	EXAM
Eight	resitting2.xlsx	Resit Dates
Eight	FlashFill.xlsx	Sheet4
Nine	Budget.xlsx	BUDGET

Large worksheets

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Titles always visible

View|Freeze panes
at top or at left side or both



	A	B	C	D	E		
1		Oxford Holiday Co. www.oxford.hols.uk/update/2010					
2	Order ID	Destination	Global Region	Holiday Cost	Age	C	
30	4323	Australia	Australia & Pacific		61		
31	4348	Australia	Australia & Pacific		53		
32	4414	Australia	Australia & Pacific		54		
33	4806	Australia	Australia & Pacific		32		
34	4835	Australia	Australia & Pacific		57		
35	4955	Australia	Australia & Pacific		54		
36	4983	Australia	Australia & Pacific		21		
37	5033	Australia	Australia & Pacific		66		
38	5046	Australia	Australia & Pacific		58		
39	5072	Australia	Australia & Pacific		54		
40	5077	Australia	Australia & Pacific		70		
41	5151	Australia	Australia & Pacific		53		
42	4293	Austria	Europe		52		

Printing part of a large worksheet

Printing a selection

Select a range of cells, then File|Print|Print Selection

Setting a Print Area for repeated printing

Select the range to be printed

Page Layout| Print Area

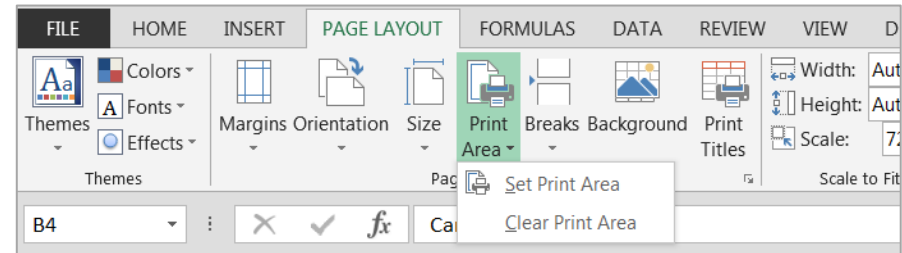
One print area for each worksheet

Setting Print Titles

Page Layout | Print Titles

Specify Rows to repeat at top

Or Columns to repeat at left



Multiple worksheets

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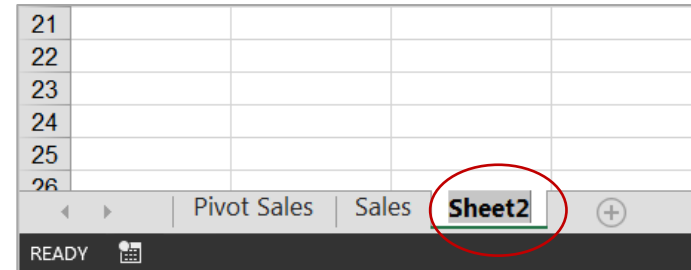


Multiple related worksheets

The image shows three overlapping Excel worksheets. The top sheet is '08 November 2007 Annual Figures' with columns for months and regions. The middle sheet is 'North' with columns for Jan, Feb, and Mar. The bottom sheet is 'East' with columns for Jan, Feb, and Mar. The data is as follows:

Region	Jan	Feb	Mar
Region 1	8.52	4.08	6.09
Region 2	9.90	9.97	5.11
Region 3	8.67	3.38	7.59
Region 4	8.72	3.70	7.61
Region 5	9.70	5.11	9.85
Region 6	6.96	7.68	4.43
Region 7	9.53	7.19	7.26
Region 8	4.79	7.08	1.00
Region 9	5.18	8.37	6.56
Region 10	1.78	5.29	8.21
Region 11	4.76	6.24	9.70
Region 12	8.19	4.43	2.16
Region 13	4.34	2.99	8.94

Insert an additional worksheet



Rename - give each sheet a memorable name

Drag tabs to re-order

Grouping several worksheets

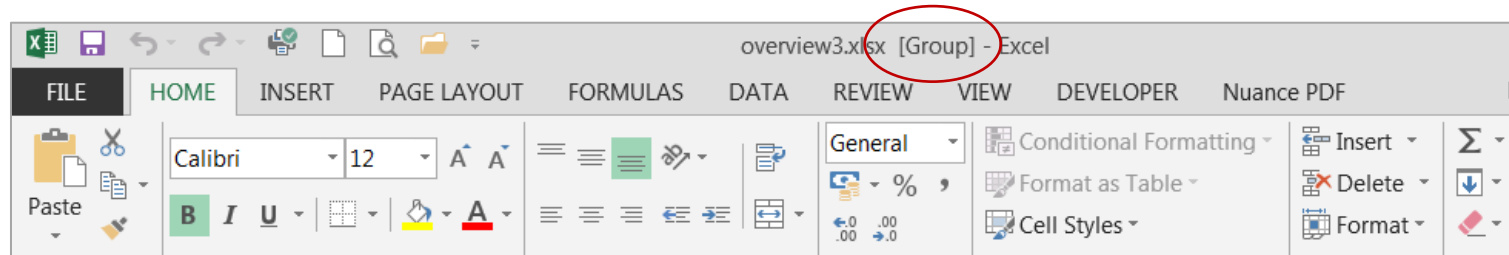
Select a range of adjacent sheets

<Shift> and click first and last tabs for required worksheets

Select non-adjacent sheets

<Ctrl> and click tabs for required worksheets

[Group] appears in the title bar



Group editing

overview3.xlsx [Group] - Excel

Then manipulate all the worksheets simultaneously:

- entering data in cells
- editing data in cells
- formatting cells
- creating formulae

	A	B	C	D
1	11 October 2007	Annual Figures		
2	East	Jan	Feb	Mar
3	Region 1	8.52	4.08	6.09
4	Region 2	2.90	9.97	5.11
5	Region 3	8.67	3.38	7.59
6	Region 4	8.72	3.70	7.61
7	Region 5	9.70	5.11	9.85

	A	B	C	D
1	11 Octobe			
2	North	Jan	Feb	Mar
3	Region 1	4.19	8.06	8.67
4	Region 2	9.99	8.26	5.30
5	Region 3	0.97	7.81	8.56
6	Region 4	3.69	6.46	6.09
7	Region 5	7.26	1.20	9.69

Calculations across worksheets

A formula can refer to cells or ranges on multiple sheets

Sheet names are marked with !

Sheet1:Sheet2!F4

F4 on *two sheets*

Sheet1:Sheet3!D3:H10

D3:H10 on *three sheets*

East:South!T16

T16 on *all four sheets*

=SUM(Sheet2!F2:F10)

=South!B12*North!K2

Practical Session 3

Learning Objective	Workbook	Worksheet
Ten	printing.xlsx	West
Eleven	overview.xlsx	<all worksheets>
Twelve	overview.xlsx	<all worksheets>
Thirteen	overview.xlsx	<all worksheets>

More about Spreadsheets ...

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Other courses

Working out your sums and calculations

Good practice with pivot tables

Good practice with charts

Good practice with lookups



Dealing with that difficult spreadsheet

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