CHAPTER 1 **SPREADSHEETS**

INFOCUS

Spreadsheets are very easy to use and make working with numbers and different kinds of calculations very simple. There are no cryptic commands you have to perform in order to view the data you wish to see and no complex understanding is required of menus functions.

So it's not hard to understand why spreadsheets have become a favourite in the computer application world. But what exactly are spreadsheets? How do they work? What are the basic underlying concepts, and where are they best deployed?

In this session you will:

✓ gain an understanding of spreadsheets and how they work
✓ gain an understanding of the size and capacity of a spreadsheet
✓ gain an understanding of what a spreadsheet can do for you
✓ gain an understanding of what spreadsheets can be used for and what is inappropriate.

HOW SPREADSHEETS WORK

Word processing packages are designed to process words – they let you write letters, compose faxes, prepare reports, write books, and much more. *Spreadsheet* packages on the other hand, are designed to process numbers. While word processing applications are perfect for creating documents, spreadsheets are ideal for budgets, statistics, sales analyses, and the like.

What Is A Spreadsheet?

According to the *Oxford Dictionary of Computing* a spreadsheet is…

> *"A program that manipulates tables consisting of rows and columns of cells, and displays them on a screen; the cells contain numerical information and formulas, or text… The value in a numerical cell is either typed in or is calculated from a formula in the cell; this formula can involve other cells. Each time the value of a cell is changed by typing in a new value from the keyboard, the value of all other cells whose values depend on this one are recalculated."*

The screen below shows a spreadsheet application being used to calculate weekly pay for four employees. Spreadsheet applications are laid out as tables comprising **rows** and **columns** – notice how the columns have alphabetical headings and the rows are numbered (down the side) numerically. The intersection of a column and a row is known as a **cell**. Your data, comprising text (referred to as **labels**), numbers (referred to as **values**) or **formulas** is typed into these cells.

Text is typed into cells and is normally used as labels – here text has been used as headings, to list employees, and to identify the types of calculations.

	A	B	C	D	E	F
1	**Weekly Pays**					
2						
3	First Name	Last Name	Hourly Rate	Hours	Gross Pay	
4						
5	Margaret	Adams	15.5	24	372	
6	John	Brown	16.75	16.2	271.35	
7	Grace	Francis	12.5	12	150	
8	Stephen	Simpson	9.65	18.2	175.63	
9						
10			**Total**	70.4		
11			**Average**	17.6		
12			**Maximum**	24		
13			**Minimum**	12		
14						
15						

Numerical information appears here as values representing the Hourly Rate and the Hours worked.

It also appears here as formulas which calculated the Gross Pay, the Total, the Average, and the Maximum and Minimum hours and pays.

What Are Formulas?

In the example above, the gross pays, total, average, maximum, and minimum figures are *formulas* that are dependent on the data values under *Hourly Rate* and *Hours*. Each time a value in *Hourly Rate* or *Hours* is changed, all of the formulas that are dependent on that value are recalculated instantly. In the screen below, the hours worked by *Stephen Simpson* have changed from *18.30* to *27.50*, and the hourly rate for *Grace Francis* has increased from *12.50* to *18.00* – notice how the relevant *Gross Pay* information and statistics have changed.

	A	B	C	D	E	F
1	**Weekly Pays**					
2						
3	First Name	Last Name	Hourly Rate	Hours	Gross Pay	
4						
5	Margaret	Adams	15.5	24	372	
6	John	Brown	16.75	16.2	271.35	
7	Grace	Francis	18	12	216	
8	Stephen	Simpson	9.65	27.5	265.375	
9						
10			**Total**	79.7		
11			**Average**	19.925		
12			**Maximum**	27.5		
13			**Minimum**	12		
14						
15						

Only two changes, to the value in hours for Stephen Smith and the hourly rate for Grace Francis, led to the instant recalculation of many of the formulas in the other cells – this is an important aspect of spreadsheeting.

THE CHARACTERISTICS OF A SPREADSHEET

Imagine several large sheets of paper, each ruled into columns and rows, and you have the concept underlying the structure of a spreadsheet – except that spreadsheets are electronic pieces of paper. Each sheet is where you can do your work, so these individual sheets have become known as worksheets. Spreadsheets have been around since the late 1970s.

A History Of Spreadsheets

Spreadsheets were developed with a specific use in mind. One of the earliest spreadsheet programs was developed in the mid-70s by Dan Bricklin, an MBA student at *Harvard Business School*.

Dan found that he had to create a number of complex business models that required tables of numbers that had to be constantly added and averaged. These numbers were written up on large sheets of paper with grand totals and averages at the bottom. He was required to enter new numbers and recalculate the bottom line to come up with a variety of business models. Dan got a bit tired of doing this on his calculator. So he developed an electronic version of a large sheet of paper that was ruled into columns and rows, and that could perform calculations. Spurred on by his friends, he refined this product and marketed it as *VisiCalc*. It was very successful with accountants and other people who had to prepare tables of numbers.

In the 1980s *VisiCalc* was overtaken by another product, *Lotus 1-2-3*. This product added more functionality to the spreadsheet concept, allowing the user to draw graphs based on the numbers and to perform some elementary sorting and querying of the data just like a database package.

Since the advent of Windows 3.0 in June 1990, *Microsoft Excel* has become the predominant spreadsheet product.

The Anatomy Of An Excel Spreadsheet

Spreadsheets are just like electronic sheets of paper that have been ruled up into tables comprising of **columns** and **rows**. In **Excel**, each piece of ruled paper is referred to as a **worksheet** and it is actually made up of 16,384 **columns** across the screen, and 1,048,576 **rows** down the screen. If you hold a ruler up to the screen each column measures about 2.1 cm in width and about 0.5 cm in height.

There are 1,048,576 rows down the screen labelled from 1 to 1,048,576

There are 16,384 columns across the screen labelled from A to XFD

	A	B	C	D	E	F
1	**Weekly Pays**					
2						
3	**First Name**	**Last Name**	**Hourly Rate**	**Hours**	**Gross Pay**	
4						
5	Margaret	Adams	15.5	24	372	
6	John	Brown	16.75	16.2	271.35	
7	Grace	Francis	18	12	216	
8	Stephen	Simpson	9.65	27.5	265.375	
9						
10			**Total**	79.7		
11			**Average**	19.925		
12			**Maximum**	27.5		
13			**Minimum**	12		
14						
15						

You can have as many worksheets in a workbook as your computer 's memory will allow

In **Excel**, when you save your work it is saved in a file known as a **workbook**. A workbook is made up of one or more **worksheets** – you can have as many worksheets in a workbook as your computer memory will allow. Each worksheet is given a tab at the bottom of the screen with a **label** such as *Sheet1*, *Sheet2*, etc.

When a row and a column intersect you have a **cell**. Each cell can hold up to 32,767 characters (each character roughly equivalent to a letter or number – for example, the name *John* occupies 4 characters of space, one for each letter).

WHAT A SPREADSHEET CAN DO

Over the years the functionality of spreadsheets has increased. Today spreadsheets provide three main functions. Primarily they allow you to type numbers to perform calculations. They also allow you to display those numbers pictorially as graphs. Finally, spreadsheets allow you to enter data into lists and to perform operations such as sorting, filtering, and summarising of those lists.
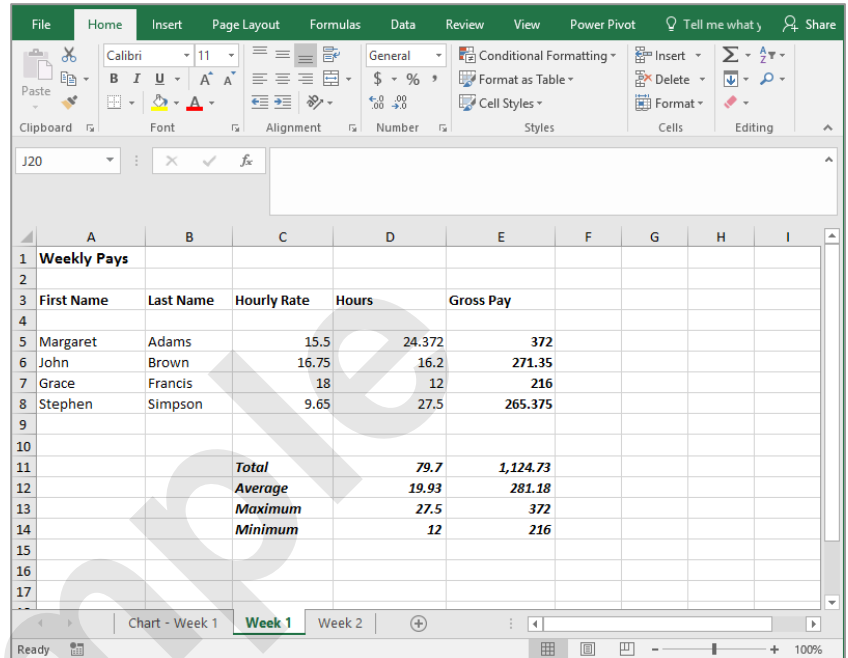
Performing Calculations

Spreadsheets are most commonly identified as applications that help you process numbers. Numbers are entered into cells and formulas that use these numbers are automatically and instantly recalculated. This is sometimes referred to as *numeric modelling*.

Creating Graphs

Graphs, or *charts* as they are known in Excel, allow you to pictorially view the data in a worksheet. Charts are created based on one or more series of numbers that are in the worksheet. These numbers may have been typed or may appear as the result of a calculation. Like formulas, charts are automatically updated when the data in the worksheet changes.

Working With Lists

A list is simply a collection of items organised into columns and rows – and since that is how a worksheet is organised it is only logical that list-type operations can be performed. These operations include the ability to filter (search and display) specific data, the ability to sort the data either numerically or alphabetically, and the ability to summarise the data such as displaying the total of a particular column.

THE APPROPRIATENESS OF SPREADSHEETS

Basically spreadsheets can be used for virtually any task that uses numbers and needs to be calculated. While they initially gained momentum in the accounting professions, spreadsheets are now used throughout the business community, in government, manufacturing, science, and many other areas of industry.

Advantages Of Spreadsheets

There are millions of uses in the modern world for spreadsheet applications such as Microsoft Excel.

- **In Business and Government:** Spreadsheets are used for a diverse range of purposes, including budgeting, analyses of sales and costs, monthly reporting of sales and costs, financial modelling, loan recalculation and amortisation, petty cash, bank and credit card reconciliations, producing simple lists, producing charts and graphs for business presentations, and more.
- **In Industry:** Spreadsheets are used in manufacturing for estimating things such as materials, costs, and the like, and for analyses of data captured by manufacturing or scientific equipment. Other uses of spreadsheets include price lists and statistical analyses for quality control.
- **At Home:** Spreadsheets can be quite useful for things such as tracking personal finances, credit card and bank reconciliations, hobby and small business bookkeeping, asset registers, and the like. The lists functionality is perfect for keeping small lists (consisting of about several hundred lines) of things such as names and addresses, CD collections and wine collections. Spreadsheets can also be used for sporting clubs, hobby associations, and other groups or clubs where basic accounting and member records need to be kept.

Disadvantages Of Spreadsheets

Spreadsheets are probably the simplest of all of the personal computer applications to use. As a consequence some people tend to use spreadsheets for everything, including tasks that they are not designed for such as lengthy text documents.

Some of the pitfalls of working with spreadsheets include:

- **Capacity:** Spreadsheets are like electronic pieces of paper ruled into columns and rows that allow you to perform calculations. The piece of electronic paper that you work with, known as a *worksheet*, is very large. However, spreadsheets have one disadvantage – all of the worksheet must be loaded (or at least pass through) the computer's memory, known as RAM. So while a worksheet may appear to have the capacity to be very large, it actually needs to be kept relatively small in order to perform efficiently.

  Having said this, there is no reason why you can't create a whole series of smaller workbooks that are linked together.
- **Text:** You shouldn't attempt to produce text-based documents such as a letter or a memo using a spreadsheet. Spreadsheets are designed to work with numbers and perform complex calculations, and are structured with cells in order to fulfil this purpose. Word processing programs such as Microsoft Word are a far better choice for a text document.
- **Database:** Spreadsheets are useful for producing and manipulating lists – providing they are kept small. However, some users create a list in a spreadsheet and then keep adding new data until there are too many entries for it to continue to be efficient. Usually lists of more than several hundred lines (sometimes known as *records*) are better placed into a database application such as Microsoft Access.

CHALLENGE EXERCISE
Spreadsheets

Tasks:	Completed:
Before starting this exercise you MUST have completed all of the topics in the chapter Spreadsheets…	
1 In your own words what is a "spreadsheet"?	☐
2 Spreadsheets are ruled up into tables comprising of what?	☐
3 List the three main spreadsheet programs that have been developed since the mid-1970s.	☐
4 List the three main things that can be done with Microsoft Excel.	☐
5 List two possible uses for spreadsheets in business.	☐
6 List two possible uses for spreadsheets in industry.	☐
7 List two things that spreadsheets should not be used for.	☐

Files required for exercise:	None
Files/work created by student:	Photocopy of answer sheet (next page)
Exercise Completed:	☐

CHALLENGE EXERCISE WORKSPACE
Spreadsheets

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1 In your own words what is a "spreadsheet"?

_____

_____

_____

2 Spreadsheets are ruled up into tables comprising of what?

_____

_____

3 List the three main spreadsheet programs that have been developed since the mid-1970s

1. _____   2. _____

3. _____

4 List the three main things that can be done with Microsoft Excel.

1. _____   2. _____

3. _____

5   List two possible uses for spreadsheets in business.

1. _____   2. _____

6 List two possible uses for spreadsheets in industry.

1. _____   2. _____

7 List two things that spreadsheets should not be used for.

1. _____

2. _____

NOTES:

A GUIDE TO BRILLIANT SPREADSHEETS

Spreadsheet applications such as **Excel** have been in existence for many years. They have been used for many different purposes and situations and have saved countless hours of work. However, spreadsheets must be clear and easy to understand in order for them to achieve their maximum usefulness.

A spreadsheet with incorrect data or poor formatting that makes the data difficult to understand can result in poor business decisions based on the outcome of flawed workbooks. While there is no standard, universally recognised code of practice for spreadsheets, there are certain techniques that will help to avoid problems.

This session is based on ideas and suggestions from the staff and students of the *London School of Economics* and their contribution is acknowledged and recognised accordingly.

In this session you will:

✓ gain an understanding of meeting organisational requirements
✓ gain an understanding of the importance of workbook planning
✓ gain an understanding of good design and organisation within a workbook
✓ gain an understanding of how to ensure formulas work as they should
✓ gain an understanding of ways that make your workbook easier to understand and use
✓ gain an understanding of what spreadsheets can be used for and what is inappropriate.

MEETING ORGANISATIONAL REQUIREMENTS

Number processing programs such as Microsoft Excel allow you to create a huge range of spreadsheets, charts, tables and graphs. While most personal spreadsheets are designed from personal taste, an organisation's spreadsheets should be produced according to the image that the organisation wants to convey to the public.

Organisational Logo

An organisation's logo is usually a special graphic image that is used to identify the organisation to the public. These images are stored digitally as image files, and can easily be imported into number processing programs such as Microsoft Excel. Organisational logos are generally found on the first page of a spreadsheet or they may be found at the top (header) or bottom (footer) of every page.

Organisational Colour Scheme

As well as an organisational logo, each organisation will further brand itself by having specific corporate colours that are used throughout their spreadsheets. Usually the corporate colours will be the same colours as those used in the logo. These colours may be used in business spreadsheets, brochures, flyers and other advertising material to further help identify the organisation to the public. Microsoft Excel allows you to apply colour to cells, for example, as well as to apply and customise *cell styles*. Themes contain colour schemes and you can customise these to match organisational requirements. As colour printing becomes less expensive, more spreadsheets are being printed with coloured elements, such as shapes and borders, which reflect the organisation's corporate colours.

Established Guidelines

Large organisations often have established guidelines in place for producing organisational spreadsheets. These guidelines will most likely be found in the company's *Style* guide or similar spreadsheet. These guidelines are developed so that employees can produce consistent spreadsheets that convey the organisation's image.

Styles

In number processing programs you can create spreadsheets that have a consistent look and feel by using styles. A *style* is a stored set of formatting attributes that can easily be applied to text. Many organisations will have a range of styles that you are required to use when producing business spreadsheets and these may be contained in the organisation's templates (see below). Information about using styles will also be contained within the company's *Style* guide or similar spreadsheet.

Templates

Templates are often used in organisations for most standard business spreadsheets and are made available to all users. Each template will already contain the prescribed layout and formatting as well as the organisation's styles. Many templates already contain standard or boilerplate text to reduce the time it takes the user to create a spreadsheet. These templates will usually be available on the organisation's intranet or network.

Organisational Details

With organisational spreadsheets it is important to be able to locate them easily. Information such as the file name, file location, author, date, and/or time is often found in the footer (bottom) of the first page or each page of the spreadsheet and this information will help to locate electronic copies of spreadsheets. Again, the established guidelines for the organisation will spell out requirements.

Copyright Legislation

It is important that spreadsheet content adheres to copyright laws and requirements. Organisations that produce spreadsheets that fail to meet copyright guidelines are often the subject of law suits. Again, the established guidelines for the organisation or your supervisor should indicate what can be placed in a spreadsheet and how it should be presented.

GOOD PLANNING IS ESSENTIAL

Good planning leads to great workbooks and great workbooks, irrespective of how simple or complex they are, are easy to use and work with. Consider the data that needs to be presented and how it needs to be organised, then build the workbook layout around that structure. Always check, verify and test your workbooks before using them or distributing them to others.

Think About Your Audience

A well-designed workbook will make it easy for others to:

- read the data
- understand the main purpose of the data, and,
- use the information.

Whether you are creating a workbook for your own use, or that of others, ensure that you spend time planning, designing and testing the data. Even if you intend for a workbook to be for your own use, there is always the possibility that someone else may need to use it. For instance, if you are absent from work, or if a colleague wishes to use your workbook as a template for their own purposes. If you are creating a workbook for other users it is especially important to carefully plan the workbook. Think about what you are trying to communicate and try to make the information as clear and easy to understand as possible.

A Workbook Plan

Data that is logically related should be represented in a way that visually links the data so users can clearly see any relationships between the data.

Workbooks usually have a minimum of three categories of information: *constants* (sometimes known as *assumptions*)*, inputs* and *results*.

Separate the three types of information so that it is easy to distinguish each one. If you are creating large, complex workbooks, consider using different *worksheets* in the same *workbook* rather than placing these three categories in a single long or wide worksheet.

The Results Area(s)

The *results* areas of your workbook usually contain formulas that perform calculations using data in the *constants* and the *input* areas.

Try to insert a blank row or column before your *total* areas. This will ensure that the totals will automatically expand to include any additional rows containing values that are added to the *input* area. It also means that the totals are treated separately when performing other functions such as sorting, filtering, etc. If you can't insert a blank row or column, use formatting options such as borders to create a visual separation from the data input area.

Testing

Always test your formulas and the overall operation of your workbook before you publish it. If possible, ensure someone else double-checks the calculations and results before you allow others to use it.

ORGANISATION AND DESIGN

It is important to spend time considering the best way to present your data, particularly when presenting it to others. Good organisation and design within a workbook can save you time as it ensures there is less chance of errors in both data entry and formula results.

Simple Tips For Keeping Data Organised

Even for complex, detailed information, keep the layout and structure of the workbook and its data as simple and clear as possible. Here are some suggestions for organising your data:

- Present the data in a top-to-bottom, left-to-right layout as this is the default way workbooks calculate. It also makes it easier for others to read the workbook data.

- Separate *constants*, *input* cells, *calculations* (results) cells.

- Where possible, try to use one formula per row or column. This maintains the readability of the data and makes results easier to read and understand.

- If you have large amounts of data, consider using separate worksheets within the same workbook and name the worksheet *tabs* to identify the content of each.

29	
30	
31	

YTD Results | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | ⊕

Ready
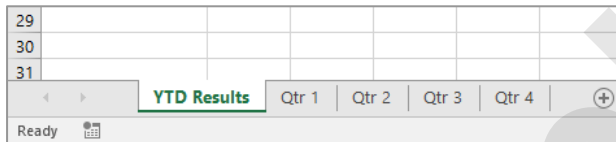
- Manually created *lists* should have headings formatted differently from the data to make the headings stand out from the data. Also try to ensure consistent formatting within a column. Don't use blank rows within the data area as this prevents the correct use of analysis tools such as *Filtering*, auto-recognition in *Advanced Filtering* and *Pivot Tables*.

- Make sure cells bordering a list (the *data area*) are blank. This makes the data area more easily identifiable and it ensures that unrelated information isn't mixed up with the list data.

	A	B	C	D	E	F	G	H	I	J
1										
2										
3	Employee Number	First Name	Surname	Date Of Birth	Age	Region	Department	Gross Salary	Tax	Net Salary
4	X3456	John	Smith	23-Dec-52	62	North	Sales	$34,000	$7,140	$26,860
5	G4533	Bill	Bloggs	12-Mar-50	65	North	Accounts	$35,000	$7,350	$27,650
6	E3422	Mary	Howard	14-Feb-63	52	South	Admin	$24,000	$3,600	$20,400
7	H6755	Betty	Jones	12-Dec-51	63	South	Management	$57,000	$18,240	$38,760
8	G7777	Sam	Smith	15-Apr-62	53	North	Production	$27,000	$5,670	$21,330
9	H5566	Tan	Doon	12-Sep-47	68	South	Production	$33,000	$6,930	$26,070
10	J7566	Freddy	Michaels	5-Nov-66	49	North	Accounts	$24,000	$3,600	$20,400
11	G5677	John	Williams	3-Oct-60	55	South	Sales	$34,500	$7,245	$27,255

- Use clear, unambiguous labels to describe the contents or purpose of cells in the worksheet – avoid abbreviations if you can.

	A	B	C	D	E	F	G	H	I
1									
2		BCM Dairy Products							
3		Nutritional Comparison							
4						Number of Cheeses			
5						Average Calcium (mg)			
6						Maximum Fat (g)			
7						Count > 25% Fat			
8						Median Energy (kj)			
9						Standard Deviation Protein			
10									
11									
12		Cheese Type	Protein	Fat	Energy	Calcium	Sodium	% Fat	Light
13		per 20g	(g)	(g)	(kj)	(mg)	(mg)		
14		Blue Vein	4.1	6.7	319	108	156		
15		Brie	3.8	5.8	282	94	121		