What is meant by computer hardware?

The physical components that make up a computer system

Peripherals

Input Devices:

- Convert real world data into a form that the computer can process

Example – a keypress must be turned into a binary signal

Output Devices:

- To disseminate information that has been produced from a computer

Example – a paper report can be produced by a printer device

Secondary Storage Devices:

- For data and information retention

Example – hard disk drives and USB storage devices keep data that a computer can read at a later date

The central processing hardware components

Processors

Advanced circuity that can follow instructions to perform arithmetic and make logical decisions

Main Memory

Provides the processer immediate access to the instructions and data that it is currently using

EXAMPLES OF INPUT DEVICES

Monitor (aka Screen or VDU)
A common device to display ***softcopy*** output

Speakers
To output sound (similar headphones)

Printers
To produce a ***hardcopy*** output
There are different technologies:

- **Inkjet** – squirts a fine stream of ink onto the paper
- **Laser** – heat fixes toner where light is shone onto paper
- **Dot Matrix** – dots to form characters are impacted through an inked ribbon (old fashioned but still in use as can be used with carbon paper)

Plotter
Draws an image onto large sheets of paper

Projector
Image displayed by shining light onto a surface

Document Scanner
Converts a paper document into a digital document format

Joystick
Sends left and right, up and down movements and button presses

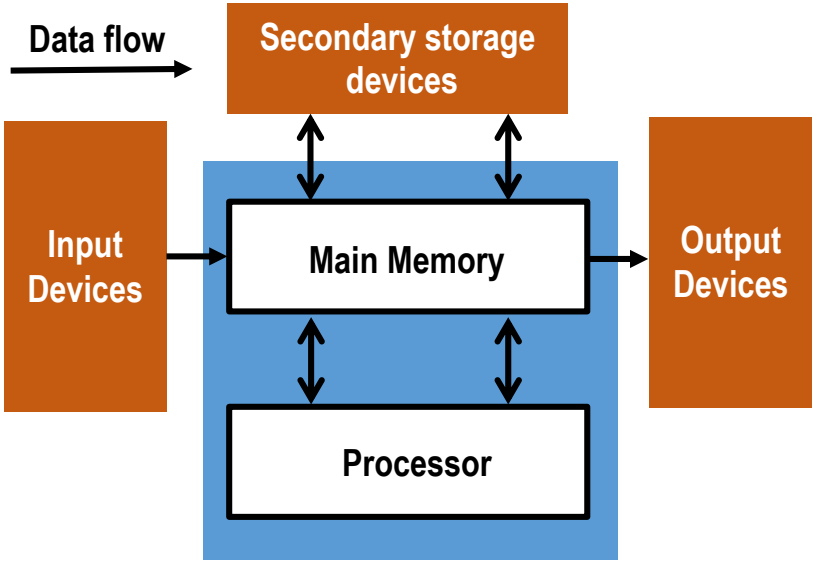
Keyboard
Convert keypress information to data

Mouse
Send up and down // left and right movement data and button presses

Camera
Captures moving image data digitally

The hardware model

- **Peripheral devices** work with data that is not currently processed.
- **Central processing devices** data that is currently being processed

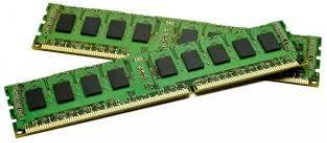


The processor hardware

Most of what is seen here is the housing and connections points which surround a very small processor chip

Main memory hardware

Holds data that the processor is **currently working with**



RAM
(Random Access Memory)
Volatile retains data as long as power is supplied

ROM

- The data in the chip is fixed at the time of manufacture and stays after power removed.
- Variations - PROM, EPROM, EEPROM

What is a spreadsheet?

A type of ***application software*** where data is organised into rows and columns.

- Each **column** has a letter e.g. **B**
- Each **row** has a number e.g. **4**
- A **cell** is a single space on the spreadsheet identified by a column letter and row number **B4**

	A	B	C
1			
2			
3			
4			
5			

Spreadsheet Cells

	A	B
1	First number	45
2	Second number	12
3	Numbers added	57

- **Labels** contain string data called text – A2 holds 'second number'
- **Values** are numbers – B2 holds the value 12
- **Calculated** what is displayed is computed by a formula – B3 is worked out by adding B1 and B2 together

If a value in B1 or B2 changes the spreadsheet will change B3 using **automatic recalculation**

Formulas with basic arithmetic operators

= at the start of a cell tells the spreadsheet to use a formula to display the result of a calculation.

Arithmetic operators are symbols like + - * and / used in a formula

Examples of arithmetic operators in formulas

+ to **add** cells, *E11 will 15.99 by computing 12.99 added to 3*

	C	D	E
10	Goods	Postage & Packing	Total
11	12.99	3	=C11+D11

***** to **multiply** two cells, *I11 will display 47.88 which is 3.99 multiplied by 12*

	G	H	I
10	Cost per item	Number of items	Total value
11	3.99	12	=G11*H11

- to **subtract** one cell value from another, *E14 will display 21 which is 23 minus 2*

	C	D	E
13	Price	Discount	Amount
14	23	2	=C14-D14

/ to **divide** one cell by another, *I14 will display 17.50 which is 3105 divided by 6*

	G	H	I
13	Winnings	How many winners	Amount per person
14	105	6	=G14/H14

Spreadsheet Ranges

The first cell is separated from the last cell in a range by a **colon :**

	A	B	C
1			
2	4	10	1
3	8	15	16
4	7	1	12

- **A2:C2** 4, 10, 1
- **A2:A4** 4, 8, 7
- **A2:C4** 4, 10, 1, 8, 15, 6, 7, 1, 12

The SUM function

If more than one number is to be added it is good practice to used the SUM() function. In the spreadsheet below:

	B	C	D
5	7	4	3
6	8	9	6
7	2	5	1

- **=SUM(B5:D5)** is 14 i.e. (7+4+3)
- **=SUM(C5:C7)** is 18 i.e. (4+9+5)
- **=SUM(B5:D7)** is 45 i.e. (7+4+5+8+9+6+2+5+1)

The AVERAGE function

Works out the mean average, all the numbers added divided by the number of numbers. In the spreadsheet below:

	B	C	D
5	2	1	3
6	8	9	6
7	5	2	1

- **=AVERAGE (B5:D3)** is 2 i.e. (2+1+3) divided by 3
- **=AVERAGE (C5:C7)** is 4 i.e. (1+9+2) divided by 3
- **=AVERAGE (B5:D7)** is 4.111 i.e. (2+1+3+8+9+6+5+2+1) divided by 9

Maximum value function

Will display the **largest** value in a spreadsheet range:

	A	B
1	=MAX(A4:B5)	
2	=MAX(A4:B4)	
3		
4	4	10
5	8	15

- A1 will display **15** *the largest value in 4, 10, 8 and 15*
- A2 will display **10** *the largest value between 4 and 10*

Minimum value function

Will display the **lowest** value in a spreadsheet range:

	A	B
1	=MIN(A4:B5)	
2	=MIN(A4:B4)	
3		
4	4	10
5	-3	15

- A1 will display **-3** *the lowest value in 4, 10, -3 and 15*
- A2 will display **4** *the lowest value between 4 and 10*

Cell sizes

In these two examples cells A2 and B2 are not big enough to display the data

	A	B
2	Tot	##

	A	B
2	Tot	6E+O6

First solution: widen the column width

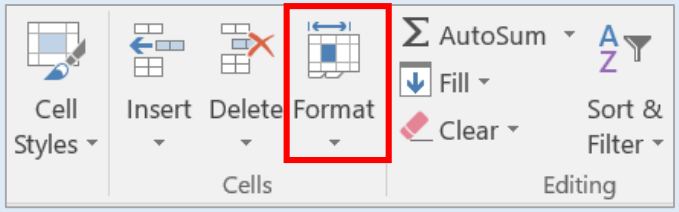
	A	B
2	Total earnings	6000000

Second solution: increase the height of a row and use text wrapping

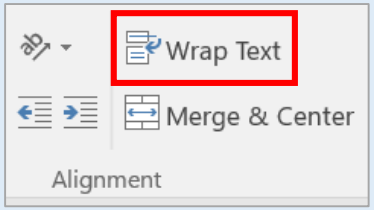
	A	B
2	Total earnings	6000000

Using Microsoft Excel – cell sizes

Column height and row widths can be changed using the **Home** tab, in the Cells group, click Format



Set a cell wrap from the **Home** tab, in the Alignment group, click the cell(s) then Wrap Text



Presenting information

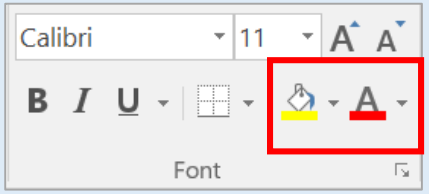
Information should be easy for the user to read by using colour, fills, merging cells, drawing cell borders, alignment, font sizes and styles. NOTE - too many colours make information difficult to read.

	A	B	C	D	E	F	G	H	I
1	**Handy Discount Calculator**								
2			Number of items bought						
3			1	2	3	4	5	6+	
4	Amount spent	10	0	0	0	0	0	0.05	
5		50	0.1	0.15	0.2	0.25	0.3	0.35	
6		100	0.2	0.3	0.4	0.5	0.6	0.65	
7		200	0.3	0.45	0.6	0.75	0.9	0.95	
8									

Using Microsoft Excel – Colour

Select the cells that you want to change the colour of:
Click **Home**
Then click on the arrow next to **Fill Colour** Button 

or **Font Colour** 



What is an Algorithm?

- a **set of steps** that are followed
- to **solve a problem**

Algorithms are often associated with computer programs but can be written to solve for any type of problem.

For example, a cooking recipe is a form of algorithm

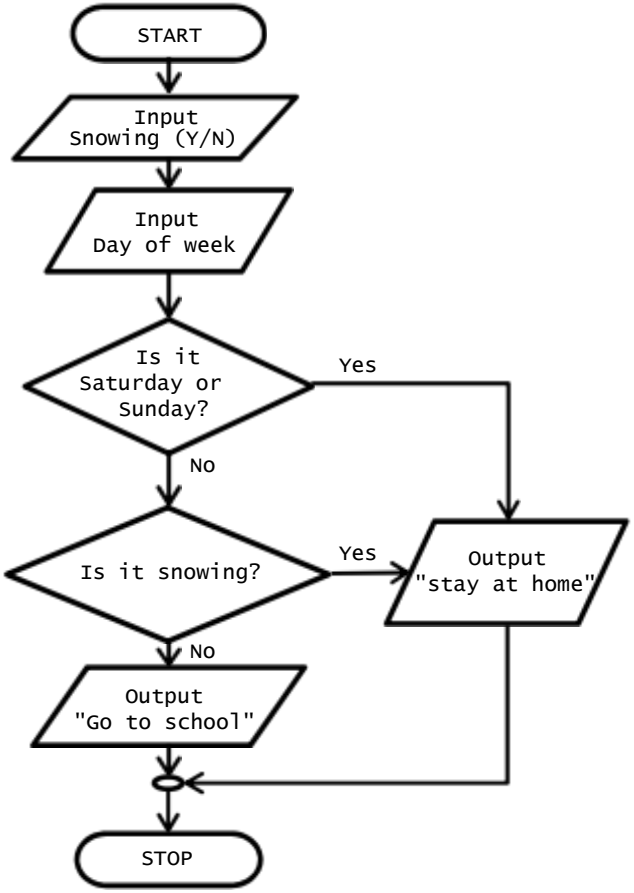
- … it gives information (as a set of steps to follow)
- … that explains how to make a meal (the problem to be solved)

There are many ways to express a solution to a problem for example

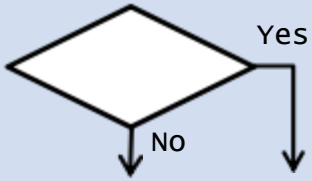
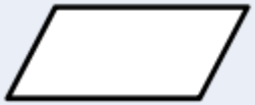
- **Program flowcharts** – easy to understand by following flow lines from one part of the solution to the next
- **Pseudocode** – a way of expressing the solution is something like computer code
- **Structure charts** – a way of expressing a solution by breaking problems into successively smaller problems

Program Flowcharts

Here is a **flowchart** to decide whether to go to school or not



Symbols that are used

Symbol	Meaning
	**Terminator** Must start and end with a terminator
	Flowline To connect steps, must have a direction arrow
	**Decision** Allows different course of action to be decided on. Flow lines must be labelled Yes and No
	**Input/output** When data leaves or enters the algorithm
	**Process** For calculations
	**Connector** To join flowlines, perhaps on anther page

Pseudocode

Steps are written in something similar to computer code
As long as the meaning is clear detail should be avoided

Often uses **indentation**

Example

```
DO
    OUTPUT 'What is the best subject you take?‘
    answer = INPUT user inputs the best subject they take
    IF answer = 'Computer Science' THEN
      OUTPUT 'Of course it is!'
    ELSEIF answer =  ‘ICT’
      OUTPUT ‘Not a bad choice’
    ELSE
      OUTPUT 'Try again!'
    END IF
UNTIL answer = 'Computer Science'
```

Standard algorithms in Computer Science

Commonly used by computer programs.

For example computer programs often need to

- **Search** to find something
- **Sort** to put information in to an order such as ascending alphabetical order.

- There are many standard algorithms to perform the same task because they work more efficiently in different situations
- **Searching**
  - **LINEAR searching** takes longer to find the information required but does not require the data to be sorted first
  - **BINARY searching** is much faster, especially with large amounts of data, but needs the data to be sorted beforehand
- **Sorting**
  - a **BUBBLE** sort is faster when the data is nearly in order
  - an **INSERTION** sort is best used when completely unordered

Linear Searching

Work from the beginning of a list until the item is found or the end of the list.

- For example search the list of numbers for 13

– Check the first item: 2 does not equal 13.

– Check the second item: 3 does not equal 13.

– Check the third item: 7 does not equal 13.

– Check the fourth item: 5 does not equal 13.

– Check the fifth item: 13 = 13 Stop searching as the item has been found.

Binary Searching

Look at the mid item in the list and reduce the list to the side that the item is in, until found.

For example find the word 'lemon' in the list below:

butterscotch	chocolate	lemon	mint	strawberry	tango	vanilla

- Compare 'lemon' to the item in the middle, 'mint' alphabetically greater so take the sub list to the left of mint:

butterscotch	chocolate	lemon

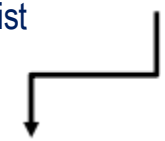
- Compare 'lemon' to 'chocolate'. Chocolate is alaphabetically lower less so split and take the sublist to the right of chocolate

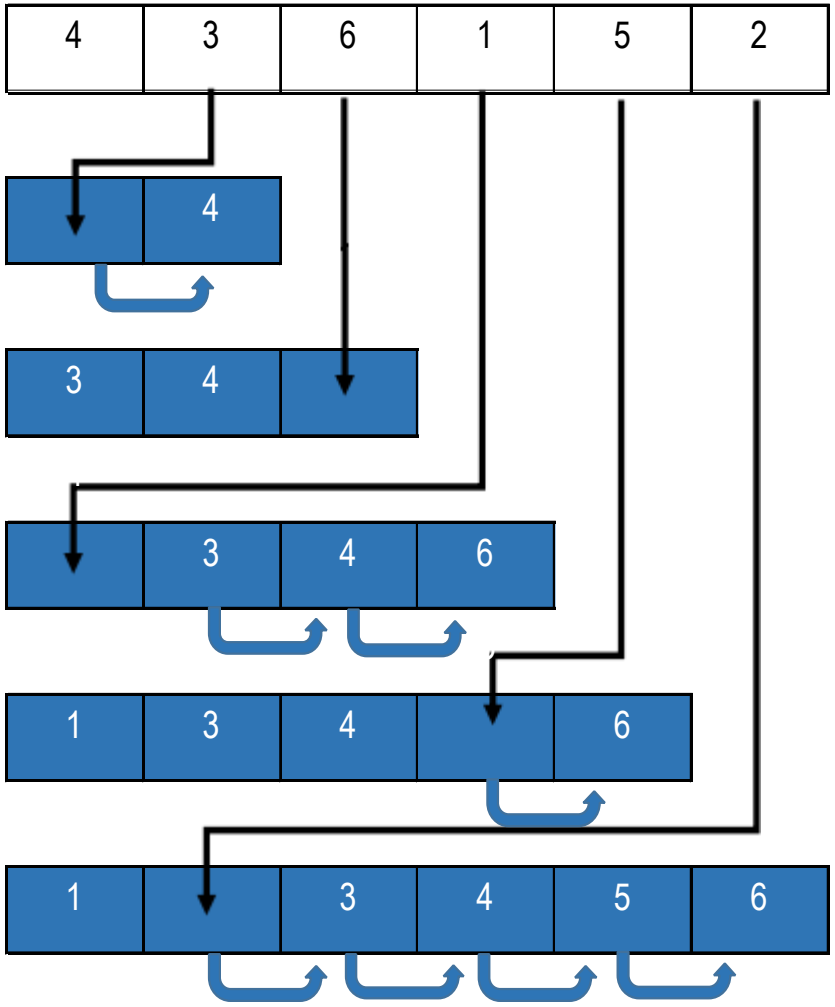
lemon

- Compare 'lemon' to 'lemon' item is found!

Insertion sorting

- Starting with the second element until the end of the list.
  For example [3] and going through each one after another ([6] [1] [5] and finally [2])
- Shuffle  elements up to make space to be able to
- Insert each element into the correct position in the sub-list



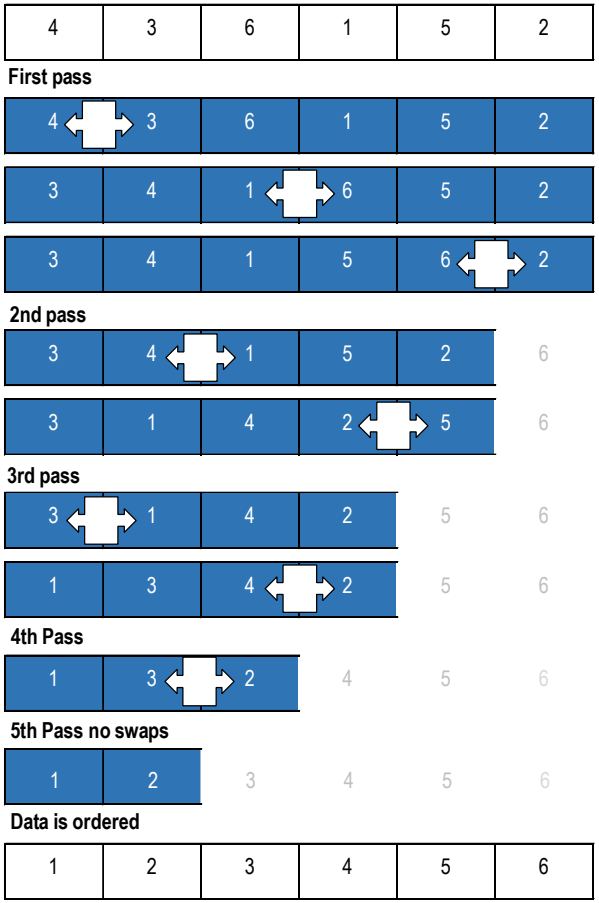


Bubble Sorting

The algorithm perform several passes through list comparing elements each time

So each time

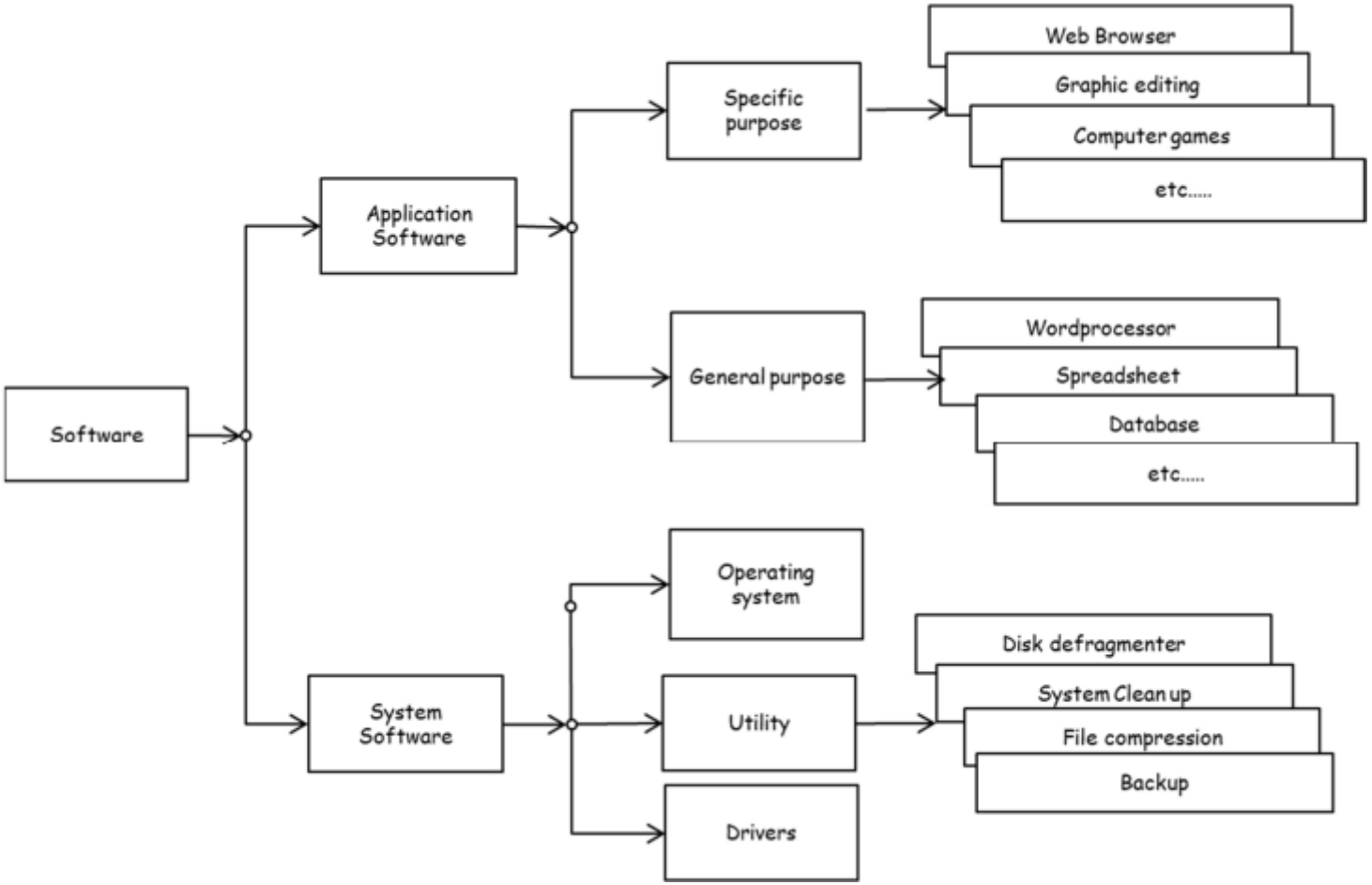
- Compare each element with the next, Swap if out of order
- Exclude the last element, (In the example, [6] then [5][6] then [4][5][6] then [3][4][5][6]), in the next pass of swaps because, (like a bubble floating to the top), in will be in position
- If a pass doesn't have any swaps the list is in order and the algorithm ends.



Definitions

- **What is software?**
  - The programs that run on computer hardware
- **Software types**
  - **APPLICATION SOFTWARE**
    - Perform tasks that would have to be completed even if computers did not exist.
      - Example word-processing to create documents or web browsers to display Information which might otherwise be read in books
  - **SYSTEM SOFTWARE**
    - Perform tasks needed to keep a computer working...
    - by controlling and managing hardware and applications

Categories


Software
Application Software
System Software
Specific purpose
General purpose
Operating system
Utility
Drivers
Web Browser
Graphic editing
Computer games
etc.....
Wordprocessor
Spreadsheet
Database
etc.....
Disk defragmenter
System Clean up
File compression
Backup

Application Software (Specific purpose sub category)

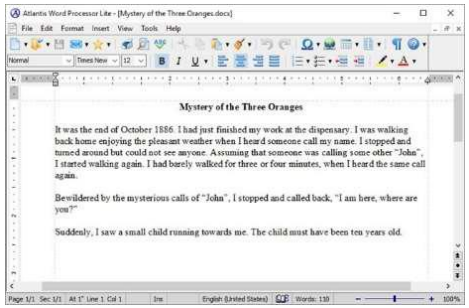
- **WEB BROWSER**
  - for viewing web pages sent through a network and
  - turn HTML into viewable documents

- **GRAPHICS SOFTWARE**
  - edit vector or bitmap images
  - create digital animation

- **COMPUTER GAMES**
  - for entertainment
  - Often run on purpose designed

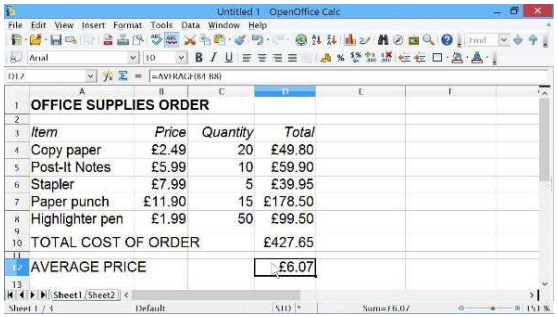
Application Software (General purpose sub category)

- **WORD PROCESSORS**
  - to write text based documents such as
    - Letters and mail-merge
    - books, dissertations etc.



- **DESKTOP PUBLISHING**
  - organising layout of text and graphics
    - leaflets, posters, flyers magazines

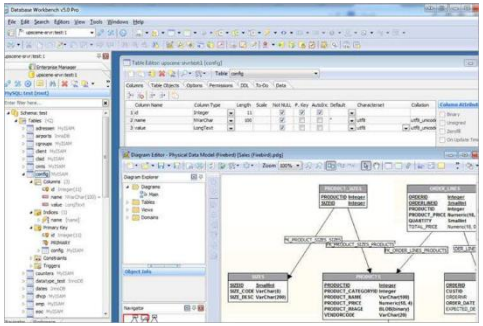
- **SPREADSHEETS**
  - work with data in a tabular format
  - Model scenarios using 'What if'



More examples of Application Software (General purpose subcategory)

- **PRESENTATION**
  - to create slides of information to display in a meeting or class

- **DATABASE**
  - for storing information that has complex relationships
  - creating forms
  - reporting from the data



Systems software

- **OPERATING SYSTEMS**
  - **Provides the computer's basic functions, such as**
    - **Enabling multi-processing** (running more than one program at a time)
    - **Managing hardware** (controlling peripherals like printers, tracking memory use)
    - **Providing a user interface**
    - **User control** (Login and passwords)

- **UTILITY PROGRAMS**
  - **To analyse, configure, optimize or maintain a computer,** *examples*
    - Disk defragmenter
    - System clean-up removing unwanted files
    - Compress files
    - Backup

- **DRIVERS**
  - used as an interface to allow for differences between hardware and the computer types