

Excel & Python

Master in Management

Excel Fundamentals

2026

Concepts - Spreadsheet

- Electronic equivalent to the spreadsheets used in accounting maps for analysis
- Allows the organization of data in tables (rows and columns)
- Each cell on the table contains either a data element or a formula
- The formulas perform calculations and/or use functions based on data from other cells

History of Spreadsheet Tools

- 1969: **LANPAR** (Language for Programming Arrays at Random) ; Mainframe
- 1979: **Visicalc**; Apple II computers
- 1982: **Multiplan**; Microsoft; also ported to Apple computers
- 1983: **Lotus-1-2-3**; Lotus Software, later bought by IBM
- 1985: **Excel**; for Apple Macintosh. Launched in 1987 for Windows

Example

Example problem: We want to analyse a table showing the monthly cost of groceries, with a total per month and per item.

	A	B	C	D	E	F	G
1	CUSTOS	Janeiro	Fevereiro	Março	...	Dezembro	Total Anual
2	Açúcar	4,00	19,00	8,00	26,00	14,00	71,00
3	Arroz	12,00	20,00	15,00	24,00	21,00	92,00
4	Farinha	14,00	5,00	12,00	8,00	26,00	65,00
5	...	17,00	24,00	10,00	12,00	35,00	98,00
6	Ovos	27,00	25,00	13,00	23,00	21,00	109,00
7	Total Mensal	74,00	93,00	58,00	93,00	117,00	

Totals per
column

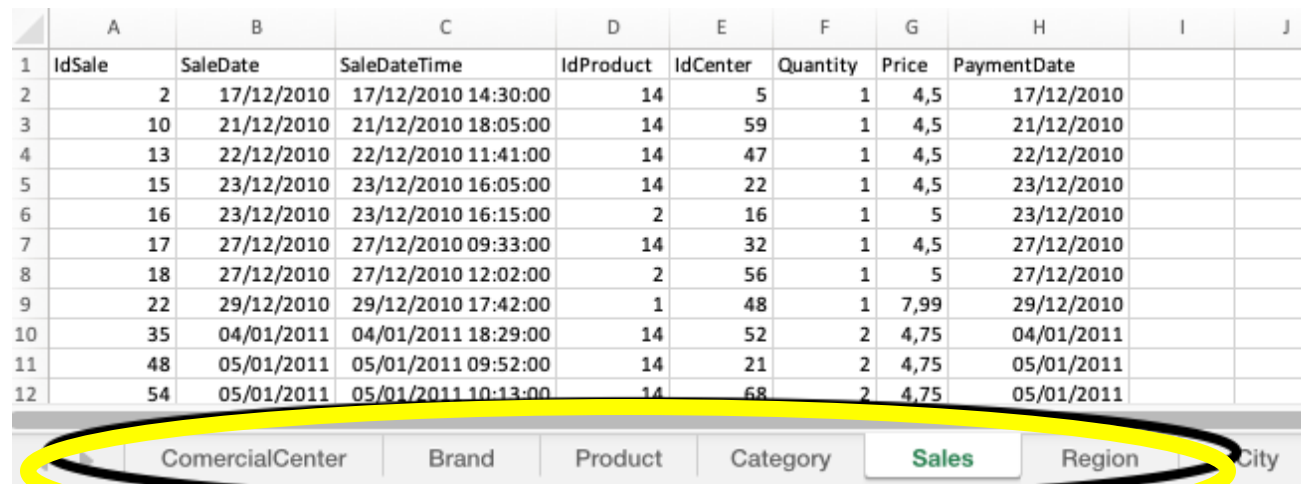
Totals
per row

The power of spreadsheets is that, by changing any cell, the content of its dependents are immediately changed.

Workbook

To organize in a single file several related data (Ex: ComercialCenter, Brand, Product, Sales), Excel allows storing in a single file, a set of worksheets:

Workbook → Set of Worksheets (spreadsheets)



	A	B	C	D	E	F	G	H	I	J
1	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate		
2	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	17/12/2010		
3	10	21/12/2010	21/12/2010 18:05:00	14	59	1	4,5	21/12/2010		
4	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	22/12/2010		
5	15	23/12/2010	23/12/2010 16:05:00	14	22	1	4,5	23/12/2010		
6	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	23/12/2010		
7	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	27/12/2010		
8	18	27/12/2010	27/12/2010 12:02:00	2	56	1	5	27/12/2010		
9	22	29/12/2010	29/12/2010 17:42:00	1	48	1	7,99	29/12/2010		
10	35	04/01/2011	04/01/2011 18:29:00	14	52	2	4,75	04/01/2011		
11	48	05/01/2011	05/01/2011 09:52:00	14	21	2	4,75	05/01/2011		
12	54	05/01/2011	05/01/2011 10:13:00	14	68	2	4,75	05/01/2011		

ComercialCenter Brand Product Category Sales Region City

- Switching between the sheets is done in the tabs at the bottom of the book.
- The worksheets can be renamed by right clicking on the tab.
- To change the order of a worksheet, simply drag it with the mouse to the new position.

Absolute and relative cell references

Excel cells can contain formulas. The formulas use data from other cells, so they refer to address (row / column) of data :

SUM												
	A	B	C	D	E	F	G	H	I	J	K	
1	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate	IVA	TotalSale		
2	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	17/12/2010	21%	=F2*G2*(1+I2)	F2*G2*(1+I2)	
3	10	21/12/2010	21/12/2010 18:05:00	15	59	1	6	21/12/2010	21%	€ 7,26	F3*G3*(1+I3)	
4	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	22/12/2010	21%	€ 5,45	F4*G4*(1+I4)	
5	15	23/12/2010	23/12/2010 16:05:00	5	22	1	20	23/12/2010	21%	€ 24,20	F5*G5*(1+I5)	
6	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	23/12/2010	21%	€ 6,05	F6*G6*(1+I6)	
7	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	27/12/2010	21%	€ 5,45	F2*G2*(1+I2)	
8	18	27/12/2010	27/12/2010 12:02:00	2	56	1	5	27/12/2010	21%	€ 6,05		

These
formulas
use
relative
references

Absolute and relative cell references

If we want to isolate the rate of VAT (IVA) to be the same for all products, we would have:

	A	B	C	D	E	F	G	H	I	J	K
1		IVA	21%								
2	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate	TotalSale		
3	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	17/12/2010	€ 5,45	F2*G2*(1+\$C\$1)	
4	10	21/12/2010	21/12/2010 18:05:00	15	59	1	6	21/12/2010	€ 7,26	F3*G3*(1+\$C\$1)	
5	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	22/12/2010	€ 5,45	F4*G4*(1+\$C\$1)	
6	15	23/12/2010	23/12/2010 16:05:00	5	22	1	20	23/12/2010	€ 24,20	F5*G5*(1+\$C\$1)	
7	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	23/12/2010	€ 6,05	F6*G6*(1+\$C\$1)	
8	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	27/12/2010	€ 5,45	F2*G2*(1+\$C\$1)	

◀ ▶	ComercialCenter	Brand	Product	Category	Sales	Region	City	+
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By preceding the cell address with the dollar sign ("\$"), the reference becomes absolute

- In absolute references, Excel keeps the address unchanged when copying a formula from one cell to another, i.e. fixes the address of the cell.
- You can fix
 - Only the row: C\$1
 - Only the column: \$C1
 - The row and the column: \$C\$1

Formatting cells

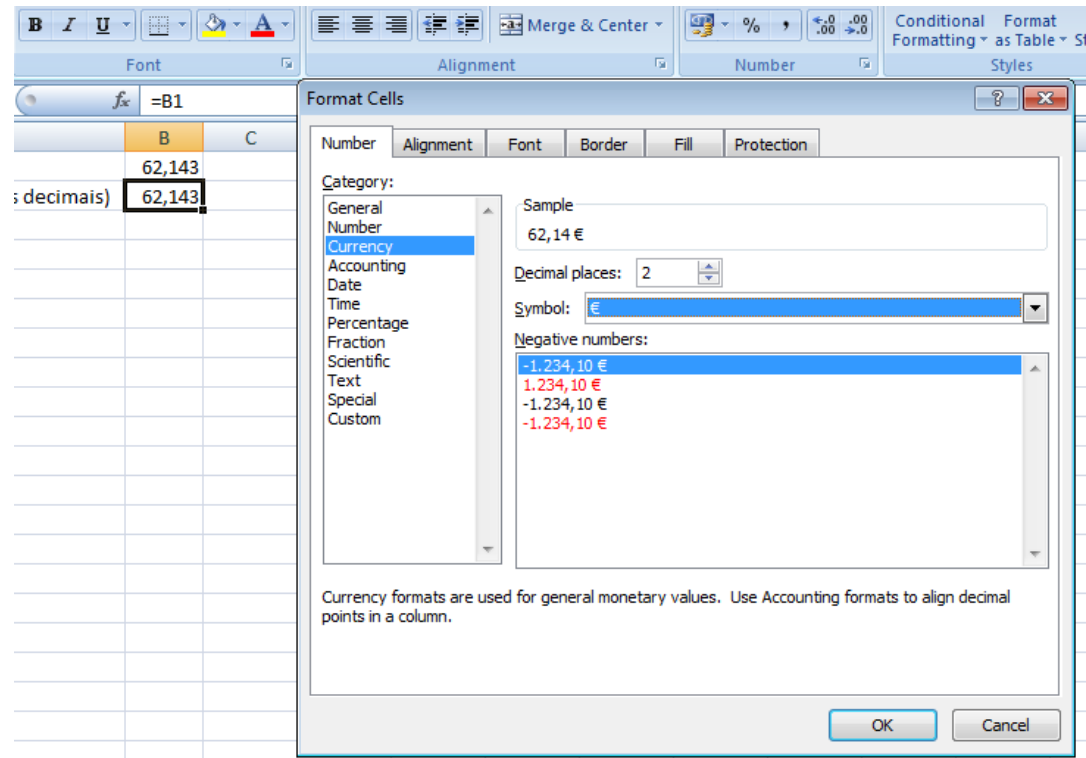
Suppose we want to view data in Excel for better presentation and understanding. For example, to format values like "EURO":

Formatting zone

	A	B	C	D	E	F	G	H	I	J	K	L
1		IVA	21%									
2	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate	TotalSale			
3	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	17/12/2010	€ 5,45			
4	10	21/12/2010	21/12/2010 18:05:00	15	59	1	6	21/12/2010	€ 7,26			
5	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	22/12/2010	€ 5,45			
6	15	23/12/2010	23/12/2010 16:05:00	5	22	1	20	23/12/2010	€ 24,20			
7	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	23/12/2010	€ 6,05			
8	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	27/12/2010	€ 5,45			
9	18	27/12/2010	27/12/2010 12:02:00	2	56	1	5	27/12/2010	€ 6,05			
10	22	29/12/2010	29/12/2010 17:42:00	1	48	1	7,99	29/12/2010	€ 9,67			
11	35	04/01/2011	04/01/2011 18:29:00	14	52	2	4,75	04/01/2011	€ 11,50			

ComercialCenter Brand Product Category Sales Region City +

Formatting options



Attention!

formatting **≠** rounding !!!



	A	B
1	Number not formatted	62,14286
2	Same number with Euro format	62,14 €

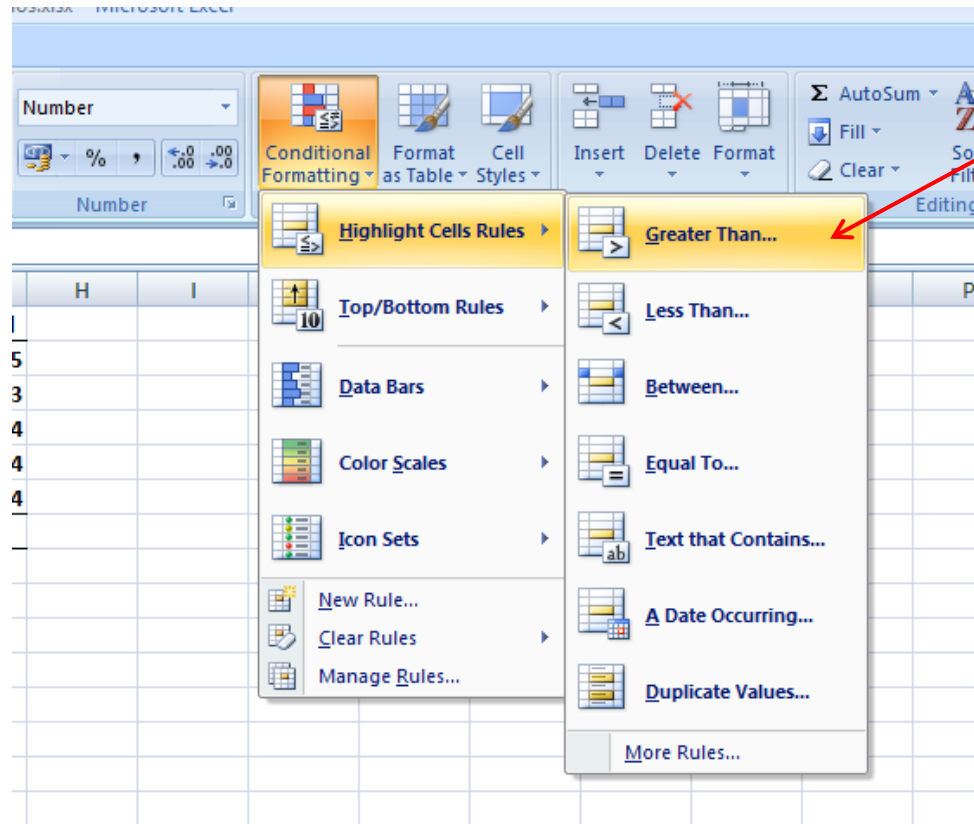
Conditional Formatting

We want to highlight cells that have a cost over € 20.00

	A	B	C	D	E	F	G	H	I	J
1	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate	IVA	TotalSale
2	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	17/12/2010	21%	€ 5,45
3	10	21/12/2010	21/12/2010 18:05:00	15	59	1	6	21/12/2010	21%	€ 7,26
4	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	22/12/2010	21%	€ 5,45
5	15	23/12/2010	23/12/2010 16:05:00	5	22	1	20	23/12/2010	21%	€ 24,20
6	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	23/12/2010	21%	€ 6,05
7	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	27/12/2010	21%	€ 5,45
8	18	27/12/2010	27/12/2010 12:02:00	2	56	1	5	27/12/2010	21%	€ 6,05
9	22	29/12/2010	29/12/2010 17:42:00	1	48	1	7,99	29/12/2010	21%	€ 9,67
10	35	04/01/2011	04/01/2011 18:29:00	14	52	2	4,75	04/01/2011	21%	€ 11,50
11	48	05/01/2011	05/01/2011 09:52:00	14	21	2	4,75	05/01/2011	21%	€ 11,50

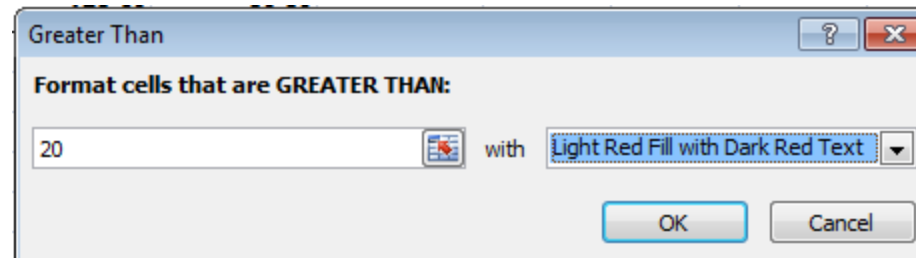
Select the cells to
format

Conditional Formatting - Result



Choose
option

In the next window,
enter the reference
value and the format
to stress



Conditional Formatting - Result

1	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate	IVA	TotalSale
2	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	17/12/2010	21%	€ 5,45
3	10	21/12/2010	21/12/2010 18:05:00	15	59	1	6	21/12/2010	21%	€ 7,26
4	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	22/12/2010	21%	€ 5,45
5	15	23/12/2010	23/12/2010 16:05:00	5	22	1	20	23/12/2010	21%	€ 24,20
6	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	23/12/2010	21%	€ 6,05
7	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	27/12/2010	21%	€ 5,45
8	18	27/12/2010	27/12/2010 12:02:00	2	56	1	5	27/12/2010	21%	€ 6,05
9	22	29/12/2010	29/12/2010 17:42:00	1	48	1	7,99	29/12/2010	21%	€ 9,67
10	35	04/01/2011	04/01/2011 18:29:00	14	52	2	4,75	04/01/2011	21%	€ 11,50
11	48	05/01/2011	05/01/2011 09:52:00	14	21	2	4,75	05/01/2011	21%	€ 11,50

Conditional Formatting Example

	A	B	C	D	E
1	studName	1st Lab	2nd Lab	3rd Lab	4th Lab
2	Dan Prince	5,6	16,6	16,1	19
3	Helen Campbell	11,5	9,8	14,5	3,3
4	Robert Manning	4,4	12,2	13,6	19,7
5	Robert L. Leisure	16	19,8	18	19,7
6	Carla C. Booth	19	9,5	14,8	16,2
7	Edward Brewer	3,6	12,5	3,2	19,7
8	Francisco Lynch	14,3	9,7	6,6	15,9
9	Richard Brown	13,7	9	11,3	19,8
10	Richard L. Guy	7,5	7,7	17,6	12,5
11	John Dickey	15,6	19,1	19	18,8
12	Regina K. Moreno	6,8	14,9	19,6	17,5
13	Eileen Bess	17,3	11,7	10,5	3,2
14	Bradford Branch	3,4	13,3	6,7	18,5
15	Ernest Trowbridge	5	18,1	17,5	9
16	Michael Vanness	8,2	16,8	15,5	19,1
17	Susan F. Ledesma	6,7	9,1	9,3	3,3
18	Sofia Wark	5,9	3,8	12,4	8,2
19	Carmen Ewing	3,7	9,6	11,6	4,5
20	Vincent Littleton	5,5	11,6	11,4	5,9
21	Katherine Davidson	19,8	8,7	10,7	16,8
22	Nancy M. Ward	13,9	3,6	16,9	10,4
23	Fidel G. Boney	8,1	14,5	11	10,9
24	John Johnson	13,3	3,2	7,2	12,4
25	Monnie W. Emmons	14,4	7,3	6,3	17
26	Brian Brown	8,7	4	5,9	12,8
27	Annie Bently	19,1	7,9	9,3	19,1
28	Jeremy Choe	13	7,7	19,8	9
29	Nicholas Ray	4,7	12,4	7,9	18

Highlight all grades bellow 6,5

Concepts

Formulas in Excel

- Formulas in Excel always begin with the "=" sign
- The most common elements in the formulas are the **operators**, **addresses** and **constants**
- If one cell is part of a formula, when its value is changed, the result of the formula will reflect this change

Samples of Formulas

formula	description
=20+A5	Adds 20 (constant) to the content of A5 cell
=(B1+B2)*5/4	Adds the content of B1 and B2 cells, and multiplies the result by 5 and afterwards divide the result by 4
=20*3/2	Multiplies 20 by 3 and divide result by 2
=A1/B4	Divide the content of A1 cell by the content of B4 cell

Calculation operators used in Excel

Type	Operator	Examples
Arithmetic	+ Addition - Subtraction * Multiplication / Division () Brackets % Percentage ^ Exponentiation	=A4*D5-10+D6/5 =300*(0,8-A5) =D4*21% =D5^2
Comparison or logical	= Equal to > Greater than < Less than >= Greater or equal than <= Less or equal than <> Different of	
Reference	: Range of cells between two coordinates ; Union (and) between a set of cells	A1:C10 B1;B5;B11
Text	& Concatenate	=A5*B8 & " kilos of carrots"

Rules of operator precedence

The term precedence - priority - of operators or factors refers to the order in which Excel performs calculations in a formula. Excel follows the following rules of precedence common to mathematics:

1. Expressions in brackets are calculated first
2. Then follows the Exponentiation
3. Multiplication and division are calculated before addition and subtraction
4. Operators with the same precedence level are calculated from left to right

Functions and Formulas (definition)

A **function** is a predefined formula that operates on a value or set of values and returns a result.

With functions, we can greatly reduce the work of creating formulas.
For example:

- formula without a function: = B1+B2+B3+B4+B5+B6+B7+B8
- function formula: = SUM (B1: B8)

All functions are defined by a name and set of parameters, enclosed in brackets. In the previous example, SUM is the function name, and B1:B8 is the parameter.

Attention: "B1:B8" ≠ "B1;B8"

B1:B8 refers to the **range** of cells from B1 to B8 (8 values)

B1;B8 refers to cell B1 and cell B8 (2 values)

Conditional SUM: SUMIF(range; criteria; [sum_range])

	A	B	C
1	Product	Category	Total Spent
2	Apples	FRESH PRODUCE	7,40
3	Avocados	FRESH PRODUCE	2,50
4	Bacon	FREEZER	4,30
5	Baking powder	BAKING GOODS	7,50
6	Baking Soda	BAKING GOODS	2,10
7	Bananas	FRESH PRODUCE	7,60
8	Beef/Chicken	FREEZER	2,90
9	Berries	FREEZER	8,40
10	Breadcrumbs	GRAINS	4,80
11	Broccoli	FREEZER	3,80
12	Brown Sugar	BAKING GOODS	6,60
13	Carrots	FRESH PRODUCE	9,70
14	Chocolate Chips	BAKING GOODS	9,20
15	Cocoa Powder	BAKING GOODS	8,40
16	Cookie Dough	FREEZER	10,00
17	Corn	FREEZER	5,90
18	Flour	BAKING GOODS	4,10
19	Garlic	FRESH PRODUCE	3,40
20	Juice Concentrate	FREEZER	7,00
21	Lemons/Limes	FRESH PRODUCE	6,50
22	Onion	FRESH PRODUCE	2,30
23	Pasta	GRAINS	6,30
24	Pizza :)	FREEZER	4,50
25	Potatoes	FRESH PRODUCE	8,90
26	Powdered Sugar	BAKING GOODS	8,20
27	Puff Pastry	FREEZER	8,90
28	Quinoa	GRAINS	10,00
29	Rice	GRAINS	9,90
30	Shrimp	FREEZER	8,50
31	Spinach	FRESH PRODUCE	4,20
32	Strawberries	FRESH PRODUCE	3,10
33	Sugar	BAKING GOODS	2,00
34	Tomatoes	FRESH PRODUCE	5,50
35	Vanilla	BAKING GOODS	5,70

What to evaluate

G	H
Totals by Category	
Category	Total Spent
FRESH PRODUCE	61,1
FREEZER	66,9
BAKING GOODS	58,3
GRAINS	25,2

Conditional SUM: SUMIF(range; criteria; [sum_range])

	A	B	C
1	Product	Category	Total Spent
2	Apples	FRESH PRODUCE	7,40
3	Avocados	FRESH PRODUCE	2,50
4	Bacon	FREEZER	4,30
5	Baking powder	BAKING GOODS	7,50
6	Baking Soda	BAKING GOODS	2,10
7	Bananas	FRESH PRODUCE	7,60
8	Beef/Chicken	FREEZER	2,90
9	Berries	FREEZER	8,40
10	Breadcrumbs	GRAINS	4,80
11	Broccoli	FREEZER	3,80
12	Brown Sugar	BAKING GOODS	6,60
13	Carrots	FRESH PRODUCE	9,70
14	Chocolate Chips	BAKING GOODS	9,20
15	Cocoa Powder	BAKING GOODS	8,40
16	Cookie Dough	FREEZER	10,00
17	Corn	FREEZER	5,90
18	Flour	BAKING GOODS	4,10
19	Garlic	FRESH PRODUCE	3,40
20	Juice Concentrate	FREEZER	7,00
21	Lemons/Limes	FRESH PRODUCE	6,50
22	Onion	FRESH PRODUCE	2,30
23	Pasta	GRAINS	6,30
24	Pizza :)	FREEZER	4,50
25	Potatoes	FRESH PRODUCE	8,90
26	Powdered Sugar	BAKING GOODS	8,20
27	Puff Pastry	FREEZER	8,90
28	Quinoa	GRAINS	10,00
29	Rice	GRAINS	9,90
30	Shrimp	FREEZER	8,50
31	Spinach	FRESH PRODUCE	4,20
32	Strawberries	FRESH PRODUCE	3,10
33	Sugar	BAKING GOODS	2,00
34	Tomatoes	FRESH PRODUCE	5,50
35	Vanilla	BAKING GOODS	5,70

What to compare to

G	H
Totals by Category	
Category	Total Spent
FRESH PRODUCE	61,1
FREEZER	66,9
BAKING GOODS	58,3
GRAINS	25,2

Conditional SUM: SUMIF(range;criteria;[sum_range])

	A	B	C
1	Product	Category	Total Spent
2	Apples	FRESH PRODUCE	7,40
3	Avocados	FRESH PRODUCE	2,50
4	Bacon	FREEZER	4,30
5	Baking powder	BAKING GOODS	7,50
6	Baking Soda	BAKING GOODS	2,10
7	Bananas	FRESH PRODUCE	7,60
8	Beef/Chicken	FREEZER	2,90
9	Berries	FREEZER	8,40
10	Breadcrumbs	GRAINS	4,80
11	Broccoli	FREEZER	3,80
12	Brown Sugar	BAKING GOODS	6,60
13	Carrots	FRESH PRODUCE	9,70
14	Chocolate Chips	BAKING GOODS	9,20
15	Cocoa Powder	BAKING GOODS	8,40
16	Cookie Dough	FREEZER	10,00
17	Corn	FREEZER	5,90
18	Flour	BAKING GOODS	4,10
19	Garlic	FRESH PRODUCE	3,40
20	Juice Concentrate	FREEZER	7,00
21	Lemons/Limes	FRESH PRODUCE	6,50
22	Onion	FRESH PRODUCE	2,30
23	Pasta	GRAINS	6,30
24	Pizza :)	FREEZER	4,50
25	Potatoes	FRESH PRODUCE	8,90
26	Powdered Sugar	BAKING GOODS	8,20
27	Puff Pastry	FREEZER	8,90
28	Quinoa	GRAINS	10,00
29	Rice	GRAINS	9,90
30	Shrimp	FREEZER	8,50
31	Spinach	FRESH PRODUCE	4,20
32	Strawberries	FRESH PRODUCE	3,10
33	Sugar	BAKING GOODS	2,00
34	Tomatoes	FRESH PRODUCE	5,50
35	Vanilla	BAKING GOODS	5,70

Where do sum

G	H
Totals by Category	
Category	Total Spent
FRESH PRODUCE	61,1
FREEZER	66,9
BAKING GOODS	58,3
GRAINS	25,2

=SUMIF(\$B\$2:\$B\$35;G3;C2:C35)

Statistical Functions - Measures of Central Tendency

Average (addresses) - Arithmetic mean of the values on of a set of cells.

Mode (addresses) - Most frequent value (if there is not a more common, excel will show “#N/A”).

Median (addresses) - Central value of a set of values. Ex: (2, 3, 5, 10, 11).

Note:

These functions ignore empty cells, logical values and text.

Statistical Functions - Measures of Central Tendency

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=AVERAGE(C2:C7)	Average of values C2 to C7	2183,33
11	=MODE(C2:C7)	Mode of values C2 to C7	4200
12	=MEDIAN(C2:C7)	Median of values C2 to C7. If the number of values is even, Excel calculates the medium from the 2 central values	1750

Statistical Functions - Measures of Central Tendency

Average subject to a condition: **AVERAGEIF(range;criteria;[average_range])**

	A	B	C
1	Cathegory	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=AVERAGEIF(A2:A7;"vegetables";C2:C7)	Average of sales values that belong to the "Vegetables" cathegory	3566,67
11	=AVERAGEIF(C2:C7;"<=1200")	Average of sales values that were not higher than 1200	800

Statistical Functions - Measures of Dispersion

STDEV.P (addresses) - Standard deviation of a set of values that correspond to the entire population

STDEV.S (addresses) - Standard deviation of a set of values that correspond to a sample

VAR.P (addresses) - Variance of a set of values that correspond to a population

VAR.S (addresses) - Variance of a set of values that correspond to a sample

Statistical Functions - Measures of Dispersion

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=STDEV.P(C2:C7)	Standard Deviation os Sales	1538,85
11	=VAR.S(C2:C7)	Variance of the sample of sales	2841666,67

Maximum and Minimum Functions

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=MAX(C2:C7)	Maximum value	4200,00
11	=MIN(C2:C7)	Minimum value	400

Counting of Cells

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	No values
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=COUNT(C2:C7)	Number of values. Ignores cells that do not contain numbers	5
11	=COUNTA(C2:C7)	Number of values, including cells that contain values other than numbers	6
12	=COUNTIF(C2:C7;">1000")	Number of values over 1000	4

Excel

Logical Functions

Logical Functions - Introduction

The logical conditions are composed of three words "**IF**", "**Then**", "**Else**" (If not). In our day-to-day we are using logical conditions

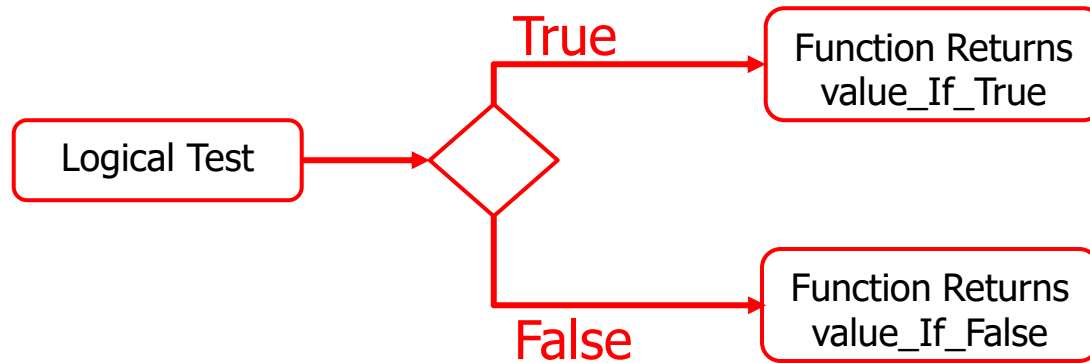
If driving at a speed higher than 120 km per hour on the motorway
then I risk to get a mighty fine, **Else** I'll not get a speed limit fine.

If you eat this cake **then** you will ruin your diet, **Else** you will keep your elegance.

In Excel it is also possible to test logical conditions in a cell: **IF**(logical_test; value_if_true; value_if_false)

Logical Functions - IF

- =IF (logical_test ; value_If_True ; value_If_False)



- The return values (value_if_True / value_If_False) can be anything (values, formulas, references to cells, etc.)

Logical Functions – AND / OR

- =AND (condition_1; [condition_2]; [condition_3]; ...; [condition_k])
 - Results "TRUE" if **all the conditions** evaluate to TRUE, otherwise results FALSE
- =OR (condition_1; [condition_2]; [condition_3]; ...; [condition_k])
 - Results "FALSE" if **all the conditions** evaluate to FALSE, otherwise results TRUE

Example:

	A	B	C	D	E	F	G	H	I	J	K
1	studName	1st Lab	2nd Lab	3rd Lab	4th Lab	Final					
2	Dan Prince	5,6	16,6	16,1	19	=IF(OR(B2<6,5;C2<6,5;D2<6,5;E2<6,5);"FAIL";AVERAGE(B2:E2))					
3	Helen Campbell	11,5	9,8	14,5	3,3	FAIL					
4	Robert Manning	4,4	12,2	13,6	19,7	FAIL					
5	Robert L. Leisure	16	19,8	18	19,7	18,4					
6	Carla C. Booth	19	9,5	14,8	16,2	14,9					
7	Edward Brewer	3,6	12,5	3,2	19,7	FAIL					
8	Francisco Lynch	14,3	9,7	6,6	15,9	11,6					

Logical Functions – IFERROR

- =IFERROR (**value** ; **value_if_error**)
 - Returns **value** unchanged, except if value is an error;
 - In that case, returns **value_if_error**

- Ex:

=IFERROR (X / Y; "divide by zero")

Will normally return the value of X divided by Y;

Exeption:

If Y is equal to zero, then the string "divide by zero" will be returned

	A	B	C	D
1	X	23		
2	Y	34		
3	X/Y	=IFERROR(B1/B2;"Divide by Zero")		

Exercise 1

Use the Excel file 1_GDP.xlsx, containing the ratio of real GDP to the average population per year, from 2000 until 2019, for each European Country. Data was collected from the Eurostat website.

Based on that data:

1. Find the average of the “per Capita GDP” for each country from 2000 to 2021.
2. Calculate, by year, the average, mode, median, standard deviation, maximum value and the minimum value of the GDP per capita.
3. For EACH YEAR, format the values of GDP per capita so that countries below the average (of that year), appear in a different colour.
4. For each country, count the number of years where the GDP per capita was above the average of that country.

Exercise 2

Use the file 2_Sales and Calls.xls.

Based on that data:

1. In the first sheet, calculate the discount value of 10% for items with cost above 200,00€. Use references to the cells containing the discount percentage and the limit value.
2. In the second sheet, calculate the discount value of 10% for items with cost above 200,00€ or which are tagged in promotion
3. In the third sheet, calculate the discount value of 10% for items with cost above 200,00€ and which are tagged in promotion.
4. On the sheet "Calls", calculate the annual bonus value for each employee, considering that if the number of customer calls is equal or greater than 500, the employee gets 5 euros bonus per call; if the number of customers customer calls is equal or greater than 350, the employee gets 2 euros bonus per call; if the number of customer calls is lower than 350, the employee gets "no bonus".



Table Search Functions

1. VLOOKUP

Vertical search of a value in a table

VLOOKUP (lookup value; table array; col index num; [approximate])

Looks for a value in the first column of a range and returns the corresponding value of another column specified.

Approximate can have the values **TRUE** or **FALSE**.

For example:

= **VLOOKUP** (3375; A2: C21; 3) returns "**Manager**", ie, the function searched in the first column of the range A2: C21 by the value 3375 and returned the contents of the cell that was in column 3 of that line.

	A	B	C
1	empNo	monthSalary	Cathegory
2	3063	2 565,00 €	Werhouse Worker
3	3174	1 768,00 €	Factory Worker
4	3200	2 857,00 €	Werhouse Worker
5	3232	6 326,00 €	Manager
6	3361	1 521,00 €	Factory Worker
7	3375	5 978,00 €	Manager
8	3415	3 555,00 €	FieldEngineer
9	3560	2 930,00 €	Werhouse Worker
10	3630	1 724,00 €	Factory Worker
11	3861	7 821,00 €	Manager
12	3954	4 340,00 €	FieldEngineer
13	3976	4 226,00 €	FieldEngineer
14	3982	2 670,00 €	Werhouse Worker
15	4395	2 925,00 €	Werhouse Worker
16	4824	2 015,00 €	Factory Worker
17	4859	2 831,00 €	Werhouse Worker
18	4895	5 707,00 €	Manager
19	4923	1 629,00 €	Factory Worker
20	4931	1 815,00 €	Factory Worker
21	4973	5 987,00 €	Manager

VLOOKUP

= VLOOKUP (3375; A2: C21; 2)
returns "**5978**", i.e., the function
searched the first column in the range
A2: C21 with the value 3375 and
returned the contents of the cell that
was in column 2 of this line.

= VLOOKUP (3380; A2: C21; 2) returns
"**5978**", but the 3380 employee is not
there, so the function will return the
largest value that is less than 3380. In
this case the employee is 3375, so it
returns what is in column 2 of that line,
i.e. 5978.

	A	B	C
1	empNo	monthSalary	Cathegory
2	3063	2 565,00 €	Werhouse Worker
3	3174	1 768,00 €	Factory Worker
4	3200	2 857,00 €	Werhouse Worker
5	3232	6 326,00 €	Manager
6	3361	1 521,00 €	Factory Worker
7	3375	5 978,00 €	Manager
8	3415	3 555,00 €	FieldEngineer
9	3560	2 930,00 €	Werhouse Worker
10	3630	1 724,00 €	Factory Worker
11	3861	7 821,00 €	Manager
12	3954	4 340,00 €	FieldEngineer
13	3976	4 226,00 €	FieldEngineer
14	3982	2 670,00 €	Werhouse Worker
15	4395	2 925,00 €	Werhouse Worker
16	4824	2 015,00 €	Factory Worker
17	4859	2 831,00 €	Werhouse Worker
18	4895	5 707,00 €	Manager
19	4923	1 629,00 €	Factory Worker
20	4931	1 815,00 €	Factory Worker
21	4973	5 987,00 €	Manager

VLOOKUP

In most cases however, we do not want that to happen. Although useful in certain situations this approximate search can produce unwanted results and important information failures. The same formula with the parameter “**approximate**” changed to **FALSE** would be:

= VLOOKUP (3380; A2: C21; 2; FALSE)
returns **#N/A**, meaning that the function did not find the desired value.

	A	B	C
1	empNo	monthSalary	Cathegory
2	3063	2 565,00 €	Werhouse Worker
3	3174	1 768,00 €	Factory Worker
4	3200	2 857,00 €	Werhouse Worker
5	3232	6 326,00 €	Manager
6	3361	1 521,00 €	Factory Worker
7	3375	5 978,00 €	Manager
8	3415	3 555,00 €	FieldEngineer
9	3560	2 930,00 €	Werhouse Worker
10	3630	1 724,00 €	Factory Worker
11	3861	7 821,00 €	Manager
12	3954	4 340,00 €	FieldEngineer
13	3976	4 226,00 €	FieldEngineer
14	3982	2 670,00 €	Werhouse Worker
15	4395	2 925,00 €	Werhouse Worker
16	4824	2 015,00 €	Factory Worker
17	4859	2 831,00 €	Werhouse Worker
18	4895	5 707,00 €	Manager
19	4923	1 629,00 €	Factory Worker
20	4931	1 815,00 €	Factory Worker
21	4973	5 987,00 €	Manager

VLOOKUP

- 1. If "approximate" is TRUE then 1st column (the search array) must be sorted in ascending order. Otherwise VLOOKUP will give wrong results
If "approximate" is FALSE then the 1st column (search array) does not have to be sorted**
- 2. VLOOKUP is not case sensitive**

VLOOKUP

	A	B	C	D	E	F	G	H	I
1	studNo	studName	1st Lab	2nd Lab	3rd Lab	4th Lab			
2	95239	Dan Prince	5,6	16,6	16,1	19		92367	Michael Vanness
3	90450	Helen Campbell	11,5	9,8	14,5	3,3			
4	90892	Robert Manning	4,4	12,2	13,6	19,7			
5	91882	Robert L. Leisure	16	19,8	18	19,7			
6	98406	Carla C. Booth	19	9,5	14,8	16,2			
7	99959	Edward Brewer	3,6	12,5	3,2	19,7			
8	92369	Francisco Lynch	14,3	9,7	6,6	15,9			
9	93311	Richard Brown	13,7	9	11,3	19,8			
10	99154	Richard L. Guy	7,5	7,7	17,6	12,5			
11	94603	John Dickey	15,6	19,1	19	18,8			
12	95077	Regina K. Moreno	6,8	14,9	19,6	17,5			
13	94678	Eileen Bess	17,3	11,7	10,5	3,2			
14	96264	Bradford Branch	3,4	13,3	6,7	18,5			
15	95728	Ernest Trowbridge	5	18,1	17,5	9			
16	92367	Michael Vanness	8,2	16,8	15,5	19,1			
17	95867	Susan F. Ledesma	6,7	9,1	9,3	3,3			
18	97287	Sofia Wark	5,9	3,8	12,4	8,2			
19	93524	Carmen Ewing	3,7	9,6	11,6	4,5			
20	92634	Vincent Littleton	5,5	11,6	11,4	5,9			
21	96810	Katherine Davidson	19,8	8,7	10,7	16,8			
22	95137	Nancy M. Ward	13,9	3,6	16,9	10,4			
23	97154	Fidel G. Boney	8,1	14,5	11	10,9			
24	93380	John Johnson	13,3	3,2	7,2	12,4			
25	93005	Monnie W. Emmons	14,4	7,3	6,3	17			
26	91263	Brian Brown	8,7	4	5,9	12,8			
27	92418	Annie Bently	19,1	7,9	9,3	19,1			
28	93578	Jeremy Choe	13	7,7	19,8	9			
29	96150	Nicholas Ray	4,7	12,4	7,9	18			

=VLOOKUP(H2; A2:F29 ; 2 ;FALSE)

Lookup Value: What are we looking for?

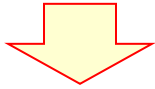
VLOOKUP

	A	B	C	D	E	F	G	H	I
1	studNo	studName	1st Lab	2nd Lab	3rd Lab	4th Lab			
2	95239	Dan Prince	5,6	16,6	16,1	19		92367	Michael Vanness
3	90450	Helen Campbell	11,5	9,8	14,5	3,3			
4	90892	Robert Manning	4,4	12,2	13,6	19,7			
5	91882	Robert L. Leisure	16	19,8	18	19,7			
6	98406	Carla C. Booth	19	9,5	14,8	16,2			
7	99959	Edward Brewer	3,6	12,5	3,2	19,7			
8	92369	Francisco Lynch	14,3	9,7	6,6	15,9			
9	93311	Richard Brown	13,7	9	11,3	19,8			
10	99154	Richard L. Guy	7,5	7,7	17,6	12,5			
11	94603	John Dickey	15,6	19,1	19	18,8			
12	95077	Regina K. Moreno	6,8	14,9	19,6	17,5			
13	94678	Eileen Bess	17,3	11,7	10,5	3,2			
14	96264	Bradford Branch	3,4	13,3	6,7	18,5			
15	95728	Ernest Trowbridge	5	18,1	17,5	9			
16	92367	Michael Vanness	8,2	16,8	15,5	19,1			
17	95867	Susan F. Ledesma	6,7	9,1	9,3	3,3			
18	97287	Sofia Wark	5,9	3,8	12,4	8,2			
19	93524	Carmen Ewing	3,7	9,6	11,6	4,5			
20	92634	Vincent Littleton	5,5	11,6	11,4	5,9			
21	96810	Katherine Davidson	19,8	8,7	10,7	16,8			
22	95137	Nancy M. Ward	13,9	3,6	16,9	10,4			
23	97154	Fidel G. Boney	8,1	14,5	11	10,9			
24	93380	John Johnson	13,3	3,2	7,2	12,4			
25	93005	Monnie W. Emmons	14,4	7,3	6,3	17			
26	91263	Brian Brown	8,7	4	5,9	12,8			
27	92418	Annie Bently	19,1	7,9	9,3	19,1			
28	93578	Jeremy Choe	13	7,7	19,8	9			
29	96150	Nicholas Ray	4,7	12,4	7,9	18			

=VLOOKUP(H2 ; A2:F29 ; 2 ;FALSE)

Table Arrey: Where are we looking?

VLOOKUP



	A	B	C	D	E	F	G	H	I
1	studNo	studName	1st Lab	2nd Lab	3rd Lab	4th Lab			
2	95239	Dan Prince	5,6	16,6	16,1	19		92367	Michael Vanness
3	90450	Helen Campbell	11,5	9,8	14,5	3,3			
4	90892	Robert Manning	4,4	12,2	13,6	19,7			
5	91882	Robert L. Leisure	16	19,8	18	19,7			
6	98406	Carla C. Booth	19	9,5	14,8	16,2			
7	99959	Edward Brewer	3,6	12,5	3,2	19,7			
8	92369	Francisco Lynch	14,3	9,7	6,6	15,9			
9	93311	Richard Brown	13,7	9	11,3	19,8			
10	99154	Richard L. Guy	7,5	7,7	17,6	12,5			
11	94603	John Dickey	15,6	19,1	19	18,8			
12	95077	Regina K. Moreno	6,8	14,9	19,6	17,5			
13	94678	Eileen Bess	17,3	11,7	10,5	3,2			
14	96264	Bradford Branch	3,4	13,3	6,7	18,5			
15	95728	Ernest Trowbridge	5	18,1	17,5	9			
16	92367	Michael Vanness	8,2	16,8	15,5	19,1			
17	95867	Susan F. Ledesma	6,7	9,1	9,3	3,3			
18	97287	Sofia Wark	5,9	3,8	12,4	8,2			
19	93524	Carmen Ewing	3,7	9,6	11,6	4,5			
20	92634	Vincent Littleton	5,5	11,6	11,4	5,9			
21	96810	Katherine Davidson	19,8	8,7	10,7	16,8			
22	95137	Nancy M. Ward	13,9	3,6	16,9	10,4			
23	97154	Fidel G. Boney	8,1	14,5	11	10,9			
24	93380	John Johnson	13,3	3,2	7,2	12,4			
25	93005	Monnie W. Emmons	14,4	7,3	6,3	17			
26	91263	Brian Brown	8,7	4	5,9	12,8			
27	92418	Annie Bently	19,1	7,9	9,3	19,1			
28	93578	Jeremy Choe	13	7,7	19,8	9			
29	96150	Nicholas Ray	4,7	12,4	7,9	18			

=VLOOKUP(H2 ; A2:F29 ; 2 ;FALSE)

Column Number:
Which column has
the result?

VLOOKUP

	A	B	C	D	E	F	G	H	I
1	studNo	studName	1st Lab	2nd Lab	3rd Lab	4th Lab			
2	95239	Dan Prince	5,6	16,6	16,1	19		92367	Michael Vanness
3	90450	Helen Campbell	11,5	9,8	14,5	3,3			
4	90892	Robert Manning	4,4	12,2	13,6	19,7			
5	91882	Robert L. Leisure	16	19,8	18	19,7			
6	98406	Carla C. Booth	19	9,5	14,8	16,2			
7	99959	Edward Brewer	3,6	12,5	3,2	19,7			
8	92369	Francisco Lynch	14,3	9,7	6,6	15,9			
9	93311	Richard Brown	13,7	9	11,3	19,8			
10	99154	Richard L. Guy	7,5	7,7	17,6	12,5			
11	94603	John Dickey	15,6	19,1	19	18,8			
12	95077	Regina K. Moreno	6,8	14,9	19,6	17,5			
13	94678	Eileen Bess	17,3	11,7	10,5	3,2			
14	96264	Bradford Branch	3,4	13,3	6,7	18,5			
15	95728	Ernest Trowbridge	5	18,1	17,5	9			
16	92367	Michael Vanness	8,2	16,8	15,5	19,1			
17	95867	Susan F. Ledesma	6,7	9,1	9,3	3,3			
18	97287	Sofia Wark	5,9	3,8	12,4	8,2			
19	93524	Carmen Ewing	3,7	9,6	11,6	4,5			
20	92634	Vincent Littleton	5,5	11,6	11,4	5,9			
21	96810	Katherine Davidson	19,8	8,7	10,7	16,8			
22	95137	Nancy M. Ward	13,9	3,6	16,9	10,4			
23	97154	Fidel G. Boney	8,1	14,5	11	10,9			
24	93380	John Johnson	13,3	3,2	7,2	12,4			
25	93005	Monnie W. Emmons	14,4	7,3	6,3	17			
26	91263	Brian Brown	8,7	4	5,9	12,8			
27	92418	Annie Bently	19,1	7,9	9,3	19,1			
28	93578	Jeremy Choe	13	7,7	19,8	9			
29	96150	Nicholas Ray	4,7	12,4	7,9	18			

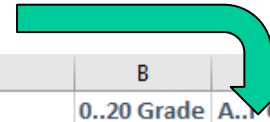
=VLOOKUP(H2 ; A2:F29 ; 2 ; FALSE)

Do we want an approximation?

VLOOKUP (approximate search)

Suppose you want to convert a range of values, for example, grades 0..20 to classifications A..F:

=VLOOKUP(B2;\$E\$2:\$F\$10;2;TRUE)



	A	B	C	D	E	F
1	studentName	0..20 Grade	A..F Class		Conversion Table	
2	Carl Michael	18,8	A-		0	F
3	Bessie Patel	16,4	B-		9,5	C-
4	Robert L. Shilling	12,6	C		11,5	C
5	Karen Campbell	9,3	F		13,5	C+
6	Joseph R. Cruz	19	A-		14,5	B-
7	Felicia P. Dodge	8,4	F		16,5	B
8	Hazel C. Bannister	11,4	C-		17,5	B+
9	James Tune	13,1	C		18,5	A-
10	Fawn Witt	0	F		19,5	A
11	Gary Renfrow	3,7	F			
12	Mason X. Marquis	17,5	B+			
13	Jamie Castaldo	11,5	C			
14	Cynthia Johnson	12,1	C			
15	Minnie Coleman	16,6	B			
16	Charlotte H. Derrick	15,3	B-			
17	Yvonne Rosas	10,2	C-			
18	Ruben Marshall	17,9	B+			
19	Maria Monk	1,3	F			
20	Anthony Libby	12,7	C			
21	Mickey Rusch	1,3	F			
22	Randy Reed	2,9	F			
23	Maurice Steptoe	14,8	B-			
24	Carl H. Hicks	17,9	B+			
25	Howard Elliot	20	A			
26	Camille Chamberlain	17,1	B			

2. HLOOKUP

Horizontal search of a value in a table

HLOOKUP (lookup value; table array; row index num; approximate)

Looks for a particular value in the first line of a range and returns the corresponding value in another specified line. *Approximate* values can be **TRUE** or **FALSE**.

	A	B	C	D	E	F	G	H
1	empNo	3063	3174	3200	3232	3361	3375	3415
2	monthSalary	2 565,00 €	1 768,00 €	2 857,00 €	6 326,00 €	1 521,00 €	5 978,00 €	3 555,00 €
3	Cathegory	Werhouse Worker	Factory Worker	Werhouse Worker	Manager	Factory Worker	Manager	FieldEngineer

For example: **= HLOOKUP (3232; B1: H3; 3; FALSE)** returns "**Manager**", i.e., the function searched in the first row of the range B1: G3 by the value 3232 and when it is found, returns the cell contents that were in line 3 of this column.

=XLOOKUP(lookup_value, lookup_array, return_array, [if_not_found], [match_mode], [search_mode])

Extended Lookup function, available only in the newer versions of Excel.

The XLOOKUP function searches a range or an array, and then returns the item corresponding to the first match it finds. If no match exists, then XLOOKUP can return the closest (approximate) match.

	A	B	C	D
1		Emp ID	Employee Name	Department
2		1234	ID not found	
3				
4		Emp ID	Employee Name	Department
5		4390	Ned Lanning	Marketing
6		8604	Margo Hendrix	Sales
7		8389	Dianne Pugh	Finance
8		4937	Earlene McCarty	Accounting
9		8299	Mia Arnold	Operations
10		2643	Jorge Fellows	Executive
11		5243	Rose Winters	Sales
12		9693	Carmela Hahn	Finance
13		1636	Delia Cochran	Accounting
14		6703	Marguerite Cervantes	Marketing

With XLOOKUP, you can look in one column for a search term and return a result from the same row in another column, regardless of which side the return column is on. Works both Horizontally and Vertically.



SumProduct

Lists of values

- Consider the following shopping list:

Product	Unit Price	Quantity
Pencils	1,32	113
Red Pens	1,85	110
Blue Pens	1,83	146
Rubbers	0,75	125
Duct Tape	1,43	109
Staples	0,48	151

- To calculate the total value, we must multiply unit price by quantity for every line and then sum everything:

$$1,32 * 113 + 1,85 * 110 + ... + 0,48 * 151$$

SUMPRODUCT(array1, [array2], [array3], ...)

- The function sumproduct calculates it:

	A	B	C	D	E
1	Product	Unit Price	Quantity		
2	Pencils	1,32	113		
3	Red Pens	1,85	110		
4	Blue Pens	1,83	146		
5	Rubbers	0,75	125		
6	Duct Tape	1,43	109		
7	Staples	0,48	151		
8					
9		Total	=SUMPRODUCT(B2:B7;C2:C7)		
10					



Date and Time Functions

Date and Time Functions

Before exploring the functions that Excel offers to make calculations with date and time it should be understood the way that Excel works with dates.

For Excel there are two systems of dates, the **system 1900** and **system 1904**. The system 1900 is what is activated by default in Excel for **Windows** and the system 1904 is activated by default in Excel for **Macintosh**.

Either one, start counting the days from **January 1st**. This means that the day number one is **January 1st, 1900** in system 1900, and **January 1st, 1904** in system 1904.

Note: It is not very important to know what is the model in use, what is relevant is to understand that every date is an integer number representing the number of days since day one, which is either 1900-01-01 or 1904-01-01

Functions of Date and Time

Dates are represented by integer values. This means that Excel can calculate, for example, the **difference between two dates**, in an extremely simple way, just by subtracting two integers.

To better understand this mechanism, you may open an Excel spreadsheet and insert a date into any cell. Then format the cell in the **General** format. Notice that the date takes the form of an integer value. This value is the number of days from **January 1st, 1900**.

Functions of Date and Time

The **time of day** is represented by a single value, in this case a real number between **0** and **1**. For example 0.5 represents noon (12:00).

The corresponding time of day is calculated by the following formula:

$$value = \frac{\text{hours}}{24} + \frac{\text{minutes}}{1440} + \frac{\text{seconds}}{86400}$$

For example:

$$8h10m = \frac{8}{24} + \frac{10}{1440} = 0,340277778$$

This means that if we represent the day **22nd November 2010 at 14h 35m 22s**, this moment is represented by **40504.60789**

Note: You do not have to remember these calculations, because Excel has specific functions to perform them, as we will see further on.

Date and Time Functions

TODAY (system date);

NOW (date and time system);

DATE (integer value of a date);

DAY (between 1 and 31: number of the day from a given date);

WEEKDAY (weekday);

MONTH (between 1 and 12: month number from a given date);

YEAR (year number from a given date)

Today: system date
=TODAY()

The function takes no arguments

When the function is inserted into a cell, Excel returns the system date. But it is not updated automatically.

The cell will be updated when the spreadsheet is recalculated in its entirety, which occurs in two situations:

1. When you press **F9** to force recalculation of entire worksheet;
2. Whenever you change the value of any cell.

If on November 22nd, 2019 the user activates function **TODAY()**:

=TODAY() returns **22-11-2019**

Now (date and time system)
=NOW()

The function takes no arguments

When the function is inserted into a cell Excel returns the system date and time. The date and time of the cell will not be automatically updated.

The cell will be updated when the spreadsheet is recalculated in its entirety, which occurs in two situations:

1. When you press **F9** to force recalculation of entire worksheet;
2. Whenever you change the value of any cell.

If on November 22nd, 2019 by 15 hours 55 minutes and 35 seconds the user activate the function **NOW()**:

=NOW() returns **22-11-2019 15:55:35**

Date (integer value of a date)
=DATE(*year;month;day*)

This function returns the integer value corresponding to a certain date. It is useful when you want to handle directly the value of date in the system corresponding date.

Often this function turns out not to be necessary because when you insert a date into a cell that is immediately converted to its integer value, but sometimes it becomes necessary to incorporate the entire value of a date calculation expressions or VBA programs that involves knowing the value of the entire date.

=DATE(1950;5;19) returns 18402
=DATE(2015;12;25) returns 42363

IMPORTANT NOTE

In the following functions:

DAY, WEEKDAY, MONTH and YEAR

the serial number can be represented by integer value date, e.g. 40441, quoted date as "20-09-2015" or by reference to the cell that contains the date

Day (between 1 and 31 days of the entire value of a date)
=DAY(serial number)

This function returns the day (between 1 and 31) corresponding to a certain date.

The date can be specified by its integer value, by the date quoted or the address of the cell that contains the date in the format DD-MM-YYYY

=DAY(18402) returns **19** [remember that =DATE(1950;5;**19**) returns 18402]

	A	B	C
1	21-09-2015	21	=Day(A1)
2			

=DAY("21-09-2015") returns **21**

Weekday (weekday) **=WEEKDAY(serial number; return type)**

This function takes an integer value or date and returns a value between 1 and 7 corresponding to the week in accordance with the following correspondence:

return type = 1 or non specified

1	Sunday
2	Monday
3	Tuesday
4	Wednesday
5	Thursday
6	Friday
7	Saturday

return type = 2

1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday
7	Sunday

=WEEKDAY(42330) returns **1** [means that day 22/11/2015 is Sunday]

	A	B	C
1			Function
2	Date	20-09-2015	
3	Day	20	=Day(B2)
4	Weekday	1	=Weekday(B2)

Month (between 1 and 12 months of an integer value from a date)
=MONTH(*serial number*)

	A	B	C
1			Function
2	Date	20-09-2015	
3	Day	20	=DAY(B2)
4	Weekday	1	=WEEKDAY(B2)
5	Month	9	=MONTH(B2)

Or

-MONTH ("20-09-2015")

Or

-MONTH(42267)

Year (year of an integer value of a date)
=YEAR(*serial number*)

	A	B	C
1			Function
2	Date	20-09-2015	
3	Day	20	=DAY(B2)
4	Weekday	1	=WEEKDAY(B2)
5	Month	9	=MONTH(B2)
6	Year	2015	=YEAR(B2)
-			

Or
-YEAR ("20-09-2015")
Or
-YEAR (42267)

Some time functions

	A	B	C
1			Função
2	Date	20-09-2015 15:30	
3	Hour	15	=HOUR(B2)
4	Minute	30	=MINUTE(B2)
5	Second	0	=SECOND(B2)

= TIME (hour; minute; second) gives as result the number of time series

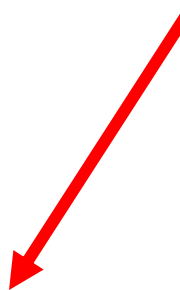
Ex: = TIME (15;30; 0) gives as result 0,645833333

Age

	A	B	C	D	E	F	G	H
1	Student ID	Student First	Student Last	Last, First	DOB	Current	Gender	Address
2	22590	Angeline	Baird	Baird, Angeline	02/16/99	21	Female	123 6th St.
3	72004	John	Fry	Fry, John	03/13/97	23	Female	71 Pilgrim Avenue
4	79117	Stacey	Osteen	Osteen, Stacey	01/09/98	23	Male	70 Bowman St.
5	3422	Rodney	O'Shea	O'Shea, Rodney	01/13/97	24	Male	4 Goldfield Rd.
6	32456	Garry	Dagostino	Dagostino, Garry	12/19/96	24	Male	44 Shirley Ave.
7	11847	Ruthie	Calhoun	Calhoun, Ruthie	01/29/99	22	Female	514 S. Magnolia St.
8	62353	Kelly	Somerville	Somerville, Kelly	09/21/99	21	Male	892 SE. Iroquois St.
9	49898	Maryann	Howard	Howard, Maryann	01/05/96	25	Female	800 East River Ave.
10	84080	Vernon	Raynor	Raynor, Vernon	03/30/96	24	Male	50 West Beach Drive

Calculate the date of due payment.

Do not forget to format the cell with **Days to Payment** as **General**.



	A	B	C	D	E	F	G	H	I	J
1	Days to payment		60							
2	IdSale	SaleDate	SaleDateTime	IdProduct	IdCenter	Quantity	Price	PaymentDate	IVA	TotalSale
3	2	17/12/2010	17/12/2010 14:30:00	14	5	1	4,5	15/02/2011	21%	€ 5,45
4	10	21/12/2010	21/12/2010 18:05:00	15	59	1	6	19/02/2011	21%	€ 7,26
5	13	22/12/2010	22/12/2010 11:41:00	14	47	1	4,5	20/02/2011	21%	€ 5,45
6	15	23/12/2010	23/12/2010 16:05:00	5	22	1	20	21/02/2011	21%	€ 24,20
7	16	23/12/2010	23/12/2010 16:15:00	2	16	1	5	21/02/2011	21%	€ 6,05
8	17	27/12/2010	27/12/2010 09:33:00	14	32	1	4,5	25/02/2011	21%	€ 5,45
9	18	27/12/2010	27/12/2010 12:02:00	2	56	1	5	25/02/2011	21%	€ 6,05
10	22	29/12/2010	29/12/2010 17:42:00	1	48	1	7,99	27/02/2011	21%	€ 9,67
11								Total Sales December		€ 69,56

Exercise 3 – Salary Sheet

Use the Excel file 3_Salary Sheet.

Based on that data:

1. The base salary is calculated based on the employee category on the Constants sheet
2. The seniority bonus is calculated considering a percentage of the base salary for each complete year in the company. The percentage is in the Constants sheet.
3. The lunch allowance is a value for each working day but the absent days will have to be deducted. All values are in the constants sheet.
4. The Social Security tax and IRS are calculated from the base salary plus the seniority bonus. The lunch allowance is exempt from all taxes.
5. Fill in the statistical map on the Stat Map sheet, based on the Net Salary

Text Functions

LOWER, UPPER, PROPER

Column B contains the text you want to format:

1. All Uppercase - UPPER (Text)
2. All in lowercase - LOWER (Text)
3. All the words start with capital letters - PROPER (Text)

	A	B	C	D	E
1	Class Number ▼	Class Name ▼	UPPER(Text) ▼	LOWER(text) ▼	PROPER(text) ▼
2	COM 201	Introduction to Communication I	INTRODUCTION TO COMMUNICATION I	introduction to communication i	Introduction To Communication I
3	COM 202	Introduction to Communication II	INTRODUCTION TO COMMUNICATION II	introduction to communication ii	Introduction To Communication Ii
4	COM 210	Introductory Communication Topics	INTRODUCTORY COMMUNICATION TOPICS	introductory communication topics	Introductory Communication Topics
5	COM 220	Introduction to Public Speaking	INTRODUCTION TO PUBLIC SPEAKING	introduction to public speaking	Introduction To Public Speaking
6	ENGL 101	Writing from Sources I	WRITING FROM SOURCES I	writing from sources i	Writing From Sources I
7	ENGL 102	Critical Reading & Writing	CRITICAL READING & WRITING	critical reading & writing	Critical Reading & Writing
8	ENGL 103	Writing from Sources II	WRITING FROM SOURCES II	writing from sources ii	Writing From Sources Ii
9	ENGL 109	Introductory Composition	INTRODUCTORY COMPOSITION	introductory composition	Introductory Composition
10	ENGL 111	Composition: Literature	COMPOSITION: LITERATURE	composition: literature	Composition: Literature
11	ECON 200	Introduction to Microeconomics	INTRODUCTION TO MICROECONOMICS	introduction to microeconomics	Introduction To Microeconomics

TRIM (text)

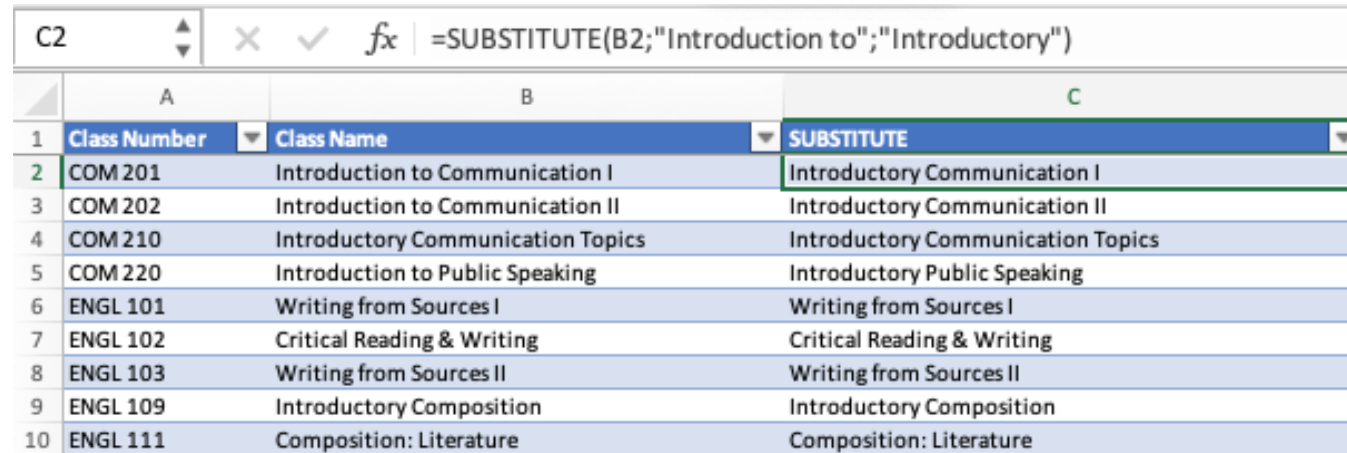
Column B corresponds to the import of a text file that contains multiple spaces between words, that we intend to remove

	A	B	C
1	Class Number ▼	Class Name ▼	TRIM ▼
2	COM 201	Introduction to Communication I	Introduction to Communication I
3	COM 202	Introduction to Communication II	Introduction to Communication II
4	COM 210	Introductory Communication Topics	Introductory Communication Topics
5	COM 220	Introduction to Public Speaking	Introduction to Public Speaking
6	COM 201	Introduction to Communication I	Introduction to Communication I

The trim function (text) removes spaces in a text, leaving only one space between words

SUBSTITUTE(text; old_text; new_text; [instance_num])

Column B corresponds to the import of a text file where we want to replace the words "Intruduction to" with "Introductory"



The image shows an Excel spreadsheet with three columns: A (Class Number), B (Class Name), and C (SUBSTITUTE). The formula bar at the top shows the formula =SUBSTITUTE(B2;"Introduction to";"Introductory"). The spreadsheet contains 10 rows of data. The first row is a header. The second row shows the formula being applied to the first data row. The subsequent rows show the results of the formula being applied to the remaining data rows.

	A	B	C
1	Class Number	Class Name	SUBSTITUTE
2	COM 201	Introduction to Communication I	Introductory Communication I
3	COM 202	Introduction to Communication II	Introductory Communication II
4	COM 210	Introductory Communication Topics	Introductory Communication Topics
5	COM 220	Introduction to Public Speaking	Introductory Public Speaking
6	ENGL 101	Writing from Sources I	Writing from Sources I
7	ENGL 102	Critical Reading & Writing	Critical Reading & Writing
8	ENGL 103	Writing from Sources II	Writing from Sources II
9	ENGL 109	Introductory Composition	Introductory Composition
10	ENGL 111	Composition: Literature	Composition: Literature

The function SUBSTITUTE (text; old_text; new_text; instance_num) replaces **old_text** by **new_text** in **text**.

If **instance_num** is specified, only the occurrence **instance_number** in **text** is changed;

If **instance_num** is not specified all occurrences are replaced

EXACT (text1; text2)

Column B corresponds to the import of a file, and column C to the import of another file. The aim is, for each line, to check whether the occurrences are equal

D2

✖

✔

fx

=EXACT(B2;C2)

	A	B	C	D
1	Class Number	Class Name	SUBSTITUTE	EXACT
2	COM 201	Introduction to Communication I	Introductory Communication I	FALSE
3	COM 202	Introduction to Communication II	Introductory Communication II	FALSE
4	COM 210	Introductory Communication Topics	Introductory Communication Topics	TRUE
5	COM 220	Introduction to Public Speaking	Introductory Public Speaking	FALSE
6	ENGL 101	Writing from Sources I	Writing from Sources I	TRUE
7	ENGL 102	Critical Reading & Writing	Critical Reading & Writing	TRUE
8	ENGL 103	Writing from Sources II	Writing from Sources II	TRUE
9	ENGL 109	Introductory Composition	Introductory Composition	TRUE
10	ENGL 111	Composition: Literature	Composition: Literature	TRUE
11	ECON 200	Introduction to Microeconomics	Introductory Microeconomics	FALSE

The function EXACT (text1; text2) compares two values, returning TRUE if they are exactly the same and FALSE otherwise. This function is CASE-SENSITIVE

CONCATENATE(text1; test2; [textn]; ...) or
text1&test2&...[testn]

Suppose we want to add a new column with the class number and name

C2			$\times$	$\checkmark$	f_x	=CONCATENATE(A2;" , "; B2)
	A	B	C			
1	Class Number	Class Name	CONCTENATE			
2	COM 201	Introduction to Communication I	COM 201 , Introduction to Communication I			
3	COM 202	Introduction to Communication II	COM 202 , Introduction to Communication II			
4	COM 210	Introductory Communication Topics	COM 210 , Introductory Communication Topics			
5	COM 220	Introduction to Public Speaking	COM 220 , Introduction to Public Speaking			
6	ENGL 101	Writing from Sources I	ENGL 101 , Writing from Sources I			
7	ENGL 102	Critical Reading & Writing	ENGL 102 , Critical Reading & Writing			
8	ENGL 103	Writing from Sources II	ENGL 103 , Writing from Sources II			
9	ENGL 109	Introductory Composition	ENGL 109 , Introductory Composition			
10	ENGL 111	Composition: Literature	ENGL 111 , Composition: Literature			
11	ECON 200	Introduction to Microeconomics	ECON 200 , Introduction to Microeconomics			
12	ECON 201	Introduction to Macroeconomics	ECON 201 , Introduction to Macroeconomics			

The function CONCATENATE (text1; [text2]; ...) joins up to 255 strings and/or numeric values in a single string.

"&" does exactly the same.

CONCAT (text1, [text2, ... text_n])

Suppose we want to compose the name of a person from their individual characters and from the individual names of their birth city

	A	B	C	D
1	Letras do nome	Nomes da cidade de nascimento	Nome completo, naturalidade	Função
2	J	New	John, New York	=CONCAT(A2:A5; ", "; B2; " "; B3)
3	o	York		
4	h			
5	n			

The function CONCAT (text1, [text2, ... text_n]) concatenates a list or range of text strings.

The advantage of CONCAT over CONCATENATE is that CONCAT allows ranges

NOTE: See also "TEXTJOIN" function, [when available](#)

LEN (text)

We want to count the number of characters in a string

	A	B	
1	Texto	Nº de Caracteres	Função
2	ISEG	4	=LEN(A2)
3	R Quelhas 6	11	=LEN(A3)
4	1200-781 LISBOA	15	=LEN(A4)
5	123,5	5	=LEN(A5)
6			

The LEN (text) returns the number of characters in a string

LEFT (text; numchar) and RIGHT (text; numchar)

Extract ***numchar*** characters from ***text*** starting from the **LEFT** or from the **RIGHT**.

	A	B	C	D	E
1	Dados	LEFT	Função LEFT	RIGHT	Função RIGHT
2	Preço de Venda	Preço	=LEFT(A2;5)	Venda	=RIGHT(A2;5)
3	Lisboa, Portugal	Lisboa	=LEFT(A3;6)	Portugal	=RIGHT(A3;8)
4					

FIND (find_text; within_text; [start_num])

This function searches the string **find_text** inside another string **within_text** and returns the position where it was found. It starts searching from position **start_num** (1 if omitted)

	A	B	C	D	E
1	Dados	FIND	Função FIND	LEFT	Função LEFT
2	Preço de Venda	6	=FIND(" ";A2)	Preço	=LEFT(A2;FIND(" ";A2)-1)
3	Lisboa, Portugal	7	=FIND(", ";A3)	Lisboa	=LEFT(A3;FIND(", ";A3)-1)
4					
5					

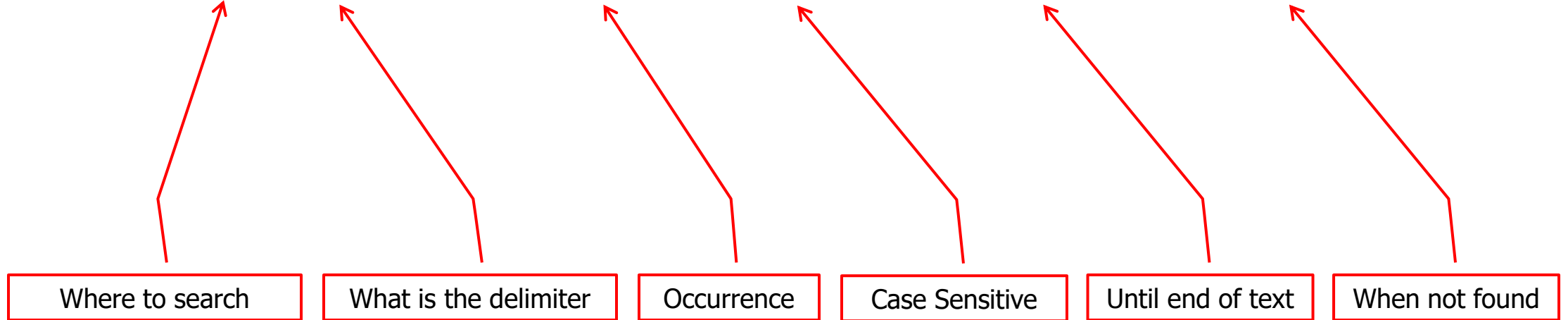
MID (text; start_num; num_chars)

Returns a specific number of characters from **text**, starting at **start_num**, with length **num_chars**.

	A	B	C	D	E
1	Nome Completo	Nome Próprio	Função	Apelido	Função
2	José Silva	José	=MID(A2;1;FIND(" ";A2)-1)	Silva	=RIGHT(A2;LEN(A2)-FIND(" ";A2))
3	Marta Ribeiro	Marta		Ribeiro	
4	Joana da Costa	Joana		da Costa	
5					

Functions MID, LEFT, RIGHT, LEN, and FIND, when applied together, allow a reasonable ability to manipulate characters in Excel.

=TEXTBEFORE(text; delimiter; [instance_num]; [match_mode]; [match_end]; [if_not_found])
=TEXTAFTER(text; delimiter; [instance_num]; [match_mode]; [match_end]; [if_not_found])



Example:

	A	B	C
1	Full Name	First Name	Last Name
2	Beatrice Geraldine Burchett Lee	Beatrice	Lee
3	Carol Janet Howland Cassidy	Carol	Cassidy
4	Hortensia Roy Marshall Armstrong	Hortensia	Armstrong
5	Jacqueline Raymond Mcdaniel Frawley	Jacqueline	Frawley
6	Gladys Mary Torres Colunga	Gladys	Colunga
7			
8			
9	Fórmula used ->	=TEXTBEFORE(A2;" ";1)	=TEXTAFTER(A2;" ";-1)

Exercise 4 – Text Functions

Use the Excel file 4_TextFunctions, containing a list of names.

Based on that data, fill the columns with formulas to get the desired values

Text functions

They are used normally **to manipulate data imported from external sources** or to **format data**

- Converting data types (eg text to numeric)
- Change data format (eg convert text to uppercase)

http://office.microsoft.com/en-us/excel-help/list-of-worksheet-functions-by-category-HP010079186.aspx#BMtext_functions

TEXT (value; format_text)

Column A corresponds to a numeric value and a date.
It is intended to convert these numeric values in a more readable format

	A	B	C
1	Number	Text	Function used
2	241,5384	241,54€	=TEXT(A2; "000,00€")
3	22/11/2019	sexta-feira, 22 - novembro - 2019	=TEXT(A3;"dddd, dd - mmmm - aaaa")
4	43791	sexta-feira, 22 - novembro - 2019	=TEXT(A4;"dddd, dd - mmmm - aaaa")

TEXT function (value, Format_text) converts numeric values in a set of characters in the specified format

VALUE (text)

Column A corresponds to the import of a file in text format.
It is intended to obtain from this text the numeric numeric value
and put it in column B

	A	B	
1	Text	Number	function used
2	Price: 123,45€	123,45	=VALUE(MID(A2;8;6))
3	Price: 034,56€	34,56	=VALUE(MID(A2;8;6))
4	Price: 348,03€	348,03	=VALUE(MID(A2;8;6))
5	Price: 009,43€	9,43	=VALUE(MID(A2;8;6))
6			

The function VALUE (text) takes a set of characters in numerical value. If the text is not "convertible" is returns #VALUE!

Information functions

Information functions

Are routinely used **to validate the contents of a cell**

Consider the following student assessment table

	A	B	C	D	E
1		40%	60%		
2	Name	1st Test	2nd Test	Final	Result
3	Ann	12,9	9	10,56	Approve
4	John	13		-----	Fail
5	Louis	1,6	14	-----	Fail
6	Mary	11	9	9,8	Approve
7					
8	Rules to be approved				
9	1st test $\geq 9,5$				
10	2nd test $\geq 8,5$				
11	Final (= 40% 1st + 60% 2nd) $\geq 9,5$				

ISBLANK (value)

Suppose we want to fill the column "Final" with the string "-----" if the cell "2nd test" is blank or to leave it blank otherwise

	A	B	C	D	E	F
1		40%	60%			
2	Name	1st Test	2nd Test	Final	Result	
3	Ann	12,9	9			=IF(ISBLANK(C3),"-----","")
4	John	13		-----		
5	Louis	1,6	14			
6	Mary	11	9			
7						
8	Rules to be approved					
9	1st test >= 9,5					
10	2nd test >= 8,5					
11	Final (= 40% 1st + 60% 2nd) >= 9,5					

Function ISBLANK (value) returns TRUE if the cell is empty and FALSE otherwise

ISBLANK (value)

Now we want to fill the column "Final" with "-----" in case of cell "2nd test" is blank or "1st Test" <9.5. Otherwise,
Final = 40%*ALS+60%*Exame

	A	B	C	D	E	F
1		40%	60%			
2	Name	1st Test	2nd Test	Final	Result	
3	Ann	12,9	9	10,56		=IF(OR(ISBLANK(C3);B3<9,5);"-----";B3*40%+C3*60%)
4	John	13		-----		
5	Louis	1,6	14	-----		
6	Mary	11	9	9,8		
7						
8	Rules to be approved					
9	1st test >= 9,5					
10	2nd test >= 8,5					
11	Final (= 40% 1st + 60% 2nd) >= 9,5					

ISTEXT(value)

Now we want to fill the column "Result" with the string "Fail" if "Final" is a string and leave it blank otherwise

	A	B	C	D	E	F
1		40%	60%			
2	Name	1st Test	2nd Test	Final	Result	
3	Ann	12,9	9	10,56		=IF(ISTEXT(D3),"Fail","")
4	John	13		-----	Fail	
5	Louis	1,6	14	-----	Fail	
6	Mary	11	9	9,8		
7						
8	Rules to be approved					
9	1st test >= 9,5					
10	2nd test >= 8,5					
11	Final (= 40% 1st + 60% 2nd) >= 9,5					

Function ISTEXT (value) returns TRUE if value is a text and FALSE otherwise

ISNUMBER(value)

Now we want to fill the column "Result" with "Approved" if "Final" is a number ≥ 9.5 and "Fail" otherwise

	A	B	C	D	E	F
1		40%	60%			
2	Name	1st Test	2nd Test	Final	Result	
3	Ann	12,9	9	10,56	Aprove	=IF(AND(ISNUMBER(D3);D3>=9,5);"Aprove";"Fail")
4	John	13		-----	Fail	
5	Louis	1,6	14	-----	Fail	
6	Mary	11	9	9,8	Aprove	
7						
8	Rules to be approved					
9	1st test $\geq 9,5$					
10	2nd test $\geq 8,5$					
11	Final (= 40% 1st + 60% 2nd) $\geq 9,5$					

Function ISNUMBER (value) returns TRUE if value is a number and FALSE otherwise

ISERROR(value)

IFERROR(value; value_if_error)

	A	B	C	D	E
1					
2	X	6,86	0	4,18	abc
3	Y	3,14	9,58	0	8,72
4	X/Y	2,184713376	0	#DIV/0!	#VALUE!
5	=IF(ISERROR(X/Y);"Got an Error";X/Y)	2,184713376	0	Got an Error	Got an Error
6	=IFERROR(B2/B3;"Got na Error")	2,184713376	0	Got na Error	Got na Error

Function **ISERROR(value)** returns **TRUE** if there is an error
(#N/A, #VALUE!, #REF!, #DIV/0!, #NUM!, #NAME?, Or #NULL!)

And **FALSE** otherwise

Function **IFERROR(value; value_if_error)** returns **value** or, if
value contains na error, returns **value_if_error**

Pivot Table

Pivot Table

What is a PivotTable? In its most basic form, a PivotTable takes data and summarizes it so you can make sense of it, all without typing any formulas!

Give feedback on this tutorial

The value fields are the ones where we can apply maths or stat functions

This is data.

Date	Buyer	Type	Amount
01-Jan	Mom	Fuel	\$74
15-Jan	Mom	Food	\$235
17-Jan	Dad	Sports	\$20
21-Jan	Kelly	Books	\$125
02-Feb	Mom	Food	\$235
20-Feb	Kelly	Music	\$20
25-Feb	Kelly	Tickets	\$125

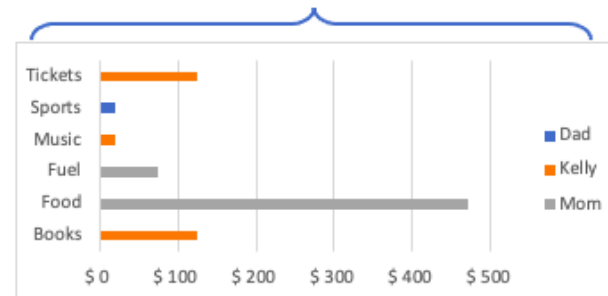
This simple PivotTable summarizes the data.

Buyer	Sum of Amount
Dad	\$20
Mom	\$544
Kelly	\$270
Grand Total	\$834

A more sophisticated PivotTable

Sum of Amount	Buyer			
Type	Dad	Kelly	Mom	Grand Total
Books		\$125		\$125
Food			\$470	\$470
Fuel			\$74	\$74
Music		\$20		\$20
Sports	\$20			\$20
Tickets		\$125		\$125
Grand Total	\$20	\$270	\$544	\$834

This PivotChart summarizes and visualizes the data.



Pivot Table

Excel looks at your data...

Date	Buyer	Type	Amount
01-Jan	Mom	Fuel	\$74
15-Jan	Mom	Food	\$235
17-Jan	Dad	Sports	\$20
21-Jan	Kelly	Books	\$125
02-Feb	Mom	Food	\$235
20-Feb	Kelly	Music	\$20
25-Feb	Kelly	Tickets	\$125

...and then lists the fields, by name, here.

PivotTable Fields

Choose fields to add to report: [Settings]

Search []

- ☐ Date
- ☐ Buyer
- ☐ Type
- ☐ Amount

More Tables...

Drag fields between areas below:

Filters	Columns
Rows	Values

Condition

Condition

Several aggregation functions available here

The rows and columns fields provide a condition to the value field, which sums them up.

Pivot Table

Excel looks at your data...

...and then lists the fields, by name, here.

Date	Buyer	Type	Amount
01-Jan	Mom	Fuel	\$74
15-Jan	Mom	Food	\$235
17-Jan	Dad	Sports	\$20
21-Jan	Kelly	Books	\$125
02-Feb	Mom	Food	\$235
20-Feb	Kelly	Music	\$20
25-Feb	Kelly	Tickets	\$125

PivotTable Fields

Choose fields to add to report: [Settings]

Search [Search]

☐ Date
☐ Buyer
☐ Type
☐ Amount
More Tables...

Drag fields between areas below:

Filters	Columns
Rows	Σ Values

1st Condition

2nd Condition

Several aggregation functions available here

We can set two conditions in rows for example, to the value field, which sums them up, allowing drill-down to dig into the values

Pivot Table

		Row Labels	Sum of Amount
First row field	→	⊙ Dad	\$2 000
		Sports	\$1 000
Second row field	⎵	Taxes	\$500
		Airfare	\$500
First row field	→	⊙ Kelly	\$935
		Books	\$250
		Music	\$20
		Tickets	\$125
Second row field	⎵	Dining	\$20
		Parking	\$20
		Electronics	\$125
		Clothes	\$125
		Music lessons	\$250
First row field	→	⊙ Mom	\$1 427
		Food	\$470
		Fuel	\$74
		Electricity	\$70
		Medical	\$74
Second row field	⎵	Dental	\$235
		Auto insurance	\$74
		Club dues	\$125
		Health insurance	\$70
		Home insurance	\$235
		Grand Total	\$4 362

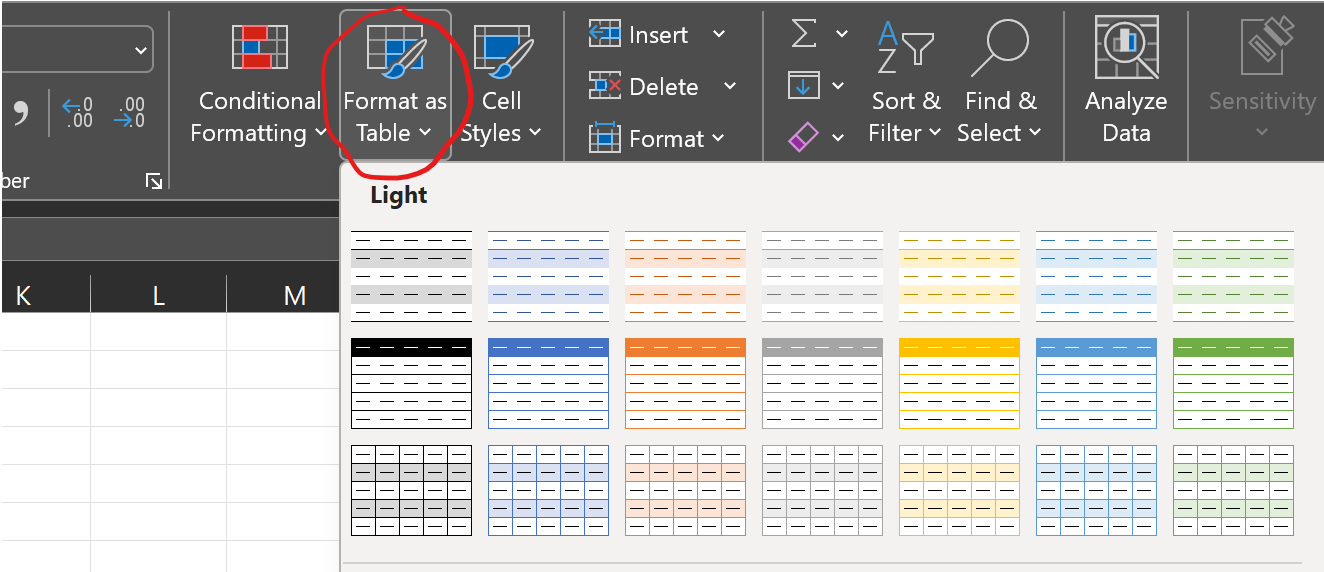
Excel Tables

Excel tables are a powerful way to automate some functions to manage data

Format as Table

	A	B	C	D	E
1	studNo	studName	1.Test	2.Test	LAB
2	4635	Dan Prince	17,3	13,5	10,38
3	4115	Helen Campbell	17,4	14,4	16,2
4	5700	Robert Manning	8,95	14,7	5,37
5	4336	Robert L. Leisure	10,6	13,7	15
6	4627	Carla C. Booth	17,5	17,6	17,54
7	6651	Edward Brewer	8,1	12	5,66
8	5243	Francisco Lynch	17,1	10	14,26
9	5788	Richard Brown	14,5	12,8	13,82
10	4688	Richard L. Guy	17,7	15,6	16,86
11	4183	John Dickey	17,9	18	17,94
12	5297	Regina K. Moreno	16,1	20	17,66
13	5454	Eileen Bess	15,8	13,2	14,76
14	6804	Bradford Branch	16,5	20	17,9
15	6147	Ernest Trowbridge	17,8	19,6	18,52
16	5378	Michael Vanness	14,4	14,76	14,544
17	5694	Susan F. Ledesma	13,5	19,2	15,78
18	6599	Sofia Wark	15,5	19	16,9
19	5840	Carmen Ewing	17,1	19,6	18,1
20	4222	Vincent Littleton	17,8	18,4	18,04
21	4815	Katherine Davidson	14	11,2	12,88
22	6605	Nancy M. Ward	19,7	3,2	13,1
23	6006	Fidel G. Boney	17,8	8,4	14,04
24	6896	John Johnson	15,8	17,2	16,36
25	4672	Monnie W. Emmons	16,9	11,2	14,62
26	4074	Brian Brown	17,2	19,6	18,16
27	6604	Annie Bently	15,9	8,4	12,9
28	5544	Jeremy Choe	19,8	20	19,88
29	6156	Nicholas Ray	10,9	7,48	9,532

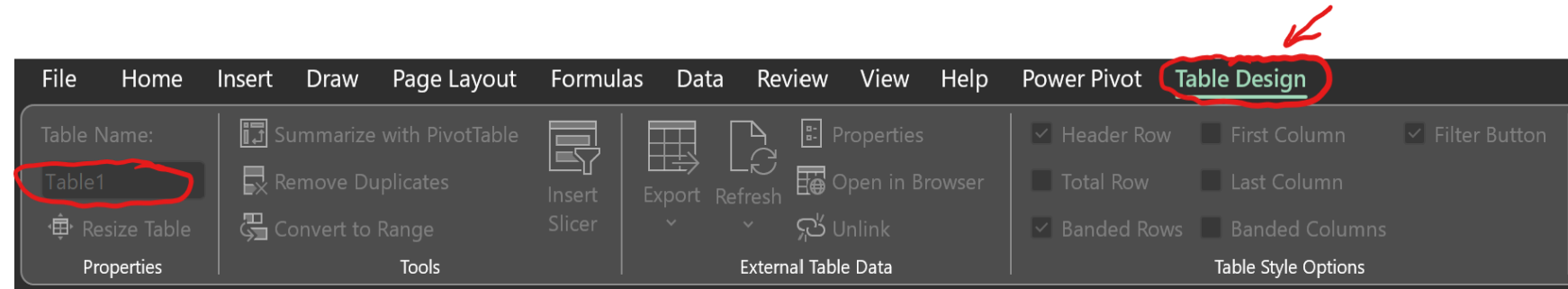
On the Home Menu, choose:



Result

	A	B	C	D	E
1	studNo	studName	1.Test	2.Test	LAB
2	4635	Dan Prince	17,3	13,5	10,38
3	4115	Helen Campbell	17,4	14,4	16,2
4	5700	Robert Manning	8,95	14,7	5,37
5	4336	Robert L. Leisure	10,6	13,7	15
6	4627	Carla C. Booth	17,5	17,6	17,54
7	6651	Edward Brewer	8,1	12	5,66
8	5243	Francisco Lynch	17,1	10	14,26
9	5788	Richard Brown	14,5	12,8	13,82
10	4688	Richard L. Guy	17,7	15,6	16,86
11	4183	John Dickey	17,9	18	17,94
12	5297	Regina K. Moreno	16,1	20	17,66
13	5454	Eileen Bess	15,8	13,2	14,76
14	6804	Bradford Branch	16,5	20	17,9
15	6147	Ernest Trowbridge	17,8	19,6	18,52
16	5378	Michael Vanness	14,4	14,76	14,544
17	5694	Susan F. Ledesma	13,5	19,2	15,78
18	6599	Sofia Wark	15,5	19	16,9
19	5840	Carmen Ewing	17,1	19,6	18,1
20	4222	Vincent Littleton	17,8	18,4	18,04
21	4815	Katherine Davidson	14	11,2	12,88
22	6605	Nancy M. Ward	19,7	3,2	13,1
23	6006	Fidel G. Boney	17,8	8,4	14,04
24	6896	John Johnson	15,8	17,2	16,36
25	4672	Monnie W. Emmons	16,9	11,2	14,62
26	4074	Brian Brown	17,2	19,6	18,16
27	6604	Annie Bently	15,9	8,4	12,9
28	5544	Jeremy Choe	19,8	20	19,88
29	6156	Nicholas Ray	10,9	7,48	9,532

New menu with specific table functions



Adding a column:

	A	B	C	D	E	F
1	studNo	studName	1.Test	2.Test	LAB	Final
2	4635	Dan Prince	17,3	13,5	10,38	
3	4115	Helen Campbell	17,4	14,4	16,2	
4	5700	Robert Manning	8,95	14,7	5,37	
5	4336	Robert L. Leisure	10,6	13,7	15	
6	4627	Carla C. Booth	17,5	17,6	17,54	
7	6651	Edward Brewer	8,1	12	5,66	
8	5243	Francisco Lynch	17,1	10	14,26	
9	5788	Richard Brown	14,5	12,8	13,82	
10	4688	Richard L. Guy	17,7	15,6	16,86	
11	4183	John Dickey	17,9	18	17,94	
12	5297	Regina K. Moreno	16,1	20	17,66	
13	5454	Eileen Bess	15,8	13,2	14,76	
14	6804	Bradford Branch	16,5	20	17,9	
15	6147	Ernest Trowbridge	17,8	19,6	18,52	
16	5378	Michael Vanness	14,4	14,76	14,544	
17	5694	Susan F. Ledesma	13,5	19,2	15,78	
18	6599	Sofia Wark	15,5	19	16,9	
19	5840	Carmen Ewing	17,1	19,6	18,1	
20	4222	Vincent Littleton	17,8	18,4	18,04	
21	4815	Katherine Davidson	14	11,2	12,88	
22	6605	Nancy M. Ward	19,7	3,2	13,1	
23	6006	Fidel G. Boney	17,8	8,4	14,04	
24	6896	John Johnson	15,8	17,2	16,36	
25	4672	Monnie W. Emmons	16,9	11,2	14,62	
26	4074	Brian Brown	17,2	19,6	18,16	
27	6604	Annie Bently	15,9	8,4	12,9	
28	5544	Jeremy Choe	19,8	20	19,88	
29	6156	Nicholas Ray	10,9	7,48	9,532	
30						

	A	B	C	D	E	F
1	studNo	studName	1.Test	2.Test	LAB	Final
2	4635	Dan Prince	17,3	13,5	10,38	
3	4115	Helen Campbell	17,4	14,4	16,2	
4	5700	Robert Manning	8,95	14,7	5,37	
5	4336	Robert L. Leisure	10,6	13,7	15	
6	4627	Carla C. Booth	17,5	17,6	17,54	
7	6651	Edward Brewer	8,1	12	5,66	
8	5243	Francisco Lynch	17,1	10	14,26	
9	5788	Richard Brown	14,5	12,8	13,82	
10	4688	Richard L. Guy	17,7	15,6	16,86	
11	4183	John Dickey	17,9	18	17,94	
12	5297	Regina K. Moreno	16,1	20	17,66	
13	5454	Eileen Bess	15,8	13,2	14,76	
14	6804	Bradford Branch	16,5	20	17,9	
15	6147	Ernest Trowbridge	17,8	19,6	18,52	
16	5378	Michael Vanness	14,4	14,76	14,544	
17	5694	Susan F. Ledesma	13,5	19,2	15,78	
18	6599	Sofia Wark	15,5	19	16,9	
19	5840	Carmen Ewing	17,1	19,6	18,1	
20	4222	Vincent Littleton	17,8	18,4	18,04	
21	4815	Katherine Davidson	14	11,2	12,88	
22	6605	Nancy M. Ward	19,7	3,2	13,1	
23	6006	Fidel G. Boney	17,8	8,4	14,04	
24	6896	John Johnson	15,8	17,2	16,36	
25	4672	Monnie W. Emmons	16,9	11,2	14,62	
26	4074	Brian Brown	17,2	19,6	18,16	
27	6604	Annie Bently	15,9	8,4	12,9	
28	5544	Jeremy Choe	19,8	20	19,88	
29	6156	Nicholas Ray	10,9	7,48	9,532	
30						

Formatting is automatic

Inserting a formula:

	A	B	C	D	E	F	G	H	I
1	studNo	studName	1.Test	2.Test	LAB	Final			
2	4635	Dan Prince	17,3	13,5	10,38	=AVERAGE(Grades@[1.Test]:[LAB])			
3	4115	Helen Campbell	17,4	14,4	16,2	AVERAGE(number1; [number2]; ...)			
4	5700	Robert Manning	8,95	14,7	5,37				

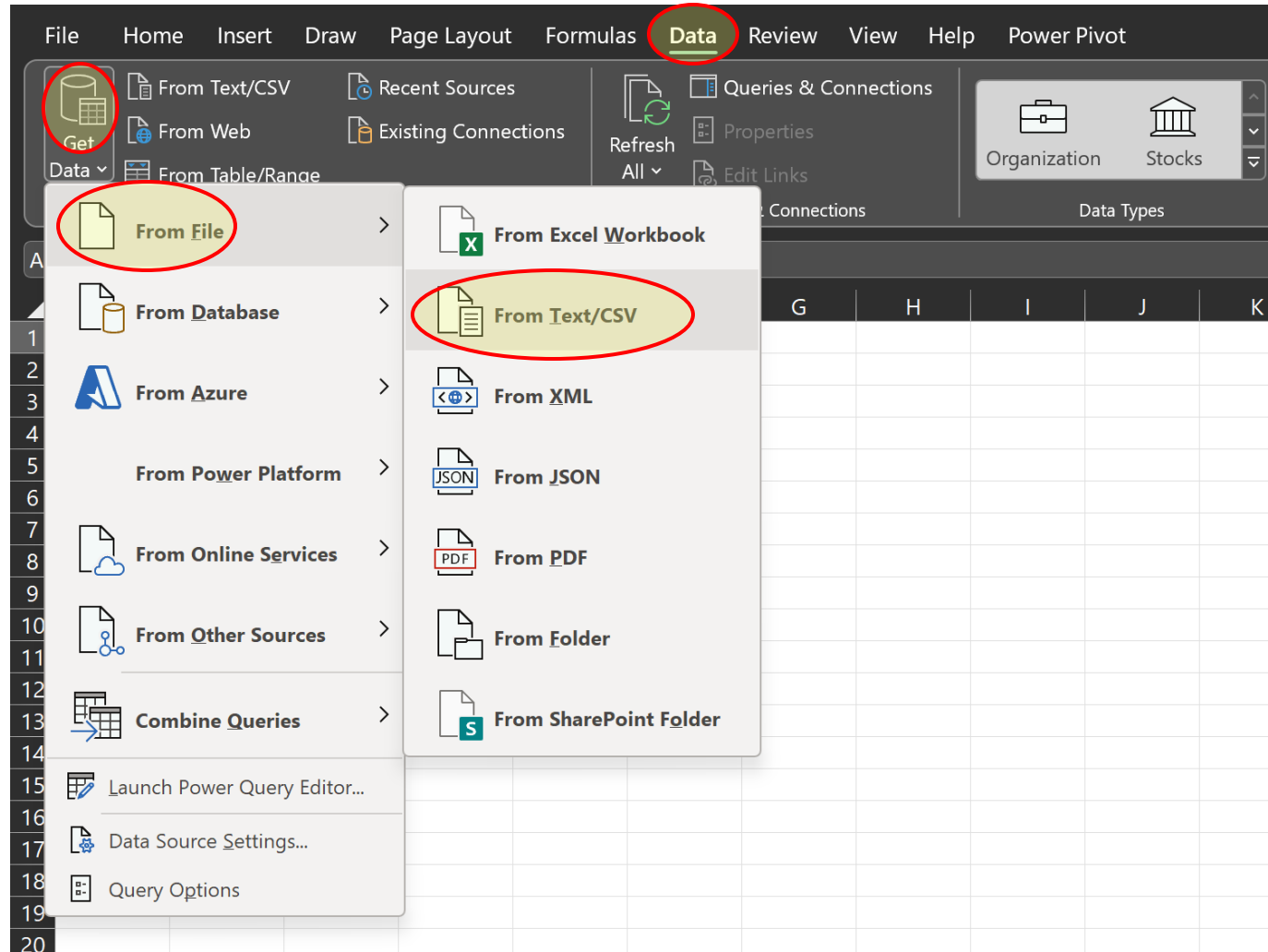
Autofill is automatic

	A	B	C	D	E	F
1	studNo	studName	1.Test	2.Test	LAB	Final
2	4635	Dan Prince	17,3	13,5	10,38	13,72667
3	4115	Helen Campbell	17,4	14,4	16,2	16
4	5700	Robert Manning	8,95	14,7	5,37	9,673333
5	4336	Robert L. Leisure	10,6	13,7	15	13,1
6	4627	Carla C. Booth	17,5	17,6	17,54	17,54667
7	6651	Edward Brewer	8,1	12	5,66	8,586667
8	5243	Francisco Lynch	17,1	10	14,26	13,78667
9	5788	Richard Brown	14,5	12,8	13,82	13,70667
10	4688	Richard L. Guy	17,7	15,6	16,86	16,72
11	4183	John Dickey	17,9	18	17,94	17,94667
12	5297	Regina K. Moreno	16,1	20	17,66	17,92
13	5454	Eileen Bess	15,8	13,2	14,76	14,58667
14	6804	Bradford Branch	16,5	20	17,9	18,13333
15	6147	Ernest Trowbridge	17,8	19,6	18,52	18,64
16	5378	Michael Vanness	14,4	14,76	14,544	14,568
17	5694	Susan F. Ledesma	13,5	19,2	15,78	16,16
18	6599	Sofia Wark	15,5	19	16,9	17,13333
19	5840	Carmen Ewing	17,1	19,6	18,1	18,26667
20	4222	Vincent Littleton	17,8	18,4	18,04	18,08
21	4815	Katherine Davidson	14	11,2	12,88	12,69333
22	6605	Nancy M. Ward	19,7	3,2	13,1	12
23	6006	Fidel G. Boney	17,8	8,4	14,04	13,41333
24	6896	John Johnson	15,8	17,2	16,36	16,45333
25	4672	Monnie W. Emmons	16,9	11,2	14,62	14,24
26	4074	Brian Brown	17,2	19,6	18,16	18,32
27	6604	Annie Bently	15,9	8,4	12,9	12,4
28	5544	Jeremy Choe	19,8	20	19,88	19,89333
29	6156	Nicholas Ray	10,9	7,48	9,532	9,304

Power Query

Power Query is a useful tool to manage data transformation and loading

Loading Data



Load Powerquery

nama_10_pc_page_tabular.csv

File Origin: 1252: Western European (Windows) Delimiter: Tab Data Type Detection: Based on first 200 rows

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10
freq,unit,na_item,geo\TIME_PERIOD	2012	2013	2014	2015	2016	2017	2018	2019	2020
A,CP_NAC_HAB,B1GQ,AL	459530	466320 d	482950	497900	511970	539640	571010	592780	579340 p
A,CP_NAC_HAB,B1GQ,AT	37820	38210	38990	39890	40920	42000	43610	44780	42540
A,CP_NAC_HAB,B1GQ,BE	34770	35210	35950	36960	37960	39130	40260	41630	39560 p
A,CP_NAC_HAB,B1GQ,BG	11310	11320	11650	12480	13380	14520	15650	17260	17300
A,CP_NAC_HAB,B1GQ,CH	81150	81670	82160	81590	81860	82080	84480	84800	81760
A,CP_NAC_HAB,B1GQ,CY	22500	20880	20450	21100	22230	23550	24840	26090	24240 p
A,CP_NAC_HAB,B1GQ,CZ	389080	394150	412910	438720	454020	482620	509180	542820	533560
A,CP_NAC_HAB,B1GQ,DE	34130	34860	36150	37050	38070	39530	40620 p	41800 p	40490 p
A,CP_NAC_HAB,B1GQ,DK	338940	343790	351080	358390	367920	380390	388910	397280	398610
A,CP_NAC_HAB,B1GQ,EA	29510	29740	30270	31070	31840	32960	33990	35010	33290
A,CP_NAC_HAB,B1GQ,EA12	29950	30190	30830	31800	32570	33690	34710	35730	33960
A,CP_NAC_HAB,B1GQ,EA19	29230	29480	30110	31070	31840	32960	33990	35010	33290
A,CP_NAC_HAB,B1GQ,EE	13520	14320	15240	15710	16530	18120	19570	20930	20190
A,CP_NAC_HAB,B1GQ,EL	17060	16400	16270	16300	16190	16450	16730	17090 p	15440 p
A,CP_NAC_HAB,B1GQ,ES	22050	21900	22220	23220	23980	24970	25750	26420 p	23690 p
A,CP_NAC_HAB,B1GQ,EU15	31040	31190	32200	33800	33890	34620	35530	36590	:
A,CP_NAC_HAB,B1GQ,EU27_2020	25760	26020	26580	27500	28200	29320	30290	31310	29940
A,CP_NAC_HAB,B1GQ,EU28	26690	26870	27750	29180	29340	30150	31090	32160	:
A,CP_NAC_HAB,B1GQ,FI	37130	37570	37880	38570	39580	41080	42320	43440	43030

Load Transform Data Cancel

Transform Data

nama_10_pc_page_tabular - Power Query Editor

File Home Transform Add Column View

Close & Load Refresh Preview Properties Advanced Editor Manage Query

Choose Columns Remove Columns Keep Rows Remove Rows Sort Split Column Group By

Data Type: Text Use First Row as Headers Use First Row as Headers Use Headers as First Row

Merge Queries Append Queries Combine Files Combine Parameters Data source settings New Source Recent Sources Enter Data New Query

Queries [1] nama_10_pc_page_ta...

= Table.TransformColumnTypes(Source,{{"Column1", type text}, {"Column2", type text}, {"Column3", type text}, {"Column4", type text}, {"Column5", type text}, {"Column6", type text}})

	A ^B _C Column1	A ^B _C Column2	A ^B _C Column3	A ^B _C Column4	A ^B _C Column5	A ^B _C Column6
1	freq,unit,na_item,geo\TIME_PERIOD	2012	2013	2014	2015	2016
2	A,CP_NAC_HAB,B1GQ,AL	459530	466320 d	482950	497900	511970
3	A,CP_NAC_HAB,B1GQ,AT	37820	38210	38990	39890	40920
4	A,CP_NAC_HAB,B1GQ,BE	34770	35210	35950	36960	37960
5	A,CP_NAC_HAB,B1GQ,BG	11310	11320	11650	12480	13380
6	A,CP_NAC_HAB,B1GQ,CH	81150	81670	82160	81590	81860
7	A,CP_NAC_HAB,B1GQ,CY	22500	20880	20450	21100	22230
8	A,CP_NAC_HAB,B1GQ,CZ	389080	394150	412910	438720	454020
9	A,CP_NAC_HAB,B1GQ,DE	34130	34860	36150	37050	38070
10	A,CP_NAC_HAB,B1GQ,DK	338940	343790	351080	358390	367920
11	A,CP_NAC_HAB,B1GQ,EA	29510	29740	30270	31070	31840
12	A,CP_NAC_HAB,B1GQ,EA12	29950	30190	30830	31800	32570

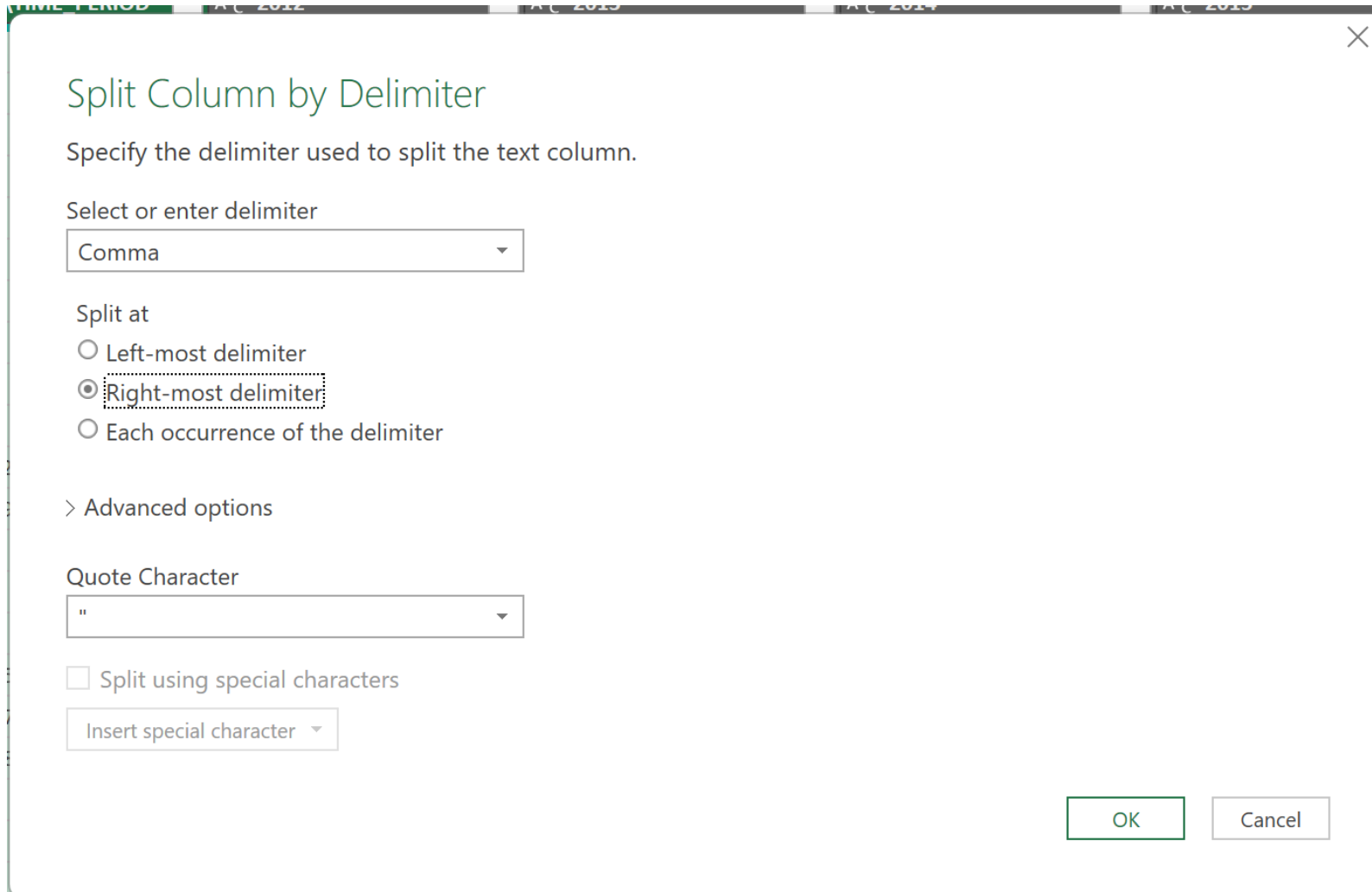
Split a Column

The steps are recorded...

The screenshot shows the Power Query Editor interface. The ribbon includes tabs for File, Home, Transform, Add Column, and View. The 'Transform' tab is active, showing options like Split Column, Group By, and Replace Values. A context menu is open over the first column, with 'Split Column' selected, and a sub-menu showing options like 'By Delimiter...', 'By Number of Characters...', and 'By Positions...'. The 'Query Settings' pane on the right shows the 'APPLIED STEPS' list, which includes 'Source', 'Changed Type', 'Promoted Headers', and 'Changed Type1'. A red circle highlights the 'APPLIED STEPS' list, and a red arrow points from the text 'The steps are recorded...' to this circle.

	A ^B C freq,unit,na_item,geo\TIME_PERIOD	A ^B C 2013	A ^B C 2014	A ^B C 2015	A ^B C 2016
1	A,CP_NAC_HAB,B1GQ,AL	466320 d	482950	497900	511
2	A,CP_NAC_HAB,B1GQ,AT	38210	38990	39890	409
3	A,CP_NAC_HAB,B1GQ,BE	35210	35950	36960	379
4	A,CP_NAC_HAB,B1GQ,BG	11320	11650	12480	133
5	A,CP_NAC_HAB,B1GQ,CH	81670	82160	81590	818
6	A,CP_NAC_HAB,B1GQ,CY	20880	20450	21100	222
7	A,CP_NAC_HAB,B1GQ,CZ	394150	412910	438720	454
8	A,CP_NAC_HAB,B1GQ,DE	34860	36150	37050	380
9	A,CP_NAC_HAB,B1GQ,DK	343790	351080	358390	367
10	A,CP_NAC_HAB,B1GQ,EA	29740	30270	31070	318
11	A,CP_NAC_HAB,B1GQ,EA1	30190	30830	31800	325
12	A,CP_NAC_HAB,B1GQ,EA1	30110	31070	31070	318
13	A,CP_NAC_HAB,B1GQ,EE	15240	15710	16300	165
14	A,CP_NAC_HAB,B1GQ,EL	16270	16300	16300	161
15	A,CP_NAC_HAB,B1GQ,ES	22220	23220	23220	239
16	A,CP_NAC_HAB,B1GQ,EU2	32200	33800	33800	338
17	A,CP_NAC_HAB,B1GQ,EU2	26580	27500	27500	282
18	A,CP_NAC_HAB,B1GQ,EU2	26870	27750	29180	293
19	A,CP_NAC_HAB,B1GQ,FI	37570	37880	38570	395
20	A,CP_NAC_HAB,B1GQ,FI	33080	33420	33420	334

Split a Column



The screenshot shows a dialog box titled "Split Column by Delimiter" with a close button (X) in the top right corner. The main instruction reads "Specify the delimiter used to split the text column." Below this, there is a section "Select or enter delimiter" with a dropdown menu currently showing "Comma". Underneath, the "Split at" section contains three radio button options: "Left-most delimiter", "Right-most delimiter" (which is selected and highlighted with a dashed border), and "Each occurrence of the delimiter". An expandable section labeled "> Advanced options" is shown below. Inside this section, there is a "Quote Character" dropdown menu set to "\". At the bottom of the advanced options, there is an unchecked checkbox labeled "Split using special characters" and a corresponding "Insert special character" dropdown menu.

TIME PERIOD AC 2012 AC 2013 AC 2014 AC 2015

Split Column by Delimiter

Specify the delimiter used to split the text column.

Select or enter delimiter

Comma ▼

Split at

- ☐ Left-most delimiter
- ☒ Right-most delimiter
- ☐ Each occurrence of the delimiter

> Advanced options

Quote Character

" ▼

☐ Split using special characters

Insert special character ▼

OK Cancel

Other Transformations

- Remove unwanted columns
- Remove unwanted text
- Change text into numbers
- rename columns, etc.
- ...

Unpivot columns

nama_10_pc_page_tabular - Power Query Editor

File Home Transform Add Column View

Group By Use First Row as Headers Count Rows Table

Data Type: Text Replace Values Unpivot Columns Detect Data Type Fill Move Rename Pivot Column Convert to List Any Column

Split Column Format Extract Parse Text Column

Statistics Standard Scientific Rounding Information Number Column

Date Time Duration Date & Time Column

Queries [1] nama_10_pc_page_ta...

= Table.TransformColumnTypes("#Extracted Text Before Delimiter",{{"2021 ", type number}, {"2020 ", type number}, {"2019 ", type number}, {"2018 ", type number}})

		1.2 2013	1.2 2014	1.2 2015	1.2 2016
1	AL	459530	466320	482950	497900
2	AT	37820	38210	38990	39850
3	BE	34770	35210	35950	36960
4	BG	11310	11320	11650	12480
5	CH	81150	81670	82160	81550
6	CY	22500	20880	20450	21100
7	CZ	389080	394150	412910	438720
8	DE	34130	34860	36150	37050
9	DK	338940	343790	351080	358350
10	EA	29510	29740	30270	31070
11	EA12	29950	30190	30830	31800
12	EA19	29230	29480	30110	31070
13	EE	13520	14320	15240	15710
14	EL	17060	16400	16270	16300
15	ES	22050	21900	22220	23220
16	EU15	31040	31190	32200	33800
17	EU27_2020	25760	26020	26580	27500
18	EU28	26690	26870	27750	29150
19	FI	37130	37570	37880	38570
20	FR	31820	32080	32420	33020
21	HR	78380	78970	79150	81760
22	HU	2923920	3069080	3325930	3553310
23	IE	38180	38830	41900	55970
24	IS	5753540	6084450	6372510	6985630
25	IT	76000	76740	76000	77450

Copy
Remove
Remove Other Columns
Duplicate Column
Add Column From Examples...
Remove Duplicates
Remove Errors
Change Type
Transform
Replace Values...
Replace Errors...
Create Data Type
Split Column
Group By...
Fill
Unpivot Columns
Unpivot Other Columns
Unpivot Only Selected Columns
Rename...
Move
Drill Down
Add as New Query

Unpivot - Result

= Table.RenameColumns("#Replaced Errors",{{"freq,unit,na_item			
	A ^B _C CountryCode	A ^B _C Year	1.2 Value
1	AL	2012	459530
2	AL	2013	466320
3	AL	2014	482950
4	AL	2015	497900
5	AL	2016	511970
6	AL	2017	539640
7	AL	2018	571010
8	AL	2019	592780
9	AL	2020	579340
10	AL	2021	0
11	AT	2012	37820
12	AT	2013	38210
13	AT	2014	38990
14	AT	2015	39890
15	AT	2016	40920
16	AT	2017	42000
17	AT	2018	43610
18	AT	2019	44780
19	AT	2020	42540
20	AT	2021	44970
21	BE	2012	34770
22	BE	2013	35210
23	BE	2014	35950
24	BE	2015	36960
25	BE	2016	37960
26	BE	2017	39130
27	BE	2018	40260

Finish by loading the data

The screenshot shows the Power Query Editor interface. The 'File' menu is open, and the 'Close & Load' option is highlighted. The 'Close & Load To...' option is also visible. The 'Import Data' dialog box is open, showing options for how to view the data and where to put it. The 'Table' option is selected for viewing the data. The 'New worksheet' option is selected for where to put the data. The 'Add this data to the Data Model' checkbox is checked.

File | nama_10_pc_page_tabular - Power Query Editor

File Home Transform Add Column View

Get Data Close & Load Refresh Preview Query Manage

Choose Columns Remove Columns Keep Rows Remove Rows Sort Split Column Group By Data Type: Text Use First Row as Headers Replace Values Merge Queries Append Queries Combine Files

Close & Load Close & Load To...

nama_10_pc_page_ta...

1 2 3 4 5 6

Import Data

Select how you want to view this data in your workbook.

☒ Table
☐ PivotTable Report
☐ PivotChart
☐ Only Create Connection

Where do you want to put the data?

☐ Existing worksheet:
= \$A\$1

☒ New worksheet

☒ Add this data to the Data Model

Properties... OK Cancel

= Table.ReplaceErrorValues("#Unpivoted Other Columns", {"Value", 0})

A ^B C Attribute	1.2 Value
2012	459530
2013	466320
2014	482950
2015	497900

Exercise 5 - Students

Use the Excel file 5_Students, containing the student's information and grades.

Based on that data:

1. On the sheet "students details" fill in the age of the students and their names. Format the Table "as a table".
2. Create an email address for each student in the domain "mim.ulisboa.pt", appending the first name initial, dot last name. For example, for Angeline Baird, her email address should be "a.baird@mim.ulisboa.pt"
3. In the sheet "Grades", create a new column with the name of the Class and another with the student's name. Use "Format as Table"
4. Create a Pivot-Table to analyse grades by different perspectives.