



UNIVERSITÀ  
DEGLI STUDI  
DI BERGAMO

Dipartimento  
di Ingegneria Gestionale,  
dell'Informazione e della Produzione

# 22059 – APPLIED TOPICS IN MANAGEMENT ENGINEERING

**Excel, Access and Matlab**

Prof. Giuseppe Pellegrini

Prof. Renato Redondi

# Course

- Applied Topics in Management Engineering
- 22059-ENG - Applied Topics in Management Engineering (6 credits)
- Teachers
  - Prof. Giuseppe Pellegrini
  - Prof. Renato Redondi, [renato.redondi@unibg.it](mailto:renato.redondi@unibg.it)
- Period from 24th February 2020 to the 1<sup>st</sup> June 2020
- Schedule: Monday 8:30:10:30  
Wednesday 9:00-11:00
- Classroom A003 (Building A, ground floor)



# Organization

- Reception times: Monday 10:30-13:30, by appointment via e-mail
- e-mail
  - [renato.redondi@unibg.it](mailto:renato.redondi@unibg.it)
- Online Material site: e-learning Moodle
  - <https://elearning15.unibg.it/course/view.php?id=1515>
  - download and print before each lesson
  - Download the files (e.g. Excel, Matlab, Access) to be employed during lectures
- The online notes cover "the core" of the topics.
- It is essential to attend the laboratory lectures



# Reference books and references

## Major references

- Lecture notes, case studies and other material distributed by the course teachers

## Bibliography

- Alexander, M., Kusleika, R., & Walkenbach, J. (2018). Excel 2019 Bible. John Wiley & Sons.
- Alexander, M. & Kusleika, R. (2018). Access 2019 Bible. John Wiley & Sons.
- Matlab online support materials
- On-line tutorials and other materials referenced to in each lecture



# Examination

- There are no intermediate tests
- The final exam consists in **the preparation of two reports and the related discussion:**
  - the first regards the topic of statistical quality control, to be agreed with Prof. Pellegrini
  - the second regards economics and company organization issues, to be agreed with Prof. Redondi
- To be admitted to the examination, students must register online



# The course - objective

**The student will acquire the following practical skills:**

- 1- the use of excel for solving problems related to statistical quality control and the economy and business organization;
- 2- the use of Access to solve problems related to database management, the analysis of products and business processes; and
- 3) the use of Matlab with simulation, sampling and quality control applications.



# The course - content

The course consists of the following subjects:

- 1- Introduction to the use of **Excel, Access and Matlab**. Solving typical problems such as data conversion between different formats and the generation of random numbers for simulation purposes.
- 2- Practical applications in the field of statistical quality control (sampling, quality control charts, etc.);
- 3- Practical applications in the field of business economics and organization, management control and information management (investment analysis, clustering and database management)



# EXCEL

## What is MS Excel?

- It is a spreadsheet program.
- It is used to enter, edit, format, sort numeric data and perform mathematical computations.

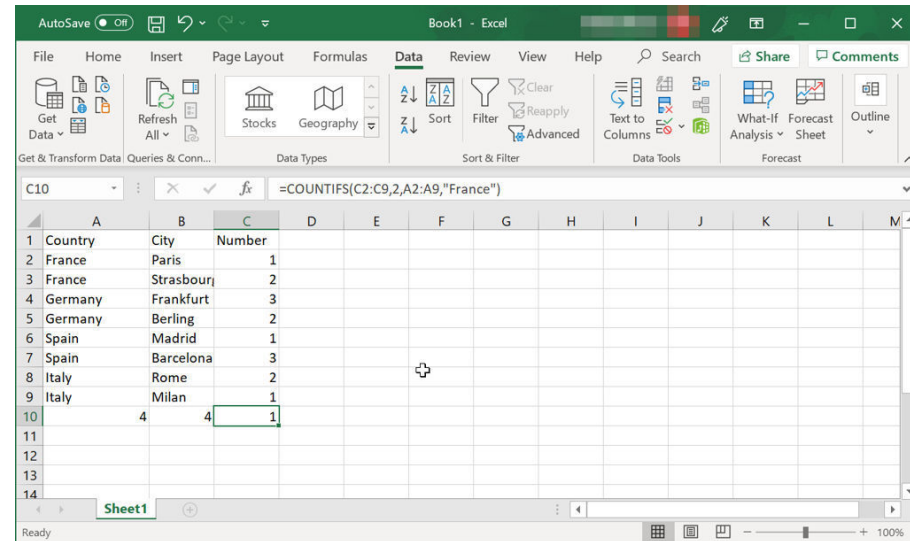


Fig.1: The Excel interface



# AGENDA

## Lecture I

- CHARTS
- FORMULAS
  - Relative and Absolute Cell References
- FUNCTIONS
- WHAT-IF ANALYSIS
- SAVINGS
- FURTHER MATERIAL



# CHARTS

- Creating a chart is quick and easy.
- You can choose between several types of charts such as:
  - Line charts
  - Bar charts
  - Pie charts
  - Column charts

and so on

- Showing data in a chart can help you evaluate your data and make comparisons between different values.



# CHARTS

## How to make a chart

1. Select the cells you want to chart, including the column titles and row labels.
2. From the Insert tab, click the desired Chart command.
3. Choose the desired chart type from the drop-down menu.
4. The selected chart will be inserted in the worksheet.

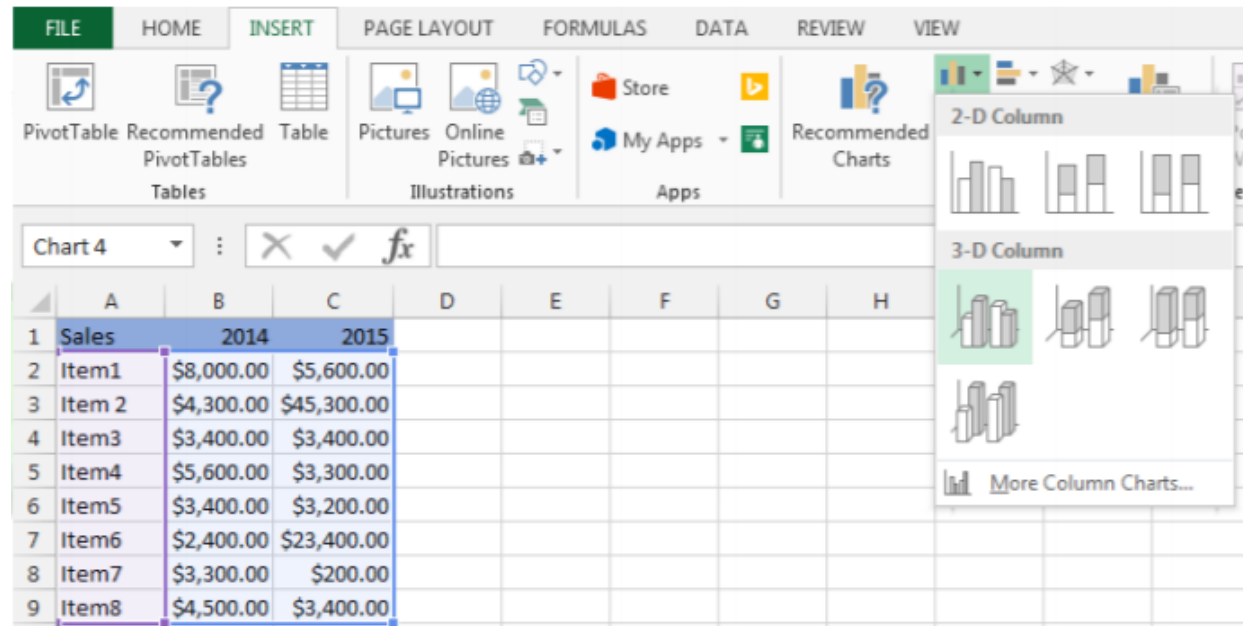


Fig.2: The selection of cells

# CHARTS

## How to edit chart layout and style

- After inserting a chart, from the **Design tab**, you may change the way your data is displayed.
- You may add chart elements - such as chart titles, legends, and data labels—to make your chart easier to read:

1. Click the Add Chart Element command on the Design tab
2. Choose the desired element from the drop-down menu.

To edit a chart element, (e.g. chart title), simply double-click the placeholder and begin typing

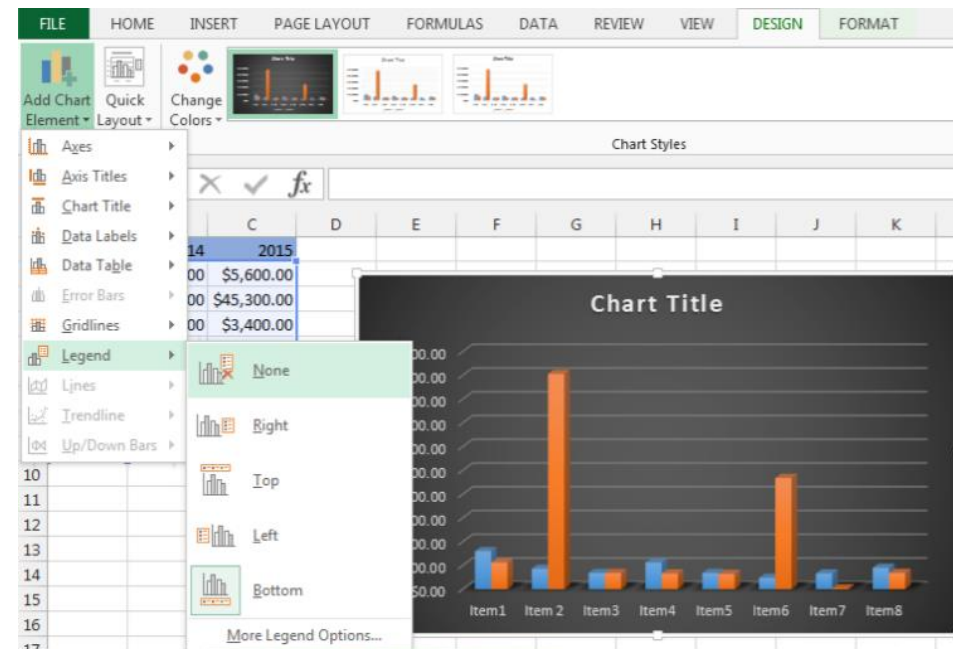


Fig.3: Inserting a legend

# FORMULAS

## How to enter a formula

- In Excel you can perform mathematical computations using formulas.
- All formulas in Excel must begin with an **equals sign (=)**.
- Formulas may be Simple (a single mathematical operator) or Complex (more than one mathematical operator).



The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D
1	Menu Item	Price	Quantity	Total
2	Item 1	\$2.29	20	\$45.80
3	Item 2	\$2.29	30	\$68.70
4	Tax			<code>=(D2+D3)*0.075</code>
5	Total			

The formula bar at the top shows the formula `=(D2+D3)*0.075` being entered into cell D4. The formula bar also includes a dropdown menu set to 'SUM', a checkmark, and a function icon.

Fig.4: Inserting a complex formula

# FORMULAS

## Relative and Absolute Cell References



- Cells references may be:
  - Relative: references change when a formula is copied to another cell.
  - Absolute: absolute references remain constant when a formula is copied to another cell.

### Relative Cell References

- By default, all cell references are relative.
- These are convenient to use when you want to repeat the same calculation across multiple rows or columns.

Click and hold the fill handle to drag the formula into the cells below

	A	B	C	D
1	Item	Price	Quantity	Total
2	Item 1	\$2.00	4	\$8.00
3	Item 2	\$4.00	2	
4	Item 3	\$6.00	1	
5	Item 4	\$3.00		
6	Item 5	\$2.00	5	
7	Item 6	\$8.00	3	
8	Item 7	\$2.00	3	
9	Item 8	\$1.00	6	
10	Item 9	\$9.00	2	
11	Item 10	\$7.00	5	
12	Total			

Fig.5: Dragging the formula

	A	B	C	D
1	Item	Price	Quantity	Total
2	Item 1	\$2.00	4	\$8.00
3	Item 2	\$4.00	2	\$8.00
4	Item 3	\$6.00	1	\$6.00
5	Item 4	\$3.00		\$0.00
6	Item 5	\$2.00	5	=B6*C6
7	Item 6	\$8.00	3	\$24.00
8	Item 7	\$2.00	3	
9	Item 8	\$1.00	6	
10	Item 9	\$9.00	2	
11	Item 10	\$7.00	5	
12	Total			

Fig.6: Calculation of the value in each cell

# FORMULAS

## Absolute Cell References

- It is represented by the dollar sign (\$).
- $\$A\$1$  (F4): The column and the row do not change when copied
- $A\$1$ : The row does not change when copied
- $\$A1$ : The column does not change when copied



	A	B	C	D	E
1	Sales Tax				7.50%
2	Item	Price	Quantity	Total	Tax
3	Item 1	\$2.00	4	\$8.00	$=(B3*C3)*\$E\$1$
4	Item 2	\$4.00	2	\$8.00	
5	Item 3	\$6.00	1	\$6.00	
6	Item 4	\$3.00		\$0.00	
7	Item 5	\$2.00	5	\$10.00	
8	Item 6	\$8.00	3	\$24.00	
9	Item 7	\$2.00	3	\$6.00	
10	Item 8	\$1.00	6	\$6.00	
11	Item 9	\$9.00	2	\$18.00	
12	Item 10	\$7.00	5	\$35.00	
13	Total				

Click and hold the fill handle to drag the formula into the cells below

Fig.7: Absolute reference

# FUNCTIONS



## How to enter a function

- A function is a predefined formula that performs calculations using specific values in a particular order.
- In Excel you can use functions in order to quickly find the sum (SUM), average (AVERAGE), count (COUNT), minimum value (MIN) and maximum value (MAX) for a range of cells.
- Each function has one or more arguments. Multiple arguments are divided by a comma.
- Some of the most common functions used are:
  - SUM (A1,C3)
  - AVERAGE (A1:A3)
  - COUNT (argument)
  - MIN/MAX (argument)

	A	B	C	D	E	F
1	34		65		6	
2	21		23			
3	56					
4						
5	=SUM(A1:A3,C1:C2,E1)					
6						

Fig.7: Example of multiple arguments



# WHAT-IF ANALYSIS

## GOAL SEEK (RICERCA OBIETTIVO)



- You may use “Goal seek” to find the input value that produces a known result.

Click on Data Tab

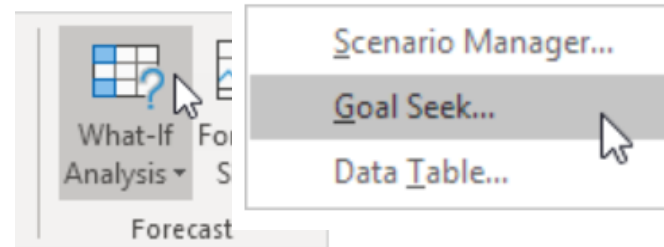


Fig.8: Goal seek on the Data tab

- For example, use “Goal seek” to find the quantity that you must sell of the fourth product in order to have 20000 euro of revenue.

	A	B	C	D
1	<b>Product</b>	<b>Price</b>	<b>Quantity</b>	
2	1	2,00 €	1117	2.234 €
3	2	2,00 €	2002	4.004 €
4	3	1,00 €	1478	1.478 €
5	4	5,00 €	1765	8.825 €
6				
7			REVENUE	16.541 €

Ricerca obiettivo

Imposta la cella:

Al valore:

Cambiando la cella:

OK      Annulla

	A	B	C	D
1	<b>Product</b>	<b>Price</b>	<b>Quantity</b>	
2	1	2,00 €	1117	2.234 €
3	2	2,00 €	2002	4.004 €
4	3	1,00 €	1478	1.478 €
5	4	5,00 €	2457	12.284 €
6				
7			REVENUE	20.000 €

Fig.9: «Goal Seek» example



# WHAT-IF ANALYSIS

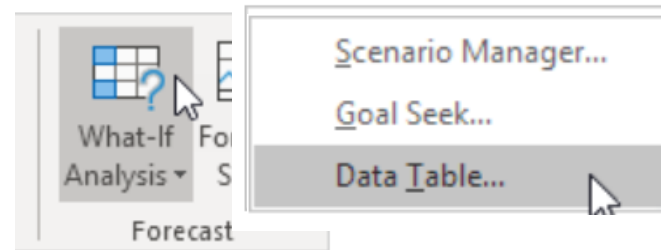
## DATA TABLE (TABELLA DATI)

- You may use “Data table” to create a data table to try out different values for formulas.
- For example, use “Data Table” to calculate the total profit if you sell at the lower price different % of products.

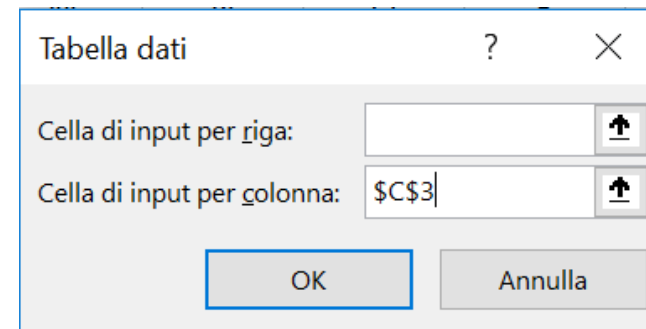
Step 1: Selecting the range in which you have to calculate the total profit with different %

	A	B	C	D	E
1	Total number of		% sold for the lower		
2	products		price		
3	1000		20%		
4					
5			Number of products	Price	
6	Lower price		200	0,60 €	
7	Highest price		800	3,00 €	
8					
9			Total Profit	2.520 €	
10					
11			2.520 €		
12		20%			
13		30%			
14		40%			
15		50%			
16		60%			
17		70%			
18		80%			
19		90%			
20		100%			

Step 2: Click on Data Tab:



Step 3: Select the cell which the % refer to



	A	B	C	D	E
1	Total number of		% sold for the lower		
2	products		price		
3	1000		20%		
4					
5			Number of products	Price	
6	Lower price		200	0,60 €	
7	Highest price		800	3,00 €	
8					
9			Total Profit	2.520 €	
10					
11			2.520 €		
12		20%	2520		
13		30%	2280		
14		40%	2040		
15		50%	1800		
16		60%	1560		
17		70%	1320		
18		80%	1080		
19		90%	840		
20		100%	600		

Fig.10: «Data Table» example

# SAVING

## How to save a workbook

1. Select the Save command on the Quick Access Toolbar.
2. If you're saving the file for the first time, the Save As pane will appear in Backstage view.
3. Choose where to save the file and give it a file name.
4. Click Save. The workbook will be saved.
5. Now, you can click the Save command again to save your changes as you modify the workbook.

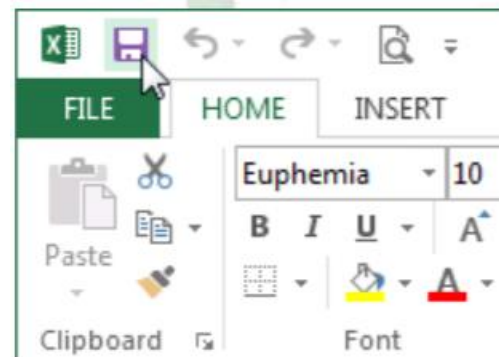


Fig.11: Selecting the save command

# FURTHER MATERIAL

To review and deepen the topics of this lecture



1. <https://www.youtube.com/watch?v=3o110ILgYDo&list=PLIKpQrBME6xLYoubjOqowzcCCd0ivQVLY&index=10&t=0s>
2. <https://www.youtube.com/watch?v=oSNuRasYI60&list=PLIKpQrBME6xLYoubjOqowzcCCd0ivQVLY&index=5>
3. <https://www.youtube.com/watch?v=JI0Qk63z2ZY&list=PLIKpQrBME6xLYoubjOqowzcCCd0ivQVLY&index=18>
4. <https://www.youtube.com/watch?v=OhnkuBVTcg8>
5. <https://www.youtube.com/watch?v=y7S9ecg1wdQ>
6. Alexander, M., Kusleika, R., & Walkenbach, J. (2018). Excel 2019 Bible. John Wiley & Sons.