
Lezione 16

UTILIZZO DEL SOFTWARE

MINITAB

SOMMARIO

- ❏ **ESPLORAZIONE DI UNA FUNZIONE DI MINITAB**
- ❏ **VISUALIZZAZIONE DELL'HELP**
- ❏ **IDENTIFICAZIONE ED APERTURA DI UN
WORKSHEET DI INTERESSE**
- ❏ **SCHEMA DI REALIZZAZIONE DELL'ELABORATO**
- ❏ **FUNZIONI DI RIFERIMENTO PER L'ELABORATO**

ESPLORAZIONE DI UNA FUNZIONE: “CUSUM”

The screenshot displays the Minitab software interface. The 'Stat' menu is open, and the 'Control Charts' sub-menu is selected. Within the 'Control Charts' sub-menu, the 'CUSUM...' option is highlighted. The main window shows a worksheet with columns C1 through C16 and rows 1 through 8. The status bar at the bottom indicates the current task: 'Draw a cumulative sum control chart'.

MINITAB - Untitled

File Edit Manip Calc Stat Graph Editor Window Help

Session

22/11

Welcome to Minitab

Worksheet 1 ***

	C1	C2	C3	C4	C8	C9	C10	C11	C12	C13	C14	C15	C16
1													
2													
3													
4													
5													
6													
7													
8													

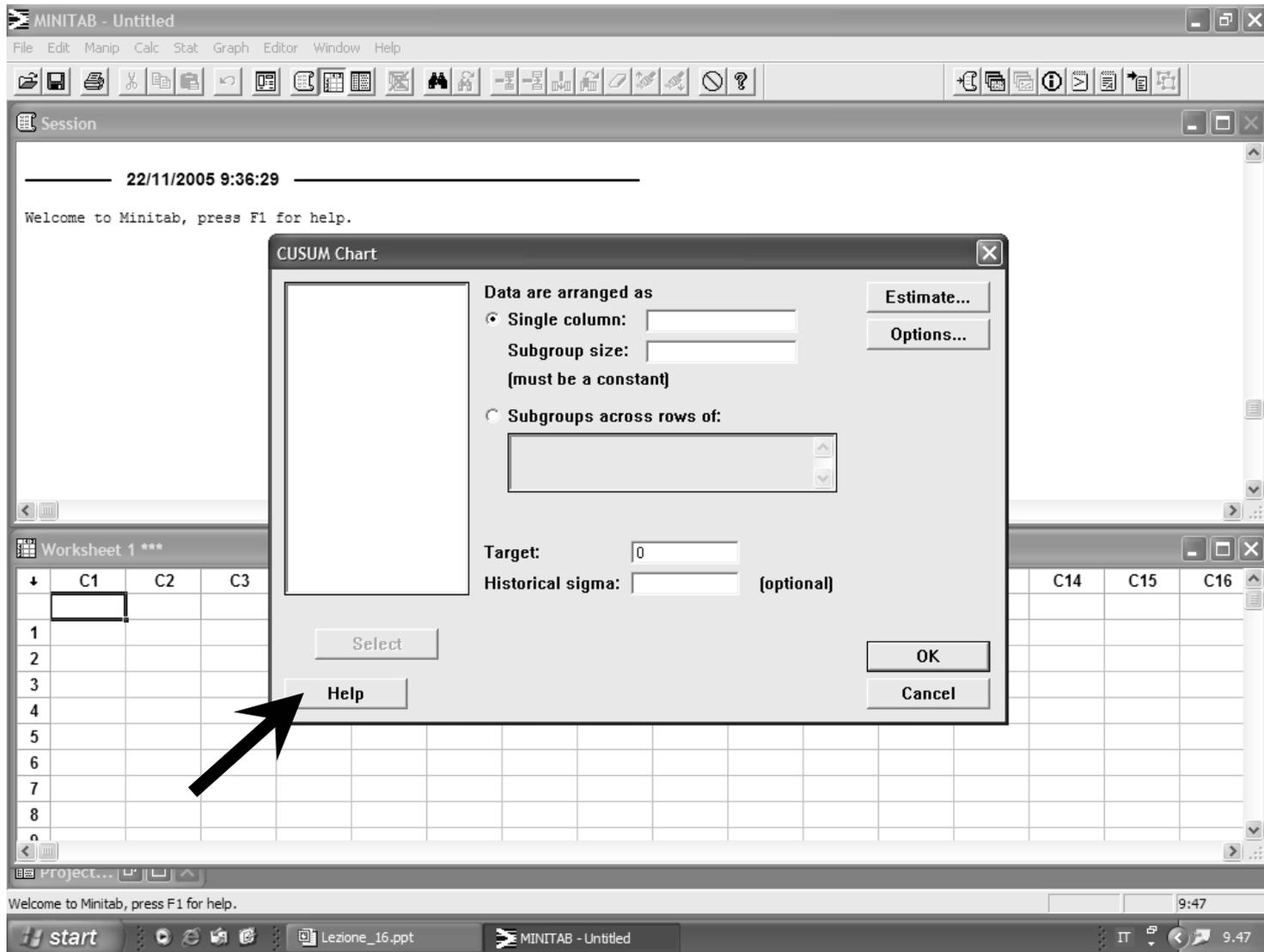
Project...

Draw a cumulative sum control chart

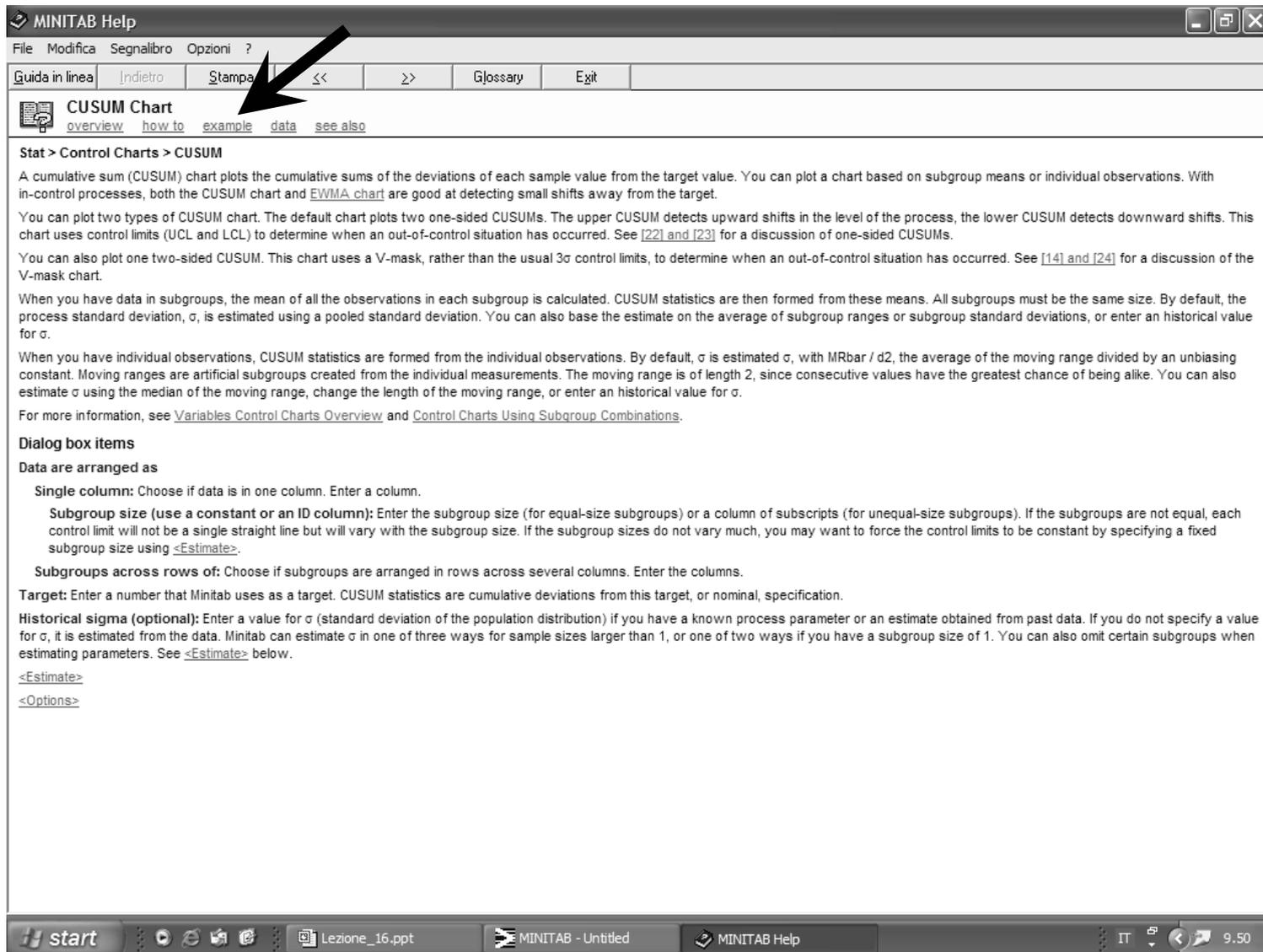
9:43

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FINESTRA DI DIALOGO DELLA FUNZIONE “CUSUM”



HELP DELLA FUNZIONE “CUSUM”



MINITAB Help

File Modifica Segnalibro Opzioni ?

Guida in linea [Indietro](#) [Stampa](#) << >> [Glossary](#) [Exit](#)

CUSUM Chart

[overview](#) [how to](#) [example](#) [data](#) [see also](#)

Stat > Control Charts > CUSUM

A cumulative sum (CUSUM) chart plots the cumulative sums of the deviations of each sample value from the target value. You can plot a chart based on subgroup means or individual observations. With in-control processes, both the CUSUM chart and [EWMA chart](#) are good at detecting small shifts away from the target.

You can plot two types of CUSUM chart. The default chart plots two one-sided CUSUMs. The upper CUSUM detects upward shifts in the level of the process, the lower CUSUM detects downward shifts. This chart uses control limits (UCL and LCL) to determine when an out-of-control situation has occurred. See [\[22\]](#) and [\[23\]](#) for a discussion of one-sided CUSUMs.

You can also plot one two-sided CUSUM. This chart uses a V-mask, rather than the usual 3σ control limits, to determine when an out-of-control situation has occurred. See [\[14\]](#) and [\[24\]](#) for a discussion of the V-mask chart.

When you have data in subgroups, the mean of all the observations in each subgroup is calculated. CUSUM statistics are then formed from these means. All subgroups must be the same size. By default, the process standard deviation, σ , is estimated using a pooled standard deviation. You can also base the estimate on the average of subgroup ranges or subgroup standard deviations, or enter an historical value for σ .

When you have individual observations, CUSUM statistics are formed from the individual observations. By default, σ is estimated σ , with $MR\bar{r} / d_2$, the average of the moving range divided by an unbiasing constant. Moving ranges are artificial subgroups created from the individual measurements. The moving range is of length 2, since consecutive values have the greatest chance of being alike. You can also estimate σ using the median of the moving range, change the length of the moving range, or enter an historical value for σ .

For more information, see [Variables Control Charts Overview](#) and [Control Charts Using Subgroup Combinations](#).

Dialog box items

Data are arranged as

Single column: Choose if data is in one column. Enter a column.

Subgroup size (use a constant or an ID column): Enter the subgroup size (for equal-size subgroups) or a column of subscripts (for unequal-size subgroups). If the subgroups are not equal, each control limit will not be a single straight line but will vary with the subgroup size. If the subgroup sizes do not vary much, you may want to force the control limits to be constant by specifying a fixed subgroup size using [<Estimate>](#).

Subgroups across rows of: Choose if subgroups are arranged in rows across several columns. Enter the columns.

Target: Enter a number that Minitab uses as a target. CUSUM statistics are cumulative deviations from this target, or nominal, specification.

Historical sigma (optional): Enter a value for σ (standard deviation of the population distribution) if you have a known process parameter or an estimate obtained from past data. If you do not specify a value for σ , it is estimated from the data. Minitab can estimate σ in one of three ways for sample sizes larger than 1, or one of two ways if you have a subgroup size of 1. You can also omit certain subgroups when estimating parameters. See [<Estimate>](#) below.

[<Estimate>](#)

[<Options>](#)

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ESEMPIO DI APPLICAZIONE DELLA FUNZIONE “CUSUM”

MINITAB Help

File Modifica Segnalibro Opzioni ?

Guida in linea Indietro Stampa << >> Glossary Exit

Example of Two One-sided CUSUM Charts

[main topic](#) [interpreting results](#) [session command](#) [see also](#)

Suppose you work at a car assembly plant in a department that assembles engines. In an operating engine, parts of the crankshaft move up and down a certain distance from an ideal baseline position. AtoBDist is the distance (in mm) from the actual (A) position of a point on the crankshaft to the baseline (B) position.

To ensure production quality, you took five measurements each working day, from September 28 through October 15, and then ten per day from the 18th through the 25th. You already drew an [X chart](#) and an [R chart](#) of this data. On the X chart, subgroup 5 failed a test for special causes. Now, to look for small shifts away from the target, you want to plot the CUSUMs.

- 1 Open the worksheet **CRANKSH.MTW**.
- 2 Choose **Stat > Control Charts > CUSUM**.
- 3 In **Single column**, enter AtoBDist. In **Subgroup size**, enter 5. Click OK.

Graph window output

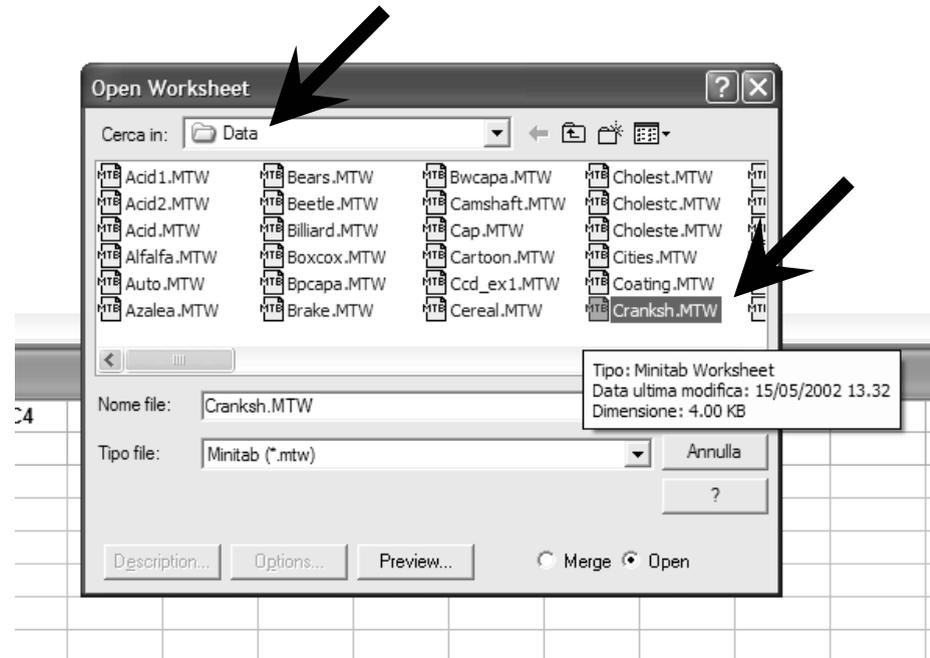
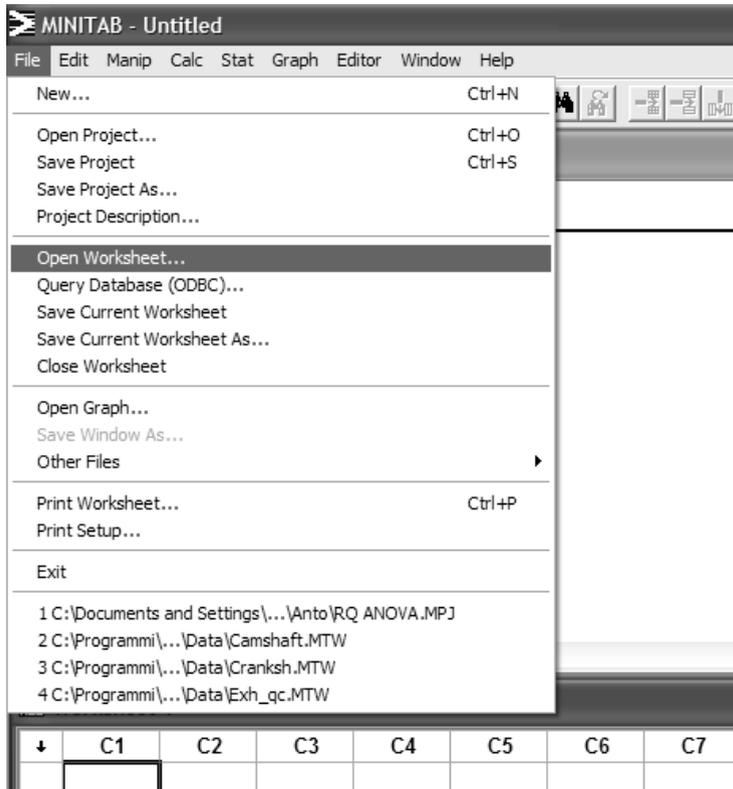
CUSUM Chart for AtoBDist

The chart displays the cumulative sum of deviations from the target for 25 subgroups. The y-axis is labeled 'Cumulative Sum' and ranges from -5 to 10. The x-axis is labeled 'Subgroup Number' and ranges from 0 to 25. Two horizontal lines represent the control limits: an upper CUSUM line at 5.67809 and a lower CUSUM line at -5.67809. The data points, connected by a line, start near zero, rise to a peak of approximately 10 at subgroup 6, then fluctuate around zero for the remainder of the process.

Subgroup Number	Cumulative Sum
1	0.0
2	1.0
3	5.0
4	3.5
5	6.0
6	10.0
7	9.0
8	8.5
9	7.0
10	6.5
11	2.5
12	1.5
13	3.5
14	4.0
15	2.5
16	3.0
17	0.0
18	-1.0
19	-4.0
20	-3.0
21	-1.0
22	2.0
23	0.0
24	-1.0
25	0.0

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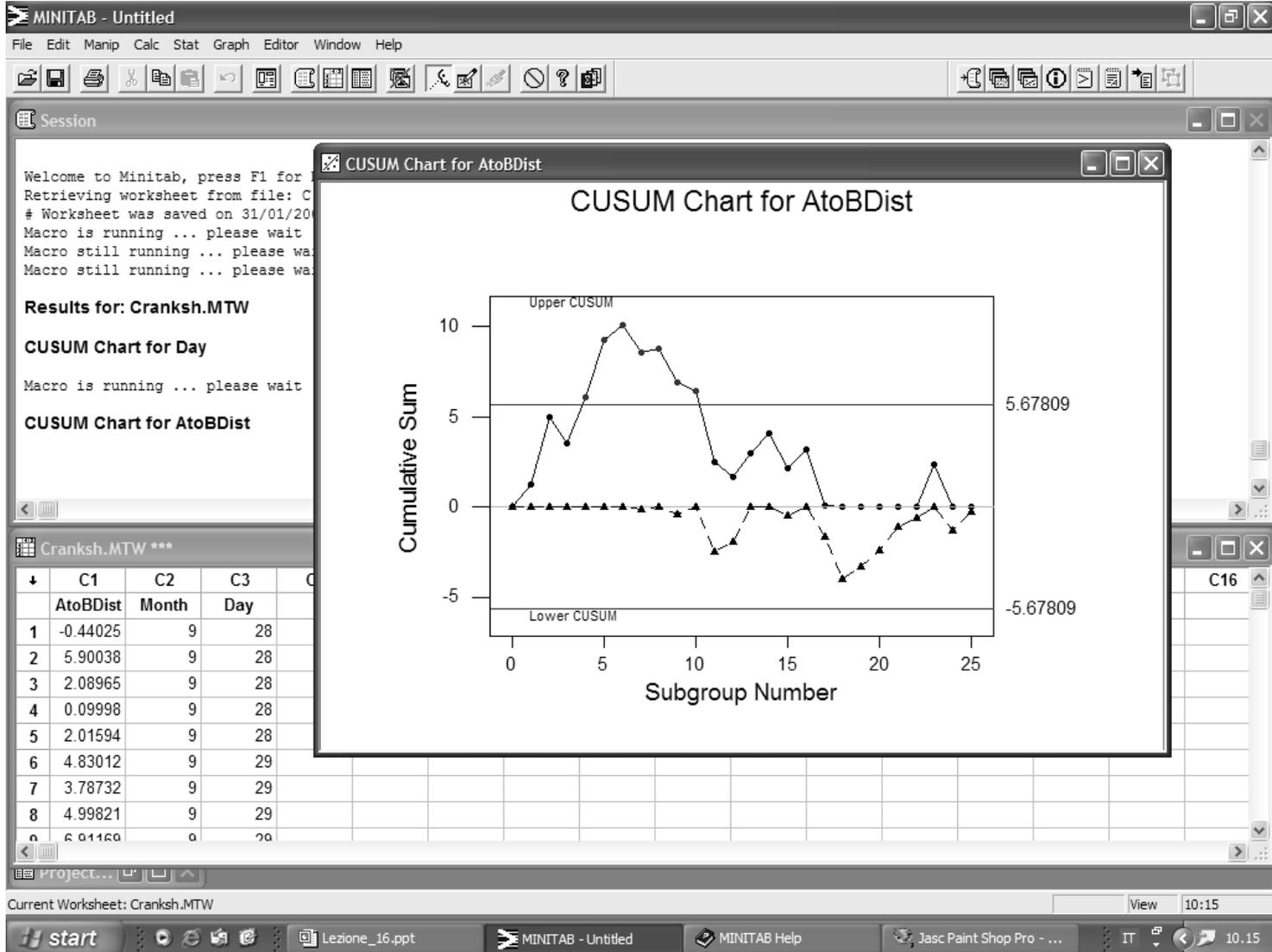
APERTURA DI UN WORKSHEET PER LA FUNZIONE “CUSUM”



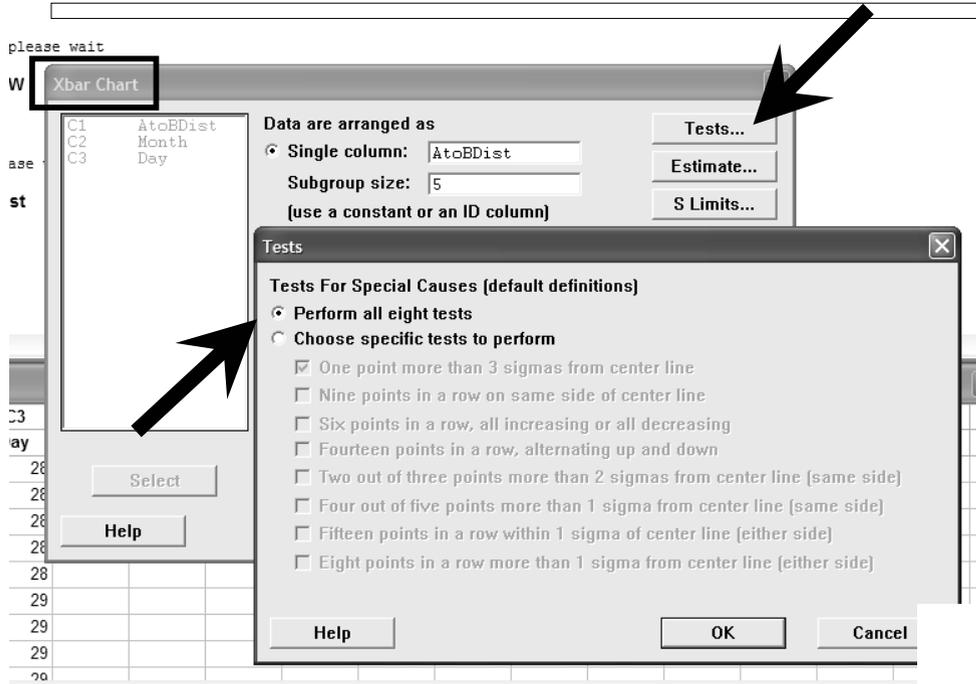
SCHEMA DI REALIZZAZIONE DELL'ELABORATO

- Presentazione del caso studio, a partire dalla traccia dell'help, integrandolo con considerazioni tratte dalle lezioni in aula e dai testi di riferimento
- Analisi del caso studio:
 - applicazione della funzione “esplorata” (esplorandone anche i vari sotto-menu)
 - applicazione di funzioni collegate a quella “esplorata”
 - integrazione con altre procedure statistiche (es. statistica descrittiva)
- Esportare tutto il materiale (output testuale e grafici) relativo all'analisi effettuata in un documento word
- Integrare con commenti, considerazioni, ecc.

APPLICAZIONE DELLA FUNZIONE "CUSUM"



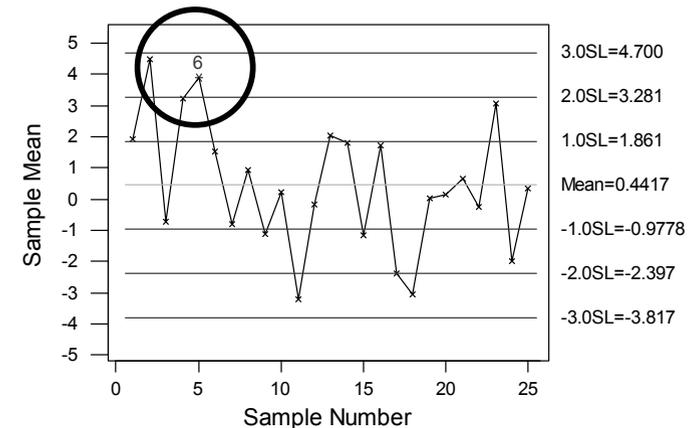
APPLICAZIONE DI UNA FUNZIONE COLLEGATA ALLA "CUSUM"



TEST 6. 4 out of 5 points more than 1 sigma from center line (on one side of CL).

Test Failed at points: 5

X-bar Chart for AtoBDist



FUNZIONI DI RIFERIMENTO PER L'ELABORATO

The image displays three overlapping screenshots of the Minitab software interface, illustrating the 'Stat' menu and its sub-menus. The interface includes a menu bar (Stat, Graph, Editor, Window, Help) and a toolbar with various icons. The main window shows a 'Dist' plot with the text '5 points more than 1 side of CL)' and 'oints: 5'. The 'Stat' menu is open, showing the following sub-menus:

- Basic Statistics
- Regression
- ANOVA
- DOE
- Control Charts
- Quality Tools
- Reliability/Survival
- Multivariate
- Time Series
- Tables
- Nonparametrics
- EDA
- Power and Sample Size

The 'Quality Tools' sub-menu is expanded, showing the following options:

- Define Tests...
- Box-Cox Transformation...
- Xbar-R...
- Xbar-S...
- I-MR...
- I-MR-R/S (Between/Within)...
- Z-MR...
- Xbar...
- R...
- S...
- Individuals...
- Moving Range...
- EWMA...
- Moving Average...
- CUSUM...
- Zone...

The 'ANOVA' sub-menu is expanded, showing the following options:

- One-way...
- One-way (Unstacked)...
- Two-way...
- Analysis of Means...
- Balanced ANOVA...
- General Linear Model...
- Fully Nested ANOVA...
- Balanced MANOVA...
- General MANOVA...
- Test for Equal Variances...
- Interval Plot...
- Main Effects Plot...
- Interactions Plot...

The 'Time Series' sub-menu is expanded, showing the following options:

- Run Chart...
- Pareto Chart...
- Cause-and-Effect...
- Capability Analysis (Normal)...
- Capability Analysis (Between/Within)...
- Capability Analysis (Weibull)...
- Capability Sixpack (Normal)...
- Capability Sixpack (Between/Within)...
- Capability Sixpack (Weibull)...
- Capability Analysis (Binomial)...
- Capability Analysis (Poisson)...
- Gage Run Chart...
- Gage Linearity Study...
- Gage R&R Study (Crossed)...
- Gage R&R Study (Nested)...
- Attribute Gage R&R Study
- Multi-Vari Chart...
- Symmetry Plot...
- Time Series Plot...
- Trend Analysis...
- Decomposition...
- Moving Average...
- Single Exp Smoothing...
- Double Exp Smoothing...
- Winters' Method...
- Differences...
- Lag...
- Autocorrelation...
- Partial Autocorrelation...
- Cross Correlation...
- ARIMA...