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Course ID: S04

DATA ANALYSIS WITH MINITAB

Onsite course: 2-day workshop

1. What is this course about?

The ability to analyse and control performance is an essential requirement for the effective management of processes that deliver value to customers. Process control involves observation, data collection, tabulation, graphical representation and both qualitative and quantitative analysis.

This two-day workshop aims to give participants a solid grounding in data collection, graphing and basic analysis techniques in Minitab. Participants will be introduced to the Minitab statistical software application, and will learn when and where to use analysis techniques in order to aid decision making. It will enable participants to develop standards with regards to data collection, analysis and reporting appropriate for their processes.

2. What will you achieve?

At the end of the course, you will

- Understand data types and the importance of appropriate data collection methods;
- Understand the nature and relevance of descriptive statistics in process performance measurement;
- Understand how to establish and review statistical process control charts for variable and attribute data;
- Be able to define process capability and understand the difference between control and capability;
- Understand when and where each tool is best applied, and
- Be able to use Minitab as an everyday tool in support of data analysis and control.

3. How will you be supported?

During this onsite course, you will

a) be able to listen to and interact with the course tutor and other participants;
b) be able to ask questions and complete in-course quizzes to self-assess your understanding of the topic;
c) be able to download soft copy presentation files, with data sets and case studies, for your own future use.

In addition, Lean Ireland tutors will be available online to answer any data analysis questions that arise after the workshops, as and when required.

4. Workshop agenda

Time	Day 1: Data collection & graphing, descriptive statistics	Day 2: Statistical Process Control & Process Capability Analysis
08.30	• Introductions • Introduction to Minitab, worksheets & displays, data entry and column and cell updating, sorting, Stat & Graph menu features, importing from Excel, changing data types, Minitab Assistant, layout tool, help. • Data types & data collection • Graphing techniques: run, Pareto, box plot & histogram • Layout tool & exporting graphs	• Statistical process control for individuals & samples: ImR, XbarR, c, u, p and np charts • The meaning of control, Nelson's rules for out-of-control conditions
12.45	• Lunch	• Lunch
13.00	• Introduction to descriptive statistics, measures of location – mean mode & median, data sets & interactive exercises • Measures of spread – range, standard deviation & variance • Properties of the normal distribution, Z scores and prediction	• Introduction to process capability analysis (PCA) • Capability indices Cp, Cpk, Pp, Ppk, capability for individuals, capability for samples, Control vs. capability • PCA for non-normal data
16.30	- Review & close	- Review & close

The course is laid out in 2 all day workshops, giving a total of 15 contact hours. The course can be modified or extended to include additional topics listed in the attachment.

5. Who is this course for?

This course is designed for those who need an introduction to data analysis in Minitab. The course is paced to meet the needs of beginner to intermediate data analysis practitioners. Typical participants include supervisors, line leads, project managers, financial accountants, supply chain analysts, process engineers and laboratory quality analysts.

6. Where can you find out more?

Please contact Bernie Rushe at Lean Ireland,

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Data Analysis with Minitab: topic menu

Topic	Content
Minitab	Introduction to Minitab, worksheets & displays, data entry and column and cell updating, sorting, Stat & Graph menu features, importing from Excel, changing data types, Minitab Assistant, layout tool, help.
Data collection & graphing	Data types, data collection and recording, run charts, Pareto charts, histograms & box plots, data sets & interactive exercises, comprehension quiz, assignment.
Descriptive statistics 1: location	Measures of location – mean mode & median, graphical summary information, application in case study, data sets & interactive exercises, graphing location, Layout tool & exporting graphs, comprehension quiz, assignment.
Descriptive statistics 2: variation	Measures of spread – range, standard deviation & variance, graphical summary information, application in case study, data sets & interactive exercises, graphing spread, comprehension quiz, assignment.
Properties of the normal distribution	Graphical summary information, properties of the normal distribution, Z table, Z scores & prediction, normality test & sample size, probability plot and P value, data sets & interactive exercises, probability distribution plots in Minitab, central limit theorem and sampling distributions, comprehension quiz, assignment.
SPC for variable data	Control charts for individuals & samples – ImR, XbarR & XbarS, identifying out of control, testing for control in Minitab, data sets & interactive exercises, calculating limits, control chart selection, control and capability, comprehension quiz, assignment.
SPC for attribute data	Control charts for attribute data – c, u, np & p, identifying out of control, testing for control in Minitab, data sets & interactive exercises, calculating limits, control chart selection, control and capability, comprehension quiz, assignment.
Measurement systems analysis	Measurement definitions & challenges with measurement systems, designing a variable data Gauge R&R exercise in Excel or Minitab, repeatability & reproducibility, interpreting graphs and statistics, % contribution, % tolerance, distinct measurement categories (DMC) precision vs. accuracy, bias, linearity, Gauge R&R with attribute data, assignment.
Correlation & regression	Scatter plots and simple linear regression, the regression equation $y = mx + c$, measuring the strength of the relationship – R^2 value, the residuals patterns, data sets & interactive exercises, confidence intervals, correlation, causation & prediction, comprehension quiz, assignment.

Topic	Content
Multiple regression	Review of simple linear regression equation, P values and R^2 value, fitting the regression model, identifying significance, the regression equation, the residuals patterns, data sets & interactive exercises, correcting for lack of fit & non-linear analysis, assignment.
Analysis of Variance 1: one way ANOVA	Sample collection guidelines, testing for equal variances, simple graphical analysis of means & variation, one way ANOVA, ANOVA calculations and results in Minitab, ANOVA calculations from first principles: within & between variation, data sets & interactive exercises, residuals, power report & Tukey analysis, comprehension quiz, assignment.
ANOVA 2: balanced ANOVA	Data sampling plan, crossed & nested, testing for equal variances, the experimental matrix, balanced ANOVA, interpreting Minitab results, ANOVA graphs – main effects & interaction, pairwise comparison of means, general linear model, MANOVA, comprehension quiz, assignment.
Hypothesis testing for means	Null and alternative hypothesis, Type I & type II errors, significance & confidence levels, Student's t table & the t distribution, tTest for comparing two sample means, data sets & interactive exercises, testing against a reference value & testing difference, comprehension quiz, assignment
Hypothesis testing for variance	Null and alternative hypothesis, Type I & type II errors, significance & confidence levels, Chi square distribution, single variance comparison, F distribution, 2 variance comparison, data sets & interactive exercises, comprehension quiz, assignment.
Hypothesis testing for proportions	Null and alternative hypothesis, Type I & type II errors, significance & confidence levels, the z table and the normal distribution, 1 proportion test, 2 proportion test, data sets & interactive exercises, comprehension quiz, assignment.
Confidence intervals	Descriptive statistics for location & variation (revision test), probability in statistics, confidence intervals, prediction intervals, power & sample size, data sets & interactive exercises, comprehension quiz, assignment.
Process capability analysis (PCA)	Capability & control, capability indices Cp & Cpk for normal data, capability for individuals, capability for samples, data sets & interactive exercises, capability indices Pp & Ppk, capability and sigma levels, comprehension quiz, PCA for non-normal data, assignment.