



# Statistics in Practice

## **WHY APPLIED STATISTICS?**

After years of neglect in industry, statistics is finally being recognized as one of the cornerstones of “good decision making”. The statistical analysis and validation of results is no longer merely encouraged but demanded; this is the case both for conclusions from the analytical lab as for research results. This course is intended for anyone who wants to retrieve the information from statistical numbers and graphs so easily produced by software.

## **COURSE SET-UP**

During the first two days all basic statistical concepts and techniques are treated, which will guide the participants through a correct statistical analysis of their results, originating from experiments or other sources. The third day expands the statistical toolbox with such methods as two-way ANOVA, nested designs for the identification of the most important sources of variation (e.g. for an R&D study), polynomial regression and the analysis of contingency tables. Theory will alternate with hands-on computer exercises.

## **COURSE OBJECTIVE**

As a result of this course, participants will acquire a good insight into statistics and they will be able to choose an appropriate technique and interpret the results correctly.

## **INTENDED AUDIENCE AND PRIOR KNOWLEDGE**

This course is intended for anyone who wants to acquire a solid background in statistical thinking and master the application of it to questions that arise in every day’s work. Although theoretical details are skipped whenever possible, it is still about statistics. And although no prior knowledge is required, some affinity for numbers is a definite plus.

## **PRACTICAL**

Each course day will be held from 8.30 am to about 5 pm. The course dates and fees are listed on the application form. The course fee includes handouts and lunches.

To apply, send us back the application form, or apply on-line, at least 20 days before the start of the course .



## COURSE CONTENTS

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### Module 1 (2 days)

- Descriptive statistics
  - Graphical techniques: scatter plots, histogram, dotplot, boxplot, normal probability plot
  - Descriptive statistics: means, median, variance, IQR, ...
  - Describing the similarity between variables: covariance & correlation
  - Autocorrelation
- Good data collection practice
  - Sampling strategies
  - Paired comparisons
- Dealing with random variables (probability distributions)
  - Properties of distributions of random variables
  - Distributions for discrete and continuous variables: Binomial, Poisson, normal distribution, Weibull, ...
- Functions of random variables: the z-distribution,  $\chi^2$ , t and the F-distribution
- Confidence intervals for means, difference in means, variances, proportions, capability indices, ...
- Hypothesis testing
  - Hypothesis testing with confidence intervals
  - Classical hypothesis testing
  - Statistical significant versus practical relevant
  - Type I and Type II errors
  - Power and sample size calculations
- One-way ANOVA
- Simple Linear Regression

### Module 2 (1 day)

- Two-way ANOVA
- Random effects and nested ANOVA – Variance Components Analysis (R&R study)
- Polynomial Regression
- Cross-tabulation / Contingency tables: Chi-square and Fisher's exact test

### Some cases & applications:

Detecting and proving a change in a process / Quantifying and judging the difference between two products or systems / Deciding on the equivalence of analysis methods / Setting a specification taking the customers' measurement error into account / Calculating the effect of variation in addition and adjustment of a component on the process performance / Calculating the number of data needed to detect a certain improvement / Investigating the effect of different types of constituents on the product properties / Identifying the major source of variation / Investigating the effect of a process parameter on a characteristic