Qi *statistics*

Quality Insight
Quality Decisions

Contents

Overview and Company Profile

Qi Statistics Ltd is a leading UK provider of Statistical Consultancy and Training in Product Manufacturing and Consumer Research, supporting companies worldwide in data analytics and making data-driven decisions.

We have over 20 years' experience of Training and Consultancy in the following areas:
- Sensory & Consumer
- Market research
- Manufacturing
- Pharmaceuticals
- Retail
- General Business

Qi is jointly run by Anne Hasted and Gemma Hodgson. Anne is recognised worldwide as an expert in applying statistical methods to sensory and consumer research and has also worked extensively in manufacturing and process improvement, with over 30 years' experience. Gemma has worked as a statistician, trainer and consultant for over 20 years across a wide variety of projects working extensively in manufacturing and process improvement and began her career in the pharmaceutical industry at Pfizer. Anne and Gemma lead a group of highly experienced statisticians, each with specialist skills, who have worked with multinational companies across many industries and applications. Uniquely, they are able to take complex statistical methods and concepts and interpret them into understandable terminology for clients.

We regularly attend and contribute to papers and conferences, often in collaboration with our clients. Through our interaction with academic and commercial professionals we also ensure we are proficient and up-to-date with the most recent advances in statistical methods and data analytics.

In addition to our Training, Consultancy and Analysis services, Qi markets a variety of in house software for sensory and consumer research;
- **SenPAQ© for analysis of sensory panel data,**
- **TurfPAQ (TURF Calculator)**
- **Design Express for generating presentation orders for consumer test designs.**

We also develop bespoke software for preference mapping/product optimisation and automated reporting.

We jointly develop and market EyeOpenR® in partnership with Logic8.

What Qi can offer to your business

"Data analytics", "data science" and "big data" are becoming the buzz-words of the decade and more data is being collected than ever before. But is everyone able to keep up with what to do with it once it's collected?

If your business collects data and you're not sure whether you are getting the maximum benefit from it, talk to us. We will help you decide whether you are collecting appropriate data to meet your business needs and, if you are, whether you would benefit from one of our services.

Consultancy and Analysis

Qi offers general statistics consultancy and support at all levels. As every client has different needs, our support will always be tailored to your requirements and experience offering a flexible service which changes as your needs change.

Examples include:
- Expert review of your analysis procedures
- Advice on which method suits your problem best
- Impartial advice on choosing software
- Experience and use of many stats software packages including: SAS®, JMP®, XLSTAT®, R, SIMCA, MINITAB®, Design Expert, etc.

There are three main levels of consultancy service available:

1. The provision of extra resource/experience as a full package solution –design your study, analyse and report your data
2. Skills development – we can design your trial or analyse your data and then show you how it was done so that you are fully engaged in its conduct and the outputs
3. Analysis Masterclass – we work with you and take you through step by step of the analysis, giving you the confidence to do it independently next time

We can provide extra resource or expertise tailor made for your project
- Helping meet objectives efficiently and innovatively through advice at an early stage
- Designing your experiment for optimal efficiency
- Survey and Sample Design
- Sample Size Calculations
- Analysis of data ("big" or otherwise!)
- Interpretation of Statistical Results

Statistical Software

Options for purchase directly from Qi via our website:

This is specialist statistical software (written by our skilled Qi Statisticians), designed to be user-friendly and quick to use, primarily aimed at Sensory and Consumer scientists. A demo version can be viewed or downloaded directly from our website at http://www.qistatistics.co.uk/software and then a license key can be purchased from us once you decide you want the full version.

• SenPAQ©
• Design Express
• TurfPAQ
• OptiPAQ (available soon)

Software we jointly offer with Logic8:

• EyeOpenR® for sensory and consumer data analysis.

This is a joint project started several years ago and now fully up and running. Logic8 provide the interface and software support and hosting and Qi provide the statistical analysis code behind the scenes through the use of R-macros and coding functionality. The software is aimed at beginner to intermediate sensory and consumer data scientists/statisticians, but can be customized for more expert analyses.

EyeOpenR® is a user-friendly web-based data analysis tool that can be purchased as part of the EyeQuestion data collection tool or as a standalone software to use with other data formats. A demo version can be provided before you buy. Some of the most up to date and not widely available sensory and consumer analysis techniques are now available and easy to run in EyeOpenR®.

Bespoke software:

To reduce costs and time for repetitive work we can develop automated Excel macros, JMP® scripts, R macros and SAS® or R routines to automatically analyse your data and generate the report in your company format, e.g. as a Microsoft Office based product.

If you are not sure yet what analysis methods these are, or what you need for your data, then talk to us and we can help you decide!

For those who already know what they want, our software currently covers the

• Simple descriptive statistics + graphics
• Analysis of Variance (ANOVA)
• Principal Component Analysis (PCA)
• Canonical Variates Analysis (CVA)
• Partial Least Squares (PLS)
• Multidimensional Scaling (MDS)
• Penalty Analyses (for JAR and CATA data)
• Internal/External Preference Mapping

• Cluster Analysis
• Multiple Factor Analysis (MFA)
• Flash Profiling Analysis
• Free Sorting Analysis
• Analysis of ranking data
• Analysis of Check-All-that-apply data (CATA)
• Napping®
• Panel Performance
• Temporal Dominance of Sensations (TDS)

Training

We pride ourselves on our approach to Training. Our emphasis is always on the application of the statistical techniques rather than the underlying mathematics.

Our training is designed to be "user friendly", with experience gained and enhanced through workshops that provide plenty of hands on excercises using industry pertinent data. The focus is on applying the correct statistical methods and being able to intercept and explain the outputs.

We offer a broad range of face-to-face or webinar style courses built around any appropriate statistical package which you license. These can be customised to your data and directed to your particular needs These could be:

- General public courses (organised directly by Qi Statistics or in collaboration with other partners)
- 1-1 Knowledge/Skill Transfer & in-House Training for groups of 2-25 resulting in courses that are:
  - customised to your requirements and budget
  - delivered at the right level
  - taught using your software (if applicable)
  - delivered with practical analysis workshops with annotated solutions using your data if possible
  - tailoring exercises to be business relevant

Basic Statistics Training
Course Program
(Non-software based)
Duration 0.5 – 1 day (SEN1-0)

Pre-requisite
No prior knowledge of statistics is required.

Course Summary
Most basic level – aim is to enable participants to understand statistics reports/presentations, and interpret what they see correctly to make informed decisions, rather than carry out analysis themselves.

Software
(Non-software based)

Flexibility
This usually runs for 0.5-1 day, but duration of the course will be based on level of current experience of all participants.

Course Content
- Visualisations to Aid Understanding
- Summary Measures (Averages - Mean/Median/Mode)
- Describing Variation (Standard Deviation & Standard Error)
- Presenting Results (Confidence Intervals)
- Formal Testing (T-Test, Significance of Test (p value))
- Making Comparisons (Analysis of Variance)
- Visualisations for presentation and explanation

Analysis of Sensory data using SenPAQ©
Duration Half-day (SEN1-1)

Pre-requisite

No previous knowledge of SenPAQ© is assumed. This course would be ideal for new users of SenPAQ©, those who are thinking of purchasing, or existing user who require a refresher.

Course Summary

This short course covers the basics of how to use SenPAQ© to perform popular techniques for analysing sensory and consumer data, and then understanding and interpreting the output.

Software

You will be able to download a free demo version of SenPAQ© from our website for use for the duration of the course. After the course the full version can be bought at a discounted price if the training has been attended.

Flexibility

This course can also be offered remotely as a webinar.

Course Content

Topics covered will be as follows:
- ANOVA
- Comparison of means
- Panel performance
- Principal components analysis
- Canonical variates analysis

Maximising the value of your data using EyeOpenR®
Duration: 1 day (SEN1-2)

Pre-requisite

A basic awareness of how statistics is used is assumed, however we do go back to the beginning and there will be plenty of reminders of statistical concepts along the way. This course also serves as a useful refresher to those who previously studied statistics or who have used these techniques with other software and would like to find out how EyeOpenR® works compared to other packages.

Course Summary

This course covers the easy to use features in the recently launched new EyeOpenR® software for investigating, visualising and performing common statistical techniques on data sets typical to sensory research plus other applications.

Software

Participants will gain experience using the software through illustrative examples with data from a variety of sensory tests. In this way the course ensures that statistical concepts are understood in a non-mathematical way and then practiced using real data examples.

Flexibility

This course can be customized for those who have specific sensory/consumer data analysis needs.

Course Content

Basic concepts need to be learned before statistics can be used to full potential to give useful and informative answers. By keeping mathematical details to a necessary minimum we can focus on the concepts and interpretation of the statistical results from EyeOpenR®. We aim to explain the objectives of the techniques and to send you away with a better understanding of which technique to use when and how to run these in the EyeOpenR® software package.

There will be plenty of opportunity for practice using EyeOpenR® through "hands-on exercises" for which annotated solutions will be provided.

Course Outline

- Introduction to EyeOpenR®
- Statistics Inference – Visualisations, Estimation & ANOVA for Sensory
- Panel Performance
- Discrimination Tests
- Multivariate data – Correlation & Association
- Principal Components Analysis (PCA)
- Analysis of 'Rapid Methods' data

Statistics for Sensory Analysis
Duration 3 days (SEN1-3)

Pre-requisite
Only the most basic statistical knowledge is assumed.

Course Summary
We offer training in three one day modules, any one of these can be run on its own or combined with the other modules into a two or three day training course. Each module covers key statistical techniques used in the analysis of data collected by sensory panels. Emphasis is placed on the interpretation of the statistical tests and mathematical details are kept to a minimum. The training is suitable for sensory scientists, or for those involved in the interpretation of sensory data.

Software
As part of the training package we supply a free copy of SenPAQ©, our own software for analysing sensory profile data, for each delegate. The training also requires a general statistical software package. We can advise on appropriate software packages.

Flexibility
We can customise the module content to meet specific requirements.

Course Content

Module 1 Analysis of Sensory Panel Data (one scale variable at a time)

Fundamentals
- Precision of a mean – standard error and confidence interval
- Panel noise variation – interaction v panellist repeatability
- Comparison of means – t test
- Comparison of variability – F test

Analysis of Variance
- How it works
- Interpretation
- Comparison tests and LSD's
- Assumptions – which of my sensory variables will not give valid test results?
- How to deal with these problem attributes

Methods of assessing panel performance
- Three key measures: repeatability, discrimination and consistency

Module 2 Analysis of Sensory Panel Data (using many scale variables together)

Introduction to multivariate data
- Multivariate Data displays
- Correlation

Principal Component Analysis (PCA)
- How many underlying sensory dimensions are there in my profile?
- Producing product maps using PCA
- Interpreting the map

Canonical Discriminant Analysis
- Visualising product differences relative to panel variation

Cluster Analysis
- Grouping products using sensory similarities

Generalised Procrustes Analysis
- Overlaying data matrices to form a consensus map
- Applications to panel perfomance and free choice profiling

Module 3 Linking Sensory and Consumer Liking Data, Consumer Sensory Measures

Simple Regression Modelling
- Predicting liking from key sensory variables, identifying key drivers
- Principal Component Regression

Partial Least Squares Regression
- How it works, applications

Sorting and Napping Tasks
- Analysing data from free sorting tasks
- Napping methods and analysis using Multiple Factor Analysis

Introduction to Statistics using R
Duration 2 days (SEN1-4)

Pre-requisite
No previous experience in R is required.

Course Summary
This course aims to familiarize you with the R environment, and will give you freedom in running statistical analyses in R.

During the first day, an introduction to R (both as a software and a programming language) is given. You will be assisted in your first steps in R, by learning how to import/export data, play with datasets (extracting a value, a row, a column, etc.), load and use packages, run your first analyses, do your first graphics, etc.

On the second day, you will be introduced to classical statistical analyses (such as ANOVA, regressions, etc.) and to programming by automatizing some analyses. You will be then introduced to major analyses you might be interested in, and you will be practicing your analyses skills.

These modules are meant to be very practical, hence will be presented through real situation examples. The aim of this training is to give you tips and tools to be able to run it yourself within your company.

Software
Users will need to have R installed on their computer **(R is a free software and can be downloaded from http://cran.r-project.org/).**

Flexibility
For in-house courses, we can customise the module contents of day 2 to meet specific requirements.

Course Content

- Introduction to R
- Import/Export dataset
- Basic actions on the dataset
  - Summary
  - Notion of objects
  - Notion of value/vector/matrix/list
  - Transforming numerical variables to factors
- Using the help
- Introduction to packages
  - Installing packages
  - Loading and using package.

Day 1 part II: More advanced topics

- Handling missing data
- First calculations
  - Mean
  - Standard deviation
  - Range
  - Etc.
- Introduction to simple graphics

Day 2 part I: Programming

- Scale data:
  - Correlation
  - t-test
  - ANOVA/regression (including prediction)
  - Post'hoc test
- Categorical/Nominal data:
  - Frequency tables
  - Chi-squared test
  - Cochran test
- Automatisation of the analyses
  - Adding loops to perform multiple analyses (ANOVA on many attributes)

Day 2 part II: Practical session – Sensory analysis focussed

- Introduction to particular packages (sensR, FactoMineR, SensoMineR)
- Provide a list of analyses (Panel performance, discrimination tests, PCA, MFA, preference mapping, etc.)
- Application using real-life data.

Statistics for Consumer Research
Duration 1-3 days (CON2-0)

Pre-requisite
Only the most basic statistical knowledge is assumed.

Course Summary
We offer training in three, one day modules, any one of these can be run on its own or combined with the other modules into a two or three day training course. Each module covers key statistical techniques used in the analysis of data collected in consumer research studies to compare products or brands. Emphasis is placed on the interpretation of the statistical tests and mathematical details are kept to a minimum. The training is suitable for both market researchers and consumer scientists working on product evaluation and optimisation.

Software
We base the training around a suitable statistical software package. We recommend XLSTAT®, JMP® or EyeOpenR® but can advise on appropriateness of other software packages.

Flexibility
We can customise module content to specific requirements.

Course Content

Module 1 Analysis of Consumer Data – testing for differences

Testing for differences in response between products
- Precision of a mean – standard error and confidence interval
- Analysis of Variance of hedonic scale data
  - How it works
  - Interpretation
  - Multiple Comparison tests and LSD's
- Power and sample size
- Non parametric methods for analysing scale data
- Analysis of binary scale data (Paired preference CATA)

Penalty Analysis
- Measuring effects of attribute variables and their impact on acceptability

Module 2 Multivariate methods

Introduction to multivariate data
- Multivariate Data displays
- Correlation

Principal Component Analysis (PCA)
- Producing product maps using PCA
- Interpreting the map
- Cluster Analysis
  - Identifying groups of consumers with different preferences.
  - Demographic profiling and cluster validation
  - Internal preference mapping techniques for cluster visualisation

Correspondence Analysis
- Visualising brand attribute associations
- Interpreting cluster solutions

Module 3 Linking Sensory and Consumer Liking Data, Consumer Sensory Measures

Simple Regression Modelling
- Predicting liking from key sensory variables, identifying key drivers
- Principal Component Regression

Preference Mapping
- External and Internal mapping methods to link liking and product characteristics (sensory or analytic)
- Comparison of methods
- Identifying an "optimum" product and predicting its product characteristics

Introduction to Bayesian Network Analysis for Market and Consumer Research
Duration 1 day (CON2-1)

Pre-requisite
A knowledge of basic statistical concepts and methods is assumed.

Course Summary
This one-day workshop gives an introduction to Bayesian Networks and their application to data from consumer and market research.

Software
We deliver the training using an evaluation copy of HUGIN Explorer Software.

Flexibility
We can customize the module content to meet specific requirements.

Course Content
- Introduction – Bayesian probability models
- Automatic learning algorithms
- Statistical aspects – measures of fit
- Applications to consumer data
  - Clustering variables
  - identifying drivers of liking
- Cross Validation
- Hands on exercises using the HUGIN explorer data
- Comparisons with traditional preference modelling techniques

Experimental Design for Product Reformulation, Optimisation and Preference Modelling

Duration - dependant on modules selected (1-3 days) (CON2-2)

Pre-requisite
A knowledge of basic statistics is recommended before attempting this course.

Course Summary
This course provides hands-on training in experimental design (DoE) for researchers and new product developers who need to understand how product components work together to influence consumers and to optimise performance characteristics. Directed towards the analysis of data from consumer and sensory trials, we cover the application of classical design techniques to preference mapping and liking optimisation.

Software
A statistics package with DOE functionality is required to take part in the workshops and put into practice the techniques discussed. We recommend Design Expert, JMP® or MINITAB® but can advise on suitability of other software packages.

Flexibility
We can customise the module content to meet specific requirements.

Course Content

Module 1 Exploring Ingredient and Process Functionality using DoE Introduction

- Introduction to Experimental design, why is it so important? What are the advantages of the approach.
- Contexts for use, product data, sensory data, consumer responses.
- Factorial designs and Analysis, statistical assessment of effects, interpretation of interactions,
- Model selection techniques

Module 2
Designing Experiments For Data Collection Using Sensory Panels And Consumer Tests.

- How to set up and analyse experiment to allow for measurement uncertainties inherent in sensory and consumer data

Power
- Investigating the power of my experimental design

Exploring Process Functionality using Fractional designs
- What if we want to investigate lots of factors but can't afford a full experiment?
- Introduction to fractional designs-benefits and risks of these approaches
- Exercises in generating fractional process designs
- Analysis of fractional designs

- Response Surface designs aims and applications
- Exercises in generating optimisation designs
- Analysis and display of models for optimising consumer response.
- Contour plots, response surface plots
- Presentation and decision making, optimising for both cost and quality
- Optimisation– desirability measures and interpretation

Module 4 D Optimality

- D-Optimality concepts
- Generating a design to a fixed sample size.
- Evaluating the design

Mixture Designs
- Introduction to simple mixture designs , designing within mixture constraints

Module 5 Further Topics

I can't control my factors – what can I do?
- Identifying factors in multivariate data
- Principal Components with rotation.
- Taking the factors into design software and analysing as an experimental design

Consumer Test Applications
- Using D-Optimal designs to select an optimal subset of products from the sensory profile for consumer testing
- Designing the product test and designing the consumer test

External Preference Mapping
- Modelling consumer responses based on sensory product data to identify the optimal product. Preference mapping in multiple dimensions

Now I've found the optimal product – how do I make it?
- How to predict properties of the most desired product

Conjoint Analysis
- Applications of experimental design to concept testing: motivations and purpose.
- Conjoint analysis jargon
- Applications and example

Market Research Statistical Toolkit
Duration 2 days (MAR3-0)

Pre-requisite
Only basic statistics knowledge is assumed – mean, standard deviation, simple hypothesis testing.

Course Summary
This training covers techniques widely used in market research. Focus is on interpretation of the analyses.

Software
The course is offered in XLSTAT or JMP.

Flexibility
We can customise the module content to meet specific requirements.

Course Topics
- Basic Stats Refresher. Testing for difference in means and proportions, interpretation of significance, confidence intervals. Correlation and causation.
- Factor analysis to aggregate attitudinal questions
- Cluster analysis to find groups of respondents with same attitudes
- Conjoint Methods – aims, designs, analysis and interpretation
- Best-Worst Scaling – aims, conduct, analysis and interpretation
- TURF Analysis – methodology, applications, interpretation

Making Sense of Multivariate Data Multivariate Methods for Market Research
Duration - dependent on modules selected (usually 1-3 days) (MAR3-1)

Pre-requisite
Only basic statistical knowledge is assumed – e.g. means, variability, t-test

Course Summary
This training explains the purpose of each technique, how to interpret the significance testing and the data structures required. We illustrate the use of the techniques using case studies.

Software
Access to a general statistics package is required to take part in the course workshops and have a go yourselves at analyzing some data to fully understand how to apply the methods. We recommend XLSTAT® or JMP® but can also advise on the appropriateness of other software packages. Usually free demo versions can be used for the training if the software is not already available, so no purchases are necessary.

Flexibility
We can build a customised training programme to suit the needs of the client in terms of both the software being used and the application areas. We build the training programme from the following list of options after discussion between the client and the trainer.

Course Topics
- Analysis of Variance
- Principal Component Analysis (PCA)
- Factor Analysis
- Correspondence Analysis
- Multiple Factor Analysis (MFA)
- Multidimensional Scaling
- Clustering Techniques
- Conjoint Methods
- Generalised Procrustes Analysis(GPA)
- Canonical Variates Analysis (CVA)
- Multiple Regression
- CHAID / Logistic Regression
- Partial Least Squares (PLS)
- Structural Equation Modelling/Path PLS

Basic Statistics Training Course Program (Non-software based)
Duration 0.5 – 1 day (MAN4-0)

Pre-requisite
No prior knowledge of statistics is required

Course Summary
Most basic level – aim is to enable participants to understand statistics reports/presentations, and interpret what they see correctly to make informed decisions, with the ability to ask the right questions, rather than routinely carry out analysis themselves.

Software
(Non-software based)

Flexibility
Duration of the course will be based on level of current experience of all participants.

Course Content
- Visualisations to Aid Understanding
- Summary Measures (Averages - Mean/Median/Mode)
- Describing Variation (Standard Deviation & Standard Error)
- Presenting Results (Confidence Intervals)
- Formal Testing (T-Test, Significance of Test (p value))
- Making Comparisons (Analysis of Variance)
- Visualisations for presentation and explanation

Experimental Design for Process Development and Improvement
Duration 2 days (MAN4-1)

Pre-requisite
Knowledge of basic statistical methods (t-test, ANOVA, regression and correlation) will be assumed.

Course Summary
The aim of the course is to introduce attendees to the benefits of statistical experimental design. To use statistical software to both design and analyse experiments. To understand and interpret the graphical and statistical outputs. To enable attendees to develop a programme of experimentation from screening key variables to process optimisation.

Software
Access to a general statistics package is required to take part in the course workshops and have a go yourselves at analyzing some data to fully understand how to apply the course content. We recommend MINITAB® but can also advise on the appropriateness of other software packages such as Design Expert, XLSTAT®, JMP® etc.

Usually free demo versions can be used for the training if the software is not already available, so no purchases are necessary.

Flexibility
We can customise the course content to meet specific requirements. This course can also be offered as a series of 6 webinar modules, each of 2 hours in length.

Course content
- Statistical modeling refresher
- Factorial experiments – benefits, design issues, interpretation of effects and importance of understanding interactions
- Screening design – to deal with many factors, fractional factorials benefits and dangers
- Optimisation experiments – Experimental designs for process optimization: Box-Behnken, central composite and other options
- Optimisation, identification of viable operating regions when there are many output parameters Mixture design.

Process Capability Workshop
Duration: 1 day (MAN4-2)

Pre-requisite
No previous statistics training is required

Course Summary
We offer this training to enable the understanding of statistical process capability measures (Cp, Cpk, etc) and to interpret capability analysis outputs. Through this course you will better understand the assumptions made in the analysis and how to deal with data that does not meet these assumptions. We will address the question of how much data is required to assess process capability reliably. The course is suitable for anyone wanting to better understand the impact of their data on their manufacturing processes, to improve production levels, decrease costs, improve precision and overall improve the efficiency of their processes.

Software
Access to a general statistics package is required to take part in the course workshops and have a go yourselves at analyzing some data to fully understand how to apply the course content. We recommend MINITAB® but can also advise on the appropriateness of other software packages such as XLSTAT®, JMP® etc.
Usually free demo versions can be used for the training if the software is not already available, so no purchases are necessary.

Flexibility
We can customise the module content to meet specific requirements.

Course Content
- Statistics refresher
- Process Capability
- Design of Capability studies –sample size
- Non Normal Data
- What to do if process not capable
- Identifying assignable sources of variation

Making Data do the Work:
Essential and Advanced Statistics for Manufacturing R&D (Hands on course using MINITAB® following six sigma best practice)
Duration: 3 days (MAN4-3)

This series of courses covers the statistical techniques for investigating, performing and interpreting common statistical techniques on data sets typical to manufacturing. There are many basic concepts that need to be understood before statistics can be used to its full potential to give useful and informative answers to the business and there are also many ways statistics can be taught and learnt! This course aims to break the myth that statistics is 'boring' or 'too tricky' and show you how it actually could save you time and improve your working day!

Pre-requisite
No previous knowledge is required for Day 1 and once Day 1 is completed, participants will be ready to take on either of the other 2 day courses. If day 1 is not attended, a basic awareness of how statistics is used is assumed, together with an understanding of the topics covered on the day 1 course. However there will be plenty of reminders of statistical concepts given along the way throughout both of the 2 day courses.

Course Summary

The course ensures that statistical concepts are understood in a non-technical way and then applied using real data examples and relevant software. The software of choice for the course will be MINITAB®.

We aim to explain the objectives of the techniques and to send you away with a better understanding of which technique to use when and how to run these in the MINITAB® software package.

Mathematical details are kept to a necessary minimum and where used are thoroughly and non-technically explained. The focus is on the interpretation of the outputs from MINITAB® and illustrated with examples using data from a variety of manufacturing scenarios. There is plenty of opportunity for practice using MINITAB® through "hands on exercises" for which annotated solutions are provided.

Software

MINITAB®

Flexibility

There are several possible options for attending this course, either as day 1 alone (1 day in total), either of the 2 day courses alone (2 days in total), or day 1 plus one of the 2 day options (3 days in total).

More details in the individual aspects of the course are given below, however if you would like more information or to discuss customizing examples with your typical data please contact us.

Course content

Day 1: Fundamental Statistical Concepts and Analysis Methods (optional)

THEN EITHER

Days 2&3 (Option 1): Assessing Quality – Process Control, Capability & Measurement Systems Analysis

OR
Days 2&3 (Option 2): Experimental Design for Process Development and Improvement

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Day 2&3 (Option 1): Assessing Quality – Process Control, Capability & Measurement Systems Analysis

Training Objectives:
• To understand how to investigate if processes are on track (monitoring), showing a trend or just subject to a lot of random variation
• To introduce attendees how to assess the quality of their processes and outputs using accepted statistical techniques (the course covers all the topics suggested in the statistical section of the six sigma green belt training)
• To use statistical software to both design and analyse efficient and capable processes
• To understand and interpret the graphical and statistical outputs provided by the software

Topics Covered:
• Statistical Process Control
• Objectives & Aims
• Control charts

• Statistical Process Capability
• Measures of capability (Cp, Cpk)
• Potential vs Actual Capability
• Design of capability studies
• Non-normal capability
• Gage R&R

Day 2 &3 (Option 2): Experimental Design for Process Development and Improvement

Training Objectives:
• To introduce attendees to the benefits of statistical experimental design
• To use statistical software to both design and analyse experiments
• To understand and interpret the graphical and statistical outputs
• To enable attendees to develop a programme of experimentation from screening key variables to process optimisation

Topics Covered:
• Statistical modelling refresher
• Factorial experiments - benefits, design issues, interpretation of effects and importance of understanding interactions
• Screening designs - how to deal with many factors, fractional factorials benefits and dangers
• Optimisation experiments - Experimental designs for process optimisation: Box-Behnken, central composite and other options.
• Optimisation, identification of viable operating regions when there are many output parameters
• Mixture designs

Statistic Fundamentals for Research & Industry Using Statistical Software
Duration 2 days (MAN4-4)

Pre-requisite

No previous knowledge of statistics or the software package is necessary with this course, as we start right from the beginning. It also serves as a useful refresher course to those who once studied statistics as part of a college course.

Course Summary

This basic but wide-ranging course covers the easy to use features in statistical software for investigating, visualising and performing basic statistical techniques on data sets typical to research and industry settings. There are many basic concepts that need to be understood before statistics can be used to its full potential to give useful and informative answers. This course ensures that these concepts are understood in a non-technical way and then practiced using real data examples.

Mathematical details are kept to a necessary minimum and we focus on the interpretation of the outputs from software and illustrate applications with case studies using data from surveys, instrumental analysis, manufacturing processes, clinical trials and biological data. We aim to explain the objectives of the techniques and to send you away with a better understanding of which technique to use when.

Software

There is plenty of opportunity for practice using software through "hands on exercises" for which annotated solutions are provided. The right software package for your company will be recommended and discussed as part of initial discussions. We typically recommend MINITAB®, XLSTAT® or JMP®'.

Flexibility

We can customise the module content to meet specific requirements. We can also reduce the content to run as a 1 day course.

Course Content

Day 1 Back to the beginning – Refresh the absolute basics of statistics
- Types of data
- Summary Measures
- What is variability?

How sure are we? - Assessing Variability
- Data Visualisation
- Frequency Distributions
- Measures of Variability
- Degrees of Freedom
- Descriptive Statistics

The answer could be…? - Estimation
- Estimation
- Confidence Intervals
- Presenting Results
- Data Requirements

Which is better? - Making Statistical Comparisons
- Testing against a target (T Tests)
- General Hypothesis tests
- Comparison of 2 samples (means and variance) inc ANOVA
- Problems with statistical significance and p-values

Day 2 Analysis of Binary (Yes/No)Data
- Estimating Response Rates with uncertainty
- Testing for significance

Power & Sample Size
- How big a sample do I need to meet my objectives?
- What is statistical power?
- Statistical performance v practical considerations
- Power & Sample Size

Correlation & Simple Regression
- Correlation – what is measures
- Simple trend modelling – assessment of fit
- Diagnostics

Multiple Regression & Further Modelling
- Variable selection techniques
- Pitfalls for the unwary
- Modelling curvature

Study Design
- Issues to consider

Getting More out of Data
Basic Statistics Using EXCEL
Duration 2 days (BUS5-0)

Pre-requisite
No previous statistics knowledge is required

Course Summary
We start by explaining basic statistical summary measures and their interpretation. We will show you how to use EXCEL Pivot tables to cross tabulate data and also how to display data graphically and interpret the graphs. We then investigate relationships between performance measures and show you how to investigate data trends.

Software
Microsoft Excel

Flexibility
We can customise the module content to meet specific requirements.

Course content
- Data Display – histograms, pareto charts, statistical distributions
- Summary Statistics
  - measures of average mean, median
  - measures of variation range, standard deviation
  - key linkage between the two measures
  - Percentiles
- EXCEL Pivot tables
- Assessing individual data values, outliers
- Investigating relationships between variables - correlation
- Simple Trend Analysis
- Decision making based on samples –sampling uncertainty, standard errors and confidence intervals
- Testing for difference in measured responses
- Testing for difference in response rates
- How large a sample do I need? Concept of power

Modeling Trends and Forecasting for Business Analysis
Duration 1 day (BUS5-1)

Pre-requisite
Some knowledge of basic statistical concepts is assumed (mean, standard deviation, significance testing). This is offered in one of our other courses for Business customers (see associated flyer).

Course Summary
We offer training in one day to provide an understanding of statistical regression methods, simple forecasting methods and their application.

Software
A statistical software package with some time series forecasting is required (XLSTAT®, MINITAB®, JMP®, etc.).

Flexibility
We can customise the module content to meet specific requirements.

Course Content
• Linear Regression – how it works, assumptions and limitations
• Applications to sales forecasting with seasonal effects, importance of checking assumptions
• Introduction to time series modelling
  • Forecasting techniques
  • Smoothing techniques
  • ARIMA models

Statistics Fundamentals for Research & Industry Using Statistical Software
Duration 2 days (RND6-0)

Pre-requisite

No previous knowledge of statistics is necessary with this course, as we start right from the beginning. It also serves as a useful refresher course to those who once studied statistics as part of a college course.

Course Summary

This basic but wide-ranging course covers the easy to use features in statistical software for investigating, visualising and performing basic statistical techniques on data sets typical to research and industry settings. There are many basic concepts that need to be understood before statistics can be used to its full potential to give useful and informative answers. This course ensures that these concepts are understood in a non-technical way and then practiced using real data examples.

Mathematical details are kept to a necessary minimum and we focus on the interpretation of the outputs from software and illustrate applications with case studies using data from surveys, instrumental analysis, manufacturing processes, clinical trials and biological data. We aim to explain the objectives of the techniques and to send you away with a better understanding of which technique to use when.

Software

There is plenty of opportunity for practice using statistical software through "hands on exercises" for which annotated solutions are provided. We can recommend appropriate software packages.

Flexibility

We can customise the module content to meet specific requirements. This can also be reduced to run as a 1 day course.

Course Content

Day 1 Back to the beginning – Refresh the absolute basics of statistics
- Types of data
- Summary Measures
- What is variability?

How sure are we? - Assessing Variability
- Data Visualisation
- Frequency Distributions
- Measures of Variability
- Degrees of Freedom
- Descriptive Statistics

The answer could be…? - Estimation
- Estimation
- Confidence Intervals
- Presenting Results
- Data Requirements

Which is better? - Making Statistical Comparisons
- Testing against a target (T Tests)
- General Hypothesis tests
- Comparison of 2 samples (means and variance) inc ANOVA
- Problems with statistical significance and p-values

Day 2 Analysis of Binary (Yes/No)Data
- Estimating Response Rates with uncertainty
- Testing for significance

Power & Sample Size
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Experimental Design for Process Development and Improvement
Duration 2 days (RND6-1)

Pre-requisite
Knowledge of basic statistical methods (t-test, ANOVA, regression and correlation) will be assumed.

Course Summary
The aim of the course is to introduce attendees to the benefits of statistical experimental design and to use statistical software to both design and analyse experiments. Following the course, attendees will be better able to under-stand and interpret the graphical and statistical outputs as well as develop a programme of experimentation from screening key variables to process optimism. The course includes a hands on practical using the 'Statapult' to get participants fully engaged with how design issues can affect results.

Software
Access to a general statistics package is required to take part in the course workshops and have a go yourselves at analyzing some data to fully understand how to apply the course content. We recommend MINITAB® but can also advise on the appropriateness of other software packages such as Design Expert, XLSTAT®, JMP® etc.
Usually free demo versions can be used for the training if the software is not already available, so no purchases are necessary.

Flexibility
We can customise the module content to meet specific requirements.

Course content
- Statistical modeling refresher
- Factorial experiments – benefits, design issues, interpretation of effects and importance of understanding interactions
- Screening design – to deal with many factors, fractional factorials benefits and dangers
- Optimisation experiments – Experimental designs for process optimization: Box-Behnken, central composite and other options
- Optimisation - identification of viable operating regions when there are many output parameters
- Mixture designs

Process Capability Workshop
Duration 1 day (RND6-2)

Pre-requisite
No previous statistics training is required

Course Summary
We offer this training to enable the understanding of statistical process capability measures (Cp, Cpk, etc) and to interpret capability analysis outputs. Through this course you will better understand the assumptions made in the analysis and how to deal with data that does not meet these assumptions. We will address the question of how much data is required to assess process capability reliably. The course is suitable for anyone wanting to better understand the impact of their data on their R&D processes, to improve production levels, decrease costs, improve precision and overall improve the efficiency of their processes.

Software
Access to a general statistics package is required to take part in the course workshops and have a go yourselves at analyzing some data to fully understand how to apply the course content. We recommend MINITAB® but can also advise on the appropriateness of other software packages such as XLSTAT®, JMP® etc.

Usually free demo versions can be used for the training if the software is not already available, so no purchases are necessary.

Flexibility
We can customise the module content to meet specific requirements.

Course Content
• Statistics Introduction/refresher
• Process Capability
• Design of Capability studies –sample size
• Non Normal Data
• What to do if process not capable?
• Identifying Assignable sources of variation

For further information and pricing regarding any courses in this brochure please contact:

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