

POWER CALCULATIONS AND SAMPLE SIZE ESTIMATION

This course is intended for people who conduct hypothesis testing and who wish to master the concepts of alpha risk, beta risk, test power and required sample sizes. Beyond the statistical tools used, the course will define the best experimental design practices.

Emphasis will be placed on finding the optimal sample size in order to compare means or proportions.

Throughout the course, the following underlying question will be essential:

"When I want to compare populations, how many (what n) values should I sample to ensure a statistical conclusion of acceptable quality?"

This is a step that precedes statistical processing and is often overlooked, which can lead to erroneous conclusions in the statistical approach to comparisons.

If, at the end of a hypothesis test, I cannot conclude that there is a difference between the means of two samples, is it because there is actually no difference, is it because the sample I have selected is not representative of the population or is the sample size just not optimal for me to detect it?

As specified earlier, during this course, we will focus on solving the issues caused by the last reason: finding the optimal sample size in order to test a hypothesis.

Duration: 7 hours (1 day)

Location: The course is available in-person at your premises or online via videoconference.

Price (excluding VAT) :

- Inter-company online training : n/a
- Intra-company online training : \$1900,00 per training
- Intra-company on site training : \$1900,00 per training + trainer's travel expenses

Trainee profiles:

- Technicians – Employees – Executives – Researchers – Students
- Anyone wishing to master the issues of test sizing (alpha risk, beta risk, power of a test, required sample size...) applied to comparison of means and proportions

Required experience:

- It is essential that participants have a good knowledge of basic statistical concepts:
 - Descriptive data analysis
 - Confidence intervals
 - General hypothesis testing procedures (H_0/H_1 , p-value)
 - Student Tests

Training objectives

- Review the constraints related to experimentation (objectives to be achieved, cost, statistical quality, etc.)
- Convert a business problem into an experimental problem and a statistical problem
- Define the general approach to designing an experiment
- Define the relationships between the risks of a hypothesis test: alpha risk, beta risk and test power
- Control the impact of alpha risk and sample size on the quality of an estimation of a mean or proportion
- Design a test (i.e., calibrate the number of subjects needed)
- Calculate the power associated with a test as a function of n to compare means, proportions, variances

Training syllabus

- **General information on experimentation as it relates to the design**
 - Main goals while setting up an experiment:
 - Determine the trials to be carried out
 - Determine the number of repetitions required
 - Organize the trials taking into account the experimental constraints
 - Ensuring a relevant level of statistical quality
 - Constraints : Cost constraints, Logistical constraints, Quality requirements for statistical analysis
 - Control of the risks associated with experimental practice: Risk of pure experimental error, Statistical risk due to sampling error (alpha, beta risks)
 - Measurement error: Repeatability error, Reproducibility error
 - Best sampling practices: Consequences of sampling on statistical conclusions, Consequences of sampling on decisions (relevant and erroneous)
- **Review of the tools needed for hypothesis testing and power calculations**
 - Descriptive data analysis: Measures of position, Measures of dispersion, Graphical tools
 - Individual value distributions: Normality
 - Difference between standard deviation and SEM
 - Confidence intervals: Of a mean, Of a standard deviation, Of a proportion
 - General approach to hypothesis testing:
 - H0/H1 and real-life applications
 - P-value
 - Alpha risk
 - Decision making and risk rating

- Statistically significant effect

- **Impact of alpha risk and sample size on confidence intervals**
 - Link between the alpha risk and the range of a confidence interval
 - Link between the sample size and the estimation quality of a statistical parameter
 - Explanation of the confidence interval: Of a mean, Of a standard deviation, Of a proportion

- **Power of a test**
 - Definitions of beta risk and test power
 - Relationship between alpha risk, beta risk and power of a test
 - Relationship between test power and detectable (or detected) delta
 - Graphical illustrations of the different relationships (alpha, beta, delta, standard deviation, n)
 - The aim depending on context: Calculate the n, Calculate the power, Calculate the effect

- **Applications and implementation**
 - Designing a Student-type comparison test of 2 means
 - Designing an ANOVA-type, k-means comparison test
 - Designing a comparison of proportions test such as Chi-square, or Fisher's exact

Training organization

Arkesys teaching team:

- **Thierry Anthouard** is the head of the Arkesys Group's statistical training program and has always been passionate about the field of statistics. In 1992, he launched the development of the Arkesys Group's statistics training program. His "by example" pedagogical approach allows him to popularize statistics and to make it accessible to all learners. As a consultant supporting of key accounts, he adapts to all types of contexts and learning issues.
- **Jérôme-Philippe Garsi** is a statistical instructor with 13 years of experience in the training field. Since his doctorate on clinical issues, his work is mainly focused on the interest of populations, their health and well-being. At ease with any audience, he makes pedagogy and the simplification of scientific knowledge a priority. To do so, he always takes the greatest care to be clear in his written documents as well as in his oral presentations.

Teaching techniques:

- Theoretical explanations followed by guided practice and autonomous learning
- Additional support documents are posted online after the course
- Supplemental exercises can be loaded onto a USB key

Follow-up: evaluating training participation and results

- Attendance sheets
- Review and evaluation exercises

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- Evaluation at the end of the course
- Certificate of completion of the course

Accessibility for disabled people:

People with disabilities who wish to take this course can contact us directly so we can examine together the best way to proceed.

Amount of time the course materials will be available before it starts: 2 weeks

Online training: The link to the virtual classroom will be sent by email the week before the course starts.

Contact: For further information you can contact us by email at: training@xlstat.com or by phone at (646) 412 3348.