UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Metodi Statistici per l'Amministrazione delle Imprese - 1

2223-2-E1802M119-T1

Learning objectives

Students will be prepared to locate proper statistical techniques to support decision-making in business. Students will learn how to manage uncertainty in business and how to strive for quality improvement in production, by using suitable data-processing tools. Students will develop a critical approach when dealing with data processed by third parties, focussing on the fulfillment of the underlying assumptions. Moreover, students will develop the ability to communicate the outcomes of data processing, even to people without any statistical knowledge. Finally, students will learn how to understand other statistical techniques, not covered in this course, which might be dealt with for study or work.

Contents

First, the course aims at providing suitable knowledge of probability and of statistical techniques for sample data, especially those concerning economic phenomena and business. Moreover, statistical techniques to monitor and to improve the quality of manufacturing processes will be studied.

Detailed program

Events and probability. Random experiments, basic combinatorial calculus, assignment of probabilities. Basic rules of probability. Probability of the complement of an event, union of events, intersection of events. Conditional probability. Product rule. Independent events. Bayes theorem. Discrete random variables. Probability functions. Expectation. Variance. Discrete uniform distribution. Binomial distribution. Poisson distribution. Hypergeometric distribution. Continuous random variables. Continuous uniform distribution. Normal distribution. Normal approximation to the binomial distribution.

Sampling and sampling distributions. Finite and infinite populations. Parameters and statistics. Simple random sampling and other schemes of sampling. Point estimation. Estimators and their properties. Estimators and sampling distributions. Sample mean. Sample proportion. Interval estimation. Confidence intervals, margin of error, confidence level. Confidence intervals for the population mean: known and unknown variance. Determination of the sample size. Confidence intervals for a proportion. Hypothesis testing. Null and alternative hypothesis. Type I and type II errors. Significance level of a test. Critical-value approach and p-value approach. One-sided and two-sided tests. Relationship between two-sided tests and confidence intervals. Tests on the population mean: known and unknown variance. Tests on a proportion. Tests and confidence intervals for the difference of two means: paired and independent samples. Tests and confidence intervals for the difference of two proportions. Chi-squared test: goodness-of-fit test and test of independence. Linear regression model. Assumptions of the model. Least squares method. Goodness-of-fit. Standard error of the estimate. Confidence intervals and tests for the parameters of the model. Forecasting. Graphical analysis of residuals.

Control charts. Choice of the control limits. Choice of the sample size and of the sample frequency. ARL, average run length and ATS, average time to signal. Interpreting a control chart. Control charts for the mean (x-bar charts) and for the range (R charts). Charts for the proportion and for the number of non-conforming items (p charts and np charts). Choice of the sample size in p charts. Charts for the number of non-conformities and for the mean number of non-conformities (c charts and u charts). Process capability. Process capability ratio. Capability indices for not centered processes.

Prerequisites

Basic statistics. Descriptive statistics. Basic mathematics.

Teaching methods

Frontal lessons (theory and examples). Practical sessions (exercises).

Assessment methods

The exam has a written test, containing both exercises and questions about theory, approximately in proportions of 70% and 30%. The written test is organized into exercises composed by questions, each graded as 2 to 4 points. The total score is 31 (corresponding to full mark cum laude). The written test lasts 120 minutes. Examples of written tests, with solutions, can be found on the e-learning.

Students with a grade of at least 18/30 in the written test can ask for a supplementary oral, which may raise or lower the former mark. The oral deals with the whole program.

A single date for exam-papers showing is set, where students can ask for details about corrections and criteria used to grade. On this occasion, students declare if they want to do the supplementary oral. Presence to exam-papers showing is compulsory as, when a definite decision about the final mark cannot be taken, the teacher can make the oral mandatory.

Textbooks and Reading Materials

D. Anderson, D. Sweeney, T. Williams "Statistica per le analisi economico-aziendali", 2010, Apogeo Education – Maggioli Editore.

D. C. Montgomery "Controllo Statistico della Qualità (seconda edizione)", 2006, McGraw-Hill

Reference to the textbooks is crucial to attend lessons and practical sessions. Additional materials are provided by the e-learning website.

Semester

Second semester.

Teaching language

Italian.

Sustainable Development Goals