UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Experimental Plans for Marketing

2627-2-F7704M013-F7704M013-2

Learning objectives

The course covers experimental designs, with particular emphasis on their practical application through case studies related to business contexts. The aim is to introduce statistical models for analysing the relationship between a quantitative variable and one or more qualitative variables, with particular attention to parameter estimation and interpretation.

At the end of the course, students will have acquired the following competencies:

Knowledge and understanding
Students will acquire knowledge of the main experimental designs and statistical models used to analyse the relationship between a quantitative variable and one or more qualitative variables, understanding their underlying principles, parameter estimation methods, and interpretation.

Applying knowledge and understanding
Students will be able to apply the statistical models covered in the course to practical problems, with particular reference to case studies in business contexts, and to correctly interpret the results obtained.

Making judgements
Students will be able to critically evaluate the results of statistical analyses and identify the most appropriate way to interpret them within the relevant operational context.

Communication skills
Students will be able to present and interpret the results of statistical analyses using appropriate terminology and to communicate their main implications in relation to the specific applied problem under consideration.

Learning skills
Students will develop the ability to independently use the methodological tools acquired during the course to address statistical analysis problems similar to those examined throughout the course.

Contents

Experimental designs with one or more factors, linear models.

Detailed program

Review of basic statistic: Statistical indicators, random variables, expected value, variance, and their properties. Random variables: normal, Student's t, Chi-square, Fisher's F. Point estimates of the mean and variance. Hypothesis testing for the mean in the case of sampling from a normal distribution. Introduction to R software for solve statistical problems.

Completely randomized single-factor experimental designs: Description of the experimental design and objectives. Specification of the model interpreting the quantitative dependent variable, interpretation of parameters, and assumptions. Hypothesis testing to be performed on model parameters. Estimation and hypothesis testing with known and unknown parameters. Decomposition of total sample deviance into within-group deviance and between-group deviance. Variance estimator based on within-group deviation and variance estimator based on between-group deviation: definitions, expected value, probability distribution. Construction of the test statistic. Balanced and unbalanced design. ANOVA table. p-value. Statistical indicators. Applications.

Completely randomized two-factor experimental designs: Description of the experimental design and objectives. The model interpreting the dependent quantitative variable, interpretation of parameters, assumed hypotheses, and useful graphs for main effects and interaction parameters. Descriptions of hypotheses to be tested. Decomposition of total sample variance: variance due to the first factor, variance due to the second factor, variance due to interaction between the two factors, variance due to error. Construction of the test statistic. ANOVA table. Applications.

Linear model with qualitative variables: Review of the linear model, assumptions underlying it, and parameter estimation. Specification of the model with one quantitative covariate and one qualitative covariate with two levels. Specification of the model with one quantitative covariate and one qualitative covariate with multiple levels. Linear model with interactions between variables and multiple qualitative covariates. Interpretation of the model, hypothesis testing on parameters, and implementation. Applications.

Extension of linear model concepts to generalized linear models: Specification of the model with one quantitative covariate and one qualitative covariate with two levels. Interpretation of the model, and applications.

The applications will be partly carried out with the support of the statistical software R.

Prerequisites

Knwoledge of basic statistics and inference.

Teaching methods

Frontal lectures with presentation of practical examples.

Assessment methods

The exam is in written form. The written exam includes exercises designed to assess the student's ability to apply the concepts studied to solve practical problems and interpret the results obtained to provide practical guidance to operators in the context under consideration.

Textbooks and Reading Materials

Piccolo, D. *Statistica per le decisioni*. Il mulino, terza edizione, 2020.
Optional: Dean, A., Voss, D., Dragulji?, D. *Design and Analysis of Experiments* (Springer Texts in Statistics) 2nd ed. 2017.
Optional: Montgomery, D. C., *Progettazione e analisi degli esperimenti*, 2005.

Semester

Second semester

Teaching language

Italian

Sustainable Development Goals