UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Statistics for Business

2425-3-E3301M159

Learning objectives

The objective of the course is to provide students with a solid preparation regarding the most used statistical techniques for quality control from a business perspective.
The student will acquire the ability to identify and apply the appropriate statistical techniques for the description of the quality characteristics of the goods produced.
Furthermore, as regards the application of knowledge and understanding, the student, on the one hand, will acquire the necessary competence to interpret the results obtained and, on the other, will develop his own critical spirit in reading graphic and numerical results relating to the quality of production processes.
Finally, the student will be able to evaluate the limits of the techniques applied, and to decide on the possible use of other and more sophisticated statistical techniques.

Contents

This course presents the main methods for Statistical Quality Control (QC).
The first part will focus on statistical inference techniques, the second on QC elements and the third on statistical control of the production process and control charts.
The contents become accessible to those who have the preparation provided by the second year "Statistical Methods" course.
The elements of statistical inference will be presented from a practical and QC-oriented angle.

Detailed program

The course program is divided into three parts.

PART I - Inference elements: reminders and new tools.
• Tools considered already acquired:

1. Random variables: probabilities, distributions, densities, expected values, independence;
2. Families of discrete and continuous random variables;
3. Central limit theorem and its applications;
4. Using Gaussian tables;
   • References on the following topics:
5. Inferential Statistics;
6. Point estimate and estimators;
7. Estimation by intervals and confidence intervals for μ and p;
8. Probability and coverage error;
9. Exact and approximate confidence intervals (IdC) for μ and p.
   • New tools:
10. A new random variable (vc): Student's t;
11. Exact IdC for μ with ? unknown;
12. IdC for variance;
13. Punctual estimate and IdC for difference between two averages;
14. Statistical tests;
15. Errors of the first and second kind;
16. The p-value and its interpretation;
17. Statistical texts for various parameters of interest;
18. Calculation of the power of the test and determination of the sample size
19. Normality test.

PART II – introduction to statistical quality control.

1. Quality control (QC) elements – introductory example;
2. QC terminology;
3. Statistical methods for quality control, in particular during production; some graphical methods (branch-leaf, box, Pareto graphs) and inferential methods (control charts);
4. Sources of variability, sampling frequency and sample size;
5. Study of the typical trends of the control charts.

PART III – control charts for variables and for attributes and elements of process capabilities.

1. Introduction.
2. Control charts for Mean and Standard Deviation (CCMS):
   2.1 Statistical foundations for mean control charts (CCM);
   2.2 Definition of CCM;
   2.3 Control chart (CC) for Variance.
   2.4 Statistical foundations for the control chart for Standard Deviation (CCS);
   2.5 Structure of Shewhart's control charts;
   2.6 Definition of CCS;
   2.7 CCMS for variable n.
3. Control Charts for Mean and Range (CCMR):
   3.1 Statistical foundations for mean control charts (CCM);
   3.2 Definition of CCM;
   3.3 Statistical foundations for range control charts (CCR);
   3.4 Definition of CCR.
4. CCMR for Single Measurements.
5. Control charts for Attributes.
6. Some considerations on CC
7. Elements of Process Capability.

Prerequisites

Passing the Statistical Methods course exam.

Teaching methods

Teaching with different teaching methods:

- lessons carried out in presence mode for a number of hours not less than 70% of the total hours of the course;
- the remaining hours of lessons may be delivered, upon communication from the teacher, remotely in synchronous mode.

Assessment methods

The exam will only be **written**. There are no intermediate tests and will focus on the topics presented in class. In detail, the final test will be made up of two parts, each of which will have a weight equal to 50% of the final score of the test:
PART 1: **open questions** which involve the exposition of specific theoretical topics covered in class in order to evaluate the student's ability to explain and argue the theoretical and methodological aspects of statistical quality control presented in class as well as the skills of them to implement autonomous reflections on the critical points of the program;
PART 2: **exercises** which consist of answers to practical questions that require the application of the technical specifications and statistical definitions presented in class. In this context, the student's ability to independently solve specific practical problems and to apply the theoretical notions acquired during lessons to specific concrete cases is assessed.

Textbooks and Reading Materials

Douglas C. Montgomery: “Statistical Quality Control”; Ed. McGraw-Hill.
Furthermore, other teaching material prepared by the teacher are available in the teaching materials on the course's e-learning page.

Semester

First semester

Teaching language

Italian

Sustainable Development Goals

QUALITY EDUCATION