SUBJECT: ADVANCED STATISTICAL INFERENCE (200604)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

1. introduction
2. Point estimate 1: Methods to find estimators
3. Point estimate 2: Evaluation of estimates
4. Hypothesis Testing
5. Confidence regions

PRIOR SKILLS:

The MESIO UPC-UB includes two compulsory subjects: Advanced Statistical Inference and Foundations of Statistical Inference. Advanced Statistical Inference is mandatory for all graduate students in statistics or mathematics (path 1) and Foundations of Statistical Inference is compulsory for all students from other degrees (path 2). Students from path 2 can choose Advanced Statistical Inference as optional. Students from path 1 can not choose Foundations of Statistical Inference. This course is mandatory for all graduate students in statistics or mathematics. Statistical knowledge required of an undergraduate-level in statistics or mathematics. Basic mathematical analysis skills required: integration of functions of one or two variables, derivation, optimization of a function of one or two variables. * Basic probability skills required: the most common parametric distributions, properties of a normal distribution, the law of large numbers and the central limit theorem. * Basic statistical inference skills required: using the likelihood function for simple random sampling (independent identically distributed data), inference in the case of normality, estimation of maximum likelihood for parametric models with only one parameter and simple random sampling. Chapters 1 through 5 from book "Statistical Inference" by Casella and Berger (2001).

SUBJECT: CLINICAL TRIALS (200627)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

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TOPICS:

Background
A1: Analysis of parallel trials without baselines
A2: Analysis of parallel trials with baselines
A3: Analysis of cross-over trials
A5: CT design, protocol and statistical analysis plan
A5: Regulatory and journal reporting standards
B1: Ethics, Multiplicity
B2: Equivalence. Pragmatic trials
B3: Sample size rationale.
B4: Randomization.
B5: Cluster trials
B6: Sistematic revisions and meta-analysis
B7: Adaptative designs

PRIOR SKILLS:

The student is expected to have some basic knowledge on descriptive statistics and statistical inference (estimation and testing), including the following: frequency tables and contingency tables; descriptive statistics for continuous variables; histograms, boxplots and scatterplots; interpretation of p-values and confidence intervals, and concepts such as statistic, parameter, and confidence level; one- and two-sided tests, null and alternative hypotheses, significance level, power, and sample size; t-tests on means; classic non-parametric tests for location (Mann-Whitney Wilcoxon rank sum and signed rank tests); z-tests on proportions and independence chi-square test; measures of effect such as difference of means and difference and ratio of proportions. For exemple, the student is expected to be able to compute the variance of the difference of 2 random variables; the CI95% and the p-value for the means difference of two normally distributed independent

random variables; as well as for the difference of 2 proportions from dichotomic outcomes The student is also expected to have some familiarity with a statistical package, preferably R. Although not strictly required, it would also be helpful to have some further knowledge about: - Interpretation of hypotheses and P values within the Fisher evidence framework, as well as the distinction between the hypotheses to be tested and the required assumptions (see http://en.wikipedia.org/wiki/P-value) - The concepts of alpha, beta, power, Null and Alternative hypotheses within the Neyman-Pearson framework (seehttp://en.wikipedia.org/wiki/Type_I_and_type_II_errors) - The intraclass correlation coefficient (http://en.wikipedia.org/wiki/Intraclass_correlation) - The basics concepts of experimental design (specially the "principles" in http://en.wikipedia.org/wiki/Design_of_experiments) - The concept of collinearity (http://en.wikipedia.org/wiki/Collinearity#Usage_in_statistics_and_econometrics)

REQUIREMENTS:
Basics of experimental design, inference and R.

SUBJECT: CONTINUOUS OPTIMISATION (200616)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

Computational modelization solution of mathematical optimization problems.
Unconstrained optimization
Constrained optimization

PRIOR SKILLS:

A background equivalent to one/two degree-level semesters of algebra, analysis and optimization/operations research is advisable, though not mandatory, as the course intends to be self-contained.

SUBJECT: ECONOMETRIC ANALYSIS (200625)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

PONS FANALS, ERNEST (Dept UB) - epons@ub.edu

TOPICS:

ECONOMETRIC MODELS
TIME SERIES ECONOMETRIC MODELS. UNIT ROOTS
ECONOMETRIC MODELS FOR PANEL DATA
ECONOMETRIC MODELS FOR LIMITED DEPENDENT VARIABLE
ECONOMETRIC MODELS FOR SPATIAL DATA

PRIOR SKILLS:

The course assumes a level of knowledge of statistics similar to what you can assume as prior access to the master. Students should be familiar with the concepts of hypothesis testing and statistical significance in a lineal model framework. Concepts necessary to follow the course can be found for example in the text "Practical Regression and Anova using R " available on the R website (http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf).

SUBJECT: FOUNDATIONS OF STATISTICAL INFERENCE (200605)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

1. Introduction to inference
2. Sampling
3. Parameter estimation
4. Confidence Intervals
5. Hypotheses testing
6. The general linear model
7. ANOVA models

PRIOR SKILLS:

The MESIO UPC-UB includes two compulsory subjects: Advanced Statistical Inference and Foundations of Statistical Inference. Advanced Statistical Inference is mandatory for all graduate students in statistics or mathematics (path 1) and Foundations of Statistical Inference is compulsory for all students from other degrees (path 2). Students from path 2 can choose Advanced Statistical Inference as optional. Students from path 1 can not choose Foundations of Statistical Inference. The course assumes a basic knowledge of the concepts of probability theory. The student should know and work with major discrete and continuous probability models: Poisson, Binomial, Exponential, Uniform, Normal. In particular the student should be able to use the cumulative distribution functions and density functions or probability mass, for calculating probabilities and population parameters of the main distributions. It is also assumed the skill to work with the expectation and variance of random variables. Finally, it is important to know and understand the implications of the central limit theorem. You can consult the following material: Statmedia free version: http://www.ub.edu/stat/GrupsInnovacio/Statmedia/demo/Statmedia.htm Probabilidad y estadística de Evans, Michael J. (2005) Michael J. Evans (Autor) y Jeffrey Rosenthal Edit. Reverter http://www.reverte.com/motor ?id_pagina=catalogo/ficha&idcategoria=6&idsubcategoria=47&idlibro=664 Morris H. DeGroot and Mark J. Schervish Probability and Statistics (4th

Edition) Addison-Wesley (2010) ISBN 0-321-50046-6
http://www.pearsonhighered.com/pearsonhigheredus/educator/product/products_detail.page?isbn=0201524880

SUBJECT: FUNDATIONS OF BIOINFORMATICS (200630)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

VEGAS LOZANO, ESTEBAN (Dept UB) - evegas@ub.edu

TOPICS:

1. Introduction to Bioinformatics
2. Basic Concepts of Molecular Biology
3. Biological Databases: Concepts, Types and Applications
4. Sequence Alignment.
5. Probabilistic models of biological sequences.
6. Gene prediction and genome annotation.
7. Functional and systems genomics.

REQUIREMENTS:

Knowledge of statistical software R. References: -R: A self-learn tutorial. http://www.nceas.ucsb.edu/files/scicomp/Dloads/RProgramming/BestFirstRTutorial.pdf -simpleR- Using R for Introductory Statistics: http://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf

SUBJECT: LIFETIME DATA ANALYSIS (200609)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

Basic concepts and parametric models
Censoring and truncation
One sample non-parametric inference
Two sample comparison
Parametric regression
Semi-parametric regression: Cox Model

PRIOR SKILLS:

In order to follow the course successfully the student has to be familiar with the following concepts: estimation theory and confidence intervals, likelihood function, maximum likelihood estimation, regression models, hypothesis tests. The student will have to use the R software for homework and data analysis. Chapters 1 through 3 of the book "Principles of Statistical Inference" Cox, Cambridge University Press (2006) should be mastered.

SUBJECT: LINEAR AND GENERALIZED LINEAR MODELS (200641)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

PÉREZ CASANY, MARTA (Dept EIO) - marta.perez@upc.edu
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TOPICS:
Linear Model
Exponential families
Generalized Linear models

PRIOR SKILLS:
With respect to the Theory of Probability, the students should know the basic probability distributions, their main properties and the situations that they are able to model in an appropiate way. They also have to be familiarized with the main concepts of Statistical Inference corresponding to a first course of Statistics.

REQUIREMENTS:
We start modelization from scratch, so there are no pre-requisites. Nevertheless, some knowledge about linear regression and/or ANOVA will help better undestand the subject.

SUBJECT: MATHEMATICS (200607)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

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TOPICS:

Combinatorics
Linear Algebra
Metric Notions
The Concept of Function
The Concept of Limit
Infinite Sums

PRIOR SKILLS:

The Mathematics course is a leveling course for students in Path 2 (students whose degree is neither mathematics nor statistics). Students in Path 1 can not choose the Mathematics course. Prior knowledge is not necessary. Nevertheless, we encourage you to read the following sections of the book "Discrete Mathematics and Its Applications" (see the bibliography): 1.1 Propositional Logic 1.2 Applications of Propositional Logic 1.3 Propositional Equivalences 1.4 Predicates and Quantifiers 1.5 Nested Quantifiers 1.6 Rules of Inference 1.7 Introduction to Proofs 1.8 Proof Methods and Strategy 2.1 Sets 2.2 Set Operations 2.3 Functions 9.1 Relations and Their Properties 9.5 Equivalence Relations 9.6 Partial Orderings (numbering refers to the 7th edition) Language of instruction will be adapted to students.

SUBJECT: MODELS AND METHODS FROM OPERATIONS RESEARCH (200643)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Introduction to models and formulations of Operations Research
Characteristics of Integer Programming models
Mathematical Optimization
Short recall of the Simplex method in matriz form
Linear Programming methods and their properties
Network flow models: max flow, min-cost flow
Cutting plane methods
Enumerative methods.
Basic models in integer programming and their properties
Advanced models and methods of integer programming and combinatorial optimization
Lagrangean relaxation in integer programming.
The knapsack problem.
Practical presentation
The traveling salesman problem.
Practical fulfillment

PRIOR SKILLS:

Each student may choose between two different levels for the course: introductory or advanced, depending on her/his interest and previous knowledge on Operations Research. The introductory level is followed with topics 1-5. Alternatively, the students who choose the advanced level, will only follow the topic 6 (Advanced models and methods of Integer and Combinatorial Optimization). The level of items 1-5 of the course, are basic and follow to a large extent the books - Luenberger, David G; Ye, Yinyu. Linear and nonlinear programming [en línea]. 3rd ed. New York: Springer, cop. 2008. ISBN 978-0-387-74502-2. - Ahuja, Ravindra K; Magnanti, Thomas L; Orlin, James B. Network flows : theory, algorithms, and applications.

Englewood Cliffs, N.J.: Prentice Hall, cop. 1993. ISBN 013617549X. The level of item 6, as well as its content follow, to a large extent, the text: Laurence Wolsey. Integer Programming. Wiley-Interscience series in discrete mathematics. John Wiley and Sons. New York. 1998. ISBN: 0-471-28366-5.

REQUIREMENTS:

In order to follow properly this course and obtain its maximum output it is necessary to have previous basic knowledge on calculus with one and several variables, and to have basic knowledge of matrices and bases in vector spaces. It is highly recommended to know some basic programming techniques. Topic 6 of the course has a higher level. In order to follow it properly and obtain its maximum output it is necessary either to have followed previously topics 1-5, or to have basic knowledge of modeling techniques and models in Operations Research and of Linear Programming.

SUBJECT: OPTIMIZATION IN ENERGY SYSTEMS AND MARKETS (200638)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Introduction : centralized vs. market operation of energy systems.
Optimization of centralized energy systems operations.
Market clearing models
Uncertainty in electricity markets
Optimal market operations for electricity producers
Optimal market operations for retailers and consumers.

PRIOR SKILLS:

- Fundamentals on continuous and integer optimization. - Stochastic programming modeling. - Mathematical programming languages (AMPL, GAMS, SAS/OR,...)

REQUIREMENTS:

- A background equivalent to the courses Continuous Optimization, Integer and Combinatorial Optimization and Stochastic Programming is recommended.

SUBJECT: RISK QUANTIFICATION (200620)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

1. Introduction
2. Multivariate models for risk management e english
3. Measures of dependence and copulas
4. Risk Measures
5. Extreme Value Theory

REQUIREMENTS:

Basic notions of statistical inference (as in DeGroot and Schervish, 2012) and multivariate analysis (principal components; see, for instance, Peña, 2002).
DeGroot, M.; Schervish, M. (2012) Probability and statistics. 4th ed. Pearson, 2012. Peña, D. Análisis de datos multivariantes. McGraw-Hill, 2002.

SUBJECT: SIMULATION (200608)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Topic 1. Introduction to simulation.
Topic 2. Input Data Analysis.
Topic 3. Samples generation.
Topic 4. Introduction to discrete systems simulation.
Topic 5. Design of simulation experiments.
Topic 6. An introduction to the bootstrap and to permutation tests

PRIOR SKILLS:

* Probability, statistical inference and Linear Models * Some skills in a general purpose programming language, especially an scripting language. Familiarity with the R statistical software environment.

SUBJECT: SOFTWARE FOR STATISTICS AND OPTIMIZATION (200601)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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ALEMANY LEIRA, RAMON (Dept UB) - ralemany@ub.edu

TOPICS:

Introduction to R [Introductory level]
R objects
Descriptive and exploratory analysis with R
Basic programming with R
Statistical inference with R: hypothesis tests and regression models
Intermediate-level R topics
Introduction to SAS
Basic procedures with SAS
Transformation and manipulation of data
Introduction to matrix calculus with SAS: SAS/IML
Advanced procedures
Introduction to linear programming with SAS

PRIOR SKILLS:

Concerning the R lectures, there will be two courses: an introductory-level course and an intermediate/advanced-level course. The first is for students with no or little experience of R, the second for students who have worked with R previously such as students with a degree in statistics. By contrast, the SAS lectures will be the same for all students.

REQUIREMENTS:

The intermediate/advanced-level R course requires that students have experience in working with R.

SUBJECT: SPATIAL EPIDEMIOLOGY (200633)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

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TOPICS:

1. GEOSTATISTICS
2. LATTICE DATA
3. SPATIAL POINT PROCESSES

SUBJECT: STATISTICAL LEARNING (200644)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Introduction to statistical learning
Penalized regression estimators: Ridge regression and Lasso
Generalized Additive Models
Tree-based Methods
Artificial Neural Networks
Support Vector Machine

PRIOR SKILLS:

Familiarity with the foundations of calculus in one and more variables. Intermediate studies in probability and inference. Skills using the R environment for statistical computing and programming. Any good online R course may help, like http://www.ub.edu/stat/docencia/EADB/Curso%20basico%20de%20R.htm.

REQUIREMENTS:

"Fundamentos de Inferencia Estadística" o "Inferencia Estadística Avanzada"
"Computación en Estadística y en Optimización"

SUBJECT: STATSITICAL PROGRAMMING AND DATABASES (200645)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

Introduction to Python
Working with Python
Getting started with Python
Functions and Object Oriented Programming
Introduction to NumPy
Matplotlib
Python scikits
scikit-learn
Practical Introduction to Scikit-learn
Introduction to the relational data bases
SQL and relational algebra
Distributed data bases
Concurrency problems

PRIOR SKILLS:

Non compulsory subject. The student has already developed several abilities in Statistics and/or Operations Research previously. A B2 (Cambridge First Certificate, TOEFL PBT >550) level of English is required.

SUBJECT: STATISTICS FOR BUSINESS MANAGEMENT (200622)
SEMESTER: 2017-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

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TOPICS:

¿ Statistics: The why and the what. Data quality. Evolution of the use of statistics. Proactive statistics.
¿ The role of statistics in product design: Relationship between variability and customer satisfaction. Reducing variability, robust products. Planning tests (experiments).
¿ Statistics in quality management. Planning, control and improvement. Improvement programs. Six Sigma methodology.
¿ Statistics in other areas: customer management, financial services, process management
¿ Selling statistics: internally and eternally
Data Science: Organizational and managerial aspects (roles and responsibilities). Valorization

PRIOR SKILLS:

Knowledge of basic statistics: exploratori data analysis, inference. Interest in knowing how and where statistics can provide a valuable contribution in business environments.

REQUIREMENTS:

Basic knowledge of data analysis, probability models and inference: Exploratory data analysis and graphical representations. Basic concepts of probability models (normal distribution, binomial and poisson). Basics inference. Knowledge can be acquired in any basic statistics text book.

SUBJECT: ACTUARIAL STATISTICS (200619)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

PÉREZ MARÍN, ANA MARIA (Dept UB) - amperez@ub.edu

TOPICS:

Section 1. Life Insurance Statistics
Section 2. Non-life Statistics

PRIOR SKILLS:

Students should have previous knowledge of calculus of probability, random variables, probability distributions and characteristics of probability distributions (means, variances, etc.). It is also recommended to have prior knowledge in algebra of events. Recommended book to the introduction to actuarial statistics. López Cachero, Manuel. Estadística para actuarios. Madrid : Editorial MAPFRE : Fundación MAPFRE Estudios, Instituto de Ciencias del Seguro, D.L. 1996

SUBJECT: ADVANCED EXPERIMENTAL DESIGN IN CLINICAL RESEARCH (200628)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

BLOCK 1. HIERARCHICAL FACTOR MODELS, REPEATED MEASURES AND CROSS-OVER DESIGNS
BLOCK 2. BIOEQUIVALENCE
BLOCK 3. ASSESSMENT OF THE DATA QUALITY: RELIABILITY AND CONCORNDANCE OF MEASUREMENTS

REQUIREMENTS:

- It is necessary that students have basic knowledge of R. In the following link the materials from a course to introduction to R are available http://www.ub.edu/stat/docencia/EADB/Curso%20basico%20de%20R.htm - It is recommended that students have taken a course in Design of Experiments or have basic knowledge on this subject. In particular it is recommended that students know the methodology outlined in chapters 12 and 13 included in Montgomery, DC (2001). Design and analysis of experiments, 5th edition. John Wiley & sons.

SUBJECT: ADVANCED TOPICS IN SURVIVAL ANALYSIS (200629)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

B1: Beyond the Cox Model
B2: Multivariate Survival Analysis
B3: Interval Censoring
B4: Counting Processes

PRIOR SKILLS:

Students must know the basic concepts of survival analysis as taught in the first semester Lifetime Data Analysis course. These concepts include: Censored data, Likelihood in the presence of censoring, Continuous parametric distributions other than normal, Kaplan-Meier survival estimator, Log-rank test, Accelerated Failure Time Model, Cox proportional hazards model, Diagnostic of the Cox Regression model. The student can find these concepts in chapters 2-4, 7-8, 11-12 in the book "Survival analysis: techniques for censored and truncated data" by Klein and Moeschberger.

SUBJECT: BAYESIAN ANALYSIS (200611)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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PUIG ORIOL, XAVIER (Dept EIO) - xavier.puig@upc.edu

TOPICS:

1- Bayesian Model
2- Bayesian Inference
3- Hierarchical Models
4. Model selection
5- Bayesian computation
6- Aplications

PRIOR SKILLS:

We start from scratch and hence there are no pre-requisites for this course. But having some basic knowledge of statistics, at the level of what is covered in Chapters 1 to 12 of the 2004 book "All of Statistics"of Larry Wasserman will help get the best out of the first two thirds of the course. Having some basic knowledge of applied linear and generalized linear models, at the level of the 2005 book "Applied Linear Regression" by Sanford Weisberg will help get the best out of the last one third of the course.

REQUIREMENTS:

We start from scratch, without any pre-requisites. But having basic knowledge of statistics will help better understand the differences between the Bayesian approach to statistical inference and model selection and the non Bayesian approach. Having some basic knowledge of applied linear and generalized linear models is not required but it will also help get the best out of this course.

SUBJECT: DISCRETE NETWORK MODELS (200634)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Introduction to discrete network models and their applications.
Basic concepts in discrete network models.
Types of demand in network optimization.
Modeling alternatives for discrete network models.
Applications of discrete network models.
Solution methods.
Development of the practical assignment

PRIOR SKILLS:

The course does not follow a traditional text, since, to a large extent, it is based on proposals of problems made by the students themselves. The type of models that are studied can be found in: > Ball, M.O., Magnanti, T.L., Monma, C.L., Nemhauser, G.L. (Eds). Handboks in Operations Research and Management Science. Volume 7: Network models Elsevier. 1995. > Contreras, I., Fernández, E. (2012) General network design: a unified view of combined location and network design problems. European Journal of Operational Research 219, 680-697.

REQUIREMENTS:

It is highly recommended to have followed the course Integer and Combinatorial Optimization, of which the current course is the best complement. Basic knwoledge on modeling techiques in Operations Research and Integer Programming is required. Basic knwoledge on some programming language is required.

SUBJECT: EPIDEMIOLOGY (200632)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Introduction to epidemiology
Epidemiological measures: concepts and estimation
Aspects of epidemiological studies
Analysis of epidemiological studies

PRIOR SKILLS:

The student has to be familiar with the concepts of statistical inference: the likelihood function, maximum likelihood estimation, hypothesis testing, and linear regression models. In particular, the student should be familiar with the contents of the first three chapters of the book "Principles of Statistical Inference" Cox (Cambridge University Press, 2006).

REQUIREMENTS:

Knowledge of the software package R.

SUBJECT: FINANCIAL STATISTICS (200626)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

1. Option valuation and risk measurement
2. Volatility models

PRIOR SKILLS:

The course assumes basic levels of statistics similar to those that can be achieved in the first semester of the Master. Some basic concepts related to Finance would help to follow the course. The prior skills that are desirable are the ones from the course "Time Series" or to be familiar with ARIMA models (see the second chapter of the book "Analysis of Financial Time Series" de Ruey S. Tsay, Ed. Wiley, 2nd edition).

SUBJECT: LARGE SCALE OPTIMIZATION (200618)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:
DUALITY
DECOMPOSITION METHODS
INTERIOR-POINT METHODS

PRIOR SKILLS:
Basic knowledge of Operations Research / Optimization / Modelling in Mathematical Programming / Basic Linear Algebra.

SUBJECT: LONGITUDINAL DATA ANALYSIS (200612)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

Linear Mixed Model (LMM).
Generalized Estimation Equations (GEE).
Longitudinal Data Analysis with multivariate response.
Generalized Linear Mixed Model (GLMM).
Introduction to Missing Data Analysis.

PRIOR SKILLS:

The prior skills that are desirable are the ones from basic courses in mathematical statistics and probability in the degree courses. Two referencies that can help to prepare in this preliminary phase are: Gómez, G. (2002) Estadística Matemàtica 1 (Teoria). Apunt de la FME. Universitat Politècnica de Catalunya. Gómez, G, Nonell, R and Delicado, P. (2002) Estadística matemàtica 1. (Problemes). Apunts de la FME. Universitat Politècnica de Catalunya It is supposed that the student knows the linear model and the generalized linear model. This knowledge can be previously obtained and consolidated in the subject on linear models that it is taught during the first seven weeks of the second semester.

SUBJECT: MULTIVARIATE DATA ANALYSIS (200606)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Multivariate descriptive statistics
Multivariate statistical inference.
Discriminant analysis and cluster analysis.

PRIOR SKILLS:

1. This course presupposes knowledge of linear algebra: diagonalization of a symmetric matrix, vector projection, vector derivation of linear and quadratic functions. 2. It is also necessary to have successfully completed a course on statistical inference covering the classical univariate tests (Student's t test, Fisher's F test).

SUBJECT: OMICS DATA ANALYSIS (200631)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

1. Introduction to molecular biology, omics and high throughput technologies
2. Analysis of microarray data
3. Analysis of other high-throughput data

PRIOR SKILLS:

The course assumes no prior knowledge more than the usual of a student in a Master's Degree of Statistics. However a good attitude toward biology (not being afraid to speak of DNA or gene expression) and a good knowledge of the R programming language can help to get the most out of the course. Ideally this course would be taken after an introduction to bioinformatics as part of a bioinformatics oriented curriculum. However, given that currently there is no guarantee that ideally the two subjects are relatively independent so that, although it is interesting to have completed "Fundamentals of Bioinformatics" to have some familiarity with the problems that can be solved using the techniques developed here, is not considered essential.

REQUIREMENTS:

The course assumes basic levels of statistics similar to those that can be achieved in the first semester of the Master. Students should be familiar with the concepts of hypothesis testing and statistical significance, analysis of variance and basic techniques of multivariate statistics such as principal component and cluster analysis. Concepts necessary to follow the course can be found for example in the text "Applied Statistics for Bioinformatics using R" available on the R website (cran.r-project.org/doc/contrib/Krijnen-IntroBioInfStatistics.pdf)

SUBJECT: PROBABILITY AND STOCHASTIC PROCESSES (200603)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

FABREGA CANUDAS, JOSE (Dept MAT) - josep.fabrega@upc.edu

TOPICS:

1. Generating Functions and Characteristic Function
2. Branching Processes
3. The Multivariate Gaussian Distribution
4. Sequences of Random Variables
6. Random Walks
7. Markov Chains
8. The Poisson Process

PRIOR SKILLS:

Students should be familiar with the topics covered in a first undergraduate course on probability. In particular, basic knowledge of the following subjects is assumed: - Elementary probability theory. - Basic probability models: binomial, geometric, Poisson, uniform, exponential, and normal distributions. - Random variables. Joint probability distribution and density functions. Independence and correlation. Concepts necessary to follow the course can be found, for example, in the following references: - C.M Grinstead and J.L. Snell, Introduction to Probabiliy (chap. 1-7), http://www.dartmouth.edu/chance/teaching_aids/books_articles/probability_book/book - S. Ross, A First Course in Probability, 8th ed., Pearson Education International, 2010. - M. Sanz-Solé, Probabilitats, Univ. Barcelona, 1999.

SUBJECT: QUANTITATIVE MARKETING TECHNIQUES (200621)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Topic 1: Structural analysis of survey data
Topic 2: Survey data modelling
Topic 3: Open-ended questions and free comments: a tool for studying costumer's preferences. Data collection and statistical analysis
Topic 4: Design of new products. Conjoint analysis (Conjoint analysis)
Topic 5: Sensory evaluation of products. Experience design and data analysis.
Topic 6: Holistic methods for product comparison

PRIOR SKILLS:

Prior skills The course assumes basic levels of statistics . Students should be familiar with techniques of multivariate statistics such as principal component analysis and clustering. Concepts relative to hypothesis testing and statistical significance, as well as good knowledge of analysis of variance will be appreciated. The main concepts necessary to follow the course can be found, for example, in the text "Explortory Multivariate Analysis by Example Using R" described on FactoMiner Package website (http://factominer.free.fr/) The course assumes a good knowledge of the R programming language.

SUBJECT: SIMULATION FOR BUSINESS DECISION MAKING (200623)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

Introduction
Description of Examples
Paradigms
Formalisms
Experiment Design
Verification, Validation and Accreditation
Simulation Systems
New Paradigms
New Components
Practical Cases

REQUIREMENTS:

The course assumes basic levels of statistics similar to those that can be achieved in the first semester of the Master. Students should be familiar with the concepts of hypothesis testing and statistical significance, analysis of variance. Concepts necessary to follow the course can be found for example in the text "Simulation modeling and analysis" of Law, A. M.; Kelton, W.D. The course assumes a good attitude toward business and decision making problems although environmental and social problems will also be analyzed due to its inherent relation with business and decision making. Ideally this course would be taken after an introduction to simulation as part of a simulation oriented curriculum. Although it is interesting to have completed "SIM - Simulation? and to have some familiarity with the problems that can be solved using the techniques developed there, is not considered essential.

SUBJECT: SOCIAL INDICATORS (200624)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

FERNÁNDEZ ARDÈVOL, MIREIA (Dept UB) - mireia.fernandez@ub.edu

TOPICS:

Bolck 1. Institutional and legal environment of official statistics
Block 2. Processes for the production of statistical information
Block 3. Statistical sources and social indicators systems

PRIOR SKILLS:

- A minimal familiarity with the official or public statistics. - Basic abilities in descriptive and statistical inference. - Knowledge of statistical sampling and main statistical information sources - Basic knowledge of macroeconomics, business economics, sociology and demography.

REQUIREMENTS:

In terms of the thematic content, focused on the socio-demographic and economic indicators usually generated by national statistical offices, it is recommended to have a minimum knowledge of the usual statistical information on demographics, social conditions, and macroeconomics related to a country. Also, as the institutional environment is practically reduced to governments that generate official statistics, it is desirable to have a minimal familiarity with the public legal aspects or principles, and with governmental practices. With regard to instrumental aspects, the optimal monitoring of the course requires a basic knowledge of the standard procedures of descriptive statistics and inferential statistical concepts, which are at the basis of most of the demographic and economic indicators. It is also recommended some practical experience in dealing with current data on individual characteristics and the interpretation of tabulated data or aggregate statistical information (such as composite or synthetic indicators).

SUBJECT: STOCHASTIC OPTIMIZATION (200617)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

CASTRO PÉREZ, JORDI (Dept EIO) - jordi.castro@upc.edu

TOPICS:

Introduction.
Stochastic modelling.
Basic Properties.
Solution methods.

PRIOR SKILLS:

Basic knowledge of Operations Research / Optimization / Mathematical Programming and Modelling .

REQUIREMENTS:

Introductory course to Operations Research. Or chapters 1-3 of "F.S. Hillier, G.J. Lieberman, Introduction to Operations Research, McGraw-Hill" (or first chapters of a similar book).

SUBJECT: TIME SERIES (200610)
SEMESTER: 2017-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Analysis and modeling of univariate time series. ARIMA models. ARIMA forecasting models
Outlier, Calendar Effects and Intervention Analysis
Machine Learning-based Forecasting methods
Applications of the Kalman Filter
Structural Models in State Space
Introduction to Volatility Models

PRIOR SKILLS:

The course assumes basic levels of statistics similar to those that can be achieved in the first semester of the Master. Students should be familiar with the concepts related with statistical models, like linear models, and hypothesis testing and statistical significance. Some basic concepts related to the Box-Jenkins methodology for fitting ARIMA models would help to follow the course (see the three first chapters of 'Time Series Analysis and Its Applications. With R examples' 3rd Edition Shumway and Stoffer http://www.stat.pitt.edu/stoffer/tsa3/). Although many examples come from the econometric field, methodology from the course might be applied in different areas (ecology, epidemiology, engineering,...) Methods of prediction based on Machine Learning techniques, in particular artificial neural networks (ANNs) will be treated. The course will introduce techniques related with state-space models and the Kalman filter. Prior basic knowledge of this framework will also help to follow the course, but it is not essential. A good knowledge of the R programming language can help to get the most out of the course.

REQUIREMENTS:

Knowledge about the linear model will be useful