MASTER IN STATISTICS AND OPERATIONS RESEARCH

MESIO UPC-UB

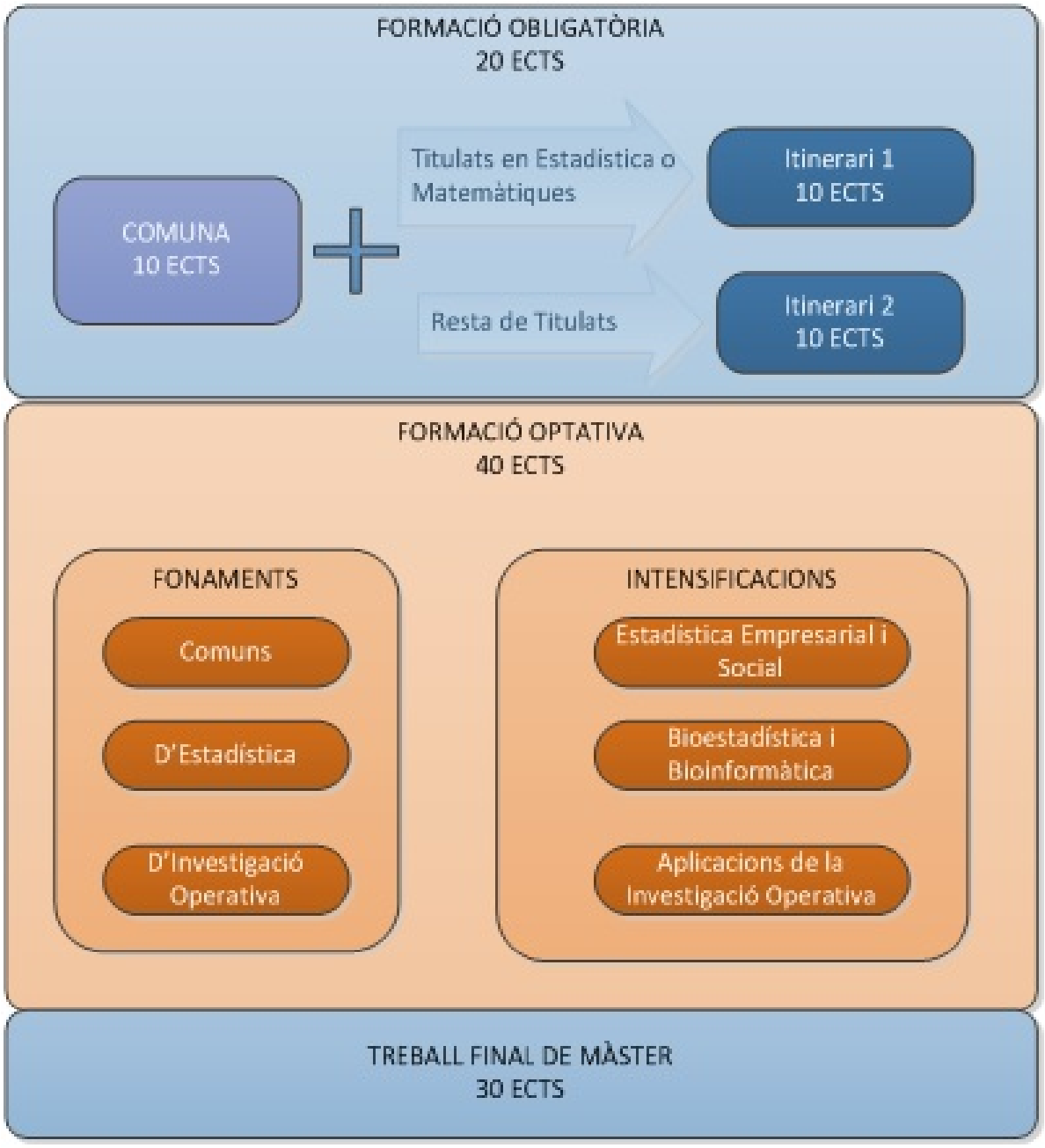
Curriculum

Contents, Prior Skills and Requirements for every subject

2016-17

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

UNIVERSITAT DE BARCELONA


FORMACIÓ OBLIGATÒRIA
20 ECTS
COMUNA
10 ECTS
Titulats en Estadística o Matemàtiques
Itinerari 1
10 ECTS
Resta de Titulats
Itinerari 2
10 ECTS
FORMACIÓ OPTATIVA
40 ECTS
FONAMENTS
Comuns
D'Estadística
D'Investigació Operativa
INTENSIFICACIONS
Estadística Empresarial i Social
Bioestadística i Bioinformàtica
Aplicacions de la Investigació Operativa
TREBALL FINAL DE MÀSTER
30 ECTS

Code	Subject	ECTS	Q	Observations
200601	Software for Statistics and Optimization	5	1	Compulsory Training
200602	Management of Statistical Information	5	2	Compulsory Training
200603	Probability and Stochastic Processes	5	1	Compulsory Training Pathway 1
200604	Advanced Statistical Inference	5	1	Compulsory Training Pathway 1
200605	Foundations of Statistical Inference	5	1	Compulsory Training Pathway 2
200606	Multivariate Data Analysis	5	1	Compulsory Training Pathway 2
Optional Training				**Intensification**
200607	Mathematics	5	1	Common Training
200608	Simulation	5	1	Common Training
200609	Lifetime Data Analysis	5	1	Fundamentals of Statistics
200610	Time Series	5	2	Fundamentals of Statistics
200611	Bayesian Analysis	5	2	Fundamentals of Statistics
200612	Longitudinal Data Analysis	5	2	Fundamentals of Statistics
200614	Computational Intensive Methods	5	2	Fundamentals of Statistics
200641	Linear and Generalized Linear Models	5	2	Fundamentals of Statistics
200615	Integer and Combinatorial Optimization	5	1	Fundamentals of Operations Research
200616	Continuous optimization	5	1	Fundamentals of Operations Research
200617	Stochastic optimization	5	2	Fundamentals of Operations Research
200618	Large scale optimization	5	2	Fundamentals of Operations Research
200619	Actuarial Statistics	5	2	Business and Social Statistics
200620	Risk Quantification	5	1	Business and Social Statistics
200621	Quantitative Marketing Techniques	5	2	Business and Social Statistics
200622	Statistics for Business Management	5	1	Business and Social Statistics
200623	Simulation for Business Decision Making	5	2	Business and Social Statistics
200624	Social Indicators	5	2	Business and Social Statistics
200625	Econometric Analysis	5	1	Business and Social Statistics
200626	Financial Statistics	5	2	Business and Social Statistics
200627	Clinical Trials	5	1	Biostatistics and Bioinformatics
200628	Advanced Experimental Design in Clinical Research	5	2	Biostatistics and Bioinformatics
200629	Advanced Topics in Survival Analysis	5	2	Biostatistics and Bioinformatics
200630	Foundations of Bioinformatics	5	1	Biostatistics and Bioinformatics
200631	Omics Data analysis	5	2	Biostatistics and Bioinformatics
200632	Epidemiology	5	2	Biostatistics and Bioinformatics
200633	Spatial Epidemiology	5	1	Biostatistics and Bioinformatics
200634	Discrete Network Models	5	2	Applications of Operations Research
200642	Optimization in Data Science	5	1	Applications of Operations Research

1 credit corresponds to 25 hours of student involvement (approximately).

Subjects from other master programs. Curs 2016-17

Suggested subjects from other UPC or UB master programs to MESIO UPC-UB students.

They can choose up to 3 of these subjects.

Master in Data Mining and Business Intelligence: MIRI (FIB, UPC)

Focusing on Machine and Statistical Learning

a.	Machine Learning (ML-MIRI)	Spring semester
b.	Kernel based Machine Learning and Multivariate Modeling (KMLMM-MIRI)	Fall semester
c.	Advanced Statistical Modeling (ASM-MIRI)	Fall semester

Focusing on Big Data Management

d.	Open Data (OD-MIRI)	Spring semester
e.	Complex and Social Networks (CSN-MIRI)	Fall semester
f.	Cloud Computing (CLC-MIRI)	Spring semester

Master in Supply Chain and Transort Logistics (SCTL) ETSEIB and UPC

a.	Introducció a la Cadena de Subministrament	Fall semester
b.	Modelització de Sistemes de Transport i Logístics	Fall semester
c.	Anàlisi de Dades de Transport i Logística	Fall semester
d.	Mètodes Quantitatius a la Cadena de Subministrament	Fall semester
e.	Models d'Optimització de Xarxes de Transport	Fall semester
f.	Models Avançats de Demanda	Fall semester
g.	Demanda de Sistemes de Transport	Spring semester
h.	Models de Simulació de Trànsit	Spring semester
i.	Transport de Mercaderies	Spring semester

Master in Automatic Control and Robotics (ETSEIB – UPC)

Scientific Python for Engineers (3 ECTS;)

Master in Biomedical Engineering (Faculty of Physics-UB and ETSEIB-UPC)

Biomedical Informatics (2,5 ECTS;)

Horaris curs 2016-17, Q1

MESIO UPC-UB

01/07/2016

(Tardor)					
	Dilluns	**Dimarts**	**Dimecres**	**Dijous**	**Divendres**
13:30 - 15:00	COMPUTACIÓ EN EST. I OPT. (grup A) (*) **Aula PC2**	EPIDEMIOLOGIA ESPACIAL **Aula 002**	MESIO UPC-UB lunch Seminar	EPIDEMIOLOGIA ESPACIAL **Aula 002/PC1**	COMPUTACIÓ EN EST. I OPT. (grup A) (*) **Aula PC2**
15:00 - 16:30	SIMULACIÓ **Aula PC3** ANÀLISI TEMPS VIDA **Aules 004/PC1** OPTIMITZACIÓ ENT. I COMBIN. **Aula 005**	QUANTIFICACIÓ RISCOS **Aula 002** ESTAD. GESTIÓ EMPRESARIAL **Aula 003** ASSAJOS CLÍNICS **Aula 004** OPTIM. EN DATA SCIENCE **Aules 005/PC3**	QUANTIFICACIÓ RISCOS **Aula 002** ESTAD. GESTIÓ EMPRESARIAL **Aula 003** ASSAJOS CLÍNICS **Aula 004** OPTIM. EN DATA SCIENCE **Aula 005**	SIMULACIÓ **Aula 002/PC3** ANÀLISI TEMPS VIDA **Aula 004** OPTIMITZACIÓ ENT. I COMBIN. **Aula 005**	OPTIMITZACIÓ CONTÍNUA **Aula 002** ANÀLISI ECONOMÈTRICA **Aula 003** FONAMENTS BIOINFORMÀTICA **Aules 004/PC3**
16:30 - 17:00					
17 - 18:30	FON. INFERÈNCIA ESTAD. **Aula 002** INFERÈNCIA EST. AVANÇADA **Aula 003**	PROB. I PROCESSOS ESTOC. **Aula 002** MATEMÀTIQUES **Aula 003**	OPTIMITZACIÓ CONTÍNUA **Aules 002/PC3** ANÀLISI ECONOMÈTRICA **Aules 003/PC1** FONAMENTS BIOINFORMÀTICA **Aula 004**	FON. INFERÈNCIA ESTAD. **Aules 002/PC1** INFERÈNCIA EST. AVANÇADA **Aula 003**	PROB. I PROCESSOS ESTOC. **Aula 002** MATEMÀTIQUES **Aula 003**
18:30 - 19:00					
19:00 - 20:30	ANÀLISI MULTIVAR. DADES **Aules 002/PC2**	COMPUTACIÓ EN EST. I OPT. (grup B) (**) **Aula PC2**	ANÀLISI MULTIVAR. DADES **Aula 002**	COMPUTACIÓ EN EST. I OPT. (grup B) (**) **Aula PC2**	

(*) Grup A: estudiants amb coneixements de R

(**) Grup B: estudiants amb nivell introductori de R

Vicedegà de postgrau en Estadística - Director del MESIO
Unitat d'Organització Docent i Relacions Laborals

MESIO UPC-UB

(Primavera)					
	Dilluns	**Dimarts**	**Dimecres**	**Dijous**	**Divendres**
13:30 - 15:00	(*)MOD. LIN. I LIN. GENLZTS./ (*)AN.DADES LONGITUDINALS **Aula 003** ESTAD. FINANCERA **Aula 004**	SÈRIES TEMPORALS **Aula 003**	MESIO UPC-UB lunch Seminar	SÈRIES TEMPORALS **Aules PC1/PC2**	(*)MOD. LIN. I LIN. GENLZTS./ (*)AN.DADES LONGITUDINALS **Aula 003/PC3** ESTAD. FINANCERA **Aules 004/PC1**
15:00 - 16:30	(*) MOD. LIN. I LIN. GENLZTS./ (*)AN.DADES LONGITUDINALS **Aula 003**	ESTAD. ACTUARIAL **Aula PC1** DISSENY EXP. AV. INV. CL. **Aula PC2** PROGRAMACIÓ ESTOCÀSTICA **Aula 103**	MÈT. COMPUTACIÓ INTENSIVA **Aula PC1** SIMUL. PR. D. EMPRESARIALS **Aula 100** EPIDEMIOLOGIA **Aula 005**	ESTAD. ACTUARIAL **Aula 004** DISSENY EXP. AV. INV. CL. **Aula 003** PROGRAMACIÓ ESTOCÀSTICA **Aula 103**	(*)MOD. LIN. I LIN. GENLZTS./ (*)AN.DADES LONGITUDINALS **Aula 003/PC3**
16:30 - 17:00					
17:00 - 18:30	MÈT. COMPUTACIÓ INTENSIVA **Aula PC1** SIMUL. PR. D. EMPRESARIALS **Aula 100** EPIDEMIOLOGIA **Aula 005**	ANÀL. SUPERVIVÈNCIA AV. **Aules 004/PC3** MODELS DISCRETS EN XARXES **Aula 005** ANÀLISI BAYESIANA **Aula 003**	ANÀL. DADES ÒMIQUES **Aules 003/PC3** INDICADORS SOCIALS **Aula 004** OPTIM. GRAN DIMENSIÓ **Aula 005** TÈC. QUANT. MÀRKETING **Aules 103**	ANÀL. SUPERVIVÈNCIA AV. **Aules 004/PC3** MODELS DISCRETS EN XARXES **Aula 005** ANÀLISI BAYESIANA **Aula 003/100**	ANÀL. DADES ÒMIQUES **Aules 003/PC3** INDICADORS SOCIALS **Aula 004** OPTIM. GRAN DIMENSIÓ **Aula 005** TÈC. QUANT. MÀRKETING **Aules 103/100**
18:30 - 19:00					
19:00 - 20:30	GESTIÓ INFORMACIÓ EST. (grup A) (**) **Aules 003/PC2**	GESTIÓ INFORMACIÓ EST. (grup B) (**) **Aules 003/PC2**	GESTIÓ INFORMACIÓ EST. (grup A) (**) **Aules 003/PC2**	GESTIÓ INFORMACIÓ EST. (grup B) (**) **Aules 003/PC2**	

(*) L'assignatura MODELS LINEALS I LINEALS GENERALITZATS s'impareix durant la primera meitat del curs, 6 hores a la setmana (repartides en 2 dies, a raó de 2 sessions d'1,5 hores cada dia). El mateix horari té l'assignatura ANÀLISI DE DADES LONGITUDINALS durant la segona meitat del curs.

(**) Dilluns 6 de febrer. Classe pels dos grups per presentar l'assignatura
Dimecres 8 de febrer i cada dilluns i dimecres fins dimecres 8 de març -> Grup A
Dijous 9 de febrer i tots els dimarts i dijous fins dijous 9 de març -> Grup B
A partir del dilluns 13 de març només un grup que farà classe els dilluns i els dimecres

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COMPULSORY TRAINING

COMMON COMPULSORY TRAINING

SUBJECT: SOFTWARE FOR STATISTICS AND OPTIMIZATION (200601)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

LANGOHR, KLAUS GERHARD (Dept EIO) - klaus.langohr@upc.edu
PÉREZ MARÍN, ANA MARIA (Dept UB) - amperez@ub.edu
ALEMANY LEIRA, RAMON (Dept UB) - ralemany@ub.edu

TOPICS:
Introduction to R
R objects
Descriptive and exploratory analysis with R
Basic programming with R
Statistical inference with R: hypothesis tests and regression models
Linear programming with R
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: MANAGEMENT OF STATISTICAL INFORMATION (200602)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

GÓMEZ MELIS, GUADALUPE (Dept EIO) - lupe.gomez@upc.edu
SÁNCHEZ PLA, ÀLEX (Dept UB) - asanchez@ub.edu
TORT-MARTORELL LLABRES, JAVIER (Dept EIO) - xavier.tort@upc.edu
GABARRÓ VALLÉS, JOAQUIN (Dept CS) - gabarro@cs.upc.edu

TOPICS:
Introduction to the relational data bases
SQL and relational algebra
Transactions
Languages for web applications
Web programming languages
Preparation for research and Information skills
Technical and Scientific Writing
Oral presentations

PRIOR SKILLS:
Compulsory subject for all students. The student has already developed several abilities in Statistics and/or Operations Research in the previous semester. The student must know basic computing environment and programming capabilities such as those developed by the mandatory course "Statistical Computation and Optimization". A B2 (Cambridge First Certificate, TOEFL PBT >550) level of English is required.

SUBJECT: PROBABILITY AND STOCHASTIC PROCESSES (200603)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English

TEACHING STAFF:

FABREGA CANUDAS, JOSE (Dept MAT) - josep.fabrega@upc.edu
SERRA ALBO, ORIOL (Dept MAT) - oriol.serra@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: ADVANCED STATISTICAL INFERENCE (200604)
SEMESTER: 2016-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).

COMMON COMPULSORY "PATH 2"

SUBJECT: FOUNDATIONS OF STATISTICAL INFERENCE (200605)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

MIÑARRO ALONSO, ANTONIO (Dept UB) - aminarro@ub.edu
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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: MULTIVARIATE DATA ANALYSIS (200606)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:
SALICRÚ PAGES, MIQUEL (Dept UB) - msalicru@ub.edu
DELICADO USEROS, PEDRO (Dept EIO) - pedro.delicado@upc.edu

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).

OPTIONAL TRAINING

COMMON TRAINING

SUBJECT: MATHEMATICS (200607)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

MORA GINÉ, MERCÈ (Dept MAT) - merce.mora@upc.edu
SACRISTAN ADINOLFI, VERA (Dept MAT) - vera.sacristan@upc.edu

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: SIMULATION (200608)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

OCAÑA REBULL, JORDI (Dept UB) - jocana@ub.edu
MONTERO MERCADÉ, LIDIA (Dept EIO) - lidia.montero@upc.edu

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.

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: LIFETIME DATA ANALYSIS (200609)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

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JULIÀ DE FERRAN, OLGA (Dept UB) - olgajulia@ub.edu
LANGOHR, KLAUS GERHARD (Dept EIO) - klaus.langohr@upc.edu

TOPICS:
Basic concepts and parametric models
Censoring and truncation
One sample non-parametric inference
Two sample comparison
Parametric regression
Semi-parametric regression: Cox Model
Survival analysis for discrete times

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: TIME SERIES (200610)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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PONS FANALS, ERNEST (Dept UB) - epons@ub.edu
MUÑOZ GRACIA, M. PILAR (Dept EIO) - pilar.munyoz@upc.edu

TOPICS:
Analysis and Modelling Univariate Time Series:
Outlier, Calendar Effects and Intervention Analysis
Applications Toward Econometry: Unit Roots and Co-integration
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,...) 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

SUBJECT: BAYESIAN ANALYSIS (200611)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

GINEBRA MOLINS, JOSEP (Dept EIO) - josep.ginebra@upc.edu
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: LONGITUDINAL DATA ANALYSIS (200612)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

SERRAT PIE, CARLES (Dept MAT) - carles.serrat@upc.edu
PEREZ ALVAREZ, NURIA (Dept EIO) - nuria.perez@upc.edu

TOPICS:

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

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: COMPUTATIONAL INTENSIVE METHODS (200614)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

-Topic 1. Bootstrap Method
-Topic 2. Permutation and Randomization Tests
- Topic 3. Optimization algorithms for parameter estimation
- Topic 4. EM Algorithm

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: LINEAR AND GENERALIZED LINEAR MODELS (200641)
SEMESTER: 2016-S2 - Spring
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 appropriate 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 understand the subject.

SUBJECT: INTEGER AND COMBINATORIAL OPTIMIZATION (200615)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

Combinatorial optimization problems
Characteristics of Integer Programming models
Short recall of the Simplex method in matriz form
Cutting plane methods
Enumerative methods.
Lagrangean relaxation in integer programming.
The knapsack problem.
Practical presentation
The traveling salesman problem.
Practical fulfillment

PRIOR SKILLS:

The level of the course, 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 the following disciplines: > Operations Research: Basic modeling techniques and models in Operations Research. Linear Programming. > Linear Algebra: Basic concepts on matrices and bases in vector spaces. > Computing: Basic programming tèchniques.

SUBJECT: CONTINUOUS OPTIMISATION (200616)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English

TEACHING STAFF:

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

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: STOCHASTIC OPTIMIZATION (200617)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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NÚÑEZ DEL TORO, ALMA CRISTINA (Dept EIO) - cristina.nunez@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: LARGE SCALE OPTIMIZATION (200618)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

CODINA SANCHO, ESTEVE (Dept EIO) - esteve.codina@upc.edu
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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: ACTUARIAL STATISTICS (200619)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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

TOPICS:
Section 1. Life 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: RISK QUANTIFICATION (200620)
SEMESTER: 2016-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: QUANTITATIVE MARKETING TECHNIQUES (200621)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

BECUE BERTAUT, MONICA M. (Dept EIO) - monica@eio.upc.edu

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 "Exploratory 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: STATISTICS FOR BUSINESS MANAGEMENT (200622)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

1. Statistics: The why and the what. Data quality. Evolution of the use of statistics. Proactive statistics.
2. The role of statistics in product design: Relationship between variability and customer satisfaction. Reducing variability, robust products. Planning tests (experiments).
3. Statistics in quality management. Planning, control and improvement. Improvement programs. Six Sigma methodology.
4. Statistics in other areas: customer management, financial services, process management
5. Selling statistics: internally and externally.

PRIOR SKILLS:

Knowledge of basic statistics: exploratory 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). Basic inference. Knowledge can be acquired in any basic statistics text book.

SUBJECT: SIMULATION FOR BUSINESS DECISION MAKING (200623)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

FONSECA CASAS, PABLO (Dept EIO) - pau@fib.upc.edu
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CASANOVAS GARCIA, JOSE (Dept EIO) - josepk@fib.upc.edu
BARCELÓ BUGEDA, JAIME (Dept EIO) - jaume.barcelo@upc.edu

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: 2016-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:
From the point of view of the thematic content, focusing on the socio- demographic and economic indicators that typically generate 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. In turn , given that 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 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: ECONOMETRIC ANALYSIS (200625)
SEMESTER: 2016-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: FINANCIAL STATISTICS (200626)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

CHULIÁ SOLER, HELENA (Dept UB) - hchulia@ub.edu

TOPICS:

1. Term structure of interest rates
2. Portfolio immunization
3. 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: CLINICAL TRIALS (200627)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: English Castellano

TEACHING STAFF:

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DE JOVER ARMENGOL, LLUÍS (Dept UB) - lluis_jover@ub.edu

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: ADVANCED EXPERIMENTAL DESIGN IN CLINICAL RESEARCH (200628)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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OCAÑA REBULL, JORDI (Dept UB) - jocana@ub.edu

TOPICS:

BLOCK 1. SOME EXPERIMENTAL DESIGNS
1.1. BALANCED INCOMPLETE BLOCK DESIGN (BIB)
1.2. CROSSOVER DESIGNS
BLOCK 2. BIOEQUIVALENCE AND Y EQUIVALENCE
2.1. INTRODUCTION TO BIOEQUIVALENCE (BE)
2.2. FURTHER BIOEQUIVALENCE APPROACHES AND RELATED CONCEPTS
2.3. EQUIVALENCE TESTS
BLOCK 3. ASSESSMENT OF THE DATA QUALITY: RELIABILITY AND CONCORNDANCE OF MEASUREMENTS
3.1. INTRODUCTION
3.2. ANALYSIS WITH QUALITATIVE DATA
3.3. ANALYSIS WITH CONTINUOUS DATA

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: 2016-S2 - Spring
TEACHING LANGUAGES: English

TEACHING STAFF:

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LANGOHR, KLAUS GERHARD (Dept EIO) - klaus.langohr@upc.edu

TOPICS:
B1: Beyond the Cox Model
B2: Counting Processes
B3: Multivariate Survival Analysis
B4: Special Issues: Interval Censoring and survival-longitudinal joint modelling

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: FUNDATIONS OF BIOINFORMATICS (200630)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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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: OMICS DATA ANALYSIS (200631)
SEMESTER: 2016-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: EPIDEMIOLOGY (200632)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:
LANGOHR, KLAUS GERHARD (Dept EIO) - klaus.langohr@upc.edu

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: SPATIAL EPIDEMIOLOGY (200633)
SEMESTER: 2016-S1 - Autumn
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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TOPICS:

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

SUBJECT: DISCRETE NETWORK MODELS (200634)
SEMESTER: 2016-S2 - Spring
TEACHING LANGUAGES: Castellano

TEACHING STAFF:

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RODRÍGUEZ PEREIRA, JESSICA (Dept EIO) - jessica.rodriguez@upc.edu

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: OPTIMIZATION IN DATA SCIENCE (200642)
SEMESTER: 2016-S1 - Autumn

TEACHING LANGUAGES: English

TEACHING STAFF:

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TOPICS:

Optimization in statistical problems.
Introduction to SVMs
Statistical data protection.

PRIOR SKILLS:

Basic concepts of Statistics and Operations Research.

SUBJECTS FROM OTHER MASTER PROGRAMS. CURS 2016-17

Master in Data Mining and Business Intelligence, MIRI (FIB, UPC)

http://masters.fib.upc.edu/masters/master-data-mining-and-business-intelligence

Focus on Machine and Statistical Learning

a. Machine Learning (ML-MIRI) Spring semester

The aim of machine learning is the development of theories, techniques and algorithms to allow a computer system to modify its behavior in a given environment through inductive inference. This inference is based on observed data that represent incomplete information about a phenomenon or process. Machine learning is a meeting point of different disciplines: statistics, artificial intelligence, programming and optimization, among others. The course is divided into conceptual parts, corresponding to several kinds of fundamental tasks: supervised learning (classification and regression), unsupervised learning (clustering, density estimation) and semi-supervised learning (reinforcement and transductive). Specific modeling techniques studied include artificial neural networks and support vector machines.

http://www.fib.upc.edu/en/masters/miri/syllabus.html?assig=ML-MIRI#tabs-2

b. Kernel based Machine Learning and Multivariate Modeling (KMLMM-MIRI) Fall semester

The first part of the course is devoted to Kernel-Based Learning and Support Vector Machine for classification, regression and novelty detection. Kernel functions are defined, and their properties and construction are addressed. Then specific kernels for different data types are introduced, such as real vectors, categorical information, feature subsets, strings, probability distributions and graphs. The course also reviews the basic theoretical foundations of kernel-based methods, focusing on statistical learning theory

The second part of the course extends the multiple linear regression to the multivariate response variable case. The correlation coefficient between two variables is extended to two groups of variables by Canonical Correlation Analysis. Finally Partial Least Squares Regression is introduced as a technique that, in some sense, extends Principal Components Analysis to the regression context.

http://www.fib.upc.edu/en/masters/miri/syllabus/KMLMM-MIRI.htm#tabs-2

c. Advanced Statistical Modeling (ASM-MIRI) Fall semester

The course covers different statistical regression models: simple and multiple linear regression, parametric non-linear regression, generalized linear model, nonparametric regression, generalized nonparametric regression. The model selection and validation is emphasized. A fundamental part of the course is the study of real cases, both by teachers and by students at the weekly assignments.

http://www.fib.upc.edu/en/masters/miri/syllabus.html?assig=ASM-MIRI#tabs-2

Focus on Big Data

d. Open Data (OD-MIRI) Spring semester

Big Data is traditionally defined with the three V's: Volume, Velocity and Variety. Traditionally, Big Data has been associated with Volume (e.g., the Hadoop ecosystem) and recently Velocity has earned its momentum (especially, with the arrival of Stream processors such as Spark). In this course the student will be introduced to advanced database technologies, modeling techniques and methods for tackling

Variety for decision making. We will also explore the difficulties that arise when combining Variety with Volume and / or Velocity.
http://www.fib.upc.edu/en/masters/miri/syllabus.html?assig=OD-MIRI#tabs-2

e. Cloud Computing (CLC-MIRI) Spring semester

Cloud computing is a service model for large-scale distributed computing based on a converged infrastructure and a set of common services over which applications can be deployed and run over the network. In this course we will provide a background on the principles and the state-of-the-art of large-scale distributed computing, and the means to understand and apply the model and services of cloud computing. In terms of principles, the course looks at how scale affects systems properties, issues (such as virtualization, availability, locality, performance and adaptation), system models (game-theoretic, economic, evolutionary, control, complexity), architectural models (multi-tier, cluster, cloud), environment and application requirements (such as fault tolerance, content distribution). In the other side, Big Data has become a hot topic in the field of large-scale distributed computing in recent years, impossible to separate it from Cloud Computing. Particularly, the exponential and fast growth of very different types of data has quickly raised concerns about how to store, manage, process and analyze that data. The second part of the course will start with a brief review of Big Data technologies that will shape our near future as well as attempts to visualize in which direction this technology will take us. The goal is to help students become part of this profound transformation that is causing big data and encourage the desire to want to delve further into this exciting world of technology and become actively involved.
http://www.fib.upc.edu/en/masters/miri/syllabus.html?assig=CLC-MIRI#tabs-2

f. Complex and Social Networks (CSN-MIRI) Fall semester

Networks are structures that show up where there is any kind of interaction: in social behavior, in biological, physical or chemical processes, among many others. Important real-world processes such as the spread of disease or people's buying patterns can be explained through the use and study of networks. This course will cover the fundamental aspects of networks: what are they and how can we measure them? What are their characteristics and properties? What type of processes are they able to carry out? How can we model them? Can we predict their behavior?

http://www.fib.upc.edu/en/masters/miri/syllabus.html?assig=CSN-MIRI#tabs-2

Master in Automatic Control and Robotics (ETSEIB – UPC)

Scientific Python for Engineers (3 ECTS;)

The goal of the class is to learn skills for scientific programming, focused on the application of advanced machine learning tools on robotics. Students will learn to develop structured and problem solving thinking in a competitive environment.

Master in Biomedical Engineering (Faculty of Physics-UB and ETSEIB-UPC)

Biomedical Informatics (2,5 ECTS;)

The course is structured in two stages. First the instructors will provide broad introductory lectures and advanced lectures on the use of python and Scientific Python, R and interfacing of both languages to database systems. Students will be asked to read scientific papers, write reviews and present selected papers in the area of biomedical data mining, and they will be expected to participate and contribute to the class discussion. Classes will be mainly practical, with hands on interactive sessions aimed to solve small tasks while incrementally approaching to the data mining process. This first part will take half of the teaching time of the course. The second stage of the course contains no lectures and is focused to the development of a research project. This research project involves the design of the programmatic analysis of a very large (in terms of BigData) biomedical dataset in an open challenge format. In this team work project, students will use the acquired data mining techniques with the integration of Python, scientific python, R, to extract relevant information from the database, including statistics and visualization.