

Métodos Cuantitativos

Código: 40094
Créditos ECTS: 15

| Titulación | Tipo | Curso | Semestre |
|--|------|-------|----------|
| 4313805 Análisis Económico / Economic Analysis | OB | 1 | 1 |

Contacto

Nombre: Francisco Obiols Homs

Correo electrónico: Francesc.Obiols@uab.cat

Equipo docente

Jordi Caballé Vilella

Katerina Chara Papioti

Uso de idiomas

Lengua vehicular mayoritaria: inglés (eng)

Prerequisitos

sin
prerrequisitos

Objetivos y contextualización

This module provides students advanced quantitative tools. These tools are necessary for economic analysis.

This module covers optimization, and probability and statistics . The module is organized in two sections. The first section covers the foundations of optimization theory. The second section provides students with the theoretical foundations of probability and statistics necessary for econometric and financial analysis.

Competencias

- Analizar conceptualmente un problema económico concreto utilizando herramientas analíticas avanzadas.
- Capacidad de articular los fundamentos de la teoría económica derivándolos analíticamente a través de razonamientos matemáticos.
- Capacidad de identificar los fundamentos del análisis estadístico y de las técnicas econométricas derivándolos de las leyes de la probabilidad y la estadística.
- Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
- Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

Resultados de aprendizaje

1. Describir los temas de estadística sobre los que se basa el análisis económico estocástico y el análisis empírico
2. Distinguir los elementos a incluir y los supuestos necesarios para plantear un problema de decisión con interacciones estratégicas muy sencillas
3. Enmarcar una pregunta económica de decisión en un contexto estratégico sencillo en un problema matemático y derivar su respuesta a través de la lógica matemática
4. Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
5. Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.
6. Utilizar las matemáticas para analizar problemas económicos

Contenido

I. Optimization

1. Sets and Metric Spaces:

- 1) Ordered Sets (Equivalence Relations, Order Relations, Partially Ordered Sets, Weakly Ordered Sets)
- 2) Metric Spaces (Open and Closed Sets, Convergence)

2. Functions and Correspondences:

- 1) Monotonicity
- 2) Continuity
- 3) Fixed Point Theorems (Tarski, Banach, Brower)

3. Linear Spaces and Linear Algebra:

- 1) Subspaces
- 2) Basis and Dimension
- 3) Affine and Convex Sets
- 4) Normed Linear Spaces
- 5) The determinant
- 6) Systems of Linear Equations

4. Smooth functions, Optimization and Comparative Statics:

- 1) Linear Approximation and the derivative
- 2) Mean Value Theorem
- 3) Unconstrained Optimization, Equality and Inequality constraints
- 4) Envelope Theorem

5. Difference and Differential Equations:

- 1) Types and Solution concepts

II. Probability and Statistics

1. Probability

Combinatorics. Events and measurable spaces. Probability. Conditional probability. Theorem of total probability. Bayes' theorem.

2. Measure Theory

Lebesgue measure. Lebesgue-Stieltjes measures and distribution functions. Measurable functions. Integral with respect to a measure. Absolute continuity of measures and the Radon-Nikodym theorem. Product measures and Fubini's theorem.

3. Random Variables and Distributions

Random variables. Probability distributions. Distribution function of a random variable. Discrete random variables and probability functions. Absolutely continuous random variables and densities. Random vectors and marginal distributions. Independent random variables. Generalized conditional probability and distribution.

4. Expectation

Mathematical expectation. Moments. Chebyshev's inequality. The moment-generating function of a random variable. Product moments. Mean and variance of linear combinations of random variables. Conditional expectation. The law of iterated expectations. Jensen's inequality.

5. Special Distributions

The discrete uniform, Bernoulli, binomial, Pascal, geometric, and hypergeometric distributions. The multinomial and multivariate hypergeometric distribution. Integration by parts and by change of variable to polar coordinates. The uniform, gamma, exponential, chi-square, and beta distributions. The normal and the multivariate normal distributions.

6. Functions of Random Variables

The distribution of a function of a random variable. The probability function of a function of a random variable. The density of a function of a random variable. Characteristic functions, moment-generating functions, and Laplace transforms of functions of random variables.

7. Stochastic Processes and Limiting Distributions

Stochastic processes. Filtrations and martingales. Markov processes. Convergence in probability, in mean square, in distribution, and almost sure convergence. Convergence of distribution functions and of probability measures. The Poisson distribution as the limit of binomial distributions. The standard normal distribution as the limit of standardized binomial distributions. Laws of large numbers. The central limit theorem.

8. Sampling

Random samples and statistics. The distribution of the sample mean. The distribution of the variance of a random sample from a normal population. The t distribution. The F distribution.

9. Estimation

Point estimation. Efficiency of estimators. The sample mean and sample variance as unbiased estimators. The Cramér-Rao lower bound for unbiased estimators. Asymptotic properties of estimators: consistent estimators. Sufficient estimators. The method of moments. Maximum likelihood estimation. Bayesian estimation. Interval estimation.

10. Hypothesis Testing

Statistical hypotheses and their tests. The power function of a test. The Neyman-Pearson lemma. Likelihood ratio tests. Acceptance intervals. The p -value. Contingency tables. Goodness of fit.

Metodología

- Theory classes
- Practical classes
- Learning based on problem solving
- Tutorials
- Personal study
- Study groups
- Textbook reading
- Article reading

Actividades

| Título | Horas | ECTS | Resultados de aprendizaje |
|---|-------|------|---------------------------|
| Tipo: Dirigidas | | | |
| Problems sets, tutorials | 112,5 | 4,5 | 1, 2, 3, 5, 4, 6 |
| Theory classes | 112,5 | 4,5 | 1, 2, 3, 5, 4, 6 |
| Tipo: Autónomas | | | |
| Personal study, study groups, textbook readings, article readings | 150 | 6 | 1, 2, 3, 5, 4, 6 |

Evaluación

Final Exams

A module consists of different courses which are evaluated through final exams, problem sets and assignments and other class activities such as class attendance, presentations, etc.

Class attendance and active participation

20%

Actividades de evaluación

| Título | Peso | Horas | ECTS | Resultados de aprendizaje |
|---|------|-------|------|---------------------------|
| Problem sets and assignments | | | | |
| Class Attendance and Problem sets and assignments | 50% | 0 | 0 | 1, 2, 3, 5, 4, 6 |
| Final Exams | 50% | 0 | 0 | 1, 2, 3, 5, 4, 6 |

Bibliografía

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- Bierens, H.J. (2004), Introduction to the Mathematical and Statistical Foundations of Econometrics, Cambridge

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DeGroot, M.H. and Schervish (2012), M.J., Probability and Statistics, Pearson.

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