Probability

A.A. 2011/2012
Graduate School of Economics and Management
Universities of Ca' Foscari Venezia, Padova and Verona

TEACHER RESPONSABLE: Prof. Marco Minozzo
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Teaching

The course will take place over 9 weeks (from the 4th of October 2011 to the 29th of November 2011) for a total amount of 30 hours (20 hours lessons; 10 hours exercises). The lessons will take place according to the following calendar:

Tuesday, 4th October 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Thursday, 6th October 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 11th October 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 18th October 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 25th October 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 8th November 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Thursday, 10th November 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 15th November 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 22nd November 2011, 14.00-17.00 (3 hours), Aula Messedaglia;
Tuesday, 29th November 2011, 14.00-17.00 (3 hours), Aula Messedaglia.

Availability

The course is intended for 1st year students on PhD in Management and in Economics and Finance.

Pre-requisites

Introduction to Mathematics and Elementary Statistical Theory (elementary set theory, textbook pp 1-13). Attendance at more advanced courses such as Real Analysis, Probability, Distribution Theory and Inference would be desirable.

Objectives of the course

The purposes of this course are: (i) to explain, at an intermediate level, the basis of probability theory and some of its more relevant theoretical features; (ii) to explore those aspects of the theory most used in advanced analytical models in economics and finance; (iii) to give an introduction to some concepts of statistical inference. The topics will be illustrated and explained through many examples.

Assessment

A two-hour written paper at the end of the course. The exam should take place the 12th of December 2011, from 14.00 to 16.00.

COURSE CONTENT

1. Axiomatic definition of probability. Properties of probability measure. Conditional probability, stochastic independence.
2. Random variables, distribution functions and density functions. Expectation and moments of random variables.
3. Some parametric families of random variables.
4. Multivariate random variables. Joint and conditional distributions. Stochastic independence. Expectation. Covariance and correlation. Independence and expectation. Cauchy-Schwartz

inequality.
5. Bivariate normal distribution. Density function, moments, marginal and conditional densities.
6. Distributions of transformations of random variables.
7. Convergence of sequences of random variables. Laws of large numbers. Central limit theorems.
8. Sampling and sampling distributions. Sample mean. Order statistics. Sample cumulative distribution function.
9. Statistical theory. The basics of point estimation and hypotheses testing from the frequentist viewpoint.
10. A different view of probability and statistics: the Bayesian paradigm.

Textbook

A.M. Mood, F.A. Graybill, D.C. Boes (1974). Introduction to the Theory of Statistics. McGraw-Hill.

A set of exercises with solutions will be distributed by the teacher.

Indicative reading

Chapter 1. Probability
[no Example 1.20, Example 1.28]

Chapter 2. Random Variables, Distribution Functions, and Expectations

Chapter 3. Special Parametric Families of Univariate Distributions
[no 3.2.3, Theorem 3.7, Theorem 3.8, just the definition of the negative binomial, 3.2.6, 3.4.1]

Chapter 4. Joint and Conditional Distributions, Stochastic Independence, More expectation

Chapter 5. Distributions of Functions of Random Variables
[no Formula 5.13, Theorem 5.4, Theorem 5.8, Example 5.13]

Chapter 6. Sampling and Sampling Distributions
[no 6.2, 6.3.5, 6.3.6, 6.3.7, 6.4, 6.5.2, Theorem 6.16]

Chapter 11. Nonparametric Methods
[just 11.1, 11.2, 11.2.1 (no Formula 11.7)]

Appendix A. Mathematical Addendum
[no A.2.3, no multinomial theorem]

Further readings

G. Casella and R.L. Berger (2002). Statistical Inference, second edition. Duxbury Thompson Learning.
M.J. Evans and J.S. Rosenthal (2003). Probability and Statistics - The Science of Uncertainty. W.H. Freeman.
D. Stirzaker (2003) Elementary Probability, Cambridge University Press.
L. Wasserman (2004). All of Statistics, Springer.

Advanced readings

R.B. Ash and C.A. Doléans-Dade (2000). Probability and measure theory, Harcourt/Academic Press.
M.J. Schervish (1995). Theory of Statistics, Springer.