



Programme of Course "Calcolo delle probabilità A"

- Code: DT0022
- Type of course unit: Compulsory (Bachelor Degree in Mathematics curriculum Generale)
- Level of course unit: Undergraduate Degrees
- Semester: 2

Number of ects credits: (Bachelor Degree in Mathematics) 6 (workload 150 hours)

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1	Course objectives	This course provides an extensive introduction to probability theory and to its main techniques and motivations. In this course there is also an introduction to the Markov chains that are one of the most important example of random processes. On successful completion of this module, the student has the knowledge of the basic concept in probability and knows how to apply them in the study of concrete problems.
2	Course content and learning outcomes (dublin descriptors)	<p>Topics of the module include:</p> <ul style="list-style-type: none"> • Events and their probabilities. Probability spaces. Conditional probability. Independence and relation with product spaces. • Random variables and their distribution. Discrete and continuous random variables. Independence. Main distributions. Random vectors. Conditional distribution and conditional expectations. Functions of random variables. • Expectation and moments. Variance and covariance. Independence. Inequalities: Cauchy-Schwarz, Markov, and Chebyshev. • Convergence of random variables: convergence in law, quadratic mean and in probability. Law of large numbers. • Generating functions. Continuity theorem. The central limit theorem. • Markov chains. Transition probability and Chapman-Kolmogorov equations. Examples: random walk, birth-death processes. Stopping times. Classification of states. Properties and characterizations of transient and recurrent states. Stationary distributions. Reversible processes. Regular chains: the Markov-Kakutani theorem. <p>On successful completion of this module, the student should :</p> <ul style="list-style-type: none"> • On successful completion of this course, the student should have profound knowledge of basic definitions and techniques in probability, have knowledge and understanding of Markov chains, have profound knowledge of the fundamental concepts of probability theory. • On successful completion of this course, the student should understand the connections with other fields of mathematics and should be aware of potential applications. • On successful completion of this course, the student should make informed choice on the suitability of the probabilistic models and approximation in concrete problems. • On successful completion of this course, the student should communicate the results and the understanding of its studies during the course. • On successful completion of this course, the student should be able to read and understand books and seminar in elementary probability topics.
3	Course prerequisites	Analysis and geometry at the first two years level.
4	Teaching methods and language	<p>Lectures and exercises</p> <p>Language: Italian</p> <p>Reference textbooks</p> <ul style="list-style-type: none"> • S. Ross, <i>A First Course in Probability</i>, Prentice Hall. 1998. • P. Baldi, <i>Calcolo delle Probabilità</i>, McGraw-Hill. 2007. • D. Stirzaker, <i>Elementary probability</i>, Cambridge University Press. 2003. • F. Caravenna P. Dai Pra, <i>Probabilità, Un'introduzione attraverso modelli e applicazioni</i>, Springer. 2013.

5	Assessment methods	Written and oral test
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