



### PROBABILITY

<b>Enrollment year</b>	2014/2015
<b>Academic year</b>	2015/2016
<b>Regulations</b>	DM270
<b>Academic discipline</b>	
<b>Department</b>	DEPARTMENT OF MATHEMATICS "FELICE CASORATI"
<b>Course</b>	MATHEMATICS
<b>Curriculum</b>	PERCORSO COMUNE
<b>Year of study</b>	2°
<b>Period</b>	1st semester (01/10/2015 - 15/01/2016)
<b>ECTS</b>	9
<b>Lesson hours</b>	84 lesson hours
<b>Language</b>	ITALIAN
<b>Activity type</b>	ORAL TEST
<b>Teacher</b>	RIGO PIETRO (titolare) - 6 ECTS REGAZZINI EUGENIO - 3 ECTS
<b>Prerequisites</b>	Study of intermediate analysis and measure theory will provide helpful background
<b>Learning outcomes</b>	Deep analysis of the Kolmogorov theory of probability, with a view to its application to the study of the general theory of stochastic processes.
<b>Course contents</b>	<ol style="list-style-type: none"><li>1.- Kolmogorov probability space. Construction through the extension theorems of Kolmogorov and Ionescu-Tulcea. Analysis of the condition of stochastic independence.</li><li>2.- Expectation, basic inequalities (Tchebyshev, Jensen maximal Kolmogorov) convergence of sequences of random elements: in probability and almost sure: Borel-Cantelli lemmata and other 0-1 laws (Kolmogorov, Hewitt-Savage).</li><li>3.- Integral transformations of probability distributions.</li><li>4.- Laws of large numbers: Khintchin weak law, Etemadi strong law.</li></ol>

5.- Weak convergence of probability laws: the Prokhorov theory. The central limit theorem: the Lindeberg formulation for triangular arrays of independent random numbers.

5.- Conditional expectation as Radon-Nikodym derivative and as projection (regression function). Existence of regular conditional distributions.

6.- Sequences of random numbers forming a (s)martingale: convergence, optional stopping theorems and applications to real analysis, maximal inequalities, gambler ruin problem, strong laws of large numbers.

**Teaching methods**

Lectures on the theory and introduction to problem solving through exercises assigned in the form of homework.

**Recommended or required readings**

In addition to teacher's notes, see: Erhan Cinlar (2011) Probability and Stochastics. Springer.

**Assessment methods**

Oral examination together with check of some of the problems assigned as homework.

**Further information**

Oral examination together with check of some of the problems assigned as homework.

**Sustainable development goals - Agenda 2030**

[Sbl legenda sviluppo sostenibile](#)