UCLouvain

lmat1371

2017

Probability Theory

5 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Segers Johan ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	LMAT1271 - calcul des probabilités et analyse statistique. LMAT1322 - Théorie de la mesure. *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	Probability spaces. Modes of convergence of sequences of random variables. Convergence in distribution.
Aims	Contribution of the course to learning outcomes in the Bachelor in Mathematics programme. By the end of this activity, students will have made progress in: - Recognise and understand a basic foundation of mathematics. '- Choose and use the basic tools of calculation to solve mathematical problems. '- Recognise the fundamental concepts of important current mathematical theories. - Show evidence of abstract thinking and of a critical spirit. '- Argue within the context of the axiomatic method Recognise the key arguments and the structure of a proof. '- Construct and draw up a proof independently. 1 '- Evaluate the rigour of a mathematical or logical argument and identify any possible flaws in it. '- Distinguish between the intuition and the validity of a result and the different levels of rigorous understanding of this same result. Learning outcomes specific to the course. By the end of this activity, students will be able to: - To work with probabily measures, random variables and their distributions in an abstract framework. - Prove and apply the convergence of a sequence of random variables : almost surely, in probability and in distribution. - Prove and apply the independence of a family of sigma-fields or random variables. - Make connections between probability theory and other branches of mathematics, in particular measure theory, complex analysis and functional analysis. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	Assessment is based on a written examination that focuses on theory and on exercises. This is an 'open book' examination. It tests knowledge and understanding of fundamental concepts and results and of their proofs, and the ability to construct and write a coherent argument.
Teaching methods	Learning activities consist of lectures and exercise sessions. These two activities are given in presential sessions. In the lectures, the teacher first gives an overview of the chapter in question, setting the main results in the overall context of the course. Students are then invited to read and study the chapter in detail, especially the proofs and theorems. This individual work is guided by the revision questions in the relevant documents on Moodle. In the following session, a number of points and proofs are reviewed as a result of students' questions. In the exercise sessions, students carry out exercises whose numbers have previously been announced on Moodle. The exercises themselves and hints to their solutions are found in the course notes. Students advance at their own pace, and the teaching assistant supplies individual explanation.
Content	The course comprises three parts. The first one treats probability spaces seen as measure spaces with total mass equal to unity. The second part is about different modes of convergence of sequences of random variables, the main result being the strong law of large numbers. The subject of the third and final part is convergence in distribution, culminating in the central limit theorem. The following concepts are treated : - Probability spaces - Random variables - Expectation

	- Convergence of random variables - Independence - Law of large numbers - Convergence in distribution - Characteristic functions - Central limit theorem
Inline resources	Page on Moodle (http://moodleucl.uclouvain.be/course/view.php?id=4703). The webpage contains a document with the numbers of the exercises to be prepared for the tutorials as well as documents with supplementary questions and exercises.
Bibliography	Syllabus disponible sur iCampus.
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Statistics: General	STAT2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Bachelor in Mathematics	MATH1BA	5	LMAT1271	