




5.00 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.
Main themes	Probability spaces. Modes of convergence of sequences of random variables. Convergence in distribution.
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p><b>Contribution of the course to learning outcomes in the Bachelor in Mathematics programme.</b></p> <p><b>By the end of this activity, students will have made progress in :</b></p> <ul style="list-style-type: none"> <li>- Recognise and understand a basic foundation of mathematics.</li> <li>-- Choose and use the basic tools of calculation to solve mathematical problems.</li> <li>-- Recognise the fundamental concepts of important current mathematical theories.</li> <li>- Show evidence of abstract thinking and of a critical spirit.</li> <li>-- Argue within the context of the axiomatic method Recognise the key arguments and the structure of a proof.</li> <li>-- Construct and draw up a proof independently.</li> <li>-- Evaluate the rigour of a mathematical or logical argument and identify any possible flaws in it.</li> <li>-- Distinguish between the intuition and the validity of a result and the different levels of rigorous understanding of this same result.</li> </ul> <p><b>Learning outcomes specific to the course.</b></p> <p><b>By the end of this activity, students will be able to :</b></p> <ul style="list-style-type: none"> <li>- To work with probability measures, random variables and their distributions in an abstract framework.</li> <li>- Prove and apply the convergence of a sequence of random variables : almost surely, in probability and in distribution.</li> <li>- Prove and apply the independence of a family of sigma-fields or random variables.</li> <li>- Make connections between probability theory and other branches of mathematics, in particular measure theory, complex analysis and functional analysis.</li> </ul>
Evaluation methods	<p>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.</p> <p>During the course, some tests are organized allowing the students not only to practice their skills but also to get a joker for some of the exam questions.</p>
Teaching methods	<p>Learning activities consist of lectures and exercise sessions.</p> <p>In a typical lecture, the teacher first gives an overview of a chapter, motivating and giving context to the mathematical definitions and results. Students are then invited to read and study the chapter in detail and to solve the questions in the text. During this stage, the teacher interacts with the students individually or in small groups.</p> <p>The exercises to be solved in the tutorials are announced in advance, allowing the students to prepare themselves.</p>
Content	<p>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.</p> <p>The following concepts are treated :</p> <ul style="list-style-type: none"> <li>• Probability spaces</li> <li>• Random variables</li> <li>• Expectation</li> <li>• Convergence of random variables</li> <li>• Independence</li> </ul>

	<ul style="list-style-type: none"> <li>• Law of large numbers</li> <li>• Convergence in distribution</li> <li>• Characteristic functions</li> <li>• Central limit theorem</li> </ul>
Inline resources	The syllabus and some additional documents are available on the MoodleUCL course page.
Bibliography	Syllabus disponible sur Moodle.
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Statistics: General	STAT2M	5		
Bachelor in Mathematics	MATH1BA	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Certificat d'université : Statistique et science des données (15/30 crédits)	STAT2FC	5		