UCLouvain

binge1131

2024

Probability

4.00 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Heuchenne Cédric ;Uyttendaele Nathan (compensates Heuchenne Cédric) ;
Language :	French
Place of the course	Bruxelles Saint-Louis
Learning outcomes	**At the end of this learning unit, the student is able to :** • **understand** and **model** the randomness of certain phenomena • **correctly** model simple experiments (drawing from an urn with or without a discount) and **calculate** the probabilities of the events of interest • **apply** these basic models to real-life situations (gambling, insurance, calculating the profitability of a stock, etc.); • **describe** a random experiment using uni- and bi-variate random variables; • **use** discrete and continuous random variables to **calculate** probabilities in real problems; • **study** the properties of functions of random variables.
Evaluation methods	The evaluation will take place in June and August, in person via Moodle. The type of exam is designed to assess the student's mastery of the technical and computational aspects of the course, their rigor in these areas, their ability to interpret the results obtained, and to evaluate their reasoning. Such an evaluation not only tests the student's understanding of the course (comprehending its concepts, applying them in exercises, and interpreting results) but also requires the ability to go slightly beyond the material covered in lectures and practical sessions, using their own initiative. In other words, it involves making the effort to fully grasp the course material to be able to use it effectively. The June and/or August evaluations will in no way be an identical replica of previous years' exams. Simply focusing on past exam questions and practical exercises, hoping to find the same (or nearly the same) ones in the exam, will not be enough to pass; this is entirely insufficient. During the evaluations, students will be allowed to use a basic calculator (single-line display). The exam will be closed-book. **Note:** This course plan may evolve throughout the term, depending on the dynamics with students, and from year to year, as improvements are made to the course and practical sessions.

Teaching methods	Lectures and exercise sessions (practical sessions). The lectures and practical sessions (TPs) are held in person; both the course and the TPs will be complemented by potential Question/Answer sessions on Teams, and by the use of the Moodle platform, where students are required to enroll. Communications and instructions related to the course and TPs will be sent to students via announcements on Moodle. a) The lecture provides a systematic introduction to the theoretical and methodological foundations of probability theory and its probabilistic reasoning. In addition to intuitive explanations of the material, the lecture emphasizes formalized concepts and manipulations that allow for a rigorous understanding of probability theory. It is accompanied by concrete examples, particularly selected from the field of economics but also from areas of interest to management engineering students, aimed at illustrating and applying the theory. Throughout the course, a particular effort is made to involve students in the development and discovery of concepts useful for statistics and their applications. Active participation in the course should enable students to fully benefit from the practical sessions that complement the lecture and to immediately engage in a research-oriented approach. By the end of the course, students should be able to understand and model the random aspects of simple experiments and calculate the probabilities of resulting events. They should also be able to apply these models to more complex and real-world situations and describe these phenomena through appropriate random variables (univariate and multivariate). Additionally, they will be required to know the properties of functions of random variables and how these concepts apply directly to the framework of statistical analysis (sampling). This course opens the door to various other courses in the management engineering curriculum and prepares students for the quantitative methods necessary for their future projects and final theses. This course is particularly designed to prepare students for the Advanced Statistics course (INGE1231) and Econometrics (ECGE1330). b) The practical sessions are based on a collection of exercises, which largely includes exercises from the reference book (W.M.S.). c) Active participation in lectures and practical sessions, as well as participation in any Question/Answer sessions, is essential; success depends on it. Regular personal work (particularly understanding the course and finding solutions to the proposed exercises) must be done by the student from the first week of the course. It is absolutely essential that students get into the rhythm of the course and TPs from the start of the semester. Each student must therefore dedicate sufficient personal study time to ensure that they understand and master the material as it is covered, using their lecture notes, course videos, slides, the reference book (W.M.S.), and the educational resources related to the TPs. By the end of the semester, the period before the exam should not be a time of discovery, but a time of reviewing material that has already been understood and acquired. The expected personal work is in no way rote memorization. What will be evaluated in the exam is not the student's ability to recall information, but rather their in-depth understanding of the concepts and explanatory mechanisms, as well as their ability to use them appropriately, not forgetting the computational aspect. Other reference books, available at the University Library or online, are suggested to students as complementary resources for their more or less formalized approach and/or for their range of solved or unsolved exercises.
Content	This "Probability" course is based on an English reference textbook: D. Wackerly, W. Mendenhall, and R. Scheaffer, *Mathematical Statistics with Applications,* Duxbury Press, 7th Edition, 2008. This course covers the classical aspects of probability theory but places the concepts discussed in the context of their use in mathematical statistics. The probabilistic model and the basic properties of probability are central to the course. We will also consider random experiments where the characteristic of interest can be modeled by a random variable (discrete, continuous, uni- or multivariate). The analysis of functions of random variables is presented and motivated by their implications in the analysis of sampling distributions of statistics that will appear in statistical inference (INGE1231 - Advanced Statistics). Special emphasis will be placed on the importance of the "central limit theorem." • Chapters 1 to 7 of the reference book (W.M.S.) are covered in this Probability course. • Chapters 7 to 14 form the content of the subsequent Advanced Statistics course (INGE1231). This course focuses on the following chapters: • Introduction to Statistics (W.M.S., Chapter 1) • Probability (W.M.S., Chapter 2) • Discrete Random Variables (W.M.S., Chapter 3) • Continuous Random Variables (W.M.S., Chapter 4) • Multivariate Variables (W.M.S., Chapter 5) • Functions of Random Variables (W.M.S., Chapter 6) • Sampling and the Central Limit Theorem (W.M.S., Chapter 7)
Bibliography	- Wackerly D. D., Mendenhall W and R.L. Scheaffer, Mathematical Statistics with Applications, Duxbury Press, 7th ed., 2008 (le livre de reference du cours) - Mood A.M., Graybill F.A. and D.C. Boes, Introduction to the Theory of Statistics, Mc Graw Hill Ed., 1974. (http://www.colorado.edu/economics/morey/7818/MoodGraybillBoesBook/MGB3rdSearchable.pdf) - Rohatgi V. K. and A. M. Md. Ehsanes Saleh, Introduction to probability and Statistics, Wiley-Interscience; 2d ed., 2000. - Ross S., A first course in Probability, Pearson International Edition, 9th ed., 2013. ISBN-10: 1292024925. - Comte M. et J. Gaden, Statistiques et Probabilités pour les sciences économiques et sociales, Collection Mayor, PUF, 1ère édition, 2000.

Other infos	- The course is mandatory for students in the "Management Engineering" program. - The course is recommended for students seeking a more in-depth education in statistics. - The course is not recommended for students who struggle with mathematics. - This course is part of a statistical training sequence in the field of management and economics. It will be followed by Advanced Statistics (INGE1231) and Econometrics (ECGE1330).
Faculty or entity in charge	ESPB

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor : Business Engineering	INGB1BA	4		
Bachelor : Business Engineering (French-English)	INAB1BA	4		
Bachelor : Business Engineering (French-Dutch-English)	INTB1BA	4		