binge1231
2023

In depth Statistics

5.00 credits	45.0 h + 22.5 h	Q1

Teacher(s)	Heuchenne Cédric ;
Language :	French
Place of the course	Bruxelles Saint-Louis
Prerequisites	*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.*
Learning outcomes	**At the end of this learning unit, the student is able to :** a) General aim: To introduce to the way of reasoning of statistical inference and to the fundamental methods of statistical analysis. These methods are useful in every scientific field where random and/or experimental aspects occur (human, technical, medical and natural sciences). The course will especially develop the tools and models useful for economics and management sciences. b) Specific aims: At the end of the "in depth statistics" course, the students should be able: - to understand the mechanism of statistical inference; - to correctly model an inference problem; - to solve and treat simple and standard problems of statistical inference; - to master the fundamental concepts of the estimation theory and hypothesis tests; - to apply these concepts to non-standard models; - to solve and treat classical statistical problems, regression analysis, variance analysis, and adjustment tests.
Evaluation methods	The assessment is a closed book written examination: - the examination questions will be mostly selected among the exercises and examples of the handbook (the list of relevant exercises will be given during the tutorials); - these questions will be completed by other, more theoretical, reflexive and interpretative questions; - the students will have at their disposal a form with the main discrete and continuous probability principles studied in class and their main characteristics (moments, MGF) ; - they will also have a general form including the main useful probability and statistical formulas; - the useful statistical tables will also be available. Active assistance at lectures and tutorials is highly recommended. Regular work (including solving exercises) is compulsory from the first week on. The written examination takes place during the three exam sessions, in the following way: The whole exam lasts three hours. During the first part (90'), the student will be assessed on his understanding of the course, requiring personal reflection on the entire subject matter and the mastery of the course material. The second part (90') will be devoted to solving exercises. Each part counts for # of the final mark. The students will be entitled to use the form mentioned above, the statistical tables and their calculator (not alphanumerical).

Teaching methods	a) The lecture is a systematic initiation to theoretical and methodological foundations of mathematical statistics; the teaching method is supported by intuitive explanations and formalized concepts of the mathematical statistics. In order to illustrate and apply the theory, the course is accompanied by concrete examples selected in the field of economics but also in the ones of interest of the management engineer.
	It is accompanied by examples that aim to illustrate the theory. A special effort is made throughout the course to involve the students in the discovery and formulation of new statistical concepts and their applications. This active participation to the sessions should enable the students to fully benefit from the tutorials that complete the lecture and also to wholly engage in a research approach.
	The course is supported by the following English handbook : Wackerly D. D., Mendenhall W and R.L. Scheaffer, Mathematical Statistics with Applications, Duxbury Press, 7th ed., 2008. The French written slides of the lecture are also available (platform eSaintlouis).
	b) Tutorials, provided by Mr B. Peeters, are based on a collection of exercises (in continuous development) mostly available at the handbook. Mr B. Peeters continues the teaching method started in BAC 1 for the Probability course. He will set reception hours that the students are invited to comply with.
	c) Active attendance to lectures and tutorials is highly recommended; this will greatly improve chances of success. But
	a personal work is also essential to pass the exam. Regular work (including solving exercises) is compulsory from the first week on. The students have to spent enough time for understanding deeply the course material and for achieving suffisant skills. So the personal work does'nt consist in learning by heart.
	Other reference books, available at the Faculty library, will be proposed to the students, for additional information, for their more or less formalized aspect and/or their range of solved or unsolved exercises.
Content	This course, as well as the "probabilities" course, is based on the following book : W. Mendenhall, D. Wackerly and R. Scheaffer, Mathematical Statistics with Applications, Duxbury Press, 7th edition, 2008. - chapters 1 to 7 constitute the subject matter of "Probabilities" in BAC 1; - chapters 7 to 14 constitute the subject matter of "Extensive Statistics" in BAC 2.
	This course presents the following chapters: - Chapter 7: Sampling and « central-limit » theorem; - Chapter 8: Point and interval estimation: fundamental elements; - Chapter 9: Estimation theory; - Chapter 10: Hypothesis tests; - Chapter 11: Regression model and least squares adjustment (including matrix notation); - Chapter 12: Introduction to experimental plans (comparison of two means: paired or independent samples); - Chapter 13: One-criterion Variance analysis; - Chapter 14: Analysis of categorical data (Chi-square tests: goodness-of-fit test and test of independence).
Bibliography	- Wackerly D. D., Mendenhall W and R.L. Scheaffer, Mathematical Statistics with Applications, Duxbury Press, 7th ed., 2008.
	- 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.
	- Mendenhall W, Sincich T. and Nancy S. Boudreau, Statistics for Engineering and the Sciences, Pearson Prentice Hall, 6th ed., 2016.
	- Knight, K. (1999). Mathematical Statistics. ISBN-13: 9781584881780
	- Casella, G. et Berger, R.L.. (2012). Statistical Inference. ISBN-13: 9780534243128.
Other infos	- The course is compulsory for the students in Management Engineering. - The course is recommended for students looking for an in depth training in statistics. - This course is part of a logical progression in statistical training. It is normally preceded by the "probabilities" course in BAC 1 and followed by the "multivariate statistics and econometrics" course in BAC 3. - The course is to be avoided by students experiencing difficulties in mathematics.
Faculty or entity in charge	ESPB

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor : Business Engineering	INGB1BA	5	BINGE1131	🔍
Bachelor : Business Engineering (French-English)	INAB1BA	5	BINGE1131	🔍
Bachelor : Business Engineering (French-Dutch-English)	INTB1BA	5	BINGE1131	🔍