

3 credits

15.0 h + 7.5 h

Q1

Teacher(s)	von Sachs Rainer ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	A basic course on methodological statistics, including an introductory course in probability and statistics, followed by the course LSTAT2040. <i>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.</i>
Main themes	The course is a follow-up to the course LSTAT2040. Concepts in statistical methodology, in particular for optimal inference, will be treated in greater depth and will be complemented by a non-asymptotic theory.
Aims	<p>By the end of the course, the student will have become familiar with the necessary concepts in mathematical statistics complementary to (asymptotic) likelihood theory. The concept of sufficiency has become also important recently for dimension reduction in high-dimensional statistics. The student will be able to put the different themes in a general, abstract context, both regarding their application to problems in statistical analysis and regarding their interpretation. The student will master the technical tools to apply the concepts correctly and will be able to reproduce and to elaborate upon the mathematical arguments underlying the results. The concept of sufficiency has become also important recently for dimension reduction in high-dimensional statistics.</p> <p>-----</p> <p><i>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".</i></p>
Evaluation methods	<b>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</b> There will be an oral exam, preceded by a written preparation. Alternatively, the student will be evaluated on his presentation during the course.
Teaching methods	<b>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</b> The course consists of both lectures and tutorials. The lecture part of the course will often be taught by the concept of "classe inversée", i.e. students read the course material (detailed syllabus) in advance, meet the teacher to prepare a presentation and present the material in front of their peers.
Content	<b>Theory of Optimality for Statistical Inference</b> The concept of sufficiency, in particular when applied to the important and rich class of exponential families, delivers a non-asymptotic theory of optimality of statistical procedures. The applications are numerous: for risk-optimal point estimation one can define the concept of UMV(U) estimators, i.e. "uniformly minimal variance (unbiased)" estimators. For the theory of statistical hypothesis testing, to be more abstractly formalised following the Neyman principle, it is possible to characterise the optimality of existing tests via the concept of UMP(U) tests, i.e., "uniformly most powerful (unbiased)" tests. A particular challenge here is the treatment of multi parameter families. Finally, the results from test theory can be directly transferred to define optimality of confidence regions.
Inline resources	moodle
Bibliography	A part du syllabus du cours, les ouvrages suivants sont à conseiller: <ul style="list-style-type: none"> <li>- Casella, G., Berger, R.L. (2001). Statistical Inference (2nd ed). Cengage Learning.</li> <li>- Lehmann, E.L. (1999). Elements of Large-Sample Theory. Springer.</li> <li>- Lehmann, E.L., Romano, J. (2005). Testing Statistical Hypotheses (3rd ed). Springer.</li> <li>- Monfort, A. (1997). Cours de statistique mathématique (3rd ed). Economica.</li> </ul>
Other infos	The course notes will be distributed during the lectures itself. There will also be a Syllabus.
Faculty or entity in charge	LSBA

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Statistics: General	<a href="#">STAT2M</a>	3	<a href="#">LSTAT2040</a>	
Master [120] in Mathematics	<a href="#">MATH2M</a>	5		
Certificat d'université : Statistique et sciences des données (15/30 crédits)	<a href="#">STAT2FC</a>	3		