

**STAT****STAT2416 Multivariate probabilities and statistics**

[10h+5h exercises] 2.5 credits

**Teacher(s):** Ingrid Van Keilegom  
**Language:** french  
**Level:** 2nd cycle course

**Aims**

By the end of this course, the student should be familiar with the basic concepts for modelling multivariate random experiments and should be able to develop the basic techniques of statistical inference (estimation and hypothesis testing) in these models. In particular, he/she should know the properties of multivariate normal distributions and of other associated distributions, needed for solving inference problems in multivariate populations.

**Main themes**

- Multivariate random variables, conditional expectation and linear approximation
- Multivariate normal vector
- Multivariate sampling and sampling distributions in relation to the normal law (Wishart, Hotelling)
- General principles of inference (maximum likelihood and likelihood ratio)
- Standard tests for multivariate normal populations (test for a mean, comparison of means, test with linear constraints, test for covariance matrices, ...).

**Content and teaching methods**

Content :

- Random vectors : joint, marginal and conditional distributions, independence, conditional expectation and covariance, best linear approximation.
- Limit theorems
- Normal vector : general properties and conditional properties
- Estimation for a multivariate normal distribution and sampling distribution of the estimators.
- Hypothesis testing for multivariate normal distributions : linear hypothesis in the marginal and conditional model, confidence intervals.

Method :

The lectures take place during the first five weeks and are followed by two exercise sessions.

**Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)****Prerequisites**

An elementary course on probability and statistics

**Evaluation**

The evaluation consists of :

- an oral exam
- a written exam (exercises)

**Teaching materials**

The course notes will be distributed during the first lecture.

**Professor**

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**References :**

- Härdle, W. and L. Simar (2003), Applied Multivariate Statistical Analysis, manuscript, Humboldt-Universität zu Berlin, Berlin, to appear at Springer-Verlag, Berlin.
- Johnson, R.A. and D.W. Wichern (1988), Applied Multivariate Statistical Analysis, Prentice Hall, London.
- Mardia, K.V., Kent, J.T. and J.M. Bibby (1979), Multivariate Analysis, Academic Press, Duluth, London.

**Other credits in programs**

<b>MATH21/G</b>	Première licence en sciences mathématiques (Général)	(2 credits)	
<b>MATH21/S</b>	Première licence en sciences mathématiques (Statistique)	(2 credits)	Mandatory
<b>MATH22/G</b>	Deuxième licence en sciences mathématiques	(2 credits)	
<b>STAT2MS</b>	Master en statistique, orientation générale, à finalité spécialisée	(2.5 credits)	
<b>STAT3DA/E</b>	diplôme d'études approfondies en statistique (statistique et économétrie)	(2.5 credits)	
<b>STAT3DA/M</b>	Diplôme d'études approfondies en statistique (méthodologie de la statistique)	(2.5 credits)	
<b>STAT3DA/P</b>	diplôme d'études approfondies en statistique (pratique de la statistique)	(2.5 credits)	