



COURSE MODULE . DATA ANALYSIS & STATISTICS

COURSE CODE	COSI DAS
COURSE LEVEL	Master
ECTS CREDITS	5
COURSE INSTRUCTOR/S	Prof. Marc Sebban, Fabrice Muhlenbach and Emilie Morvant (UJM)
EDUCATION PERIOD	SEMESTER 1
EXPECTED PRIOR-KNOWLEDGE	BSc level basics in statistics and mathematics
LANGUAGE OF INSTRUCTION	English

AIM This course gives the necessary mathematical background to perform data analysis in terms of statistics, linear algebra and convex optimization. To develop their practical and analytical skills, students have to work on case studies Practical sessions make use of the R-free software environment for statistical computing and graphics.

TEACHING ACTIVITIES This course is based on lectures, lab classes, exercises as well as homework.

COURSE OUTLINE

- (topic 1) Basics in Statistics (probabilities, law of large numbers, discrete and continuous distributions, central limit theorem, i.i.d. variables, estimates, maximum likelihood estimation)
- (topic 2) Basics in linear algebra and convex optimization
- (topic 3) Linear Regression (batch/stochastic gradient descent, closed-form solution)
- (topic 4) Principal Component Analysis
- (topic 5) Clustering (distance functions, sequential/hierarchical algorithms, k-means)

PRACTICAL ACTIVITIES Practical works (laboratory sessions and case studies) in order to implement concepts introduced in the lectures, to practice on real applications and to train students.

LEARNING OUTCOMES¹

- ~ *Knowledge and Comprehension* of the fundamentals, principles, applications, limits, relationships, of all concepts and topics covered by this course;
- ~ *Application, Analysis, Synthesis and Evaluation* skills of the main concepts and topics covered by this course;
- ~ Ability to apply/implement concepts and principles introduced in the lectures on practical tasks and on industrial study cases;
- ~ Ability to self-learn, to understand some problems and to suggest/find solutions to solve these problems.

FORM/S OF ASSESSMENT Written exam (25%), Practical works (50%), Acquired skills (25%)

ASSESSMENT CRITERION Written exam and Practical works

Excellent - outstanding performance	A
Very Good - above the average standard but with some errors	B
Good - generally sound work with a number of notable errors	C
Satisfactory - fair but with significant shortcomings	D
Sufficient - performance meets the minimum criteria	E
Fail - some more work required before the credit can be awarded	FX
Fail - considerable further work is required	F

Detail of criteria used to assess acquired skills :

- ~ Activities and questionnaires giving evidence of knowing (5%)
- ~ Activities and questionnaires giving evidence of comprehension/understanding (5%)
- ~ Activities and questionnaires giving evidence of analysis (5%)
- ~ Activities and questionnaires giving evidence of synthesis (5%)
- ~ Activities and questionnaires giving evidence of evaluation (5%)

¹ The meaning of *keywords* in italic used to define Learning Outcomes are detailed in Annex.



Excellent	A
Very Good - above the average standard	B
Good - generally sound well	C
Satisfactory - but with significant shortcomings	D
Sufficient - performance meets the minimum criteria	E
Fail - some more work required	FX
Fail - considerable further work is required	F

The evaluation of informal learning outcomes will be based on questionnaires and laboratory notebook (self-evaluation, learning diary).

LITERATURE AND
STUDY MATERIALS

~ Introduction to Statistics and Data Analysis, R. Peck, C. Olsen, J. Devore, Brooks/cole, fourth edition, 2010.

~ Linear Algebra and its applications, David C. Lay, University of Maryland - College Park, Addison-Wesley, fourth edition, 2012.

~ Pattern Recognition, S. Theodoridis, K. Koutroubas, AP, Elsevier, fourth edition, 2009.

~ Convex Optimization, Stephen Boyd and Lieven Vandenberghe, Cambridge University Press, 2012.

CONTACT DETAILS

Prof Marc Sebban
University Jean Monnet . Saint-Etienne, France.
E-mail: marc.sebban@univ-st-etienne.fr
Office hours: 08:00 to 19:00 (from Monday to Friday)