Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	**Optimization methods for decision making** M1 Optimization methods for economics and business M2 Data science applications for resource optimization, risk evaluation and sustainability
Course code	27511
Scientific sector	MAT/06 + SECS-S/01
Degree	Master in Data Analytics for Economics and Management
Semester and academic year	tbd semester a.y. 2024/2025
Year	2nd study year
Credits	12 (6+6)
Modular	Yes

Total lecturing hours	72 (36+36)
Total lab hours	/
Total exercise hours	/
Attendance	suggested, but not required
Prerequisites	
Course page	https://www.unibz.it/en/faculties/economics-management/master-data-analytics-economics-management/

Specific educational objectives	Develop advanced knowledge w.r.t. optimization methods to support decision making without and with uncertainty. Develop knowledge on advanced statistical models and techniques for analyzing data under conditions of uncertainty. Develop skills related to the representation of different types of data commonly used in economics and/or business, such as time series and spatio-temporal data. Develop skill to select appropriate optimization models such as linear/nonlinear, deterministic/stochastic, single/multi-criteria for decision making in economics and business. Develop skills to select appropriate solution methods/techniques for optimization problems within an economic/business environment and interpret the results. Develop technical and practical knowledge to support decision-making in economic-financial institutions and enterprises.

Module 1	M1 Optimization methods for economics and business
Lecturer	TBA
Scientific sector of the lecturer	Mat/06
Teaching language	English
Office hours	please refer to the lecturer's timetable
Lecturing assistant	None
Teaching assistant	None
List of topics covered	• Linear optimization techniques • Nonlinear optimization techniques • Combinatorial optimization techniques • Multicriteria optimization and decision making • Decision making under uncertainty
Teaching format	Frontal lectures, exercises and case studies. The course will combine in-class explanation, problem-solving and case study discussion.

Module 2	M2 Data science applications for resource optimization, risk evaluation and sustainability
Lecturer	Davide Ferrari
Scientific sector of the lecturer	SECS-S/01
Teaching language	English
Office hours	please refer to the lecturer's timetable
Lecturing assistant	TBA
Teaching assistant	None
Office hours	please refer to the lecturer's timetable
List of topics covered	• Spatio-temporal data and their visualization • Measuring association and risk: covariance, spatial covariance and autocovariance • Spatio-temporal statistical models, trend-surface estimation and prediction • Tail dependence, multivariate models for extremes, extreme risk management • Real data applications in resource and risk management
Teaching format	Frontal lectures, exercises, computer labs, face-to-face discussions.

Learning outcomes	<u>1) Knowledge and understanding:</u> The student acquires knowledge of optimization models and statistical techniques needed to understand and analyze economic and business phenomena from the quantitative viewpoint in order to support decision-making processes. The student acquires in-depth knowledge of advanced statistical methods by developing programming skills and focusing on applications to economic and business data.

	Moreover, the student develops an understanding which model is appropriate for a particular economic/managing problems and which are appropriate solution methods. 2) Applying Knowledge and understanding: The student acquires the ability to apply and implement optimization methods focusing on different types of data and interpretation of results. These skills are declined in various application domains of interest to companies and public and privateorganizations. 3) Making judgments: The student acquires the ability to choose appropriate optimization models and statistical methods for data-based decision making and also judge the validity of the quantitative outcome w.r.t. correctness and relevance for the underlying economic/management problem. 4) Communication skills: The student acquires the ability to communicate effectively the results from statistical analyses of observed data, also through self-guided project work and the presentation of the results. 5) Learning skills: The course is aimed to provide the methodological and applied knowledge of mathematical optimization methods under uncertainty, necessary to address subsequent studies, including advanced courses in mathematics, statistics, computer science, as well as applied projects in laboratories and internships, and empirical analyses in the final thesis

Assessment	**M1 Optimization methods for economics and business** A written exam and a project presentation including an oral presentation. **M2 Data science applications for resource optimization, risk evaluation and sustainability** Written exam: combination of multiple choice and essay questions. Project work: development of an individual project related to the methodologies studied, their implementation in statistical software, and their applications to empirical data.
Assessment language	English
Evaluation criteria and criteria for awarding marks	**M1 Optimization methods for economics and business** The written exam of 1 hour counts 30%, the project 70% towards the final grade. Evaluation criteria are understanding of modeling features, capability of applying

	solution methods (only small scale for the written exam) problems and the capability to interpret/discuss the results w.r.t. economic/managerial decision making. **M2 Data science applications for resource optimization, risk evaluation and sustainability** To pass the M2 module exam students must obtain a positive evaluation on both final exam (50% of the grade) and project (50% of the grade). The final exam assess Skill 1 (Knowledge and understanding), while the project work and presentation aims at assesin Skills 2, 3 and 4 (Applying knowledge and understanding, Making judgements, Communication skills). Skill 5 is indirectly verified through the autonomous execution of class tasks and indiviual study required to pass the written exams.

Required readings	TBA
Supplementary readings	TBA