UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Advanced Data Management and Decision Support Systems

**2425-1-F9102Q008**

## Aims

**Module Data Management**
The aim of the data management module is to introduce the main conceptual and theoretical tools to manage data beyond the relational model. Students will learn the most important noSQL paradigms adopted in both research and industry and the basic concepts of large-scale data set processing. The management of "data in motion" will complete the contents foreseen in the module

**Module Decision Support Systems**
The aim of the course is twofold: on one hand, to introduce students to the main conceptual and theoretical tools to model rational choices in decision making; on the other hand, provide students with models and tools to design usable (i.e., effective, efficient and easy-to-use) decision support systems and evaluate them in the real world.
At the end of the course, students should have acquired and should be able to prove sufficient knowledge in the above mentioned topics, should have acquired the ability to solve problems and apply the taught notions in practical contexts, and should have reached a sufficient maturity enabling them to autonomously understand up-to-date development in related disciplines.

## Contents

**Module Data Management**
NoSQL models, Large scale data management , data integration,

**Module Decision Support Systems**
Models and definitions of decisions and decision making.
Rationality. Elements of formal decision theory: single agent, multi-agent (game theory).
Automation of decision making processes: usability and user acceptance, trust, dependence, compliance, reliance, biases.

## Detailed program

**Module Data Management**
Data Management module
NoSQL Models

- key-value,
- column based,
- document,
- graph
  Large scale data management
- hadoop,
- map reduce,
- spark
  Time series db
- introduction to TSDBMS
- models for TSDBMS
- architecture
- query language

**Module Decision Support Systems**
Models and definitions of decisions and decision making
Decision as inference and preference
Naturalistic decision making
Heuristic decision making
Rationality and rational decision making
Definitions of rational decision
Normative models
Descriptive models
Elements of formal decision theory
Single-agent decision theory (decision under ignorance and under risk)
Non-cooperative game theory
Coalitional game theory
Social choice theory
Automation of decision making processes
Levels and stages of automation
Trust in, dependence on automation
Models of user acceptance, trust, dependence, compliance (TAM, UTAUT)
Decision Biases due to automation

## Prerequisites

**Module Data Management**
Basic notion of the relational model, SQL query language
**Module Decision Support Systems**
Basic notions of probability theory and artificial intelligence, mathematical maturity

## Teaching form

**Module Data Management**
Class-room taught classes, computer-based programming exercises. Lessons will be held in presence, unless further COVID-19 related restrictions are imposed.

**Module Decision Support Systems**
Class-room taught classes, computer-based programming exercises. All lessons will be in erogative form. Lessons will be held in presence, unless further COVID-19 related restrictions are imposed.

## Textbook and teaching resource

**Module Data Management**
Slides presented by the teachers.
Textbooks
Guy Harrison. Next Generation Databases: NoSQLand Big Data. Apress.
Additional materials, readings and resources will be available on the e-learning platform.

**Module Decision Support Systems**
Slides presented by the teachers.
Textbooks
An introduction to Decision Theory (Second Edition). Martin Peterson. Cambridge University Press
Alternative: Multiagent Systems. Algorithmic, Game-Theoretic, and Logical Foundations. Yoav Shoham, Kevin Leyton-Brown. Cambridge University Press

Suggested Readings
Katsikopoulos, K., Simsek, O., Buckmann, M., & Gigerenzer, G. (2020). Classification in the wild. MIT Press
Klein, G. (2022) Snapshots of the Mind. MIT Press
Engineering Psychology and Human Performance, Cristopher D. Wickens, Justin G. Hollands, Simon Banbury, Raja Parasuraman. Psychology Press

Additional materials, readings and resources will be available on the e-learning platform.

## Semester

2n semester

## Assessment method

**Module Data Management**
Written exam (open questions) to ascertain understanding of the basic concepts taught in class and their relationships or a project related to one of the topics of the module.
**Module Decision Support Systems**
Written exam (closed and open questions) to ascertain understanding of the basic concepts taught in class and their relationships (max. grade mark 27), optional original project (either essay or prototype) for students with a written exam grade >= 18 (max. additional 5 points)

## Office hours

**Module Data Management**
Available by appointment.
**Module Decision Support Systems**
Available by appointment.

## Sustainable Development Goals

QUALITY EDUCATION