Models and decisions

ECTS credits
8 credits

Semester
Fall

In brief

Course langage: English, French

Presentation

Prerequisites

- Knowledge in Probability and Statistics Bachelor level (course programme equivalent to the course unit MAT-1A, see syllabus Year 1 Engineering Programme and course programme equivalent to the subcourse Probability and Statistics in the course unit Major Mathematics-Computer Science-Economices, see syllabus Year 2 Engineering Programme); for students interested in Financial Mathematics and Data Science, advanced courses in Probability (such as discrete Markov process) or in Statistics (such as basic of linear regression, hypothesis testing) are highly recommended.
- Basic knowledge in Economics and Accounting (course programme equivalent to the course unit ECO-1A, see syllabus Year 1 Engineering Programme)
- Basic knowledge in Finance (course programme equivalent to the elective course Finance, see syllabus Year 2 Engineering Programme)

Learning objectives

- Understand how a decision maker can assess risk
- Know how to model decision making under uncertainty
- Learn various ways to compare risky situations, their advantages and drawbacks
- Know the various biases that can impact decision making and how to measure them
- Learn how to model, estimate and predict time series
- Understand how capital structure affects the value of the firm
- Know how to conduct and present the financial analysis of a company
- Understand the workflow of a data science project in a business context

Description of the programme

Models and decisions

This course unit consists of three courses Risk and decision, Statistics and decisions, and Corporate finance, of 24 hours each, and is complemented by the first part of the data project (12 hours course and 9 hours project) devoted to business issues.

Risk and decision

1. Risk and expected utility
   i. Introduction: diversification and mutualization
   ii. Risk measure
   iii. Expected utility
2. Behavioral decision making
   i. Decision under risk
   ii. Decision under uncertainty
   iii. Time preferences
3. Introduction to financial risk management

Statistics and decisions

1. Stochastic processes in discrete and continuous time
2. ARIMA process : definition, existence, characteristics (autocovariance, partial autocovariance)
3. Estimation of ARIMA processes : identification, parameters estimation and validation
4. Extensions : SARIMA, ARCH and GARCH processes

Corporate finance

1. The Corporation
2. Introduction to Financial Statements Analysis
3. Financial Decision Making and the Law of One Price
4. The Time Value of Money
5. Interest Rates
6. Investment Decision Rules
7. Capital Markets and The Pricing of Risk
8. Optimal Portfolio Choice and the Capital Asset Pricing Model
9. Capital Structure in a Perfect Market
10Financial Distress, Managerial Incentives, and Information
11Raising Equity Capital

Data science projects: business issues

1. Evolution and current stakes of Data Science in the economic world
2. Lifecycle of data science project
3. Business and legal constraints in data science projects
4. Data Science and Entrepreneurship

Generic central skills and knowledge targeted in the discipline

- Know the measures of risk based on the quantile function, how to relate it to the notion of stochastic dominance and understand their role in financial risk management.
- Understand the concept of expected utilty, its relation with risk aversion and its limits.
- Know the difference between stationary and non-stationary processes, apply statistical techniques to make a random process stationary.
- Identify a SARIMA process, estimate its parameters and validate the model
- Know how to read and understand financial statements, and be able to use it to value projects and investments.
- Be able to account for business (collection of needs, project lifecycle, communication) and technical (data, machine learning, scaling) constraints

How knowledge is tested

- Written exam (Risk and decision): 35 %
- Tests and projects (Statistics and decisions): 35 %
- Group project (Corporate finance): 30 %

Bibliography

Risk and decision

- Gollier, Schlesinger, and Eeckhoudt (2005), *Economic and Financial Decisions Under Risk*.
- Jacquemet and L'Haridon O. (2018). Experimental Economics: Method and Applications. Cambridge University Press.

Statistics and decisions

- Brockwell and Davis (1991), *Time Series : Theory and Methods*.
- Box and Jenkins (1970), *Time Series Analysis; Forecasting and Control*.

Corporate finance

- Berk and DeMarzo (2019), *Corporate finance*.

Data science projects

- Zeng, A and Casari, A. Feature Engineering for Machine Learning. O'Reilly Media.
- Müller, A. and Guido, S. Introduction to Machine Learning with Python. O'Reilly Media.

Teaching team

- Risk and decision: Dominique Henriet (Centrale Marseille), Mathieu Lefebvre (Aix-Marseille Université), Clément Depoutre (BNP Paribas)
- Corporate Finance: Gaël Leboeuf (Aix-Marseille Université)
- Statistics and decisions: Mitra Fouladirad (Centrale Marseille), Christophe Pouet (Centrale Marseille)
- Data science projects: Alexandre Chirié (Mantiks)

Sustainable Development Goal



Reduced inequalities



Descent work and economic growth

Total des heures		**100h**
CM	Master class	72h
TD	Directed work	6h
TP	Practical work	6h
PJ		16h

Useful info

Name responsible for EU

Lead Instructor

Renaud Bourles

renaud.bourles@centrale-med.fr