Remarque
For sem. MA1. Special schedule: see the IF website http://sfi.epfl.ch/mfe/study-plan

Summary
This course presents the problem of static optimization, with and without (equality and inequality) constraints, both from the theoretical (optimality conditions) and methodological (algorithms) point of view. Economics and financial applications are provided. Dynamic optimization is also introduced.

Content
**Static optimization:**
- Constrained optimization with equality constraints: Lagrange multipliers and their interpretation.
- Constrained optimization with inequality constraints: Kuhn-Tucker method and duality theory.
- Several examples from economics and finance

Dynamic optimization
- Bellman equation and optimal control problems
- Applications to finance: dynamic portfolio optimization
- Applications to economics: dynamic consumption/saving choice.

Keywords
Optimization program, equality and inequality constraints, Lagrange and Kuhn-Tucker theorems, algorithms, Bellman equation, optimal control.

Learning Prerequisites
**Important concepts to start the course**
Basic concepts of linear algebra, mathematical analysis and probability.

Learning Outcomes
By the end of the course, the student must be able to:
- Describe optimization programs with and without equality or inequality constraints
- Solve optimization programs with and without equality or inequality constraints
- Describe algorithms adopted to solve such a univariate and multivariate optimization problems.
- Apply different algorithm to financial applications such as portfolio optimization and parameter estimation.
- Solve simple optimal control problems.

**Transversal skills**

- Use a work methodology appropriate to the task.
- Set objectives and design an action plan to reach those objectives.
- Demonstrate the capacity for critical thinking
- Use both general and domain specific IT resources and tools

**Teaching methods**

Slides.

**Assessment methods**

The grading will be based on exercises (30%), and (70%) final exam. The final exam is closed-books and closed-notes.

**Resources**

Virtual desktop infrastructure (VDI)

No

**Bibliography**


**Ressources en bibliothèque**

- Numerical Methods in Finance / Brandimarte
- Optimization in Economic Theory / Dixit
- Mathematics for Economists / Simon
- A First Course in Optimization Theory / Sundaram

**Notes/Handbook**

Slides for each lectures will be provided.