Optimization Methods in Management Science
Master in Management
HEC Lausanne

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Fall 2019 Semester

Course Overview

Course Description

This course introduces students to the theory, algorithms, and applications of optimization. It covers linear programming, graph theory, network optimization, combinatorial optimization, dynamic programming, and non-linear optimization including Lagrange multipliers, KKT conditions, Lagrange duality, conjugate gradient method, and quasi-Newton methods. Applications to logistics, manufacturing, transportation, resource allocation, modern portfolio theory and machine learning with a focus on SVM. **Exercises** and **theory** are **equally important** for the success of the class

Review of the Course Objectives

By the end of this course, students should be able to :

- understand the theory of optimization methods and algorithms developed for solving various types of optimization problems,

- be able to apply these methods and algorithms to problems encountered in management science

Final Exam

- Written exam

- Duration : 2 hours

- No documentation. Closed-book. Only non-programmable calculators

- It is likely that the final exam will contain multiple choice questions

- A Q&A session will take place during the last exercise session of the semester

Multiple Choice Questions

- Multiple choice questions with **penalties**

  - Imagine a multiple choice questions with two outputs : TRUE or FALSE

  - By randomly choosing the answers to these questions, a student should get on average half of the answers correct !

  - By introducing a penality (for example : for a good answer : + 1 pt, for a wrong answer : - 0.5 pt), then the exercise is less favorable for students choosing randomly the answers

- **Important point : when you don't know the answer to a question, is it worth or not answering it ?**

Structure of the Final Exam

- The exam will typically contain 5 exercises with one multiple choice exercise

- The multiple choice exercise may count up to 40% on the final exam! It is an effictive way to test your understanding of the theory

- Each exercise contains separate parts with a precise number of points attributed to each of them

- The questions are formulated in a way that minimizes the potential calculation errors

- Non-linear optimization is an important topic for the final exam

Other Information

- **Any topic that has been addressed during the course or the exercise sessions may be included in the exam !**

- It **may also contain** modeling exercises (mathematical formulation of a specific problem by defining what are the variables of the problem, how you define the objective function and how you take into account the constraints)

- This type of problems is present in the exercise sheets on a regular basis

Mock Exam

- Mock exam will take place on the 15th of November

- This is a non-graded exam !

- Duration : 2 hours from 2.15 pm to 4.15 pm

- No documentation. Closed-book. Only non-programmable calculators

- **You won't be allowed to take the exam back at home**

- **Solutions to the exam exercises will be given after the exam during the exercise session. No solution sheets will be distributed**

Objectives of the Mock Exam

- Prepare the students to the final exam

- Give you a flavour of the type of problems you could have in the final exam

- Test your current level of preparation

Preparation for the Mock Exam

You shoud be able to apply (non-exhaustive list) :

- the graphical method in 2D to solve LP

- the simplex algorithm (Phases I and II)

- the dual algorithm

- the shortest path algorithms

- the network simplex algorithm for the transhipment problem

- the branch and bound method

Preparation for the Mock Exam (Cont'd)

You should also understand the following concepts (non-exhaustive list) :

- feasible region, basic/non-basic variables, decision/slack variables

- optimal solutions, bounded/non-bounded problem

- dual variables, duality theorems (weak and strong), dual formulation

- tableau properties and characteristics

- adjacency and incidence matrices

- tree, shortest path tree

Course Evaluation

- On-line course evaluation will take place in November or in December

- An email with a link for the evaluation should be provided to the participants