Lehrstuhl II für Mathematik

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Summer Term 2020

Mathematical Heuristics for Discrete Optimization Problems

Content: In real-world applications, optimal decisions need to be taken within a complex system. Often these problems can be modeled with all necessary constraints as a discrete optimization problem. However, computing an optimal solution for such a problem is in many cases too time consuming. In this lecture, we focus on methods – so called heuristics – to obtain solutions in a short period of time. However, this comes at the cost of not obtaining optimal solutions. We will focus on single-population based heuristics and analyze these heuristics for different classical discrete optimization problems according to their performance. In many cases, we will prove that even simple heuristics produce an approximate solution. The goal of this course is to equip the students with a broad overview on different methods and on different classical optimization problem. This will enable them to solve real-world problems more efficiently.

Concept of the Tutorials (Non-Corona Version): Each tutorial is divided into two parts. In the first part, the participants practice their presenting skills. Therefor, for each exercise from last week's exercise sheet, a participant presents a solution to the others. In the second part, the participants train their mathematical problem-solving and teamwork skills by working together in groups on an exercise from the current sheet.

Concept of the Tutorials (Corona Version): As long as RWTH courses are restricted in order to limit the spread of the Corona virus, tutorials will be held via Zoom. You can join the Zoom sessions by an invitational link, which we will publish prior each tutorial. As in the Non-Corona version, the first part of the tutorial will consists of presentations of last week's exercises. For this, you should prepare elaborate solutions in LaTeX, which you present via screen transmission.

Since it is difficult to supervise group work via Zoom, you should prepare the current exercise sheet in advance so that we can distribute the exercises for next week's presenters. You may also ask questions to complete your solution. Note, however, that the exercise is not intended to produce the whole solution from scratch.

Concept of the Lecture (Corona Version): The first lecture on 7th April will be done via Zoom in order to discuss organizational details. After that, the lecture will be held as a reading course for as long as necessary. In order to keep up the pace of the lecture and in order to allow a return to regular lecture activities, we will regularly publish milestones to be reached by reading the script on your own. You may always ask questions via email, which we answer publicly in RWTHmoodle.

Project: During the course, the participants are supposed to work in small groups on a real-world problem, which we will introduce on 7th May. The newly learned methods should be used to solve the problem. The participants have to present and submit their results on 9th July. If necessary, presentations will be done via Zoom. Every participant will receive a grade for the project that encounts for 30% percentage of the overall grade.

Admission to the Exam: In order to be admitted to the oral exam, each participant must do the following:

- Over the course of the semester, each participant has to present two elaborate solutions, on which they worked the previous week. Note that a poor presentation might be insufficient to count towards the two required presentations.
- Each participant must take part in the project. The results must be worked out mathematically on a maximum of five pages. Details will be announced later. Furthermore, all groups must present their results, with each participant presenting the results in equal parts.

Registration: Please register in RWTHonline for the lecture and exercises.

Dates Lecture & Tutorials: If not cancelled, the lecture takes place from 8:30 to 10:00 on Tuesday and from 8:30 to 10:00 on Thursday. The exercises take place between 12:30 and 14:00 on Friday. Lectures and tutorials will both take place in the room SeMath.

Oral Exams:

- 1st period: 15th to 17th July, 2020
- 2nd period: 30th September to 1st October, 2020

Contact: If you have any questions, please use the following email address: maheu@math2.rwth-aachen.de