



FP7-PEOPLE-2009-IRSES:  
Project ID 246647

**Optimization and its Applications  
in Learning and Industry  
(OptALI)**

IRSES

**Ongoing Deliverable D1.2**

**Description of Research Seminar:  
Elective Course Student Sectioning at  
Danish High Schools**

Start date of the Workpackage: December 2010

Duration: 48 months

Due date of deliverable: November 2014

Actual submission date: December 2013

Participants: UGOE  
UNIKL  
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# Research Seminar

offered by Simon Kristiansen (University of Canterbury)

in December 2012,

in Wellington, New Zealand

Subject: Elective course student sectioning at Danish high schools

Problem: Each year the 2nd and 3rd year students, at the Danish high schools, request some elective courses which they want to attend along with their mandatory courses. The problem is then to assign the students to elective classes given their requests and assign these classes to some time slots. The main goal of the Elective Course Student Sectioning is to fulfill as many of the students' elective course requests as possible while minimizing the number of classes created. The problem is of both educational and economical nature. First of all, the students are planning their high school education such that they have the necessary merits for applying for a university education afterwards. If a student is not granted his requests he might miss a merit to get admission to his desired education. Secondly if a student is not granted his request, it might entail that the student changes high school or drops out, and this imposes some economic issues for the high school. The Danish high schools are self-governing and get a fee from the state based on the number of students which finish an education at the high school, i.e. a significant part of the high schools income is based on the students. It should be noted that the students in Denmark can freely choose between high schools. Another aspect of the economic issues is the creation of classes. For each created class there is a cost of approximately €27.000 p.a., i.e. it is not enough to grant all the requests it is also very important for the high schools to keep the number of created classes at a minimum.

Main Results: We show that the Elective Course Student Sectioning can be formulated as an MIP model and an Adaptive Large Neighborhood Search algorithm is developed for solving the problem. The ALNS algorithm has proven to be a successful method to establish solutions to the problem, and it has been implemented in the Cloud-based software system Lectio and is hence available for more than 200 Danish high schools. For testing the performance of the ALNS algorithm, 80 real life instances from different high schools have been used. In average ALNS finds solutions within 1% of the optimum and for large instances the algorithm outperforms Gurobi, which is very satisfying results.

It was shown that for some of the instances it could be an advantage to embed some mathematical programming techniques in the ALNS. However more testing is needed with open source MIP solvers, as Gurobi is not a possibility as all the clients need a license.

Participants: Student and researcher participating at the conference ORSNZ.

Publication: -