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(OptALI)

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Ongoing Deliverable D1.2

Description of Research Seminar: Optimisation based methods for University Course Timetabling

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Research Seminar

offered by Antony Phillips (UOA)

in June 2012,

in Copenhagen, Denmark

Subject: Optimisation based methods for University Course Timetabling

Problem: The University Course Timetabling Problem (UCTP) requires finding a time and a room for every class meeting (or *contact*) out of limited university resources. The problem has always drawn significant interest from the academic community, and increasingly the private sector. Despite continued advancement in computational capabilities, the large size of modern universities remains highly limiting on the use of automated methods.

The problem is commonly decomposed into a timetabling component (contacts-to-times) and a room allocation component (contacts-to-rooms). Many universities choose to internally generate a timetable using existing knowledge of their particular requirements, and then use an automated method to allocate rooms. The first part of this research involves algorithms for finding a "good" room allocation given a fixed starting timetable. This requires the consideration of many quality metrics, including

- contacts being held in proximate rooms to their home department,
- all contacts of a course being held in the same room,
- robustness to changes in contact size etc.

Furthermore, because the manual timetable generation does not take the room resources into consideration, this starting timetable may not allow for a feasible room allocation to even exist. Usually this is caused by too many contacts assigned in "peak" timeslots in the centre of the

day, but it can also occur when rooms with specialised equipment are requested simultaneously.

The second part of this research develops an efficient automated algorithm to modify the timetable as little as possible while achieving feasibility in the room allocation. The difficulty of this problem is highly dependent on the structure of the timetable, and the resulting degree of infeasibility in the room allocation. When the room allocation component is infeasible, we obtain key information which can be used to guide the timetable modification process.

Main Results: We tested our algorithm on real data from 2010 at the University of Auckland, where starting timetables were available. The Room Allocation algorithm utilises a series of sequential set packing problems which are able to consider all necessary quality metrics while keeping individual models relatively small and fast.

The timetable modification algorithm was also tested on this data, with an infeasible starting timetable. Using information from the (infeasible) room allocation attempt, the algorithm was able to quickly identify the cause of timetabling congestion. This resolved the problem as locally as possible thereby achieving a feasible timetabling solution with minimal deviation from the desired timetable structure.

Participants: students and researchers from DTU.

Publication: -