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## University Course Timetabling: From three-, to two-, to one-indexed Formulations - what's next?

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**Abstract** The essence of university course timetabling is to match courses with rooms and times. In practice, a huge number of constraints may apply to this matching, of course. In this presentation, we will focus on exact approaches, and in particular on integer programming models for university course timetabling.

Matching the tree components, courses, rooms, and times, naturally suggests to use binary variables for each possible triple. It turns out that trying to capture which triples, which room/course/time combinations are feasible, leads to nice theoretical insights and more tailored models and algorithms for university course timetabling.

The resulting models, based on two-indexed variables (for courses and times only) bear a potential to be generalized to similar resource allocation problems, in particular other timetabling problems. From a mathematical point of view, the resulting models are a kind of projection of the models with three-indexed variables

In some sense, also models based on one-indexed variables are possible. These do not appear, as one might have expected, as another projection, but as extensions to the three-indexed models.

We discuss these modeling alternatives, their advantages and disadvantages, and in particular their suitability to future challenges in university course timetabling.

**Keywords** course timetabling · integer programming · modeling

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