Examination Timetabling: A New Formulation

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Since the mid 1990's, with the implementation of increasingly flexible modular course structures by many UK Universities, the central production and coordination of the associated examination timetable has become increasingly difficult with more examination offerings having to be timetabled in such a manner as to provide students with a maximum distribution of their exams throughout the examination session. Of course, we must also ensure that time considerations are taken into account and space usage is maximised. Universities, struggling with rising student numbers, more flexibility in choice and less time to examine have increasingly relied upon automation of this task to produce efficient timetables which satisfy these constraints e.g. [1,2]. Although strong in some respects, unfortunately, many of the search methodologies currently described in the literature have some limitations in terms of potential application in a wide number of differing institutions.

The examination timetabling problem has long represented an area where new and exciting techniques have been trialed at an early stage of their development. This, in large part, is related to the inherently straight forward nature of the timetabling problem which can be expressed by the following. Students are examined over a designated time period, within a finite area of space, in such a way as to ensure they do not have two exams at the same time. This 'hard' constraint must be satisfied for a solution to be viable. The quality of the overall solution is measured by factors such as how well an individual's exams are distributed throughout the designated time period e.g. soft constraints. Both type of constraints, hard and soft, were documented in some detail for UK Universities in 1996 [1]. All subsequent research has been trialed on datasets which have been in existence from the middle part of that decade. The initiative described in this presentation sets out to update the situation with regard to the examination timetabling problem by investigating the changes in the problem along with providing new updated datasets for techniques to be subsequently trialed.

It is well reported that there is a gap between theory and practice in scheduling research (eg [3]). A major contributor to the work presented in this abstract is our spin out company, EventMAP Limited. From a practitioner's point of view, the company has reported the steady increase in complexity of the examination problem over the last five years.

Overall, there are a number of goals that we intend to tackle in this presentation. Firstly, we aim to make available a number of new examination datasets complete with the all important space details. A major criticism of the work to date is that essential information relating to space usage has not been available for the purpose of allowing a true representation of the problem to be worked on. Although the capacitated examination timetabling problem was introduced in [4], this only served to place an upper limit on seats available at any particular time period. Crucial issues related to the number and sizes of rooms were absent. The anonomised datasets of real world scenarios will be made available to the research community via a web site which will be dedicated to the datasets along with initial 'diagnostic characteristics' e.g. a conflict density matrix. In this way, we suggest that a master copy of the datasets can be held eliminating various discrepancies reported in the past [5]. This data provided by eventMAP Limited is necessary to understand the exact nature of the current real world issues within examination timetabling.

Secondly, we will introduce a new measure of solution quality which more accurately reflects the desired goals of the University sector. The issue of no room information being available with regard to the currently used datasets has meant that the optimisation function used to measure solutions has not incorporated all the necessary issues. Results using this newly introduced objective will be presented on the new University datasets. It is expected that this work will represent an important contribution in both updating and enabling the entire area of research within examination timetabling to move forwards.

Thirdly, information will be discussed with the purpose of determining the exact nature of this need and how the situation within UK universities has changed and developed since the original investigation of Burke et al in 1996[BUR96]. Details from the institutions contributing to this research via the datasets will be gathered and presented with the aim of updating the type and amount of constraints that need to be taken into consideration when providing solutions.

Finally, as mentioned earlier, eventMAP have shown that 'best' solutions to various datasets depend on the combination of different types of construction and improvement heuristics. This will be briefly discussed as a conclusion to the presentation.

References

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