



constraints may be violated) but is of high quality in terms of a weighted sum of the different constraints satisfied. This solution is then used to guide a selection algorithm with consistency checking to create a feasible timetable that still retains most of the quality of the initial solution.

*UTTSEExam* employs the Genetic Algorithm (Marin 1998) as its stochastic search technique, with Tabu Search (Rayward-Smith et al. 1996) post-optimization. This guides the Variable Ordering Method with AC-3 (Mackworth 1977) consistency checking.

### Application Modules

The *UTTSEExam* program is made up of several parts. Several modules allow the input of information, including examination, student, venue and session information. Of particular interest is the input on constraint information, which is a crucial part of any timetabling system. The system allows:

- Unary constraints (e.g. paper *X* is to be held in venue *V*),
- Binary constraints (e.g. paper *X* must be at least 3 sessions before paper *Y*),
- Inter-group constraints (e.g. all papers in group *A* must be before all papers in group *B*), and
- Intra-group constraints (e.g. the papers in group *A* must be at least 2 sessions apart).

Additionally, *UTTSEExam* allows output of all the internal information in the form of html files for ready display on the university web pages. There are also tools for defining the venue layouts and the assignment of seat numbers to each candidate.

### Benefits

When compared to the only alternative of manual scheduling, automated timetable scheduling offers tremendous benefits.

- Manual scheduling usually takes several weeks to complete. *UTTSEExam* takes only a few minutes.
- The timetable generated by *UTTSEExam* required fewer days and sessions than those created using the previous manual system. Since some of the examinations are held in commercial venues that require rental, this translates to a substantial monetary saving.
- Previous manual timetables often contain overlooked constraint conflicts. The automated timetable is conflict-free.
- *UTTSEExam* can easily handle last-minute changes to the data.
- In the future, administrators can use the system to test the feasibility of possible policy changes, like the shortening of the examination period.

### Conclusion

*UTTSEExam* is a university examination timetable scheduler that has been successfully used to create the

timetable for a major university. This demonstration seeks to reveal how the various techniques employed have been incorporated into a coherent whole. Admittedly, university examination timetabling is an immensely complex and tedious process to automate, but the potential benefits are similarly tremendous. We hope to show that the automation of university examination timetabling is well worth the effort.

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