

Transformation of the University Timetabling Problem Space Through Data Pre-Processing

Introduction

There are more than a million educational institutions in the world and the numbers are growing due to the awareness of the importance of education towards nation building. Timetabling is an important challenge faced by all educational institutions. In many educational institutions timetable is carried out manually and in most cases as a trial and error approach. The manual construction of the timetables should be avoided by having intelligent systems that can automate the process.

Background

Timetabling or scheduling has become a major problem in many organizations or institutions. Without automatic scheduling, great effort and ample of time are needed to prepare and optimize these schedules. For example in higher learning institutions, to satisfy multiple constraints examination and class scheduling such as eliminating clashes, and eliminating students having exams two in a row is still a problem. Attempts have been made to develop computer software to handle these activities. However, due to the inherent complexity of the problem, the results are not very encouraging.

Overview

The current research project started by looking at the scheduling approaches and data structures used by other researchers in solving the timetabling problems. Based on the benchmark datasets, a preprocessing was done to obtain important information to be used for the scheduling process later. The array data structure (matrix) was used for this pre-processing. Heuristic algorithm to further optimize these schedules will be constructed later.

The General Problem

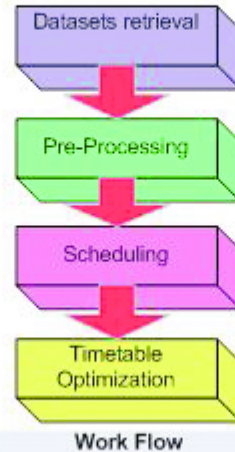
A timetabling problem is a problem with four parameters:

- T : a set of times when exams / meetings can be scheduled
- R: a set of rooms that can accommodate those exams / meetings
- M: a set of exams / meetings that need to be scheduled
- C: a set of participants for each exams / meetings

Scheduling Approaches

Examples of approaches used in scheduling are:

- meta-heuristic approaches
- multi-criteria approaches
- case-based reasoning approaches
- hyper-heuristic approaches



Datasets Retrieval

The task involves the process of retrieving the datasets from a well defined files. The datasets are the benchmark exam timetabling data for the University of Nottingham, semester 1, 1994 – 95. The files contain information pertaining to Students, Exams, Enrollments and Data (other data and constraints). Each of these files contains a snippet of information of the overall problem area.

Datasets Pre-Processing

The data after being transferred within the program memory area will go through a pre-processing stage. These process will generate a more meaningful information and higher level data that could be use to solve the timetabling problem

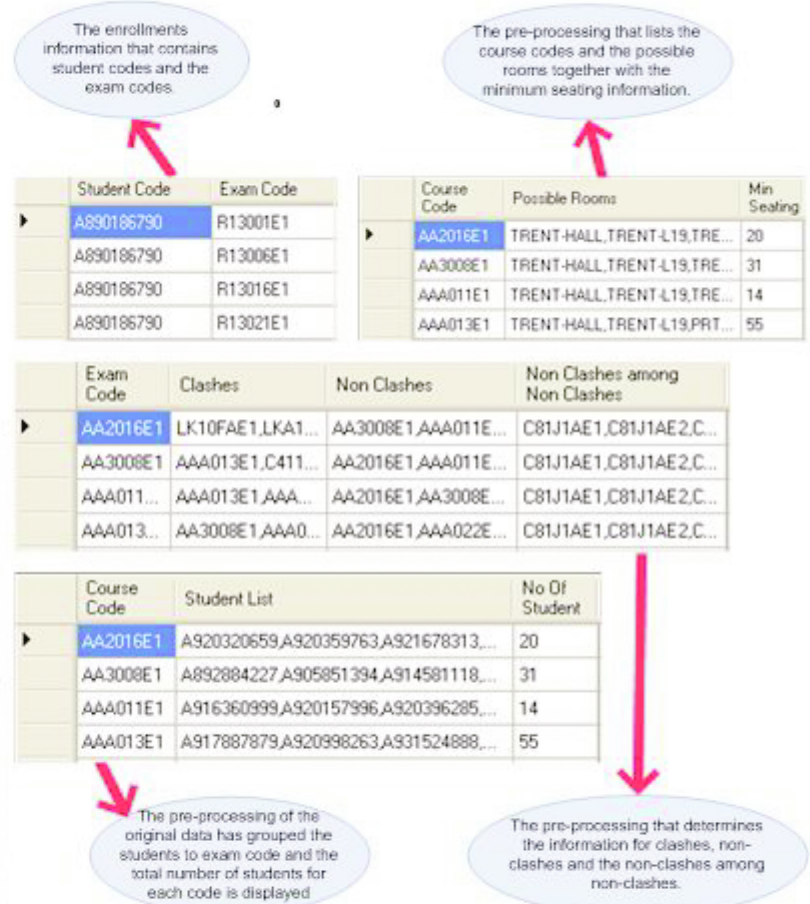
Scheduling

Scheduling will be done by using the derived information form the pre-processing stage. The timetable generated at this stage must fulfill the hard constrains imposed by the exam scheduling criteria.

Timetable Optimization

The timetable generated will be optimized to further improve the efficiency of the scheduling process using heuristic algorithm that will be constructed later.

Illustration of Data & Results of Pre-Processing



Rationale of the Research Work

The pre-processing of the datasets has extracted a lot of information that can be further utilized for the scheduling process. Initially, using the original files, a lot of cross checking and cross referencing need to be done across files and this consumes a lot of time. With the pre-processing, the information is quite rich and thus a hierarchical processing is always possible at the next level which saves a lot of time. This can improve the efficiency and make the scheduling task easier.