Solving the Examination Timetabling Problem with Controlled Avalanche of Changes

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Abstract - *The examination timetabling problem is a fairly well-studied domain with various techniques such as Genetic Algorithms, Tabu search, Simulated Annealing and Hill-climbing being developed to solve the problem. In this paper, we propose a new algorithm that is capable of producing good timetables and is fairly inexpensive in terms of both time and computing cost. This algorithm is based on a view of interrelatedness within the search space, and uses two separate processes – assigning and unassigning of exams – to produce timetables via chain reaction. The experimental results show the potential of this proposed algorithm, and if fully implemented it can be quite useful for solving real-world timetabling problems.*

Keywords: Controlled avalanche of changes, examination timetabling, chain reaction.

1 Introduction

Educational timetabling problem is one of the most important and time-consuming problems many academic institutions around the world are facing periodically. It has stimulated innovative scientific advances mainly from the fields of Operational Research and Artificial Intelligence since the 1960s. In the past ten years, we have seen an increased level of attention on this important topic. There has been a range of significant contributions to its scientific literature both in terms of theoretical and practical aspects.

Different institutions have differing views on what constitutes a good timetable. The quality of a timetable has great impact on a broad range of people including academics, students and administrators. In the process of constructing timetables, a large variety of often-contradicting constraints need to be satisfied. In most university settings with a significantly large student population and large number of courses offered, it is practically impossible to create timetables that do not violate any constraints. Along with the quality of the timetable, the time required to produce the timetable is also an important consideration. The purpose of this study is, therefore, to propose an algorithm that is capable of producing good timetables and is fairly inexpensive at the same time in terms of both time and computing cost. The experimental results show that the proposed algorithm is quite promising, and if fully implemented it can be quite comparable to the state-of-the-art algorithms.

The rest of this paper is organised as follows. The next section provides a background on the timetabling problem. The proposed algorithm is then discussed in the subsequent section, and the experimental results are provided thereafter. Finally, some conclusions are drawn regarding the algorithm and some future study areas are identified.

2 Background

Many real-world problems do not have a fixed solution-algorithm or an optimal solution. One of them is the timetabling problem that has represented a challenging and important research field. Timetabling problem comes in numerous forms such as educational timetabling, nurse scheduling, sports timetabling, transportation timetabling and so on. Among them, educational timetabling problem has generally been given more priority by researchers than other problems.

University course timetabling and examination timetabling are two areas that have attracted the most attention among all the variants of educational timetabling. University course timetabling problem is centred on the weekly scheduling of classes in a university, while the examination timetabling problem is characterised by assigning a set of exams into a limited number of timeslots, both subject to a set of constraints usually known as hard and soft constraints [1-3]. The hard constraints are constraints that cannot be violated at all costs, whereas the soft constraints are constraints that should preferably be obeyed but could be violated at a certain cost.

There has been a significant amount of timetabling research in the last decade. Many methodologies on how to derive the best timetabling solutions have been found on those vast research works. The size and complexity of modern university timetabling problems nowadays has encouraged research in metaheuristic techniques [4-5],