A MICRO-GENETIC ALGORITHM APPROACH FOR SOFT CONSTRAINT SATISFACTION PROBLEM IN UNIVERSITY COURSE SCHEDULING

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Abstrak

Masalah penjadualan kursus universiti adalah kombinasi masalah pengoptimuman. Masalah adalah lebih mencabar apabila satu set peristiwa perlu dijadualkan dalam slot masa, akan ditempatkan ke bilik yang sesuai, yang tertakluk kepada beberapa set kekangan keras dan lembut. Kesemua kekangan yang wujud sebagai peraturan-peraturan dalam setiap sumber untuk peristiwa tersebut perlu dipenuhi untuk mencapai tugas yang optimum. Di samping itu, reka bentuk jadual kursus untuk universiti adalah tugas yang sangat sukar kerana ia merupakan satu permasalahan "non-deterministic polynomial", (NP) keras. Masalah ini boleh dikurangkan dengan menggunakan pendekatan Algoritma Mikro Genetik. Pendekatan ini, mengekod perwakilan kromosom sebagai salah satu elemen penting untuk memastikan hanya sedikit bilangan kromosom individu yang tidak fisibel dihasilkan. Oleh itu, kajian ini mencadangkan pengekodan perwakilan kromosom menggunakan tatasusunan satu dimensi bagi menambahbaik pendekatan algoritma genetik mikro kepada masalah kekangan lembut dalam jadual kursus universiti. Sumbangan bagi kajian ini adalah dalam membangunkan perisian penjadualan yang efektif dan fisibel dengan menggunakan Algoritma Mikro Genetik yang mampu untuk mengurangkan pengeluaran kromosom individu yang tidak fisibel berbanding algoritma pengoptimuman sedia ada bagi jadual waktu kursus universiti, dimana data sampelnya ialah UNITAR International University. Algoritma Mikro Genetik yang dicadangkan telah diuji dalam ujian perbandingan dengan algoritma genetik biasa dan carian berpandukan kepada algoritma genetik sebagai penanda aras. Keputusan menunjukkan bahawa algoritma yang dicadangkan mampu untuk menjana bilangan minimum kromosom individu yang tidak fisibel. Keputusan eksperimen juga menunjukkan bahawa Algoritma Mikro Genetik mampu untuk menghasilkan jadual kursus terbaik untuk UNITAR International University.

Kata kunci: Mikro Genetik, Kekangan lembut, Pengoptimuman, Penjadualan

Abstract

A university course timetabling problem is a combination of optimization problems. The problems are more challenging when a set of events need to be scheduled in the time slot, to be located to the suitable rooms, which is subjected to several sets of hard and soft constraints. All these constraints that exist as regulations within each resource for the event need to be fulfilled in order to achieve the optimum tasks. In addition, the design of course timetables for universities is a very difficult task because it is a non-deterministic polynomial, (NP) hard problem. This problem can be minimized by using a Micro Genetic Algorithm approach. This approach, encodes a chromosome representation as one of the key elements to ensure the infeasible individual chromosome produced is minimized. Thus, this study proposes an encoding chromosome representation using one-dimensional arrays to improve the Micro Genetic algorithm approach to soft constraint problems in the university course schedule. The research contribution of this study is in developing effective and feasible timetabling software using Micro Genetic Algorithm approach in order to minimize the production of an infeasible individual chromosome compared to the existing optimization algorithm for university course timetabling where UNITAR International University have been used as a data sample. The Micro Genetic Algorithm proposed has been tested in a test comparison with the Standard Genetic algorithm and the Guided Search Genetic algorithm as a benchmark. The results showed that the proposed algorithm is able to generate a minimum number of an infeasible individual chromosome. The result from the experiment also demonstrated that the Micro Genetic Algorithm is capable to produce the best course schedule to the UNITAR International University.

Keyword : Micro Genetic, Soft constraint, Optimization, Timetabling

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CHAPTER 1

INTRODUCTION

In general, a university course timetabling problem usually refers to finding the exact allocated time within a limited time period for example a week, for a number of events (courses-lectures) and assignment of events to a number of resources (lecturers-rooms) in such a way that a number of constraints are satisfied.

Yang and Petrovic (2004) has defined the timetabling as the allocation of a set of subject into a classroom over a limited number of time periods to avoid the occurrence of conflicts of interests between two subjects or lecturers. A good scheduling technique that can lead to optimization is important to ensure it is able to produce all timetable for students and lecturers.

The main problem in the university timetable generation is to provide lecturers and lecture activities by matching all lectures involving the consumption a lot of time as well as the person responsible. The information required for the course schedule including room availability, time slots and several specific policy options. For example, information on room availability can be specified to the room capacity for certain events. In the domain of university timetable, it is often used to refer to the construction of schedule (with time slots) through the system by considering several numbers of constraints.

The contents of the thesis is for internal user only

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