USING MICRO GENETIC ALGORITHM FOR SOLVING SCHEDULING PROBLEMS

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ABSTRACT

Job Shop Scheduling Problem (JSSP) and Timetable scheduling are known to be computationally NP–hard problems. There have been many attempts by many researchers to develop reliable scheduling software, however, many of these software have only been tested or applied on an experimental basis or on a small population with minimal constraints. However in actual model JSSP, the constraints involved are more complicated compared to classical JSSP and feasible schedule must be suggested within a short period of time. In this thesis, an enhanced micro GA, namely micro GA with local search is proposed to solve an actual model JSSP. The scheduler is able to generate an output of a set of feasible production plan not only at a faster rate but which can generate a plan which can reduce the makespan as compare to those using manual. Also, in this thesis, the micro GA is applied to the timetabling problem of Faculty of Electrical Engineering Universiti Teknologi Malaysia which has more than 3,000 students. Apart from having more students, the faculty also offers various different types of specialized courses. Various constraints such as elective subjects, classrooms capacity, multiple sections students, lecturer, etc have to be taken into consideration when designing the solution for this problem. In this thesis, an enhanced micro GA is proposed for timetable scheduling in the Faculty to overcome the problems. The enhanced micro GA algorithm is referred to as distributed micro GA which has local search to speed up the scheduling process. Comparisons are made with simple GA methods such that a more optimal solution can be achieved. The proposed algorithm is successfully implemented at the Faculty meeting a variety of constraints not achievable using manual methods.

ABSTRAK

"Job Shop Scheduling Problem" (JSSP) dan penjadualan jadual waktu adalah masalah pengiraan "NP-hard". Ramai penyelidik telah melakukan banyak percubaan untuk membangunkan perisian penjadualan yang boleh diharap, namun begitu, banyak daripada perisian ini hanya diuji atau digunakan pada dasar eksperimen atau pada populasi yang kecil dengan kekangan yang minima. Sebagai contoh dalam model JSSP sebenar (*actual model JSSP*), kekangan-kekangan yang terlibat adalah lebih rumit berbanding dengan JSSP klasik dan jadual yang tersaur mesti dicadangkan dalam masa yang singkat. Dalam tesis ini, satu GA mikro yang dipertingkatkan, iaitu GA mikro dengan carian tempatan (*micro GA with local search*) telah dicadangkan untuk menyelesaikan model JSSP sebenar. Penjadual tersebut berupaya mencadangkan satu pelan pengeluaran yang tersaur bukan hanya pada kadar yang lebih laju, malah boleh menjana satu plan yang mengurangkan masa perlaksanaan (*makespan*) berbanding dengan cara manual. Dalam tesis ini juga, GA mikro telah diaplikasikan dalam masalah penjadualan jadual waktu di Fakulti Kejuruteraan Elektrik, Universiti Teknologi Malaysia, Johor, Malaysia yang mempunyai bilangan pelajar melebihi 3,000 orang. Selain daripada bilangan pelajar yang ramai, fakulti tersebut juga menawarkan pelbagai jenis kursus yang khusus. Pelbagai kekangan seperti matapelajaran elektif, kapasiti bilik kuliah, seksyen pelajar yang banyak, pensyarah dan sebagainya perlu diambilkira semasa merekabentuk penyelesaian untuk masalah ini. Dalam tesis ini, satu GA mikro yang dipertingkatkan telah dicadangkan untuk penjadualan jadual waktu di fakulti untuk mengatasi masalah-masalah tersebut. GA mikro yang dipertingkatkan dirujuk sebagai GA mikro yang mempunyai carian tempatan untuk mempercepatkan proses penjadualan. Perbandingan telah dibuat dengan teknik GA mudah (*simple GA*) agar penyelesaian yang lebih optima boleh dicapai. Algoritma yang dicadangkan telah diimplementasikan dengan jayanya di Fakulti dengan memenuhi pelbagai kekangan yang tidak tercapai sewaktu menggunakan cara manual.

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FKE	-	Faculty of electrical Engineering
GA	-	Genetic algorithm
GOX	-	Generalized order crossover
JSS	-	Job shop scheduling
JSSP	-	Job shop scheduling problems
Micro GA	-	Micro Genetic Algorithm
MT	-	Muth and Thompson
UTM	-	Universiti Teknologi Malaysia

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