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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Computer Science.

(Supervisor's Signature)
Full Name : DR. MOHD NIZAM BIN MOHMAD KAHAR
Position : SENIOR LECTURER
Date : 26.10.2016

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citation which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

Ashis kumar Mandal

(Student's Signature)
Full Name : ASHIS KUMAR MANDAL
ID Number : MCC14004
Date : 26.10.2016

PARTIAL EXAMINATION ASSIGNMENT APPROACHES FOR SOLVING EXAMINATION TIMETABLING PROBLEMS

ASHIS KUMAR MANDAL

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ABSTRAK

Penjadualan peperiksaan adalah salah satu jenis masalah penjadualan yang dihadapi oleh institusi akademik apabila menjadualkan peperiksaan ke dalam bilangan slot masa dan bilik yang terhad. Ia jelas bahawa membina jadual waktu yang berkualiti adalah satu tugas yang mencabar dan memakan masa kerana sifatnya yang NP-keras dengan bilangan kekangan yang banyak perlu diambil kira. Daripada kajian literasi, kebanyakan kajian menumpukan perhatian kepada membina jadual awalan diikuti oleh menambahbaik jadual waktu peperiksaan berkenaan. Walau bagaimanapun, kaedah ini lebih memihak kepada jadual awalan serta potensi algoritma tambahbaik (kadang-kala) terjejas dan gagal dalam menghasilkan jadual yag berkualiti. Tesis ini membincangkan kaedah penjadualan separa peperiksaan bagi menyelesaikan masalah penjadualan peperiksaan. Tesis ini membincangkan kaedah penjadualan separa matapelajaran bagi peperiksaan. Kemudian, sebahagian kursus ini dipilih untuk dijadualkan di ikuti dengan menambahbaik kursus separa yang telah dijadualkan ini. Keseluruhan proses ini diulangi sehingga semua kursus berjaya dijadualkan. Kami implementasi kaedah heuristik graf separa dengan hill climbing (PGH-HC) dan kaedah heuristik graf separa dengan great deluge (PGH-mGD) dalam menyelesaikan penjadualan peperiksaan. Pendekatan ini dilaksanakan pada dua set data, iaitu daripada data *Second International Timetable* (ITC2007) dan *Toronto* set data. Keputusan eksperimen menunjukkan bahawa pendekatan yang dicadangkan dapat menghasilkan jadual yang berkualiti berbanding dengan pendekatan tradisional bagi keseluruhan set data. Disamping itu, perbandingan dengan algorithm pencapaian semasa, kaedah yang dicadangkan secara umumnya menghasilkan jadual yang mampu bersaing dan bagi sesetengah set data ia mampu mengatasi keputusan penyelidik lain seperti yang dilaporkan didalam literasi.

ABSTRACT

Examination timetabling is one type of scheduling problems faced by academic institutions when allocating examinations into a limited number of time slots and/or rooms. It is obvious that the task of constructing a quality timetable is a challenging and time-consuming due to its NP-hard nature, with a large number of constraints having to be accommodated. It is observed in the literature that most of the reported research starts with constructing the initial feasible timetable(s) by allocating all examinations and then performs an improvement on the timetable. However, these traditional approaches bias toward the initial timetable where the improvement algorithms (sometimes) are affected and unable to produce a quality timetable. This thesis presents partial examination assignment approaches to address the examination timetabling problem. The proposed algorithms work by first ordering all examinations using graph heuristics ordering strategies. After that, partially selected examinations are scheduled, followed by an improvement on the partially scheduled examinations. The entire process runs until all of the examinations are assigned successfully. We have implemented partial graph heuristic with hill climbing (PGH-HC) and partial graph heuristic with modified great deluge algorithm (PGH-mGD) into solving the examination timetabling. The proposed approaches are tested on two benchmark datasets, namely Toronto dataset and the Second International Timetabling Competition (ITC2007) dataset. Experimental results demonstrate that the proposed approaches are able to produce quality solutions compared to traditional approaches for all instances of the datasets. Additionally, while compared with the state-of-the-art algorithms, our proposed approaches generally are able to produce competitive results and even outperform some of the reported results found in the scientific literature.

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LIST OF ABBREVIATIONS

ABC	Artificial Bee Colony
ACO	Ant Colony Optimisation
AI	Artificial Intelligence
EAV	Examination Assignment Value
EM	Electromagnetic-like Mechanism
ETP	Examination Timetabling Problems
GAs	Genetic Algorithms
GD	Great Deluge
GH	Graph Heuristics
HC	Hill Climbing
HH	Hyper Heuristics
IFS	Iterative Forward Search
IGA	Informed Genetic Algorithm
ITC2007	International Timetable Competition 2007
LD	Largest Degree
LE	Largest Enrolment
LWD	Largest Weighted Degree
MAs	Memetic Algorithms
OR	Operational Research
PATAT	Practice and Theory of Automated Timetabling
PGH-mGD	Partial Graph Heuristic with Modified Great Deluge
PGH-HC	Partial Graph Heuristic with Hill Climbing
PSO	Particle Swarm Optimization
SA	Simulated Annealing

SD	Saturation Degree
TGH-mGD	Traditional Graph Heuristic with Modified Great Deluge
TGH-HC	Traditional Graph Heuristic with Hill Climbing
TS	Tabu Search
UiTM	University Technology MARA
UKM	University Kebangsaan Malaysia
UMP	University Malaysia Pahang
VNS	Variable Neighbourhood Search

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