

SOLVING UMP EXAMINATION
TIMETABLING PROBLEM USING DYNAMIC
EXPLORATION STEP COUNTING HILL
CLIMBING ALGORITHM

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MASTER OF SCIENCE

UNIVERSITI MALAYSIA PAHANG



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 Science.

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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 citations 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.

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ABSTRAK

Jadual waktu peperiksaan adalah satu proses yang menugaskan peperiksaan kepada slot waktu dan bilik yang tersedia dengan tujuan untuk memenuhi kekangan. Contoh kekangan tersebut adalah peperiksaan yang tiada pertembungan, peperiksaan secara berterusan dalam hari yang sama, kekangan kapasiti bilik dan kekangan lain. Kekangan ini menyukarkan tugas pengagihan peperiksaan ke slot waktu dan bilik yang sesuai. Kini, UMP beroperasi di dua kampus yang berasingan, iaitu di Gambang dan Pekan, Pahang, Malaysia. Dua kampus yang berjarak jauh ini memberi kekangan baru dan berbeza daripada kekangan sediaada yang dibincangkan oleh para penyelidik lain. Kekangan baru ini menyukarkan lagi kerja-kerja penjadualan peperiksaan yang memenuhi kekangan dan yang berkualiti. Tambahan pula, tidak ada model matematik formal untuk membantu UMP dalam menilai kualiti jadual waktu peperiksaan yang dihasilkan. Oleh itu, isu ini membentuk motivasi penyelidikan iaitu, menyelesaikan masalah jadual waktu peperiksaan UMP yang mempunyai kekangan baru. Penyelidikan ini di mulai dengan mengembangkan model matematik formal berdasarkan kekangan baru dan menghasilkan jadual waktu peperiksaan yang dapat memenuhi kekangan semua. Kemudian, jadual waktu peperiksaan akan diperbaiki dengan menggunakan algoritma yang di panggil *dynamic exploration step counting hill climbing (DESCHC)*. *DESCHC* menggunakan nilai kadar pereputan dinamik untuk mendorong penerokaan ruang carian. Kos terikat ini akan bergantung kepada tahap penerimaan calon dan penambahbaikan kos penalti. Hasil eksperimen menunjukkan bahawa *DESCHC* dapat menghasilkan penyelesaian yang berkualiti. Data *semester 1-2014/2015*, *DESCHC* menghasilkan penyelesaian yang 92.86% lebih baik daripada jadual waktu peperiksaan UMP dan 96.13% lebih baik bagi data pada *semester 2-2014/2015*. Selain itu, penyelesaian yang dihasilkan oleh *DESCHC* juga memenuhi semua kekangan yang sukar dicapai oleh jadual peperiksaan UMP.

ABSTRACT

Examination timetabling is a process that involves assigning exams to available timeslot and room(s) to satisfy the hard and soft constraints. An example of such constraint includes no clashing, back-to-back examinations, room capacity constraints and many others. These constraints complicate the assignment of examination to available timeslot and room(s). UMP currently operates from two separate campuses in Gambang and Pekan, Pahang, Malaysia. Operating from two distant campuses forms new constraints different from those reported in the literature. These new constraints further complicate the problem in obtaining a feasible and quality examination timetable. Furthermore, there is no formal mathematical model to assist UMP in evaluating the quality of the examination timetable. Therefore, this forms the motivation of this research to solve the UMP examination timetabling problem with the new examination constraints. The work starts by developing a formal mathematical model based on the new constraints and generates a feasible initial solution of the examination timetable that satisfies the hard and soft constraints (as much as possible). Then, the initial solution is improved using our enhanced algorithm called dynamic exploration step counting hill climbing (DESCHC). The DESCHC employs a dynamic decay rate value to encourage exploration of the search space. The cost bound that acts as the level of acceptance dynamically changes depending on the acceptance of the candidate and improvement in the penalty cost. Experimental results show that DESCHC was able to produce quality solutions. In semester 1-2014/2015, DESCHC produced a solution that is 92.86% better than the UMP examination timetable. In semester 2-2014/2015, DESCHC produced a solution that is 96.13% better than the UMP examination timetable. Moreover, the solution produced by DESCHC satisfies all of the hard constraints that the UMP examination timetable failed to achieve.

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