

**BUS DRIVER SCHEDULING SYSTEM
VIA GENETIC ALGORITHM WITH ENHANCED
CROSSOVER MECHANISM**

LIM TZE SHUNG

**UNIVERSITI UTARA MALAYSIA
2009**

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**A thesis submitted to the College of Arts and Sciences in
fulfillment of the requirement for the degree of Master of Science
(Decision Science)
Universiti Utara Malaysia**

LIM TZE SHUNG

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ABSTRACT

The thesis investigates the problem and constraints related to bus driver scheduling in a case study. The unfairness of job distribution and the ineffectiveness of break-time assignment among bus drivers are factors identified as problem issues in the bus driver management. Hence, the objective of the study is to develop a model to solve the bus driver scheduling problem (BDSP). Among the approaches reviewed for solving this BDSP, genetic algorithm (GA) has been identified as the most potential solution approach. In the proposed GA, horizontal crossover with multiple-point and directed mutation techniques are introduced in its natural representation as part of the approach. The solutions obtained show that the proposed GA technique is able to improve the quality of solutions. The model has efficiently solved the bus driver scheduling problem in the case of Universiti Utara Malaysia (UUM). The proposed solution approach is able to generate quality schedule efficiently and quickly when compared to the human-generated schedule.

Keywords: Genetic algorithm, bus driver scheduling, manpower scheduling, and transportation application.

**SYSTEM PENJADUALAN PEMANDU BAS MELALUI
ALGORITMA GENETIK DENGAN PENAMBAHBAIKAN PADA
OPERATOR GENETIK**

IKTISAR

Tesis ini menyiasat masalah dan kekangan yang berkait dengan penjadualan pemandu bas dalam satu kajian kes. Ketidakadilan dalam pengagihan kerja dan masa rehat telah dikenal pasti sebagai faktor masalah dalam isu pengurusan pemandu bas. Oleh itu, objektif kajian ialah membangunkan satu reka model bagi menyelesaikan masalah penjadualan pemandu bas. Algoritma genetik (AG) telah dikenapastikan sebagai satu kaedah penyelesaian yang paling berpotensi antara semua kaedah lain yang dikaji bagi menyelesaikan masalah penjadualan pemandu bas. Dalam kaedah AG yang diusulkan, teknik-teknik seperti silang-cantum melintang dengan pelbagai titik dan mutasi terarah telah diperkenalkan dalam perwakilan penyelesaian sebenar. Penyelesaian yang diperoleh menunjukkan bahawa AG ini mampu meningkatkan kualiti penyelesaian. Model ini telah dapat menyelesaikan masalah penjadualan pemandu bas dalam kes Universiti Utara Malaysia (UUM) secara efisien. Seterusnya, kaedah penyelesaian yang diusulkan ini mampu menghasilkan jadual dengan efisien dan cepat jika dibandingkan dengan penghasilan jadual secara manual.

Katakunci: *Algoritma genetik, penjadual pemandu bas, penjadualan kakitangan, dan aplikasi pengangkutan.*

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Figure 5.5: The GA performance graph when mutation rate= 0.8 with different crossover rates

LIST OF ABBREVIATIONS

- BDSP** – Bus Driver Scheduling Problem
- DSP** – Driver Scheduling Problem
- GA** – Genetic Algorithm
- GRASP** – Greedy Randomized Adaptive Search Procedure
- ILP** – Integer Linear Programming
- LP** – Linear Programming
- NP** – Non-deterministic Polynomial
- OR** – Operation Research
- PoD** – Pointed Directed
- PTA** – Population Training Algorithm
- SCP** – Set Covering Problem
- SPP** – Set Partitioning Problem
- UUM** – Universiti Utara Malaysia

Chapter One

Introduction

Transportation companies are often faced with a very important challenge to provide better transportation services. In fulfilling this role, the companies have to establish a comprehensive transportation planning system to ensure quality of the services provided. This transportation planning is a very complex process and it can be decomposed into several sub-problems or components: timetabling, vehicle scheduling, crew scheduling and roster scheduling (Lourenco *et al.*, 1998). The relationships between these sub-problems are shown in Figure 1.1 according to the direction of the arrows.

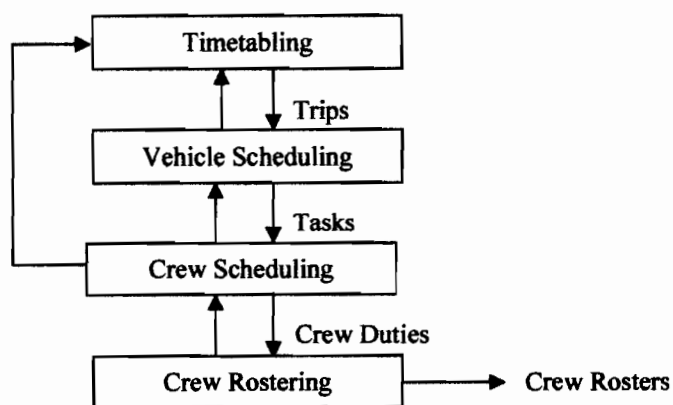


Figure 1.1: The transportation planning

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