
RESEARCH EXHIBITION IN MATHEMATICS & COMPUTER SCIENCES

REMACS 5.0



CS240 - BACHELOR OF INFORMATION TECHNOLOGY [HONS.]
CS248 - BACHELOR OF SCIENCES [HONS.]
MANAGEMENT IN MATHEMATICS
CS251 - BACHELOR OF COMPUTER SCIENCE [HONS]
NETCENTRIC COMPUTING
CS255 - BACHELOR OF COMPUTER SCIENCE [HONS]
DATA COMMUNICATION & NETWORKING

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Universiti Teknologi MARA Perlis Branch

**Research Exhibition in Mathematics and Computer Sciences
(REMACS 5.0)**

Research Exhibition in Mathematics and Computer Sciences (REMACS 5.0)

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Preface

It is with great pleasure that we present this extended abstract book, titled "The 5th Research Exhibition in Mathematics and Computer Sciences (REMACS 5.0)". This book is a collection of research work in the fields of Computer Science and Mathematics, contributed by the final year students from Universiti Teknologi MARA, Perlis Branch. The aim of this book is to showcase the diversity and depth of research in these two interrelated fields.

Mathematics and Computer Science are two fields that have seen tremendous growth and advancement in recent years. With the rise of new technologies and the increasing demand for data-driven solutions, researchers in these fields have been working hard to develop new theories, algorithms, and models that can help solve some of the most pressing problems of our time. This book is a testament to their hard work and dedication.

The abstracts in this book cover a wide range of topics, including algebra, analysis, logic, computer architecture, algorithms, artificial intelligence, machine learning, computer network, netcentric computing and many more. The work presented here is both theoretical and practical, and has the potential to impact many areas of society, from finance and healthcare to education and security.

We hope that this book will serve as a valuable resource for future students in the fields of Mathematics and Computer Science. We also hope that it will inspire more students to pursue innovative and groundbreaking research in these two fields. Finally, we would like to express our gratitude to all the contributors for their hard work and dedication, without which this book would not have been possible.



RESEARCH EXHIBITION IN MATHEMATICS & COMPUTER SCIENCES
REMACS 5.0

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EVENT SCHEDULE

8:00 – 8:30 am

- Registration

8:00 am – 12:00 pm

- FYP Project Presentation

12:00 - 2:00pm

- Lunch Break

2:15 – 2:35 pm

- National & Wawasan Setia Anthems
- Doa Recitation

2:35 – 2:45 pm

- Welcoming Address by Director of REMACS 5.0

2:45 – 2:55 pm

- Officiating & Closing Remarks from Rector of UiTM Perlis

2:55 – 3:00 pm

- REMACS 5.0 Montage

3:00 – 4:00 pm

- Awarding of Winners:
 - Best Poster
 - Best Project Award

- Photo Session

- End of Ceremony

Dress Code: Formal / Corporate

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EXTENDED ABSTRACTS

RESEARCH EXHIBITION IN MATHEMATICS & COMPUTER SCIENCES
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NUMBER OF STAFF OPTIMIZATION OF TOLLMAN SCHEDULING WITH INTEGER LINEAR PROGRAMMING

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Abstract

Scheduling problem is a great concern for several company. Larger organizations have to maintain proper scheduling of their employees to ensure good service. The schedule of toll booth collectors is one of the important elements of the company. Due to the rise of highways users, toll plaza has to make sure that they have enough workers manning the toll booths due to the increase in highways users in order to prevent any issues. They must take into consideration the staffing costs even if they can hire additional employees to make sure they do not run out of staff. Therefore, the purpose of this study was to determine optimum number of tollman working per day in order to minimize staffing costs. To achieve these objectives, Integer Linear Programming and LINGO Software were applied. The issue of too many or too few tollman will be reduced once the ideal number of tollman working has been reached. The cost of hiring new employees might be automatically decreased as a result. The data obtained those 30 workers needed per day for this company and the staffing costs per day is RM1800. Based on findings, it is recommended that a toll plaza needs a minimum of 15 tollman per day with staffing cost reduced to RM900 which has decreased staffing costs per day which still fulfil the company constraints.

Keywords: Integer Linear Programming; Optimization; Tollman; Staffing costs; LINGO Software

1. Introduction

Due to the rise of highways users, toll plazas have to make sure that they have sufficient staff manning the toll booths to avoid any problem occurring especially at manual booths. Therefore, this study aim is optimizing number of tollman needed and minimizing total staffing costs while fulfilling company requirements. This study focuses on Bentong Toll Plaza tollman on May 2022. The morning shift begins at 5.45 am until 1.45 pm, the evening shift begins at 1.45 pm until 9.45 pm, and the night shift at 9.45 pm until 5.45 am. All shifts start at the same time each day and rotate. The study will also consider the average cost of staffing per day.

2. Methodology

Integer Linear Programming method has been used to complete this study. This study contains four steps which are data acquisition, data pre-processing, model development and model application. The data obtained has been executed using general formula of Integer Linear Programming which consists of three components; notation, objective function, constraints. Notation has been used to construct the model and function equation. Objective functions are the objectives that this study wants to achieved while the constraints are the requirements state by the toll plaza also has been executed into the formula. LINGO software has been used to complete this study.

3. Results and Discussion

The objective of this study has been achieved when the number of tollman needed at Bentong toll plaza have minimized. From that, the staffing costs of hiring tollman also have been reduced. The actual schedules and costs provided was compared with the optimal solution of the Integer Linear Programming model that was carried out. From the results, 50% from their original staffing costs by hiring no more than half of their current tollman while still complying with company requirements. These findings show that Integer Linear Programming also can be apply to other scheduling problems and also can help in solving staffing costs problems.

4. Novelty of Research / Product

There have been a number of research that have conducted study about Integer Linear Programming on staffing costs and scheduling. a study from Trilling et al., 2006 has solved job scheduling problem by comparing two method which are Integer Linear Programming and Constraint Programming. A study on staffing and labour scheduling at the main security gate of a large industrial organization has been proposed using Integer Programming (IP) method (Alfares, 2001). Choi et al., (2009) has proposed IP in scheduling restaurant workers to minimize labor costs and meet service standards. Another study computed focused in determining the number of workers which will help in minimizing total staffing costs and meeting the staffing needs for each hour or shift (Mohamad & Said, 2013). Even though many research has been conducted in optimizing staff and minimizing staffing cost, it is hardly to find the research that conducted study for toll plaza in Malaysia using Integer Linear Programming.

5. Conclusion

The ideal number of tollmen has been established, the problem of having too many or too few tollmen has lessened. As a result, the cost of hiring a tollman automatically reduced. These results demonstrate that Integer Linear Programming can also be used to address other scheduling issues and reduce staffing expenditures.

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