

0-1 GOAL LINEAR PROGRAMMING FOR NURSE ROSTER

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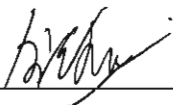
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0-1 GOAL LINEAR PROGRAMMING FOR NURSE ROSTER

YEAP JIA JUN

The report is submitted in partial fulfillment of the requirements for the
Bachelor of Computer Science (Artificial Intelligence)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2011




DECLARATION

I hereby declare that this project report entitled

NURSE ROSTERING SYSTEM

is written by me and is my own effort and that no part has been plagiarized
without citation.

STUDENT :  Date: 05/07/2011
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SUPERVISOR : _____ Date: _____
(MISS NUZULHA KHILWANI BINTI IBRAHIM)

DEDICATION

To my beloved parents, Mr. Yeap Kean Hoe and Mrs. Goh Beng Choo, for their expression of love and fully support...

To my supervisor, Miss Nuzulha Khilwani Binti Ibrahim, for making it all worthwhile...

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I would like to show my gratitude and appreciation to my supervisor, Miss Nuzulha Khilwani for all her ideas and advices in guiding me throughout the project.

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Thanks a lot.

ABSTRACT

The continuous pattern of working 24 hours a day, 7 days a week, needs a working shift environment that could affect the working conditions of the nurses. This involves social life and nurses' level of health. Therefore the development of a nurse scheduling model that can be accepted well by all parties is necessary to enable it to be applied in the nurse scheduling system. This nurse scheduling considers policy imposed by the hospital and demand from the nurses so that there is more balance, quality and fairness in the production of the nurse scheduling model. Hence, in this research, 0-1 goal programming approach is applied in the development of nurse scheduling model because of its ability to produce a model with multiple objectives. Approach to the problem was illustrated on the general hospital. The result obtained by the system shows that the developed model of nurse scheduling using 0-1 goal programming approach performs better than the manual method. This is because it was successful in meeting the hospital policy and nurses' preferences.

ABSTRAK

Corak bekerja yang berterusan iaitu selama 24 jam sehari 7 hari seminggu, memerlukan waktu kerja mengikut syif yang boleh memberi kesan yang mendalam ke atas keadaan kerja jururawat. Ini melibatkan kehidupan sosial dan tahap penjagaan kesihatan jururawat. Oleh itu pembangunan sebuah model penjadualan jururawat yang dapat diterima baik oleh semua pihak adalah perlu bagi membolehkan ia digunakan dalam sistem penjadualan jururawat. Penjadualan jururawat ini mempertimbangkan polisi yang dikenakan oleh pihak hospital dan permintaan daripada jururawat agar model penjadualan jururawat yang dihasilkan lebih adil, berkualiti dan seimbang. Justeru, dalam kajian ini, pendekatan pengaturcaraan gol 0-1 diaplikasikan di dalam pembangunan model penjadualan jururawat ini kerana keupayaannya menghasilkan sebuah model dengan pelbagai matlamat. Pendekatan ke atas masalah ini diilustrasikan ke atas jururawat di hospital awam kerajaan. Daripada hasil penyelesaian menggunakan perisian ini, didapati model penjadualan jururawat secara pengaturcaraan gol 0-1 adalah lebih baik berbanding kaedah secara manual. Ini kerana ia berjaya memenuhi polisi pihak hospital dan permintaan jururawat.

TABLE OF CONTENTS

CHAPTER	SUBJECT	PAGE
	JUDUL	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xii
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xv
	LIST OF ATTACHMENTS	xvi
CHAPTER I	INTRODUCTION	
	1.1 Project Background	1
	1.2 Problem Statement(s)	2
	1.3 Objective	3
	1.4 Scope	3
	1.5 Project Significance	4
	1.6 Expected Output	4
	1.7 Conclusion	5

CHAPTER II LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1	Introduction	6
2.2	Facts and Findings (based on topic)	7
2.2.1	Domain	7
	2.2.1.1 Scheduling	7
	2.2.1.2 Nurse Scheduling	9
	Approach	
2.2.2	Existing System	14
2.2.3	0-1 Goal Linear Programming	17
	2.2.3.1 Formulate the Problem	19
	into Mathematical	
	Statement	
	2.2.3.2 The General	20
	Formulation of the	
	Goal Programming	
	2.2.3.3 Characteristics of	21
	Linear Goal	
	Programming	
	2.2.3.4 Goal Programming	21
	Method	
	2.2.3.4.1 The	22
	Preemptive	
	Method	
	2.2.3.4.2 The	22
	Weighting	
	Method	
2.2.4	Constraints	23
	2.2.4.1 Hard Constraints	23
	2.2.4.2 Soft Constraints	24
2.3	Project Methodology	25

2.4	Project Requirements	27
2.4.1	Software Requirement	27
2.4.2	Hardware Requirement	28
2.4.3	Other Requirements	28
2.5	Project Schedule and Milestones	28
2.6	Conclusion	29

CHAPTER III ANALYSIS

3.1	Introduction	30
3.2	Problem Analysis	30
3.3	Requirement Analysis	32
3.3.1	Data Requirement	33
3.3.2	Functional Requirement	34
3.3.3	Non-functional Requirement	35
3.3.4	Others	36
3.4	Conclusion	40

CHAPTER IV DESIGN

4.1	Introduction	41
4.2	High-Level Design	41
4.2.1	System Architecture	42
4.2.2	User Interface Design	43
4.2.2.1	Navigation Design	43
4.2.2.2	Input Design	45
4.2.2.3	Technical Design	47
4.2.2.3.1	Weighted Average	48
4.2.2.4	Output Design	49
4.2.3	Database Design	50
4.2.3.1	Conceptual and Logical Database Design	52
4.3	Detail Design	53

4.3.1	Software Hardware Design	53
4.3.2	Physical Database Design	58
4.4	Conclusion	59
CHAPTER V	IMPLEMENTATION	
5.1	Introduction	61
5.2	Software or Hardware Development Environment Setup	62
5.3	Software Configuration Management	64
5.3.1	Software Configuration Environment Setup	65
5.3.1.1	Microsoft Excel Format	65
5.3.1.2	Windows File Sharing	66
5.3.2	Version Control Procedure	69
5.4	Implementation Status	70
5.5	Conclusion	72
CHAPTER VI	TESTING	
6.1	Introduction	73
6.2	Test Plan	73
6.2.1	Test Organization	74
6.2.2	Test Environment	74
6.2.3	Test Schedule	75
6.3	Test Strategy	76
6.3.1	Classes of tests	76
6.4	Test Implementation	77
6.4.1	Test Description	77
6.4.2	Test Data	78
6.5	Test Result and Analysis	78
6.5.1	First Testing	79
6.5.2	Second Testing	80

6.6	Conclusion	80
CHAPTER VII PROJECT CONCLUSION		
7.1	Observation on Weaknesses and Strengths	82
7.2	Propositions for Improvement	83
7.3	Contribution	83
7.4	Conclusion	84
	REFERENCES	85
	BIBLIOGRAFY	91
	APPENDICES	92

LIST OF TABLES

TABLE	TITLE	PAGE
3.1	Functional Requirement of Nurse Rostering System	35
3.2	Non-functional requirement	36
4.1	Input design of Nurse Rostering System	45
5.1	Version of Nurse Rostering System	67
6.1	Personal Computer Configuration	72
6.2	Test Schedule	73

LIST OF FIGURES

DIAGRAM	TITLE	PAGE
3.1	Head nurse use case	32
3.2	The dataset of the nurse roster	33
3.3	The legend for the data	33
3.4	Functional requirement of the system	34
4.1	Architecture of Nurse Rostering System	42
4.2	Navigation flow of Nurse Rostering System	44
4.3	Browse File	45
4.4	Information	46
4.5	Save as	46
4.6	The output design for the system	49
4.7	ERD Diagram	51
4.8	Roster data	57
5.1	The Software Development Environment Setup Architecture	60
5.2	Deployment Diagram	61
5.3	Roster format example	63
5.4	Create Nurse Roster Folder	64
5.5	Save Roster File	64
5.6	Share folder setting	65
5.7	Share folder setting (continue)	65
5.8	Share folder setting (continue)	66
5.9	Set permission to folder	66

6.1	Roster A	76
6.2	The objective function for Roster A	77
6.3	Roster B	77
6.4	Objective Function for Roster B	77

LIST OF ABBREVIATIONS

MCDA -	Multi-criteria decision analysis
AI -	Artificial Intelligent
MCDM -	Multi-criteria decision making
MIGP -	Mix Integer Goal Programming
ME -	Marketing executive
GP -	Goal programming
IT -	Internet Technology
LGP -	Linear goal programming
NP -	Non-deterministic polynomial-time

LIST OF ATTACHMENTS

TITLE	PAGE
Appendix A Manual-Made Nurse Roster	90
Appendix B Project Gantt Chart	92
Appendix C Unit Test Case	95
Appendix D User Manual	97
Appendix E Proposal Form	111
Appendix F Log Book	116

BAB I

INTRODUCTION

1.1 Project Background

This project is mainly used for the nurse rostering in general hospital Malaysia because every hospitals will face the Nurse Rostering Problems (NRP) or NP (Nondeterministic Polynomial time) problems based on the hard and soft constraints that cannot be avoided. The reason is that hospitals need to be staffed 24 hours a day over seven days a week in 365 days a year which has no holiday. In addition, many hospitals nurses are allowed to request preset shifts, while other nurses are scheduled around these pre-set shifts. Shift arrangement becomes a significance task in nursing administration for the purpose of providing a stable and secured nursing service to patients because human has limited energy to work for a very long period especially for the nurses that have many shifts, they need time to rest so that they are able to work in the good condition. To ensure the quality and image of a hospital, the nursing service is very important to the patient therefore they always need to be alert and focus to do their work. Therefore in order to make the nurse's duty more efficient and fair, we need to build a system to schedule the time roster for them because fairness of shift arrangement plays a key role for nurses

Besides that, mostly roster is created by the head nurse of the wad. The roster is done manually in a piece of paper without using computer system or software. This is

not a good solution for them because the roster may not be perfect to every nurse in term of fairness and not secure. Some nurse may not get a fair roster and it will cause the nurse lack of rest and cannot focus in doing their job. On the other hand, there is no database to keep the roster of the nurse and that is not secure. It is hard for the head nurse to retrieve back the previous roster and maybe the roster already lost if there is no a proper way to keep the database. Therefore, they need a system that will keep the entire roster and generate a perfect roster for the nurse.

There are some systems that been used to solve this problems using many different approach and it shown artificial intelligence approach can solve the NRP efficiently. By using 0-1 Goal Linear Programming it also can solve the NRP efficiently. BOA is one of the artificial intelligence approaches that can be use to solve the problems. 0-1 Goal Linear Programming will base on the dataset of the nurse to generate a roster to solve NRP by using its algorithm. It will schedule the shifts and working time for the nurse effectively to ensure the nurse will have comfortable working time and fair to every nurse in the hospital start form Sunday to Saturday in a month. It will make the head nurse job easier, flexible and produce a better roster for the nurse.

1.2 Problem Statement(s)

There are some problems that can be found in the nurse roster. To build and plan a nurse roster is a very complicated process because it has to base on some constraints which are soft and hard constraints. The roster has to fit to all those constraints in order to produce a perfect roster. It is a difficult task for the head nurse to create the roster for nurse and face some problems regarding the constraints while creating the roster. The head nurse might not produce the best roster to the nurse.

Besides that, the roster will be not very efficient if it is build by manually by the head nurse. As we are human, we will make some mistakes sometimes and it may has some effect to the work we produce. This will cause unbalance roster for the nurse and not fair among the nurse. Mostly head nurse will create the roster in a piece of paper. It is actually not a good way to create a roster because the paper might be lost and it is not safe. If the paper is lost, the head nurse has to redo the roster again and could not retrieve back the previous roster. It will waste time to redo the roster. Therefore, the problems have to be solved by create a system using artificial intelligence approach.

1.3 Objective

- To investigate 0-1 Goal Linear Programming in NRP.
- To model the 0-1 Goal Linear Programming in NRP.
- To apply and implement the 0-1 Goal Linear Programming in NRP.
- To generate a roster for the nurse.

1.4 Scope

The scopes of the project are listed as follows:

- The intelligent approach that will use in the system is 0-1 Goal Linear Programming to the nurse rostering.
- The target user is the head nurse for the particular wad that will handle the nurse roster.
- The roster is built for the general hospital in Malaysia.
- The system will generate the nurse roster automatically based on the hard and soft constraints.

- The system is built with Visual Studio 2010 and Microsoft Office Excel 2003 The output will be save as an excel (.xls) file.

1.5 Project Significance

The research is mainly for the nurse rostering problems. It will use an artificial intelligence approach to solve the problems. It is important to help the head nurse to prepare the roster as there are many constraints to be considered to produce a perfect roster. The system will automatically generate the roster for the nurse in the wad by using 0-1 Goal Linear Programming concept.

1.6 Expected Output

The system will be a standalone application that will be used for the wad roster. It apply artificial technique to automatic generate the roster for the nurse. The output for the roster is the first half in a month or the first 14 days in a month. Then the roster will save as a excel file so that it is easy to retrieve back the roster and easy to manage.

Besides that, there is a function that will read the text from the system. It is a text to speech system. The output will be the speech that read by the system, it actually converts the text to speech.

Lastly, the objective function will be calculated based on the generated roster where the roster meets penalties by the soft and hard constraints. Weighted average is the method that use in the objective function to calculate the result for the roster that generated by the system. The lowest the value show by the objective function, the accurate the roster that meets the soft constraints.

1.7 Conclusion

As a conclusion, the nurse rostering system is using 0-1 Goal Linear Programming to expect to produce a better nurse roster. The system will help the head nurse to automatically generate the nurse roster based on the constraints.

For the next chapter, there is a literature review of the project that will include the topic by finding facts and comparing the existing systems. Besides that, the project methodology will also be discussed in Chapter 2.

BAB II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In this chapter, the literature part of this research study will be presented and discussed. This includes the study on the nurse rostering system based on the domain of the project and the technique that will be use for the project. Besides that, the project methodology will also be determined and justified its selection. Then followed by the requirement needed to build the proposed system will also be stated. Lastly, the project schedule and milestones are planned in order the system can finished in time by following them.

Project methodology is an approach that tells user what he/she has to do and manage the project from start to finish. It describes every step in the project life cycle in deep, so users know exactly what tasks to complete, when and how. The details in this topic will be discussed later.