

UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

**NURSE SCHEDULING BY FORWARD
DYNAMIC PROGRAMMING APPROACH**

P22M19

SITI AISHAH BINTI SARMAN (2016635704)

SITI FARAHAHAH BINTI ZAKI (2016694836)

NIK NUR SALSABILA BINTI AHMAD SABRI (2016635632)

**Report submitted in partial fulfilment of the requirement
for the degree of**

Bachelor of Science (Hons.) Management Mathematics

Faculty of Computer and Mathematical Sciences

JULY 2019

ACKNOWLEDGEMENTS

IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

First of all, we would like to express our gratitude to Allah S.W.T and Prophet S.A.W for the strength to complete this Final Year Project successfully which is also unimaginable without the involvements and valuable assistance of numerous people, directly and indirectly.

Hereby, we would like to express our deepest appreciation to our final year project supervisor, Mrs. Rossidah Binti Wan Abdul Aziz, whose contribution in stimulating suggestions and encouragement, helped us to coordinate our project especially in writing this report.

Next, we are thankful to Dr. Mat Salim Bin Selamat and Mrs. Aminah Binti Abdul Malek for their advices and guidances. Most importantly, a special appreciation goes to our parents and fellow friends for their endless support and encouragement. We might not be able to complete this project without their moral supports and prayers. Last but not least, we would like to thanks everyone who are indirectly involved in this project completion, may God bless us all.

Table of Contents

ACKNOWLEDGEMENTS.....	i
CHAPTER 1	1
INTRODUCTION	1
1.0 OVERVIEW	1
1.1 INTRODUCTION.....	1
1.2 PROBLEM STATEMENT	3
1.3 RESEARCH QUESTIONS.....	4
1.4 RESEARCH OBJECTIVES	4
1.5 SIGNIFICANCE OF STUDY.....	5
1.6 SCOPE OF THE STUDY	5
1.7 DEFINITION OF TERMS AND ABBREVIATIONS.....	6
CHAPTER 2	7
BACKGROUND THEORY AND LITERATURE REVIEW	7
2.0 INTRODUCTION.....	7
2.1 BACKGROUND THEORY	7
2.2 LITERATURE REVIEW.....	8
2.2.1 NSP.....	8
2.2.2 DP METHOD.....	11
2.2.3 APPLICATION OF DP.....	12
2.2.4 APPLICATION OF DP ON SCHEDULING PROBLEM.....	13
2.3 SUMMARY	14
CHAPTER 3	16
METHODOLOGY AND IMPLEMENTATION	16
3.0 INTRODUCTION.....	16
3.1 FLOW CHART	16
3.2 DATA COLLECTION.....	19
3.3 ANALYSIS OF THE DATA	20
3.4 KEY CHARACTERISTICS OF THE STUDY	22
3.5 CHARACTERISTIC OF DP	22

3.6	DP STRUCTURE	24
3.7	NOTATION OF THE MODEL	26
3.8	FORMULATION OF CONSTRAINT	27
3.9	FORMULATION OF OBJECTIVE FUNCTION	29
3.10	SUMMARY	33
	CHAPTER 4	34
	RESULTS AND DISCUSSION	34
4.0	INTRODUCTION.....	34
4.1	RESULTS OF ANALYZING THE MANUALLY MADE SCHEDULE	34
4.2	RESULTS OF MAXIMIZING THE NURSING WORKING USING DP	36
4.3.1	RESULT OF OBJECTIVE FUNCTION.....	36
4.3.2	RESULTS OF DECISION VARIABLE	37
4.3	VALIDATION OF RESULTS	40
4.3.1	COMPARISON OF TOTAL DAY SHIFT.....	40
4.3.2	COMPARISON OF TOTAL NIGHT SHIFT.....	41
4.3.3	COMPARISON OF THE TOTAL WORKING DAY	41
4.3.4	RELATIVE ERROR FOR SCHEDULING.....	42
4.4	SUMMARY	45
	CHAPTER 5	46
	CONCLUSIONS AND RECOMMENDATIONS	46
5.0	INTRODUCTION.....	46
5.1	CONCLUSIONS.....	46
5.2	RECOMMENDATIONS	47
	REFERENCES	48
	APPENDICES	52

ABSTRACT

Nurse Scheduling Problem (NSP) is a complex problem and it is a difficult process to construct an effective schedule, which must consider all of the hospital's requirements and nurses' preferences. However, most hospitals and healthcare facilities construct the schedules manually which does not acknowledge the hospital's requirements. Therefore, they have difficulties in generating the schedule due to the issues that crop up after. Hence, a study on NSP is conducted to find the suitable method to solve NSP compared to manually made schedule. The purpose of this study is to analyze current manually made schedule with respect to the total day shift, total night shift and total working day and to determine the maximum working day and night shifts for each nurse by Dynamic Programming (DP) approach. This complex problem is divided to 13 states and four stages. The problem is solved recursively where the solution from previous stage will be used in the next stage. For instance, the solution obtained in stage one is carry forward to stage two where it is used to find the solution for stage two and this process is repeated for the next stage three and four until the final optimal solution is obtained. The result from this study indicates that DP method is compatible to find the maximum working day and night shifts for each nurse in solving NSP.