UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

A COMPREHENSIVE EVALUATION OF PUBLIC HOSPITALS IN MALAYSIA USING SEVERAL GREY RELATIONAL ANALYSIS MODELS

MUHAMMAD ARIF BIN AHMAD ZAKI – 2019230196
NUR HANIS KAHA BINTI MOHD KAHARUDDIN – 2019805464
ZUREEN SYAZIRA BINTI ZALMAN ZAIN – 2019257444
(P2M22)

Report submitted in partial fulfilment of the requirement for the degree of
Bachelor of Science (Hons.) Computational Mathematics
Faculty of Computer and Mathematical Sciences
UNIVERSITI TEKNOLOGI MARA

AUGUST 2022

ACKNOWLEDGEMENTS

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

Firstly, we are grateful to Allah S.W.T for giving us the strength to complete this project successfully.

We would like to express our deepest appreciation to our beloved supervisor, Madam Farah Azaliney Binti Mohd Amin for her continuous guidance and constant supervision. It is also an honour to have wonderful lecturers especially for Mathematical Modelling (MAT530) and Final Year Project (MSP660) courses, Dr. Nur Azlina Abd Aziz for the encouragement and consultation during classes regarding this study. So many challenges we had to face but with patience, support and teamwork, we managed to overcome them. We take it as a new experience and gain new knowledge.

We would also like to express our deepest gratitude to our family members who regularly give us support and encouragement throughout the completion of this technical report. Without their support, we will not be able to finish this entire project successfully. Lastly, we also thanked our friends and classmates who generously helped us directly or indirectly as well as motivated us to finish this report successfully. Only Allah S.W.T can reward all your kindness.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS **i**

TABLE OF CONTENTS **ii**

LIST OF TABLES **iii**

LIST OF FIGURES **iv**

ABSTRACT **v**

CHAPTER 1: INTRODUCTION **1**

1.1 Background of study 1

1.2 Problem Statement 4

1.3 Objectives 4

1.4 Significant and Benefit of Study 5

1.5 Scope and Limitation of Study 5

1.6 Definition of Terms 6

CHAPTER 2: BACKGROUND THEORY AND LITERATURE REVIEW **8**

2.1 Background Theory 8

2.2 Literature Review 8

2.2.1 Deng's Correlation Degree 8

2.2.2 Grey Absolute Correlation Degree 9

2.2.3 Grey Relative Correlation Degree 10

CHAPTER 3: METHODOLOGY AND IMPLEMENTATION **11**

3.1 Methodology 11

3.1.1 Theory of Deng's correlation degree 11

3.1.2 The grey absolute correlation degree 14

3.1.3 The grey relative correlation degree 16

3.2 Data Collection 18

3.3 Implementation **21**

3.3.1 Implementation of Deng's Correlation Degree 21

3.3.2 Implementation of Grey Absolute Correlation Degree 24

3.3.3 Implementation of Grey Relative Correlation Degree 26

CHAPTER 4: RESULTS AND DISCUSSION **30**
4.1 Deng's correlation degree 30
4.2 Grey Absolute Correlation Degree 31
4.3 Grey Relative Correlation Degree 32
4.4 Evaluation of Model Indicator 33
4.5 Average of Absolute correlation degree and Relative correlation degree 34
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS **35**
5.1 Conclusions 35
5.2 Recommendations 36
REFERENCES **37**
APPENDIX A **40**

ABSTRACT

The healthcare system in Malaysia is generally divided into two types, namely public hospitals and private hospitals. Due to the increasingly expensive medical costs in private hospitals, public hospitals have become the best alternative for patients to seek the same treatment at a minimal cost. Thus, public hospitals are always dealing with a large number of patients and indirectly it becomes a challenge to provide the best services and care to patients. Hence, the medical indicators such as the number of patients: inpatients, outpatients, emergency patients, maternal patients, surgical patients, discharge patients; arrivals at specialist clinics, bed use and the average length of stay in hospital were collected for the period from 2015 to 2018. In this study, Grey Relational Analysis (GRA) models are suitable for evaluating the performance of selected public hospitals in Malaysia such as Hospital Sultanah Aminah, Hospital Melaka, Hospital Seberang Jaya and Hospital Tengku Ampuan Rahimah since it has no special requirements for sample count and data distribution. Therefore, to provide a comprehensive evaluation, Deng's correlation degree was used to provide a ranking, while Grey absolute correlation degree and Grey relative correlation degree to analyse the main influential indicators of hospital operations management. Finally, the results show that Hospital Sultanah Aminah ranks first place followed by Hospital Tengku Ampuan Rahimah, Hospital Melaka and Hospital Seberang Jaya. In addition, the top three influencing factors were found to be arrivals at the specialist clinic, average length of stay (ALOS) and maternal patients. The combined results of the three GRA models as evaluations have provided new and comprehensive assessment techniques for hospital operations management as a reference for future improvement.