

# **Using Data Mining Techniques for Investigating of Performance in ICT at G.C.E Advanced Level**

P.N.W.A.L.K.Pemarathne

149225D

Faculty of Information Technology  
University of Moratuwa

**May 2017**

# **Using Data Mining Techniques for Investigating of Performance in ICT at G.C.E Advanced Level**

P.N.W.A.L.K.Premarathne

149225D

Dissertation submitted to the Faculty of Information Technology, University of Moratuwa, Sri Lanka  
for the partial fulfillment of the requirements of the Degree of Master of Science in Information  
Technology.

**May 2017**

## **Declaration**

I declare that this is my own work and has not been submitted any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references is given.

Name of Student

**P.N.W.A.L.K.Premarathne**

Signature of Student

.....

Date :

Supervised by

Name of supervisor

**S.C Premarathne**

Signature of supervisor

.....

**Senior Lecturer**

Date :

**Faculty of Information Technology**

**University of Moratuwa**

## **Acknowledgement**

A final thesis project like this is never the work of anyone alone. The contribution of many different people, in their different ways, have made this possible. I would like to extend my sincere thanks to all of them.

I would like to express my sincere gratitude to my supervisor Mr Saminda Premaratne the Senior Lecture of University of Moratuwa Sri Lanka, especially, Prof. Asoka Karunanada for the knowledge and assistance they provided throughout the research project. And I would like to thank the rest of my respective lecturers of the project committee, for their encouragement and insightful comments during project evaluation, which helped me to make necessary improvements.

Next I would like to express my special thanks to Mr Anura Pushpakumara the Commissioner General of Examination, Mrs Gayathri Abeygunasekara Commissioner of Examination Research and Development, Mr D.A Chandrasiri Commissioners of Examination Technology and other staff members of the Research and Development and the ICT branch for their support in providing data on exam results.

And I would like to thank all my friends who helped me to distribute my questionnaire among selected students as a sample.

I thank my colleagues who were behind me since last two years, sharing all good and bad moments in this hard time period.

Last but not least, I would like to thank my family for their unconditional support throughout my postgraduate degree. Your constant inspiration and guidance kept me focused and motivated. Thank you very much.

## **Abstract**

The statistical analysis of the examination results plays a vital role in the field of education as the quality of the education is revealed by the evaluation process. The conclusions which follow the analysis, can be a feedback of the quality of examination papers or the supplementary of the students' feedback of teachers teaching process. Therefore it provides a summary of the prevailing standard of education which lead to educational research and reform. These reforms contribute to the positive changes applied to the examination system and to the learning and teaching process continuously.

In year 2011 Information and Communication Technology was introduced to the G.C.E Advanced Level as a main subject. The main objective of this research is to identify the problems related to the ICT subject of G.C.E Advanced Level Examination and provide suggestions for the teaching process of the education system. In this issue Association Rule technique of data mining is used to identify certain patterns in the examination results.

# Table of Contents

Declaration.....	iii
Acknowledgement .....	iv
Abstract.....	v
1    Introduction.....	1
1.1    Prolegomena.....	1
1.2    Background and Motivation .....	2
1.3    Problem statement.....	6
1.4    Hypothesis.....	6
1.5    Objectives.....	6
1.5.1    Sub Objectives.....	6
1.6    Data Mining Based Approach .....	7
1.7    Structure of the thesis .....	8
1.8    Summary .....	8
2    Literature Review - Development and Challenges in Data Mining .....	9
2.1    Introduction .....	9
2.2    Early developments .....	9
2.3    Modern trends in data mining .....	12
2.4    Major Issues and Future challenges of data mining .....	13
2.5    Problem Definition.....	14
2.6    Summary .....	15
3    Technology - Data Mining Tools and Techniques. Principles of opinion mining .....	16
3.1    Introduction .....	16
3.2    Data Mining In Education Sector .....	17
3.3    Data Mining Techniques .....	17
3.3.1    Association .....	17
3.4    Summary .....	18
4    Approach.....	19
4.1    Introduction .....	19
4.2    Hypothesis.....	19
4.2.1    Input to the system .....	19
4.2.2    Output of the system .....	19

4.3	Process .....	19
4.4	Users of system.....	22
4.5	Features .....	22
4.6	Summary .....	22
5	Design .....	23
5.1	Introduction .....	23
5.2	System Design.....	23
5.3	Top level Design .....	27
5.4	User interface Design.....	27
5.5	Summary .....	27
6	Implementation .....	28
6.1	Introduction .....	28
6.2	Collection of Data.....	28
6.3	RapidMiner.....	28
6.4	Data Pre-Processing .....	28
6.5	Analysis by Questions on Exam paper .....	32
6.5.1	Grade obtained for Mathematics .....	34
6.5.2	Whether followed ICT or Not followed.....	38
6.5.3	Analysis by Gender.....	41
6.6	Analysis by the Stream sat for at the Advanced Level Exam .....	48
7	Evaluation .....	52
7.1	Introduction .....	52
7.2	Analysis by Questions on Exam paper .....	52
7.2.1	Evaluation on Grade obtained for Ordinary Level Mathematics.....	52
7.2.2	Evaluation on whether followed ICT for Ordinary Level or Not followed.....	56
7.2.3	Evaluation on Gender. ....	60
7.3	Analysis by the Stream sat for the G.C.E Advanced Level Examination.....	63
7.3.1	Commerce stream.....	63
7.3.2	Arts stream.....	64
7.3.3	Other stream.....	66
7.3.4	Engineering Technology stream.....	67
7.3.5	Bio-System Technology stream.....	68
7.4	Analysis by the Grades obtained by each stream .....	72

7.4.1	Grade A .....	72
7.4.2	Grade B.....	72
7.4.3	Grade C.....	73
7.4.4	Grade S.....	73
7.4.5	Grade F.....	74
8	Conclusion and Future work .....	75
8.1	Introduction .....	75
8.2	Conclusion.....	75
8.3	Limitations.....	76
8.4	Future Developments .....	77
8.5	Summary .....	77
9	References.....	78
10	Appendices.....	81

# Table of Figures

FIGURE 1.1 MODERN EDUCATIONAL DATA MINING .....	3
FIGURE 3.1 THE DATA MINING PROCESS .....	16
FIGURE 4.1 THE MODEL .....	20
FIGURE 5.1 TOP LEVEL DESIGN .....	27
FIGURE 6.2 SELECT THE CELLS TO IMPORT .....	29
FIGURE 6.1 FORMAT YOUR COLUMNS.....	29
FIGURE 6.3 REPLACE MISSING VALUE OPERATOR.....	30
FIGURE 6.4 VALUES REPLENISHMENT .....	30
FIGURE 6.5 EDIT PARAMETER LIST: COLUMNS .....	31
FIGURE 6.7 MISSING VALUES REPLACED DATA SET.....	32
FIGURE 6.6 MISSING VALUES REPLACED DATA SET.....	32
FIGURE 6.8 LEVEL OF DIFFICULTY IN PYTHON CHAPTER .....	34
FIGURE 6.9 PROCESS.....	35
FIGURE 6.10 INSERT COLUMNS .....	36
FIGURE 6.11 SELECTED DATA SET .....	36
FIGURE 6.12 PROCESS.....	37
FIGURE 6.13 SELECTED DATA SET .....	37
FIGURE 6.14 PROCESS.....	38
FIGURE 6.15 SELECT COLUMNS .....	38
FIGURE 6.16 PROCESS.....	39
FIGURE 6.17 PROCESS.....	39
FIGURE 6.18 SELECT COLUMNS WEB DESIGN .....	39
FIGURE 6.19 PROCESS WEB DESIGN .....	40
FIGURE 6.20 SELECT COLUMNS .....	40
FIGURE 6.21 PROCESS DFD .....	41
FIGURE 6.22 SELECT COLUMNS .....	41
FIGURE 6.23 FORMAT COLUMN.....	41
FIGURE 6.24 FORMAT COLUMNS.....	42
FIGURE 6.25 SELECTED DATA SET .....	42
FIGURE 6.26 SELECT ATTRIBUTE .....	43
FIGURE 6.27 PROCESS WITH OPERATORS .....	43
FIGURE 6.28 SELECT CELLS TO IMPORT .....	44
FIGURE 6.29 CONVERTED NUMERICAL TO BINOMINAL .....	44
FIGURE 6.30 SELECT ATTRIBUTES .....	45
FIGURE 6.31 PROCESS WITH OPERATORS .....	45
FIGURE 6.32 SELECT DATA SET .....	46
FIGURE 6.33 SELECT THE CELLS TO IMPORT.....	46
FIGURE 6.34 SELECT ATTRIBUTES .....	47
FIGURE 6.35 PROCESS WITH OPERATORS .....	47
FIGURE 6.36 SELECT CELLS TO IMPORT .....	49
FIGURE 6.37 FORMAT COLUMNS.....	49
FIGURE 6.38 FORMAT COLOMNS .....	49
FIGURE 6.39 SELECT DATA SET.....	51
FIGURE 6.40 SELECTED DATA SET .....	50
FIGURE 6.41 PROCESS WITH OPERATORS .....	50
FIGURE 6.42 NUMERICAL TO BINOMINAL CONVERTED DATA SET.....	51

FIGURE 6.43 PROCESS WITH OPERATORS .....	51
FIGURE 7.1 ASSOCIATION RULE RESULT MATHEMATICS AND PYTHON .....	52
FIGURE 7.2 ASSOCIATION RULE FOR PYTHON CHAPTER BY MATHEMATICS .....	53
FIGURE 7.3 ASSOCIATION RULE RESULT WEB DESIGN AND MATHEMATICS.....	54
FIGURE 7.4 ASSOCIATION RULE FOR WEB DESIGN CHAPTER BY MATHEMATICS.....	54
FIGURE 7.5 ASSOCIATION RULE RESULT DFD AND MATHEMATICS.....	55
FIGURE 7.6 ASSOCIATION RULE RESULT FOR DFD CHAPTER .....	56
FIGURE 7.7 ASSOCIATION RULE RESULT IT SUBJECT .....	57
FIGURE 7.8 ASSOCIATION RULE PYTHON IT SUBJECT .....	57
FIGURE 7.9 ASSOCIATION RULE RESULT WEB DESIGN IT SUBJECT.....	58
FIGURE 7.10 ASSOCIATION RULE WEB DESIGN FOR IT SUBJECT.....	58
FIGURE 7.11 ASSOCIATION RULE WEB DESIGN TABLE FOR IT SUBJECT.....	59
FIGURE 7.12 ASSOCIATION RULE RESULT DFD IT SUBJECT .....	59
FIGURE 7.13 ASSOCIATION RULE DFD QUESTION BY IT SUBJECT .....	59
FIGURE 7.14 ASSOCIATION RULE RESULT PYTHON BY GENDER.....	60
FIGURE 7.15 ASSOCIATION RULE PYTHON BY GENDER.....	60
FIGURE 7.16 ASSOCIATION RULE RESULT WEB DESIGN BY GENDER .....	61
FIGURE 7.17 ASSOCIATION RULE WEB DESIGN BY GENDER.....	61
FIGURE 7.18 ASSOCIATION RULE RESULT DFD BY GENDER .....	62
FIGURE 7.19 ASSOCIATION RULE DFD BY GENDER .....	62
FIGURE 7.20 ASSOCIATION RULE BY COMMERCE.....	63
FIGURE 7.21 ASSOCIATION RULE BY ARTS STREAM .....	65
FIGURE 7.22 ASSOCIATION RULE BY OTHER STREAM .....	66
FIGURE 7.23 ASSOCIATION RULE BY ENG_TECH STREAM .....	67
FIGURE 7.24 ASSOCIATION RULE BY GRADE .....	69
FIGURE 7.25 ASSOCIATION RULE GENERATED USING CONDITIONS.....	71
FIGURE 7.26 ASSOCIATION RULE BY A GRADES .....	72
FIGURE 7.27 ASSOCIATION RULE BY B GARDES .....	72
FIGURE 7.28 ASSOCIATION RULE BY C GRADES.....	73
FIGURE 7.29 ASSOCIATION RULE BY S GARDES.....	73
FIGURE 7.30 ASSOCIATION RULE BY F GRADES.....	74

## List of Tables

TABLE 2-1 ACHIEVEMENTS AND THE LIMITATIONS OF THE KEY RESEARCH DISCUSSION IN THIS CHAPTER.....	14
TABLE 5-1 DETAILS AN INITIAL QUESTIONNAIRE.....	24