AUTOMATIC EVALUATION AND ERROR IDENTIFICATION OF SOLUTIONS TO SINGLE-VARIABLE ALGEBRAIC QUESTIONS

Erabadda Lekamalage Buddhiprabha Harshani Erabadda

(158020V)

Thesis submitted in partial fulfillment of the requirements for the Degree of Master of Science (Research) in Computer Science and Engineering

Department of Computer Science & Engineering

University of Moratuwa

Sri Lanka

February 2017

DECLARATION

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Signature of the supervisor: Date:

Name of the supervisor: Dr. Surangika Ranathunga

Signature of the co-supervisor: Date:

Name of the supervisor: Prof. Gihan Dias

Abstract

There are two types of single-variable equation solving questions that are present in the Ordinary Level mathematics curriculum in Sri Lanka: linear equations with fractions and quadratic equations. Answers to these questions are open-ended and multi-step in nature. This thesis describes a mechanism that evaluates answers to these two types of questions and awards full/ partial credit.

It is quite common that students make mistakes in their answers, which results in partial credit. They may repeat the same errors if they do not receive feedback on their mistakes. Therefore feedback in student errors is important for any subject. This thesis introduces a method to automatically identify the errors that the students make in their answers for the aforementioned two types of questions. To the best of our knowledge, this is the first work on automatically identifying student errors in complex multi-step solutions to single-variable equation solving questions.

Our evaluations show that the system we have implemented is capable of awarding full/ partial credit to student answers according to a marking scheme and also to identify errors in student answers with minimal teacher intervention. These evaluations were carried out using student answers from different sources.

Keywords- Computer Aided Assessment, Error Identification, Computer Algebra Systems, Partial Credit, Multi Step

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my supervisors Dr. Surangika Ranathunga and Prof. Gihan Dias, for the continuous support given for the success of this research. This would not have been a success without your tremendous mentorship and advice from the beginning.

This research was supported by LK Domain Registry, University of Moratuwa Senate Research Grant, and DL4D (Digital Learning for Development) Grant. I sincerely thank colleagues from LK Domain Registry and mentors from DL4D committee for the support given.

I would like to thank all staff from the Department of Computer Science and Engineering for their kindness expressed in all occasions.

Special thanks to my loving family: my parents, husband, brother, and sister. Your encouragement always motivated me to do my best. I would also like to thank all my friends who encouraged me all times.

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LIST OF ABBREVIATIONS

A/L – Advanced Level

ATPM – Approximate Tree Pattern Matching

CAA – Computer Aided Assessment

CAS – Computer Algebra System

CM – Cross Multiplication

GCE – General Certificate of Education

ITS – Intelligent Tutoring System

LAESA – Linear Approximation and Elimination Search Algorithm

LCD – Least Common Denominator

LSA – Latent Semantic Analysis

MCQ – Multiple Choice Questions

MOOC – Massive Open Online Course

O/L – Ordinary Level