Lecture Notes in Electrical Engineering 352

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Advanced Multimedia and Ubiquitous Engineering

Future Information Technology

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Lecture Notes in Electrical Engineering

Volume 352

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and Engineering
Seoul University of Science & Technology
Seoul
Korea

Han-Chieh Chao
Institute of Computer Science
and Information Engineering
National Ilan University
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Taiwan

Hamid Arabnia
Department of Computer Science
University of Georgia
Georgia
USA

Neil Y. Yen
School of Computer Science
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ISSN 1876-1100 ISSN 1876-1119 (electronic)
Lecture Notes in Electrical Engineering
ISBN 978-3-662-47486-0 ISBN 978-3-662-47487-7 (eBook)
DOI 978-3-662-47487-7

Library of Congress Control Number: 2015940892

Springer Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer-Verlag GmbH Berlin Heidelberg is part of Springer Science+Business Media
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Message from the FutureTech 2015 General Chairs

FutureTech 2015 is the 10th event of the series of international scientific conference. This conference takes place on May 18-20, 2015 in Hanoi, Vietnam. The aim of the FutureTech 2015 is to provide an international forum for scientific research in the technologies and application of information technology. FutureTech 2015 is the next edition of FutureTech 2014 (Zhangjiajie, China), FutureTech 2013 (Gwangju, Korea), FutureTech 2012 (Vancouver, Canada), FutureTech 2011 (Loutraki, Greece), FutureTech 2010 (Busan, Korea, May 2010) which was the next event in a series of highly successful the International Symposium on Ubiquitous Applications & Security Services (UASS-09, USA, Jan. 2009), previously held as UASS-08 (Okinawa, Japan, Mar. 2008), UASS-07 (Kuala Lumpur, Malaysia, August, 2007), and UASS-06 (Glasgow, Scotland, UK, May, 2006).

The conference papers included in the proceedings cover the following topics: Hybrid Information Technology High Performance Computing, Cloud and Cluster Computing, Ubiquitous Networks and Wireless Communications Digital Convergence, Multimedia Convergence, Intelligent and Pervasive Applications, Security and Trust Computing, IT Management and Service Bioinformatics and Bio-Inspired Computing, Database and Data Mining, Knowledge System and Intelligent Agent, Game and Graphics Human-centric Computing and Social Networks, Advanced Mechanical Engineering, Computer Aided Machine Design, Control and Automations & Simulation. Accepted and presented papers highlight new trends and challenges of future information technologies. We hope readers will find these results useful and inspiring for their future research.

We would like to express our sincere thanks to Steering Chair: James J. Park (SeoulTech, Korea) and Hamid R. Arabnia (The University of Georgia, USA). Our special thanks go to the Program Chairs: Joon-Min Gil (Catholic University of Daegu, Korea), Neil Y. Yen (The University of Aizu, Japan), Muhammad Khurram Khan (King Saud University, Saudi Arabia), all Program Committee members and all reviewers for their valuable efforts in the review process that helped us to guarantee the highest quality of the selected papers for the conference.

We cordially thank all the authors for their valuable contributions and the other participants of this conference. The conference would not have been possible without their support. Thanks are also due to the many experts who contributed to making the event a success.

C.S. Raghavendra, University of Southern California, USA
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Message from the FutureTech 2015 Program Chairs

Welcome to the 10th International Conference on Future Information Technology (FutureTech 2015), which will be held in Hanoi, Vietnam on May 18-20, 2015. FutureTech 2015 will the most comprehensive conference focused on the various aspects of information technologies. It will provide an opportunity for academic and industry professionals to discuss recent progress in the area of future information technologies. In addition, the conference will publish high quality papers which are closely related to the various theories and practical applications in multimedia and ubiquitous engineering. Furthermore, we expect that the conference and its publications will be a trigger for further related research and technology improvements in these important subjects.

For FutureTech 2015, we received many paper submissions, after a rigorous peer review process, we accepted only articles with high quality for the FutureTech 2015 proceedings, published by the Springer. All submitted papers have undergone blind reviews by at least two reviewers from the technical program committee, which consists of leading researchers around the globe. Without their hard work, achieving such a high-quality proceeding would not have been possible. We take this opportunity to thank them for their great support and cooperation. We would like to sincerely thank the following invited speakers who kindly accepted our invitations, and, in this way, helped to meet the objectives of the conference: Prof. Han-Chieh Chao, National Ilan University, Taiwan and Prof. Timothy K. Shih, National Central University, Taiwan. Finally, we would like to thank all of you for your participation in our conference, and also thank all the authors, reviewers, and organizing committee members. Thank you and enjoy the conference!

Joon-Min Gil, Catholic University of Daegu, Korea
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Message from the MUE 2015 General Chairs

MUE 2015 is the 9th event of the series of international scientific conference. This conference takes place on May 18-20, 2015 in Hanoi, Vietnam. The aim of the MUE 2015 is to provide an international forum for scientific research in the technologies and application of Multimedia and Ubiquitous Engineering. Ever since its inception, International Conference on Multimedia and Ubiquitous Engineering has been successfully held as MUE-14 (Zhangjiajie, China, May 2014), MUE-13 (Seoul, Korea, May 2013), MUE-12 (Madrid, Spain, July 2012), MUE-11 (Loutraki, Greece, June 2011), MUE-10 (Cebu, Philippines, August 2010), MUE-09 (Qingdao, China, June 2009), MUE-08 (Busan, Korea, April 2008), and MUE-07 (Seoul, Korea, April 2007).

The conference papers included in the proceedings cover the following topics: Multimedia Modeling and Processing, Ubiquitous and Pervasive Computing, Ubiquitous Networks and Mobile Communications, Intelligent Computing, Multimedia and Ubiquitous Computing Security, Multimedia and Ubiquitous Services, Multimedia Entertainment, IT and Multimedia Applications. Accepted and presented papers highlight new trends and challenges of Multimedia and Ubiquitous Engineering. We hope readers will find these results useful and inspiring for their future research.

We would like to express our sincere thanks to Steering Chair: James J. (Jong Hyuk) Park (SeoulTech, Korea). Our special thanks go to the Program Chairs: Gangman Yi (Gangneung-Wonju National University, Korea) and Chengcui Zhang (The University of Alabama at Bir-mingham, USA), all Program Committee members and all reviewers for their valuable efforts in the review process that helped us to guarantee the highest quality of the selected papers for the conference.

Shu-Ching Chen, Florida International University, USA
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Han-Chieh, Chao National Ilan University, Taiwan

MUE 2015 General Chairs

Message from the MUE 2015 Program Chairs

Welcome to the 9th International Conference on Multimedia and Ubiquitous Engineering (MUE 2015), which will be held in Hanoi, Vietnam on May 18-20, 2015. MUE 2015 will the most comprehensive conference focused on the various aspects of multimedia and ubiquitous engineering. It will provide an opportunity for academic and industry professionals to discuss recent progress in the area of multimedia and ubiquitous environment. In addition, the conference will publish high quality papers which are closely related to the various theories and practical applications in multimedia and ubiquitous engineering. Furthermore, we expect that the conference and its publications will be a trigger for further related research and technology improvements in these important subjects.

For MUE 2015, we received many paper submissions, after a rigorous peer review process, we accepted only articles with high quality for the MUE 2015 proceedings, published by the Springer. All submitted papers have undergone blind reviews by at least two reviewers from the technical program committee, which consists of leading researchers around the globe. Without their hard work, achieving such a high-quality proceeding would not have been possible. We take this opportunity to thank them for their great support and cooperation. Finally, we would like to thank all of you for your participation in our conference, and also thank all the authors, reviewers, and organizing committee members. Thank you and enjoy the conference!

Gangman Yi, Gangneung-Wonju National University, Korea
Chengcui Zhang, University of Alabama at Birmingham, USA

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Contents

Development of a Bidirectional Transformation Supporting Tool for Formalization with Logical Formulas and Its Application

Shunsuke Nanaumi, Kazunori Wagatsuma, Hongbiao Gao, Yuichi Goto, and Jingde Cheng

Department of Information and Computer Sciences, Saitama University, Saitama 338-8570, Japan
cheng@aise.ics.saitama-u.ac.jp

Abstract. In many applications in computer science and artificial intelligence, logical formulas are used as a formal representation to represent and/or specify various objects and relationships among them. Transforming logical formulas into informal propositional statements, e.g., declarative sentences and mathematical formulas, is important as well as transforming informal propositional statements into logical formulas. When people obtain new logical formulas as results of deduction/reasoning based on logic, investigating the obtained formulas is also not an easy task for them. Although information systems with proving, e.g., automated theorem proving systems, formal verification systems, etc., are used in various field, in the future, information systems with reasoning, e.g., automated theorem finding systems, will also be developed and used in various fields. Thus, a tool to support bidirectional transformation between informal propositional statements and logical formulas will be demanded at that time. This paper presents an implementation of a bidirectional transformation supporting tool for formalization with logical formulas. The paper also shows application of the tool in a case study of automated theorem finding with forward reasoning.

Keywords: Bidirectional transformation, Logical formula, Formalization, Informal propositional statement.

1 Introduction

In many applications in computer science and artificial intelligence, logical formulas are used as a formal representation to represent and/or specify various objects and relationships among them [3]. Transforming logical formulas into informal propositional statements e.g., declarative sentences and mathematical formulas, is important as well as transforming the informal propositional statements into logical formulas. When people obtain new logical formulas as results of deduction/reasoning based on logic, investigating the obtained formulas is also not an easy task for them. Although information systems with proving, e.g., automated theorem proving systems, formal verification systems, etc., are used in various field, in the future, information systems

James J. (Jong Hyuk) Park et al. (eds.), *Advanced Multimedia and Ubiquitous Engineering*,
Lecture Notes in Electrical Engineering 352, DOI: 10.1007/978-3-662-47487-7_1

with reasoning, e.g., automated theorem finding systems [2], will also be developed and used in various fields.

Thus, a tool to support bidirectional transformation between informal propositional statements and logical formulas will be demanded at that time. Therefore, we proposed a bidirectional transformation method for formalization with logical formulas and designed a supporting tool for transformation between informal propositional statements and logical formulas [7], but have not implemented it yet.

This paper presents an implementation of a bidirectional transformation supporting tool for formalization with logical formulas. The paper also shows an application of the tool in a case study of automated theorem finding with forward reasoning.

The rest of this paper is organized as follows. Section 2 presents a bidirectional transformation supporting tool. Section 3 explains implementation of a bidirectional transformation supporting tool. Section 4 shows application of the tool in a case of automated theorem finding with forward reasoning, and concluding remarks is given in section 5.

2 Bidirectional Transformation Supporting Tool

2.1 Transformation Method

Any bidirectional transformation between informal propositional statements and logical formulas consists of six activities [7]. Four of six activities are the activities of transforming informal propositional statements into logical formulas, i.e., unifying, complementing, assigning, and generating. “Unifying” is to unify expressions which have same meaning. “Complementing” is to complement omitted expressions. “Assigning” is to assign words/phrases of the informal propositional statements to symbols of logical formulas. “Generating” is to generate the logical formulas from the informal propositioal statements. Two of six activities are the activities of transforming logical formulas into informal propositional statements, i.e., replacing and changing. “Replacing” is to replace symbols of logical formulas with words/phrases of target informal propositional statements according to the assignment of symbols to words/phrases used in transforming the target informal propositional statements into logical formulas. “Changing” is to change word order of the replaced formula according to a rule of the informal propositional statements.

2.2 Design of a Bidirectional Transformation Supporting Tool

We designed a bidirectional transformation supporting tool for formalization with logical formulas [7]. A bidirectional transformation supporting tool gives its users instructions and supports to do transformation between informal propositional statements and logical formulas easily. When the users do bidirectional transformation tasks, the supporting tool instructs the users to do transformation tasks every process in the six activities.

As shown in Fig. 1, the supporting tool consists of ten components: unifying component to support “unifying”, complementing component to support “complement”, assigning component to support “assigning”, generating component to support “generating”, word order changing component to support “changing”, symbol replacing component to support “replacing”, a morphological analyzer, and two databases [7]. A morphological analyzer is an external tool to do morphological analysis of declarative sentences. A synonym DB is a database that synonyms in declarative sentences are saved and to find synonyms in sentences. A user's task DB is a database in which transforming data are stored.

The supporting tool can deal with different kinds of informal propositional statements from the view point of data structure [7]. It is not necessary to change the data structure if a function to transform a new kind of informal propositional statements is added into the supporting tool, because each data table in the supporting tool is independent with different kinds of informal propositional statements.

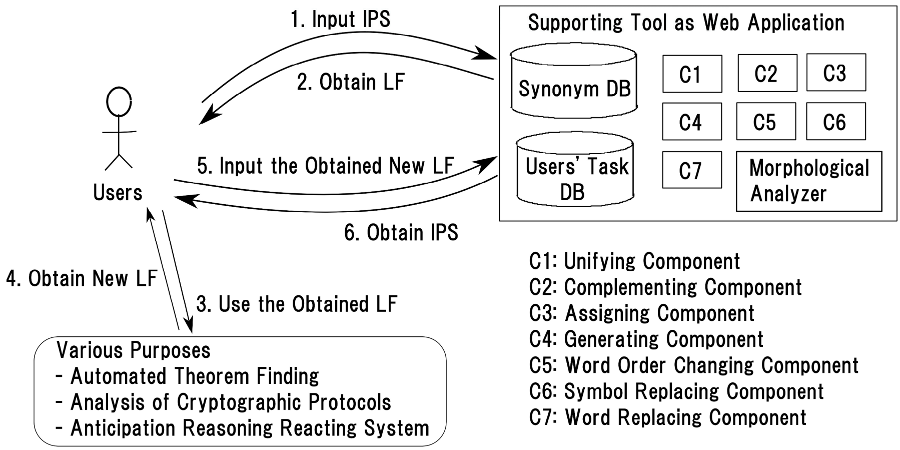

Fig. 1. Overview of a supporting tool

3 Implementation of a Bidirectional Transformation Supporting Tool

We implemented a bidirectional transformation supporting tool for formalization with logical formulas as web application. We implemented it by Java and Play Framework [4] which is a web application development framework. Moreover, we used WordNet [1, 6] as a lexical database, Enju [8] and Cabocha [5].

When a user uses the tool, the user inputs a set of informal propositional statements or logical formulas via own web browser. After that, the user does transformation tasks every one statement according to instructions given by the tool. Moreover, the tool can lighten the burden imposed on users in transforming a lot of statements or formulas because the users can do transformation tasks at same time in several people via the Internet.

4 Application of the Tool in a Case Study of Automated Theorem Finding with Forward Reasoning

The problem of automated theorem finding (ATF for short): "What properties can be identified to permit an automated reasoning program to find new and interesting theorems, as opposed to proving conjectured theorems?" [2]. In mathematical fields, to find new theorems, mathematicians continue to define more complex concepts by using previously given definitions and axioms, and already defined concepts. Then, mathematicians think, assume, and prove propositions by using the defined complex concepts. After that, they obtain new theorems. A systematic methodology of ATF by forward reasoning based on the strong relevant logic [2] has been proposed. To use the methodology, it is necessary to transform theorems expressed by mathematical formulas into theorems expressed by logical formulas. Moreover, it is necessary to transform new theorems expressed by logical formulas obtained by the methodology into theorems expressed by mathematical formulas. Our tool is needed to do such as bidirectional transformation such that it can help mathematicians to do ATF. To show the application of the tool, we used our tool for transformation between logical formulas and mathematical formulas in a case study of ATF in von Neumann-Bernays-Godel (NBG) set theory [9].

Table 1. State of formulas in each process of bidirectional transformation

	(1)	**(2)**
Inputted	$\mathbf{(x \in V) \Rightarrow (U(x) \in V)}$	$\mathbf{\forall x (O\ (x) \rightarrow\ C\ (x,\ F(V,\ V)))}$
Step1	$\forall x\ ((x \in V) \Rightarrow (U(x) \in V))$	$O\ (x) \rightarrow\ C\ (x,\ F\ (V, V))$
Step2	$\forall x\ (\in (x\ V) \Rightarrow \in (U(x)\ V))$	$ONEONE(x) \rightarrow \subseteq (x, \times(V, V))$
Step3	$\forall x\ (B(x\ V) \Rightarrow B(U(x)\ V))$	If $ONEONE(x)$, then $\subseteq (x, \times(V, V))$
Outputted	$\mathbf{\forall x\ (B(x\ V) \rightarrow B(U(x)\ V))}$	**If ONEONE(x), then** $\mathbf{(x \subseteq (V \times V))}$

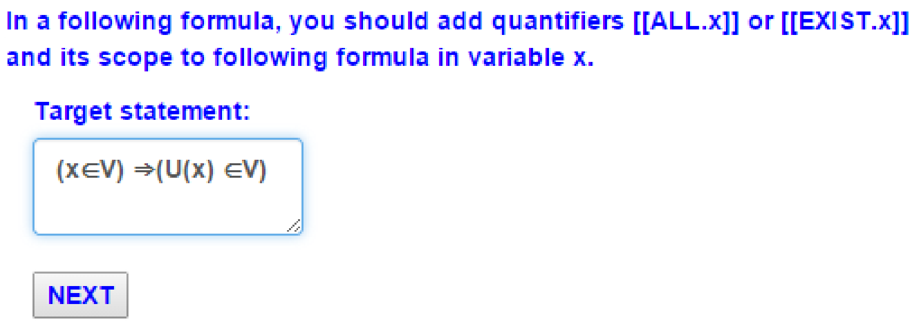

Fig. 2. Adding quantifiers in "Complementing" process in the tool

Table 2. Assignment of symbols of mathematical formulas to symbols of logical formulas

Math.	ONEONE	x	$\subseteq$	$\times$	V	=	$\in$	U	u
Logic.	O	x	C	F	V	E	B	U	u

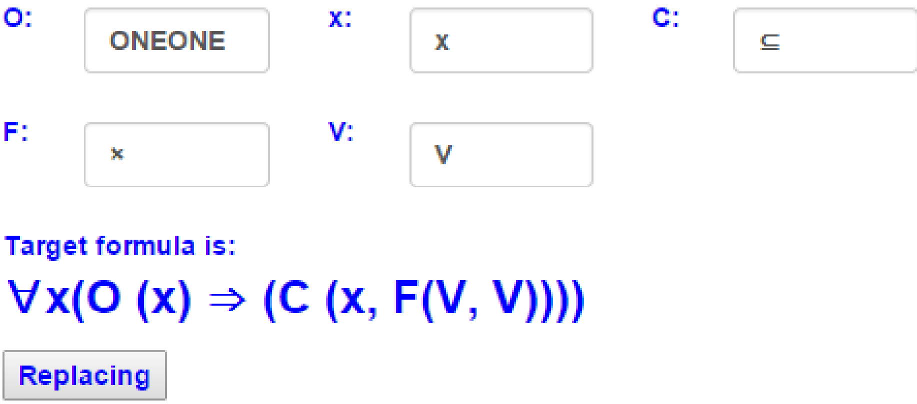

Fig. 3. “Replacing” process in the tool

Table 1 shows progress of transformation between mathematical formulas and logical formulas. Transformation of a mathematical formula into a logical formula is shown in (1) of Table 1. First, users add quantifiers to an inputted mathematical formula. Fig. 2 shows its process in the tool. Secondly, the users replace the target formula with one expressed in polish notation. Thirdly, the users assign symbols of the mathematical formula with predicates and terms of logical formulas. Fourthly, the users replace connectives of mathematical formulas with those of logical formulas. Finally, the users generate a logical formula from the inputted mathematical formula. Moreover, transforming a logical formula into a mathematical formula is shown in (2) of Table 1. First, users remove quantifiers from the inputted formula. Secondly, the users replace predicates and terms of logical formulas with symbols of mathematical formulas according to the assignment of symbols of logical formulas to symbols of mathematical formulas used in transforming mathematical formulas into logical formulas. Table 2 shows the assignment relation and Fig. 3 shows its process. Thirdly, the users replace connectives of logical formulas with those of mathematical formulas. Fourthly, the users change word order of logical formulas to that of mathematical formulas. Finally, the users generate a mathematical formula. As results of such as bidirectional transformation, we showed an application of the tool in a case of automated theorem finding with forward reasoning by showing that the tool supports to do bidirectional transformation.

5 Concluding Remarks

We presented an implementation of a bidirectional transformation supporting tool for formalization with logical formulas and showed an application of the tool in a case of automated theorem finding with forward reasoning. By using the bidirectional transformation supporting tool for bidirectional transformation between informal propositional statements and logical formulas, we can use logical formulas generated by the tool for a formal representation in many application in computer science and artificial intelligence, and we can use informal propositional statements generated by the tool for investigating new logical formulas obtained as results of deduction/reasoning based on logic. Our supporting tool can support many information systems with forward reasoning in various field in the future.

As future works, we will adapt the bidirectional transformation supporting tool to the other kinds of informal propositional statements, e.g., Chinese declarative sentences, expand the field to use our tool, and make the tool used easily.

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An Extension of QSL for E-testing and Its Application in an Offline E-testing Environment

Zhe Wang, Yuan Zhou, Bo Wang, Yuichi Goto, and Jingde Cheng

Department of Information and Computer Sciences,
Saitama University, Saitama, Japan
{wangzhe,shuugen,wangbo,
gotoh,cheng}@aise.ics.saitama-u.ac.jp

Abstract. E-testing is to perform all processes from preparing questions to marking collected answer of the questions in a completely electronic way. Now, various e-testing are done, and there are many kinds of e-testing systems. When people want to do an e-testing or order a new e-testing system, they should specify the e-testing or e-testing system. A Specification language helps to create precise and adequate specifications of e-testing and e-testing systems is demanded. QSL is a specification language for specifying various e-questionnaire and e-questionnaire systems. QSL is a hopeful candidate of the required specification language because both testing and questionnaire have similar processes. However, the current version of QSL does not take e-testing and e-testing systems into account. This paper presents an extension of QSL to deal with e-testing and e-testing systems, and shows a real application of extended QSL in case of an offline e-testing environment.

Keywords: QSL, Specification language, E-testing, Offline e-testing environment.

1 Introduction

Test is a general and indispensable method, and widely used to assess people's achievement, ability, and characteristics in education, enterprise, medicine, and government [16]. E-testing is to perform all processes from preparing questions to marking collected answer sheets in a completely electronic way. An e-testing system is a system that provides an environment with its users to do e-testing. In recent years, there are various e-testing systems have been developed ad hoc because purposes and procedures of tests are different from each other. When examiners want to use an e-testing system to execute various e-testing, they should specify the e-testing. If an e-testing system cannot satisfy examiners' needs, they may order a new e-testing system. They also should specify the e-testing system. Therefore, people need a specification language which can help them to create precise and adequate specifications for various e-testing and e-testing systems.

QSL [23] is a specification language for specifying various e-questionnaire and e-questionnaire systems, and it is a hopeful candidate of the required specification language owing to significant similarities of contents and structures between e-questionnaire

James J. (Jong Hyuk) Park et al. (eds.), *Advanced Multimedia and Ubiquitous Engineering*,
Lecture Notes in Electrical Engineering 352, DOI: 10.1007/978-3-662-47487-7_2

and e-testing. However, the current version of QSL does not take e-testing and e-testing systems into account. This paper proposes the extension of QSL for e-testing so that users can use QSL to specify various e-testing as well as e-testing systems. The paper also shows a real application of extended QSL in case of an offline e-testing environment. The rest of the paper is organized as followed: Section 2 gives introduces in QSL. Section 3 presents an extension of QSL for e-testing. Section 4 shows an offline e-testing environment as a use case of extended QSL. Finally, some concluding remarks are given in Section 5.

2 QSL: A Specification Language for E-questionnaire Systems

QSL serves as a communication tool among specifying, developing, and using various e-questionnaires and e-questionnaire systems [23]. QSL addresses the needs by providing various desirable functions of e-questionnaire systems, pointing out necessary items to make specification clear and precise, and being used as a format for data exchange.

QSL is based on XML [22]. QSL provides primitive elements that are used to specify various e-questionnaires and e-questionnaire systems. A primitive element consists of entity and representation. Entity is uniquely identified regardless of changing representations. Representation is to express the corresponding entity. We can describe specifications of various e-questionnaire systems by combining the primitive elements.

QSL can be used in three ways [22, 23]. At first, QSL can be used to specify e-questionnaire systems. In other words, QSL can be used to specify the functions the system provides. For example, QSL provides tags for four kinds of participants: sponsors who organize an e-questionnaire, questioners who design and ask questions, respondents who take part in answering, and analysts who analyze the result and give the results. Secondly, QSL can be used to specify e-questionnaires on a system, i.e., QSL can be used to describe restrictions in each process of e-questionnaire. For example, for an e-questionnaire, QSL is used to describe the distribution method such as e-mail, web-link, or other offline methods. At last, QSL can be used for a format of data exchange to describe questionnaire data and response data. For instance, QSL is used to describe various questions and answers.

3 An Extension of QSL for E-testing

3.1 E-questionnaire and E-testing

To clarify the differences between e-questionnaire and e-testing, we investigated 20 e-testing systems [1-15, 17-21] on the Internet. The differences between e-questionnaire and e-testing are in five aspects: participants, process, data, logic, and authorization. Firstly, participants are the people who take part in an e-questionnaire or e-testing. An e-testing system contains not only those four kinds of participants mentioned in Section 2, but also two new kinds of participants who are monitor and marker. Monitor is a person who monitors the whole e-testing for illegal behavior, and marker is a person who marks the responses of respondents and gives the results. Secondly, both e-questionnaire and e-testing have similar procedure except marking. After collecting the response data of all respondents, marker should mark the response data and give scores of each question and total scores of each respondent. Thirdly, data of e-questionnaire and e-testing are used to describe many research papers and record many response data by different respondents. Unlike e-questionnaire, sample answer of each question is demanded to mark answers in e-testing. Similarly, score of each answer and total score of answers are also demanded. Besides, questions in e-testing involves wider and more professional field, such as mathematical formula, periodic table of chemical elements, etc. Moreover, the logic in an e-questionnaire is a facility to control which question is showed in which order. In e-testing, the logic is used to prevent cheating activities. The new logic type for e-testing is randomization which is showing the questions and options to respondents in a random order so that they cannot peep other respondents for answers. At last, the authority is used to describe the authority of all the participants both e-questionnaire and e-testing, such as the writability and readability for a research paper, response, sample answer (for e-testing) and result. However, e-testing has more strict management of authority in order to stop and prevent illegal behaviors.

To specify various e-testing and e-testing systems, these differences should be covered by QSL. However, the current version of QSL does not deal with those differences.

3.2 QSL Extension for E-testing

According to the differences between e-questionnaire systems and e-testing system, some new elements have been extended to specify various e-testing and e-testing systems.

To deal with the difference of participants, we add two new elements to describe new participants. They are *monitor* and *marker*. An example is shown below. The participant element is *monitor* which has an attribute named "id", the value of the element is used to describe the name of the monitor.

```
<monitor id=“m001”>John Smith</monitor>
```

In order to cover the difference of data and marking procedure, we add three new elements which are *sampleanswer* , *score*, and *result*, and we add an attribute *type* for *score* which contains “question”, “section”, “total”, “respquestion”, “respsection”, and “resptotal.” The element *sampleanswer* is defined to describe the sample answer of a question. The types “question”, “section”, and “total” are used to describe the score of question, section and the total score that defined by questioner, and the types “respquestion”, “respsection”, and “resptotal” are used to describe the score of question, section and the total score getting by respondents. An example is shown below. “Blue” is the sample answer of the question “qu1.” The score of the question is “2”. The score of the question that the respondent gets is “0”, and the respondent also get “0” of total score.