

氏 名	HTOO HTOO SANDI KYAW		
授与した学位	博 士		
専攻分野の名称	工 学		
学位授与番号	博甲第	6 4 9 4	号
学位授与の日付	2 0 2 1 年 9 月 2 4 日		
学位授与の要件	自然科学研究科 産業創成工学専攻 (学位規則第4条第1項該当)		
学位論文の題目	A Study of Fill-in-blank Style Problems for Java and C Programming Learning Assistant System (Java および C プログラミング学習支援システムの空欄補充型問題に関する研究)		
論文審査委員	教授 船 曳 信 生	教授 田 野 哲	教授 野 上 保 之
学位論文内容の要旨			
<p>This thesis presents the study of fill-in-blank style problems for Java and C programming learning assistant system. First, the <i>code completion problem (CCP)</i> is proposed as a generalization of <i>element fill-in-blank problem (EFP)</i> in <i>Java programming learning assistant system (JPLAS)</i>. In contrast to EFP, CCP does not show the locations of blank elements in the problem code to encourage students to improve code reading. Then, the <i>element/code fixing problem (EXP/CXP)</i> and the <i>code amendment problem (CAP)</i> are presented to generate various fill-in-blank style problems for the students to study code debugging along with code reading. Next, the <i>blank element selection algorithm</i> for <i>C programming</i> is proposed to generate EFP and CCP in <i>C programming learning assistant system (CPLAS)</i>. In this way, this thesis introduces various fill-in-blank style exercise problems for Java and C programming learning.</p> <p>This thesis is organized as follows:</p> <p>Chapter 1 introduces the background, motivation and the contribution of the study in this thesis.</p> <p>Chapter 2 reviews the outlines of the web-based Java programming learning assistant system (JPLAS) and two representative exercise problems in JPLAS.</p> <p>Chapter 3 reviews the four algorithms that will be used in the studies of this thesis.</p> <p>Chapter 4 presents the code completion problem (CCP) in Java programming learning assistant system (JPLAS).</p> <p>Chapter 5 presents the element fixing problem (EXP) and the code fixing problem (CXP) in Java programming learning assistant system (JPLAS).</p> <p>Chapter 6 presents the code amendment problem (CAP) in Java programming learning assistant system (JPLAS).</p> <p>Chapter 7 presents the element fill-in-blank problem (EFP) in C programming learning assistant system (CPLAS).</p> <p>Chapter 8 presents the code completion problem (CCP) in C programming learning assistant system (CPLAS).</p> <p>Chapter 9 introduces related works to this thesis.</p> <p>Finally, Chapter 10 concludes this thesis with some future works.</p>			

論文審査結果の要旨

In this thesis, the applicant presented the comprehensive study of fill-in-blank style exercise problems with five contributions on improvements or advancements of the element fill-in-blank problem (EFP) for Java programming learning assistant system (JPLAS). JPLAS has been developed to offer various types of exercise problems with different levels, where any student answer is automatically marked. Among them, EFP was designed to support self-studies of novice students to learn the Java grammar and basic programming through code reading. The blank elements in EFP are automatically selected by the blank element selection algorithm.

Firstly, the applicant proposed the code completion problem (CCP) for JPLAS as the harder problem than EFP. CCP does not show the locations of the missing elements in the source code, and asks students to complete each statement by filling in the missing elements at the proper positions.

Secondly, the applicant proposed the element fixing problem (EXP) and the code fixing problem (CXP) for JPLAS for debugging study. In EFP/CXP, the blank elements in EFP/CCP are replaced by the similar but incorrect elements that will be found by the error injection algorithm.

Thirdly, the applicant proposed the code amendment problem (CAP) for JPLAS as a mixture of CCP and CXP. In CAP, either of blank or error element is randomly selected with the given probability for each blank.

Fourthly, the applicant studied EFP for C programming learning assistant system (CPLAS) by extending the works for JPLAS. The blank element selection algorithm was newly designed and implemented for C programming including the C parser.

Lastly, the applicant studied CCP for CPLAS by extending the related works.

The applicant has published three journal paper, four international conference papers, and six domestic conference papers to present the contributions.

From the overall evaluation of this thesis, the applicant has satisfied the qualification condition for the doctor degree in Engineering from the Graduate School of Natural Science and Technology at Okayama University.