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A survey of Alloy specification language and comparison with an Algebraic specification language

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One of the important tasks in the field of software engineering is *software verification*. The tasks of software verification are specifying the system and analyzing whether the system ensures the required properties. To do a software verification, there is an alternative approach that is called *formal specification*, which specifies the system by using a mathematical syntax. At this moment, there are many specification languages that help users to specify system by formal specification, which each one uses different approaches of specification and analysis. One of the interesting specification languages is *Alloy specification language* that uses a new approach for software verification.

This research aims to survey Alloy specification in deeply details about specification and analysis techniques. This report presents the descriptions of relational logic, which is the logic behind specification approach of Alloy, the syntax of Alloy when applying the logic, and the analysis technique, which based on instance finding that relies on SAT solver. So, there are many simple examples in each section of the report, which make the description of Alloy become easier to understand. Moreover, the report also presents an approach of specifying and analyzing the state transition system of concurrent system, which is the case study, in Alloy.

By the way, there are other specification languages that uses the approach of formal specification. One of the other interesting languages is an

algebraic specification language that is one of the widely used approaches. Exactly, Alloy specification language and an algebraic specification language use the different specification and analysis approaches, which make them have different advantages and disadvantages, and the appropriateness specification in different types of system. So, the comparison of the two different specification languages in many topics is the another purpose of this research.

For this research, the algebraic specification language is represented by *Maude specification language.* In the report, there are some descriptions about Maude such as rewriting logic, which is the logic behind specification approach of Maude, and an analysis approach that is a *search* command. In addition, the report also presents about Real-Time Maude that is an extension of Standard Maude and a tool for specifying and analyzing real-time and hybrid systems.

Comparison of Alloy and Maude is experimented through a non-trivial case study. The selected case study of this research is the *hospital problem*, which is one type of the concurrent system that each process uses the shared resources. This report presents the approaches of specifying and solving hospital problem in both Alloy and Maude (including Standard Maude and Real-Time Maude).

From the experimental results that include experiences of using Alloy and Maude, the report presents the description of comparison of Alloy and Maude in many topics, which including advantages and disadvantages of each one. Moreover, there are some rough guidelines for selecting the specification languages between Alloy and Maude that which one is more appropriate to specify each types of system.