Compare about Description Style of Formal Specification

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In this paper, we have a comparative study about various description style of formal specification, pay attention to its clearness and extension easily. Our research consists of

- Survey properties of mathimatical models and specification language.
- A comparative study of specification style of transition system.
- A suggestion of extensible and modifiable specification style on CafeOBJ.

Introduction

For describing specifications of software systems, we have used a colloquial text,figure and table etc, based on natural(informal) language. But, in reccent day, it increases the demand of formal specification which can describe with no-conflict, completeness and no-ambiguous, so we have many research related specification language and its description styles. Formal specification is a part of formal method, writtten by specification language based on some mathmatical model and logic exactly. Formal specification have many advantage to develop software systems, for exsample,it has high reliability and can mechnical verification. But actually, it has some disadvantage too, when specifier describe specification using specification language. For exsample, its modeling(from request specifications to mathmatical model) is very difficult and it has a lot of restriction of describing it.

In this paper, we discuss these problem, take the position of user's side, using algebraic specification language CafeOBJ and model-oriented specification language Z notation. Our approach is to describe the same exsamples both of these two languages.

Approach

In this paper, we use two specification language, Z notation and CafeOBJ. Z notation is based on ZF set theory and first-order predicate logic. CafeOBJ is based on order-sorted algebra and rewrite logic, which is an extension to each order-sorted algebra and equational logic. A Comparative study between Z notation and algebraic specification language has been written by Heisel, it models Unix File system using Z notation and PLUSS. It is similar to our research, but our approach has different concept and new algebraic techniques, like Rewrite Rule and Hidden Algebra. Our concept is, stand by user's side, to research useful and plainness about specification language. Rewrite Rule is based on Rewriteing Logic, which was introduced by Meseguer as a new unifying semantics theory for conncurrency. Hidden Algebra was introduced by Goguen and Malcom, as an algebraic semantics for object paradigm capturing its main features, has designed yet.

In our research, At first, we compare simple specification using Z and CafeOBJ, to investigate description properties of each specification language. Specially, transiton system's specification, which desclribes defficult using algebraic specification language, detailed most carefully. We described our exsamples Employment Agency using next five specification styles and analyzed these style by its comparison.

- Z specification style using Z schema.
- Explicit state approach style: (based on Initial Algebra)
- Implicit state approach style: (Baumeister's approach)
- Rewrite Rule style: (based on Rewrite Logic)
- Behavioural specification style: (based on Hidden Algebra)

Finally, as these research rusult, we have some saggestion to design extensible and modifiable specification styles on CafeOBJ. One of these is the specification style using Rewrite Rule and Class Declaration. When we use this style, we can describe transition system formaly to make difference between pre-state and post-state clear. The other is based on Hidden algebraic approach. When we want to etend our behavioural state specification, we had better change our specification more concrete version.

Conclusion

In this research, we verify possibility of describing transition system based on relation between pre-state and post-state on CafeOBJ. As result, using Rewrite Rule, we can describe it easily like Z schema. Furthermore, using Class Declearsion, we can describe extensible and more formaly. And explain the fact with exsample that Behavioural speification using some hidden sort is more extensible than one hidden sort version. In additon, this paper contains many other considerations on our experience.