Project proposal

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April 18, 2019

1 Solver for propositional dynamic logic formulas

The idea of the project is to implement a solver for formulas in propositional dynamic logic (PDL). The input would be a formula in PDL and optionally a kripke frame for that formula. The output result is either *unsat*, *sat* or *unknown*. To check the validity of a formula, the input would be its negation, and it is valid if the result is *unsat*. If a kripke frame is given, the result scope would be restricted to this kripke frame. Otherwise, the result scope would be all kripke frames.

The project is primarily code and would use the SMT solver CVC4 as a back end and apply the relation theory to implement the semantics of PDL. The project would import CVC4 abstract syntax tree (AST) for relations from another project that I am working on (Alloy2SMT translator[1]) which supports type checking and SMT models parsing, albeit it needs some refactoring to be more generic. For this project I would write a translator from PDL AST to CVC4 AST and display back the SMT models returned from CVC4 as Kripke frames and dot files for visualization using software like graphvis.

2 Progress so far

Since CVC4 AST is written in Java, I am using Java for this project along with gradle[2]. I have written an ANTLR4 grammar for PDL following the syntax in chapter 5 in [1]. The grammar also handles a kripke frame written using the set notation in chapter 5 with one difference ($m_{\mathfrak{K}}(a)$ would be written as $m(a)$). Lastly I prepared classes for PDL AST for Kripke frames, formulas and programs. Next tasks would be parsing PDL input into PDL AST and translating this AST into CVC4 AST.

3 Preferences for presentation day

April 30 is the most preferred date. May 2 is least preferred date because I have a project presentation for another class on this date.

References

[1] David Harel, Jerzy Tiuryn, and Dexter Kozen. *Dynamic Logic*. MIT Press, Cambridge, MA, USA, 2000.

[1] `https://github.com/CVC4/org.alloytools.alloy/tree/cvc4/alloy2smt`

[2] `https://github.com/mudathirmahgoub/pdl`