

Handout 4: Specification and Verification Using Higher-Order Logic (summer term 2008)

May 6th, 2008

Exercise 1 A Compiler and its Correctness

In this exercise we look at the compiler from Chapter 3.3 of the Isabelle/HOL tutorial by Nipkow, Paulson and Wenzel. Make yourself familiar with the involved languages, the compiler and the definition of its correctness.

- a) Copy the language and compiler formalizations. Write some simple source programs representing the terms “ $((a + 1) + b)$ ” and “ $(5 + (2 * (3 + 6)))$ ”. Make yourself familiar with their compilation and their execution.
- b) Add unary operators to your source language and target language.
- c) Complete the missing parts of the correctness proofs.
- d) Add an assignment statement to the source language and a store instruction to the target language.
- e) Define a new type for the representation of states of the source and the target language.
- f) Extend the `exec` and `value` functions adequately. Adapt the compiler and its correctness theorem and prove it!
- g) Regard the compilation of sequences of statements and adapt the compiler and its correctness theorem and prove it!
- h) How would you add branches and loops to the languages? What extensions are necessary?