

Exercise Sheet 9: Specification and Verification with Higher-Order Logic (Summer Term 2012)

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Exercise 1 Big and Small Step Semantics

In this exercise we consider a small While-language based on the language IMP introduced in the lecture. In particular, we want to create and show properties about an adequate small step semantics for IMP.

- a) Download the file “While.thy” from our webpage and define a small step semantics for IMP within Isabelle/HOL.

Hint: Remember that there are two different kinds of configurations: terminal and non-terminal ones. The theory already contains a datatype `config` for such configurations, which also has an additional nice syntax defined.

- b) Prove that terminal configurations are stuck w.r.t the semantics, i.e.

$$\neg \left(\langle s \rangle \rightarrow_1 y \right)$$

- c) Prove that non-terminal configurations are not stuck w.r.t the semantics.

- d) Formulate a strong property relating the small and big step semantics.

Remark: The proof of such a property is interesting, but too long for this exercise. You are of course encouraged to try it!

- e) Formulate the property that the big step semantics is deterministic and prove it.