ETH_zürich_

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Formal Methods and Functional Programming

Exercise Sheet 11: Big-Step Semantics

Submission deadline: May 16/17, 2023

Assignment 1 (Reversing Loop-Unrolling)

Task.   Prove the following statement:

$$\forall \sigma, \sigma', b, s \cdot \big(\vdash \langle \texttt{if } b \texttt{ then } s; \texttt{ while } b \texttt{ do } s \texttt{ end else skip end}, \sigma \rangle \to \sigma' \implies$$
$$\vdash \langle \texttt{while } b \texttt{ do } s \texttt{ end}, \sigma \rangle \to \sigma' \big)$$

Note: In the lectures, you have seen the proof of this result in the other direction.

Assignment 2 (Execution only Affects Free Variables)

Task.   Prove that

$$\forall s, \sigma, \sigma', x \cdot \big(\vdash \langle s, \sigma \rangle \to \sigma' \wedge x \notin \mathit{FV}(s) \implies \sigma'(x) = \sigma(x) \big).$$

Hint: The statement to prove is equivalent to

$$\forall T, s, \sigma, \sigma', x \cdot \big((\mathit{root}(T) \equiv \langle s, \sigma \rangle \to \sigma') \wedge x \notin \mathit{FV}(s) \implies \sigma'(x) = \sigma(x) \big),$$

where T ranges over derivation trees.