



## Tutorial for Program Verification Exercise Sheet 15

In this exercise sheet we work with strongest postconditions of a set of states under a given statement.

Submit your solution by uploading it as PDF in ILIAS.

### Exercise 1: Strongest Postcondition

3 Points

Below, you find six sets of states that are each given as a strongest postcondition. Write down each set without using the strongest postcondition operator. You may use any formalism that you have seen in the lecture. Recall that  $\{\varphi\}$  denotes the set of states that satisfy the formula  $\varphi$ . In the formulas below,  $i, k, x$  are integer variables and  $a$  is an array whose indices and values are integers.

- (a)  $\text{sp}(\{select(a, k) = 23 \wedge select(a, i) = 42\}, \text{assume } i==k; )$
- (b)  $\text{sp}(\{0 \leq k \wedge k \leq i\}, \text{havoc } k; )$
- (c)  $\text{sp}(\{select(a, 23) = 42\}, \text{a}[k] := 1337; )$
- (d)  $\text{sp}(\{x \cdot x > 5\}, \text{x} := \text{k}-\text{i}; )$
- (e)  $\text{sp}(\{x \% 2 = 0\}, \text{x} := \text{x}+1; )$
- (f)  $\text{sp}(\{select(a, i + 1) = 23\}, \text{i} := 2 * \text{k} + \text{i}; )$