



Dr. Matthias Heizmann
Tanja Schindler
Dominik Klumpp

Hand in until 16:00 on May 8, 2019
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Tutorial for Program Verification

Exercise Sheet 3

Exercise 1: Free Variables and Substitutions

2 Points

Consider the formulas φ_i and the substitutions σ_i for $i \in \{1, 2\}$ displayed below.

- (i) Compute the set of free variables $\text{freevars}(\varphi_i)$ for $i \in \{1, 2\}$.
- (ii) Compute the result $\varphi_i\sigma_i$ for $i \in \{1, 2\}$.

$\varphi_1 : \forall x'. (p(x, x') \wedge \exists x. p(x', x))$ and $\sigma_1 : \{x \mapsto a\}$

$\varphi_2 : \forall y. p(x, y, z)$ and $\sigma_2 : \{x \mapsto f(z), z \mapsto f(y)\}$