
Rule 0.18 *⟨Use Single-Line Variable Swapping⟩*

$$\begin{array}{c}
 \begin{array}{l}
 [\dots] \\
 \mathbf{contract} \ A \ \{ \\
 [\dots] \\
 \mathbf{function} \ f(pds) \ \{ \\
 [\dots] \\
 \quad T \ temp = var_1; \\
 \quad var_1 = var_2; \\
 \quad var_2 = temp; \\
 \quad stmts \\
 \} \\
 [\dots] \\
 \}
 \end{array}
 \end{array}
 =
 \begin{array}{c}
 \begin{array}{l}
 [\dots] \\
 \mathbf{contract} \ A' \ \{ \\
 [\dots] \\
 \mathbf{function} \ f(pds) \ \{ \\
 [\dots] \\
 \quad (var_1, var_2) = (var_2, var_1); \\
 \quad stmts \\
 \} \\
 [\dots] \\
 \}
 \end{array}
 \end{array}$$

where

- var_1 and var_2 are variables of type T being swapped;
- $temp$ is a temporary variable of type T used for the traditional swap;
- T is the type of the variables being swapped;
- pds are the parameter declarations of function f ;
- $stmts$ represents the sequence of statements following the swap.

provided

- The variables var_1 and var_2 are of the same type T ;
- The traditional three-step swap pattern is used in contract A ;
- The temporary variable $temp$ is used only for the swap operation;
- No side effects occur during the evaluation of var_1 and var_2 ;
- The tuple assignment maintains the same semantics as the traditional swap.

Invariant:

- Let s_i and s'_i be the initial state of A and A' , respectively.
- Let s_f and s'_f be the state reached by A and A' , respectively, after $A.f()$ and $A'.f()$ are executed from s_i and s'_i , respectively.
- Then, the coupling invariant is

$$\forall s_i, s'_i. (s_i = s'_i) \rightarrow (s_f = s'_f)$$
