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Tutorial for Program Verification Exercise Sheet 7

Exercise 1: Weakest precondition

Let V be a tuple of program variables. Let ϕ be a set of states (i.e., ϕ is a formula whose free variables are in V). Let ρ be a binary relation over program states (i.e., ρ is a formula whose free variables are in $V \cup V'$).

In the lecture we defined the formula $post(\phi, \rho)$ as the image of the set ϕ under the relation ρ .

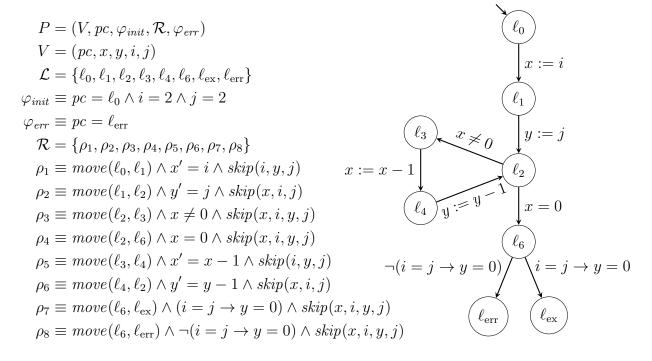
- (a) Define a function wp such that the formula $wp(\phi, \rho)$ denotes the largest set of states ψ such that $post(\psi, \rho)$ is a subset of ϕ .
- (b) Compute $wp(\phi_i, \rho_i)$ for the following pairs.

 $\phi_1 \equiv y \ge 7 \qquad \qquad \rho_1 \equiv x < y \land x' = x \land y' = y$ $\phi_2 \equiv y = 7 \land x = 23 \qquad \qquad \rho_2 \equiv x' = x + y + 3 \land y' = y$ $\phi_3 \equiv y \ge 7 \land x = 23 \qquad \qquad \rho_3 \equiv y' = y$

Note that this exercise is very similar to Exercise 5 on Sheet 6, which was not yet discussed in the exercise group. In contrast to the old exercise, the formula ϕ_2 in part (b) is $y = 7 \land x = 23$ instead of $y \ge 7$.

Exercise 2: Reachable states

Compute the set of reachable states for the program below.



2 Points

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