Technische Universität München **Summer Semester 2015**
I7
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Model Checking – Exercise sheet 12

Exercise 12.1: Abstraction refinement

We consider the following program, over the integer variables x and y:

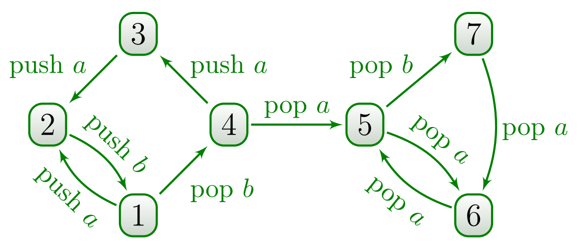
```
1 if (x >= 0) x = -x;
2 if (y >= 0) y = -y;
3 if (x + y > 0) error;
4 end
```

1. Give the set of configurations of the program (some may not be reachable).
2. Draw the abstract transition system with the predicates l_1, l_2, l_3, l_4 and "error".
3. Give a path ρ in the abstract transition system reaching a state where "error" holds.
4. What is the longest prefix (denoted ρ') of ρ that can be concretized ?
5. Denote q the state in the abstract transition system reached by ρ'. Give a predicate that separates configurations reachable by ρ' from configurations that admit a successor.
6. Draw the abstract transition system with that additional predicate.
7. How many times does we have to repeat the abstraction refinement technique to exhibit an abstract transition system that does not reach the error state ? Draw that transition system, how many predicates have we introduced ?

Exercise 12.2: Pre* in pushdown systems

Consider the following pushdown system, with stack alphabet $\Gamma = \{a, b\}$.

By (1) —push a→ (2), we indicate the presence of transitions $1a \hookrightarrow 2aa$ and $1b \hookrightarrow 2ab$. By (4) —pop a→ (5), we indicate the presence of the transition $4a \hookrightarrow 5$.



1. Let $C = 7b^* = \{7, 7b, 7bb, 7bbb, \ldots\}$. Build the p-automaton accepting $\text{pre}^*(7b^*)$.
2. Give the minimal automaton accepting the language of all stacks w such that $1w \in \text{pre}^*(C)$.