

Generic Language Technology (2011-2012)
Assignment 3 (deadline: December 5th 2012)
Link to Formal Verification of DSL Models - Dynamic
Semantics

Introduction

This assignment for the Generic Language Technology course is meant to get you acquainted with defining the dynamic semantics of a language and with generating the execution dynamics of a model given in that language.

Exercise: Dynamic Semantics

We consider a language `SSM`, which can be very well considered as a simple `StateMachine` language. The syntax of the language is given as:

Arithmetic expressions :

$$a ::= n \mid x \mid a_1 + a_2 \mid a_1 * a_2 \mid a_1 - a_2$$

Boolean expressions :

$$b ::= \text{true} \mid \text{false} \mid a_1 = a_2 \mid a_1 \leq a_2 \mid \neg b \mid b_1 \wedge b_2$$

Effects :

$$ef ::= x := a \mid \text{send } sign$$

Triggers :

$$trig ::= \text{receive } sign$$

Events :

$$ev ::= trig \mid ef$$

SimpleProcesses :

$$P ::= ev \mid \text{skip} \mid P_1; P_2 \mid \text{if } b \text{ then } P_1 \text{ else } P_2 \mid P_1 \parallel P_2 \mid P_1 \parallel_S P_2$$

where n denotes an integer, x is a variable from a given set of variables Var , $sign$ is a signal name from a given set of signal names $Signals$, and $S \subseteq Signals$. A brief intuition of the constructs is given below:

1. Events are the smallest executable entities. An event can be either a trigger or an effect;

2. $;$ denotes a sequential execution of processes: P_2 can start execution if and only if P_1 has terminated;
3. \parallel denotes interleaving of executions of P_1 and P_2 ;
4. \parallel_S denotes synchronization of processes on signals contained in set S . If P_1 (P_2) can execute event **send** $sign$ and P_2 (P_1) can execute event **receive** $sign$ for some signal $sign \in S$, then and only then the events are executed and they are executed simultaneously by the composition $P_1 \parallel P_2$. Any other events (assignments $x := a$, **send** $sign'$ for $sign' \notin S$, and **receive** $sign'$ for $sign' \notin S$), which can be executed by P_1 or P_2 , are executed by the composition $P_1 \parallel P_2$ in the interleaving fashion.

Your task is first to think about the formal representation of the dynamic semantics of the language. Second, to implement the dynamic semantic such that any model in the **SSM** language can be executed. For this you can use any technology you want, e.g., ASF+SDF, mCRL2, etc. You should document your solution properly.

Submission

Submit the following file via PEACH:

1. A file containing your solution to the assignment.