HW 10 – Structural Operational and Transition Semantics

CS 421 – Spring 2014
Revision 1.0

Assigned Thursday, April 10, 2014
Due Sunday, April 27, 2014, 11:59 PM

1 Change Log

1.0 Initial Release.

2 Turn-In Procedure

This assignment is named `hw10`. Using your favorite tool(s), you should put your solution in a file named `hw10-solution.pdf`. Your answers to the following questions are to be submitted using the svn repository as described in the section `Instruction for Solving and Submitting Assignments` on the web-page: `http://courses.engr.illinois.edu/cs421/sp2014/mps/index.html`

3 Objectives and Background

The purpose of this HW is to test your understanding of

- The difference between structural operational semantics and transition semantics.
- How to create rules for structural operational semantics.
- How to write rules for transition semantics.

All problems on the homework will be based on the language discussed in class, which has the following syntax:

$I \in Identifiers$
$N \in Numerals$
$B ::= \texttt{true} \mid \texttt{false} \mid B \;\&\; B \mid B \;\texttt{or}\; B \mid \texttt{not}\; B \mid E < E \mid E = E$
$E ::= N \mid I \mid E + E \mid E * E \mid E - E \mid -E$
$C ::= \texttt{skip} \mid C; C \mid I\texttt{::=}E \mid \texttt{if}\; B\; \texttt{then}\; C\; \texttt{else}\; C\; \texttt{fi} \mid \texttt{while}\; B\; \texttt{do}\; C\; \texttt{od}$

4 Problems

1. (20 points) Add a new if-then operator `if` B `then` C `fi` and a new do-while operator `do` C `while` B `od` to the syntax of commands `C`.

   a. (10 points) Add the structural operational semantics (*a.k.a.* natural semantics) for these operators. Note that the do-while operator works as follows. The execution of `if` B `then` C `fi` evaluates B, and if the value

is `true`, then it executes the command C, and otherwise it does nothing. The execution of `do` C `while` B `od` starts with executing the command C in the body of the loop. The loop is repeated until the boolean expression B is evaluated to false.

b. (10 points) Add the transition semantics for these operators. They has the same meaning as part a.