
HW 10 – Structural Operational and Transition Semantics

CS 421 – Fall 2013

Revision 1.1

Assigned Saturday, November 9, 2013

Due Thursday, November 21, 2013, 19:59 PM

Extension 48 hours (20% penalty)

1 Change Log

1.1 Corrected the submission date; corrected that operator added a new commands, not a new expression; deleted the phases about updating other rules. Neither of the two specific operators given require this, although there are others and you should think about what possibilities you can come up with.

1.0 Initial Release.

2 Turn-In Procedure

Answer the problems below, save your work as a PDF (either scanned if handwritten or converted from a program), and hand in the PDF. Your file should be named `hw10-solution.pdf`.

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:

$I \in \text{Identifiers}$

$N \in \text{Numerals}$

$B ::= \text{true} \mid \text{false} \mid B \ \& \ B \mid B \ \text{or} \ B \mid \text{not } B \mid E < E \mid E = E$

$E ::= N \mid I \mid E + E \mid E * E \mid E - E \mid - E$

$C ::= \text{skip} \mid C; C \mid I ::= E \mid \text{if } B \text{ then } C \text{ else } C \text{ fi} \mid \text{while } B \text{ do } C \text{ od}$

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 have the same meaning as part a.