Programming Languages (COP 4020/CIS 6930) [Fall 2014]

Assignment IX

Objectives

1. To understand several programming-language properties needed for proving type safety, including Weakening, Substitution, Inversion, and Canonical Forms.
2. To understand type safety at a technical level by proving it for a small language.

Due Date: Tuesday, December 2, 2014 (at the beginning of class, 5:00pm).

Assignment Description

Do the following by yourself.

Recall the following language L from previous assignments:
types τ ::= bool | $\tau_1 \times \tau_2$
exprs e ::= x | true | false | e_1 NOR e_2 | (e_1,e_2) | let val $(x_1,x_2) = e_1$ in e_2 end

Using the definitions discussed in class (of L's free variables, alpha-conversion, substitution, and static and dynamic semantics), prove that L is type safe. You'll need to state and prove Weakening, Substitution, Inversion, and Canonical Forms Lemmas, Progress and Preservation Theorems, and finally the Type Safety Theorem/Corollary.

Hints

This assignment may require several hours of writing, but you have all the tools needed to complete it.

As always, you may assume that expressions are implicitly alpha-converted to avoid contexts having more than one entry for the same variable.

Submission Notes

- Turn in a hardcopy (handwritten or printed) version of your solutions. Please do not email solutions or upload them into Canvas.
- Write the following pledge at the end of your submission: "I pledge my Honor that I have not cheated, and will not cheat, on this assignment." Sign your name after the pledge. Not including this pledge will lower your grade 50%.
- You may submit solutions up to 2 days late with a 15% penalty.
- If you think there's a chance you'll be absent or late for class on the date this assignment is due, you are welcome to submit solutions early by giving them to me or a TA before or after class, or during any of our office hours.