

Homework # 6

due October 18

1 Reading

Please read Chapter 9 in the textbook.

2 Discussion

In class, we discussed several dubious type rules. In particular, we discussed something similar the following system:

$$\begin{array}{c} \text{T-VAR A} \\ \hline x : T \end{array} \qquad \begin{array}{c} \text{T-ABSA} \\ t : T \\ \hline \lambda x. t : T \rightarrow T \end{array} \qquad \begin{array}{c} \text{T-APPA} \\ t_1 : T \rightarrow T' \quad t_2 : T \\ \hline (t_1 t_2) : T' \end{array}$$

... additional rules for booleans and “if” ...

Suppose we try to prove progress and preservation (for closed terms) with this “type system.” Can we do it? Explain! Give concrete examples.

If we changed the rules to

$$\begin{array}{c} \text{T-VARB} \\ \hline x : \text{Bool} \end{array} \qquad \begin{array}{c} \text{T-ABSB} \\ t : T \\ \hline \lambda x. t : \text{Bool} \rightarrow T \end{array} \qquad \begin{array}{c} \text{T-APPB} \\ t_1 : T \rightarrow T' \quad t_2 : T \\ \hline (t_1 t_2) : T' \end{array}$$

... additional rules for booleans and “if” ...

Can we prove progress and preservation? Discuss!

3 Proofs

Read Exercise 9.2.3 and prove that if $\Gamma \vdash tt : T$ then we have a contradiction. Do the proof of preservation (Theorem 9.3.9). You will need to use the substitution lemma (Lemma 9.3.8).

4 Extra

In the skeleton file, two of the helper lemmas are marked as “EXTRA.” if you complete the rest of the homework, you are invited to do these proofs. A better grade on this part will replace a poorer grade for the SASyLF part of a previous homework.

5 Graduate Students

In the substitution lemma, you will need to use “weakening” and “exchange” lemmas/properties. What flavor of type systems does *not* have weakening? Explain! When is exchange for some type systems problematic? Explain!