Seminar Advanced Topics in Semantics, Summer 2008
Session 2

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Logical Relations and a Case Study in Equivalence Checking

Small-group work

Discuss some or all of the following questions about Karl Crary's article "Logical Relations ..."

a) Solve Exercise 6.3.1: Recall that $\Gamma \vdash x \equiv y : \texttt{Unit}$ is an example showing that equivalence is type-dependent (and goes beyond merely checking for equal normal forms). Give two *closed* terms that are equivalent but have distinct normal forms.

b) Can you think of types other than `Unit` that require a type-dependent notion of equivalence?

c) Solve Exercise 6.6.4: Suppose that the language contains exactly one constant `k`. Produce a counterexample for monotonicity, i.e., find terms `s`, `t`, such that $\Gamma \vdash$ `s is t:T` but not Γ, `x:S` $\vdash$ `s is t:T`.

d) Solve Exercise 6.9.13: Argue that the equivalence algorithm terminates.

e) Solve Exercise 6.9.14: Extend the language with pairs, and sketch how the statements and proofs have to be adapted. Challenge: What about sum types?

f) Solve Exercise 6.9.15: Where does the proof break down when considering polymorphic types? What about recursive types?

Discuss any further problems, or questions you find interesting about the chapter.