Differences of Types[*]

Subtitle[†]

JOHN LEO[‡], Halfaya Research
FIRST2 LAST2[§], Institution2a and Institution2b

See Introduction.

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1 INTRODUCTION

This document is a place to record my thoughts on the Coq proof repair project headed by Talia Ringer, Nate Yazdani, and Dan Grossman. Everything in it is preliminary.

2 DIFFERENCES OF TYPES

Dependently-typed functional programs and mathematical objects which can be manipulated algebraically. One algebraic operation that can be performed is to take the difference of two types. Given types $A : T$ and $B : T$ of the same sort T this difference $B - A$ can be expressed as a function from A to B:

$$f : A \to B$$

This is perhaps not very interesting, and of course not in general unique. We can also look at the difference between two terms of different types. Given $a : A$ and $b : B$, express $b - a$ as

$$f_{ab} : A \to B \ni f(a) = b$$

This function is again not unique in general, and in fact always has the trivial solution $f_{ab}(\_) = b$).

The existence of a should provide some help in calculating b. We would like to capture somehow the notion of using a "maximally", and then defining $b - a$ to be the function that thus takes the minimal amount of effort to go from a to b.

Given that a and b are themselves algebraic structures, it should be possible to quantify the size of a term as either the size or depth of its AST. Denote $|b|$ as the size of b. Our definition of $b - a$ could then be a function $f_{ab} : A \to B$ such that $|f_{ab}(a)|$ is minimal, where we set $|a|$ to be 1.

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[‡] with author1 note
[§] with author2 note

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Note that we do not say what happens when the argument to f_{ab} is not a. We could arbitrarily set the output to b always in this case. More interesting would be to handle any term of type A, using only information about the types A and B. In this case we could define $B - A$ to be any function $f : A \to B$ that minimizes $|f(a)|$ for all $a \in A$.