

Graph Model for the untyped lambda calculus and for Verse

November 1, 2023

1 Part one: the untyped lambda calculus

This document describes a denotational semantics for a call-by-value untyped lambda calculus based on a “graph” model.

The file `simple/model.v` contains a sketch of this semantics for the untyped lambda calculus.

$$e ::= x \mid \lambda x. e \mid e_1 \ e_2$$

This semantics interprets lambda calculus terms as a graph: a set of input-output pairs, written $w \mapsto v$. This set could be infinite, or it could be approximated by some finite set.

This set also includes a trivial term `v_fun`, written \circ .

If \mathcal{W} is the domain of all semantic values then, The graph of the identity function looks like this:

$$\{w \mapsto w \mid w \in \mathcal{W}\} \cup \{\circ\}$$

But, how do we represent this set in a proof assistant?

2 Part two: verse

The files in the `verse/` subdirectory contain the semantics of a much richer language.