A Machine-Checked Correctness Proof of Normalization by Evaluation for Simply Typed Lambda Calculus

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Abstract

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Contents

1 Random header

Code block:

```
infixr 4 _⇒_

data Ty : Set where
  ι   : Ty
  _⇒_ : Ty → Ty → Ty

data Con : Set where
  •   : Con
```

```
  _,_ : Con → Ty → Con

data _∈_ (A : Ty) : Con → Set where
  vz : ∀ {Γ} → A ∈ (Γ , A)
  vs : ∀ {B Γ} → (v : A ∈ Γ) → A ∈ (Γ , B)

data Tm Γ : Ty → Set where
  var : ∀ {A} → (v : A ∈ Γ) → Tm Γ A
  lam : ∀ {A B} → Tm (Γ , A) B → Tm Γ (A ⇒ B)
  app : ∀ {A B} → (f : Tm Γ (A ⇒ B)) → (a : Tm Γ A) → Tm Γ B
```

Now let's try some inline code: `∀ a → a ∈ Γ → a ≢ foo`.

1.1 Random header again

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Theorem 1. *Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.*

Proof. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum. □

Some linky thing here. H_2O is a liquid. 2^{10} is 1024.


```
data Tm Γ : Ty → Set where
  var : ∀ {A} → (v : A ∈ Γ) → Tm Γ A
  lam : ∀ {A B} → Tm (Γ , A) B → Tm Γ (A ⇒ B)
  app : ∀ {A B} → (f : Tm Γ (A ⇒ B)) → (a : Tm Γ A) → Tm Γ B
```


1. fruits
   - apples

    - macintosh
    - red delicious
  - pears
  - peaches
2. vegetables
  - broccoli
  - chard

Apple Pomaceous fruit of plants of the genus Malus in the family Rosaceae.
Orange The fruit of an evergreen tree of the genus Citrus.

(1) My first example will be numbered (1).
(2) My second example will be numbered (2).

Explanation of examples.

(3) My third example will be numbered (3).

Table 1: Demonstration of simple table syntax.

Right	Left	Center	Default
12	12	12	12
123	123	123	123
1	1	1	1

Table 2: Here's the caption. It, too, may span multiple lines.

Centered Header	Default Aligned	Right Aligned	Left Aligned
First	row	12.0	Example of a row that spans multiple lines.
Second	row	5.0	Here's another one. Note the blank line between rows.

Table 3: Sample grid table.

Fruit	Price	Advantages
Bananas	$1.34	• built-in wrapper • bright color

Fruit	Price	Advantages
Oranges	$2.10	• cures scurvy • tasty

Table 4: Demonstration of pipe table syntax.

Right	Left	Default	Center
12	12	12	12
123	123	123	123
1	1	1	1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum. Here is a footnote reference,[1] and another[2]. Here is an inline note.[3]

This paragraph won't be part of the note, because it isn't indented. Here's a reference (Altenkirch 1993). Here's another (Altenkirch, Hofmann, and Streicher 1995). And yet another here (Altenkirch 1998).

More references abound (The Univalent Foundations Program 2013; Devriese and Piessens 2013; Brown and Palsberg 2015; McBride and Paterson 2008).

References

Altenkirch, Thorsten. 1993. "A Formalization of the Strong Normalization Proof for System F in LEGO." In *Typed Lambda Calculi and Applications*, edited by J.F. Groote M. Bezem, 13–28. LNCS 664.

———. 1998. "Logical Relations and Inductive/Coinductive Types." In *Computer Science Logic, 12th International Workshop, Csl '98*, 343–54. LNCS

[1] Here is the footnote.

[2] Here's one with multiple blocks. Subsequent paragraphs are indented to show that they belong to the previous footnote. The whole paragraph can be indented, or just the first line. In this way, multi-paragraph footnote work like multi-paragraph list items.

[3] Inlines notes are easier to write, since you don't have to pick an identifier and move down to type the note.

1584.

Altenkirch, Thorsten, Martin Hofmann, and Thomas Streicher. 1995. "Categorical Reconstruction of a Reduction Free Normalization Proof." In *Category Theory and Computer Science*, edited by David Pitt, David E. Rydeheard, and Peter Johnstone, 182–99. LNCS 953.

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