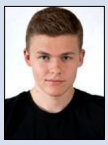

Dominik Bastian Kessler


Cyrill Hänni

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Examiner	Prof. Dr. Farhad D. Mehta
Subject Area	Software Engineering - Core Systems

The Lambda Calculus Calculator

$$\begin{array}{lcl} P & ::= & M = M \\ M & ::= & x \mid \lambda x.\ M \mid M\ M \end{array}$$

$$\lambda x.\ M \mathrel{\widehat{=}} \lambda y.\ [x := y]M \quad \text{if} \quad (y \ \underline{\text{nfin}}\ M) \qquad (\widehat{=}_{\lambda\alpha})$$

$$\frac{}{\mathsf{H} \vdash (\lambda x.\ M)\ N = [x := N]M}\ \beta$$

Lambda Calculus Rules

$$\begin{array}{ll} & \underline{\wedge}\ \top\ \bot \\ = & \underline{(\lambda p.\lambda q.\ p\ q\ p)}\ \top\ \bot & \because \delta \\ = & \underline{(\lambda q.\ \top\ q\ \top)}\ \bot & \because \beta \\ = & (\underline{\top}\ \bot)\ \top & \because \beta \\ = & \underline{((\lambda x.\lambda y.\ x)\ \bot)}\ \top & \because \delta \\ = & \underline{(\lambda y.\ \bot)}\ \top & \because \beta \\ = & \bot & \because \beta \end{array}$$

Lambda Term Derivation on Paper

Introduction: Lambda calculus is the mathematical basis for functional programming and often used to introduce it. There are currently a few lambda calculus interpreters available, but it was felt that all of them suffer from an unintuitive user experience, an unappealing user interface and require too much effort to understand.

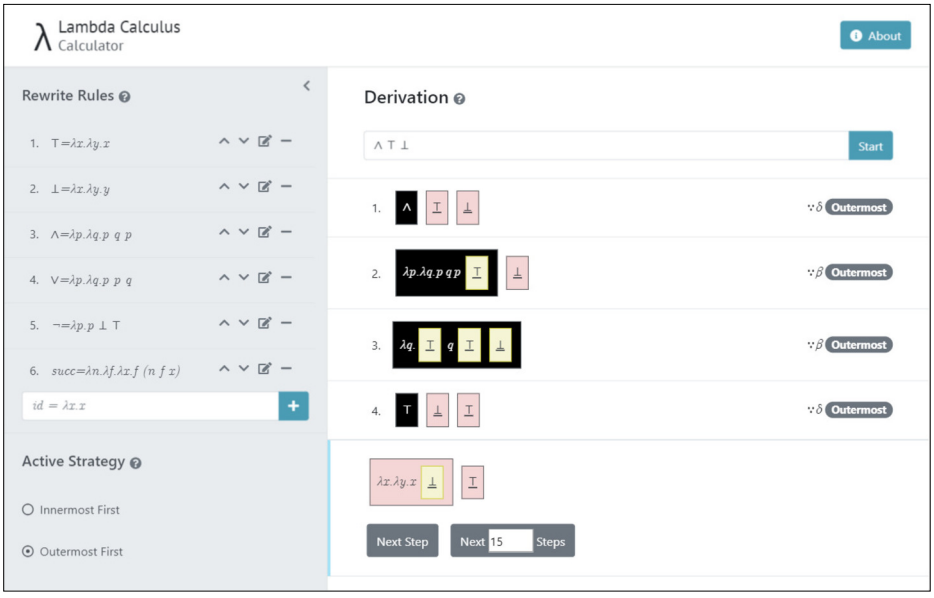
The purpose of the term project "Lambda Calculus Calculator" was to write a user friendly lambda calculus interpreter, which can be used to teach lambda calculus right from the beginning.

Result: The outcome of the study project is a single page web application written in the functional programming language elm. The focus of the application lies on the derivation of lambda terms, which can either be reduced manually or by selecting a strategy.

Lambda Calculus Calculator supports three different reduction methods: β-reductions, δ-reductions and δ-reduction for numerals, as well as two different resolution strategies: outermost first and innermost first.

The project will be released at www.lambdacalc.io to the open source community under a MIT license so that anyone can contribute to it and other universities are able to incorporate the application into their classes and adapt it to their needs.

Check out the result at https://lambdacalc.io



Lambda Calculus Calculator Application