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The search for a reduction in combinatory logic equivalent to $\lambda\beta$-reduction, Part II[☆]

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Abstract

This second part of [13] takes up the showing in detail of the properties in [13, §3] for the proposed definitions of abstraction and combinatory β-reduction. The difficult cases are (R3) (the Church-Rosser Theorem) and (R6) on irreducible CL-terms.

Keywords: λ-calculus, combinatory logic, β-reduction, $\beta\eta$-reduction, abstraction, irreducible terms, normal form

This paper is the second part of [13]. That paper was about seeking a reduction in combinatory logic (CL) corresponding to $\lambda\beta$-reduction.

It is usually thought that CL and λ-calculus are equivalent formalisms, and with respect to λ-conversion and CL equality, they are, in the sense that λ-terms M and N are β-convertible if and only if the corresponding CL-terms are equal in the sense of combinatory β-equality and the λ-terms are $\beta\eta$-convertible if and only if the corresponding CL-terms are equal in the sense of combinatory $\beta\eta$-equality. However, with respect to reduction, there is something missing. There is Curry's strong reduction, with the property that λ-term M $\lambda\beta\eta$-reduces to λ-term N if and only if the CL-term corresponding to M strongly reduces to the CL-term corresponding to N. But so far there is no corresponding β-reduction for CL.

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