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# The search for a reduction in combinatory logic equivalent to $\lambda\beta$ -reduction, Part II<sup>☆</sup>

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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  $\beta$ -reduction. The difficult cases are (R3) (the Church-Rosser Theorem) and (R6) on irreducible CL-terms.

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

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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  $\lambda$ -calculus are equivalent formalisms, and with respect to  $\lambda$ -conversion and CL equality, they are, in the sense that  $\lambda$ -terms  $M$  and  $N$  are  $\beta$ -convertible if and only if the corresponding CL-terms are equal in the sense of combinatory  $\beta$ -equality and the  $\lambda$ -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  $\lambda$ -term  $M$   $\lambda\beta\eta$ -reduces to  $\lambda$ -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  $\beta$ -reduction for CL.

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